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The New Electrical World.

With the present issue the *American Electrician* becomes part of this journal, which concurrently resumes the name by which it was known from 1883 until the consolidation with it of the *Electrical Engineer* in 1899. The Electrical World has thus finally incorporated with itself the two most formidable contestants for the field that have arisen in its history, dating back almost a generation to the founding of the *Operator*, in 1874. The consolidation of 1899 and the present one are unique in one respect, namely, that the journals merged were valuable journalistic properties, enjoying to a high degree the favor of the public to which they catered, and financially prosperous. The *American Electrician* had in the course of its life, of almost ten years, built up a subscription list unparalleled in electrical journalism, and ranged among the most prosperous technical journals in this country. The conduct, however, under one management of two such enterprises competing to a certain extent with each other, and overlapping editorially, naturally resulted in many business and editorial complications, tending to place both journals at a disadvantage. Most of all, that concentration of thought and effort which under present-day conditions is indispensable to the highest degree of accomplishment in the largest possible area was seriously affected. Under the new régime this handicap is removed, and free scope is allowed for a further stage of development, which, we believe, will be the most important in the long and successful career during which the Electrical World has ever maintained, far in advance, the lead in electrical journalism.

As to editorial policy, The Electrical World will continue to be the exponent of the entire electrical field. It will, as in the past, record the current electrical movement as a whole, the influence of which permeates every branch of the art. There will be no relaxation in the effort to keep readers informed of all new developments from the very earliest stage, of new principles from their inception; for in such a rapidly developing industry as that dealing with electricity, the indications of the present soon become the accomplishment of the future, and he will have the greatest assurance of success whose knowledge of principles, of engineering thought, of fundamental discoveries, is in advance of their practical application. While thus not giving up any of the broad features which have characterized the journal in the past, much greater attention will be devoted to the treatment of the economic and business side of the central station, the great distributor of energy to all the branches of electrical application. It cannot be denied that at present a situation is developing in this country which demands the most careful attention on the part of central station men and of those who would serve their interests. The pioneer period of central station development is closed, equipment has entered the standard stage and further advance will depend largely on extensions of business, and this in the face of a competition with gas, which was never so keen as at the present time. This brings to the fore problems of reduction of operating expenses, systems of rates to attract profitable service, extensions of the use of current to power, heating and other applications that will flatten the load curve, methods of up-to-date publicity, and systematic canvassing of prospective customers. A decrease in the rate of growth of the incandescent lamp output specifically indicates that a real situation has developed that calls for the careful consideration of the central station interests. To assist in meeting this the combined journal will devote its most earnest efforts, so that coincident with this notable consolidation of journalistic effort, there may date a new period of electrical development and prosperity. A systematic editorial campaign of broad scope has been planned to this end, which will be pushed to its full consequence, and will establish a new record in electrical journalism.

One of the reasons that led to the consolidation of the weekly and monthly journals is that a careful study of the situation presented no further reason for the existence of two separate journals treating increasingly a majority of subjects in common. On the other hand, the great subscription list of the *American Electrician* tended to demonstrate that there is a large class which has preferred a monthly to a weekly journal. The plan of consolidation, therefore, naturally involved and embodies a complete and satisfactory means of satisfying the monthly reader. To this end the first issue of each month will be the subject of a separate subscription at the rate of $1 per year, and all subscribers of the *American Electrician* will receive that particular issue during the unexpired terms of their subscriptions. While retaining all the standard features of the weekly issue, the first issue of the month will incorporate additionally all of the broader practical features of the *American Electrician*, and in size as well as scope of contents will be practically a double number. The weekly reader will thus have an extra service at no higher cost, which we believe will be warmly appreciated; and the monthly reader will also be served as in the past, but with an addition of matter that will greatly enhance to him the journal without increasing its cost. No serial will extend into the first issue of the month, which can, therefore, be bound as if it were a separate publication. While we believe that many will in time conclude it to be to their best interests to take all the issues of the month, the plan of the double number involves no obligatory features to this end. It will not, so far as its contents are concerned, be a detached number of the weekly journal, but a periodical absolutely complete in itself, and in its purely practical departments the almost exact equivalent of the monthly of which it becomes the successor.

Electrical Growth in 1905.

It is the custom of the Electrical World at the beginning of each new year to summarize the industrial growth of the preceding year in the various departments of electrical application. It is obvious that where the data cover so large a field many of the statistics must be in the nature of estimates; but since the United States Census Office began its investigations in electricity, by order of Congress, some five years ago, the bases have been laid which give reasonable certainty and accuracy to figures such as are presented herewith. The data of electrical manufacturing are collected in five-year periods, and the next are due this year; but the other electrical statistics, relative to lighting, traction, telephony, etc., are still taken by decades; and we are glad to note that the Director of the Census has strongly recommended for them also the five-year collection. It is obvious that with industries growing as rapidly as do the electrical, the changes in ten years deprive such figures of no small part of their value and significance. Every industry must know "where it is at" if effort in regard to it is to be properly and profitably directed.

For some years the average increase in electrical manufacturing was at the rate of 20 per cent over the whole field. This it would seem impossible to maintain in its total range, and it is a matter of fact that in 1904 the rate was not more than 10 per cent, failing indeed in some departments to reach that degree of augmentation. Last year was one, however, of enormous growth, and the higher cost of material and labor would also add to the increase in valuation.

The accompanying estimates are, therefore, presented on a basis of increase varying from over 20 per cent downward:

	1904.	1905.
Dynamos	$18,500,000	$22,200,000
Transformers	5,000,000	6,000,000
Switchboards for lighting and power	3,000,000	3,750,000
Motors for all purposes, including traction	15,000,000	17,000,000
Storage batteries	5,000,000	7,000,000
Primary batteries	1,250,000	1,750,000
Carbons	2,250,000	2,750,000
Arc lamps	2,500,000	3,000,000
Incandescent lamps	6,000,000	6,500,000
Lighting fixtures	3,750,000	4,500,000
Telephonic apparatus	30,000,000	37,500,000
Telegraphic apparatus	2,500,000	3,000,000
Insulated wires and cables, submarine cables	35,000,000	40,000,000
Conduits, interior and underground	2,000,000	2,500,000
Rheostats, heating and cooking apparatus	3,000,000	1,500,000
Annunciators	250,000	300,000
Electric clocks	150,000	150,000
Lightning arresters, fuses, etc.	1,000,000	1,500,000
Measuring instruments	3,350,000	4,000,000
Telpherage, etc.	250,000	300,000
Miscellaneous apparatus	19,750,000	25,000,000
Grand Total	**$175,500,000**	**$217,400,000**

To us it seems that the total of $217,400,000 is slightly high, and an all-around gain of 20 per cent would make the figure about six millions less. It is believed that the telephonic gain, affecting favorably many other departments, was far in excess of 20 per cent; but on the other hand the gain in incandescent lamps was below 10 per cent, and by competent authority is considered to have been as low as 7 per cent. On the other hand, there is excellent reason for regarding the great gain in storage batteries to be truly set forth; indeed, it is known as a matter of fact that $7,000,000 is very close to the mark. To some extent the lower gain in incandescent and arc lamps would be offset by Nernst lamps, and Hewitt mercury vapor lamps and other illuminants of kindred type, included under "Miscellaneous." There is more uncertainty about dynamos and motors, because here the question is complicated by the higher cost of copper, steel and iron, but the figures are probably not far out of the way. Even submitting the estimated grand total to a discount of 10 per cent, it is certainly impressive to find the American people's bill in 1905 for electrical apparatus rising to $200,000,000, or about $2.50 per capita.

The next element to consider in the annual calculation is the earnings of the operative, "public service" companies that stand between the producing manufacturer and the people, as a necessary means for furnishing electrical communication, transportation and illumination. Here again the bases of close estimate were laid in the census work, predicated upon which the following table may be presented as an approximation:

	1904.	1905.
Telegraph and Cable	$40,000,000	$45,000,000
Telephone	110,000,000	140,000,000
Electric Light	120,000,000	135,000,000
Street and other Railways	290,000,000	325,000,000
Isolated Plant Supply	60,000,000	75,000,000
	$620,000,000	$720,000,000

This does not include electrometallurgy, electrotherapy, municipal fire alarms and telegraphs, train telegraphy, etc. Added to the total for electrical manufacturing, it seems fairly safe to assert that in 1905 the electrical bill of the American people reached the billion-dollar mark.

In the items just given above some of the figures are conjectural, as, for example, isolated plant service. But in view of the statement often made that isolated plants use up about half the lamp production, and seeing the vast increase in factory and mine power plants, it strikes one as probably quite plausible. The startling thing is to see the telephone earnings outrun those of central stations, but we believe this to be actually the case. The census report showed telephone earnings in 1902 to be just short of $87,000,000. They have certainly increased more than 20 per cent annually since, but at that rate would be about $147,500,000 in 1905. Central station earnings in 1902 were not quite $86,000,000, and have not maintained a 20 per cent gain since; perhaps 15 would be nearer the mark, so that $135,000,000 is a liberal allowance for last year but not excessive, as the stations are entitled to an allowance for earnings by street railways on their lighting systems. The splendid street railway earnings shown are well justified by the facts. The census report gave gross earnings in 1902 as $250,500,000 and a 10 per cent annual gain would give a total in excess of that here set down. We have little hesitation, therefore, in presenting our figures not only as worthy consideration, but deserving of acceptance, gigantic as they may look, and tremendous in magnitude and significance as they undoubtedly are. The two centuries since Franklin's birth have been what they were because of the electricity he helped to subdue to human utility.

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THE GREAT TELEPHONE DEVELOPMENT.

One of the significantly large developments in the electrical field in 1905 was that witnessed in telephony. The growth there was probably much greater than in any other branch of electrical application. It might have seemed that the violent outburst of activity noted four or five years ago would have worn itself out or at least quieted down into sober advance, but the activity is so steadily maintained at a high rate it would appear to be normal rather than abnormal. At least there is still every sign that the industry is far from the point of saturation, and he would be a bold man who would predict just what that point is likely to be. A brilliant illustration of this growth sustained at a high rate is furnished by the New York Telephone Company. In June, 1899, that corporation had 32,190 subscribers in the Borough of Manhattan; in May, 1905, the number was no less than 148,595. Such expansion might seem exceptional, but in the figures just issued for the five boroughs of Greater New York for January 1 we find that the telephones in service and under contract were 242,155, showing a gain for the year of 51,491. That is an increase at the rate of at least 30 per cent per annum!

We know no good reason why 30 per cent should not be applied as a rate of telephonic growth all over the country, but it is certainly conservative to take 20 per cent, and even 25 might be safe. Dealing with the telephone industry as it was in 1902, it will be seen that some very striking figures emerge as to the conditions at the end of 1905. With 2,315,297 telephone stations in 1902, a steady gain of but 20 per cent gives over 4,000,000 at the end of 1905. The investment or capitalization was $348,031,058 and would now be $600,000,000. The gross income in 1902 was $86,825,536 and it would now be not less than $150,000,000. To some persons it may be incredible, but the fact is that the telephone industry has now surpassed in profit and productiveness the central station industry. That its pace will slow down somewhat, presently, like that of the lighting business, is highly probable, but as we have said there is absolutely no indication of any immediate intention on its part to do so.

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THE CENTRAL STATION SITUATION.

Within the past year or two it has become quite unpleasantly evident that the business of the electrical supply stations, especially in some of the larger ones, has, in spite of great apparent prosperity, and of steady improvement in the art, failed to show the full measure of growth that was fairly to be anticipated. Efforts to increase sales have never been so well organized and persistent as during this period, but their effect has been less considerable than one would desire and the net result has been somewhat discouraging. We have the welfare of the central station business deeply at heart and purpose to devote more space and attention to it than ever before. We are minded therefore to examine closely the present situation and to inquire into the causes which have led to it, with the hope of finding some adequate remedy. Without going at length into the dismal science of statistics, the fundamental facts in the case are about as follows: At the beginning of the last decade the use of electricity for lighting and power was growing with enormous rapidity. For some years the rate of increase rose steadily, especially in the larger centers of population, and it looked as though there could be no break in the era of prosperity. Within the past three or four years, however, the rate of growth has tended to diminish in many places, and while we do not recall any instance in which business has actually diminished, there are many places in which the increase has barely kept pace with the increase in population and property, or has failed to do even this. Looking at the matter quite without prejudice, such a situation must be anticipated in the growth of any commercial enterprise. There is a limit to the use of any commodity whatever, and the more rapidly its use grows during a certain period the more probable is a diminution of growth at a later period. Especially is this the case when the article in question is a luxury in the sense that it is not necessary to the continued comfortable existence of the great mass of the people. And in this regard artificial illumination as conducted at the present time must be so classified. We do not believe in reverting to the tallow dip of our great grandfather's, nor do we believe that the supply of great men will be permanently diminished from the disuse of the pine knots by which they were wont to read. The fact remains, however, that for purely utilitarian purposes, electricity and gas, and to a very large extent, oil, can be used interchangeably, and that the first named has found a very extended use for decorative and display lighting and for public illumination on a lavish scale. In other words, electric lighting during the past ten years has, in virtue of its very great effectiveness and convenience, perhaps risen considerably above its true economic plane as determined on a strict competitive basis. This does not mean that the electric lighting business is overweighted and is going to the dogs, but merely that a certain part of its growth—say, sign lighting, for example—which has served as a basis of comparison, is not normal economic growth at all. The units of artificial light per inhabitant in New York, for example, are greatly in excess of those found in any foreign city of the first class, and of the excess by far the largest portion is in electric lighting.

This at once discloses the sociological element of the problem. A great and prosperous city can and does demand much in the way of luxury; but the amount required depends not on the bank clearings so much as upon their distribution. A distinguished New York financier is reported the other day to have loaned $30,000,000 of call money, in spite of which we venture to assert that his electric light bill is altogether modest. The long and short of it is that for articles which are not necessaries of life, the market is both limited and greatly dependent on the general conditions of prosperity, so that it can neither be expected to increase indefinitely nor even to increase with the population. Of the growth in electrical service in recent years, the healthiest part has been in motor service, which has taken place along economic lines strictly; and this having been pushed vigorously has itself produced a rate of growth which obviously cannot continue indefinitely since it has taken place first in those lines where the economic necessity has been the greatest. If one were to express graphically the increase of sale of current for any given purpose in any given place over a series of years the curve would only be prevented from becoming asymptotic by a growth in population or in industry, and hence the summation of any number of such curves would partake of the same property.

The most that could be expected would be a final rate of growth commensurate with the increase in population and industry; and since the increase in population at the present time does not imply an increase in buying power per capita, but upon the whole a probable decrease, there are forces at work tending to counteract the favorable effect of growth. It is nothing surprising therefore that in the larger centers the extraordinarily rapid growth of electric service has of late been somewhat retarded, apart from all questions of competition. The extremely great rate of increase maintained for some years past could not in the nature of things hold up indefinitely. It may be temporarily resumed if new or undeveloped fields for the use of electricity are found and successfully exploited. Normal growth, apart from such fresh opportunities, must be pushed on a sharply economic basis in face of competition occasionally severe, and the policy of the supply companies must be guided by this condition. The period of rapid exploitation is closing and future growth must take place along rigidly commercial lines. There is no use in mincing words on this subject—the issue must be faced squarely. The more clearly it is understood, the less danger will there be of shutting one's eyes to the situation and drifting along, or of trying by temporary expedients to dodge the inevitable. The electrical central station business is far from a failure and is a permanent successful growing part of our civilization. The only fear for the future lies in carrying the extravagant, obsolete methods of the necessary period of exploitation into the administration of a steadily expanding competitive business. Of this condition, in some of its interesting and important features we purpose to speak later.

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Progress in Power Transmission.

Electric power transmission as an art has of late been upon waiting orders. In spite of no little activity in the building of new plants, particularly for the work of supplying interurban railways, it is a singular fact that the maximum voltage in commercial use has not been materially increased in the last three or four years. Of course, the average voltage has risen notably within that period, and plants at 20,000 volts and over have greatly increased in number, but the upper limit of pressure still sticks at or a little below 60,000 volts. We hear repeatedly of projects at higher voltage, but the plants do not seem to go in. The fact is that the transformer maker has for the time being apparently outstripped the insulator maker, and further progress depends on the latter. Aside from line insulation, power transmission at high voltage presents few difficulties. Perhaps the increasing use of steel tower and other long-span construction will in the future considerably simplify the task of line insulation. Nevertheless, steel tower lines depend on the integrity of the insulators more than do wooden pole lines, and the fundamental requirement for progress is an increase in the factor of safety in the insulators themselves. It will not do to push beyond 60,000 volts with insulators having even at that pressure inadequate factors of safety. Within the past year there have been for the first time produced insulators that have what may be considered a proper margin of safety above 60,000 volts, and therefore further advance must now be looked for.

Insulators with a sparking test in the neighborhood of 200,000 volts have now been designed, and these should considerably improve conditions on 60,000-volt circuits. The factors of safety hitherto common have been about 2.5, which is too low for really secure conditions, especially when using steel construction. When it comes to 80,000 and 100,000 volts or even higher figures, no insulator yet put on the market has sufficient margin of safety. To this difficulty may be traced the various suggestions regarding the use of the constant-current system, particularly with reference to the grandiose Victoria Falls project, which has been recently revived, and was elaborately discussed in these pages last week by Mr. Frank J. Sprague. It is undeniable that so far as the voltage strain upon the insulators is concerned, direct current has a very considerable advantage. Whether this is diminished materially by the electrolytic conditions that exist with direct current is a subject of discussion upon which little light has yet been shed. In view of the results from the large continental constant-current systems, one cannot well avoid taking the method seriously, however disadvantageous it appears as regards ordinary cases of power transmission. Direct-current working clears up most, though not all, of the difficulties due to inductance and capacity, and also tends to diminish the difficulties of lightning protection. The whole matter is likely to have a thorough overhauling in connection with the Victoria Falls project and the results will certainly be of interest.

One of the not inconsiderable factors in the development of power transmission schemes during 1905 has been the high price of copper, which still continues. The metal is certainly now at an abnormal figure, which can hardly be long maintained, although the natural tendency for some time has been upward. The effect of present prices will certainly be to encourage the use of aluminum in line construction, and also the employment of higher average voltage. A rise of 25 per cent in voltage will overbalance a rise of 50 per cent in the price of copper, and this fact of itself should make halfway measures in voltage unpopular. As to engineering features, one of the most interesting plants installed during the past season and described in these pages was that of the Chittenden Power Company in southern Vermont, unique in that the hydraulic plant is to all intents and purposes entirely artificial, being so devised as to store a large fraction of the rainfall over a limited drainage area so as to give a power supply throughout the year. There have been many plants in connection with irrigation ditches, but we know of no other case in which a new power has been created entirely for transmission purposes. It is worthy of special comment as emphasizing some latent possibilities in power supply. The time may arrive when conservation of rainfall may become an important feature of transmission economics. But this, like power transmission from coal mines, awaits a still further increase in the cost of fuel. Many recent transmissions, it is true, are from steam stations for railway purposes, but the stores of low-grade coal remain unutilized. Nor has there yet been inaugurated in this country any general power distribution from steam power like the Lancashire and Yorkshire projects in England, although we expect soon to see them. Considering the rising price of fuel and the comparatively high transportation charges outside of a somewhat limited area, the subject is well worth investigation, particularly since the economy of steam or gas generating plants is undergoing considerable improvement of late. The installation of the first of the great gas engine-driven units of the California Gas & Electric Company is a plain intimation that the gas engine cannot be left out of the reckoning. Although the circumstances in this case were of a very special character, the gas auxiliary has some important advantages, and if the California experiment turns out well, it is altogether likely to be repeated elsewhere.

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THE QUESTION OF PRIME MOVERS.

The past year has produced but slight change in the power-plant situation as regards the relative status of the various types of heat prime-movers before the engineering public. The steam engine, steam turbine and gas engine still divide the field of central station practice, with the gas turbine still below the horizon, but much talked of, written about and awaited by many as the next possible factor in the line of progress. Between the reciprocating steam engine and the steam turbine there has been but slight relative change. The latter must be accepted as thoroughly established in the field of power plant engineering, as as possessing peculiar advantages of a mechanical and adaptive character with reference to the opertion of electric generators under the condition of large central-station practice. Distinct progress has been made in the size of units available, so that turbines of a rated power of 7,500 hp to 8,000 hp and capable of an overload up to 10,000 hp and over, are now available for the purposes of central station practice. For several large installations during the past year the turbine has furthermore been selected in preference to the reciprocating engine, while in others the latter has been preferred, and on the whole the relative estimation of the two types of prime movers seems to have undergone but slight change during the year, with perhaps one exception to be noted below.

The main points on which superiority for the turbine has been claimed have related to ecomony, high rotative speed and uniformity of angular velocity. High rotative speed conduces to small size of rotating member in the generator, while uniform angular velocity is a feature of special importance with reference to the operation of alternators in parallel. These features are of course inherent in the construction of the turbine. Regarding the first point, however, the turbine can scarcely be said to have made good, at least in the degree looked for by those interested in its development. Economy is dependent on many variables, in each form of prime mover being quite differently made up, and yet the surprising result is found that the best steam turbines and the best reciprocating steam engine are in the same ultimate class as regards thermal economy. In fact, actual tests under reasonably parallel conditions show so little difference that no judicially minded engineer is likely to give the small actual difference very serious weight as a determining factor by itself; and so far as guarantees indicate, the builders of reciprocating engines seem willing to cover fully, and in some cases to better, the proposals of turbine builders, with, of course, vastly more of precedent and experience behind them. There still remain the advantages inherent in high rotative speed and uniform angular velocity within the revolution. The latter point, however, is one on which the reciprocating engine builder is not disposed to concede too far, and within reasonable limits he seems quite ready to give guarantees satisfactory to the usual demands of central station practice. The steam turbine has undoubtedly come into the field of power plant engineering to remain as a factor of importance, and its field of usefulness will presumably be one of continually increasing importance. On the other hand, it hardly seems likely from present showing that the reciprocating engine is destined to disappear or to be dispossessed of a large and important share of this general field of service.

Turning now to the gas engine, the year has recorded distinct advances along the line of adaptation and increase in size of available units, and several important installations have been made, such as that of the United Gas and Electric Co. in San Francisco, and that of the Warren and Jamestown single-phase electric railway plant. The chief limitations of the gas engine remain, however, as heretofore—irregularity of torque and consequent variation of angular velocity, with less adequate mechanical adaptation to variation in the load and especially to extreme overload, than either the steam engine or steam turbine. Multi-cylinder engines and large fly-wheels go far to reduce these limitations, however, and in the opinion of many far-seeing engineers the internal combustion engine in one form or another seems more likely to be the coming type of prime mover than any of its competitors now in the field. The problem of the gas turbine as a practicable form of prime mover still remains unsolved, but interest in the possibilities along this line was never keener than at the present moment, and much serious attention is now being directed to the study of this problem. In a recent paper M. Dugald Clerk takes a decidedly discouraging view of the prospect, and gives good reason for the belief that the gas turbine can never rival in efficiency the reciprocating form of internal combustion engine. Lücke and Reeve reach somewhat similar conclusions though from varying points of view.

An interesting line of possible progress, available in certain cases, is found in recent propositions to join the reciprocating steam engine and the steam turbine in series, operating the latter on the exhaust of the former. This is entirely legitimate from a thermodynamic viewpoint, lengthening out, as it does, the operating range of temperature. The result may well show an excellent economy, and under certain conditions the use of the two forms thus combined might result in a final economy better than with either type alone. In a recent proposition involving such a combination, one kw-hour from the turbine was guaranteed on a consumption of 45 lbs exhaust steam at atmospheric pressure. The chief questions which will arise in connection with such combinations are, however, mechanical, and will have relation to adaptation and general utility; and unless the somewhat unnatural combination can be in part justified on this score it may be doubted whether the moderate gain in over-all economy likely to be realized will be sufficient in itself to insure favorable consideration for such a combination as a general solution of the power-plant problem.

On the whole, the indications for the coming year seem to point to continued use of the three principal types of prime mover already in the field, with some relative gain on the part of the steam turbine, and still more pronounced progress on the part of the internal combustion engine. The power plant engineer will do well to hold carefully focused in view advances along all of these lines, not only with respect to the prime movers themselves, but also with respect to the many combinations of main and auxiliary equipment which go to reduce the ultimate loss of heat unutilized, and to raise the final plant efficiency as expressed by the ultimate cost of power per unit hour, with all elements of cost included which are properly chargeable to the power account.

Progress of Electrical Science in 1905.

The year which has just completed its calendar has witnessed marked development in the sciences of electricity and magnetism, as well as in their applications. In a certain sense a measure of the development in a science is found in the degree of the development of its applications. For if a science has no applications, it remains but a theory and a conceit. Its notions must necessarily be abstract, its language symbolic, and its study recondite. As, however, the applications of a science develop, its ideas become concrete, its language vernacular and its study both pleasurable and profitable. Under continued and multiform applications the gap which at first divides theory from practice narrows into nothingness. There has long ceased to be any visible division between theory and practice in electromagnetism. The publication early in the year of the discovery of the Heusler magnetic alloys of substantially non-magnetic component metals has been confirmed in various laboratories and has greatly extended our concepts of the nature of permanent magnetism. It is now generally believed that Ampère's theory of permanent magnetism is true, but in a different sense from that contemplated at the date of its promulgation. Ampère attributed the permanent magnetic properties of steel and other magnetic metals to the circulation of electric currents in the molecules of those metals. Each molecule of steel had a little electric current circulating in it, day and night, Sundays and weekdays, forever. What source of supply kept the molecular currents going was left unsuggested. Now it seems abundantly evident that every atom of matter, not merely iron matter, but matter of every kind, is composed fundamentally of minute electric charges or ions, and that these electric charges move with great speed in definite paths, or microcosmic orbits, about the electric center of the atom. Each atom appears to be a planetary system on a lilliputian scale, and the ions are the planets, millions or billions of whose years or orbital revolutions may be comprised within a single second of our time.

It is also so well known as now to be axiomatic that a moving electric charge is the electric equivalent of a current of electricity. Consequently, the orbit-spinning ions give the electric currents postulated by Ampère's theory of permanent magnetism. If the orbital revolutions of the ions are formed both of positive and negative charges in the same direction, or if the orbits are such as to displace themselves successively, the magnetic behavior of the individual atoms or planetary systems may be either trivial or zero. What is needed for powerful permanent magnetism in an atom is plenty of ions moving very rapidly in large orbits and all in the same manner from the point of view of electric currents. According to this conception, the reason that iron, nickel and cobalt are inherently magnetic is that the orbital movements of the ions in the atoms and molecules of these bodies is organized symmetrically for current rotation, whereas in the atoms of other substances the ionic movements are either electrically dissymmetrical or rhythmically irregular. It so happens, according to this theory, that in iron, nickel and cobalt, whose atomic weights are 56, 58.7 and 59, respectively, the ionic currents or charge orbits are of the right microastronomical adjustments to produce a perpetual magnetic field at distances that are great compared with the size of the orbits, or the size of the atom. The fact that the atomic weights of these the only three powerfully magnetic substances lie so close together, suggests that the orbital motion is associated intimately with the atomic weight.

The discovery that the alloy of the three substantially non-magnetic metals, manganese, aluminum and copper, results in producing a substance almost equally magnetic with nickel and cobalt, indicates that it is possible to associate atoms of different substances in such a way that although the ampere-turns in the ionic orbits of each is almost zero, yet the resultant molecular ampere-turns may be considerable. This might be conceived of in several ways. One way would be to suppose that the close vicinity of two different atoms would modify the ionic orbits of each in such a manner that the ampere orbits of the two together should give a definite resultant in a given time; whereas the ampere orbits per second of either acting alone would sum up to zero. Although no progress has yet been reported upon the magnetic qualities of alloys produced in the research attending the original discovery, yet the hope is now entertainable that the magnetic properties of iron may be exceeded artificially, or that the possibilities of Nature in the development of ionic ampere orbits have not yet been fathomed. If there were found any cheap process for treating iron, for instance, so as greatly to enhance its magnetic properties, the discovery would be likely to have much value in the electric arts.

The researches made upon radioactivity during the past year have tended to confirm the theory that radium is an unstable atomic state of matter transitional between uranium and helium. Moreover, this theory is in consonance with the general ionic theory of matter, namely, that every atom is built up of electric charges moving in definite atomic paths or orbits, so that the different atoms differ from each other only in the number and in the arrangement of the ions and their orbits. Certain groupings of orbits will be more stable than others from an electrodynamic standpoint, and an unstable atomic cosmos in time must disappear. It is even possible that some degree of electrodynamic instability attends many atoms that have hitherto been reputed stable, and that ionic collisions may occur in these microcosmos, at very rare intervals, capable of disrupting the internal forces of cohesion. According to this speculation, the phenomena of birth, life and death are not exclusive properties of the organic world. Atoms, too, may be born, live and die. This is, however, traveling somewhat out of the rutty roadway of what is determined, into the outlying regions of unwarranted belief. The same prevalent tendency of view in regard to the ionic structure of all atoms is capable of accounting for the phenomena of inertia in gross matter, as a purely electromagnetic property of the ionic charge orbits or currents, to resist change by displacement. A sudden bodily movement of a piece of matter must change the orbits and, therefore, the electric currents, of nearly all the myriads of ions in the aggregate atoms thereof. Electric currents resist change, as we know by experiment. Mechanical inertia may, therefore, be accounted for by self-induction. Nevertheless, the identity has yet to be demonstrated.

The same ionic theory, which the past year has tended to emphasize, points to the idea that all matter being composed of atoms, and all atoms of moving ions, and all ions being perhaps nothing but individual electric charges, all matter may, therefore, be nothing but organized electricity. If this proposition holds then matter is ultimately only electromagnetically energized ether, and the known universe would contain only two entities, namely, the all-pervading ether, and energy residing therein, matter being a particular form of the energy. Gravitation should somehow be explainable, then, on an electromagnetic basis. Although various suggestions have been made in this direction, no generally accepted hypothesis of gravitation has yet made its debut. As to the ultimate nature of the universal ether and of energy we are still unenlightened.

The experimental progress of the applications of wireless telegraphy has thrown much light upon the theory of ordinary electric circuits closed through wires, and we may be said now to possess definite ideas upon the manner in which electric currents rise and flow. The study of wave motion in systems devoid of wires greatly assists the understanding of wire circuits.

THE ELECTRIC RAILWAY PROSPECT.

Last year was an interesting one in electric railway circles, not so much on account of the usual increase in mileage and number of motors as by reason of the continuation of the curious situation as between the old line conservatives who adhere to the nine and thirty articles of the direct-current creed, and the heretical come-outers who have set up alternating-current tenets of their own. The whole affair has dragged along for a couple of years with wonderfully little definite progress to report so far as large work is concerned. Until the past year it has been even as His Satanic Majesty's shearing of the pig—more cry than wool—but of late a good bit has been accomplished and the promises for the future have assumed somewhat definite form. There are now, here and abroad, some dozen single-phase roads, on various systems very much alike, and while exact details of operations are wanting it is now clear that there have been no fatal defects disclosed and that on the whole several systems have been reasonably successful. It must be confessed that most of the railway engineers have taken little active interest in the new departure, some damning with faint praise, others fuming at the very mention of the topic. But a point has now been reached at which the alternating traction motor must be taken seriously, not only as a very possible recourse for special service, but as an active competitor in many fields. It would be going too far, perhaps, to say that the alternating-current advocates have proved their case beyond peradventure. Rather they have earned the right to an entirely unprejudiced hearing.

The direct-current issue was forced when a few months since the New York, New Haven & Hartford Railroad placed a large order for alternating-current locomotives. This was not only a declaration of independence but an open challenge of the policy laid down by the New York Central for its terminus. The ensuing discussion is still active as our readers have observed. The question involved is really a very complex one. In the first place, the sufficiency of the series-wound compensated alternating-current motor for large work has not been proved by experiment. However probable success may be, an element of doubt is introduced in the premises, since there are undoubtedly somewhat serious difficulties to be overcome. Granted first-class operative properties in a general way, the alternating-current motor is admittedly somewhat heavier and less efficient than its rival, and if it be equipped for working on both alternating and direct-current circuits the controlling devices become somewhat cumbersome. Hence there is in the minds of some a doubt as to the practicability of using large alternating locomotives on the circuits of the New York terminus. On the other hand, it has recently been practically demonstrated that multiple-unit control can be successfully applied to the alternating-current motors, so that the objections to the system in cases where heavy suburban service must be dealt with cannot be taken seriously. Of course back of all the formal objections to alternating-current traction lies the fact that if it proves thoroughly successful a great trade in "standard" apparatus on which profits have become good will go to the dogs and a new period of development and experiment will be suffered. It will take, of course, some years to make anything like a complete change in equipment, but in certain directions, like the use of rotary converters, the pressure would be felt at once and strongly. Hence the current arguments on the subject are not altogether without commercial bias.

One who is disposed to take a somewhat conservative view of the situation realizes that in the long run improvement is a good thing even if for a time it disturb the comfortable serenity of established precedents. And even taking a rather roseate view of alternating-current traction it is still obvious that after all the choice between alternating and direct current is in railway work as in lighting merely a question of dollars and cents. In either case there are conditions which will render one or the other method commercially preferable, and the complete replacement of one by the other is altogether improbable. Many roads are to-day being equipped for heavy traction with direct-current motors and there has been especial activity in the substantial work of changing motive power on branch railroad lines. It is one thing to find a new method economical for a new equipment and quite another to show for it so great superiority as to demand an immediate change in apparatus. Many a lighting system has felt the force of a similar situation. In large railway systems the franchise and the permanent way commonly constitute by far the largest portion of the real assets and the distributing system is a minor matter. The power stations now in use could to a large extent be utilized for an alternating system to be sure, but with the possible gains from a change so small a part of the income, and the investment for the existing system still on the books with no current provisions for replacements, one can hardly expect reckless haste in making changes. It would be far more reasonable to expect that gradually there would come a use of alternating-current equipment for outlying lines and the necessary interchange with connecting systems, leaving certainly for a long time to come the main direct-current system unchanged. The great future value of alternating-current traction will be in the large work of equipping suburban systems and fast through lines of moderate length, and gradually opening the fertile field of general railway working. It makes little difference in the long run whether the special form of alternating-current traction now in sight meets all expectations or not. The main thing is that one should be able to utilize on the working overhead conductors a much higher voltage than there is any reasonable hope of getting with the direct-current systems at present in vogue. And we feel that this advance is looked for the near future by one route or another—and with polyphase traction by no means out of the race.

SEMI-MUNICIPAL OWNERSHIP.

Whenever in these days an electric light company is unfortunate enough to have a street lighting contract expire in a city where the municipal ownership of the street lighting plant has been agitated, there sometimes comes forth out of the chaos of ideas as to how the municipal ownership business should be handled some proposition from a private company which purports to have the welfare of the city rather than any private gain at heart. This company, with great love for the commonwealth, either real or assumed, usually comes forward with a proposition for a kind of "semi-municipal ownership," the company to perform the work of lighting the city for a number of years at a good round sum, and at the end of the contract the lighting plant to be turned over to the city free of cost and payment for the plant to be made out of the regular monthly payments of the city for its lighting, such monthly payments being invariably a good round sum per lamp. Now, such propositions as this may be made in good faith by a company of public spirited but misguided citizens who really wish to serve the city, and there are usually some respectable names connected with an enterprise of this kind when it is launched. However, there is usually an African somewhere in the woodpile or at least a strong possibility that there will be one before the game is through. It seems remarkable that any municipality in this day and generation can be deluded into the belief that any such scheme of semi-municipal ownership can compare for a minute with a good, straight, short contract at reasonable rates with a corporation already in the lighting field. After all, a redeeming feature to this scheme is that at the end of a term of years it is fairly certain to bring home forcibly to a municipality the depreciation due to advance in the art as well as the depreciation caused by wear and tear.

A number of central station men have been smiling audibly recently over the kind of gold brick a certain municipality in the middle west has been engaged in purchasing for several years past. A number of years ago, if the facts have been related correctly, it began to be whispered among the business men of this city that the rates charged by the electric lighting company then lighting the streets were excessive and that it would be a simple matter to form a company to do the street lighting if a number of such business men would simply give their notes in payment for a certain amount of stock in a new street lighting company, no cash payment being required upon the stock, as that would be taken care of by a bond issue. The new company was to light the city at a good, profitable figure per lamp and at the end of the contract the entire street lighting plant was to be turned over to the city without cost. Here was a bonanza not to be neglected. The company in the field lost the contract and a new plant was erected by the new company. Citizens who gave their notes for stock no doubt thought they were performing a valuable public service. After the first interest in the plan died out, it was a simple matter for other parties to buy the citizens' stock for nominal amounts inasmuch as it had cost nothing in the first place. In the course of time, the company was merged with another doing business in the same city. That, however, was immaterial except as it complicated matters when an attempt was made to come to a settlement at the end of the contract. At that time the city discovered that it had on its hands an entirely obsolete and inefficient plant; so inefficient, in fact, that the company carrying out the contract, while keeping the old plant intact to give back to the city, had seen fit to substitute during the latter part of its contract new and more efficient apparatus with which to carry out the plans of the contract in connection with its other business. About the only moral to this tale is that maintenance and depreciation cannot be obtained by any semi-municipal ownership scheme any more than by complete municipal ownership or by contract given to a private company, and the only ones to profit are the promoters. The chances are that since the selfish interest of the private company will insure a fairly economical management, the cost to the city in the long run will be lower than with any municipal or semi-municipal ownership plant. Events of this kind not only do harm to the best interests of a city, but promote bad feeling and create a general feeling of distrust, to say nothing of the detrimental effect on the investment already made in a central station in any town.

THE ADVERTISING VALUE OF A SUBSTANTIAL POWER HOUSE

The advertising value of a well-constructed and well-kept power station and its influence upon possible customers of the central station company are not to be overlooked. The small user of light or power is not likely to give the question of what kind of a station he is supplied from a second thought. The power user who has a number of employes and in cases where a failure of power results in considerable loss of time and money, to say nothing of the inability to carry out promptly the work in hand, is tolerably sure to consider the character of service and the power station upon which he will depend for his power if he throws out his small steam or gasoline engine and purchases power from the electric light company. He will consider, first, what kind of a service the company is actually giving and the number of interruptions which have come under his notice; and second, the chances for interruption by fire or other causes in the central station. If the power house is an old wooden building with oil-soaked floors, with a lot of oil-throwing belts, and kept in a general state of disorder, he is more than likely to think of the chances of fire or break-down, and rightly.

Even though as a matter of fact the losses on central stations by fire are small, the appearances are against the kind of station we have just pictured, and in considering the re-building of a plant and the making of it as substantial and fire-proof as possible, the company should figure, not only on reduced operating expenses and the wiping out of insurance premiums, but on the psychological or advertising value that a good, substantial station has in the community. Not only does a good station have a good influence on possible users, but the whole community will have more respect for a company maintaining a neat looking station. Along with this the appearance of the company's offices must be taken into consideration. Upon the power station's general appearance may often depend the securing of a contract for city water pumping. About the only argument that can be brought up against the awarding of a contract to a central station company for the pumping of the water in a small town where the company has made an offer to do the work for considerably less than it is costing the city, is that the central station service cannot be depended upon and is liable to an interruption to which a separate steam plant maintained by the city is not liable. A substantial fire-proof power house, coupled together with a long record of uninterrupted service, is the only thing with which to combat this latter argument.

Sprague-Westinghouse.

Elsewhere in this issue on page 64 *et seq.*, will be found an open letter from Mr. Frank J. Sprague to Mr. George Westinghouse, accompanied by other letters. Owing to the late receipt of this important matter, and the various exigencies connected with the publication of the present first number of the new Electrical World, we were unable to give this correspondence its proper place more forward among the contents. It was equally impossible to secure the proofs from the printing office in sufficient time to enable Mr. Sprague to make author's revisions as fully as required and to correct one or two minor slips of the typewriter.

Topeka Tiring of Municipal Ownership.

Topeka, Kansas, owns its street lighting plant. Some portions of the city now in darkness want more street lights, but there does not seem to be much enthusiasm in the city as to enlarging the plant to furnish these extra lights. When the Topeka Edison Company was granted a new franchise last summer, it is significant that the council had it inserted in the franchise that the Topeka Edison Company could, upon due notice, be required to furnish street lights at a reasonable price to be agreed upon should the city at any time so request. The city has already asked the company to furnish a certain number of lights, which the city lighting plant is unable to supply. This does not look as if Topeka was enthusiastic about the municipal ownership of its lighting plant.

Changes and Additions to the National Electric Code.

At the annual meeting of the Underwriters' National Electric Association, held in New York December 6 and 7, the following changes and additions were made to the National Electric Code. These changes will not appear in the Code until 1907, inasmuch as a revised edition of the Code will not be printed until after the next meeting of the Underwriters' National Electric Association, which takes place early in March, 1007; but it is very probable that the more important changes adopted at the meeting will be printed and circulated in the April edition of the supplement to the Code, which is published semiannually, containing a list of approved fittings:

On the recommendation of the Committee on Car Wiring, Rule 32 *g*, 2 has been changed to read as follows: "Heaters to be constructed with a protecting ventilated metal casing providing an air space of not less than two inches on all sides of the resistances. Heaters to be so located that the resistances will be not less than four inches below the under side of the seats or from any woodwork, unless the under side of the seat, or such woodwork, is protected by not less than one-fourth inch fire-resisting insulating material, or .04 sheet metal with one inch air space between the sheet metal and the seats or woodwork."

The following changes recommended by the Committee on High-Tension Motors were adopted: Rule 8. Motors. Fine print note: "The use of motors operating at a potential in excess of 550 volts will only be approved when every practical safeguard has been provided. Plans for such installations should be submitted to the Inspection Department having jurisdiction before any work is begun."

"*a*. Must, when operating at a potential in excess of 550 volts, have no exposed live metal parts, and have their base frames permanently and effectively grounded."

"Motors operating at a potentional of 550 volts or less must be thoroughly insulated from the ground wherever feasible. Wooden base frames used for this purpose, and wooden floors which are depended upon for insulation where, for any reason, it is necessary to omit the base frames, must be kept filled to prevent absorption of moisture, and must be kept clean and dry. Where frame insulation is impracticable, the Inspection Department having jurisdiction may, in writing, permit its omission, in which case the frame must be permanently and effectively grounded."

Fine print note:—"A high-potential machine should be surrounded with an insulated platform. This may be made of wood, mounted on insulating supports, and so arranged that a man must stand upon it in order to touch any part of the machine."

"In case of a machine having an insulated frame, if there is trouble from static electricity due to belt friction, it should be overcome by placing near the belt a metallic comb connected to the earth, or by grounding the frame through a resistance of not less than 300,000 ohms."

"*b*. Motors operating at a potential of 550 volts or less must be wired with the same precautions as required by rules in Class 'C' for wires carrying a current of the same volume."

"Motors operating at a potential between 550 and 3,500 volts must be wired with multiple conductor, metal sheathed cable in approved unlined metal conduit firmly securely in place. The metal sheath must be permanently and effectively grounded, and the construction and installation of the conduit must conform to rules for interior conduits (see No. 25 and No. 49 *j* and *k*), except that at outlets approved outlet bushings shall be used."

Fine print notes:—

"The motor leads or branch circuits must be designed to carry a current at least 25 per cent greater than that for which the motor is rated, in order to provide for the inevitable occasional overloading of the motor and the increased current required in starting, without overfusing the wires; but where the wires under this rule would be overfused, in order to provide for the starting current, as in the case of many of the alternating-current motors, the wires must be of such size as to be properly protected by these large fuses."

"The insulation of the several conductors for high-potential motors, where leaving the metal sheath at outlets, must be thoroughly protected from moisture and mechanical injury. This may be accomplished by means of a pot head or some equivalent method. The conduit must be substantially bonded to the metal casings of all fittings and apparatus connected to the inside high tension circuit. It would be much preferable to make the conduit system continuous throughout by connecting the conduit to fittings and motors by means of screw joints, and this construction is strongly recommended wherever practicable."

"High potential motors should preferably be so located that the amount of inside wiring will be reduced to a minimum."

"Inspection Department having jurisdiction may permit the wire for high potential motors to be installed according to the general rules for high potential system when the outside wires directly enter a motor room (see Section *f*). Under these conditions there would generally be but a few feet of wire inside the building and none outside the motor room."

c. Same as present section.

First fine print note now under Section *d* to be placed after this section.

d. Same as present section.

First fine print note to be transferred to Section *c*.

Fine print note:—

"Starting rheostats and auto starters, unless equipped with tight casings enclosing all current carrying parts, should be treated about the same as knife switches, and in all wet, dusty or linty places should be enclosed in dust-tight, fireproof cabinets. If a special motor room is provided the starting apparatus and safety devices should be included within it. Where there is any liability of short-circuits across their exposed live parts being caused by accidental contacts, they should either be enclosed in cabinets, or else a railing should be erected around them to keep unauthorized persons away from their immediate vicinity."

f. Same as present section.

Fine print notes:—

"When it is necessary to locate a motor in the vicinity of combustibles or in wet or very dusty or dirty places, it is generally advisable to enclose it as above."

"Such enclosures should be readily accessible, dust proof and sufficiently ventilated to prevent an excessive rise of temperature. The sides should preferably be made largely of glass, so that the motor may be always plainly visible. This lessens the chance of its being neglected, and allows any derangement to be at once noticed."

"From the nature of the question the decision as to details of construction must be left to the Inspection Department having jurisdiction to determine in each instance."

On the recommendation of the Committee on Switches and Cut-Outs a fine print note has been added to Rule 51 *j*, as follows: "Switches designed for use on Edison three-wire systems to be marked with voltages, that is, the voltage between the outside wires and the neutral, and also that between the outside wires followed by the ampere rating and the wires '3 wire.' For example, '125-250-v. 30 a. 3 wire.'"

All of the changes recommended by the Committee on Flexible Tubing were adopted. These changes are as follows:

Rule 50 *C*. Must be constructed to meet the following requirements:

"*a*. Must have a sufficiently smooth interior surface to allow the ready introduction of the wire."

"*b*. Must be constructed of or treated with materials which will serve as moisture repellants."

"*c*. The tube must be so designed that it will withstand all the abrasion likely to be met with in practice."

"*d*. The linings, if any, must not be removable, in lengths of over 3 feet."

"*e*. The ½-inch tube must be so flexible that it will not crack or break when bent in a circle with 6-in. radius at 50° Fahrenheit. Other sizes must be well made and the covering must be thoroughly saturated with a dense moisture-proof compound which will not 'slide' at 150° F."

"*f*. Must not convey fire on the application of a flame from a Bunsen burner to the exterior of the tube when held in a vertical position."

"*g*. Must be sufficiently tough and tenacious to withstand severe tension without injury; the interior diameter must not be diminished or the tube opened up at any point by the application of a reasonable stretching force."

"*h*. Must not close to prevent the insertion of the wire after the tube has been kinked or flattened and straightened out."

The following suggested changes in the Rules were adopted. Rule 1, Section *c*, Generators, was amended to read as follows:

"Must, when operating at a potential in excess of 550 volts, have their base frames permanently and effectively grounded."

"Must, when operating at a potential of 550 volts or less, be thoroughly insulated from the ground wherever feasible. Wooden base frames used for this purpose, and wooden floors which are depended upon for insulation where, for any reason, it is necessary to omit the base frames, must be kept filled to prevent absorption of moisture, and must be kept clean and dry."

"Where frame insulation is impracticable, the Inspection Department having jurisdiction may, in writing, permit its omission, in which case the frame must be permanently and effectively grounded."

First fine print note: "A high-potential machine should be surrounded by an insulated platform. This may be made of wood, mounted on insulating supports, and so arranged that a man must always stand upon it in order to touch any part of the machine."

Rule 4, Resistance Boxes and Equalizers, Section *c*, first sentence was changed to read: "Wherever insulated wire is used for connection between resistances and the contact plate of a rheostat, the insulation must be slow burning (see No. 43)."

Rule 11, Transformers, Section *b*, was changed to read as follows: "In Central or Sub-stations the casing of all transformers must be permanently and effectively grounded."

A point was raised in connection with this rule regarding the grounding of the series transformers in connection with instruments, and a committee was appointed with power to make provisions for the grounding or non-grounding of these small transformers.

A fine print note was added to Rule 12, Wires, Outside Work, Section *g*, to the effect that where service wires were brought into buildings through a single iron conduit an approved service head could be used.

A number of changes were made in Rule 13 A, Grounding Low-Potential Circuits. This important rule as it now stands with amendments is as follows:

"The grounding of low-potential circuits under the following regulations is only allowed when such circuits are so arranged that under normal conditions of service there will be no passage of current over the ground wire."

The following are the Code specifications for grounding direct-current, three-wire systems:

a. Neutral wire may be grounded, and when grounded the following rules must be complied with:

1.—Must be grounded at the central station on a metal plate buried in coke beneath permanent moisture level, and also through all available underground water and gas-pipe systems.

2.—In underground systems the neutral wire must also be grounded at each distributing box through the box.

3.—In overhead systems the neutral wire must be grounded every 500 feet as provided in sections *c*, *e*, *f* and *g*.

Fine print note: Inspection departments having jurisdiction may require grounding if they deem it necessary.

Two-wire direct-current systems having no accessible neutral point are not to be grounded.

On alternating-current secondary systems the Code specifications are as follows:

b. Transformer secondaries of distributing systems should preferably be grounded, and when grounded the following rules must be complied with:

1.—The grounding must be made at the neutral point or wire, whenever a neutral point or wire is accessible.

2.—When no neutral point or wire is accessible, one side of the secondary circuit may be grounded, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 250 volts.

3.—The grounded connection must be at the transformer, or on the individual services, as provided in sections *d*, *e*, *f*, *g*, and when transformers feed systems with a neutral wire, the neutral wire must also be grounded at least every 250 feet for overhead systems, and every 500 feet for underground systems.

Fine Print note: Inspection departments having jurisdiction may require grounding if they deem it necessary.

In making ground connections we must be governed by the following regulations:

c. When the ground connection is inside of any building or the ground wire is inside of or attached to any building (except central or sub-stations) the ground wire must be of copper and have an approved rubber insulating covering National Electric Code Standard for from 0 to 600 volts.

d. The ground wire in direct-current three-wire systems must not at Central Stations be smaller than the neutral wire and not smaller than No. 4 B. & S. gage elsewhere.

The ground wire in alternating current systems must never be less than No. 4 B. & S. gage.

Fine print note: On three-phase systems, the ground wire must have a carrying capacity equal to that of any of the three mains.

e. The ground wire should, except for Central Stations and transformer sub-stations, be kept outside of buildings as far as practicable, but may be directly attached to the building or pole by cleats or straps or on porcelain knobs. Staples must never be used. The wire must be carried in as nearly a straight line as practicable, avoiding kinks, coils and sharp bends, and must be protected when exposed to mechanical injury.

Fine print note:

This protection can be secured by use of an approved moulding, and as a rule the ground wire on the outside of a building should be in moulding at all places where it is within seven feet from the ground.

f. The ground connection for Central Stations, transformer sub-stations and banks of transformers must be made through metal plates buried in coke below permanent moisture level, and connection should also be made to all available underground piping systems, including the lead sheath of underground cables.

g. For individual transformers and building services, the ground connection may be made as in Section *f*, or may be made to water piping systems running into buildings. This connection may be made by carrying the ground wire into the cellar and connecting on the street side of meters, main cocks, etc.

Where it is necessary to run the ground wire through any part of a building it shall be protected by approved porcelain bushings through walls or partitions and shall be run in approved moulding, except that in basements it may be supported on porcelain.

Fine print notes: "In connecting a ground wire to a piping system, the wire should be sweat into a lug attached to an approved clamp, and the clamp firmly bolted to the water pipe after all rust and scale have been removed; or be soldered into a brass plug and the plug forcibly screwed into a pipe-fitting, or, where the pipes are cast iron, into a hole tapped into the pipe itself. For large stations, when connecting to underground pipes with bell and spigot joints, it is well to connect to several lengths, as the pipe joints may be of rather high resistance.

"Where ground plates are used, a No. 16 Stubbs' gage copper plate, about three by six feet in size, with about two feet of crushed coke or charcoal, about pea size, both under and over it, would make a ground of sufficient capacity for a moderate-sized station, and would probably answer for the ordinary substation or bank of transformers. For a large central station, a plate with considerably more area might be necessary, depending upon the other underground connections available. The ground wire should be riveted to the plate in a number of places, and soldered for its whole length. Perhaps even better than a copper plate is a cast-iron plate with projecting forks, the idea of the fork being to distribute the connection to the ground over a fairly broad area, and to give a large surface contact. The ground wire can probably best be connected to such a cast-iron plate by soldering it into brass plugs screwed into holes tapped in the plate. In all cases, the joint between the plate and the ground wire should be thoroughly protected against corrosion by painting it with waterproof paint or some equivalent."

A point was raised by Mr. Alex. Dow, of the Detroit Edison Electric Company, in connection with Rule 13 *A*, *b*-3, that the grounding of the neutral might not always be advisable at the intervals given, although already required in the Code, on account of the liability to unbalancing by stray currents from adjacent trolley systems, and a committee was appointed to consider Mr. Dow's suggestions.

Rule 14. Wires, Inside Work, Section *e*, second sentence of first paragraph of fine print note, was amended to read as follows: "The tube must be prevented from moving out of place, either by a cleat or knob at each end, or by tapping it securely in place."

Rule 17. Switches, Cut-outs, Circuit-breakers, etc. Inside Work, Section *d*, was changed to read as follows: Time switches, sign flashers and similar appliances must be of approved design and enclosed." etc.

Rule 21. Automatic Cut-outs. Constant-Potential Systems, Section *a*, fine print note was amended to read as follows: "Where switch required by No. *22 a* is inside the building," etc.

Rule 22. Switches, Constant-Potential Systems, Section *c*. Add after word "volts" "or when used as service switches."

Rule 24. Wires, Low-potential Systems, Section *c*. The following amendment to the first fine print note suggested: "Suitable protection on side walls may be secured by a substantial boxing, retaining an air space of one inch around the conductors, closed at the top (wire passing through bushed holes), and extending not less than five feet from the floor; or for direct-current systems each wire may be placed in an approved lined conduit sufficiently strong to withstand the strain to which it will be subjected, and with the ends protected by the lining or by approved insulating bushings; or plain iron pipes lined with approved flexible tubing may be substituted for lined conduit when the tubing extends from the insulator next below the pipe to the next above it."

Rule 24. Section *c*, first paragraph of fine print note. It was suggested to amend this by striking out the words "or metal sheathed" in the fifth line.

The ideas of both these suggested amendments to Rule 24, Section *c*, were approved and the Secretary was authorized to word a rule to cover both ideas.

Rule 24. Section *r*, was amended to read as follows: "Must be rigidly supported on non-combustible, non-absorptive insulators which separate the wire at least one inch from the surface wired over. Should preferably be run singly on separate timbers, and must be kept at least five inches apart. Must be separated from contact with the walls, floor timbers and partitions, through which they may pass by non-combustible, non-absorptive insulating tubes, such as glass or porcelain." To this rule will be added the substance of the following: "At distributing centers, outlets, switches or where space is very limited, the wires may be run not less than one inch apart when supported not less than every two feet; or when necessary to run wires still closer than one inch apart, each wire must be run in separate approved flexible insulating tube or in approved iron conduit."

Rule 25. Interior Conduits. Section *d*, it was suggested to add a fine print note as follows: "Outlet or junction boxes are not required when the conduit terminates at appliances, such as meters, transformers, dynamos, and switchboards or switches and cut-outs when they are approved without enclosing."

The general idea of this suggestion was approved, and the matter was referred to a sub-committee for action.

A clause was added to Rule 25, Section *c*, and to Rule 24 *A*, to the effect that the conduit pipe in an equipment must be mechanically secured.

The following new section was added to Rule 26:

"All fixture arms made of tubing smaller than ½-inch outside diameter, also the arms of all one-light brackets, must be secured after they are screwed into position by the use of a set-screw properly placed, or by soldering or cementing or some equally good method to prevent the arms from becoming unscrewed. Arms must not be made of tubing lighter than No. 18 B. & S. gage, and must have at screw joints not less than five threads, all engaging. This rule does not apply to fixtures or brackets with cast or heavy arms."

Rule 27. Sockets. Section *b*; the suggestion that over especially inflammable stuff waterproof sockets must be used was adopted. The reason was not due to the waterproof feature of the socket, but because of the superior and peculiar construction of the waterproof socket.

Rule 42. Slow-burning Weatherproof Wire, Section *a*; the location of the second fine print note was changed so that it comes immediately under the heading of the rule on page 73.

Rule 42, Section *b*. The words "if it is on the outside" were omitted from the last line.

Rule 42, Section *c*. The words, "and must be thoroughly slicked down if it is on the outside," were omitted.

Rule 45. Flexible Cord. Section *f*, was amended to read as follows:

"Flexible cord for portable use except in offices, dwellings or similar places, where cord is not liable to rough usage, and where appearance is an essential feature, must meet all the requirements for flexible cord 'for pendant lamps,' both as to construction and thickness of insulation, and in addition must have a tough, braided cover over the whole. There must also be an extra layer of rubber between the outer cover and flexible cord, and in moist places the outer cover must be saturated with a moisture proof compound, thoroughly slicked down, as required in 'weatherproof wire' in No. 44. In offices, dwellings or in similar places, where cord is not liable to rough usage, and where appearance is an essential feature, flexible cord for portable use must meet all of the requirements for flexible cord for 'pendant lamps,' both as to construction and thickness of insulation, and in addition must have a tough, braided cover over the whole, or, providing there is an extra layer of rubber between the flexible cord and the outer cover, the insulation proper on each stranded conductor of cord may be 1/64 of an inch in thickness instead of 1/32 of an inch as required for pendant cords."

Rule 51. Snap Switches, Section *s*, third line of last paragraph. After the words, "rated current," the words, "at rated voltages," were added.

Rule 62. Transformers, Section *b* (1), was amended to read as follows: "Shall be run for eight consecutive hours at full load of watts under conditions of service, and at the end of that time the rise in temperature, as measured by the increase of resistance of the primary and secondary coils, shall not exceed 135 degrees Fahrenheit."

Rule 62. Section *b* (2), was amended in the second line by changing the words, "five minutes," to "one minute." This amendment was made contingent upon its having been officially made by the American Institute of Electrical Engineers.

Rule 64, Signaling Systems. The bold-faced heading just previous to Section *a* was transposed so that it should be just previous to Section *b*, and the last line was changed to read, "Sections *b* to *m*, inclusive, do not apply."

Rule 64, Section *o*, was amended to read as follows: "Wires where bunched together in a vertical run within any building must have a fire-resisting covering sufficient to prevent the wires from carrying fire from floor to floor, unless they are run either in non-combustible tubing or in a fireproof shaft, which shaft shall be provided with fire stops at each floor. Signaling wires and electric light or power wires may be run in the same shaft, provided that one of these classes of wires is run in non-combustible tubing, or provided that when run otherwise these two classes of wires shall be separated from each other by at least two inches. In no case shall signaling wires be run in the same tube with electric light or power wires."

Fine print note: "Ordinary rubber insulation is inflammable, and when a number of wires are contained in a shaft extending through a building they afford a ready means for carrying fire from floor to floor, unless they are covered with fire-resisting material, or unless the shaft is provided with fire stops at each floor."

Rule 69, Wires, Marine Work, Section *g*, first fine print note, was amended so as to strike out the word "flame-proof" and change the word "water-proof" to "water-proofed."

The suggestion that Rule 17-*a* be modified so as to require no protective devices on switch in the neutral of three-wire systems, and the resolution passed by the National Conference that "in cases of three-wire systems with grounded neutral a solid connection without fuse be permitted on the neutral wire," were referred to a special committee for action.

The suggestion that Rule 69 under Marine Wiring should require the use of a flame-proof braid where wires are on switchboards, and therefore exempt from being enclosed in moulding or conduit, was adopted.

An amendment to Rule 27, Sockets, Section *b*, fine print note, was suggested as follows: "Water-proof sockets must be hung by separate stranded rubber-covered wires not smaller than No. 14 B. & S. gage, which should preferably be twisted together when the pendant is over 3 feet long. These wires must be soldered directly to the circuit wires, but supported independently of them." This amendment was referred to a committee which recommended that the fine print note be incorporated in the rule so as to eliminate the fine print note entirely.

There has developed in some cases, especially with private water companies, opposition to attaching the ground wire to pipes and, in fact, some companies have prohibited it. In order that the electric lighting companies might have something besides their own opinions to offer on this subject where such opposition is met with, the Underwriters, at the suggestion of the National Conference on Standard Electrical Rules adopted the following resolution:

"Resolved: That it is the sense of this meeting that the grounding of secondary alternating current systems to water pipes, places no additional burden or menace on such water pipes."

A number of other matters came before the meeting which met with more or less approval; but these were referred to subcommittees for consideration, conference, and arranging in just the shape that they should appear in the Code, or for report to the full Electrical Committee at a later date. Among these were the rating of variable speed motors, uniformity of voltage classification in the rules and specifications for fittings, special rules for theater wiring and for equipment of electric cranes, etc.

The Automobile Show.

The sixth annual show of the Automobile Club of America is to be opened on January 6 in the new armory of the Sixty-ninth Regiment, N. G. S. N. Y., New York City, the armory being thus open to the public for the first time. The floor space available in this vast edifice is 152,000 sq. ft.

Test of 7,500-HP. Engine of the Interborough Rapid Transit System.

In accordance with the terms contained in the contract between the Allis-Chalmers Company and the Interborough Rapid Transit Company, governing the construction and operation of the nine double-cross-compound engines in the latter's power station at Fifty-ninth Street and Eleventh Avenue, New York, the former guaranteed certain operative results under specified conditions, in effect as follows:

Each engine was not to require more than 12.25 lb. of dry steam per indicated horse-power per hour, when indicating 7,500 hp to 75 r.p.m., with a vacuum of 26 in. at the low-pressure cylinders, and with a steam pressure at the throttle of 175 lb., said rating to include all steam used by the engine or by the jackets or reheater. A further memorandum agreement formulated by the representative engineers of each company governed in detail the conduct of the test; this secondary agreement being necessitated by certain features peculiar to the case involving the very essential point of the original contract.

The swing of the generator load, which averaged approximately 12 per cent plus or minus in three seconds, presented a prohibitive impediment to the use of the ordinary engine indicator as a standard for results. Thus the only method practicable was to obtain the developed electrical horse-power of the unit and correct this by the amount of the engine friction and generator losses as determined by subsidiary tests. The final decision was to make friction determinations by two methods, hereinafter designated and described as the electrical method and the continuous indicator method, the former to be considered decisive if checked up to within 10 per cent by the latter.

The engine designated as No. 8, being so situated as to permit of being isolated as a unit from the rest of the plant, was selected as representative of the complete installation. All steam and water mains and auxiliary lines in the unit were either entirely cut off from the rest of the house or separated by two valves and a bleeder or drip valve between. The unit as thus isolated consisted of seven boilers, the water ends of a boiler feed pump and a circulating pump, respectively, and the main engines.

Apparatus as required for the test was installed as follows: For weighing the total feed water as delivered by the supply line, four tanks, mounted in pairs upon two 24-ton scales, with a capacity per pair of 28,000 lb. of water, were used. The water from the weighing tanks was delivered to two reservoir tanks connected by equalizers, and then in turn to the boiler feed pump. For weighing of drips, leakage, etc., small scales and tanks were erected as necessary. Due allowance was made for all known leakage and drips. Readings were taken at fifteen-minute intervals, an hourly graphical log being maintained.

The load on the engine was measured electrically, by means of four balanced three-phase watt-hour meters of the induction type, connected to current and potential transformers, located at the terminals of the alternator.

As the potential transformers were designed for use under closely defined conditions, and could, therefore, be accurately standardized by the makers, their ratio, which is 100 to 1, was assumed to be correct. In the case of the current transformers, however, where the ratio is subject to change, due to changed secondary resistance, the ratios were re-checked under actual operating conditions. It can be seen that this method of test will correct for any error due to inductance in the secondary circuit, caused by running the current transformer leads in iron pipes, which could not be corrected for in the original manufacturer's ratio test. This test was repeated for phases 2 and 3 under similar conditions.

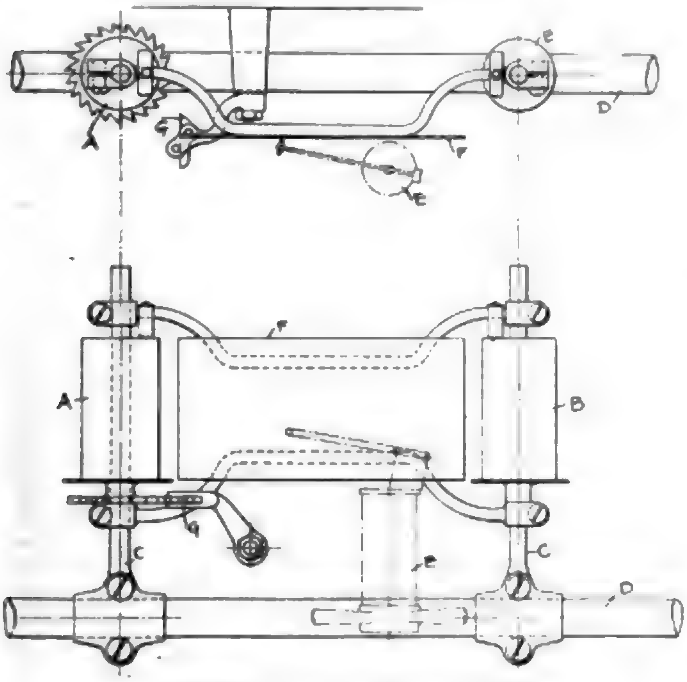
The meters were connected as follows: One in the secondary of the current transformers in phases 1 and 3, respectively, and two in that of phase 2, the object of this method being to show by the readings of the meters in the three phases that the load was balanced, while the object of the two meters in a single phase was to furnish a continual check on the calibration of the meters. It was found that all meters agreed within their limit of precision, and results were, therefore, calculated from the average of the readings of the four meters, which was taken to be the true output of the generator in kw-hours.

The combined losses in the unit were ascertained by driving the generator as a synchronous motor with the engine trailing, and measuring the watts input, which, it can be seen, would consist of combined friction and windage, I^2R losses and iron losses. As this input was too small to be measured accurately by means of the four load meters, a special meter with its standardized current transformer was used.

The unit could not be motorized for periods longer than five minutes because of the difficulty in lubricating the cylinders, which time was not long enough to allow of obtaining a dial reading on the meter; so the meter during the short run was read by counting the revolutions of the disc, timing same with two chronograph watches reading to tenths of a second, the mean power being figured by the usual calibrating formula. During this period the field current was held at that value corresponding to full-load excitation in order to make the iron losses the same as at full load. The armature volts and amperes were also read at 10-second intervals in order to obtain the power factor, which, due to the overexcitation of the field at such small load, was low, averaging for the several trials .185, with a leading current. As the meter used for this test was calibrated at a power factor of 1.0, it was necessary to check it on low values, and readings were, therefore, taken with a leading current at 10 points from 0.1 to 1.0, and a curve plotted, showing the error, which curve was used to correct all readings taken on the friction trials. To this corrected input, as the armature current was below full-load value, was added the difference between the I^2R losses at the observed value and that corresponding to full-load current. From the above the output of the generator plus the input to the generator when run as a motor, plus the difference between the I^2R loss at motor current and the same at full-load current, equals the total load on the engine in kilowatts.

The work of calibrating the electrical standards was performed by the Electrical Testing Laboratories of New York in all cases, and in addition, by comparison with the Interborough Company's own standards whenever possible, in all of which cases the same agreed within the limits of precision of the instruments tested.

For the purpose of determining the friction a continuous indicator was designed by Mr. W. L. Seabrooke, of the Interborough Company, which instrument solved the problem of indicator application to the engine. This device consists of two drums, *A* and *B*, turning freely on spindles, *C-C*, mounted on the mandrel, *D*, which has a reciprocating movement in front of the indicator, *E*, the latter being of regular standard design, except for the removal of the drum. A strip of paper winding on *A* from *B* passes over the plate *F*, thus presenting a flat recording surface. As the back pressure line is traced, the ratchet, *G*, contacts with the toothed wheel under the drum, *A*, causing it to rotate a fixed distance. This movement defines the distance between successive cards, and can take place at any point of the stroke desired. As the back pressure line is usually straight, no error is introduced and the cards present the same appearance as if taken singly. The operation is automatic, and a card is recorded for each revolution.



CONTINUOUS INDICATOR DIAGRAM DEVICE.

Using this device, two sets of indicator cards were taken on the engine running empty; one for a period of two minutes with an exciter current of 165 amp., and the other for a period of one and one-half minutes without the exciter.

RESULTS OF ENGINE TRIAL.

A summary of the test results with average is as follows. Test, December 6, 1905:

Duration	15 hours.
Preliminary operation on load	2 hours.
Load (switchboard reading)	5,079.2 kw.
Friction and electrical losses	417.3 kw.
Total load	5,496.5 kw.
I.H.P.	7,365.3.
R.P.M.	75.02.
Steam pressure	175.18 lbs. (gauge).
R.H. receiver pressure	19.1 lbs. (gauge).
L.H. receiver pressure	19.27 lbs. (gauge).
Vacuum	26.02 in.
Barometer	30.5 in.
Temp. injection water	42.36 deg. F.
Temp. R.H. discharge	74.05 deg. F.
Temp. L.H. discharge	77.38 deg. F.
Water per hour	89,906 lbs.
Weighed leakage per hour	512 lbs.
Leakage per hour (leakage test)	1,470 lbs.
Boiler level correction per hour	60 lbs. (high).
Net water per hour	87,864 lbs.
Correction for superheat	28 per cent.
Equivalent dry steam per hour	88,110 lbs.
Dry steam per kw-hour (switchboard)	17.34.
Dry steam per i.hp-hour (engine)	11.96.

The tests were under the supervision of Mr. Frank N. Waterman, who acted as referee. The following represented their several companies: Interborough Rapid Transit Company—H. G. Stott, superintendent motive power; J. Van Vleck, mechanical engineer; H. W. Butler, principal assistant engineer; Thomas Allsop, mechanical engineer, Fifty-ninth Street Power Station; C. W. Ricker, electrical superintendent; G. F. Chellis, instrument man; W. L. Seabrooke and W. S. Finlay, assistant engineers. Allis-Chalmers Company—A. M. Mattice, chief engineer; Samuel Moore, district superintendent of erection; T. T. Hubbard, engineer test; J. E. Lord, sales representative; C. A. Hoppen and C. J. Larsen, construction department; A. F. Rolf and F. Buch, electrical representatives.

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Municipal Ownership Discussed by Economists.

At Baltimore, Md., on December 28, the American Economic Association and American Political Science Association held a joint session at Johns Hopkins University, and discussed "The Case For and Against Municipal Ownership." The case for municipal ownership was presented by Frederick C. Howe of Cleveland, who said:

Municipal ownership is becoming the most insistent issue in local politics. The spontaneity of the issue indicates the deep-seated dissatisfaction with private monopoly. The elections in New York, Cleveland, and Chicago are but political cross-sections of the country at large. The conviction has become well-nigh universal, that the franchise interests are responsible for most of the municipal corruption. It is the desire for franchises, whose values run into fabulous figures, that explains not only the positive corruption, but the indifference of the better-to-do classes, and the heavy burden of reform. These franchises have been appraised at $450,000,000 in New York city; in other large cities they run into hundreds of millions. Their value depends upon no labor except the labor incident to a control of the council. They are created by grant from the city. And they can only exist through a performance of this control. This explains the activity, as well as the corruption in local politics.

These conditions will be corrected through municipal ownership. When the city owns its own franchises, all classes will demand good government and efficient service. Population can be distributed into the countryside. Cheaper light, water and heat will relieve the poor of their most serious burdens, while the incidental savings to the community will be tremendous. For municipal ownership pays. The net earnings of the New York Water Works amount to $3,800,000 per year; of the Chicago water plan $2,269,621, the Cleveland water works $500,000, and the Detroit water works $350,000. Similar showings appear from other cities. Detroit claims that it costs but $60 per lamp to light its streets by electricity. New York city earns nearly a million dollars a year from its docks, and $315,000 from its markets. The city of Cincinnati, which owns the Cincinnati Southern Railway, enjoys a revenue which will leave the property without indebtedness in fifty years time.

The other side of the question was presented by Prof. Winthrop M. Daniels of Princeton University, who argued as follows:

Despite the emphasis laid at present on the political argument for municipal ownership, the economic considerations involved cannot properly be relegated to a subordinate place. Until sufficient proof is forthcoming that city politics can be purified only by delegating to city governments enlarged industrial functions, the question is one that must be determined mainly on economic grounds. In the absence of other paramount social considerations, the test question which ought to decide this matter is: whether a city can render equally efficient service as a private corporation, at a really self-sustaining price lower than can be expected from the private corporation.

The experience of Great Britain is commonly cited as strong evidence for the presumptive success of municipal operation in the United States. Of the British evidence it may be said that while profitable municipal trading in particular cities, such as Glasgow and Liverpool, seems well attested, the success of the policy as a whole is in serious dispute. The statistical returns made by the town to the local government board are compiled by local authorities, each desirous of making a favorable showing.

These returns, moreover, are subjected to an inadequate credit, as has been attested by the Parliamentary Committee of 1903. At all events the margin of presumable net profit shown by these reports is so slight in the aggregate as to make the existence of any true profit conjectural. Moreover, there has been no general reduction of taxes in England attributable to municipal industries; finally, as regards municipal and private prices, the verdict of Major Darwin is unassailable, to wit: that "if municipal trade be regarded merely from the point of view of the consumer, we are not now in a position to determine which way the balance of the argument tells."

So far as municipal ownership in the United States is concerned, there is no general consensus of opinion among individual investigators, expert engineers, and professional accountants. The systems of bookkeeping in vogue in many public and private plants are unscientific, and outside of one or two States, non-uniform. This last consideration robs of any particular significance the report of the United States Commissioner of Labor in 1899.

Finally, it may be said, that if the corruption of city politics is inevitably bound up in the local government's grant of franchises, a betrayal of the public interest is equally possible whenever Congress frames a tariff measure or votes an appropriation, or whenever the Federal departments make contracts with railroads and other corporations. The argument for municipal operations would, by parity of reasoning, impose upon the Federal Government the direct administration of a vast number of industrial enterprises. There is, however, no necessary connection between the grant of franchises and corrupt city government.

This is attested by English experience in cities where public trading is not in vogue. If the responsibility for city administration in this country were focussed, made indivisible, and unmistakable; if the cashiering of incompetent or dishonest officials or representatives were rendered direct and easy by a radical cut in the number of persons to be voted for, there is good reason to believe that public service corporations operating under franchises could be forced to render a full return for their franchises, and would give efficient service at prices fair to the consumer and compatible with a fair corporate profit.

Electrical Engineers of the Times.—XLIII.

H. WARD LEONARD.

Harry Ward Leonard was born at Cincinnati, Ohio, February 8, 1861. Upon graduation in 1883 from the Massachusetts Institute of Technology he became a member of Mr. Edison's personal staff, and was one of four engineers selected by Mr. Edison to erect central stations throughout the United States. Two years later he accepted an appointment as electrical engineer to install central stations in the State of Ohio. In 1887 he became general superintendent of the Western Edison Light Company and in the same year organized the firm of Leonard & Izard. This firm for a time represented the Edison interests in Chicago as general agents, but later as independent electrical engineers did much important engineering work in connection with electric lighting and electric railways. In 1889 Mr. Leonard became general manager of the light and power department of the combined Edison interests of United States and Canada, then known as the United Edison Manufacturing Company, later as the Edison General Electric Company, and finally, after combination with the Thomson-Houston Electric Company, as the General Electric Company. In 1891 he resigned from the last mentioned company to establish a business of his own, which he still controls, although he has retired from active routine work and leaves to associates the detail conduct of his manufacturing interests.

Mr. Leonard has been very prolific in invention in several fields. His principal inventions are on electric locomotives, electric elevators, motor speed control, rheostats, electric heaters, automatic circuit-breakers, multiple control systems, change speed gears for automobiles, gasoline electric vehicles, distribution systems, boosters, etc. He is perhaps most generally known for his invention of the Ward Leonard multiple-voltage system, now so generally employed in factory motor drives; the Ward Leonard system for operating turrets of warships, which has been used exclusively for years in the United States Navy and is now being introduced in the British Navy; the Ward Leonard electric elevator system, now used by the Otis Company; his well known line of "fool-proof" types of rheostats and circuit-breakers; and last but not least, the Ward Leonard electric railway system, including several forms of voltage speed control as substitutes for the rheostatic and series parallel systems of control.

H. WARD LEONARD.

The first important patent on the electric railway system was issued in 1891, and in February, 1894, Mr. Leonard presented a paper before the American Institute of Electrical Engineers describing a single-phase, 20,000-volt railway system. In this paper he advocated a conversion on the train from high tension to low tension, and voltage speed control for the motors. This proposition was considered extremely radical at the time, but more recently its representative features have entered largely into electric railway practice all over the world. Mr. Leonard was also the pioneer in developing a practical regenerative motor control system, commercial installations containing this feature having been made in 1891 which are still in successful operation. Mr. Leonard's papers before the American Institute of Electrical Engineers in 1892, 1894, 1895 and 1896, advocating these advanced ideas were much discussed and his arguments in their favor vigorously attacked by many of the prominent engineers of this country and abroad. The recent developments in the electric railway field with respect to single-phase traction, voltage speed control and regenerative control, have shown that the ideas were founded on correct engineering principles.

The first recognition of Mr. Leonard's work in single-phase traction came from English and Swiss engineers. In 1902 the Oerlikon Company of Switzerland took a license under his patents, and for the past year a Ward Leonard single-phase locomotive has been in daily operation in Switzerland. In a recent communication in these columns Mr. R. Dahlander, of the Swedish Government Electric Railway Commission, which is investigating electric traction with a view to the electrification of all government steam roads, stated that the programme of the Commission includes an experimental trial of the Ward Leonard system.

Mr. Leonard is a past manager and past vice-president of the American Institute of Electrical Engineers, and a member of a number of other engineering organizations.

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CURRENT NEWS AND NOTES.

GERMAN DISTRICT PLANT.—U. S. Consul Guenther, of Frankfort, Germany, reports that a large central electric plant is projected for lighting the towns and villages of the Buedingen district and the valley of the Nidda.

FROM A POLE TOP.—At Jefferson, Tex., on December 31, several buildings were destroyed by fire including the telephone exchange. An operator thereupon perched himself on top of a telephone pole, and made it a temporary "central," transacting business.

BOSTON ELEVATED GIFT.—At the annual meeting of the Boston Elevated Railway Company, announcement was made of the distribution of about $60,000 as a New Year's gift to about four thousand men employed in the company's car service. Each employee who has been in the service six months or longer, and possessed a satisfactory record, received $15 in gold.

MARCONI LECTURE.—Mr. William Marconi will give a lecture on "Ether Telegraphy" before the New York Electrical Society at Columbia University, on the evening of Tuesday, January 16. Additional interest is given to this first address by Mr. Marconi in America by the fact that it is intended by him as a tribute to the memory and work of Benjamin Franklin, whose birthday anniversary falls on January 17.

CALIFORNIA POWER.—It is stated from San Francisco that there are now about 114 hydro-electric power plants in California, some small, some large, which generate in the aggregate a little over 200,000 hp. That this branch of industry is still in its infancy is shown by the fact that within 200 miles of San Francisco sites have been secured by powerful financial interests where over 1,000,000 hp can be produced.

LIGHTING ST. LOUIS.—Mr. J. W. Wood has been employed by the St. Louis Real Estate Exchange to submit plans with estimate of cost, for illuminating the principal business streets of the city. The plan contemplates the erection of ornamental iron poles every 100 ft. on about five miles of streets, with about 60,000 cp of lamps for the average block of 300 ft. The idea is to make St. Louis business streets the most brilliant illuminated of any city in the world. Mr. Samuel Bowman, a local real estate dealer, is promoting the scheme.

UNITED ENGINEERING SOCIETY.—At a meeting of the board of directors of the American Institute of Electrical Engineers on December 15, Mr. John W. Lieb, Jr., was appointed trustee to represent the Institute for a term of three years upon the board of trustees of the United Engineering Society invested with the care and administration of the new United Engineering Building. Mr. Lieb at the same time was made a representative of the Institute on the building committee. He succeeds Dr. Schuyler Skaats Wheeler, who by reason of his recent election to the presidency of the Institute resigns from these other bodies. The representation of the Institute, therefore, after the annual meeting of the United Engineering Society in January will consist of Messrs. Charles F. Scott, Bion J. Arnold and John W. Lieb, Jr., who are past presidents of the Institute in the order named. Work on the building is in active progress, and it is expected to lay the corner stone early in the spring.

MAYOR McCLELLAN TALKS.—In his annual address Mayor McClellan, of New York City, discussed municipal lighting and fire alarms. The mayor referred to plans now in hand for the erection of public lighting plants, and places at $7,567,000 the cost of the initial plant for Manhattan and the Bronx. The fixed charges and operating expenses will reach $1,269,000 a year, or an annual saving to the city of $434,000. The cost of a similar plant for Brooklyn and Queens is placed at $9,485,000, with annual charges of $1,424,000. The Board of Estimate has authorized the purchase of sites for the erection of electric lighting plants in Manhattan, the Bronx, Brooklyn, Queens and Richmond. These sites have since been purchased, and are now the property of the city. Next the mayor commented on the inefficiency of the city's fire alarm system and asks the Aldermen for the immediate installation of 500 new fire alarm boxes, and for the erection of a building to be used exclusively for a fire alarm central office. The total cost is placed at $1,625,000.

NORTHWESTERN ELECTRICAL ASSOCIATION CONVENTION.—As previously announced, the Northwestern Electrical Association will hold its annual meeting this year at Chicago instead of Milwaukee. The dates are January 17 and 18. A meeting of the executive committee of this association was held at Hotel Pfister, Milwaukee, on December 28. Those present were President C. H. Williams, of La Crosse; Harold Almert, of Chicago; P. H. Korst, of Janesville; Ernest Gonzenbach, of Sheboygan, and secretary Thomas R. Mercein, of Milwaukee. It was decided to hold the sessions of the convention at the Great Northern Hotel beginning on Wednesday morning, the 17th. The programme is not ready for announcement, although there will be eight or nine papers. The entertainment programme has been arranged and will consist of a theater party on Wednesday evening, and a visit to the Electrical Trades Exposition at the Coliseum on Thursday evening followed by a banquet at 10.30 p.m. The local entertainment committee consists of James Wolff, Harold Almert, W. W. Low and George S. Whyte.

ENVY, HATRED AND MALICE.—In discussing the municipal ownership agitation, the New York *Tribune* remarks: "The discussion should be cleared from all that element of envy, hatred and malice which leads to denunciation of private corporations because they make money. It is their right to make money. If they do not give a fair return they are properly subject to criticism and correction. Let regulation be as strict as the public welfare requires. The mere fact that railroads enrich their owners, however, is no argument for municipal ownership. In the early stages of municipal development the people neither had the wealth nor the faith to build railroads and gas plants, and were only too glad to offer inducements to private persons to operate under franchises. The fact that they now make much money, provided they make it honestly under their grants, is no reason for dispossessing them. The question of municipal ownership must turn in the case of every particular franchise on practical conditions. Has the city the money to acquire it, or the money in case of a new enterprise to hold it and improve it? Is the city government competent as organized to carry on the work wisely and efficiently? Will city management put the plant at the mercy of its employes or the reverse? Will it put the public utilities into the hands of the people or the people into the hands of a few persons running the public utilities?"

SIGNAL SERVICE WIRELESS.—Gen. Greely, chief signal officer of the United States Army, is quoted in the newspaper press as follows: "The new army receivers invented by the Signal Corps intercept and record the messages of all known systems. The signal service system is secret and will remain so." At present the United States Navy uses three systems of wireless telegraphy—the Fessenden, Arco-Slaby and the De Forest. Intercommunication between the vessels and the navy yards using these three systems has been impossible.

CORPORATION TAXES.—Some idea of the burden of taxation on corporate property is furnished by the annual report of the Boston Elevated Railway Company, which includes a statement as to the amount of the company's annual contribution to the public in money or its equivalent. Including compensation tax for use of streets, subway rental of $55,000, devoted to the sinking fund, ordinary taxes to $1,494,551, the balance of the subway rental, $138,143, and the rental of the East Boston tunnel for nine months and two days, $35,398, the total is $1,668,092, over 13 per cent of the gross revenue of the company for the year.

VETO AT QUINCY, MASS.—At a meeting of the Quincy, Mass. City Council on December 27 a communication was received from Mayor Thompson vetoing an order presented at the last session of the council requesting the mayor to petition the General Court of Massachusetts for authority to establish a municipal lighting plant. His objections to the order were that the legislation desired was too restrictive in its character and that the establishment of a municipal lighting plant under the conditions referred to would be a burden to taxpayers and would increase rates for gas and electricity. The veto was sustained.

THE PARIS SKY SIGNS.—Like New York, the fair city of Paris is resplendent by night with electric signs. A writer in the *St. James Gazette* says: "Paris, of late years, has broken out everywhere into electric sky signs, and if the craze for them continues it will be useless for a shop to advertise its whereabouts except with lettering which can be illuminated at night. On the Place de l'Opéra and all along the boulevards the sky signs twinkle in and out like gigantic caterpillars in a mad Christmas pantomime, some lighting all at once, others letter by letter, others again lighting in different colors, and going out at one end as the other end is illuminated."

THE REGULATORY POWER.—Discussing the recent traction merger of all the systems in New York City, the *Wall Street Journal* says: "The common-sense policy is to encourage the traction monopoly to do the square thing for the public, and watch it closely lest it do wrong. It will be subject, always, to the regulatory power of public opinion, and even if there is not actual competition, there will always be potential competition in the fact that the City of New York might construct and operate an independent system of its own. At present independent traction control, even if concentrated in the hands of men who do not do business on the altruistic principle, and with an administration falling short of the high ideal, is better than municipal ownership under corrupt political conditions. But the situation might change, so that the people would vote for municipal ownership as a relief from intolerable wrong and neglect. It is fair to assume that the traction people fully recognize this fact and will act accordingly."

TENDENCY TO CONSOLIDATE.—Mayor Douglas, of Little Falls, N. Y., in a veto message disapproving of the franchise granted by the Common Council of the city to the Hudson River Electric Power Company, raised several very interesting points. He admitted the tendency to consolidation, but urged that in Little Falls and similar places the initial competition would only tend to raise prices in the end. Moreover, he found the existing service satisfactory. He said: "The investment necessary to establish a plant for the production of gas and electricity in any city or large town requires a large sum of money. And in a city like Little Falls and, indeed, in any city under 50,000 population, the field of operation is not large enough to allow of two competing producers. This is amply demonstrated by the fact that, so far as I can ascertain, actual competition in public lighting does not now, and has never, existed for as long a period as five years. If, as a matter of fact, competition could exist in public lighting for any considerable period, we would find towns and cities from Albany to Buffalo with one, two or three companies in the field. It seems to me that every person familiar with the subject must, therefore, agree with me that such a thing as actual continued competition in public lighting in a limited field, like the city of Little Falls, cannot be had. The result is that, when one company invades the field of operation of the other, sooner or later there is a combination between the two, resulting in one producer. This is the history undoubtedly of all such efforts in this State. No one will say that there is a field for two companies to profitably carry on business in any city of 25,000 people or under."

LIGHTS AT LAWN PARTIES.—Mr. J. G. Boyd, who now represents the Columbia Incandescent Lamp Co. in Iowa, makes the following instructive note of work done by himself in popularizing the incandescent light: "One scheme I adopted in Texas, where under my operation the gross earnings were increased 700 per cent over that of my predecessors was in the matter of lawn lighting for parties. I devised a system of temporary wiring whereby it was possible to wire up a lawn with two men, erecting 150 or 200 lights, in approximately an hour after arriving there; and the dismantling was done in much less time. The method was very flexible and could be re-employed at will. Just a short time before the function was to begin, our wiremen repaired to the house clad in spotless white duck suit and cap whereon appeared the initials of the company. His duty was to look after the comfort of the guests in every way. For instance, an elderly person was inconvenienced by a fan. Our man would notice the discomfort and turn the fan slightly in another direction. A lamp popped out somewhere. At once he renewed it with another. If the affair was at the home of a non-patron, just a little extra attention was bestowed on the work. When lodges or churches had an oyster supper, we would, if permitted, arrange to keep everything hot with electric culinary apparatus with no cost for service, cutting everything in ahead of the meter. Every case of 'trouble' was promptly 'shot,' and a receipt taken evidencing that fact against the time when the man of the house would rise in his wrath and swear the matter had never been attended to. A receipt was also taken showing that the patron had a course in meter reading."

WIRELESS TO NORTH POLE.—On behalf of the Chicago *Record-Herald*, Mr. Walter Wellman, the journalist, will essay this year to reach the North Pole in a Santos-Dumont airship, built by Louis Godard in Paris, and ready next April. From an easily reached base of operations in Northern Spitzbergen he will have but 550 geographical miles to go to the pole, and a like distance for the return voyage. The whole 1,200 miles mean but 100 hours of motoring at 12 miles an hour. Santos-Dumont has repeatedly made from 19 to 23 miles an hour with small airships equipped with relatively small motors. The airship will be the largest practicable one ever built. It will be 106 ft. long and its greatest diameter will be 49 ft. Its surface will measure 23,000 sq. ft. and its volume will be 226,000 cu. ft. Inflated with hydrogen, it will have a total ascensional force of 15,300 pounds. Seven thousand pounds will be the weight of the ship and its equipment complete, leaving 8,000 pounds for cargo. The ship will be provided with three motors, with a combined energy of 70 hp. If the winds hinder no more than they help, and there are no delays, this ship can motor from North Spitzbergen to the pole in 45 hours. The airship will have an endurance capacity in buoyancy sufficient to enable it to remain 25 to 30 days in the air. It will carry 5,500 pounds of gasoline and its distance capacity during calm weather will be 1,800 miles more than the distance from Spitzbergen straight across the pole and the whole Arctic Ocean to Alaska. Wireless telegraphy stations will be established at Spitzbergen and Hammerfest, Norway, 600 miles distant. Further than this a wireless equipment will be carried in the airship, and it will be the effort to send frequent, if possible, daily dispatches to the outside world throughout all the time the expedition is in the arctic regions, even from the pole itself, if the courageous aeronauts have the good fortune to reach it.

The Marion (Hackensack River) Station of the Public Service Corporation of New Jersey.

THE engineers of the Public Service Corporation early in its organization, in the summer of 1903, planned for a greatly enlarged capacity of the generating plant of the company to take care of ever-increasing business, and in the fall of that year a very complete detail report of the future yearly requirements of plant capacity was formulated with special attention to concentration of power houses. At this time the Marion plant, named from the nearest Pennsylvania Railroad station, was planned, the necessary appropriation obtained from the Finance Committee, and ground was broken the succeeding spring.

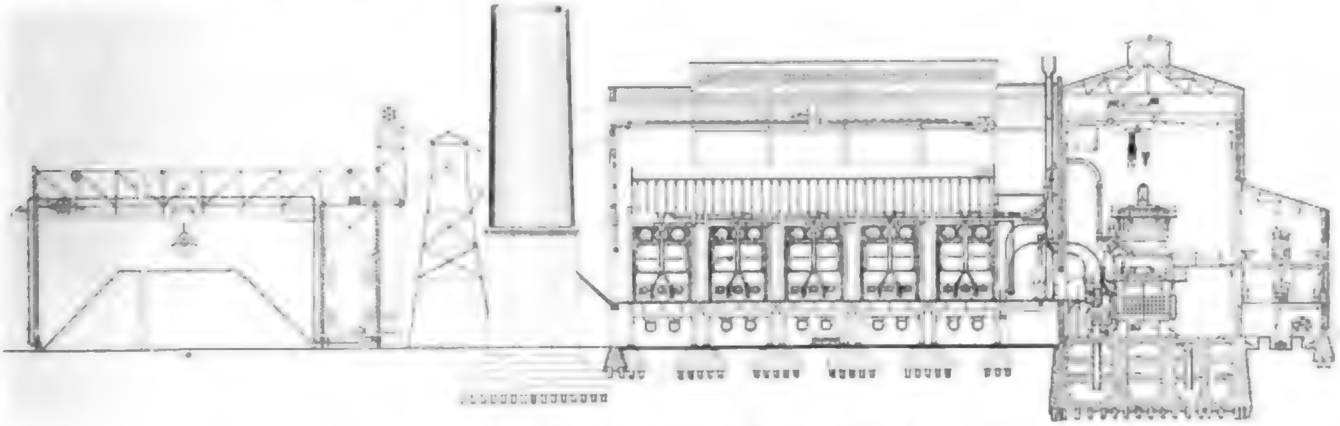


Fig. 1.—Cross-Section of Power House.

A tract of about fourteen acres on the Hackensack meadows is owned by the Corporation, lying between the Hackensack River on the west and the New York, Susquehanna & Western Railroad (Pennsylvania system) on the east. The Erie Railroad cuts across the northern corner of the property and within 200 ft. of the station building. A spur of standard-gauge track was laid to connect with the Pennsylvania tracks, the spur extending the whole length of the plot and into the engine room and beneath the ash chutes of the boilers.

The Hackensack River, within 70 ft. of the buildings, narrows at this point and is about 60 ft. deep, the immediate shore affording a dock depth at low tide of 18 ft. Thus excellent tide water facilities are afforded for coal delivery, supplemented by the facilities afforded by the railroads mentioned.

A view of the present power house structures is shown in section in Fig. 1, exhibiting the fine tide water location. A view is also given of the plant as it will be on the enlargement to 32,000 kw, showing Jersey City in the background. The map of the Northern Jersey electrical distribution system (Fig. 3) shows clearly the geographically central location of this new power house and its relative position to the present central stations and sub-stations and to the districts to be supplied.

The boggy nature of the soil required care in the construction of foundations, which are built on reinforced concrete caps laid down upon 3-ft. piling. The building is substantial, though severely plain, no attempt being made at architectural effect. The walls are of red brick, except the east end of the engine and switchboard building, and fill in a structural steel frame with trussed lantern story roof. The temporary east end walls of the engine and switchboard buildings are of corrugated iron laid on a light framework of steel. The engine room walls are lined to a height of about 20 ft. with white enamel brick; for the rest of the height a light buff brick is employed, presenting an excellent appearance. The boiler house is in two complete sections, with a brick wall partition.

The foundations of the turbo-generators are worthy of special mention, being a system of reinforced concrete arches permitting a free flow of the river immediately below the turbines, a series of 36-in. clay pipes connecting with them below a pile dock and the river. These pipes take a turn downward at the edge of the dock and were hung in position from crossbeams before the space beneath the dock was filled in. The mouth of these 36-in. inlets is 13 ft. below low tide, affording an ample supply of water for

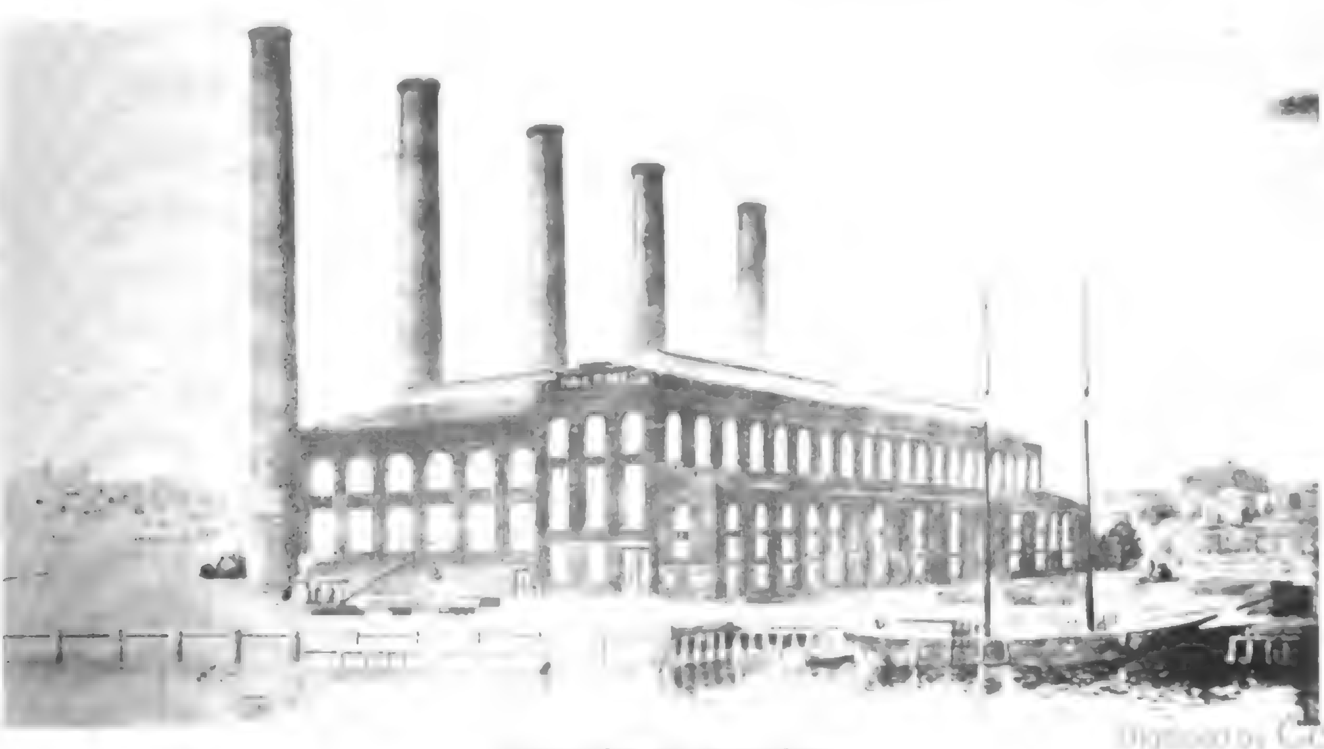


Fig. 2.—View of Power House.

condensing purposes. Provision has been made at this time for the supply of inlets for an ultimate capacity of the plant of 64,000 kw.

The condenser outflow is led at an angle and away from the intakes into the river, below grade, by a 12-ft. by 12-ft. raceway built on the sides of sheet piling, on the bottom of concrete, and planked over the top. In Fig. 5 is given a view of this work during construction.

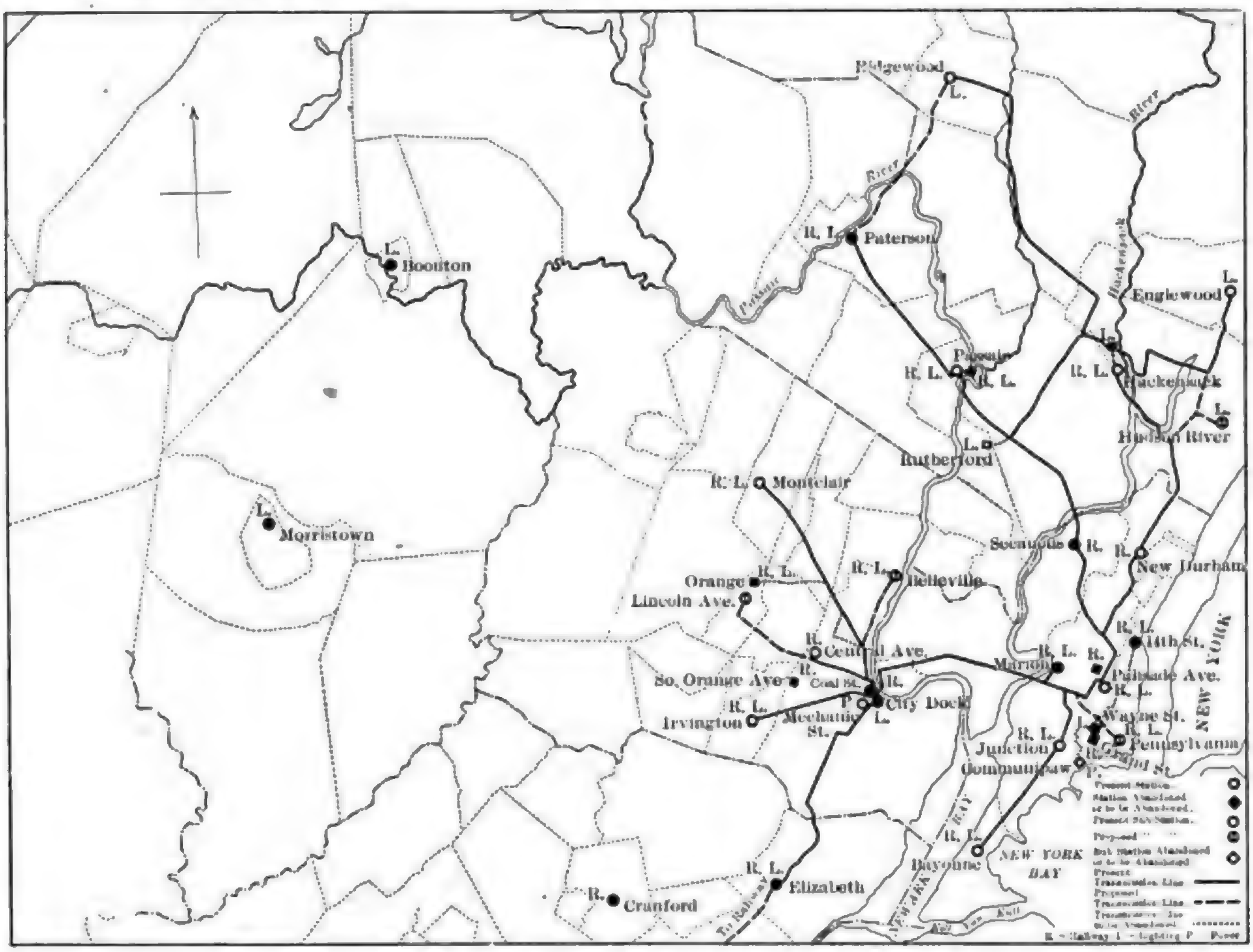


Fig. 3.—Map of North Jersey Distribution.

A view of the skeleton steel framework of the buildings is shown from a photograph taken during construction clearly exhibiting the partly completed boiler installation, which is supported on steel girders and above the level of the engine room floor.

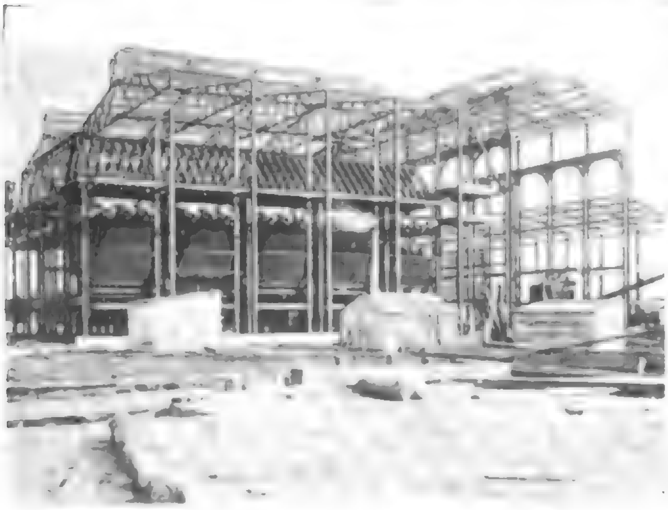


FIG. 4.—POWER HOUSE UNDER CONSTRUCTION.

The engine room is 43 ft. by 150 ft.; the two boiler rooms together are 150 ft. by 115 ft., and the switch and cable building 21 ft. by 150 ft. An electrically-operated crane runs on track supported by a girder resting on the structural columns and is capable of lifting 50 tons; it also has a 10-ton auxiliary. As the railroad tracks enter the building the crane reduces the cost of unloading and handling of material to a minimum. The switch and cable building is in reality a lean-to against the engine room wall, containing also the engineer's office.

The circular brick Custodis chimneys are located outside of the boiler house, and each is connected with a brick flue running the length of the backs of one section of boilers. Each of the present two stacks has a height of 225 ft. and is built of yellow brick. One stack is 19 ft. 4 in. outside and 12 ft. 4 in. inside diameter at the base and 11 ft. 2 in. outside, and 10 ft. 0 in. inside diameter at the top. The other is 22 ft. 2 in. diameter at the outside and 15 ft. 2 in. inside at the base, the top having a diameter outside of 15 ft. 5 in. and inside of 14 ft. 0 in. The foundation of each is alike and 37 ft. in diameter, built of concrete.

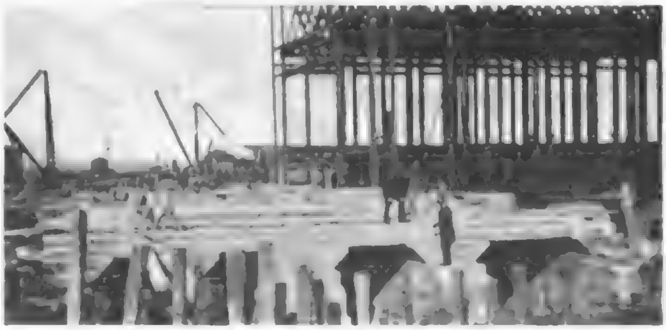
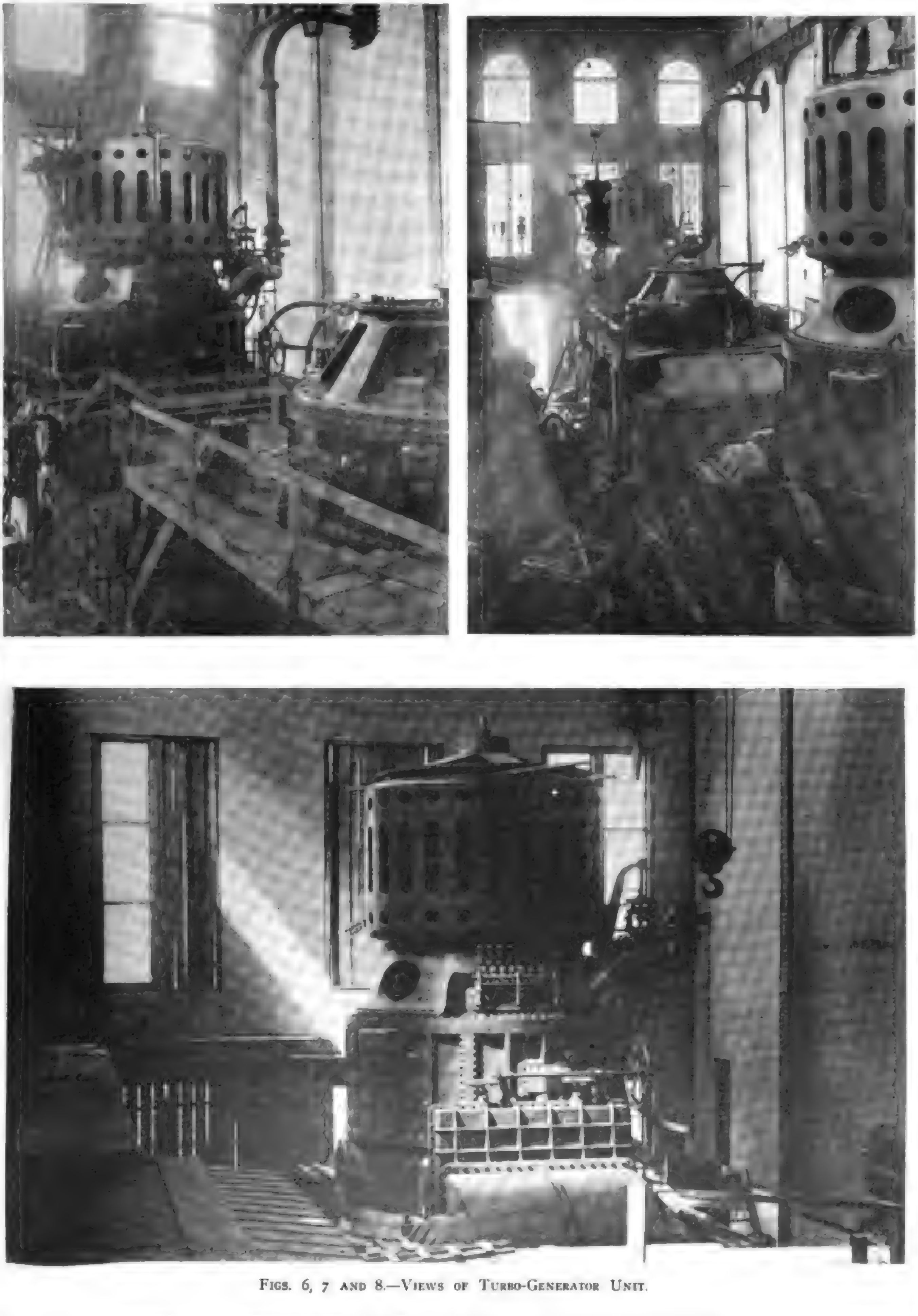


FIG. 5.—PILING AND CONCRETE WORK.

Two 5,000-kw, 13,200-volt, 25-cycle, three-phase, and one 3,000-



FIGS. 6, 7 AND 8.—VIEWS OF TURBO-GENERATOR UNIT.

kw, 13,200-volt, 60-cycle, three-phase, General Electric Curtis turbo-generators form at present the engine room installation. Provision for an additional 3,000-kw unit is made in the present engine room.

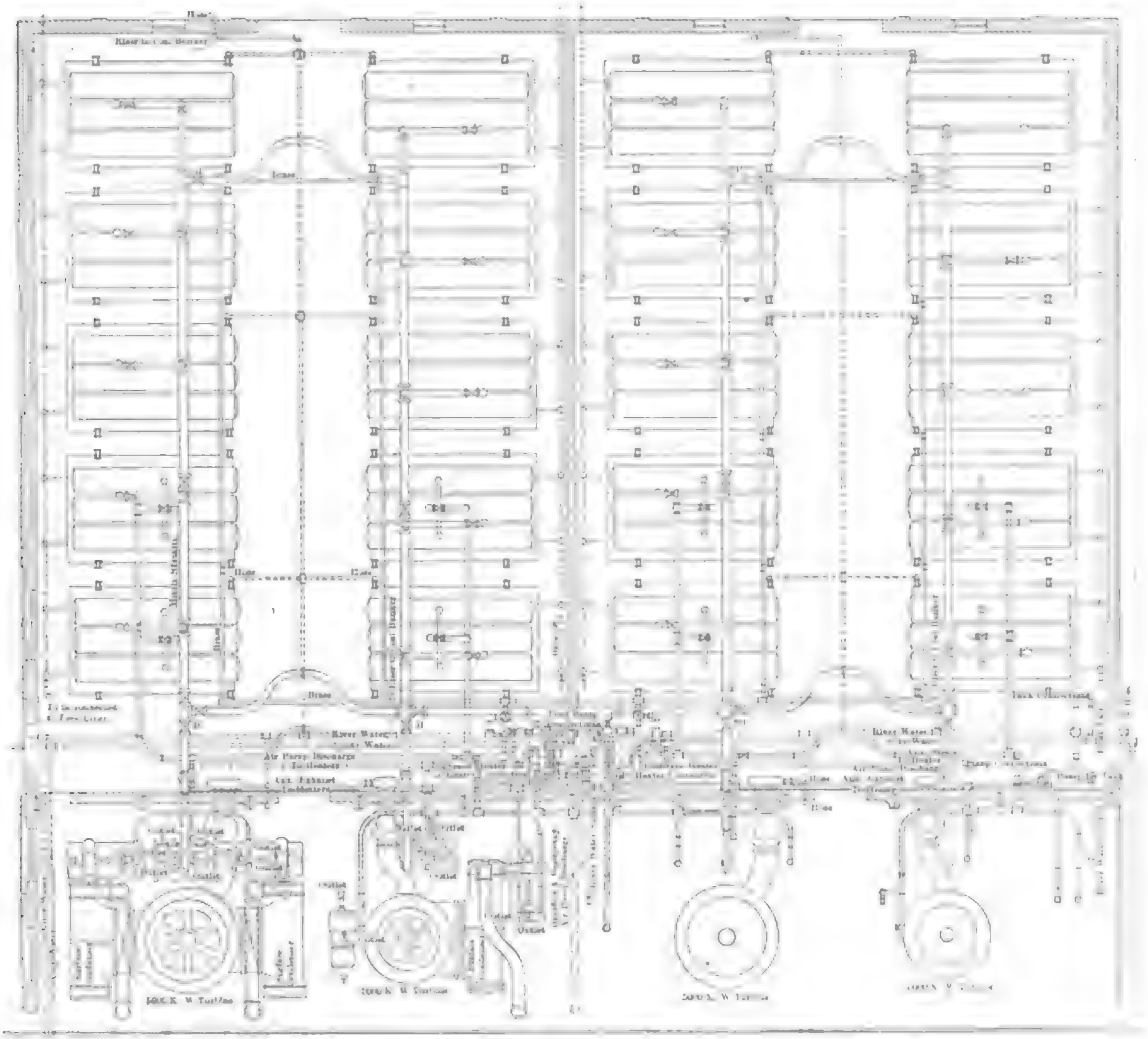


FIG. 9.—PLAN OF STATION.

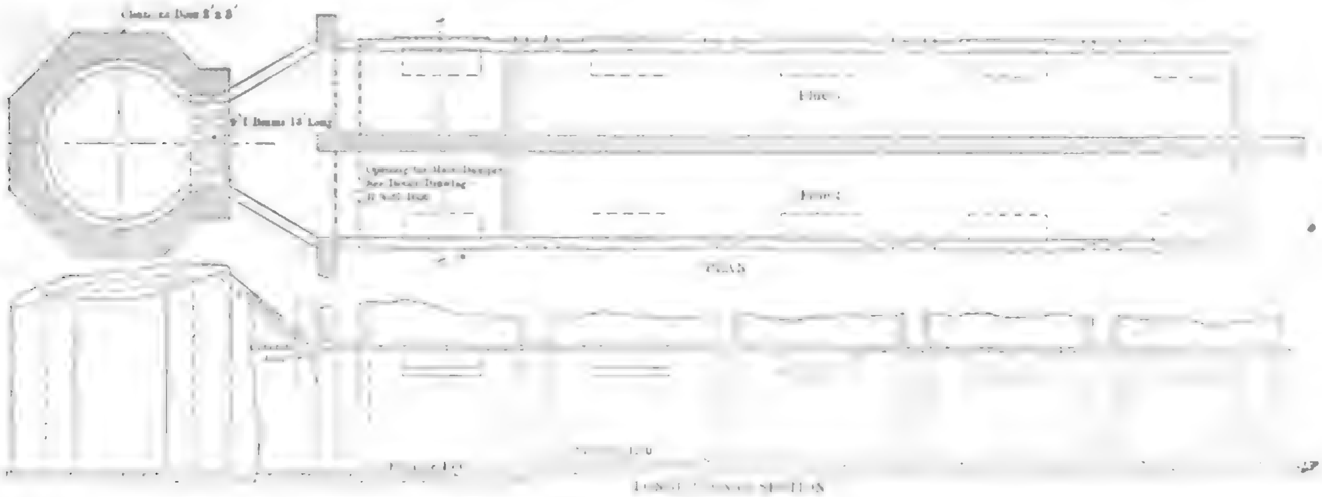


FIG. 10. DETAILS OF BOILER FLUES.

A unique feature is the double condenser built by the Wheeler Condenser & Engineering Company on each side of the 5,000-kw turbines. Each condenser has 10,000 sq. ft. of cooling surface or 20,000 sq. ft. to each 5,000-kw unit. The 3,000-kw turbine condenser has 12,000 sq. ft. of cooling surface. The top row of tubes in each condenser is used as a closed feed-water heater, the water flowing thence to an open Cochrane heater, of which there are two of 6,000 hp each. The length of each Cochrane heater is 15 ft. and the diameter 6 ft.

There are two 125-volt exciters, each of 75 kw, direct-connected to horizontal Curtis steam turbines. One of these generators is sufficient for the entire present equipment. The turbines are non-condensing, exhausting into the open heaters.

There are fifteen Babcock & Wilcox 600-hp boilers, five boilers being in a half section supplying the smaller stack and ten boilers in a section for the larger stack. Except the outer or half section row, the boilers are back to back, the flues being of brick and below the boilers and sealed with cement. The flue dampers are iron plates swung on a vertical axis and are at an angle when closed.

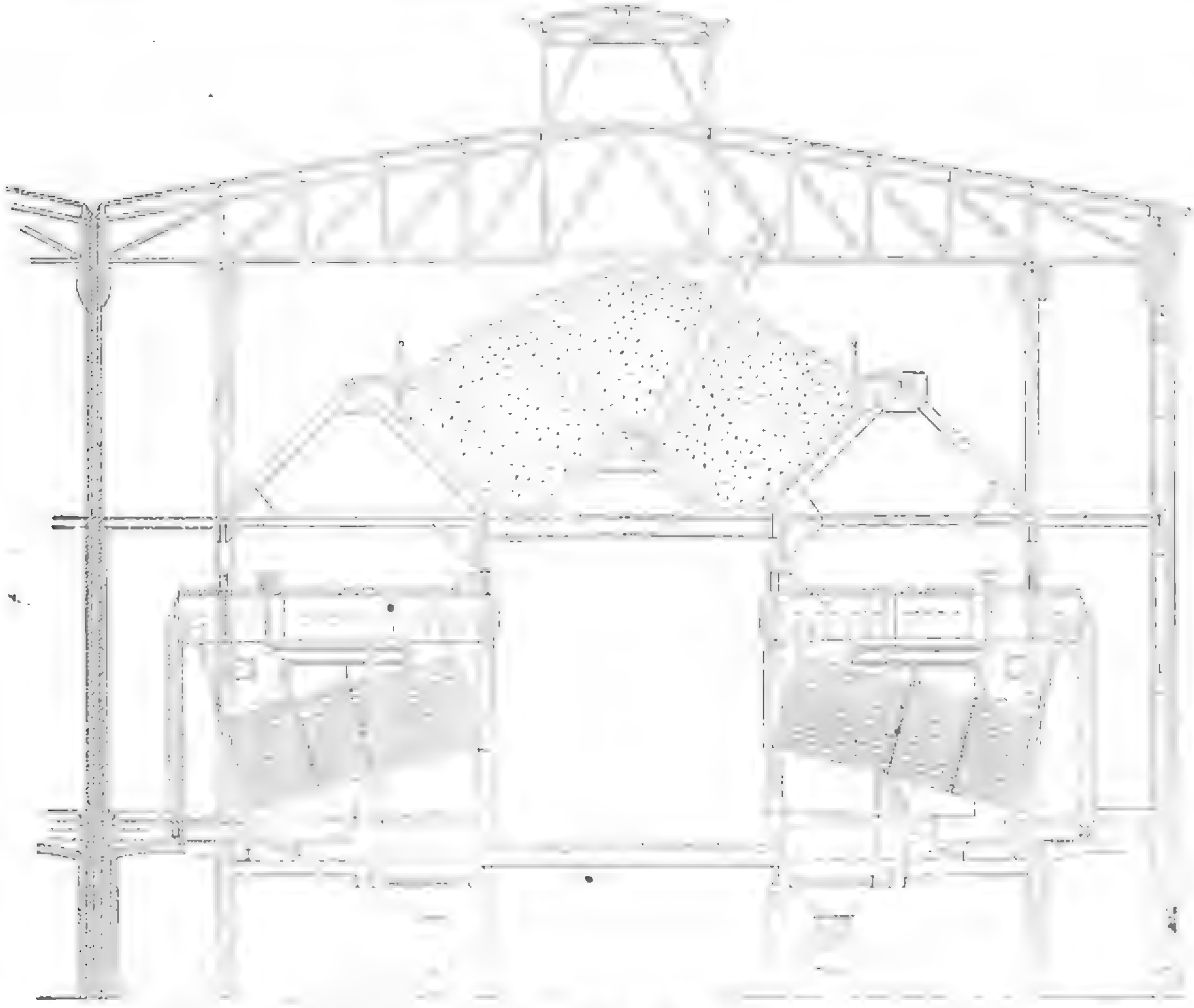


Fig. 11.—Section of Boiler Room.

McClave grates are used. There are no mechanical stokers, but provision is made so that if desired they can be installed later. The coal is mechanically handled and electrically operated from the supply pile to the storage pockets over the boiler floor space, and is let down on the floor by local coal chutes controlled by the fireman. Below each boiler is a flame plate consisting of a slab of 6-in. reinforced concrete supported at each end on iron girders. Beneath each grate is a steel hopper, lined with concrete to conduct the ashes to a chute, the opening of which is controlled at will. Ash cars on standard-gauge tracks receive the ashes direct from the chutes and convey the ashes away from the plant.

The steam piping is all overhead and is suspended from the structural steel framework, permitting free movement of expansion. So-called Van Stone joints, supplied by H. W. Kellogg, with vulcabeston gaskets, are on all the 6-in. auxiliary mains and a 10-in. live steam feeder line. All runs are curved to guard against straining joints. Chapman valves are on all steam connections, except valves below 4 in., where Hancock globe valves are used. The blow-offs are connected to the feed water lines as an emergency method of feed water supply to the boilers. The pipe covering on the superheated lines is 3 in. thick of 85 per cent magnesia, laid on in 1½-in. thicknesses, plastered with a ¼-in. layer of asbestos compound and then covered with 8-ounce duck sewed on. The other steam piping is sectional covering. The relief valves on the 5,000-kw exhaust are 36 in. and on the 3,000-kw turbine a 30-in. Blake valve.

There are three vertical Warren boiler feed pumps, each 14 in. by 11 in. by 12 in. stroke, running 50 to 100 strokes per minute and capable of delivering 980 gal. per minute. Each has an 8-in. suction and 7-in. discharge. They are set with their water cylinders below the floor line, giving a head of five feet on the suction valves, which is sufficient to insure good results when pumping hot water.

Each unit has a duplex Edward's direct-driven suction valveless air pump, supplied by the Wheeler Condenser & Engineering Company, used as a condenser and air pump, the size being 12 in. by 30 in. by 14 in. The suction drops right below into what is an inlet from the river, the diameter of the suction pipe being 24 in. with a 20-in. delivery.

The exhaust from all the steam auxiliaries goes into a main leading into the open heaters, and a dividing box in this main and between the two heaters can be adjusted by hand so as to proportion the inlet to each heater. A leader is taken from between the stages of the large turbines at about atmospheric pressure, and runs directly to the open heaters. This is to raise the temperature of the feed water up to 210° or 212°.

The system of feed water supply consists of the following parts:

The Edwards air pump receives the water of condensation from the condensers and returns it to the open heater, which acts as a hot well. The heaters are of sufficient capacity to store a ten minutes' supply to the boilers. In the run between the air pump and the heater is a primary heater consisting of the top rows of tubes of the surface condenser. The water is forced through these condenser tubes and by virtue of their contact with steam upon its return to the condenser the water is heated to the full temperature of the vacuum. It is then led to the open heaters.

The complete circuit of the system is from the boilers to the turbines as steam, from the turbines to the condenser, condenser to pump, pump through primary heater, primary heater to open heater, open heater to feed pump, and feed pump to boilers. The entrained air escapes from the discharge of the Edwards air pump through a 12-in. riser carried above the water line.

The make-up water is supplied from either the city mains or from spring water on the property. The auxiliaries in the station are all steam-driven and run non-condensing, the exhaust from

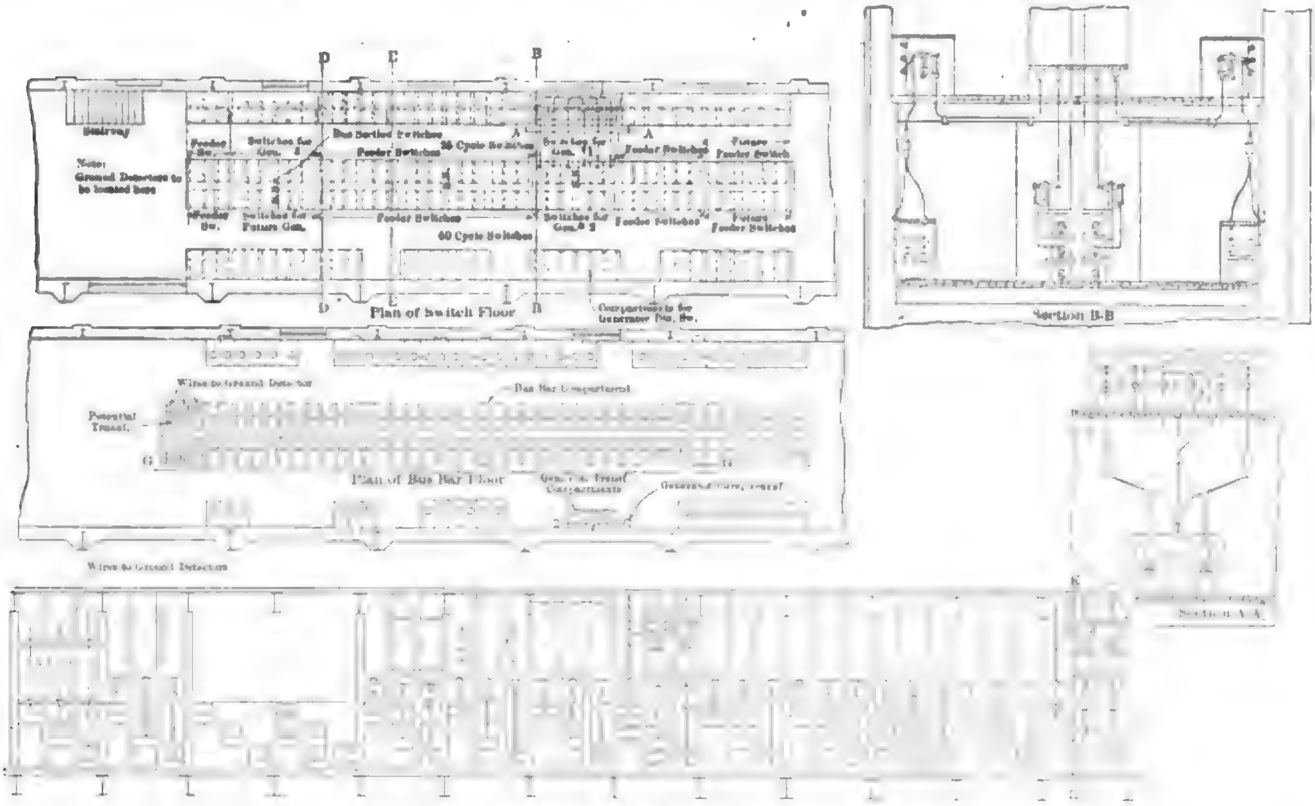


FIG. 12.—ARRANGEMENT OF SWITCHING APPARATUS.

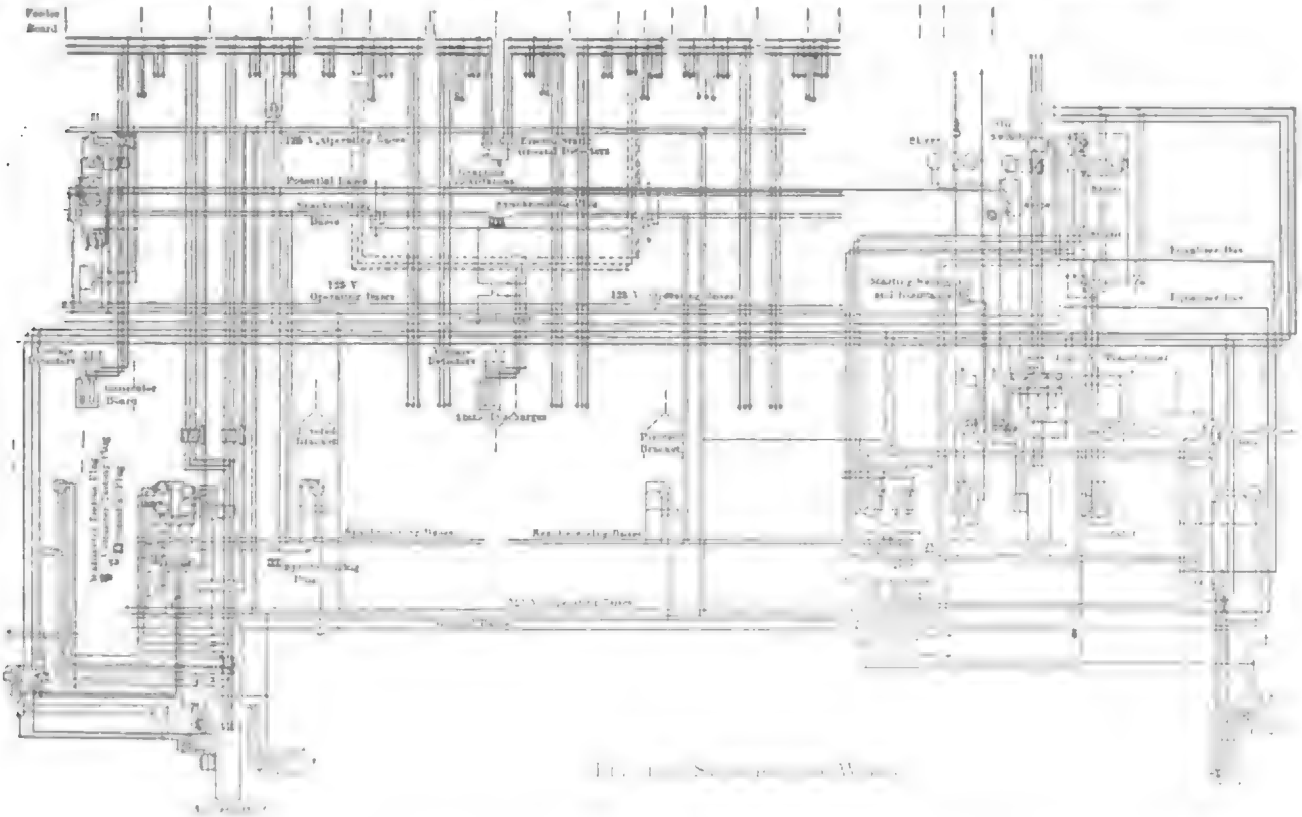


FIG. 13.—SWITCHBOARD WIRING.

them being utilized to the fullest extent for heating the feed water. The amount of such exhaust steam, however, in the turbine plant is not sufficient to raise the temperature more than 50° or 60°, so provision was made to bring this temperature up as stated.

The bottom of the vertical turbine shaft has a bearing adjustable in a vertical direction and is practically frictionless. The thrust of the revolving shaft is taken by a film of water constantly supplied by a pump at a pressure of about 800 lb. The cables from the generator to the generator busses, the exciting conductors and the general current-controlling wiring and apparatus are shown in Fig. 13.

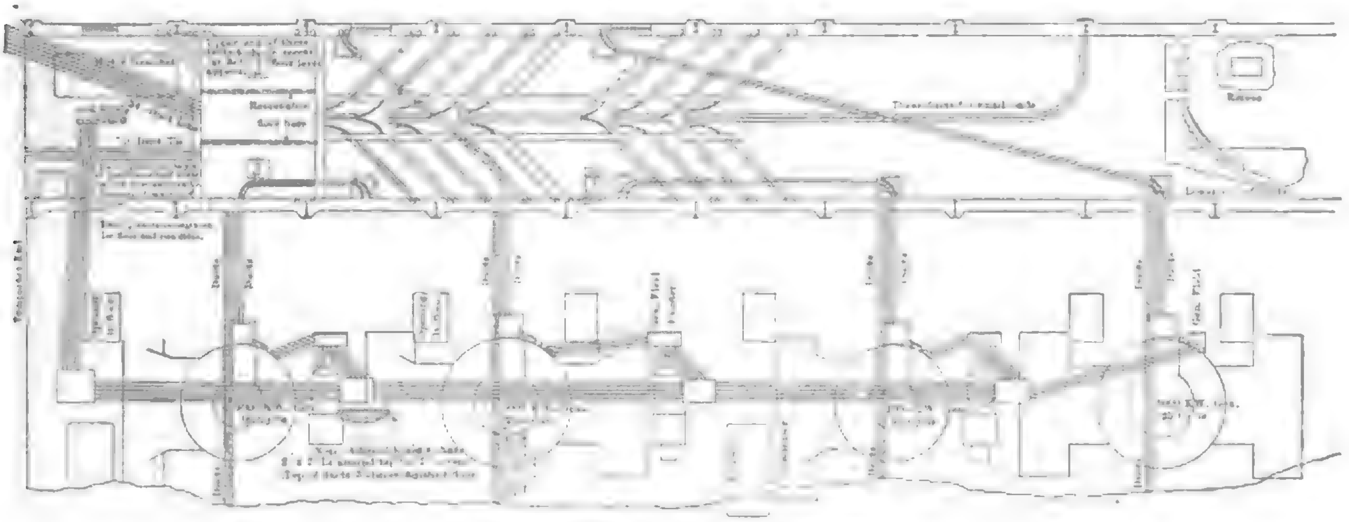


Fig. 14.—Floor and Wall Ducts.

The instrument panels and operating bench are placed at one end of the present top floor of the switchboard building and on a level with the gallery, which is on one side and end of the engine room and interconnects the turbines. The operator can overlook the generators and face his operating bench at the same moment.

Current and potential transformers supply the instruments on the panels near the operating board, so that only low voltage is in the vicinity of the operator. The current transformers also operate the automatic control of the circuit-breaking switches.

The cables are of rubber insulation except where they are a continuation into the building from underground to the second floor into cable bells, where each of the three leads are carefully brought away from each other and taped, and the bell filled with insulating compound. The cables in this case are of rubber core and paper insulation protected by a lead covering.

All the current from the exciter sets is brought to the low-tension board on the operating floor and distributed and controlled from them.

A novel feature in the equipment of the switch and cable building is a 100-kw General Electric motor-generator set consisting of three machines. There is an alternating-current, synchronous motor of 600 volts, 25 cycles, supplied by transformers stepping down from 13,200 volts. On the same shaft is a direct-current, 125-volt and a direct-current, 500-volt machine, both interchangeable as motors and generators by switching. The purpose of this special set was to attain any desired current for testing work, although additional exciter capacity is also in reserve for the larger generators. It is possible to take trolley current and generate alternating current of 600 volts or 13,200 volts for testing, or use 125-volt, direct current for exciter current or for lighting the station. Driving by the alternating end will give 500 volts direct current for operating the coal-handling or the crane motors. Or it is possible to drive the set with 125 volts direct current from an exciter and use either 500 volts direct current or 600 or 13,200 volts alternating current for testing.

The operation of this station will greatly relieve the heavy demand for energy on the other central stations of the Corporation, and provide a reserve in case of accident to any of the plants.

We are indebted to Mr. Dudley Farrand, general manager; Mr. James T. Whittlesey, chief engineer, and Mr. H. S. Vassar, assistant engineer, for information and courtesies in the preparation of this article.

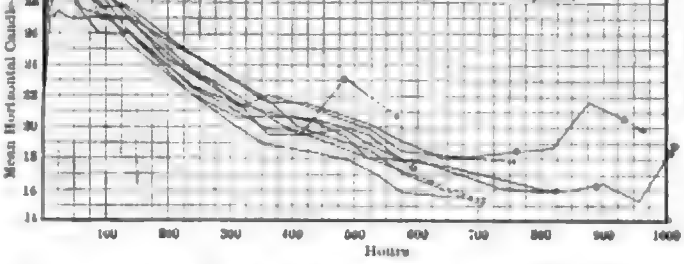
Life Tests of Tantalum Lamps.

The following figures and accompanying curves relate to a recent test of ten tantalum lamps fed by direct current. In making the photometric measurements, the lamps were rotated at a speed of about 40 to 50 r.p.m. Automatic voltage regulation supplemented by hand control was used and the average variation of pressure did not exceed ½ per cent. The lamps were burned at rated voltage and the following results were obtained:

	Initial		Broken at			Total life
Lamp No.	cp.	watts per cp.	Hours.			in hours.
*1	24.7	1.94	88			
2	23.5	1.97	890	1007	1013	1013
3	21.0	2.17	760			760
4	22.1	2.06	700			700
5	23.8	1.99	813			813
CANDLE-HOUR PERFORMANCE OF TANTALUM LAMPS.						
6	24.0	2.00	706			706
7	26.1	1.86	712			712
8	25.4	1.81	484	572		572
9	23.2	2.03	596	625		625
10	25.0	1.90	710	939	968	968
Average	23.8	1.98				763

*Lamp No. 1 was accidentally broken at the end of 88 hours and is, therefore, not included in the average.

With lamps No. 2, 8, 9, 10, when rupture first occurred in the filament it was possible to re-establish the circuit by tapping the lamp, which caused the loosened end of the filament to make contact with an adjacent section, short-circuiting part of the circuit. This caused a decrease in resistance and a corresponding increase in mean horizontal candle-power. With lamps No. 8 and 9 the filament could be repaired in this way after the first rupture only, with lamps 2 and 10 after the first and second ruptures. The last column in the above table gives the total life whereby the life of the lamp is not considered exhausted until the filament is in such condition that the circuit cannot be re-established.



TANTALUM LAMP CURVES.

The Architecture of Continental Power Plants.

By Franz Koester.

RAPID progress has been made in the general design of central stations by the architect as well as by the engineer. This, of course, varies in different countries, some laying much stress upon the artistic appearance, while others confine attention solely to utilitarian objects, disregarding entirely the general architectural features as well as the general pleasing appearance of the layout. The conditions in these respects are characteristic of the individual countries.

While in the past several years much more attention than formerly has been paid in this country to the artistic design of electrical generating stations, the architectural appearance of such plants has not yet had the importance attached that from the beginning has prevailed in some European countries. Recently a decided change has been noticeable in this country from the older position which confined attention in the design of power stations entirely to utilitarian ends, but this has been largely with respect to interior finish—walls and floors—rather than exterior architecture. The object of this article is to illustrate European power plant architecture with reference to some examples chosen almost at random.

It is remarkable that the European plants which stand out prominently with respect both to architectural features and pleasing interior, are also the most economical in operation. This close association of art and engineering science is only characteristic of the continent of Europe, and if one takes into consideration the great progress there made in the reduction of the fuel consumption to produce a hp-hour (for example, many plants operate with a steam consumption as low as 9 to 10 pounds per i.hp-hour) he will realize that engineering design has not been sacrificed to artistic effect. Although the continental engineer may consider that he has artistic taste, he seldom undertakes alone the laying down of the entire plant, but is in close touch with the designers of the architectural staff. Under these conditions, it is easily possible to create a structure pleasing to look upon.

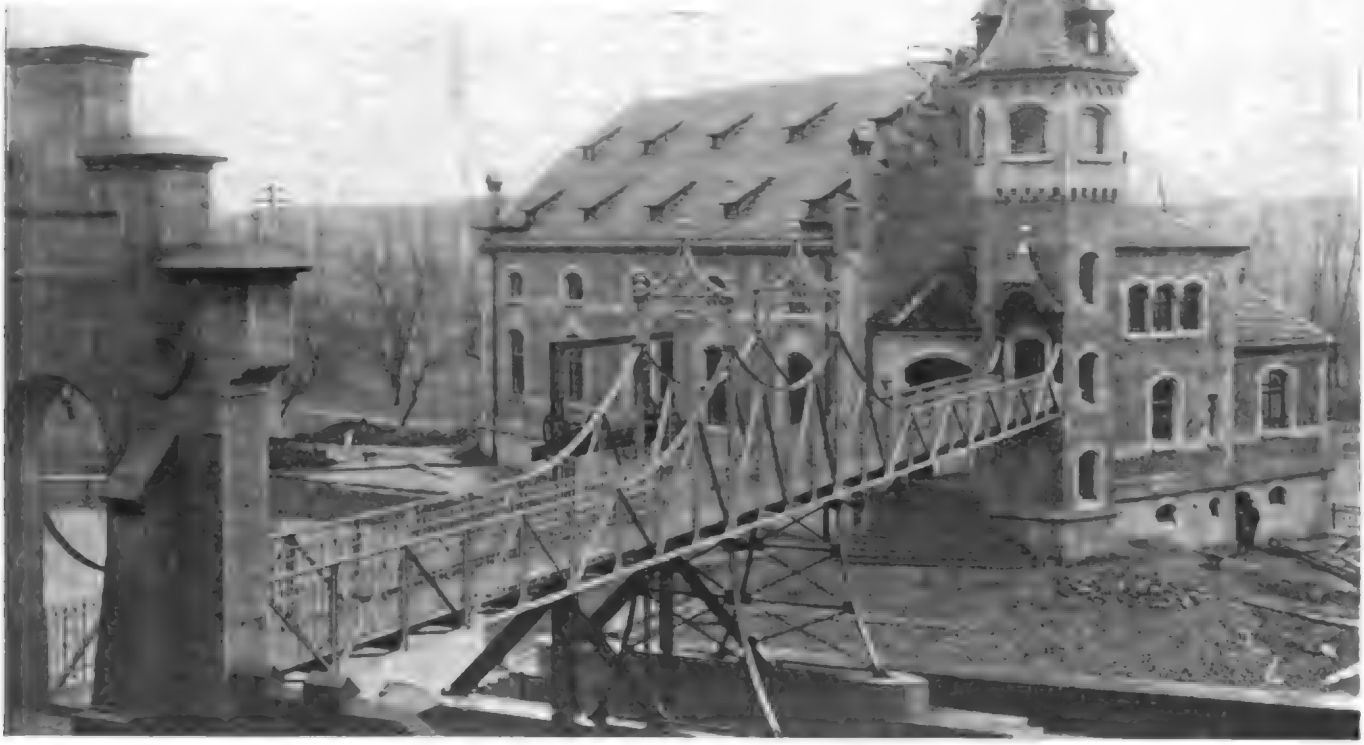


Fig. 1.—Hydro-Electric Plant of the City of Stuttgart, Germany.

In classifying power plants, we have, first, steam-driven plants; second and of almost equal importance, hydraulic plants; third, power plants equipped with combustion engines, although there are to-day only a few of these in operation; and fourth, refuse destruction generating stations, though these latter are only of limited capacity. The architectural treatment of a plant is more or less fixed by the nature of its source of power; and whatever type of plant is to be constructed, its purpose cannot be overlooked and the location must also be taken carefully into consideration. A plant located within the city confines of course requires a different architectural treatment than one lying in the suburbs or in an isolated location. The latter class is coming more and more to the front, due to the adoption of high voltages. In spite of limitations, however, on the Continent of Europe the average isolated station is better treated architecturally than the average city plants of Great Britain and America.

An example of one of these plants which is shown in Fig. 1, is the Marbach hydro-electric plant at Stuttgart, Germany. The modern and steel construction of the bridge leading from the handsome stone entrance arch to the building, spanning the head race, harmonizes with the general appearance of the building itself, the style of which will be recognized as that of the fifteenth century. This plant, which is equipped with four 300-hp hydraulic generator units and a small storage battery of 300 ampere-hours capacity, would be considered a very small plant in this country and so unimportant as not to warrant any expense for an artistic appearance.

More prominent plants are the twin municipal stations of the city of Vienna, one of which is illustrated in Fig. 2 (its twin adjoining to the left), and the municipal plant of the city of Munich shown in Fig. 4. Both of these plants are located in an unfrequented section of the respective cities, yet their design is well treated architecturally. The Munich plant is now undergoing a large extension to the left, and will receive a second chimney, thus giving it a more symmetrical appearance. Other prominent plants of artistic design are the five plants of the city of Hamburg. One of these, the Barmbech plant, is shown in Fig. 5. As all of these plants operate on a direct-current system, they are located directly in the city, which practically forced an artistic treatment. One of the most noticeable central stations from an

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architectural standpoint is that of the high pressure steam heating transmission and electric lighting system of Dresden. As this plant is located in the most prominent part of the city between the Royal and municipal buildings in the aristocratic section along the River Elbe, it was of course natural that great pains should be taken with the architectural design. This building would not at all remind one of a power plant, but rather of an institute, although a tall smoke stack rises from its center, the latter being carefully treated more as an observation tower than anything else. The entire structure is of rough-faced light gray granite. Of course, it is well understood that every precaution is taken for a complete smoke consumption.

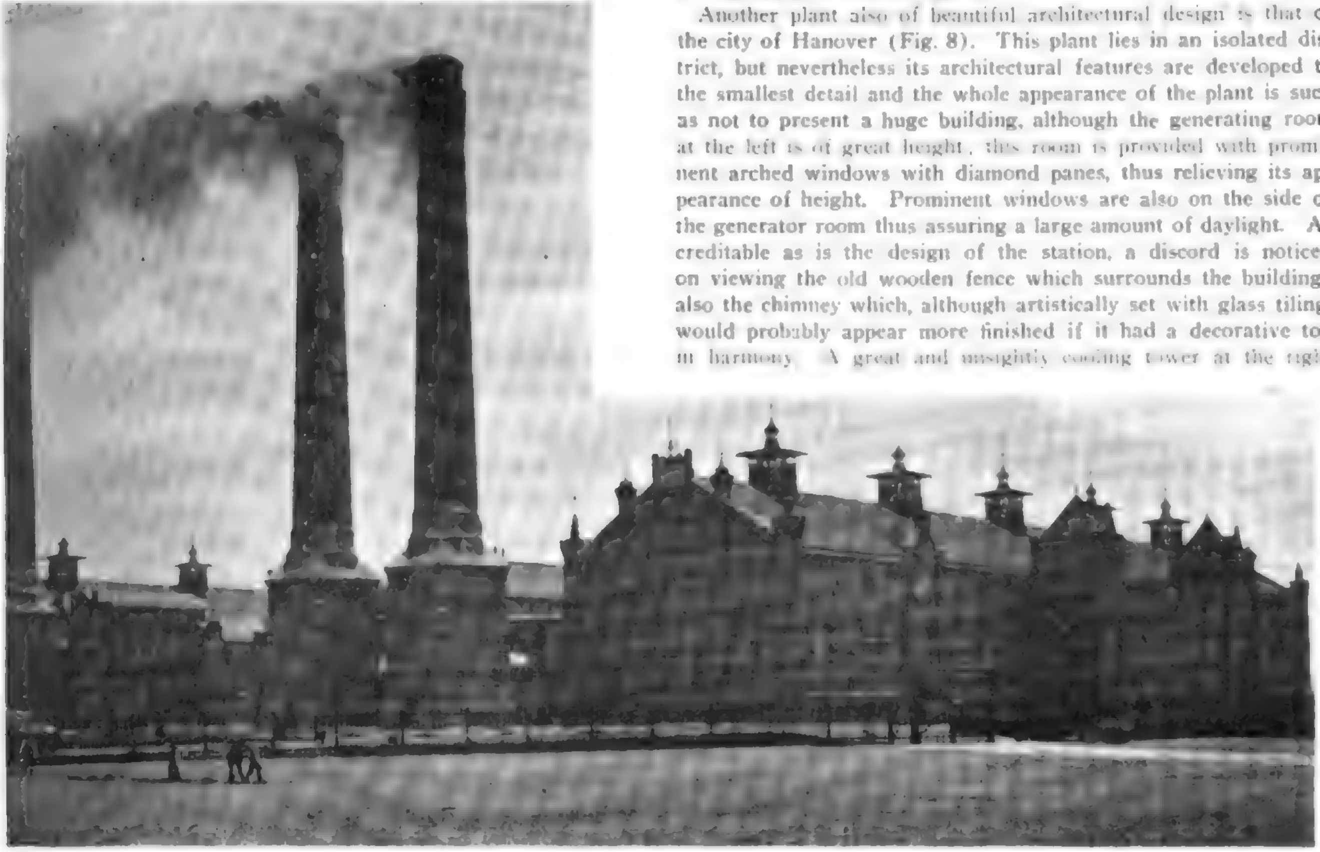


FIG. 2.—VIENNA TWIN POWER STATION.

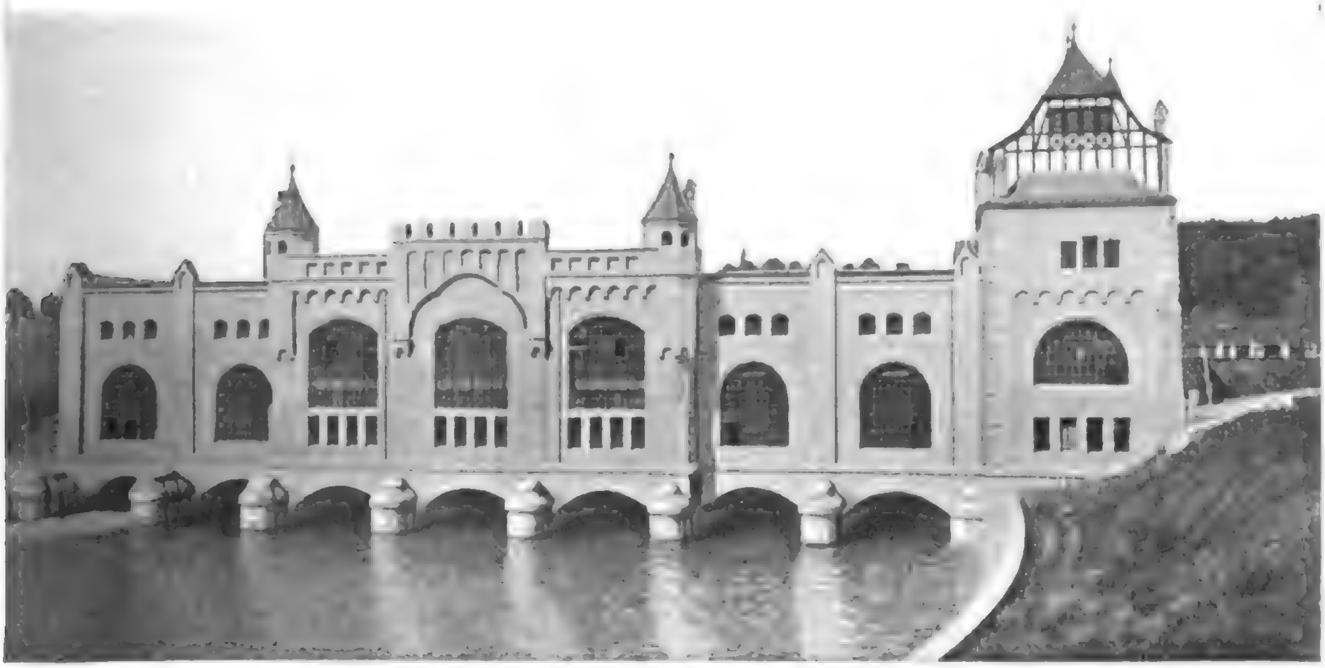


FIG. 3.—HYDRO-ELECTRIC PLANT, WANGEN ON THE AARE, SWITZERLAND.

Another plant also of beautiful architectural design is that of the city of Hanover (Fig. 8). This plant lies in an isolated district, but nevertheless its architectural features are developed to the smallest detail and the whole appearance of the plant is such as not to present a huge building, although the generating room at the left is of great height; this room is provided with prominent arched windows with diamond panes, thus relieving its appearance of height. Prominent windows are also on the side of the generator room thus assuring a large amount of daylight. As creditable as is the design of the station, a discord is noticed on viewing the old wooden fence which surrounds the building; also the chimney which, although artistically set with glass tiling, would probably appear more finished if it had a decorative top in harmony. A great and unsightly cooling tower at the right could probably have been made to match the building if it had been built of steel or reinforced concrete rather than of wood. Such features, although they surely detract from the appearance of the station, are frequently found in connection with otherwise good Continental plants.

A fine layout will be found in the twin municipal plants of Vienna (Fig. 2). Both plants lying side by side are well arranged with respect to the coal handling and condenser water systems. The pumping stations supplying the condensing water, an isolated office building and a superintendent's house and a canteen for the convenience of the workmen, are well arranged upon the plot, which is planted with trees and well covered with lawns to prevent dust and surrounded with a high fence. Another well laid out station is that of the refuse destruction plant of Hamburg, the grounds of which are also planted with grass and trees. The isolated chimney of this plant is constructed of common chimney brick with a well formed base and an appropriate top finish.

The location of a central station plant must be kept well in mind and harmonize with the prevailing surrounding style. Studying the Continental plant particularly in the mountainous countries, as Italy, Switzerland and Tyrol, where a number of

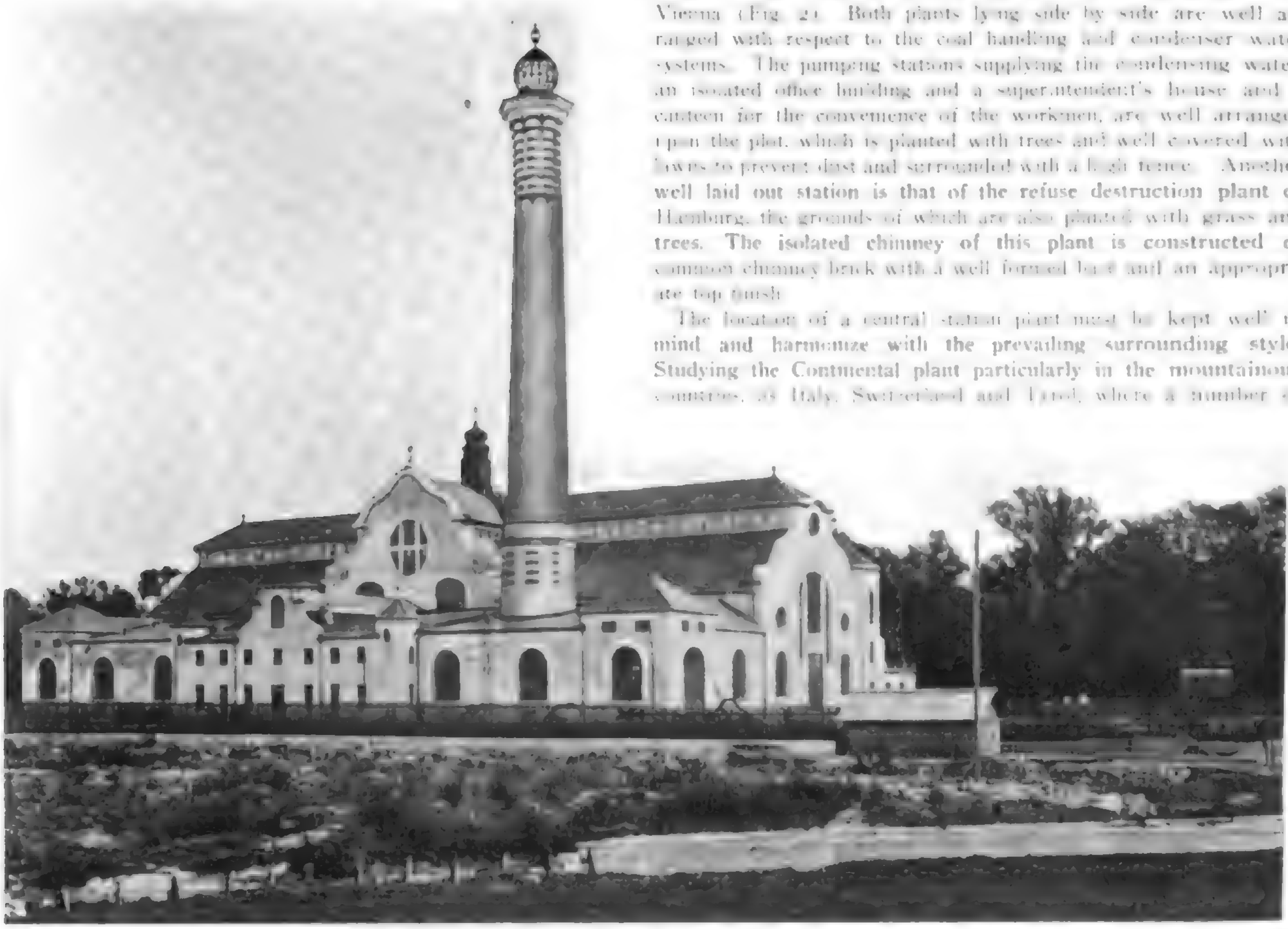


Fig. 4.—Municipal Plant, Munich, Bavaria.

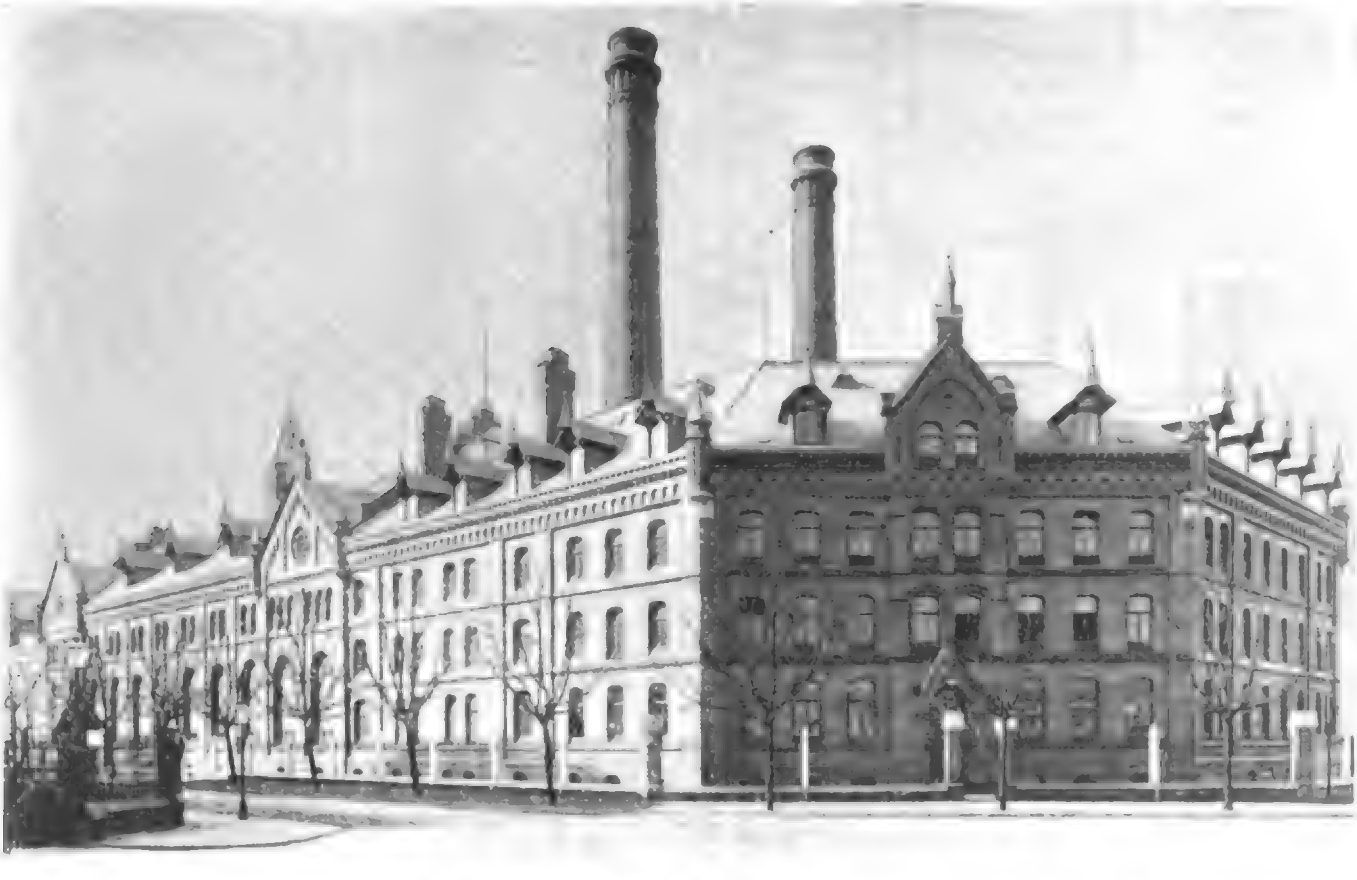


Fig. 5.—Hamburg Power Plant, "Barmbeck."

small plants utilize the water of the streams and lakes, one will observe plants designed in style as the surrounding buildings, an example of which is given in Fig. 2, representing the Plant Wangen on the Aare, Switzerland.

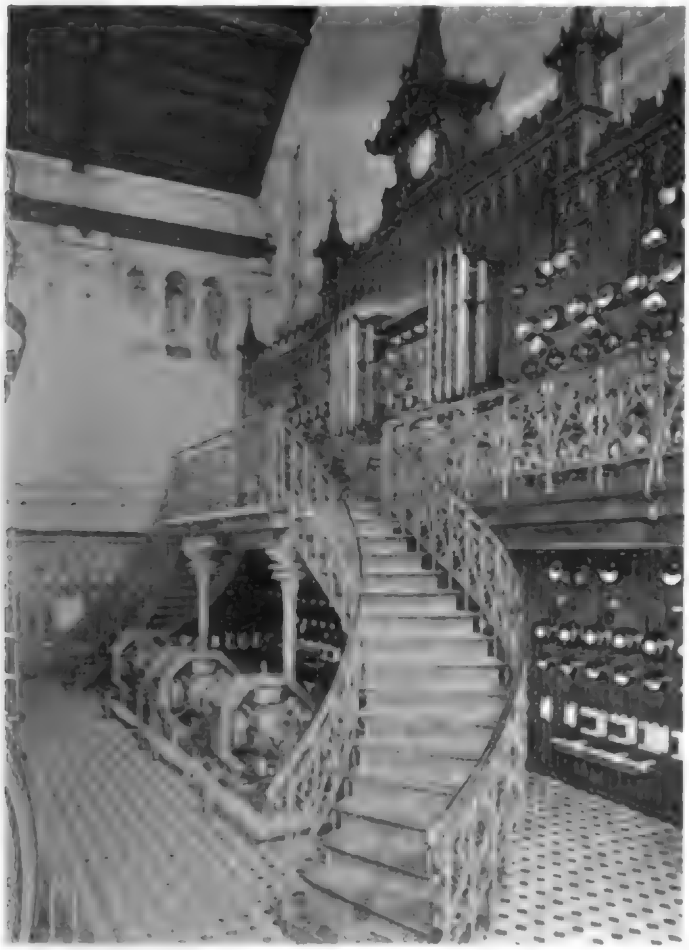


Fig. 6.—Low-Voltage Switchboard, Hamburg Plant

As steam generating plants are usually installed at the side of rivers or canals on account of coal handling and condensing water facilities, the plants of to-day are well equipped with complete coal and ash handling apparatus, and it must not be forgotten that these outfits have to match the appearance of the main power plant building and the surroundings. Modern engineering has developed such perfect coal handling apparatus that the indiscriminate spilling of coal or ashes should not more be tolerated. Cleanliness is of the utmost importance when the appearance of the plant is to be judged. Also the free supply of daylight is one of the most important factors. And it must be remembered that on the Continent where land is cheap, it is not found necessary to cramp the layout. Therefore, one will generally find single-story boiler houses, while in prominent cities of American and Great Britain

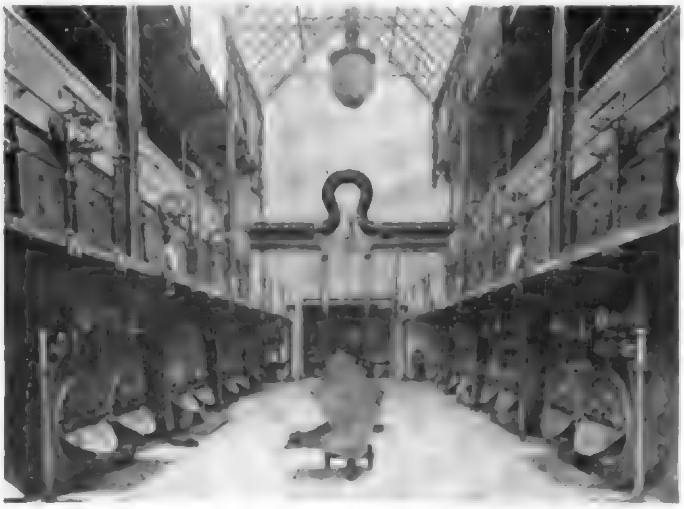


Fig. 7.—Interior of Boiler Plant, Hamburg Plant

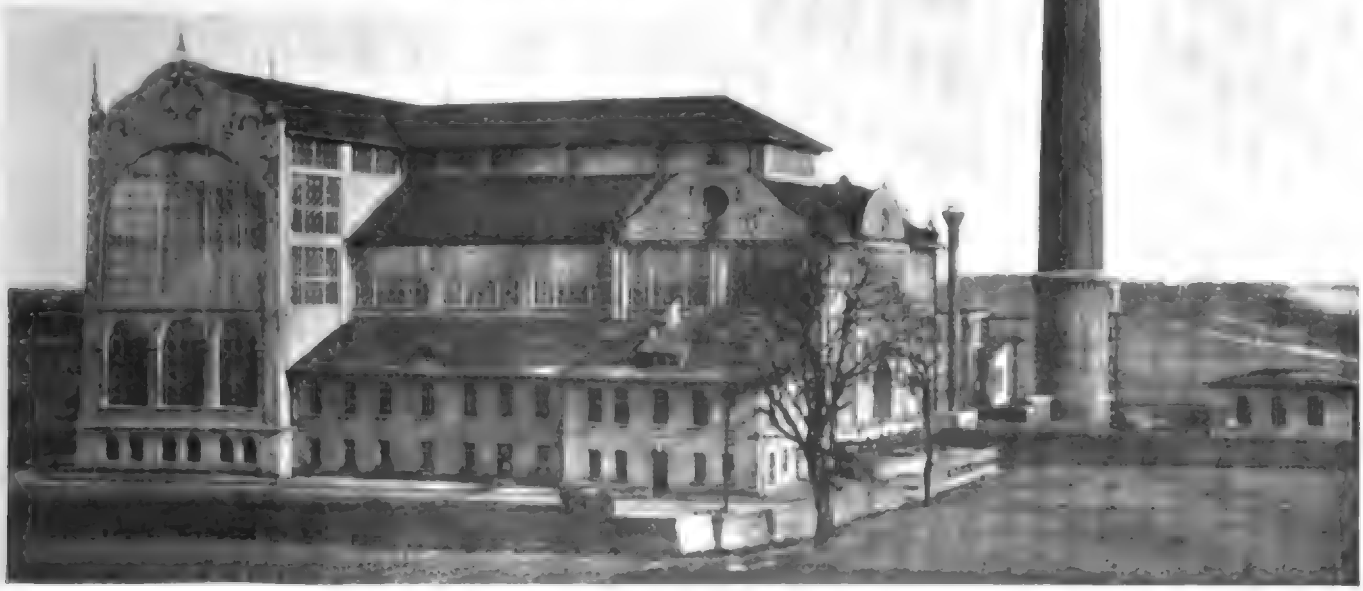


Fig. 1.—Municipal Plant, Hamburg, Germany.

two and three story boiler houses are frequently found, thus making it more difficult to supply sufficient daylight, and obliging the stokers in many instances to work by artificial light. Also these latter plants cannot so easily obtain as good air circulation as the former ones, which is a decided disadvantage. It is almost standard Continental practice to have a large glass monitor roof, well provided with louvres, running the entire length of a main boiler room aisle.

A symmetrical arrangement of boilers, galleries and pipes adds materially to the general appearance of the system. On inspecting Continental plants, one will not seldom find highly polished boiler feed pipes of copper. This, however, is not done for the appearance of the plant, but for the reduction of radiation, which it is claimed is as effective as one of the best covering systems. This system would probably have been still in use with the steam pipe system were it not for the introduction of super-heated steam which prohibits the use of copper. Instead of this the steam pipes are well covered and kept a uniform color. To obtain a good, neat appearance of the generating room, all pipes should be kept below the floor level, feeding the prime-mover from below and in all cases where pipes pass through floors or walls, round thimbles should be provided.

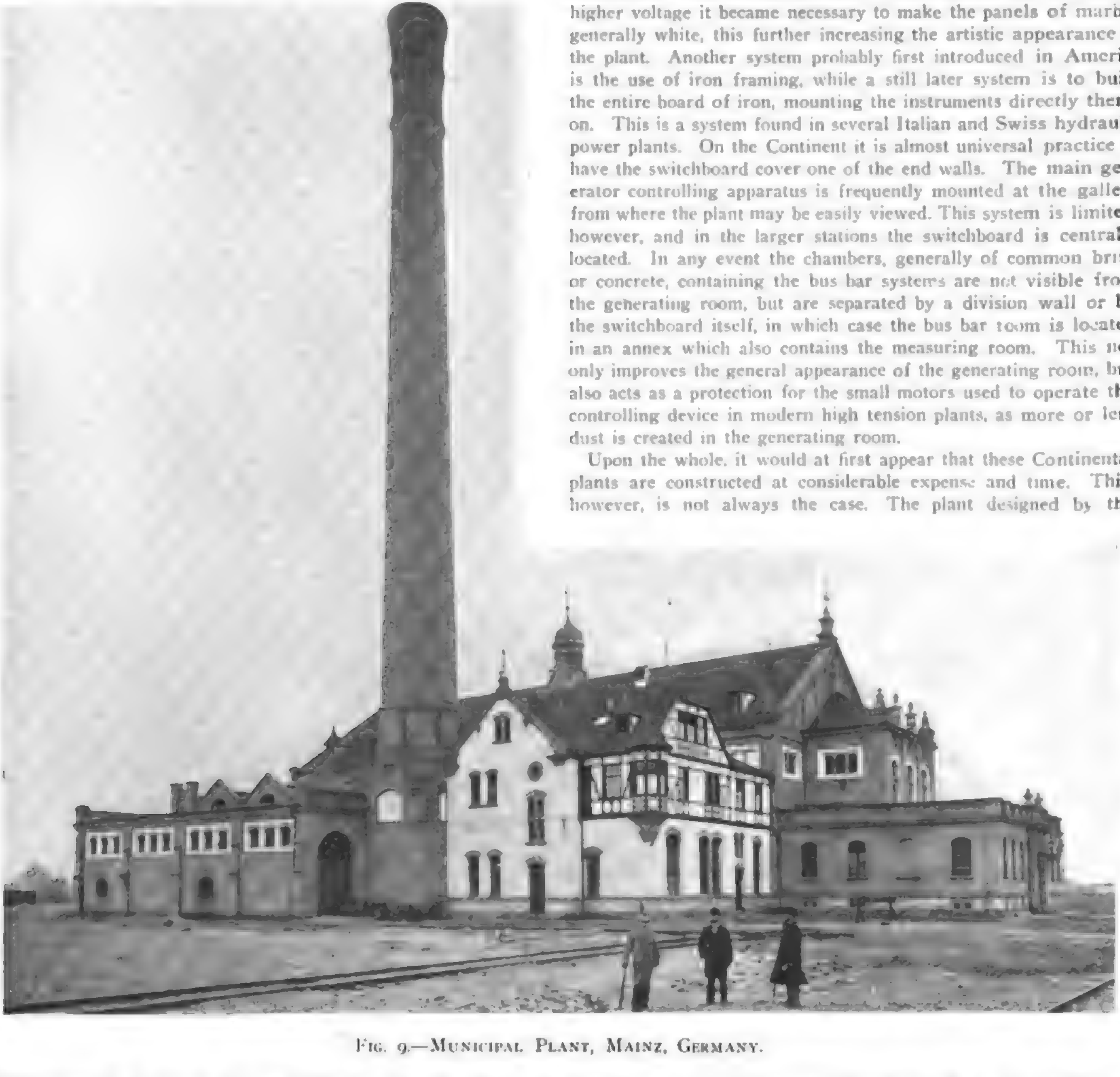


FIG. 9.—MUNICIPAL PLANT, MAINZ, GERMANY.

The symmetrical arrangement in the layout of apparatus is of the greatest importance and not only adds to the appearance of the plant, but is also an addition to the convenience which is probably more appreciated by the operator of the plant. The windows and pilasters bearing the crane girders should be so arranged as to result in a symmetrical appearance with regard to the prime movers, although frequently a plant is laid out with a view to a future increase in its equipment.

One of the main artistic features on a Continental plant is the design of the switchboard, a work accomplished both by the engineer and the architect or rather by an expert switchboard designer. It may be stated that a switchboard is seldom found designed purely for its electrical service without any decorative features. In the early power plant practice, using low-tension current, the switchboard was built entirely of wood of highly ornamental design. An example of this is given in the accompanying illustration representing the switchboard of the Hamburg plant "Zollvereinsniederlage." Of course, with the use of higher voltage it became necessary to make the panels of marble, generally white, this further increasing the artistic appearance of the plant. Another system probably first introduced in America is the use of iron framing, while a still later system is to build the entire board of iron, mounting the instruments directly thereon. This is a system found in several Italian and Swiss hydraulic power plants. On the Continent it is almost universal practice to have the switchboard cover one of the end walls. The main generator controlling apparatus is frequently mounted at the gallery from where the plant may be easily viewed. This system is limited, however, and in the larger stations the switchboard is centrally located. In any event the chambers, generally of common brick or concrete, containing the bus bar systems are not visible from the generating room, but are separated by a division wall or by the switchboard itself, in which case the bus bar room is located in an annex which also contains the measuring room. This not only improves the general appearance of the generating room, but also acts as a protection for the small motors used to operate the controlling device in modern high tension plants, as more or less dust is created in the generating room.

Upon the whole, it would at first appear that these Continental plants are constructed at considerable expense and time. This, however, is not always the case. The plant designed by the Continent engineer is cheaper in first cost and also in operation, as has frequently been conclusively proven. This, however, is due not wholly to the manufacturer and the manager of the plan, for undoubtedly the greatest responsibility rests upon the designer, who can not only reduce the first cost, but his skill and judgment will also minimize the operating expenses, and at the same time he endeavors to create a structure worthy of an aesthetic appreciation. One may probably object to the seemingly extravagant expenditure of money, but it must be noted that many of the above mentioned items may be incorporated in the design without any additional cost, and while always keeping in mind the primary object of a power plant, the constructor should strive for an artistic appearance.

The Lighting of Living Rooms and Parlors.

By J. R. Cravath and V. R. Lansingh.

In residences and especially in small residences the satisfaction of a central station customer with electric light will depend much on the intelligence and forethought exercised in designing the lighting arrangements. Poor design of these arrangements resulting either in insufficient illumination or large lighting bills is the basis of most of the reasonable complaints received by electric lighting companies from residence customers. While the electric incandescent lamp may be in many cases more expensive to operate than competing illuminants when comparison is made on the basis of total light units emitted, the fact that the rays from the electric lamp may so much more easily be directed where they are of use than those from gas or kerosene make it usually possible to keep the expense for electric light close to that of other illuminants, if the location and equipment of lights is properly planned. As the living room in the average home is the one most occupied during the evening and hence the one about the lighting of which the occupants are most particular, it naturally comes first in a consideration of residence lighting.

In order to consider the following practical examples of good and bad lighting intelligently it is suggested that the reader, if possible, have before him the tests giving the distribution of light around incandescent lamps with various types of reflectors, globes and shades given in a series of articles by the authors in the *Electrical World and Engineer* November 25, December 2, 9, 16 and 23, 1905.

The general lighting of the living room of small or moderate-sized residences and the provision for reading lights in these rooms are so closely connected that they must necessarily be considered together. The reading light is the one that is likely to be used constantly and has so much to do with the comfort and eyesight of members of the family that it needs earnest consideration. There are three common ways of obtaining a reading light. One way is to illuminate the whole room so brightly that reading is easy in any part of it. This is usually undesirable for two reasons: One is, that the eye is likely to tire more quickly in a room so brightly illuminated in all corners than it would if it had an opportunity to rest by looking from the lighter to the darker parts of the room occasionally. The cost of lighting a room so brilliantly as this makes it out of the question in the majority of rooms. We will, therefore, leave out of consideration this method of securing a reading light and consider the second and third methods. The second method is to use a lamp placed near the reader and fitted with a globe or reflector which will concentrate nearly all the light on the book or paper. If we do this, the reading lamp is likely to be of little value in the general lighting of the room and we will have to add other lights besides the reading lamp if the greater part of the room is not to be in comparative darkness. The third method, which is the one usually to be preferred where the greatest economy is an object, is to use the same light both for reading and for the general lighting of the room by equipping the reading light with a globe or reflector which will concentrate a considerable portion of its light within the area in which it is desired to read and at the same time allow enough light to radiate in all directions to give fairly good illumination over the rest of the room. There is a popular impression that the portable table lamp is better adapted to reading than a lamp on a chandelier or bracket. Such table lamps are an inheritance from the days of the candle and oil lamp. With electric light, usually much more satisfactory results can be obtained with a properly equipped reading light on or suspended from the chandelier or on a bracket on one of the side walls. The reason for this is that it is impossible with a table lamp to secure a reflector which will throw as large a proportion of the light where it is needed for reading purposes as can be obtained from the proper reflectors on chandeliers and brackets. Most of the electric portable stand lamps throw the greater part of the light down on the table around the base of the lamp, so that the readers sitting around the table get only a small percentage of the light. If we take any of the shades or reflectors, tests on which were shown in the previous articles by the authors on reflectors, shades and globes, which are at all suited for use on a portable table lamp, we will see that this is true. If the portable stand lamp is used on a library table where the readers place their books on the table each side of the lamp its use is permissible, but such is not the usual condition.

There is also considerable misconception as to the comparative distance from the reader of a lamp located 6 ft. above the floor on a chandelier as against a lamp located on a table. The average person who has never measured these distances is under the impression that the lamp on the reading table is much nearer. As a matter of fact, the distances are nearly the same. There is really for the majority of cases only about one thing to be said in favor of an electric table lamp for reading as against a properly equipped lamp on a chandelier or bracket. This is that with the table lamp it is not as likely that a reader will get the regular reflection commonly known as the "glare" from a page of white paper because the light comes so much from one side. In reading underneath a lamp on a chandelier or bracket the reader must turn the page at such an angle that he does not receive this glare from the paper. This is easily done, but many people undoubtedly suffer from this without knowing what is the trouble or taking pains to find out. Since this glare of regular reflection is likely to be more pronounced with electric light than with kerosene lamps, it is probably this that is responsible for the preference that some people have for oil reading lamps even though electric light is available in the rest of the house.

In what has been said as to the advantages of reading lights placed on chandeliers and brackets as against an electric table lamp, it must be carefully noted that the authors do not advocate trying to read with light from chandeliers which are arranged entirely for the general illumination of the room. Chandeliers should be equipped with reference to using them for reading lights if they are to be superior to electric portable table lamps.

The authors have also neglected here the consideration of a portable reading light equipped with an art glass or other fancy shade, the primary use of which is for ornamental purposes and secondarily for reading. Such shades are taken up later in this article.

In Fig. 1 is shown an excellent arrangement of chandelier for a small living room where a good reading lamp and lamps for the general illumination of the room are provided on the same fixture. On this chandelier a middle socket which points straight down is equipped with a prismatic glass reflector, which concentrates light under the chandelier for reading purposes and at the same time allows enough light to escape through the reflector to light the walls and ceilings moderately so that the single reading lamp is sufficient ordinarily, both for reading and general illumination of the room. The particular reflector shown in Fig. 1, which is a Pagoda 2301, concentrates its light over a floor area sufficiently large to permit three persons to read comfortably under it. A larger reading circle can be secured by using a reflector with less concentrated distribution. On special occasions, when the general lighting of the room rather than a concentrated light is wanted, the two lamps on the arms of the chandelier are lighted. These chandelier arms are equipped with Class B Holophane globes, which give a good general distribution of light in all directions below the horizontal and also diffuse the glare from the lamps to make the lighting comfortable to visitors and others who may sit facing it. The same general scheme could manifestly be used with a chandelier having three or four arms carrying lamps for the general lighting of the room. The chandelier as it stands in Fig. 1 is in a room 14 ft. square with dark walls and rugs and is equipped with 8-cp lamps in the arm sockets and a 16-cp in the center socket for reading. This candle power can, of course, be increased at the desire of the user. In a light finished room of this size, lamps of this candle power would be more than sufficient, but may not suit all tastes in a room with dark walls. The center or reading lamp is not used when general illumination is desired, and vice versa, the lamps for general lighting may usually be turned off when the reading light is on. If an especially strong concentrated light is wanted, an attachment plug with 16 in. of drop cord can be hung from the middle socket so as to bring the lamp about one foot above the head of a person seated under it. With a good concentrating type of reflector on the end of the drop cord, this makes an excellent arrangement for sewing on dark goods at night or any work requiring an extra strong light for one person. For ordinary reading, a 2 or 4-cp lamp in a concentrating reflector will be sufficient for one person, with the lamp on a drop cord hung about one foot above the head. Such an arrangement is not to be recommended, however, unless some provision is made also for the general lighting of the room by turning on one of the lamps on the chandelier, because the room will be in comparative darkness with the exception of the very bright area immediately under the reflector, and it is too violent a change for the eye to frequently glance from the brightly illuminated page to the darkened room.

While it is desirable, as indicated before, to rest the eye occasionally while reading with artificial light by glancing from the brightly lighted page to parts of the room not so brilliantly illuminated, it is not good to have this change too violent. Thus, suppose, for example, a person is reading under an opaque concentrating reflector such as the frosted aluminum or X-ray types; the light on the reading page will be very strong, and the balance of the room, especially if it has dark rugs and walls, will be almost in darkness. A change from the brightly lighted page to the dark corners of the room is extremely violent and is a strain on the eye, although a change less violent would be a helpful rest to the eye. Many modifications of Fig. 1 suggest themselves. For the general lighting of the room Class B Holophane globes were chosen in this case as before explained because they gave the proper distribution of light below the horizontal and at the same time diffused the light so that persons sitting around the room in general conversation would not be annoyed by the glare from the bare filaments of the lamp. The same purpose could be accomplished in a different way by selecting some type of reflector which would give a good intensity in all directions below the lamp and using inside the reflector lamps with frosted bulbs. Reflectors giving such a distribution can be found in the articles referred to on reflectors. The opal bell with crimped edge probably comes the nearest to the requirements as far as distribution of light is concerned. It is important to remember in the general lighting of a living or reception room where a number of people are likely to be sitting around in positions facing the chandelier to avoid anything which would allow the undiffused rays from a large portion of the bare filament of a lamp to fall in the eyes. For this reason, whenever open reflectors are used, they should be equipped with frosted bulb lamps. On a chandelier like that shown in Fig. 1, if the reading lamp does not have a frosted bulb, it ought to be turned off when general illumination on special occasions is desired. It will be noticed that the sockets on the arms of the chandelier, Fig. 1, are placed pendant or pointing straight down. With a globe of the Class B Holophane type or with any reflector giving a similar distribution of light, an angle of 10 degrees from the vertical should not be exceeded with these sockets, otherwise an unnecessary amount of light will be thrown up toward the ceiling and high side walls.

In Fig. 2 is shown a good example of how not to arrange a reading lamp. Here the portable, electric table lamp is attached by an extension cord to one of the sockets on a chandelier. The table lamp, like most of its kind, throws the better part of its light on the table, while the persons reading are supposed to sit around the table at some distance from the lamp. The extension cord from the chandelier is a nuisance and unsightly. This chandelier could be easily converted to afford an efficient reading light by replacing the opal ball on the bottom of the chandelier by a reflector or a Class A Holophane globe for throwing light down. If a number of persons were to read under the chandelier, an opal dome reflector could be used to advantage, as it would throw light over a considerable area. The same reflector might be used on the chandelier shown in Fig. 1, supposing that the other glassware on it was changed to harmonize. Returning to Fig. 2, the opal bell reflectors on the three arms of the chandelier are excellent for the particular purpose of general illumination in this particular room. When placed at an angle of 45 degrees, as on this chandelier, they throw considerable light to the high side walls and illuminate the pictures which are placed high. They should be used with frosted bulb lamps. In the majority of cases the arms of this chandelier, Fig. 2, if equipped with opal bell reflectors of this kind should have sockets pointed nearly straight down, otherwise too much light goes to the high side walls. On this chandelier, as it is shown, the opal ball on the bottom absorbs a large percentage of the light and does not direct the rays in useful directions.

Fig. 3 is an example of a common arrangement of chandelier for parlor and living room lighting. Its greatest defect is that no provision is made for reading lamps unless they be attached in place of the lamps in one of the sockets, which is an unsightly and unsatisfactory arrangement. Where such a chandelier is used, other provisions should be made for a reading lamp, but it is too frequently the case that they are not made. The chandelier as shown in Fig. 3 is equipped with fluted opal cone reflectors of the type shown in the chapter on that subject. These, when placed at an angle of 45 degrees, will, on a three-light chandelier in the middle of a square room, as in Fig. 3, give an excellent distribution of light for the general illumination of the room. Frosted bulbs should always be used in them when so placed to avoid the glare in the eyes of the occupants. A general illumination of a room is usually wanted only at times when a number of people are using a room, and it is at such times that some are sure to be sitting facing the light. To throw the light from a strong reflector in the eyes of the guests, in addition to the undiffused light of the bare incandescent lamp filament, is anything but hospitable treatment, and in the course of an evening will cause discomfort, although its cause may not be apparent to the person affected.

Fig. 4 shows how a good reading light was obtained from a chandelier like that in Fig. 3. A short length of drop cord was attached to one of the sockets and a reflector harmonizing with those on the chandelier was hung pendant, as seen, so that it throws its light directly down. This, of course, is a make-shift, but is intended simply as a suggestion as to how many existing arrangements can be made tolerably satisfactory. The chandelier was equipped with etched glass shades. The reading lamp was placed in a prismatic glass reflector, and the light for reading under the chandelier is far better since the change with one 16-cp lamp than it was formerly with the lamps on the three chandelier arms, although, of course, the general illumination is not as good.

Fig. 5 shows an excellent chandelier arrangement for both reading and general illumination in a small living room where minimum expense both in first cost and operation is desired. This is simply a two-light chandelier with both sockets vertical, equipped with prismatic reflectors. This concentrates enough light for reading in the center of a room while giving good enough illumination for ordinary purposes in the far corners. These reflectors (Pagoda 2301) give their concentrated light over a fairly wide area as compared with many others of this type. If a more concentrated light is desired, an attachment cord and plug can be put on as in Fig. 6. This attachment equipped with a powerful concentrating reflector (Pagoda 2641) can be used either hung up on the chandelier, as shown, or let down for sewing or work requiring intense light. This chandelier is not as good an all-around arrangement as that of Fig. 1, as it does not provide so well for the general illumination of the room. It is, however, fairly satisfactory for most purposes. The reflectors nearly cover the lamp bulbs so that not much of the bare lamp filament is visible to a person seated in one corner of the room. Even this little is objectionable, and it would be better to have it covered by using a frosted bulb lamp.

Fig. 7 is another good example of how not to do it. The reading lamp located on the table equipped with a downwardly pointed socket and opal fluted cone shade throws nearly all its light on the table. The absurdity of trying to read by such an arrangement can be seen by consulting the test given in the previous article on reflectors showing the light distribution from this reflector. The absurdity of the arrangement is further emphasized by the presence on the wall immediately back of the reading table of a bracket with a socket pointed at just the right angle to throw a good light for reading purposes.

Fig. 8 shows how the arrangement in Fig. 7 was thus converted into a very efficient reading arrangement by simply putting a good concentrating type of reflector on the wall bracket and moving the large table away so that those desiring to read could sit within the range of the concentrated light from the reflector on the bracket.

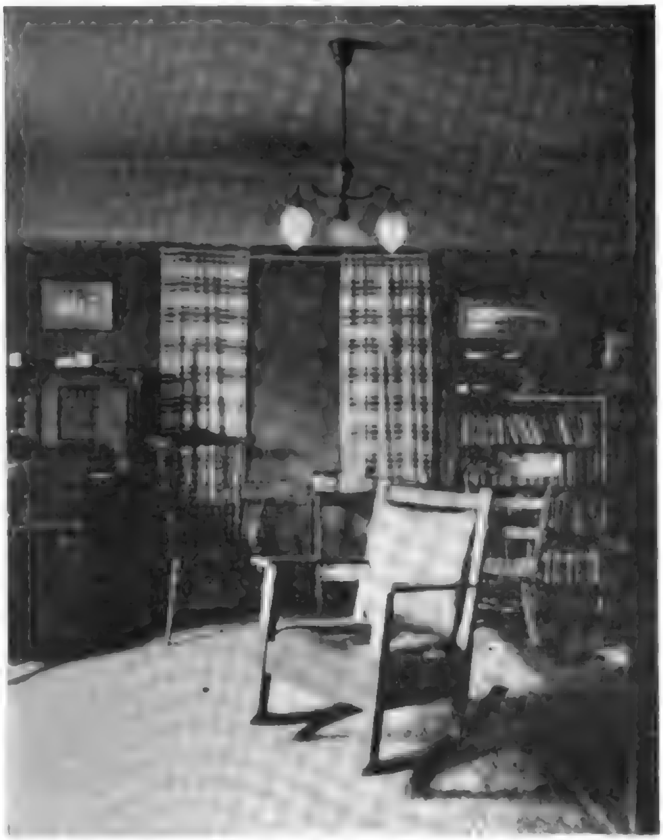


FIG. 1.—LIGHTING ARRANGEMENT FOR LIVING ROOM.

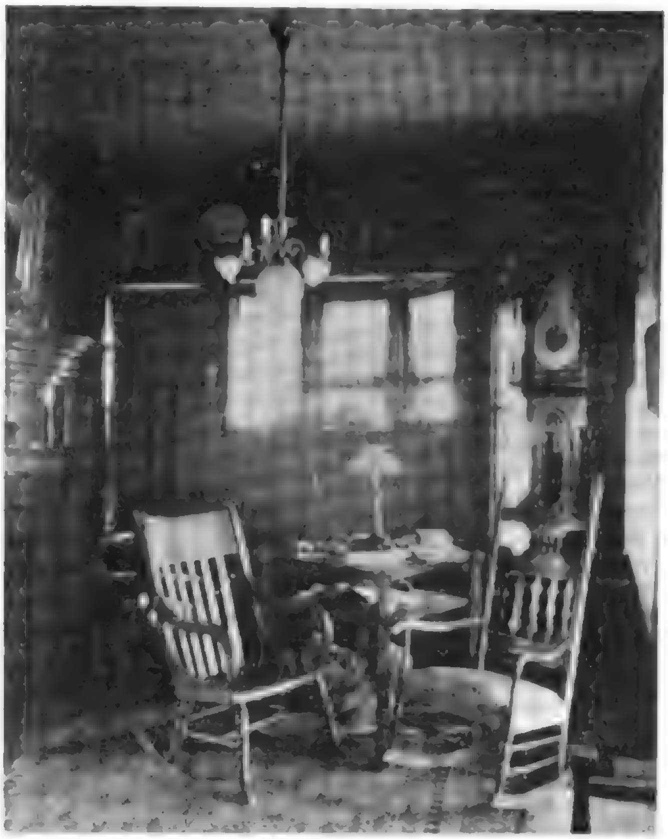


FIG. 2.—POOR ARRANGEMENT OF READING LAMP.

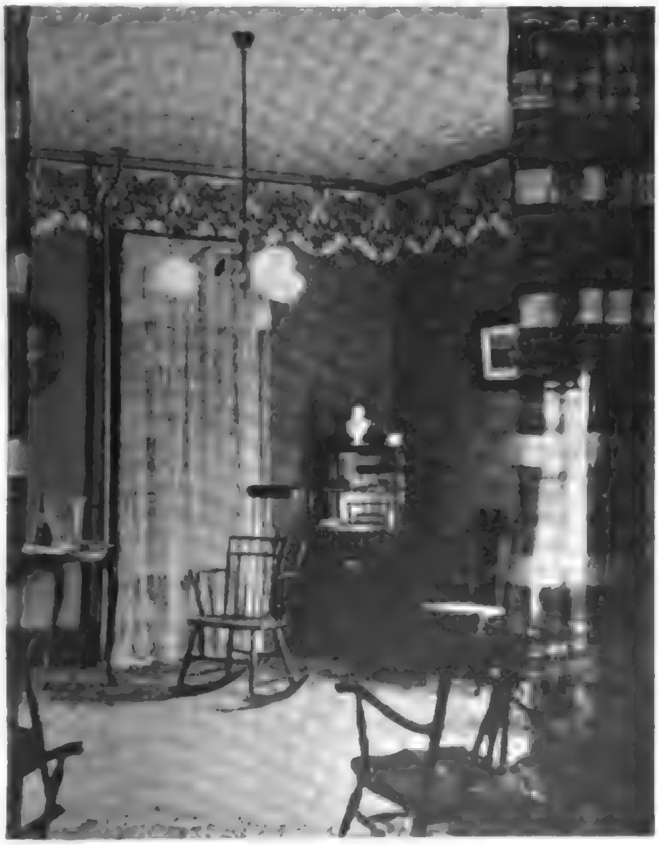


FIG. 3.—COMMON ARRANGEMENT OF CHANDELIER.

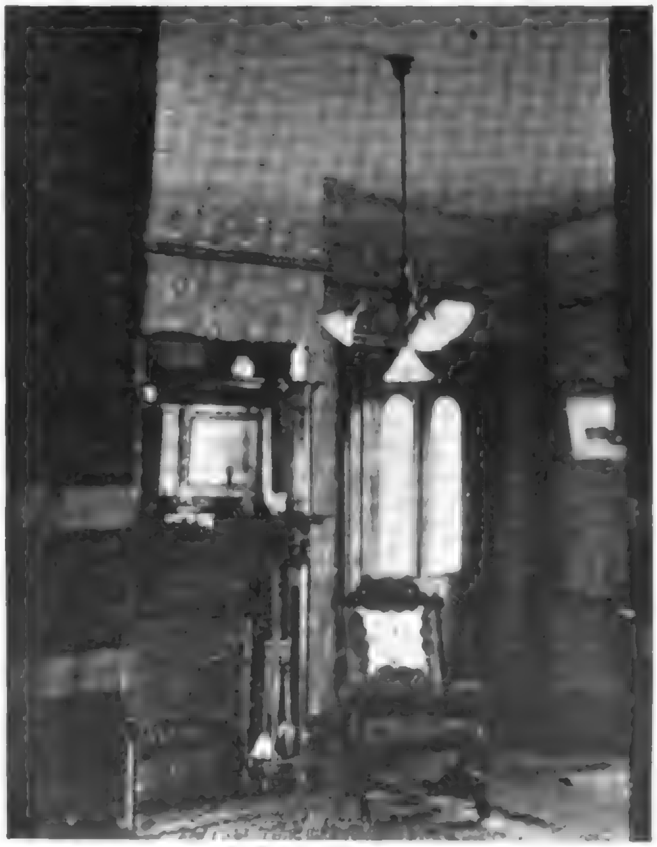


FIG. 4.—GOOD ARRANGEMENT OF READING LAMP.

Fig. 9 shows a good way of lighting a small parlor with a chandelier having sockets at an angle of 45 degrees. This is a similar case to that shown in Fig. 3. No concentrated light was wanted in any portion with the possible exception of the piano, and for this, sufficient light is obtained from the chandelier. The chandelier is equipped with three Class A Holophane globes, these globes of the Class A type being such as to concentrate much of the light in the direction in which the tip of the lamp points. This chandelier in Fig. 9 was previously equipped with opaline bell reflectors, which allowed so much of the light to escape towards the ceiling that there was not enough at the piano and in the lower part of the room. It is a mistake to equip a chandelier of this kind with any type of globe or reflector which will give a general distribution of light at a wide angle below the horizontal unless the lamp is

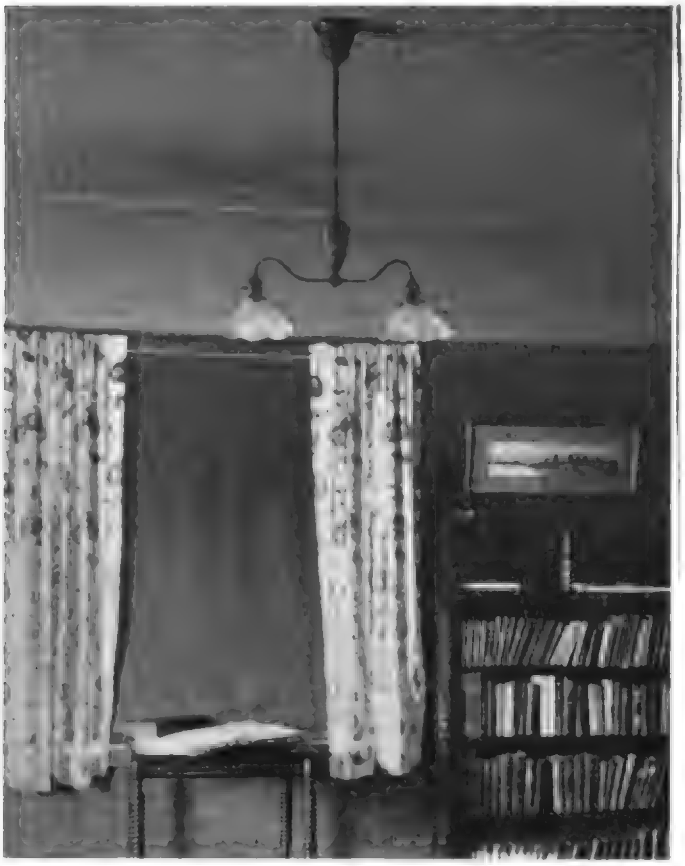


FIG. 5.—EXCELLENT CHANDELIER ARRANGEMENT.

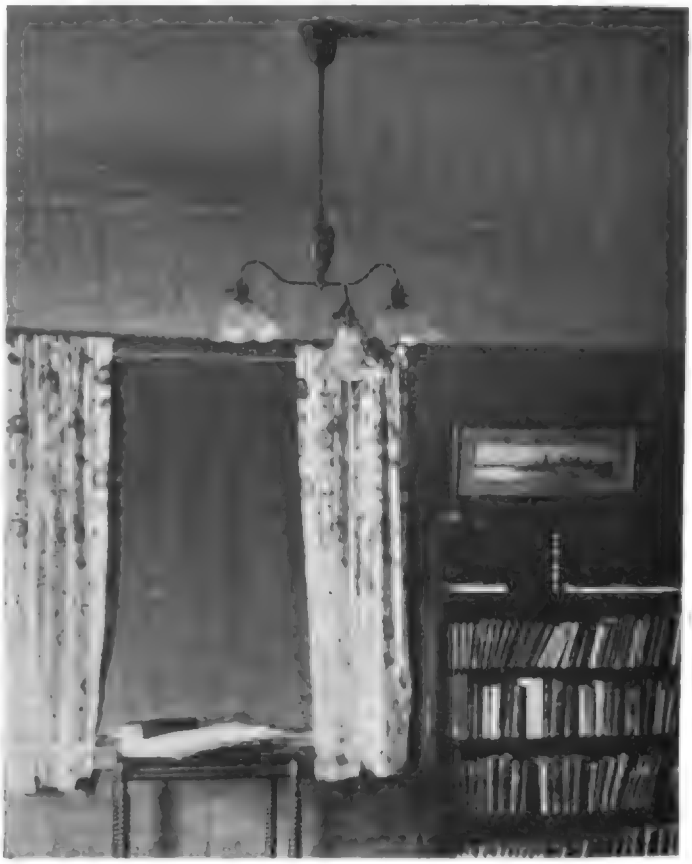


FIG. 6.—ARRANGEMENT FOR CONCENTRATED ILLUMINATION.

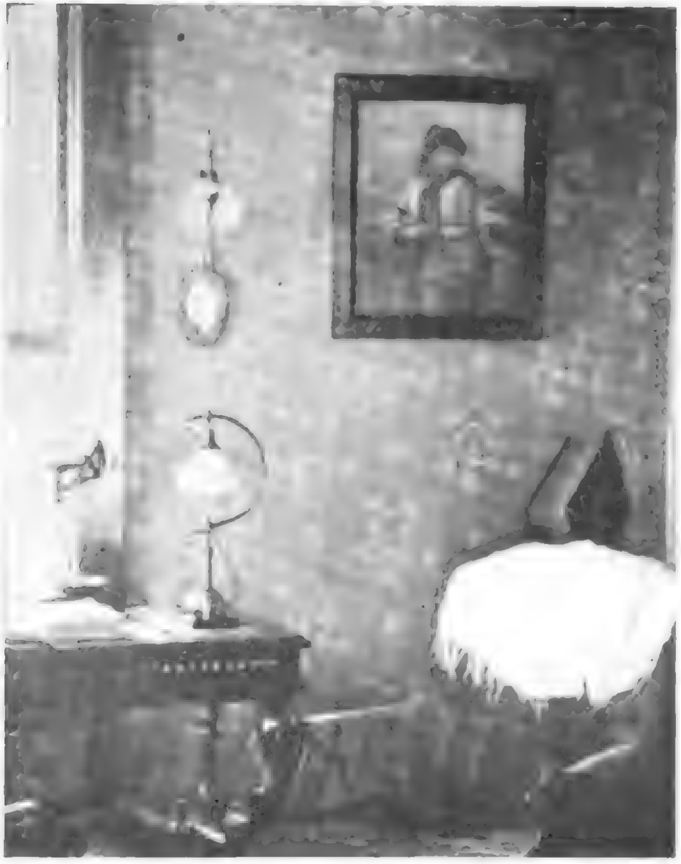


FIG. 7.—POOR ARRANGEMENT OF READING LAMP.

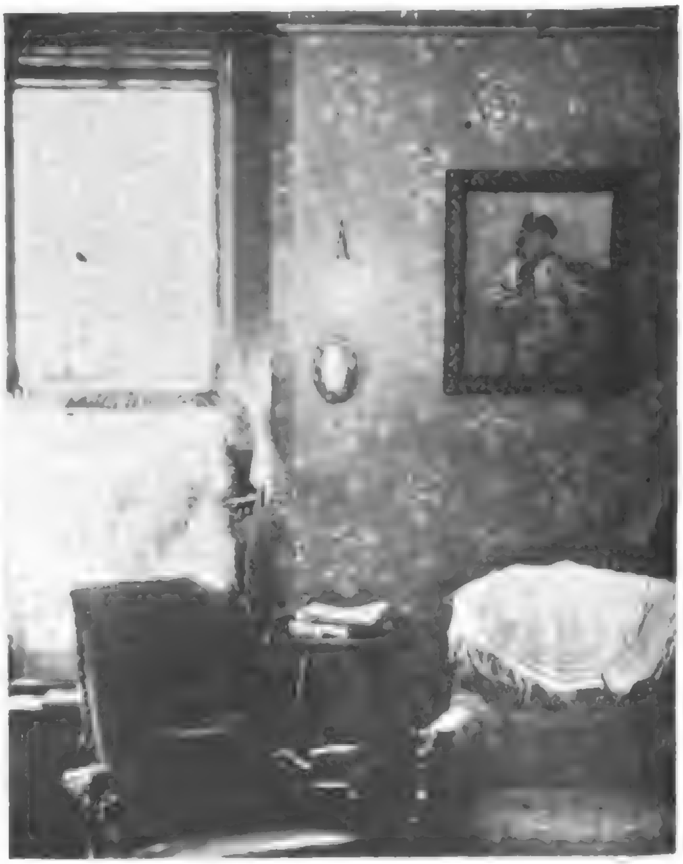


FIG. 8.—EFFECTIVE ARRANGEMENT FOR READING LAMP.

placed in a pendant or vertical position because of the necessarily large portion of the light directed up.

Fig. 10 is a good example of a handsome table lamp which is useful principally for decorative purposes. It has the same shortcomings as all electric table lamps, namely, the inability to throw a large proportion of its light in directions most needed, unless the light is needed on the table near the lamp. It does, however, add considerably to the artistic appearance of a room, and the authors do not wish to be understood as condemning artistic, ornamental lamps of this kind. When they are used, however, it should be with a full understanding of their inefficiency for all purposes except those mentioned. There are cases where expense is of secondary importance and by equipping decorative lamps with sufficiently high candle power lights, they can be made to do satisfactory useful work. As a general thing, ornamental lamps of this kind might better be provided with a low candle power lamp and used simply for decorative purposes, depending on something else for the useful illumination. Such a large lamp as that shown in Fig. 10 might have the two lamps in it fitted with small opal or prismatic glass reflector pointed in a direction to throw the light where needed.

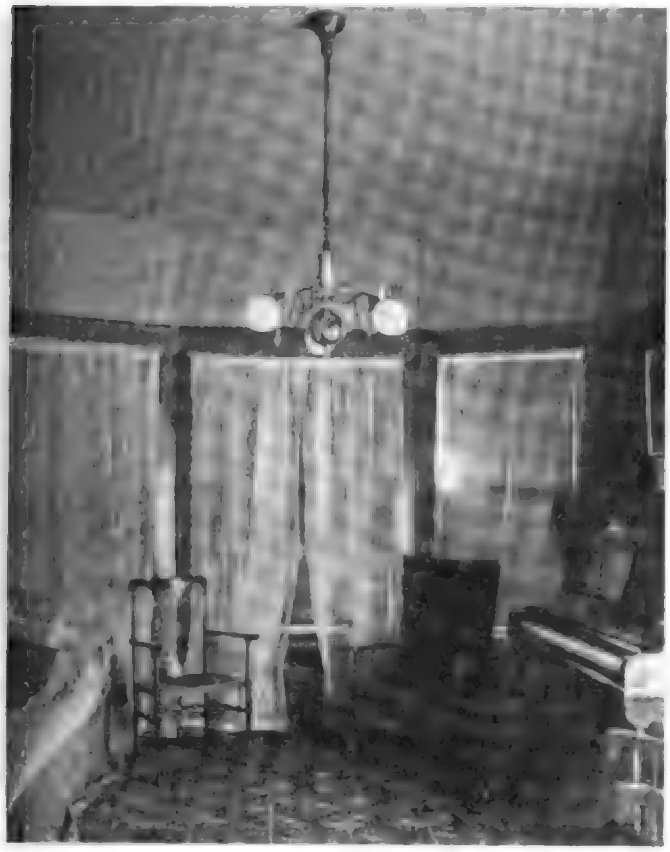


FIG. 9.—EXCELLENT ARRANGEMENT FOR SMALL PARLOR.

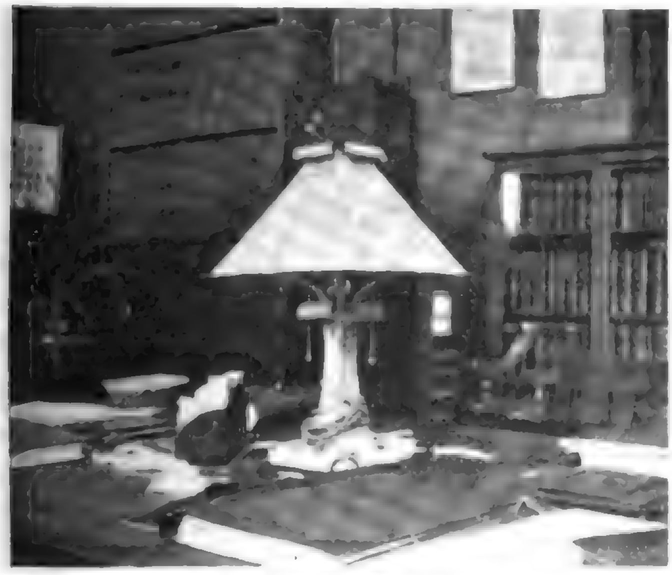


FIG. 10.—GOOD ARRANGEMENT FOR TABLE LAMP.

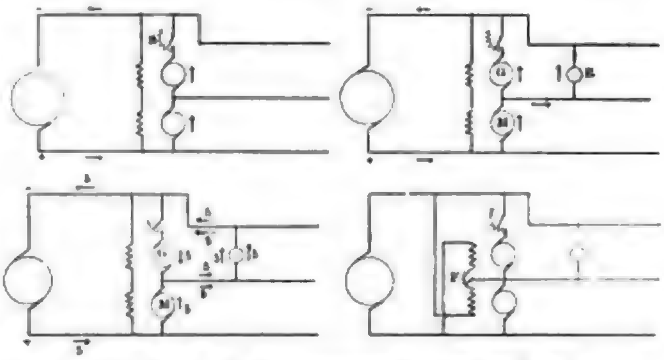
The Three-Wire Balancer Set.

By Douglas H. Cohen.

Having had occasion recently to analyze the electrical action of the motor-generator balancer as used in three-wire systems, I thought the results might be of interest to other readers of your pages. Referring to Fig. 1, if two direct-curent machines with armatures coupled together and identical in every respect be started up as motors by means of the starting resistance, *S*, the voltages across the armatures will be equal, since the machines and speeds are identical.

If we now connect a high resistance, *R* (Fig. 2), representing an unbalanced load, it will shunt some of the current around machine, *G*. As the resistance, *R*, is decreased, the voltage on that side of the system will become lower, till it is equal to the counter e.m.f. of machine, *G*, when the current in the armature, *G*, will cease, and the current in *R* will equal the current in *M*. As the resistance, *R*, is decreased more, the current in armature, *G*, will reverse, machine, *G*, acting as a generator, and driven by the motor, *M*, as shown in Fig. 3, in which the paths and values of the motor and generator currents are indicated for an assumed load, neglecting machine losses.

It will be seen that the motor current supplies half of the unbalanced load, while the energy developed by it in the motor causes the generator to furnish the other half. As a matter of fact, the motor current will be somewhat larger than the generator current, as the motor absorbs the power necessary to supply the losses of both machines.



FIGS. 1, 2, 3 AND 4.—ARRANGEMENTS OF DIRECT-CURRENT, THREE-WIRE BALANCERS.

Now let us consider the voltage regulation under load.

Motor terminal e.m.f. = generated (counter) e.m.f. + IR drop.
Generator terminal e.m.f. = generated e.m.f. — IR drop.

The generated e.m.f.'s being equal, since the machines and speeds are identical, it is evident that as the unbalanced load increases, the motor terminal e.m.f. will increase and the generator terminal e.m.f. will decrease, the voltage between "outers" being assumed constant.

In order to keep the voltages balanced automatically, the motor generated (counter) e.m.f. should be decreased, and the generator generated e.m.f. should be increased, in proportion to the respective IR drops. This can be largely accomplished by cross-connecting the field coils, as shown in Fig. 4, as is frequently done at the present time.

At no load the field rheostat, *F*, can be adjusted to compensate for any slight inequalities in excitation or air gaps, and as the unbalanced load comes on, the voltage may be exactly balanced by moving the contact toward the overloaded side. In this analysis the slight effects due to armature reaction, etc., have not been considered.

Exposed Circuit Wiring.

By Louis J. Auerbacher.

THE various kinds of circuit wiring in which the wires are supported on porcelain insulation, and including exposed surface wiring, outside circuit wiring, concealed knob and tube work are the least expensive methods of wiring, and if properly and neatly installed make a very satisfactory job from the electrical standpoint.

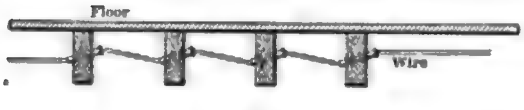


FIG. 1.

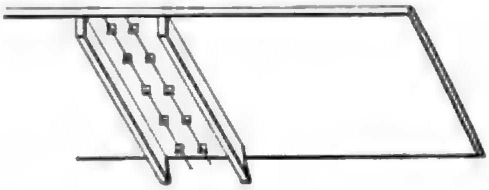


FIG. 2.

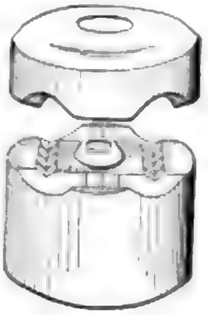


FIG. 3.

Knob and tube work is extensively used for wiring houses of frame construction. The holes in the floor beams are drilled just a trifle smaller than the porcelain tube so that these can be tightly driven in without breaking. Porcelain tubes for this work have a shoulder on one end which butts against the beams. The holes are drilled with a long bit, resting against the top of the beam next to the one drilled; the holes are thus drilled at an angle and the wires zig-zag when threaded through the tubes. In estimating, 10 per cent additional wire must be allowed for the additional length of wire required for the "zig-zagging." (See Fig. 1.) Do not run the two-circuit wires closer together than 6 in. Where the wires are brought out for outlets, cover them with flexible or porcelain tubing, especially where they pass through the plaster walls or ceiling.

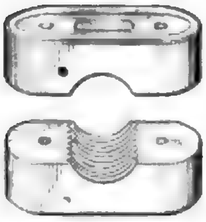


FIG. 4.

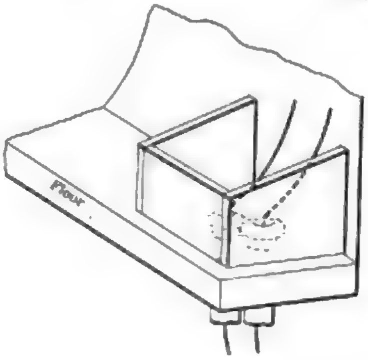


FIG. 5.

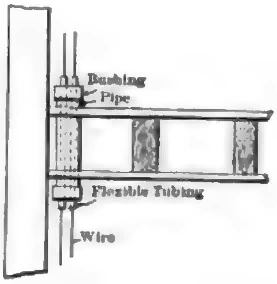


FIG. 6.

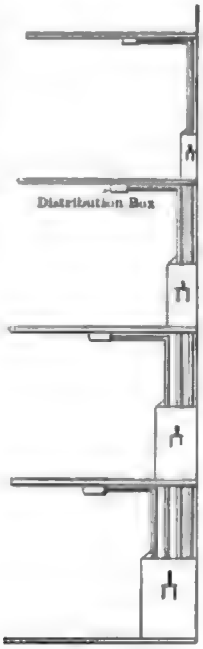


FIG. 7.

Either single braided rubber-covered wire or fire and weatherproof wire is permitted by the underwriters for this class of work. In a dry building the fire and weatherproof wire is preferable, as it is cheaper and the insulation does not deteriorate as rapidly as the rubber-covered wire. The wires must not run near water pipes, for if they do the wiring is classed as liable to dampness, and in such cases rubber-covered wires must be used. Where wires cross each other cover one with a porcelain tube, which should be fastened with tape or cleated down to prevent the tube slipping out of place. Joints must, of course, be very carefully made and soldered, so as to prevent loosening up and arcing. Then a layer of pure rubber tape should be put over the joint as well as two layers of friction tape, the latter then being thoroughly painted with moisture-proof paint.

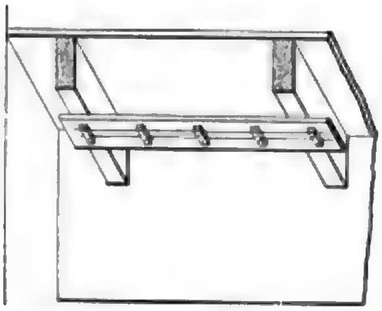


FIG. 8.

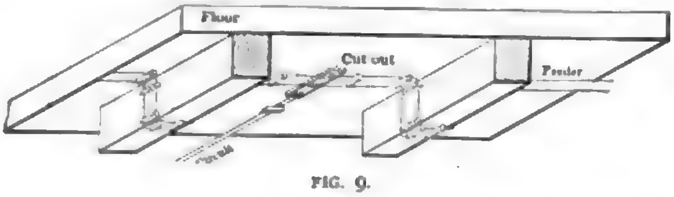


FIG. 9.

The feeders, or risers as they are sometimes called, should be run on porcelain knobs fastened to the studding. Porcelain two-wire cleats should not be used for this purpose. A good type of insulator is shown in Fig. 2. The wire is clamped and held tight between the upper and lower section of the insulators. This method of fastening wires to insulators is better than using tie wires. The slight additional cost of the split insulators over the solid ones is more than compensated by the saving in labor and in tie wires. If tie wires are used they must have insulation equal to that of the wire tied. It takes 8 in of wire to properly tie a No. 14 wire to a standard 3-in. insulator. The wires must be supported at least every 4½ ft. and if exposed to injury must have the porcelain supporters closer.

In unfinished attics wires must be run the same as if concealed, and in no case should they be exposed by running on the upper side of beams. Wires running near water tanks must be rubber covered, as the underwriters class them as exposed to moisture.

Wires run on ceilings of low basements, where they are liable to injury, must be protected by a wooden guard strip on each side. This strip should be ⅞ in. thick and as high as the insulators or cleats. (See Fig. 3.) In this class of wiring as well as in all others, no wires smaller than No. 14 B. & S. gauge should be used, and no more than 660 watts allowed to a circuit. All wires larger than No. 8 B. & S. must be soldered into lugs where connections are made.

Factories of open mill construction having wooden beams and girders are usually wired with conductors run on porcelain cleats and knobs. The mains, if No. 4 B. & S. size or larger, should be run on single cleats as shown in Fig. 4. Although the rule is that the wires should be supported every 4½ft., exceptions are made on wires of No. 8 B. & S. gauge or larger. If the wires are not exposed to injury they can be run from beam to beam instead of breaking around.

If heavy wires are to be run through the beams a special form of brace will be found serviceable, by means of which holes can be easily drilled parallel with the floor instead of at an angle. This method of drilling saves labor as well as 10 per cent of wire, which, in heavy cables, is an item. It also avoids the difficulty of pulling heavy wires through tubes set at an angle in the beams.

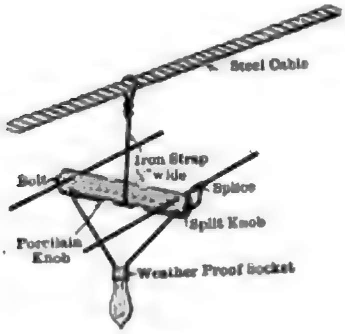


FIG. 10.

Where wires pass through partitions or walls they must be protected by porcelain tubes. When they pass through the floor they must have porcelain bushings, which must be protected by a "kicking block." (See Fig. 5.) They can also be passed through an iron pipe running 6 in. out on each side of the floor. In running the wires through the pipe they must be protected by flexible tubing. (See Fig. 6.)

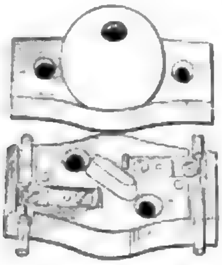


FIG. 13.

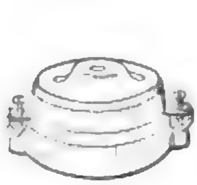


FIG. 14.

Always pass all wires of a circuit through one pipe, especially if the circuit is an alternating one, otherwise induction will cause trouble. The underwriters insist on this, even when direct current is used. They say that they cannot tell at what future time the alternating may be substituted, and naurally then cause trouble.

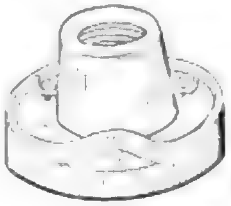


FIG. 16.

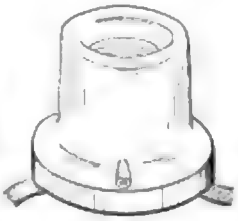


FIG. 17.

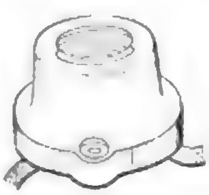


FIG. 18.

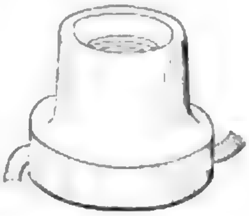


FIG. 19.

In installing feeders for building not subject to dampness it is best to place them on the walls. In dry buildings the fire and weatherproof wire can be used, otherwise rubber-covered wires must be installed, which add considerably to the cost.

In running feeders on the walls they should be boarded in at least 6 ft. high, as a protection from injury. If a floor-switch is used it can be mounted on the front of the boxing. The holes through which the wires pass to the switch should be bushed with porcelain, or the wires should be covered with flexible tubing. A system of feeders for a 4-story factory system is illustrated in Fig. 7.

The circuit wiring should be run on porcelain cleats, provided the building is dry. If exposed to dampness or acid fumes the wires must be run on knobs and be rubber-covered. Standard cleats are glazed, and in two pieces, with grooves 2½ in. apart, to carry both wires. The wires must be supported at least every 4½ ft. If the beams are further apart so that supports are over 4½ ft. apart, a running board must be run from beam to beam, and the wires cleated on the board. (See Fig. 8.) It is a good plan to avoid this by running the circuit wires parallel with beams or girders so as to cut out the expense of the running board. This can usually be accomplished by running a sub-feeder from beam to beam and feeding the circuits in this manner, as shown in Fig. 9.

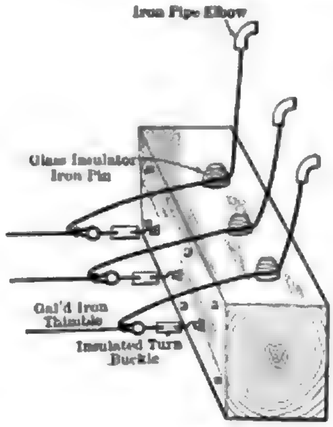


FIG. 11.

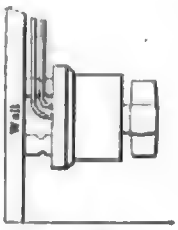


FIG. 12.

On low ceilings or in lofts where cases are piled up, guard strips, shown in Fig. 2, must be provided.

In stables, breweries and all buildings subject to dampness and acid fumes wires must be run on porcelain knobs, *not* cleats, and must be rubber-covered. Feed wires running up side walls must be *boxed* in, or can be installed in iron conduits. *Mouldings are never permitted* where dampness exists. All sockets and fittings for use in damp buildings must be specially made to withstand moisture.

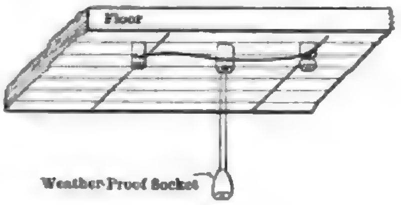


FIG. 15.

Where wires cross damp pipes they should run over the pipes, not under, so that the moisture cannot drip on the wires. The wires should be covered with porcelain tubes where crossing pipes, to protect them in case they fall on the pipes. The tubes should be securely taped on the wires.

In wiring stores, offices, or buildings having flat ceilings, cleats should be used. This is the cheapest and quickest way to wire such places, and where appearance does not count, is preferred for these reasons. Wires should have no kinks and must be stretched very tightly. In wiring circuits with cleats, a good plan on straight runs is to tighten both ends after stretching the wires, and then fill in with cleats at least every 4½ ft.

When circuits are run out of doors great care must be used in properly insulating the wires. Only waterproof devices and rubber-covered wire should be used for such work. At the point where wires run out of a building it is a good plan to have a switch and cut-out. Run them out in iron tubes so bent as to form a drip loop. An iron elbow pointed downward and with brushings on the end makes a good fitting for this purpose.

In summer gardens and outdoor places of amusement open circuit wiring is extensively used. Use only porcelain knobs, no cleats, for outdoor circuit wiring. All the fittings should be waterproof, and care must be used in the selection of sockets.

Strings of lights are very frequently desired to light gardens, walks, etc. A good scheme for wiring up such a string is shown in Fig. 10. The strain is taken by a galvanized iron cable. To this are attached the lamps by means of iron hangers. The split insulators on the ends grip the circuit wire as well as the socket wire. Such a method of stringing wires is the best to use, though a little more expensive than stringing them without the galvanized wire support. The circuit wires are pulled tight and fastened to the porcelain circuit breakers, as illustrated. Use insulated turnbuckles to keep the galvanized wire taut, which when slack can thus be readily tightened up.

In factory work where there are a number of detached buildings supplied by a central plant, outside line work becomes a necessary branch of the wireman's trade. For such work triple-braided weatherproof wire should be used. Where wires enter and leave buildings they should have suitable supports, and the insulated turnbuckles should be used to take the strain off the pins and insulators. (See Fig. 11.) Use a good quality of insulator, as illustrated, and screw it on an iron pin. Wooden pins break too easily and for that reason should not be used.

Lightning arresters should be installed on all outside feeders unless the runs are very short. Care must be used to properly install the lightning arresters, for if improperly erected they are dangerous. The ground wire should run to the ground in a straight line, not having any angles or bends. If run through an iron pipe the wires should be soldered to the pipe or the arrester becomes useless.

Stranded wires should be used; and should be fastened securely to a copper ground-plate, and then soldered. This plate should be buried in damp ground surrounded by pulverized coke, or charcoal. The ground plate should have at least two square feet of surface and be 1/16 in. thick. Paint over with waterproof paint where the wires are soldered to the plate, to prevent corrosion.

In selecting fittings, such as rosettes, receptacles, etc., for use in connection with exposed wiring, the points to consider are prices, adaptability, appearances, and last but not least, whether they are National Electric Code standards—that is, are approved by the underwriters.

Snap switches for use in connection with exposed wiring should be mounted on small porcelain knobs, as shown in Fig. 12. This allows the wire to be brought through the back of the switch without coming in contact with the walls.

The commonest type of fixture is the drop light, in which the lamp socket is connected by means of flexible cord to the circuit wires. This connection is best made through a porcelain rosette, so that the strain shall not come on the connection.

Receptacles of various types are used in connection with open wiring. Those herewith illustrated are suitable for the work. It is best to use those not having the exposed contact ears. (Figs. 13 and 14.)

For use in connection with wiring in damp places or out of doors weatherproof devices are necessary. For weatherproof drop lamps use No. 14 B. & S. flexible rubber-covered wire, which should be soldered directly on the circuit wires and to the leading wires on the socket, which should be weatherproof. (See Fig 15.) Lamp cord should never be used in damp places. A good receptacle for damp places is shown in Fig. 16. The base projects beyond the connecting plugs and a rim carries the drip away from the exposed contacts. Other forms of weatherproof receptacles are furnished with wires already connected, as are shown in Figs. 17, 18 and 19. With these it is necessary to solder the wires to the circuit wires and mount them on knobs, unless the wires are brought through the sides, as shown in Fig. 19.

District Supply in Rural Communities.

The problem of supplying a large district with electric light and power from one large power station favorably located as regards fuel and water has always been an attractive one for engineering consideration ever since the high voltage transmission of power began to be talked of. Such district supply, to small towns and villages, however, has had to await the development of high voltage transmission on a large scale before the experience and the apparatus necessary to cheaply construct small transmission lines were available. The time has now arrived, however, when, by virtue of the development in heavy power transmission, it is possible to obtain at a very reasonable figure the apparatus and technical knowledge necessary to construct fairly cheap and reliable transmission lines operating at from 6,000 to 20,000 volts, over which power can be transmitted from one large country village to a number of smaller ones in the same locality without running up an investment in transmission line which is prohibitory. The supply of a large number of villages from one power station has naturally been accomplished first in the suburban districts around our largest cities, where there are a large number of small towns a short distance apart. The small load to be obtained in any one town, would make the operation of a small central station in each town unprofitable. By supplying these towns over transmission lines from one or two central stations the character of the investment is entirely changed giving it not only better returns but a stability that no single small plant operating in a suburban village could have. In the case of companies operating in the suburban districts around large cities, the usual rapid growth of the population of such districts, as well as the size of the population dependent on any one station of transmission line, has justified a somewhat more expensive construction than can be justified in the case of village to village supply in rural communities where the villages are not only small but a considerable distance apart. It is with this latter class of district supply companies that we propose to deal especially in this article, as we believe that at the present time we are at the beginning of great development along this line among the rural communities, and especially those of the Middle West where stations in villages of less than 2,000 inhabitants are common. A number of companies operating in such rural villages have begun to extend their lines to neighboring towns with results so satisfactory that progressive central station owners in other towns, favorably situated for transmitting power to neighboring villages, will not fail to take advantage of the situation.

The problem as it usually presents itself to the manager of a country electric light plant is something like this: Given a village of 1,000 to 2,000 inhabitants 7 to 15 miles distant from a larger town, and an electric light plant in both villages, will it pay to build a transmission line and transmit power, abandoning the steam plant in the small village? Or, if the smaller village has no plant at present, can one be put in and service maintained over the transmission line at a profit and with satisfaction to consumers? Generally speaking, the answer to these questions is yes. Experience in Illinois shows that through the open country a fairly substantial but small transmission line can be built at an expense of from $250 to $300 per mile. The cost of step-up and step-down transformers and lightning protection will, of course, be somewhat in proportion to the power to be transmitted, approximating $20 per kw of capacity, but in any event, it is evident, without any very exact calculation, that a pole line with the necessary step-up and step-down apparatus will in most cases cost no more than a small steam plant to supply the same capacity. The supply of a small village over a transmission line rather than with a small steam plant will usually mean the saving of the wages of one man in the smaller village. If the village is large enough to require the services of two men to operate the plant, one of these can be dispensed with. If a village plant is so small that it is operated by one man, it can sometimes be operated without any regular sub-station attendant if supplied over the transmission line, and an arrangement can be made with some man having other business in the small village to answer emergency calls to replace fuses, etc., an occasional visit being made by employees regularly maintained at the company's headquarters in the larger town. So much for saving of labor. As to saving of coal, it is well known that a very small plant equipped with high speed engines and carrying full load only a short time each day is about as uneconomical a proposition from the standpoint of fuel and maintenance as anything known in the central station line. The cost of maintaining the transmission line is not anywhere nearly as large as that of maintaining the small steam plant, and the reliability and freedom from interruptions is greater with transmitted power. The larger station would usually have some little reserve, while a small station has no reserve, consisting usually of one boiler and one engine. This, too, in a country where boiler scale and lack of attention thereto may put the boiler out of business for a week at a time at most unexpected and unfortunate times. The cost of fuel per kilowatt hour in a large station as compared with a small station depends, of course, upon the types of equipment in both stations, but under conditions existing in country electric light stations the cost of fuel to supply the load in the small town in addition to the previous load is insignificant compared to the fuel required to run the small plant alone. Along with this question of generating economy must be considered several other items. It may frequently be the case that a power service which will give a day load can be maintained in the smaller town when it is supplied over the transmission line and that such service would be entirely out of the question if a small steam plant in that town had to be operated all day to supply the service. The addition of such a power service in a small town to the power load already on the station in the larger town not only adds to the economy of generating current in the larger town but may, if steam heating is done from the larger station, enable additional customers to be taken profitably on the steam heating service, which service should usually be kept down to an amount which can be supplied from the exhaust steam all day without the necessity of putting live steam into the mains. Last, but not least, if a central station company can thus reach out to surrounding villages and supply the majority of those within a given radius, it makes it possible to employ a better grade of talent both in the engineering and business departments, putting it more on a par with companies operating in larger towns. To sum up the whole situation, district supply throws open the possibilities of making several small, poorly paying central stations into one profitable well managed company. The following accounts of plants successfully operating a district supply service will be found of interest:

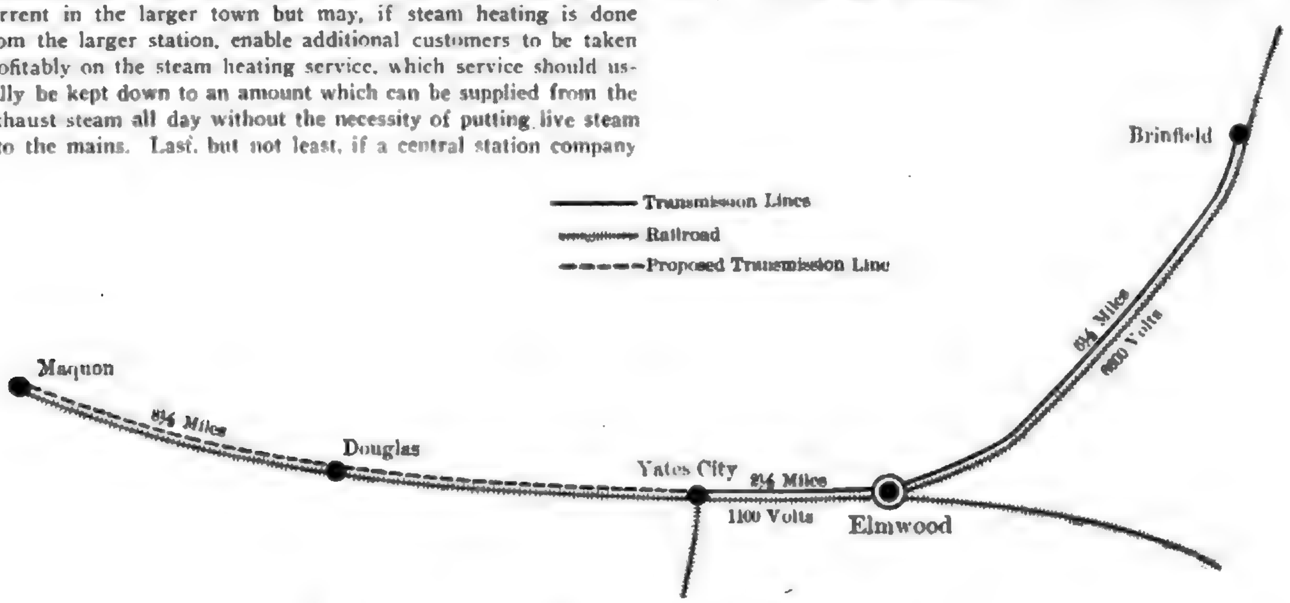


FIG. 1.—MAP OF RURAL DISTRICT SUPPLY AT ELMWOOD, ILL.

DISTRICT SUPPLY AT ELMWOOD, ILL.

Some time ago when E. L. Brown, the owner of the electric lighting plant at Elmwood, Illinois, found that he had developed a load on the station, nearly as large as was possible in Elmwood, he began to cast about for new fields to conquer. The result is, that from the electric plant of Elmwood electric lighting service is now supplied to two other country villages. Elmwood had a population in 1900 of 1,582. Two and one half miles distant, is Yates City, the population of which in 1900, was 650. The first move was to extend the 1,100-volt single-phase circuit of the company to Yates City, to do electric lighting at that place. This extension, of course, involved no engineering problems other than those met in 1,100-volt distribution around Elmwood. Last year a larger step was taken to increase the load. A franchise for electric lighting was secured at Brimfield, a town 6½ miles northeast of Elmwood. Brimfield had a population in 1900, of 677.

The map, Fig. 1, shows the location of Elmwood with reference to the other towns supplied. This 6½-mile transmission line to Brimfield, is operated at a voltage of 6,600. The permission to set poles was purchased for a nominal consideration of farmers, almost the entire distance; this purchased right of way, being just outside of the right of way of the Chicago, Burlington & Quincy Railroad, which connects the two towns. No difficulty was experienced in purchasing this right to set poles. In the work of securing the right of way, Mr. Brown was accompanied by a farmer who was acquainted with nearly all of those from whom it was necessary to secure the right. The right of way expense therefore, was purely nominal, otherwise it would have been impossible to build the line at a cost that would have made it practicable.

Fig. 2 gives a good idea of the pole line and construction. There is nothing remarkable in the pole line. Twenty-five foot cedar poles with 6-in. top were employed, except where extra height was needed for some special purpose. The usual two-pin cross-arm with the common separation between wires of 28 in. was used, the transmission circuit, of course, being single-phase. The cross-arms are bolted to the poles. By bolting the cross-arms and gaining out the poles to receive the cross-arms, it was thought unnecessary to brace the cross-arms. The poles were placed 130 ft. apart. The wire is No. 6 medium hard drawn copper. The insulators are the Victor No. 15 glass.

The cost of the pole line between the two towns, 6½ miles, was approximately $1,650, or $255 per mile. No special substation or transformer house is used for the step-up and step-down transformers. The electric light plant and office at Elmwood, is shown in Fig. 3. In front of the office is seen the step-up transformer with its lightning arresters, located on a platform half way up the pole. This arrangement of transformer and arresters, is shown more in detail, in Fig. 4. The transformer is 30 kw, oil-insulated, of Ft. Wayne manufacture. The lightning arresters and kicking coils, of General Electric manufacture, are in the boxes, seen on the opposite side of the pole, from the transformer. Fuses have been provided on the pole for the transformer but these will not be used, as they are unnecessary so long as there is a fuse on that circuit in the station. Separate feeders from the station, of course, supply this transformer.

The step-down arrangement at Brimfield, is similar to the step-up arrangement at Elmwood. The method of managing the business at Brimfield is interesting, as it does away with the expense of a man on regular pay at Brimfield. There are two men engaged in other work at Brimfield, who have been at times employed on electric light work by the company, and these men can be called up by telephone any time to answer emergency calls, such as puting in fuses, or making light repairs at Brimfield. The heavier work is done by the company's regular employees.

Eight and one-half miles beyond Yates City, is the town of Maquon. Mr. Brown contemplates building a transmission line to that point, sometime in the future.

The station at Elmwood is somewhat of a temporary character, having been hurriedly rebuilt some time ago, after a fire which completely destroyed it. It contains three boilers, 66 in. by 16 ft., of the horizontal return flue type, housed in a brick boiler room. Another boiler of the same size is being added. The generating plant contains two 100-kw Ft. Wayne 133-cycle generators, and one 90-light Wood series arc dynamo. The engines are high speed, and transmit power through the medium of a line shaft. The coal burned is a mixed nut and slack, which costs only 40 cents per ton. Four men are kept regularly on the pay roll, in addition to Mr. Brown, who gives the business most of his time. Extra men are hired when there is an unusually large amount of work, in the way of wiring houses, or construction.

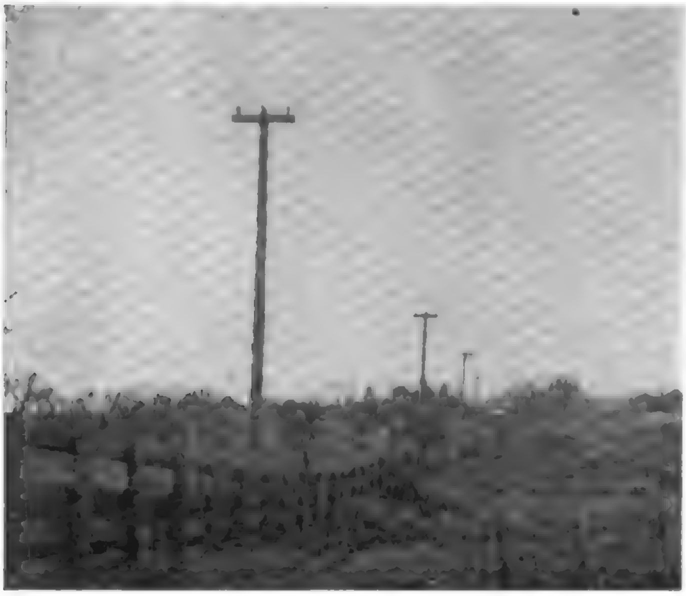


FIG. 2.—TRANSMISSION LINE.

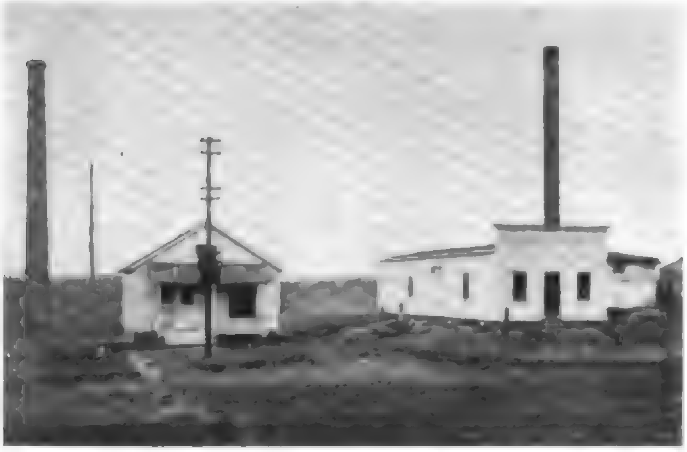


FIG. 3.—ELECTRIC LIGHT PLANT, OFFICE AND STEP-UP TRANSFORMER AT ELMWOOD, ILL.

The rate authorized by the franchise is 20c. per kw-hour, but Mr. Brown has voluntarily reduced it to 10c. per kw-hour. The minimum bill to any customer is one dollar per month. It is interesting to note that after the change was made from flat rates to the meter system, the peak load is less than it was before, although the gross amount of business done is greater, and the gross revenue better. An unusual system of wiring customers' premises is in vogue whereby the company retains ownership of the wire on the customers' premises, the customer paying for the labor of installation at a rate of 50 cents per lamp. The customer owns the fixtures on his premises. Mr. Brown considers this system attracts a number of customers in a small town, who would otherwise think they could not afford to put in electric lights. No day service is given at present.

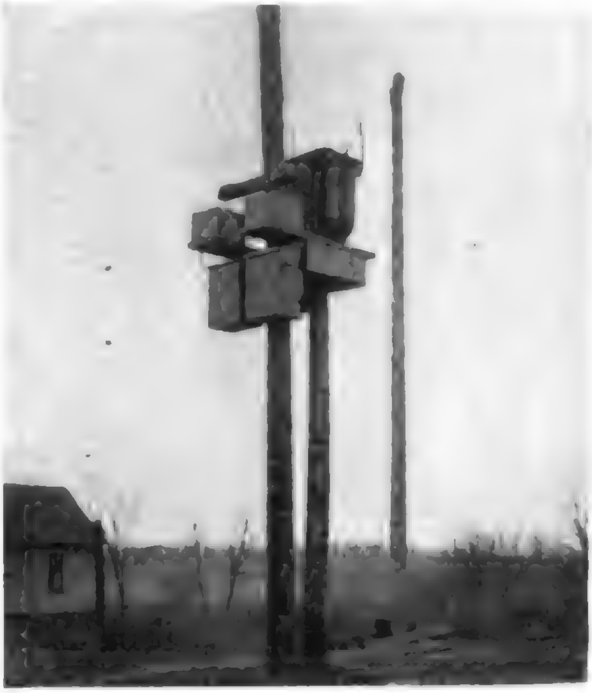


FIG. 4.—30-KW, 6600-VOLT STEP-UP TRANSFORMER AND LIGHTNING ARRESTERS ON POLE, ELMWOOD, ILL.

DIRECT SUPPLY AT FAIRBURY, ILLINOIS.

The Fairbury (Illinois) Electric Light, Heat & Power Company, furnishes an excellent example to other small companies operating in country villages, of what can be done in the way of reducing operating expenses, and increasing the revenue, by supplying neighboring small villages electric light and power from one plant. Fairbury, where the central station is located, was credited by the 1900 census with a population of 2,187 while Forrest, about five miles distant, had a population of 952. The population of Fairbury has evidently increased very much since 1900. To the casual observer, it would appear, to have a population somewhere between 2,500 and 3,000. Many new houses have been built since 1900. Forrest has now probably from 1,200 to 1,400 inhabitants.

The company has been operating electric lighting service in Forrest with current transmitted over a 6600-volt transmission line from Fairbury, since November 1, 1903. Previous to that time, a small electric light plant had been in operation at Forrest for several years, but it had always been an unprofitable undertaking, a great many managers and owners having tried to make it pay without success. It was a direct-current plant with one engine and one boiler. In 1903 the Fairbury Electric Light, Heat and Power Company purchased the plant for $2,250, which was, of course, less than one-half of the original cost, and represented a little more than its value as scrap. By some fortunate trades, the company was able to realize about $1,800 on the old plant, the boiler being traded for a lot of coal at a neighboring coal mine, the engine and dynamo sold to second-hand dealers, while the copper used in the direct-current distribution, was utilized for alternating-current distribution in Fairbury and Forrest.

In January, 1903, when the steam plant was being operated at Forrest, $125 worth of coal was burned, and the engineer was paid $50 per month. This made an expense of $175 for that month, not including incidentals, or the time given to the plant by the owner, who also gave it some attention, in addition to the engineer.

In January, 1904, the Forrest load was carried by means of the transmission line from the station at Fairbury. The Fairbury station for this month burned less than $25 worth more coal than in January, 1903. This extra $25 worth of coal, not only took care of the lighting of Forrest but also took care of the increase of load in Fairbury. At Fairbury a 55-hp grain elevator motor running about seven hours per day had been added since January, 1903, to say nothing of the actual growth of miscellaneous light and power business during the year. Moreover, coal cost 2½ cents per ton more than in 1903, and service was given to Forrest 23 hours per day, while before it had been given only during the night. The management estimates, that $15 worth of coal probably represented the actual coal required, in the lighting of Forrest.

The gross income of the Forrest plant, when it was taken over was about $165, the best month in the year. The gross income from Forrest now is over $275 the best month in the year. The cost of labor at Forrest is still about the same as previously, because one man is kept there to do wiring, and look after the interests of the company in that town. The services of this man, however, are made necessary by the increase in business.

The great reduction in operating expenses by virtue of the transmission line has been given, and it is now in order to inquire into the cost of the line and the character of its construction, as well as the cost of changing the existing distributing system in Forrest. The 6,600-volt, single-phase transmission line from the step-up transformers in Fairbury, to the step-down transformer in Forrest, a distance of 4¾ miles, cost about $1,500, or $316 per mile, for the pole line. The step-up and step-down transformers, each of 50 kw capacity, with lightning arresters, etc., cost $500 each. The high-tension line proper, therefore, cost about $2,500. Besides this there was the expense of changing the distribution in Forrest from direct to alternating-current. The cost of purchasing transformers and changing the Forrest distribution system, was about $3,000, making a total investment in the Forrest plant of $5,500, including the purchase price. The reduction in the operating expenses as before given, it is seen was enough to make the change profitable. At the present time there is no power load at Forrest, but it is hoped to soon secure some motors there, including water pumping for the city and railroads. It goes without saying that the change was a good thing for the Forrest service, as the current is now on the lines 23 hours per day, and it is possible to obtain power service where it could not before be obtained.

The transmission line of 4¾ miles length, and operated at 6,600 volts, was built mainly with 20-ft. poles, having 7 in. tops, as seen in Fig. 2. The poles are placed 120 ft. apart. At highway crossings, and in the towns at either end, higher poles are used. The distance between wires is 36 in. The insulators are Hemingray glass type, grooved, double petticoat, bought in the open market. The wire is No. 8 soft drawn copper, the soft drawn being selected because of some disastrous experiences President Foster had with hard drawn copper in a neighboring city.

The station at Fairbury contains three horizontal return flue boilers. Two of these are 5 ft. x 16 ft. with 4-in. flues and one 5 ft. x 14 ft. with 2½-in. flues. The latter boiler was purchased from a mill, which was procured as a power customer by so doing. As the company needed the boiler and it was necessary to take it to secure the power business from this mill, it was considered a good move. The engine room contains two high speed engines, one Ideal and one New York Safety. From one of these engines is driven one 120-kw, 1,100-volt, 125-cycle General Electric single-phase alternator, and one 35-kw alternator. From the other engine is driven a 70-kw alternator and a 90-kw Fort Wayne 500-volt, direct-current power generator. All of the present power load except fan and dental motors is carried from the 500-volt, direct-current generator. The engine room is of wood with a concrete floor. It is expected to put up a brick building in place of the wooden one next year and to provide for additional capacity.

The maximum or peak alternating-current load at Fairbury is 107 amperes at 1,100 volts. The peak load on the Forrest feeder is 35 kw. The maximum load on the direct-current power service is 65 kw. The connected power load is 128 hp in 500-volt motors. The company has secured almost every power user in Fairbury except the city pumping plant. The city is now spending from $3,500 to $3,900 per year pumping its water. The company offered to do the city pumping for the amount of the present city's coal and coal haulage bills, which would result in the saving for the city of something like $2,000 per year. The mayor's brother-in-law runs the city's pumping plant, however, so the company is waiting for a change of administration before any further attempts to secure the pumping contract.

Power is sold by meter in both towns. There are about 240 meters in Fairbury, of which 200 are in residences. Gasoline arcs have been temporarily making some inroads in the commercial store lighting business. The rates are 13 cents per kw-hour for residences, and 10 cents for stores, with no minimum bills.

The rates for power are from 10 cents down to 2½ cents per kw-hour, although the company has but one customer who gets as low as 3½ cents. This is a large motor with a steady load. The company does not furnish free lamp renewals, and sells lamps to customers at 25 cents each. Various types of meters are in use, those in Forrest being mostly of Fort Wayne manufacture. The meters now being installed are Westinghouse. For a small town, the company is making great headway in the introduction of electric flat irons, having over a dozen in service, and the number rapidly increasing. The city of Fairbury takes 83 25-candle, 3.5 ampere incandescent street lights, and six alternating-current arcs. Forrest takes forty similar incandescent and four arcs.

The average coal consumption per month for the year is 175 tons; 200 tons were burned in November, 1905. Coal is mined near by and obtained at a very low rate, averaging about 50 cents per ton.

The operating force required is three men in the station, the equivalent of two men at Fairbury on outside work, and one man at Forrest, besides the time given to the business by Mr. H. A. Foster, vice-president and manager, and W. B. Decker, secretary and treasurer.

The gross earnings for Fairbury were $1,134 per month for November, 1905, in Fairbury, and $275 in Forrest. The total amount invested in the company's property is about $35,000.

Central Station Economics in Massachusetts. A Study of Two Typical Medium-Sized Companies.

In the remarkable material development of which the United States is the seat, the electrical engineer is playing an unprecedented part, but already the signs are at hand that the pioneer work of the nineteenth century is being superseded by activities in which the elimination of waste, the meeting of competition and the securing of new business are the vital factors. Particularly is this true in the central station industry, which to-day faces gas competition of the keenest kind, while at the same time the possibilities in the way of improved operation and extended applications of electricity are unusually attractive.

The small and medium-sized central stations are subject to the same laws of supply and demand which control the service of the largest plants. In many quarters there has been and is a feeling that the resources of a company of the lesser magnitude do not warrant the application of the same kind of operating analysis of the adoption of the advertising and general business methods of the large companies. While this is true as far as total expenditures are concerned, it is a grave mistake to overlook the results which can be secured by the practice of these advanced methods on a smaller scale. In the hope that the managers of small or medium-sized plants will find helpful suggestions in the methods of two typical Massachusetts companies operating in cities of about 40,000 inhabitants, the following accounts of these plants have been prepared:

SALEM ELECTRIC LIGHTING COMPANY.

The Salem Electric Light Company was formed in 1881 and was the third electric light company in Massachusetts to do business. For nearly a quarter of a century the president has been Mr. Charles H. Price and the treasurer, Mr. H. M. Batchelder. The present general manager is Mr. S. Fred Smith. The company serves Salem and a small part of Peabody, including a population of about 40,000. A single power plant located in Salem supplies the territory. This station contains eight 125-hp horizontal return tubular boilers operating at 115 lb. pressure, and one 350-hp Babcock & Wilcox water-tube boiler built for 150 lb. or over. The chimney is of brick, 130 ft. in height, with an inside diameter of 6 ft. at the base and 6 ft. 6 in. at the top.

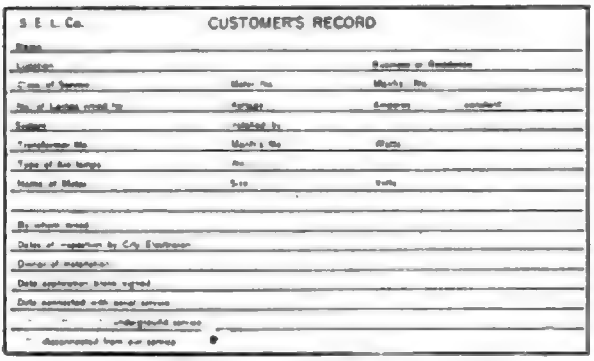
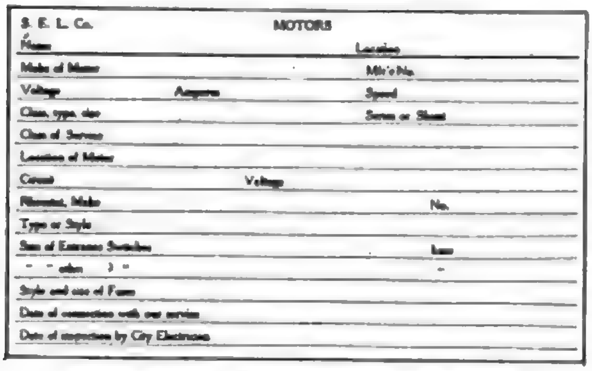

S. E. L. Co. CUSTOMER'S RECORD

FIG. 1.—SALEM ELECTRIC LIGHTING COMPANY.

The engine and generator equipment includes one 500-hp Greene horizontal cross-compound engine driving by shafting two 200-kw, 2,300-volt, General Electric, three-phase alternators; a D-62 and a 100-kw, 500-volt generator and a 100-kw exciter; a McIntosh & Seymour, 635-hp, vertical, compound engine, direct-connected to a 400-volt, General Electric alternator and a 900-hp engine of the same make and type direct-connected to a 600-kw alternator. There are also three 125-volt machines aggregating 95 kw, and a 200-kw, General Electric, 500-volt generator driven by a 2,300-volt synchronous motor. The feed-water heater is of National make. City water is used in the boilers and is metered on the cold side. The condensing plant is of Deane & Worthington make, with a Barr condenser in addition. Four of the horizontal return tubular boilers are equipped with Reagan grates, as is also the Babcock & Wilcox boiler. The coal quality is determined largely from kw-hour records and weight tallies, together with an inspection of the ashes, which are normally small in bulk, spongy and soft. The boilers are operated with some banked and others cold, according to the load conditions. For fire protection the power house is supplied with extinguishers, pails and hose, the boiler house and parts of the station not immediately in proximity to electrical machinery being equipped with wet sprinklers. Daily records of the coal consumption per kw-hour are filed and summarized monthly in a report to the general manager, reproduced in blank form herewith (Fig. 6). This blank is remarkably complete and shows at a glance the performance of the station and condition of the entire distributing equipment of the company, including network, renewals, repairs, sales, etc.


S. E. L. Co. MOTORS

Name Location

Make of Motor Mfr's No.

Voltage Ampere Speed

Class, type, size Series or Shunt

Class of Service

Location of Motor

Circuit Voltage

Rheostat, Make No.

Type or Style

Size of Entrance Switches

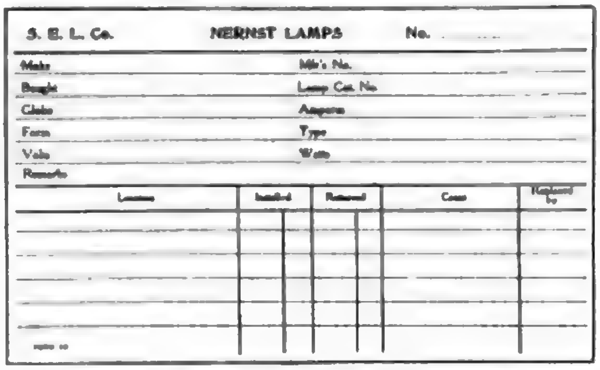
Style and size of Fuses

Date of connection with our service

Date of inspection by City Electrician

FIG. 2.—SALEM ELECTRIC LIGHTING COMPANY.

The efficiency of production in the power plant has been lately increased by the use of direct-connected units. The total output of the station during the year ending June 30, 1905, was 2,862,083 kw-hours. The service furnished covers street lighting by alternating-current, 6.6-amp., enclosed series arcs; 220-volt, three-phase power for miscellaneous work, incandescent lighting at 2,300 volts primary, 60 cycles, 112 volts secondary, and a 125-volt, direct-current circuit from the exciter which is used for automobile charging at owners' residences, etc., dental motors and furnaces. About 25 electric automobiles are in use in Salem by physicians and other persons, and the convenience of being able to charge one's machine at home is much appreciated by the customers of the company.


S. E. L. Co. NERNST LAMPS No.

Make Mfr's No.

Bought Lamp Co. No.

Globe Ampere

Form Type

Volts Watts

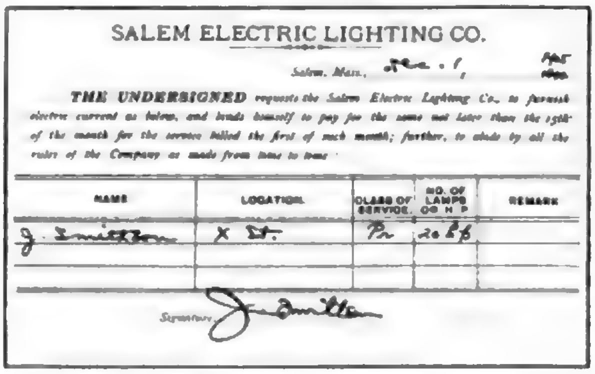
Remarks

Location	Installed	Removed	Cause	Replaced by

FIG. 3.—SALEM ELECTRIC LIGHTING COMPANY.

Pole tests are made yearly on the company's lines, and large transformers are fast replacing smaller scattered units. This practice is now followed exclusively, at Salem, and transformers as high as 800 lights capacity are in service. The three-wire secondary system is used in all such installations. All transformers are of the General Electric Company's type and pattern. As the company's lines extend all over the territory of which Salem is composed, there is no difficulty in supplying customers located long distances from the power house. Portable watt-hour meters are used in service tests, and in the tunnel adjoining the tracks of the Boston & Maine Railroad at Salem the vibration is so severe that watt-hour meter tests have to be made at least every three months.

The card index is elaborately employed at Salem and some of the more representative cards are reproduced herewith. Records of commercial lamp locations, sizes, the history of each customer's installation (Fig. 1, lines for dates of inspection on reverse), conditions as to wiring, inspection, disconnections and apparatus, transformer and meter records, locations, removals, tests, loads, voltage and type, arc lamp records, Nernst lamp particulars (Fig. 3) and motor data (Fig. 2, lines for data of inspection on reverse), are all filed completely and compactly for ready reference by the card system. The company does not employ long contract forms in dealing with the customers; the signature and service particulars are filed on a 3-in. by 5-in. card only, as shown in Fig. 4.


SALEM ELECTRIC LIGHTING CO.

Salem, Mass., [illegible]

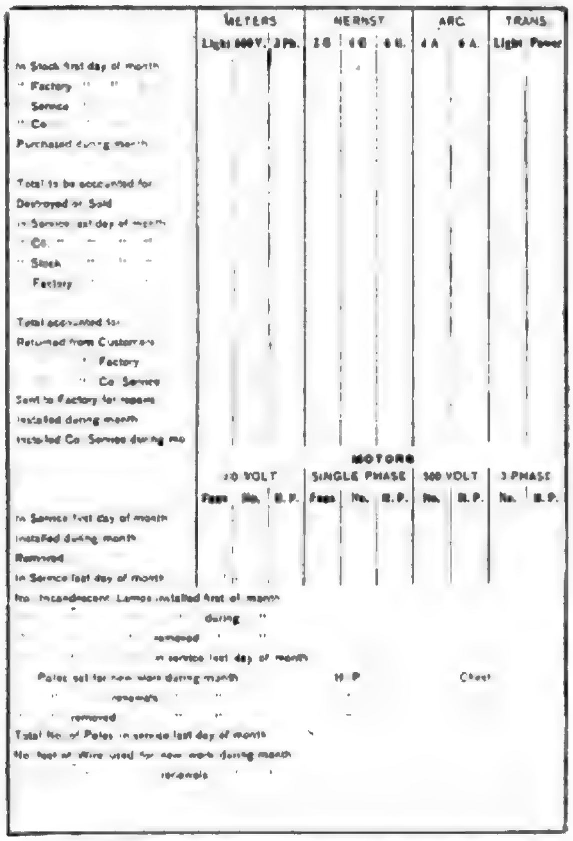
THE UNDERSIGNED requests the Salem Electric Lighting Co. to furnish electric current as below, and binds himself to pay for the same not later than the 15th of the month for the service billed the first of such month; further, to abide by all the rules of the Company as made from time to time.

NAME	LOCATION	CLASS OF SERVICE.	NO. OF LAMPS OR H P	REMARK
J. [illegible]	X St.	Pr	[illegible]	

Signature,

FIG. 4.—SALEM ELECTRIC LIGHTING COMPANY.

The superintendent, his assistant and the foreman of construction each is provided with a residence telephone by the company. A special feature of the Salem situation is that the company carries out inside construction and wiring. A force of about a dozen men and a foreman are engaged upon this work. Each man is thus to a certain extent an advance agent of the company; and a considerable amount of new business is gained in this way. The foreman does more or less soliciting also. The company advertises frequently in the local papers, changing the text as appears desirable. Applications of electricity are shown at the office occasionally, preferably about the 15th of the month, when bills are principally paid. Lamps, fixtures and heating apparatus usually form the basis of this exhibition, which would be made more extensive if space were available at the office.

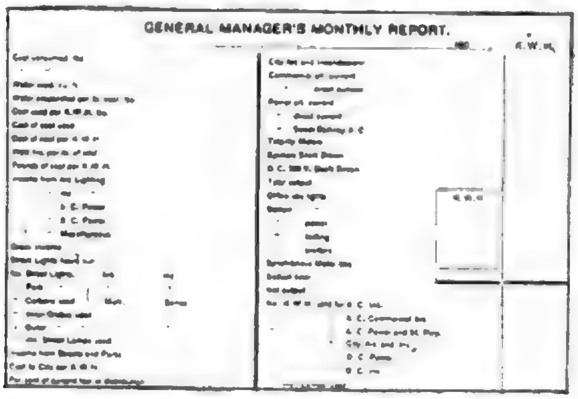


	METERS		NERNST			ARC		TRANS	
	Light 100V.	3 Ph.	2 G.	4 G.	6 G.	4 A.	6 A.	Light	Power
In Stock first day of month									
" Factory " " "									
Service "									
" Co.									
Purchased during month									
Total to be accounted for									
Destroyed or Sold									
In Service last day of month									
" Co. " " " "									
" Stock " " "									
Factory "									
Total accounted for									
Returned from Customers									
" Factory									
" Co. Service									
Sent to Factory for repairs									
Installed during month									
Installed Co. Service during mo.									

	MOTORS									
	110 VOLT			SINGLE PHASE			500 VOLT		3 PHASE	
	Fans	No.	H.P.	Fans	No.	H.P.	No.	H.P.	No.	H.P.
In Service first day of month										
Installed during month										
Removed										
In Service last day of month										

No. Incandescent Lamps installed first of month
" " " " during "
" " " removed " "
" " " in service last day of month
Poles set for new work during month H. P. Chest.
" " renewals " "
" " removed " "
Total No. of Poles in service last day of month
No. feet of Wire used for new work during month
" " " " renewals " "

FIG. 5.—SALEM ELECTRIC LIGHTING COMPANY.



GENERAL MANAGER'S MONTHLY REPORT.

FIG. 6.—SALEM ELECTRIC LIGHTING COMPANY.

The rate of incandescent service is 20 cents per kw-hour, with a 25 per cent discount if the bill is paid by the 15th of each month. At the end of the year if the bill amounts to $500 or over, an extra 10 per cent discount is made, covering the whole year; if the bill equals or exceeds $1,000, another 10 per cent is deducted. Very large consumers are given a special rate. Signs are supplied at incandescent rates, and power rates vary from 10 cents to 2 cents per kw-hour, according to the amount used. Lamp renewals are free. Commercial arc lamps are supplied at 20 cents per kw-hour, with 50 per cent discount. Summer resort lighting is executed at 25 cents per kw-hour, with 25 per cent discount for prompt payment of bills. Electric heaters are supplied at incandescent rates in small installations and practically at power rates in large establishments.

Gas competition has been well met by Nernst and "Meridian" lamps. During the last 14 months over 667 three-glower Nernst lamps have been installed. The glowers are renewed free of charge by the company. Inspectors are available at any time to give advice to customers as to the proper use of apparatus. No apparatus is rented by the company, but wiring is installed at cost prices.

HAVERHILL ELECTRIC COMPANY.

The Haverhill Electric Company supplies power and lighting current in the city of Haverhill and the near-by town of Groveland. It serves a population of about 40,000, based upon the 1905 State census. Its officers are: President, C. H. Tenney; vice-president, F. P. Royce; treasurer, E. A. Bradley; general manager, A. B. Tenney; local manager, H. T. Sandry; chief electrician, F. C. Sargent.

The power station is located in Haverhill on Water Street and the local offices of the company are located on Merrimac Street, Haverhill. The general offices are at 84 State Street, Boston, and the Haverhill Company is one of several under the same general centralized management.

At Harverhill the power station is in process of remodeling after the best standards of modern practice, and the new work is nearly completed. The equipment consists of four 125-hp horizontal return tubular boilers and two 650-hp Babcock & Wilcox boilers; one Harris-Corliss, horizontal, cross-compound, 350-hp engine belted to a 500-kw, direct-current generator for 600-volt service; one Harrisburg, tandem-compound, 800-hp engine belted to a 500-kw, 600-volt generator, and two 1,000-kw Westinghouse-Parsons steam turbines, 1,800 r.p.m., direct-connected each to a 2,200-volt, three-phase, 60-cycle alternator; two Brush arc machines, each driven by a 100-hp induction motor, and a 125-hp induction motor driving a D-62 generator which carries the direct-current motor load after 7 p.m. All but one of the exciters is motor driven.

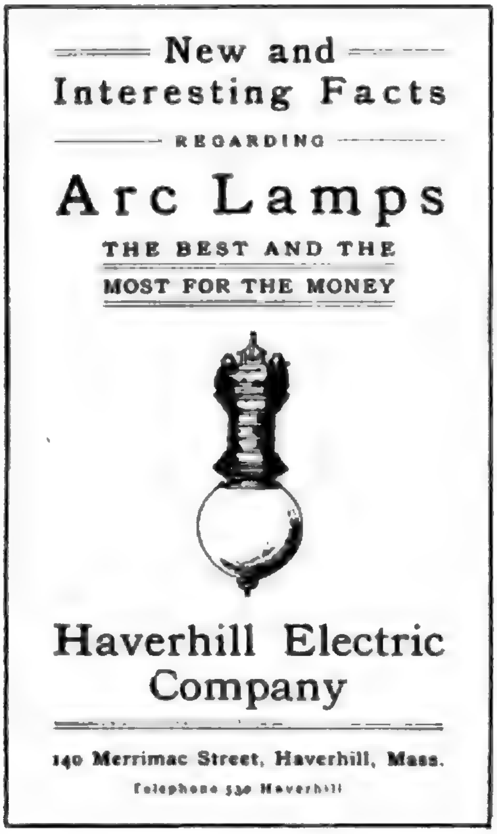
The boilers are equipped with induced draft supplied by two Sturtevant fan engines. The turbines are equipped with Worthington surface condensers. Fuel is handled from barges on the Merrimac River by an industrial railway and a Robins belt conveyor, automatic stokers being a possibility of the near future. The coal is fed to the boiler room by gravity from the overload bunkers. Ashes are handled by a belt conveyor. The engine room is equipped with a hand-power traveling crane of 20 tons capacity.

The distribution circuits of the Haverhill station are in somewhat of a transition state from direct to alternating current. The 550-volt, direct-current power load is gradually being changed to alternating, but at present power is supplied at 2,200 volts, three-phase, 60 cycles, stepped down to 550 volts for induction motors from 5 hp up, and also at 550 volts direct current. The Brush arcs are of the 9.6-amp., direct-current type, for street lighting. Incandescent lighting is carried out on the 2,200-volt, single-phase plan with 104-volt or 208-volt secondaries. Multiple-arc lamps of the alternating type are largely used in commercial service. Not an air-cooled transformer is in service at Haverhill.

The operation of the power station is regularly checked by kw-hour and fuel records, and the cost of manufacture is now being decreased by the introduction of modern equipment, with its higher efficiency at all loads. These records are kept daily and in the near future an improved blank will be substituted for the present style of record. Water consumption, oil and supplies are also carefully supervised. The power house force works on ten-hour shifts. Drawings and data are filed mainly in the Boston office. The circuits are tested daily for grounds and crosses, and large transformers with concentrated loads are superseding the smaller scattered transformers. The largest transformers have an output sufficient to maintain 200 16-cp lamps. The three-wire secondary system is not used. At the power station the old boilers are usually not used except under specially heavy loads, and after midnight the fires of such as are not needed are banked. The power house is equipped with sand pails and chemical extinguishers for fire protection. All the old series arcs in use in mercantile establishments are now superseded by multiple arcs on the alternating-current system. The economy of distribution was much improved during the summer of 1905 by the changing of the frequency from 133 and 125 cycles to 60 cycles. The elimination of some of the belted apparatus in the power station was also a step toward higher efficiency in current generation.

Telephones in residences at the expense of the company are provided in the case of the local manager, chief engineer, electrician, line foreman and assistant. Meters are tested by the stop-watch method, with indicating instruments.

Standard advertisements are carried in the local press. Circular letters are mailed to customers occasionally, as matters of interest come up. A prominent feature of the company's advertising is the use of a "talking sign" at its main office in Haverhill. This sign can be changed at will, and it tells the story of applications of electricity in a most striking and effective manner. One man devotes his entire time to the securing of new business. An admirable exhibit of electrical appliances is maintained at the Haverhill office. Pamphlets (Fig. 11) and circulars bearing upon rates and equipment are pigeon-holed near the door so that customers coming in to pay bills or to inspect the premises may freely partake of the information. Near the cashier's desk an illuminated sign points the way to the window ledge, and on a shelf in the rear is disposed a variety of electric heating equipment with facilities for its immediate operation.



New and
Interesting Facts
REGARDING
Arc Lamps
THE BEST AND THE
MOST FOR THE MONEY

Haverhill Electric
Company

140 Merrimac Street, Haverhill, Mass.
Telephone 530 Haverhill

FIG. 11.—HAVERHILL ELECTRIC COMPANY.

One of the most interesting exhibits in the outer office is a group of high-frequency incandescent lamps mounted upon a panel with the rates shown below, the lamps being wired for regular service. These bear the legend:

HIGH-EFFICIENCY UNITS.
Cost per lamp per hour at regular rates

140 cp. Distributed	240 cp. Downward	105 cp. Distributed	180 cp. Downward	70 cp. Distributed	120 cp. Downward
3¾c.	9¾c.	2 8/10c.	2 8/10c.	1¾c.	1¾c.

Another panel of the same character shows the cost per lamp per hour at regular net rates, the lamps being either ordinary incandescents, "Meridians," 25-cp and 50-cp, or "Hylos," 16 and 1-cp:

2 cp.	4 cp.	8 cp.	16 cp.	25 cp.	32 cp.	50 cp.
2/10c.	3/10c.	4/10c.	¾c.	9/10c.	1 5/10c.	1 8/10c.

A table of prices of high-efficiency units is also mounted upon the wall:

No.	Watts.	Lamps.	Holder.	Reflector.	Total.
3	125	$0.50	$0.15	$0.70	$1.35
4	187	.70	.15	.90	1.75
5	250	.90	.15	1.05	2.10

In the rear is a room about 30 ft. square devoted to the display of chandeliers, lamps, shades, drop lights, signs, fixtures, fittings and Christmas tree equipment. The room is provided with dark curtains, so that the daylight may be readily eliminated, and with easy chairs and rugs for the comfort of its patrons. A large display window fronting on Merrimac Street is also utilized to exhibit electrical equipment appropriate to the season.

Quotations for power and its sale are based upon the following scheme of rates: (1) Service or "Readiness-to-serve" charge. This is $1.50 per "hp of demand" per month. (2) Power charge, ranging from 3.7 cents per kw-hour to 8 cents per kw-hour, according to the amount consumed. For customers desiring to avoid the monthly service charge, and for those who propose to use power but a few hours during the day, non-contract service is rendered on the regular lighting rates, which are:

First 50 kw-hours, at 15 cents; next 50 kw-hours, at 13 cents; next 100 kw-hours, at 11 cents; next 50 kw-hours, at 10 cents; additional power, at 12 cents.

A minimum charge of $1 per month is made to all power consumers on this basis. The "hp of demand" is determined by tests made by the company's electrician, and it represents the maximum horse-power required to operate the factory or establishment. The result of this test is used for the first year's contract unless the customer increases his plant, when it is determined afresh.

Commercial arc lamp rates are based upon a minimum monthly charge of $1.50 net per connected lamp per month, with the following net rates:

The first 32 arc lamp-hours per month at 7½ cents; next 50 arc lamp-hours per month at 3 cents; balance arc lamp-hours per month at 2 cents.

Customers who do not wish to guarantee the minimum charge of $1.50 per month per lamp are allowed arc lamp service at regular incandescent rates. In stores or factories where there is no wiring the company furnishes all the material and labor free of expense, provided the customer makes a three-year contract. If a two-year contract is made the company pays two-thirds, and if a one-year contract, one-third the cost of installation. Concentric diffusers are supplied free of charge and the company maintains the lamp free of charge.

In connection with incandescent lighting rates it was formerly the practice of the company to allow discounts varying from 20 to 40 per cent, according to the size of the bill rendered. This schedule was not considered equitable, for if a customer's bill, for instance, amounted to $19.99 he was entitled to a 25 per cent discount, whereas, if he consumed one cent's worth more of current he would get a 30 per cent discount; or in other words, by burning one lamp one hour longer the net bill for the service rendered would be $14 instead of $14.96. Hence the sliding scale was adopted, as previously tabulated. If the mains are near the customer's premises no charge is made for connecting the service. In case a deposit is asked the company pays 6 per cent interest upon it. The first set of lamps and renewals are free to the customer. Electric sign and heating rates approximate the incandescent schedule. When the bills are rendered 10 per cent is added to the net rates. This is taken off if the bill is paid within 10 days.

Gas competition is met by the use of 6-amp., alternating-current, multiple enclosed arc lamps, by high efficiency and "Meridian" incandescents. Some 4-amp., alternating arc lamps are in use also. The card index is largely used in the office for meter, motor, soliciting and test records. The first installation of high-efficiency lamps is charged to the customer. An initial charge of 10 cents for turn-bulb "Hylo" lamps and 12 cents for pull-string "Hylos" is made, with free renewals. When apparatus is purchased for customers a charge of 10 per cent to cover handling is made. The electrician and the inspectors do all in their power to help customers get the full benefit of their equipment.

LETTERS ON PRACTICAL SUBJECTS.

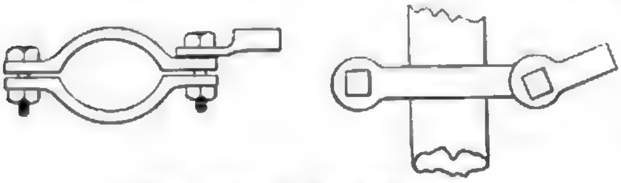
GROUNDING LOW-POTENTIAL CIRCUITS.

It might interest your readers to know that in Boston and vicinity the grounding of secondaries is being rapidly accomplished. The following rules which were gotten up by a conference between the Boston Board of Underwriters, the Boston Municipal Wire Department, the Boston Edison Company and the New England Insurance Exchange have been in force since March. These rules are not intended to modify, but to explain and amplify Rule 13 *A* of the National Electrical Code so as to provide more detail requirements than now exist where any part of the grounding is inside of buildings. In connection with these rules the user is directed also to Rule 13 *A* of the National Electric Code. The rules follow:

1. The usual report must be filed with the New England Insurance Exchange for each installation to which ground is attached.

2. Before any ground is placed on the neutral of a three-wire or on either side of a two-wire installation, a test for grounds must be made, a voltmeter being used to determine the insulation of the system; and where more than one installation is supplied from the same transformer or bank of transformers a test must be made of all such installations before any ground connection is made.

Where the insulation resistance between any installation and ground is below that given by the table in Rule 66 of the National Electrical Code, the party making the test shall notify the New England Insurance Exchange and such installation must be examined and brought to an insulation which will equal that called for by the table, before said installation or any other installation supplied by the same transformer or bank of transformers may be grounded.



FIGS. 1 AND 2.—GROUNDING CLAMP.

3. When the ground connection or any part of the ground wire is inside of any building other than a central station or sub-station, then the following provisions must be complied with:

(*a*) The size of the ground wire to be not smaller than No. 4 B. & S. gauge, and to have an approved rubber insulating covering, National Electrical Code Standard for from 0 to 600 volts

(*b*) The ground wire shall be connected to the system on the street or service side of the main cut-out and switch, the connection being made by a thoroughly made joint properly soldered and taped.

(*c*) The ground connection to be made only to water pipes. The connection must, if practicable, be made on the street side, *i. e.*, the entrance side of all service cocks, meters, etc.—and always as near as practicable to the point where the water pipe enters the building. The ground wire to be sweated into a lug attached to an approved clamp (Figs. 1 and 2), and the clamp firmly bolted to the water pipe. All rust and scale must be removed from the pipe where the clamp is attached

(*d*) The ground wire to be kept as far as practicable on the outside of the building, to which it may be directly attached by cleats or straps or on porcelain knobs. Staples must never be used

(*e*) Where it is necessary to run the ground wire through any part of a building other than the basement, it shall be run in approved moulding. In basements, the ground wire shall be supported on porcelain or run in approved moulding.

(*f*) Wherever the ground wire passes through any wall of a building, it shall be protected by an approved porcelain bushing.

(*g*) The ground wire should always be run in as straight a line and with as few bends as practicable, and must be properly protected where exposed to mechanical injury.

The proper protection can be secured by use of an approved moulding, and as a rule the ground wire on the outside of a building should be in moulding at all places where it is within 7 ft. from the ground.

As these detail requirements had proved useful and satisfactory in the New England territory, both to the electrical and insurance interests, it was thought best to recommend them for adoption by the Underwriters' National Electric Association, and at the December meeting they were adopted and incorporated in the Code, with the exception, of course, of the details of testing and reporting, which would vary in the different departments.

Boston, Mass. C. M. Goddard.

SOME OPERATING EXPERIENCES.

When operating electrical machinery the operator may sometimes encounter experiences which at first thought seem to depart radically from fundamental laws governing the action of electrical machinery, but which upon investigation prove to be due to very simple causes. The following experiences gained in the operation of a 10,000-hp hydro-electric plant may be of interest to some of your readers. The first trouble encountered was due entirely to armature reaction. In this case the machine was an 875-kw. 175-volt 14-pole shunt-wound direct-current generator carrying a load of 5,000 amperes. The load on this generator under normal conditions is perfectly steady, the output being consumed in electric furnaces for the manufacture of chloride of potash. Occasionally, however, these furnaces fluctuate considerably, the variation sometimes amounting to from 1,500 to 2,000 amperes. Early one morning the load began to fluctuate very much, and before the attendant could "kill" the machine it emitted a considerable volume of smoke. This was rather unusual, as the voltage was generally reduced on the machine until the furnaces were adjusted; the voltage was then increased to normal without any indication of trouble on the machine.

On making an investigation to determine the cause of the smoke, nothing could be found wrong with the armature, but it was found that one turn of each of the fourteen field coils had been very hot, in fact, sufficiently so to blister the paint. This was a puzzler at first, but on further examination the cause was easily explained. The coils were wound with No. 4 wire, and there was no covering over the coil except the cotton covering on the wire. The turn which had heated abnormally was the last turn of the coil and the end of the last turn was soldered to the turn next to it in order to hold the end in place, thus making a closed loop of one turn around each pole. The remaining solution of the problem was then obvious. The variation of current in the armature, which possibly amounted to 3,000 amperes, was very rapid and regular, and in consequence the armature reaction, which varied directly with the current in the armature, induced a current in this closed turn around each pole, and inasmuch as this turn naturally had a very low resistance an enormous current was induced in it, causing it to heat excessively. It might be added in passing that this turn was the last one on the coil and nearest the armature, thus obtaining the maximum effect of the armature reaction and acting somewhat similar to a damper on a rotary converter.

After remedying this trouble the machine was built up and the load put on without giving any further trouble. Another machine which caused some trouble was a 700-kw 2,200-volt 125-cycle single-phase alternator. This machine had been dismantled in order to make some repairs to the turbine to which it was connected. The alternator is of the internal revolving-field type, the revolving field being 8 ft. in diameter and having 60 poles. The machine ran at 275 r.p.m After the repairs in the turbine had been completed and the machine reassembled, it was started up and gradually brought up to normal speed without exciting the field, in order to make certain everything was all right. After everything had been going nicely for a few minutes the signal was given to put on the load and the switchboard attendant proceeded to build up the machine. The machine had not reached more than one-third of its normal voltage when it uttered a dismal groan and emitted smoke. The alternator was immediately "killed" and an examination made for hot coils in the armature, as it was thought that possibly in reassembling the machine some of the coils had been crossed, but nothing hot could be found.

Another attempt was made to build up the machine, and although the voltage was run up a little higher, the same noise was emitted, but it was discovered that it was not smoke that the machine was throwing out, but dust caused by the revolving field rubbing against the armature on the left-hand side of the machine. The machine was instantly stopped, and on investigation it was found that in resetting the armature it had been set about 1/16 in. off center, thus bringing the armature nearer the poles on the left-hand side than on the right-hand side; although there was still an air-gap of ⅛ in. on the close side, which accounted for the machine running free when the field was not excited. When, however, current was sent through the field coils, there being an air-gap of ⅛ in. on one side and ¼ in. on the other, the magnetic attraction between the field and the armature was great enough to pull the field over against the armature on the left-hand side and cause it to rub, although this does not seem possible when one takes into consideration that the shaft is 16 inches in diameter and the bearings were all in their proper places. After jacking the armature over to its proper position the machine was started up and the load put on without giving any further trouble.

Niagara Falls, N. Y. E. C. Channing.

SOME PRACTICAL ELECTRICAL KINKS.

In electrically operated plants the reversal of the polarity of a generator usually causes considerable annoyance and trouble, especially if other generators are to be connected with the reversed machine. In plants where only one unit is employed, the reversal of this unit does not usually cause any trouble, since if the output is used for incandescent electric lighting it would be only necessary to reverse the connections of the voltmeters and ammeters, which does not require the shutting down of the reversed unit in order to make these changes. Where two or more units are employed the polarity of each generator must be the same, otherwise it will be impossible to couple them on the same busbars. Referring to Fig. 3 and assuming that generator No. 1 is in motion and reversed, two remedies are available. The generator in motion may be re-reversed, or the generator at rest may be reversed. In practice the quickest remedy will be to reverse the generator at rest, because the reversed generator is in motion and in order to reverse this machine it will be necessary to start up another unit and shut down the reversed machine. A generator may be reversed very quickly and without causing the slightest damage in the following way:

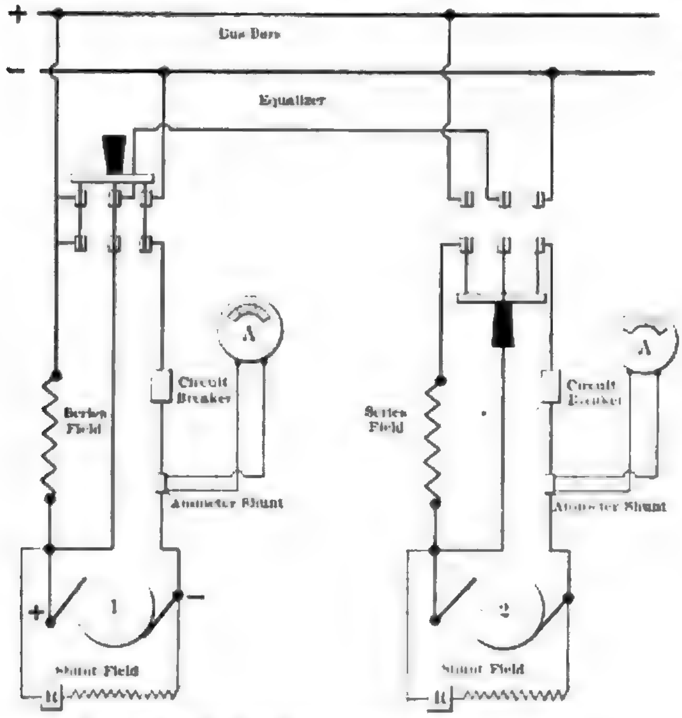


FIG. 3.—COMPOUND-WOUND GENERATORS IN PARALLEL.

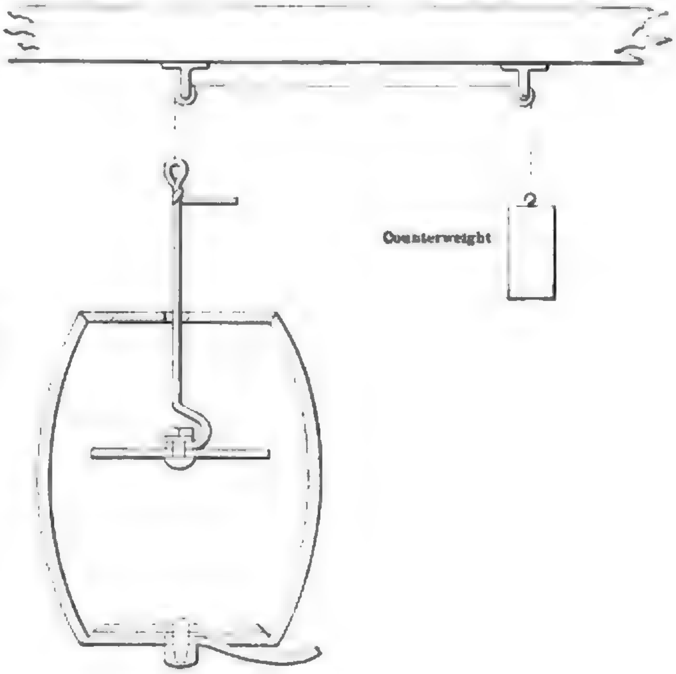


FIG. 4.—BARREL RHEOSTAT.

It is assumed that the machine to be reversed is at rest and it is important before beginning operations to open the main switch of this machine. All the brushes should now be raised or insulated from the commutator, and after this is done some fuse wire substituted for the main switch (from 25 to 75-ampere fuse wire will be sufficient for the average size generator). The substitution of fuse wire across the terminals of the switch will have the same effect on the circuit as if the main switch were closed. The fuse wire should next be covered with some material, preferably asbestos paper, so as to preclude the possibility of fire or injury to persons when the fuse wires blow. Everything is then ready for reversing the machine. By simply throwing back the brushes on the commutator, or quickly removing the insulation from between the brushes and the commutator, as the case may be, the reversal of polarity will take place and the fuse wire which was substituted for the main switch will be blown. The machine can then be started up as usual and it will be found that it will have the same polarity as the dynamo which supplied the current for the reversal. The simplicity of this method is obvious and excludes the necessity of changing the dynamo leads and finding the positive and negative wires.

A simple method of determining which is the positive and which the negative lead from a dynamo is as follows: Mix one part of iodide of potassium with ten parts of distilled water and moisten some white blotting paper with this solution. When the ends of the leads are placed on the opposite ends of a small strip of this paper the positive lead will leave a discoloration, while no evidence of color will be found at the negative lead. The positive or negative pole of a motor or generator may be easily found with a pocket compass, the positive pole of the motor or generator attracting the south pole of the compass needle. A dynamo may reverse its polarity owing to the breaking of a field wire or owing to the rapid burning out of the rheostat, and the polarity may also be reversed if the exciting current is not sent through the field coils in the proper direction.

The "barrel" rheostat is a good temporary device whenever the regular rheostat burns out. The following notes regarding its use may be of interest. When using this form of water rheostat care should be taken not to employ too much acid or salt in order to increase the conductivity of the water, because the moment current begins to flow through the water a rapid wasting away of the positive plate will take place and this may lead to trouble. Referring to Fig. 4, it is evident that with an acid solution and with the upper or movable plate connected to the positive lead the electrolytic action may eat away the conductor connected to the plate and thus permit this to fall, with the result that the polarity of the generator may be reversed. If, as shown, pulleys and weights are used to hold the plate in certain positions, the wasting away of the wires supporting the positive plate will finally render this wire too weak to support the weight of the plate, and hence the plate will drop, and unless the balancing weight is supported independently the wire will be drawn out of the water, the circuit suddenly opened and the reversal of the dynamo almost sure to follow. For this reason it is best to connect the negative lead to the movable plate and the positive lead to the plate at the bottom of the barrel.

When using the barrel rheostat it will be found that the voltage cannot be controlled with the same ease as with the ordinary rheostat, but further variation of the voltage may be obtained by manipulating the throttle valve of the engine or by shifting the brushes. It is not always advisable to shift the brushes for voltage control, it being more practical to partly close the throttle valve of the engine and in this way control the voltage until sufficient load is indicated on the ammeter, or until the voltage begins to fall. The throttle valve of the engine may then be opened full. If the generator is fairly proportioned to the load and the engine which drives the generator fairly accurate in governing—that is, if the variation of speed from no-load to full-load is not excessive—the throttle valve of the engine may be opened wide when the movable plate of the water rheostat is as far removed as practicable from the stationary plate. As the load increases the distance between the plates must, of course, be lessened, so as to decrease the resistance, just as one would cut out the coils in the ordinary rheostat.

Brooklyn, N. Y. Wm. Kavanagh.

GASOMETER FOR A SMALL GAS ENGINE.

Fig. 5 shows a device for supplying gas to a small gas engine, as a substitute for the rubber bag so commonly used. But little explanation is required as the cut makes it plain. The inner reservoir for gas is 7½ in. in diameter. The tank or outer reservoir is not fitted with a tight cover, but is supplied with a bar across the top that acts as a guide for the spindle of the movable inner receptacle. The space between the two is filled with water, which acts as a frictionless packing or seal to prevent the escape of gas. Weights are put on the spindle to give the desired pressure.

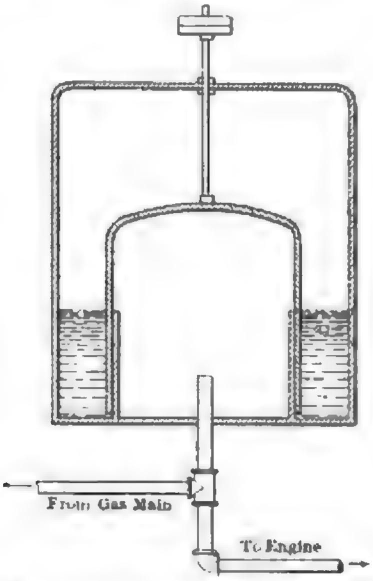


Fig. 5.—Gasometer for Small Gas Engine.

Cincinnati, O. Jas. L. Thomas.

DRIP PIPES FOR HIGH-SPEED ENGINES.

Fig. 6 illustrates the cylinder of a high-speed engine with a drip valve at each end, and drip pipes connected near the center by a Y instead of a tee, which works well in practice. If a tee is used here it sometimes causes trouble as follows:

The first steam admitted to the cylinder when the engine is started is quickly turned into water, and a portion of all that is used for several minutes takes the same course. This water is pushed along in advance of the piston until it goes into the drip pipe at the end of the cylinder. It is sent into this pipe with more or less force, hence when it comes to a tee, all of it does not drop into the vertical outlet as intended, as some of it is shot across and forced into the other end of the cylinder, or at least preventing the free escape of water through that part of the piping, resulting in clicking and pounding that is unpleasant and unprofitable. When a Y is used this is prevented, as the water is sent downward from both ends of the cylinder.

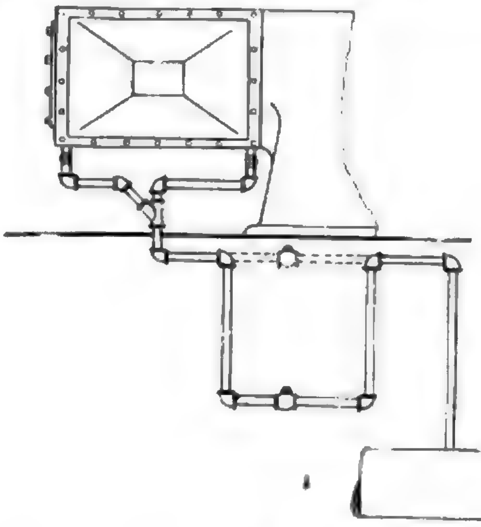


Fig. 6.—Drip Pipe.

The dotted lines show the piping and check valve as originally arranged, which was not satisfactory. This pipe discharged into a large drip pipe which takes hot water from other sources and conveys it to the sewer. When the engine was standing still, vapor from this pipe backed up into the cylinder, keeping it warm during the day and causing it to rust at night. The check valve was examined carefully, but no imperfection could be found in it. Had there been a few pounds back pressure more or less, the disk which was made of what is commonly called hard rubber composition, would have been held to its seat, making a tight joint, but owing to the absence of pressure the check valve allowed vapor to work back through it. A loop was made in the piping, as shown by the full lines, which lowered the check valve about 2 ft., causing it to be covered with water at all times. This proved to be a satisfactory remedy, as the cylinder was not heated by steam entering through these pipes. Water standing in such a loop will prevent vapor from passing through it, but the check valve is necessary in order to keep this water from being drawn out of the loop into the engine cylinder by the piston while shutting down.

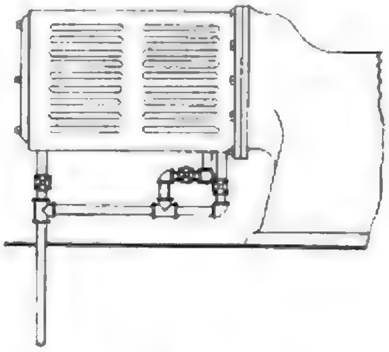


Fig. 7.—Drip Pipe.

Fig. 7 illustrates another unsatisfactory arrangement of drip piping, because it proved dangerous. Hot water from the head end passed down through the tee shown, but when the crank end of cylinder was drained under pressure, water struck this tee, forming an obstruction which caused pounding and clicking in the cylinder. If both drip valves were nearly closed it gave temporary relief, but they ought to be wide open when starting the engine. Between these two drip valves another pipe is connected by means of a tee as shown, and this is the worst feature of the arrangement. This engine has been run at a slow speed for 15 minutes with all three valves wide open, and an attempt was then made to give it full speed within one minute, but the pounding was so severe that it had to be slowed down and another attempt made by increasing the speed very slowly, although there is a good separator in the steam pipe close to the steam chest which removes all water that collects while steam is traveling from the boiler. If the steam chest drip valve is closed the engine can be brought up to full speed in three minutes with very little noise due to water, which proves that this pipe should not be connected to the other as shown, but ought to be carried separately to a more distant point.

Pittsburg, Pa. Chas. L. Hitchings.

REDUCING THE COST OF WATER.

The engineer of a five-story shop found that the expense of water for his boiler was an important item, as it came from the street main through a meter that apparently did not fail to indicate every cubic foot that passed through it. Water for various purposes was pumped from driven wells into a tank on the roof, the outlet pipe of which was located so that all of the water could not be drawn out of it, thus leaving some for use in case of emergency.

Whenever the cost of water from the street main is burdensome, the first plan for reducing this cost that is considered by a steam plant owner, is the use of well water, but a competent engineer knows that trouble and expense is almost sure to result from such action, therefore wishes to avoid it if possible.

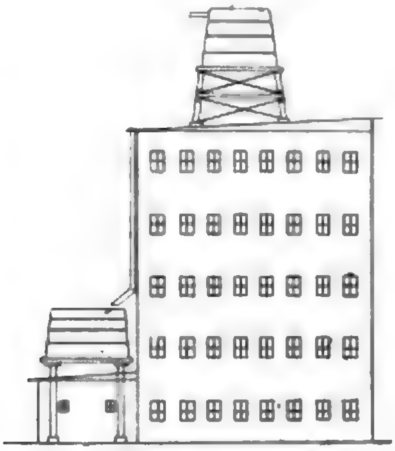


FIG. 8.—REDUCING THE COST OF WATER.

In this case the engineer sent a sample of the well water to a chemist for analysis, who rendered the following report:

		Grains per U. S. Gallon.
1.	Calcium Carbonate	1.68
2.	Calcium Sulphate	3.33
3.	Calcium Chloride	2.91
4.	Magnesium Carbonat	2.00
5.	Sodium Chloride	3.45
6.	Free Carbonic Acid	.26
7.	Iron, Alumina and Silica	.42
8.	Incrusting Solids	10.44
9.	Non incrusting Solids	3.45
		27.94

These names are not familiar to the average working engineer, as he has little use for them, and the following explanation was given by a friend to whom the matter was referred:

1, chalk or shell lime; 2, common lime; 3, chloride of lime; 4, a substance like aluminum; 5, salt; 6, oxide of carbon; 7, iron white clay and flint; 8, scale forming impurities; 9, quality uncertain.

A sample of the water was sent to another chemist, who made a report practically agreeing with this, which convinced the owner that it was not wise to evaporate such water in a boiler and leave much of the solid matter to form scale, therefore this plan was abandoned and another adopted.

The boiler house is one story high and above the roof a large tank was placed as shown in Fig. 8. It did not rest on the roof, but on four heavy timbers set on end, each supported by a suitable foundation, making a substantial structure. When it rains all water falling on the large roof of main building flows into this tank, and is used for boiler feeding. If the upper tank overflows, the well water also finds its way into the lower tank, but there is not enough of this to do much harm, as it is mixed with rain water, which is pure except the particles of dust, etc., which it absorbs on its way through the air, and takes up from the roof.

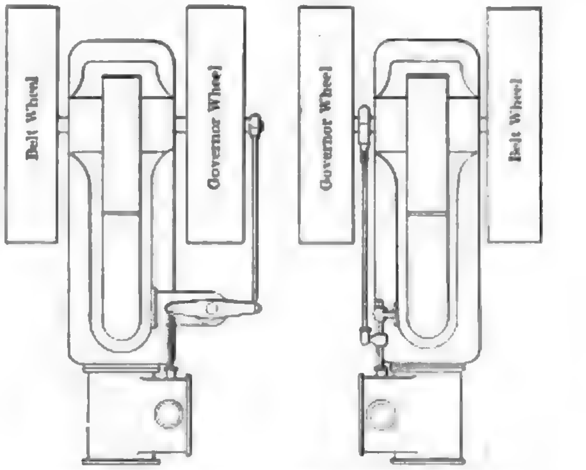
In practice this is not harmful and the plan is a good investment on account of the saving made in the water bills, also as providing water that does not fill the boiler with scale. It is recommended to other steam plant owners as worthy of adoption.

Milwaukee, Wis. James T. Branch.

RIGHT AND LEFT-HAND ENGINES

In the case of a slow speed side crank engine it seems easy to decide whether it is of the right or left hand type, for if we stand facing the cylinder head and the fly wheel is on the right hand side, it is a right hand engine, and if on the other side it is a left hand. When a center crank engine fitted with two wheels is considered the case is different, because both sides look alike when viewed from the cylinder head.

There is a difference, however, as follows: With a side crank engine the valve gear is on the same side as the fly wheel, therefore if the valve gear of a center crank engine is on the right hand side it is a right-hand engine. Fig. 9 shows an outside connected engine because the rod which transmits motion from the governor to the valve is outside of the wheel. Fig. 2 is a left-hand engine because the valve gear and governor is at the left hand side. It is inside connected because the valve rod is between the governor wheel and the frame, or in other words, it is inside of the governor wheel.



FIGS. 9 AND 10.—RIGHT AND LEFT-HAND ENGINES.

Boston, Mass. Robert K. Hand.

PROBLEM IN MOTOR WIRING.

I submit the following problem in motor wiring to your readers for their consideration. Two series motors are connected to a line shaft, and the simplest arrangement of switches is required to obtain the following results:

1. One motor in circuit.
2. Two motors in series.
3. Two motors in parallel.
4. Two fields in parallel, armatures in series.
5. Two armatures in parallel, fields in series.

The connections must be so arranged that the armatures of the motors will not interfere with each other, and the motors are to be connected to a common four-point controller.

RIGBY, PA. R. A. BLACK.

PROBLEMS IN LAMP AND INSTRUMENT WIRING

Usually in wiring problems some particular object is of primary importance and this should be clearly defined. For example, Mr. Simon in your November issue asked for a solution in a case where there are five series arc lamps requiring 35 volts each, which are to be connected to a 105-volt circuit so that three will be burning at one time, the center lamp being connected to each group; that is to say, it is required to connect lamp No. 3 so that it will burn with either lamps Nos. 1 and 2 or with lamps Nos. 4 and 5. The object is not here clearly defined. For instance, it is not stated whether it is an ornamental job or whether economy in the use of switches is the main object, or if safety of operation is the principal consideration.

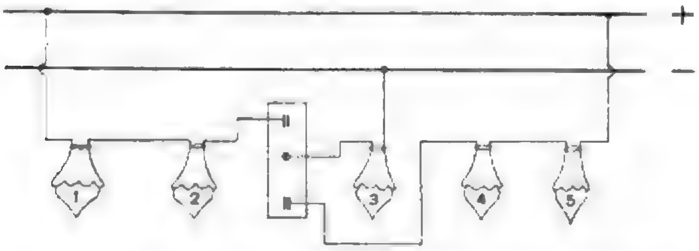


FIG. 11.—SOLUTION USING ONE SINGLE-POLE, DOUBLE-THROW SWITCH.

If all that is desired is to wire the five lamps so that they will burn regardless of the length of the line, number of switches, etc., then any arrangement will do. If it is desired to use as few and as simple switches as possible, the solution shown by Fig. 11 is as good as any,—one single-pole double-throw switch being required.

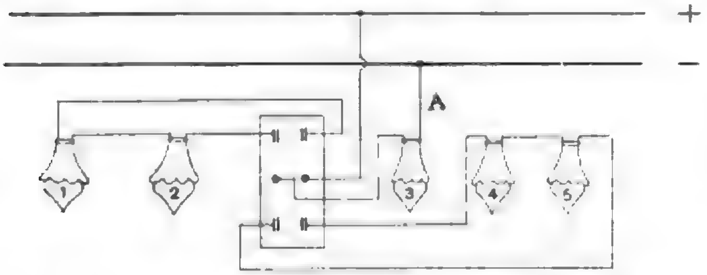


FIG. 12.—SOLUTION USING A DOUBLE-POLE, DOUBLE-THROW SWITCH.

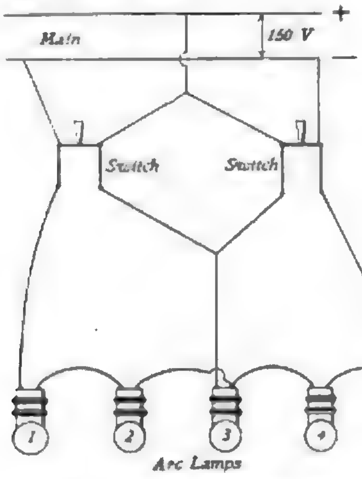


FIG. 13.—MR. MAURY'S SOLUTION.

In this case one side of the line on the lamps not burning is always alive. With the arrangement shown in Fig. 2 this slight difficulty is obviated. By the addition of a single-pole, single-throw switch at *A*, the entire line can be opened when none of the lamps are needed. If these lamps are all within close radius of the switches, almost any arrangement of lines would do; but supposing that lamp No. 3 was a mile away and the idea was to save copper, or supposing these lamps were run from a machine only able to carry three lamps at a time, then the solution offered by Mr. Maury (Fig. 13) would permit any one to throw both sets of lamps in circuit and overload the circuit. In some cases it is very desirable to open both sides of the line on "dead" lamps and in such a case the solution offered by Mr. Purcell (Fig. 14) would be lacking. The above examples show the desirability of defining the conditions of a problem.

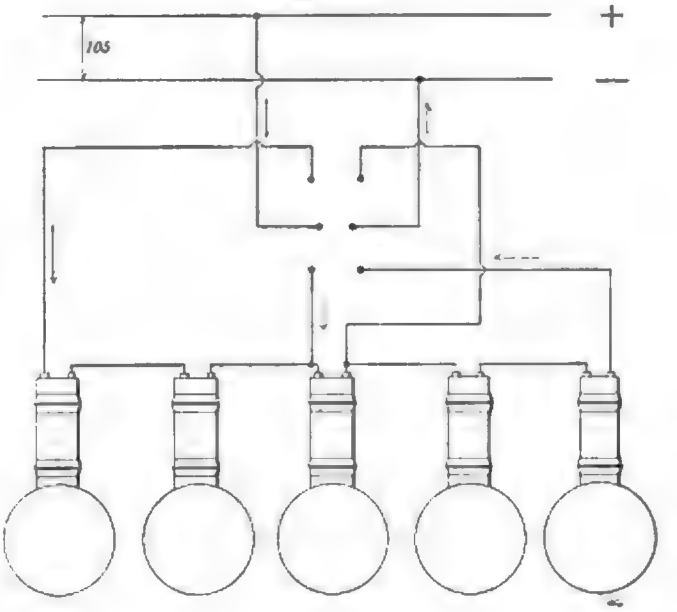


FIG. 14.—MR. PURCELL'S SOLUTION.

Such a case occurred to me recently. One circuit carrying 48 16-cp 110-volt lamps and another with 32 16-cp 110-volt lamps were fed from a distributing board some distance from the dynamo room. Current was obtained from transformers and this current was delivered to bus-bars on the board. The switches used were double-pole single-throw. It was desired to cut in on these two circuits only current from a 220-volt direct-current machine of small size at such times as the main plant was shut down. A "tail switch" was put in to cut off 16 of the lights from the larger circuit and an arrangement of switches installed to throw the circuits on a kind of three-wire system. Some one plugged them in wrongly with the result that all the lamps were burned out. They then changed the lamps from 110 to 220 volts, and the same thing occurred. The rewiring of the circuit was contemplated when the case was referred to me. I installed one switch (Fig. 15) which changed the circuit from 110 to 220 volts and rendered it impossible to throw 220-volt current either through the 110-volt lamps or back into the transformer or vice versa. How was this done?

I also had two exciter circuits and one ammeter which I desired to use on either circuit while both exciters were running, and of course I did not wish to open the circuit on either while changing the instrument, or use the instrument on both circuits simultaneously. I solved the problem with as few switches as possible, and afterward arranged these so that it was impossible to open the circuit while changing the ammeter. I am interested to know how your readers would have solved this problem.

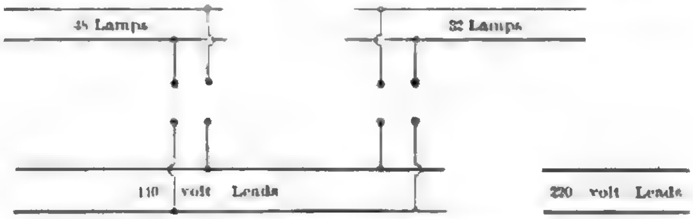


FIG. 15.—MR. WHITE'S PROBLEM.

BLAINE, WASH. F. G. A. WHITE.

IMPROVEMENTS IN APPLIANCES AND APPARATUS.

New Insulators.—Fig. 1 herewith shows a vertical section of a high-voltage insulator recently patented by G. W. Thomas. Instead of providing the central lower part of the insulator with a female thread, as is common, for the reception of the corresponding male thread of the wooden supporting thread, a pin of porcelain or other vitreous material is cemented to the body of the insulator as indicated, the surfaces near the top being roughened to give the needed holding surface for securing the cement. The vitreous pin is provided with a broad base which rests on the cross-arm, a bolt with a shouldered head on its upper end passing through the pin and cross-arm. Between the shouldered head of the bolt and the top of the pin a cushion washer is provided. The vitreous pin merely rests upon the cross-arm sidewise, mechanical strains being taken by the iron bolt.

The insulator pin shown by Fig. 2 forms the basis of a patent granted to W. T. Goddard. The base or standard consists of a hollow column having a broad, flat bottom and vertical strengthening ribs tapering toward the top. The bolt is threaded at its lower end and has a relatively long head projecting above the top of the base and forming a shank adapted to enter and to be secured in the hole of the insulator. This head is ribbed so as to provide a good holding surface for the cement and at the same time afford shoulders which bear against the top of the base and support the projecting head against bending. The bolt is secured in the base from longitudinal movement as shown, so that in the event of the wooden cross-arm shrinking the base cannot fall away from the head of the bolt and thus deprive the bolt of the lateral support secured by the bearing of the ribs on the top of the base. As the base is only subject to crushing strains this is made of cast iron, the bolt being forged from steel.

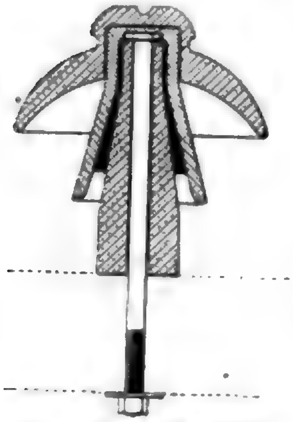


FIG. 1.—HIGH-VOLTAGE INSULATOR.

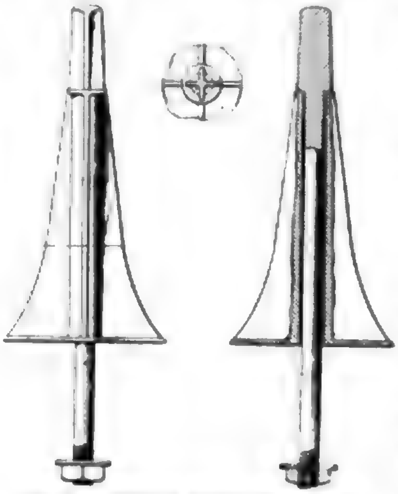


FIG. 2.—GODDARD INSULATOR PIN.

In order to meet different conditions and requirements of service, it is sometimes advisable to employ insulators having hoods of various sizes which are separable and which may be employed interchangeably, so that in case of breakage or injury to any part this may be readily replaced and the insulator as a unit restored to its full power. Fig. 3 shows a vertical cross-section through a form of insulator recently patented by Louis Steinberger. Mounted upon a cross-bar is an insulator pin provided at its bottom with a shoulder and with a stud passing through a hole in the cross-arm, which is secured in any desired manner. The upper end of the pin is provided with a hood having a frusto-conical portion, a shoulder and a threaded portion or head. The upper hood is of insulating material and has diametrical slots and an annular slot so as to enable the insulator to support cables and wires; it is also provided with internal and external threaded portions as shown. The lower hood is also threaded, and disposed between the upper and lower hoods is a washer of soft rubber which is inserted for the purpose of increasing the resilience of the hoods relatively to each other when screwed tightly together and also for improving the insulating properties of the two hoods when so secured. It will be noted that the connection between the two hoods is independent of the action of the insulator pin, so that the two hoods may be screwed together and mounted as a composite insulator, or may be mounted one at a time. While not limiting the insulating material, the patentee prefers "electrose."

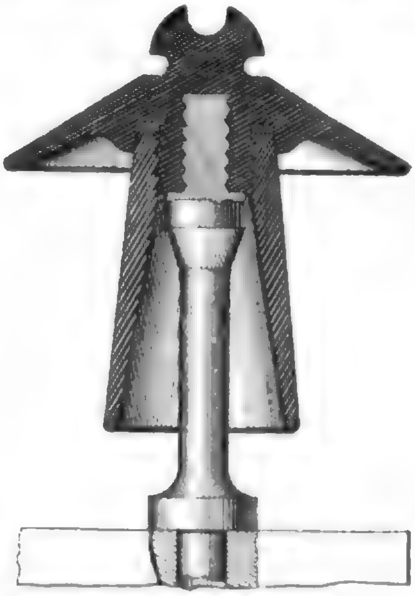


FIG. 3.—COMPOSITE INSULATOR.

In the installation of incandescent electric lights for street lighting the current is frequently taken from a line of high potential through the medium of a transformer, and in such cases it is often desirable that the lamp should be separated from the supporting bracket by an insulator which is substantially free from moisture throughout at least a considerable portion of its exterior surface and which will thoroughly insulate against the passage of a powerful current, so that the danger which might result from current on the lamp side of the fixture passing into the separating bracket may be reduced to a minimum. Fig. 4 herewith shows partly in section and partly in elevation a lamp socket, a portion of a lamp, a portion of a bracket arm and an insulator embodying the invention recently patented by Louis McCarthy. The insulator is of molded composition and has one or more skirts or projections for shedding moisture. An opening is provided through it to permit the passage of supply wires, the opening being of sufficient size for the reception of surplus wires. Independent metallic sleeve connections insulated from each other are molded into the insulator so as to serve as a means for attaching the latter to the contiguous portions of the construction.

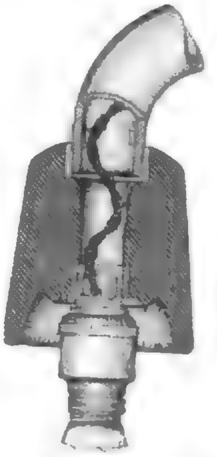


FIG. 4.—M'CARTHY INSULATOR.

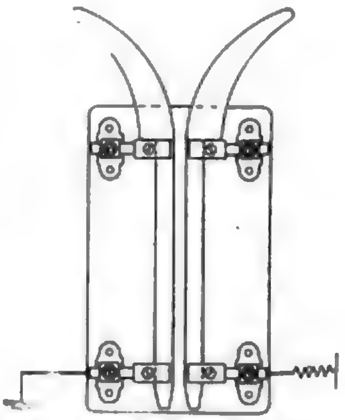
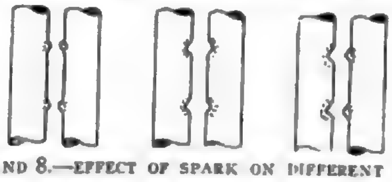


FIG. 5.—JORDAN SPARK ARRESTER.

High-Voltage Spark Arrester.—The high-voltage spark arrester shown in elevation in Fig. 5 recently patented by Fritz Jordan, consists of two vertically disposed bars, one of metal and the other of carbon, the object being to keep the distance between the electrodes at the point of discharge constant. One side of the arrester is connected with the line through an intermediate high resistance and the other side is connected to earth; it is provided with the well-known horn-shaped appendages at the top, which are added merely for the sake of increased safety and which do not come into action in normal working. If both conductors were made of metal it might happen that when a spark jumped across them globules of fused metal would form and the distance between electrodes thereby be reduced, so that successive sparks would be formed under pressures which would vary from the one for which the apparatus was originally constructed. The inventor takes advantage of the fact that when a spark is formed projections of fused metal appear at the surface of metal electrodes, whereas with carbon electrodes depressions are formed.


FIGS. 6, 7 AND 8.—EFFECT OF SPARK ON DIFFERENT ELECTRODES.

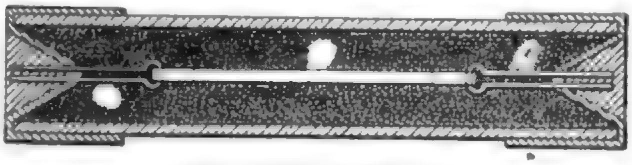


FIG. 9.—SACHS SAFETY FUSE.

This is illustrated more clearly in Figs. 6, 7 and 8, the first showing the effect of a spark between two metallic electrodes, the second showing the effect of a spark between two carbon electrodes, and the third showing the result of a spark between a carbon electrode and a metal electrode. In the latter case the formation of molten metal on the metal electrode corresponds to the depression on the carbon electrode, so that the distance apart of the electrodes remains the same.

Safety Fuse.—In the construction of safety fuses, especially of the commercial fuse cartridges, difficulty is experienced in making the necessary joint between the fuse terminals and the end caps, owing to the fact that the heat required to make this joint is likely to disconnect the joints between the fuse strip and its respective terminal wires. Mr. Joseph Sachs has devised a method of overcoming this difficulty, which he recently patented. He employs with a casing and fuse strip, end caps of peculiar construction and fuse-strip terminal wires which are electrically and mechanically connected to the end caps in such a manner that there is no liability of disrupting the joint between the fuse strip and its terminal wires when making the joint between the latter and the end caps. Figs. 9 and 10 are central longitudinal sections taken axially at right-angles to each other of a safety fuse embodying these improvements. The insulated casing is provided with end caps, the end faces of which are axially cupped or recessed so as to form an inwardly projecting funnel-shaped wall providing a central recess in the face of each end cap. The fusible metal is of the kind commonly employed in devices of this class, and the terminals consist of wires having good conductivity which are looped centrally and through which loops the ends of the fuse strip are passed, returning upon themselves, and joined by soldering the parts together or otherwise. The ends of the fuse-strip terminal wires extend through the central apertures of the cupped portions of the end caps and into the recesses. Into these latter is then poured a metal which surrounds the ends of the fuse terminal wires, filling the recess and thereby making both mechanical and electrical connection between the fuse-strip terminal wires and the end caps. A modification is shown in Fig. 11. Here the ends of the fuse strip are secured between plates riveted together, the terminals or caps of the fuse device being cast and provided with slots into which these riveted plates are passed and secured by making a joint with molten metal, as in Figs. 9 and 10. A filling material, such as chalk, plaster of paris or soapstone in a granulated form, is employed to surround the fuse strip and its terminals. The granular material is used because it has been found that it tends to prevent the fuse strip sagging or hanging down when about to be disrupted. It also serves to dissipate the heat and absorb the gases after the dissipation.

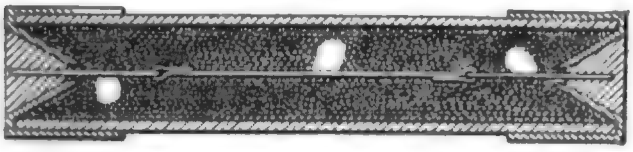


FIG. 10.—SACHS SAFETY FUSE.

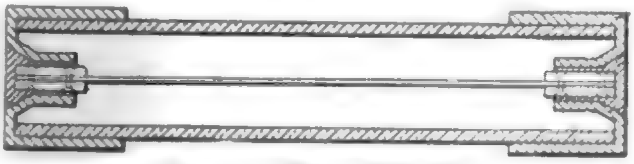


FIG. 11.—SACHS SAFETY FUSE.

Insulator.—Fig. 12 shows a two-part insulator recently patented by Herbert Sinclair, the object being to provide an insulator which will be less liable to be pulled out of place and which will furnish a good support for the conductors. The insulator has an oval cross-section with the long axis in a plane perpendicular to the length of the wire groove and is provided with corresponding notches in the adjacent faces of the body and cap to form a cross groove for the wire, the adjacent faces being correspondingly concave and convex. The wire receiving grooves are correspondingly curved to give a sufficient kink to the wire to hold it firmly from longitudinal slip. As an aid to placing the cap in position, corresponding ledges are provided at the edges of the concavo-convex faces of cap and body, and a centering teat is provided on the body to enter a corresponding recess in the under side of the cap.

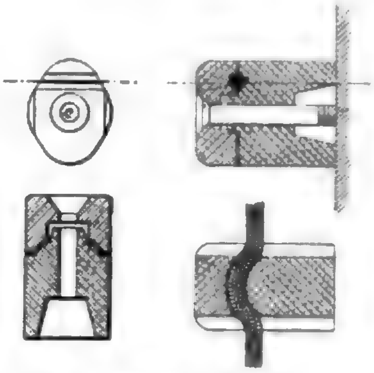


FIG. 12.—SINCLAIR INSULATOR.

Engine Trials with Superheated Steam.—The results of a series of trials on an engine using superheated steam are abstracted by *The Mechanical Engineer* from a paper recently presented to the Société Industrielle du Nord de la France by Messrs. A. Obrey and P. Bonet. The engine was of the compound-condensing type with cylinder 15.75 in. and 26.77 in. in diameter by 27.56 in. stroke. Both cylinders were jacketed, the low-pressure jacket being supplied with steam taken through a reducing valve direct from the main steam pipe. Steam was furnished by a B. & W. boiler having a heating surface of 1,453 sq. ft., the steam on leaving the boiler being passed through an independently fired superheater with a heating surface of 145 sq. ft. The steam pipe between the superheater and the engine was 102 ft. long, 4.32 in. in diameter, and the surface through which heat could be lost between the superheater and the engine was 123 sq. ft. No record figure in the matter of steam economy was expected, but the interest of the trial lay in the fact that the coal consumption as well as the steam consumption was noted, and it was found that the economy in fuel was markedly less than that realized in the weight of steam needed per hp-hour. Taking steam at 120 lb. pressure, the best result noted was a saving of 10/58 per cent in the amount of fuel needed per hp as compared with the same engine working with saturated steam. The superheat in this case was 268° F. The saving in steam under the same conditions was much more marked, amounting to not less than 24.65 per cent. With lower superheats the saving in coal was much less, being about 6.3 per cent when the steam was superheated about 178° F. only, though the saving in steam under these conditions was over 16 per cent. There was a considerable loss in the pipe connecting the engine to the superheater. The pipe was completely lagged and when supplying saturated steam the fall of temperature in the pipe was reasonably small, there being a drop of 7½ lb. in pressure for this length of pipe. With superheated steam the loss amounted to 1.33° F. of temperature per ft. run.

Wire Connector.—Fig. 13 shows a form of wire connector recently patented by N. W. Lillie and Anton Freier. The connector consists of a strip of good electrical conducting metal, the edges of the strip being bent around toward each other so as to form parallel recesses to receive the ends of the wire which are to be connected. The edges may be bent until they come nearly into contact with the base of the strip to form a tube, or in some cases one or both edges may be bent over only far enough to form a channel to receive the wire which can then be inserted lengthwise instead of edgewise. In the latter construction it is desirable to make a sharp bend just back of the edge of the strip so that the edge will lie in close contact with the wire and be drawn into close engagement with it during the twisting process. A feature of the invention consists in making the middle of the connector softer and more pliable than the ends. This result is obtained by drawing the temper of the strip in the middle portion and leaving the ends comparatively hard. Fig. 14 shows a slight modification, and Fig. 15 is a plan view of two wires connected.

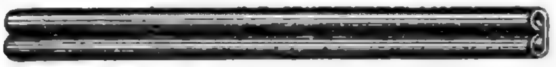


FIG. 13.—WIRE CONNECTOR

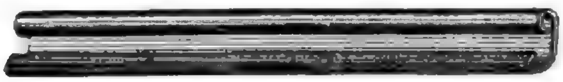


FIG. 14.—WIRE CONNECTOR.

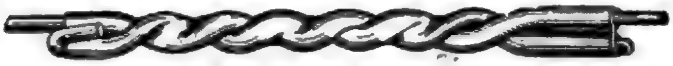


FIG. 15.—APPLICATION OF WIRE CONNECTOR.

Steam Pipe Arrangements.—William H. Fowler, in an article in *The Manchester Mechanical Engineer*, calls attention to the fact that where a number of boilers are set side by side, so that the steam main has to cross them transversely, the main should be placed from 6 to 8 ft. from the junction valves, so that the connecting pipe will serve as an elastic springing length and allow for any mere differences of level that may arise between individual boilers owing to their being shut off or to the sinking of the foundations. Further, the branch on the boiler stop valve should be at the same level as the main pipe. The springing length should not be connected to the main pipe with an elbow looking upwards, as in Fig. 16, since in the event of a boiler being shut off and the drain pipe near the stop valve being closed or choked the steam would condense in the springing length and gradually fill it. When the boiler is restarted under these conditions it is almost impossible to avoid water hammer and numerous fatalities have resulted from this mal-arrangement.

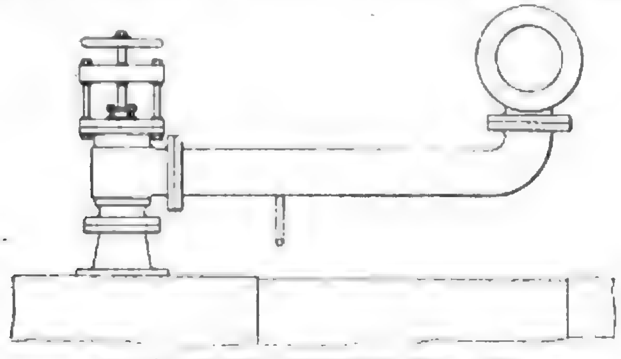


FIG. 16.—WRONGLY CONNECTED STEAM PIPE.

Joint for Electric Conductors.—Fig. 17 herewith shows a joint for electrical conductors recently patented by A. Fleeger. A sleeve of conducting material sufficiently ductile to permit of its being swaged is slipped over one of the wires before the ends are intercoiled, and after the wires have been intertwisted the sleeve is slipped over the joint and the ends lying beyond the enlarged part are reduced in diameter by a swaging process until they tightly grip and firmly hold the straight portions of the wires as indicated in Fig. 17. The annular shoulders thus formed serve as abutments to prevent any movement of the wires relatively to each other, thus adapting the joint to successful longitudinal strains. The entire joint is enclosed in such a way as to protect it from the weather while the grip is so intimate that a joint of high conductivity results.

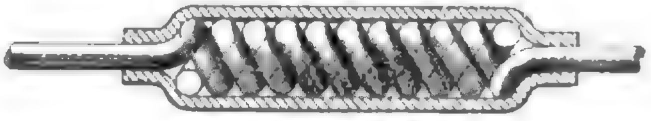


FIG. 17.—FLEEGER JOINT.

Economies of Electric Driving.—In a recent lecture before the Leeds Association of Engineers, Mr. Percy Rosling in comparing the methods of obtaining current for electric drive drew attention to the following points in favor of central station supply: Freedom from trouble in providing power for the works; use of a larger amount of capital on money-earning tools, thus increasing the capacity of the works; the ability to run the whole of the works short hours in slack times, and the possibility of running a portion of the works overtime or double-shift economically. It was shown that in actual practice a gain of from 4 to 10 per cent had been affected in output by the use of induction motors, owing to their regularity of speed and the elimination of slip in main and intermediate belts. The author stated that where the only costs of production, other than wages and material, were in the neighborhood of 30 per cent of the capital employed, the money spent on generating plant ought to be debited 50 per cent of its cost per annum to bring it into line with the rest of the capital. Otherwise the money spent on generating plant could be more profitably employed in productive machinery. In no case in a money-making concern should the generating plant be debited with less than 17½ to 20 per cent per annum.

Insulated Wire Support.—With the object of supplying a support for the insulator whereby the former may be readily opened to enable the latter to be readily placed therein, and also to improve the construction of the insulator to facilitate its attachment to the wire, J. A. Sullivan has patented the device shown in Fig. 18 herewith. The support comprises a pair of semi-cylindrical sections, one of which is provided on one side with a curved tongue and on the opposite side with an outstanding lug having a slot in its outer end. The other section has on one side an outstanding lug which is provided with a bolt hole to register

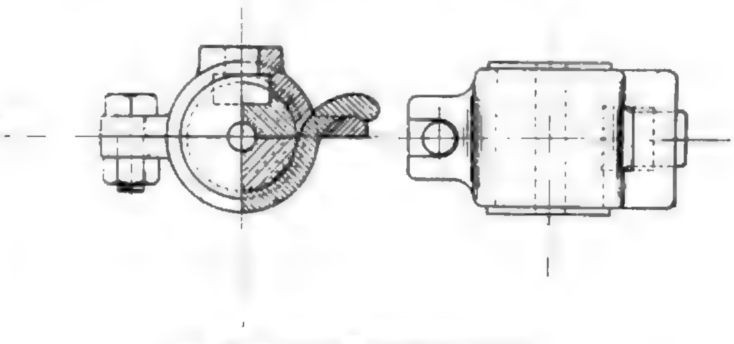
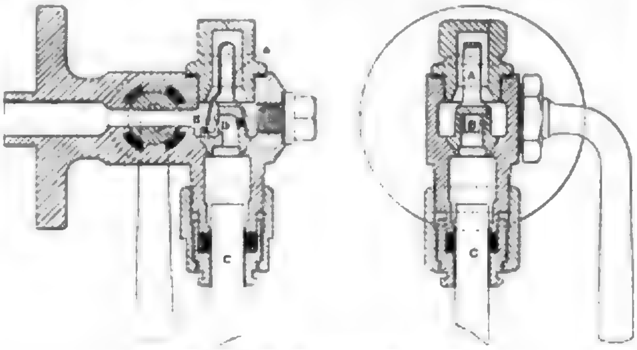


FIG. 18.—INSULATED WIRE SUPPORT.

with the inner end of the slot on the other section. On the opposite side of the section is an outstanding arm which is provided with an opening through which the tongue of the other section may be passed. One section is also provided with an opening for the passage of the stem of a bolt used to secure the device to a hanger, and also has a socket of suitable size and shape to receive a portion of the head of the bolt. The insulator comprises two semi-cylindrical sections provided at their ends with flanges which bear against the ends of the support and are thereby locked in place. One section of the insulator is provided with a recess which registers with the socket of the support and receives the head of the hanger bolt.

Water Gauge.—Where water gauges have the top and bottom arms respectively provided with automatic valves, it is desirable to provide not only against the closing of the automatic valve in the top arm during the operation of "blowing through," but against its closing under certain other conditions which may accidentally arise in working. With a view to holding the automatic valve in the top arm in its seat during the operation of blowing through, it has been proposed to suspend or support the valve opposite its seat by means of a spring or flexible carrier. This means, however, would not suffice in the event of a gauge glass breaking. Should the spring or carrier itself break, or otherwise fall, the valve seats itself, whereupon the passage through the top arm to the gauge glass is closed and a condition of danger engendered. An arrangement shown in Figs. 19 and 20 herewith to provide against such an occurrence is described in *The Manchester Mechanical Engineer*. The valve is supported in the top arm by means of a spring carrier, and the orifice which it closes is arranged at the side of or above, instead of beneath, the latter. The spring carrier *A* is sufficiently stiff to hold the valve *B* in its seat *B*1 during the operation of blowing through, but should the gauge glass break the valve is forced against its seat and intercepts the escape of steam. If the spring carrier break the valve falls away from its operative position and during normal working is no longer capable of gaining its seat and closing the passage to the gauge glass.



FIGS. 19 AND 20.—WATER GAUGE.

Indicating Fuse.—Fig. 21 shows an improved thermal cut-out recently patented by B. D. Horton. The fuse is curved in the center as shown and a loop of wire is passed through the turn and connected to an outer plate. Beneath this plate and held in compression by the loop of wire passing around the fuse is a spring. Under an excess of current the fuse heats and melts and the spring acts to pull the loop of the wire through the turn in the fuse and project the plate, making it immediately apparent that the electric connection has been destroyed.

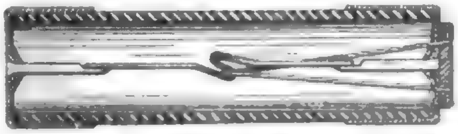


FIG. 21.—HORTON CUT-OUT.

Fusible Cut-Out.—With the object of providing a simple device for instantly disrupting the arc formed by the blowing of a fuse, thereby preventing damage to the fuse block and parts to which this is attached, G. Baehr has devised and patented the fusible cut-out shown by Fig. 22. Generally stated, the invention consists in arranging the terminals, and especially the passage ways between the terminals, so that the latter shall be circuitous or tortuous, thus preventing the formation of an arc when a fuse blows, or at least quickly quenching the same. The base of the fuse block has a substantially flat face and is provided on opposite sides with recesses in which the binding posts are secured, the latter having hook-like terminals attached to them. The base is raised to cause the cover to snap into place and also to prevent it from working loose. On the upper face of the cover are hook-like terminals which interlock with the hook terminals in the base to hold the two parts together in the well-known manner, the connection being made by sliding the cover in a straight line with reference to the base instead of rotating it. It will be obvious, however, that by a slight rearrangement of these parts they can be made to interlock by a rotary movement as is customary. The leads are brought through a central opening in the cover as usual, and the ends of the wires are connected to binding posts, secured to two metal bases as indicated. Interposed between these two metal bases is a comparatively deep rib. Projecting upwardly from the body of the cover is a V-shaped rib with branches extending out toward the corners of the block and having the apex of the V surrounding the hole through the block, while another rib projects out toward one side and connects with the rim formed on the outer edge of the cover, so that the whole represents a Y. On each side of the branches of the V-shaped rib are triangular projections which are located so as to leave a narrow passage between them and the branches of the V and leading down into close proximity to the terminals. The fuses lie in the grooves or passages formed by the projecting ribs and triangular projections of the cover.

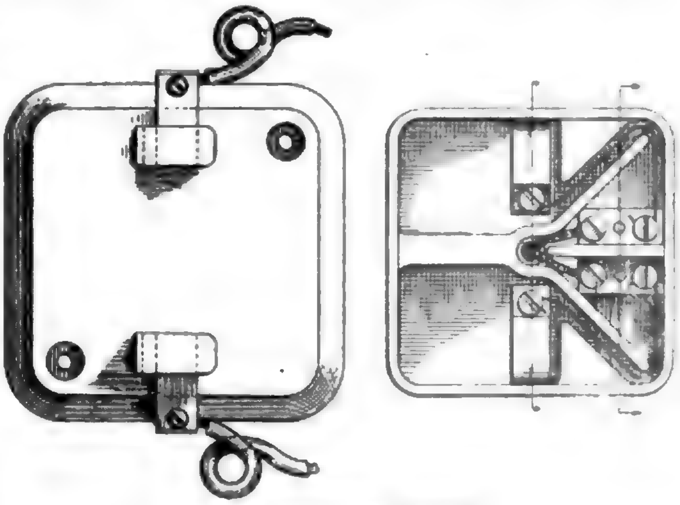


FIG. 22.—FUSIBLE CUT-OUT.

Surface Condensers.—The differences of opinion that exist among engineers on certain points of surface condenser design were evident during the discussion of a recent paper read by R. W. Allen on "Surface Condensing Plants," before the British Institute of Civil Engineers. As regards the saving effected by running with a 25-in. vacuum, as compared with exhausting to atmosphere, experiments and general experience have shown that with ordinary engines nothing is to be gained by a higher vacuum than 25 in. It is worthy of note that during the condensing trials forming the subject of the paper it was found that the loss of water by evaporation in the cooling towers was no less than 75 per cent of the amount required by the engines. Figures given show that 4,300 gallons of circulating water were lost per day in this way, in addition to 326 gallons of feed-water unaccounted for, so that the condensing engine wasted 4,626 gallons as compared with 7,726 gallons carried away with the exhaust and other losses of the non-condensing plant. Notwithstanding the almost universal practice of working the condensers with the tubes horizontal, one speaker maintained that a considerable improvement could be gained by having the tubes vertical. The latter should be very short and the water should be passed through them with a high velocity. Another speaker also advocated a high velocity of the circulating water, but for another reason. He ascribed the corrosion of the tubes to particles of rust from the condenser shell becoming lodged in the tubes and gradually eating their way through. The usual velocity of 200 to 300 per minute was not sufficient to sweep out the tubes, and he found that by passing the water through at a much higher speed troubles from corrosion were avoided. The Hon. C. A. Parsons believed in copper tubes where there was much sulphur in the water, and W. J. Harding held that the best way to prevent corrosion of the tubes was to permit free corrosion of the shell, which latter should be made thick enough to allow for it. It was pointed out that a very slow deposit either of scale inside or of grease outside the tubes had a very serious effect on the vacuum, and one speaker found the trouble of keeping the tubes clean so great that he had abandoned the surface condensers in favor of the jet condensers. This speaker remarked in reference to the cooling surface necessary in condensing plants, that from his experience in using deep well or town water, the condensing of about 6 lb. of steam per sq. ft. was all that could be relied upon. In a large turbine installation with a river running outside the engine room wall not more than 7½ lb. per sq. ft. could be reckoned on. Another speaker thought 8 lb. per sq. ft. too great an allowance unless the cooling water entered at a temperature below 85° F. Still another speaker, on the other hand, held that there was no difficulty in condensing 9 or 10 lb. of steam per sq. ft., as in ordinary marine practice as much as 25 lb. per sq. ft. were frequently dealt with, and he had seen a condenser which would certainly maintain a good vacuum when condensing at the rate of 35 lb. per sq. ft. One of the most interesting points raised in the discussion was the advisability of using separate air and water pumps to deal with the products of condensation. The author believed that the advantages did not warrant the additional complications. The Hon. C. A. Parsons supported the idea of the dry and wet pump system on the practical grounds of small air leaks being less prejudicial on account of the large displacement of the dry pump.

Automatic Paralleling of Alternators.—The paralleling of alternating-current generators manually depends so much upon the human factor for its successful accomplishment that any automatic device which eliminates this factor should be welcome A scheme for paralleling alternators automatically has recently been patented by G. A. Burnham. A conventional plan of circuits is shown by Fig. 23 and Fig. 24 is a side elevation of the electromagnetic switch by which the automatic paralleling of the alternators is brought about. The core of the solenoid carries at its outer end a roller which normally supports the switch in its open position, the latter tending to close under the action of a spring. The magnet is constructed to release the switch only at the instant when the strongest flux, created when the various currents flowing through it are in step, occurs. The magnet is mounted on the switchboard and connected in series with the synchronizing bars; but it is normally short-circuited by a push switch. The operation of paralleling is as follows: Assume that the generator on the left is connected to the line and that the generator on the right is to be paralleled with it. The branch circuits for the synchronizing bus-bars are connected across the brushes of the respective generators and each includes the primary winding of a transformer. These circuits are closed; but the plug switches in the secondary circuit are left open until the voltage of the incoming machine has been brought up to normal. The plugs are then inserted, connecting the phase lamp and the electromagnet in series in the two circuits, the current being shunted, however, by the push switch. When the lamp shows the phases of the machines to be nearly in step, the circuit through the push switch is opened and the current traverses the electromagnet. When the machines are in step, the magnetic flux in the magnet is strongest and the latter releases the switch, thus throwing the machines in parallel. The main switch of the incoming generator may then be closed at leisure.

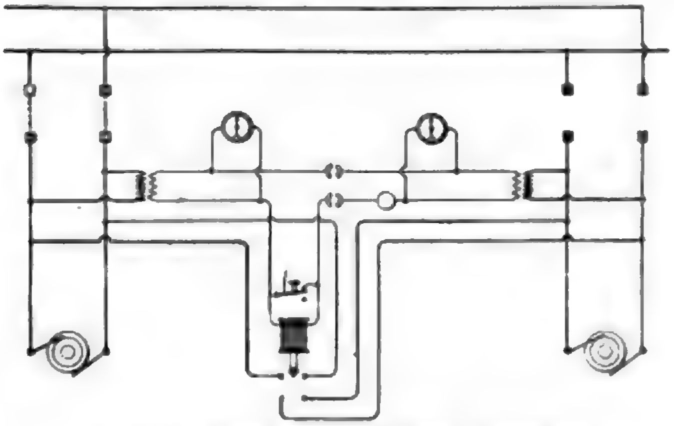


FIG. 23.—AUTOMATIC PARALLELING ALTERNATORS.

Magnetic Clutch.—In the ordinary magnetic clutch, if one of the members should be accidentally sprung, only a portion of the meeting faces would be in contact and an induced strain produced upon the parts so that slippage would be liable to result. Another disadvantage is the tendency which the parts have to remain clutched after the magnet has been de-energized owing to the residual magnetism. To overcome these disadvantages is the purpose of G. A. Damon in a recently granted patent. Fig. 25 is an elevation partly in section of a clutch mechanism embodying his improvements. Aligning bearings are mounted upon a suitable base and the shaft is journaled to each of the bearings, the shafts having an end thrust. Upon the abutting end of one shaft is mounted a magnet member and upon the opposing end of the other shaft an armature is supported. The meeting faces are shaped to conform to each other and have annular beveled portions concentric with the common axis of the shaft. One of the faces is oppositely beveled to the other so that the members will center themselves when brought together. The magnet members consists of a ring having in its meeting face a groove containing the magnet coil which is covered by a sheet of thin copper. This ring is connected to a yielding support consisting of a spring metal disc which is fastened to a hub keyed to the shaft. The hub carries collecting rings which are insulated from it and from each other and are respectively connected with opposite ends of the magnet coil by conductors insulated from the other parts. The two members are so arranged with relation to each other that their meeting faces are normally spaced apart. When the magnet is energized the spring metal support moves sufficiently to it to allow the faces of the two members to come together. The tension thus brought upon the disc will cause the members to be instantly released and the magnet member to return to its normal position when the magnet is de-energized. The armature member is keyed to its shaft and its periphery adapted as a pulley for conveying or receiving power, and if it is desired to convey power the shaft to which the magnet member is secured is connected with any suitable driving mechanism.

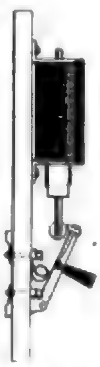


FIG. 24.—SWITCH.

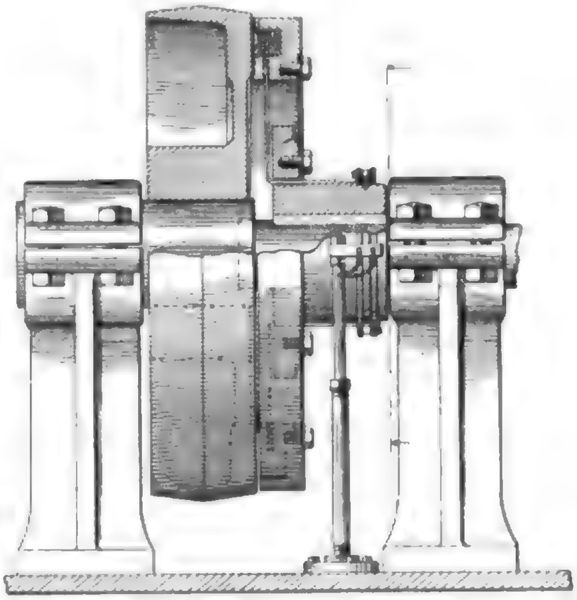


FIG. 25.—MAGNETIC CLUTCH.

ANSWERS TO QUERIES.

Is it good practise to use chloride of zinc as a flux in soldering electric conductors? T. E.

No. In some countries, especially Germany, the use of acids or chloride of zinc is prohibited by electrical rules in soldering cables or other similar conductors. It is claimed that the joint subsequently becomes defective. The soldering is done with rosin as a flux.

In draining a high-pressure steam main is it sufficient to tap small pipe connections in the bottom of the fittings for the drips? J. G.

In well-proportioned high-pressure steam mains, the velocity of the steam is about 100 feet per second and steam traveling at this rate will in most cases carry the water of condensation over or past such small openings. Moreover such small openings cannot take care of a large slug of water if the boilers should prime. It is becoming quite common to use drip-pocket openings the full size of the pipe up to 12 inches inclusive. This provides an opening so large that there is no possibility of the water being carried over or past them.

I wish to employ a phase meter to indicate the phase relations of the currents and potentials in a polyphase circuit and would be obliged if you could inform me as to their accuracy on balanced and unbalanced loads. G. R. S.

Phase meters for polyphase circuits are all equally accurate on balanced loads provided they have been correctly calibrated and possess no faults due to purely mechanical causes. This accuracy is not affected by variations in wave form or in current frequency. The calibration of the scale is affected by the number of coils used in the instrument, by the ratios of the ampere turns used with these coils, by the distribution of the windings and by the magnetic nature and properties of the magnetic circuits, especially if these contain iron; but the accuracy of the indications is not dependent upon any of these considerations, if the working of the instrument is satisfactory from a mechanical point of view. Phase meters can be easily and accurately calibrated for balanced loads by means of a direct-current method of test. The error on unbalanced circuits is generally serious for loads which are badly out of balance. The error like that of a wattmeter increases rapidly as the power factor of the load diminishes. It can only be reduced at the expense of complications in the instrument, by increasing the number of coils used in the fixed and moving systems and by arranging the coils and magnetic circuits to be symmetrical in regard to one another. If the true power factor of the load is $\cos \phi$, the reading of the instrument is $\cos \phi + \theta \sin \phi$, where θ is the phase error due to the unbalanced load, and is the product of two factors, one of which is the maximum value of θ determined by the amount the load is out of balance, and the other may have any value between $+1$ and -1 and determines whether the instrument reads high or low.

Kindly advise me how to wind a slow releasing magnet coil for direct current?

The ordinary method of winding a magnet probably results in about as slow a releasing magnet as any. Greater retardation may be obtained by placing a copper sleeve around the iron magnet core before winding the magnet.

The current from a three-phase generator is passed through three transformers connected in mesh where the voltage is stepped up for power transmission over a long line. Would a break in one of the transformers prevent the transmission of power? W. A. DeV.

No. It would appear at first thought that there remained the e.m.fs. of but two phases; but in reality there are still three displaced e.m.fs. One of the e.m.fs., however, is not produced in the defective side; but is the resultant of the e.m.fs. of the other two phases. As a result of the break, the remaining phases will obviously be heavily overloaded.

How can I kill the spark across two points from ten cells of battery connected to a solenoid; the current flowing being about five amperes? I have tried shunts of copper wire placed before, after and across the spark but without any satisfactory result. H. L. C.

Connect a resistance of either graphite or German silver across the break, making the resistance of the graphite or German silver twenty times that of the solenoid.

Kindly give me the size of wire and other figures necessary to construct an alternating current magnet which will hold an armature with a pull of about 25 pounds. The voltage of the supply is 220. G. H. M.

Use a U-shaped core of laminated iron, the poles having a cross-sectional area of ¾ in. by ¾ in. Make the width of the core from center to center of the poles 2 in. and the length of the poles 2 in. Wind the magnets with No. 19 single cotton-covered wire, taking out taps from the layers next the top and from the top. Connect the circuit with whichever taps give the best results.

I wish to run twenty-four 16-cp incandescent lamps on a 110-volt circuit, the lamps to be run in multiple and each lamp to be spaced one-quarter of a mile apart. Kindly give me the size of engine and dynamo to install. M. T. S

It would not be advisable for you to undertake the installation of such a plant. The cost of copper for carrying the current even with a 20 per cent. drop would be prohibitive. It would be more economical to install an alternator and run the incandescent lamps in series. Reliable systems of series incandescent lamp lighting are in successful operation.

Will a rotary converter operated in the usual manner, that is, taking power from an alternating-current circuit, change in speed only with changes in the frequency of the alternator supplying it? F. L.

A rotary will run in synchronism with the frequency of the current supplied and its speed will change with changes in the frequency. There are several causes, however, which tend to produce excessive and dstructive speed in the rotary. If the alternators speed up abnormally, the rotary will speed up in conformity with the increase; but if the alternating-current supply mains are interrupted and the rotary is connected at the direct-current end to a circuit supplied from other sources, it is driven as a motor from that circuit, and if the machine is provided with a series field winding as is frequently the case, the field strength is reduced by the reversal of current through that winding, and the speed will increase abnormally. If the rotary is operated inversely—that is, receives direct-current and delivers alternating-current the speed of the rotary is affected not only by variations in the e.m.f. of the direct-current line; but also by changes in the character of the load supplied from the alternating-current side of the machine.

I am operating a number of small induction motors, and oftentimes when starting these, the fuses either blow or the circuit breakers fly open. How can this be avoided? M. M.

When starting small induction motors and motors which are not equipped with finely graduated rheostats, the inrush of current through the machine is frequently great enough to blow the fuse or throw the circuit breaker if these be arranged with regard to the full-load current of the machine. If the circuit breaker be adjusted for the normal full-load current and a fuse of ample carrying capacity to withstand the initial rush of current when the motor is started be installed in conjunction with a circuit-closing switch which first connects the motor armature to the circuit through the fuse and by further movement transfers the connection to the circuit breaker and opens the fuse connection, this difficulty may be avoided.

Should the series field winding of an electric motor used for elevator purposes assist or oppose the shunt field winding? H. F.

In most cases the series winding is arranged to assist the shunt winding; but there are systems in which the series winding assists the shunt winding only while the motor is coming up to speed, and opposes it after full speed has been reached.

Kindly give me the pitch for the armature leads of a four-pole motor having sixty-three armature coils. N. J.

Each end of a coil should be located in slots between which there are either fifteen or sixteen teeth, and the two terminals should be connected to the commutator in such a manner that there will be thirty bars between them.

Does ordinary machine oil injure the insulating properties of mica? I have a number of 500-volt motors and the machine oil which creeps from the bearings on to the commutator causes jumping between the segments. J. M. D.

Your trouble may be accounted for by the presence of the oil on the commutator. This is not due to any action of the oil on the mica, nor to any lack in the insulating properties of the oil, but to the fact that the oil becomes gummy by oxidation and lodging between the copper segments gathers particles of conducting material such as carbon or copper dust which eventually short-circuits the segments.

CENTRAL STATION SALE OF CURRENT

FROM time to time we have described the systematic business-getting methods for increasing the sale of electric current which have been developed by some of the larger central stations, and more recently we have taken every opportunity to point out that in the present central station situation no lighting company, however small, can afford to neglect the application in its line of work of the ideas of better salesmanship prevailing in other fields of commercial effort. To assist in this work, which we consider to be of the highest importance to the central station industry, we shall in this department give space and welcome to practical hints and suggestions as to modern publicity and business-getting, with particular reference to the central station, and more especially in the interest of the medium-sized and smaller stations which have not at their command large funds for such purposes. These latter plants cannot afford to employ expensive methods of advertising and solicitation, and, while desiring to secure all the advantages resulting from plans and schemes embodied in the most recent business methods, must cut their cloth according to their own measure.

It will be the endeavor to proceed practically in this department, not offering mere suggestions but putting the information so far as possible in a form for direct and immediate practical application.

CLASSIFYING ADVERTISING.

Two forms of printed publicity can be used, the indirect appeal and the direct form of solicitation. The former most generally consists of newspaper advertising, though any printed form of general nature naturally comes in the same class.

The direct form of solicitation—to the individual prospective customer—is very largely in vogue, and if skillfully applied is very effective.

However, whatever the form, the advertising should always be along common-sense lines, and in any town where the name and address of every possible customer, together with his requirements, can be readily had, it is just as practical to address that customer directly through the mails, with either printed matter or letters, as it is to go to him and ask him to use electricity for lighting or for power. One letter is not as efficacious as one personal visit, but it is much cheaper, while repeated letters can often be employed where repeated personal calls would be entirely out of the question owing to the cost, and very often owing to the decided disinclinations of the "prospect" to receive the company's representative so frequently.

But the highest efficiency from any form of advertising, whether it is general publicity or direct solicitation, will always be found in connection with personal solicitation. Every central station has a salesman connected with the company. In the smaller towns he may have a good many other duties besides, and may be a general manager or superintendent, or have some official title in connection with the company; yet we venture to say there are very few central stations that do not have some employee whose business it is to try and secure customers. Unless this is done, the new business obtained will, of course, be inconsequential, be the other circumstances what they may.

It will not answer to run a series of even good advertisements in the papers and then sit down in the office and expect the people to flock in. There will be no flocking. Here and there, a customer may be so influenced that he will come into the office and ask for prices, but the real value of the advertising will have been lost unless it is energetically followed up by personal canvass from the office or works.

The returns from properly executed forms of advertising involving the employment of the mails in direct solicitation, will be somewhat better than mere newspaper general publicity, since knowing the customer's name and address, and what he particularly wants, is a great aid toward success, because the central station manager or superintendent has an intimate knowledge of the restricted territory which he serves. This superiority of direct mail solicitation of course, would not be true, if the material to be sold had to be disposed of throughout a large territory, for it would then be difficult and too expensive to secure the names of probable customers and classify them according to their most important needs, and this classification of the lists of names and addresses must always be done.

But even with a direct form of appeal through the mails a full measure of success justifying the expenses will not be obtained unless the advertising is closely followed up, by not necessarily a house to house canvass, but by a canvass that shall embrace all the names on the lists that have been addressed through the mails.

The best form of circularization through the mails, and the use of letters covering the same purpose, is only secured where it is made easy for the addressee to answer when the advertising has sufficiently interested him. If a plan on such lines is carefully prepared, it will facilitate the work of the subsequent personal solicitation, by giving the agent, or solicitor, an immediate fruitful field in which to work, if the direct advertising campaign is carried on with skill.

Later we will go into details as to just how a plan of this description should be prepared to secure the best results.

PATIENCE IN ADVERTISING.

In laying out an advertising campaign and considering the appropriation necessary, there should be no "flash in the pan."

We cannot say that it is worse than useless to put out now and then some printed booklet, or take a "flier" in the local papers; but it can safely be asserted that such a method will not produce results at all commensurate with the outlay.

There should be no great expectations of immediate results when an advertising campaign is begun. Here and there, in exceptional cases, contracts may be closed as the result of one advertising letter, or one newspaper advertisement; but it is persistence, and the accumulative effect of continued advertising that counts in the long run. If it were possible from the effects of an occasional advertisement to reap a rich reward, then it would be simple for all of us soon to grow rich, since whatever we had to advertise would only require some public announcement to produce profitable sales. Many people have advertised on such lines, and with great expectations; few, if any, have been successful.

The great advertisers of the country, those who have made money and great wealth by advertising, have only succeeded at the expense of persistency—as one advertising agent has said, "keeping everlastingly at it."

The advertiser in any large electrical field, should not only keep everlastingly and intelligently at it, but he should plan and design his advertising at least on a yearly basis, and even then he must have patience in waiting for his reward. Some central stations who have persistently made very large appropriations year after year, have found that the most profitable returns—the really large returns—come only after two or three years of continuous effort. Generally speaking, every advertisement that is put forth secures a large portion of its strength by reason of the familiarity of the reader with previous similar advertisements. The advertiser should remember that he is familiar with the merits of electric lighting and power—he ought to be, for it is his sole consideration week after week, month after month, and year after year—but to the possible customer it is at the beginning of no interest whatsoever, or at the best, of very slight interest. It is by continually hammering, by persistently sticking to, the subject, by never shifting the ground, though always successively presenting your subject differently and attractively, that one will be able to interest and convert the curiously unobservant whom it is wished to make an enthusiastic consumer.

SKILL IN PREPARING THE ADVERTISING

The great trouble with the novice who attempts to write advertising of any form, is the fact that he is prone to write narrowly from his own point of view, and not from that of the person at whom the advertisement is directed.

It is by the careful avoidance of this error, and familiarity through long association with all advertising problems, that the specialist in advertising writing has been evolved. The writing of successful advertising is distinctly a profession calling for specializing in the highest degree. It has become a profession just as medicine is a profession, or just as the practice of law can be considered a specialty.

Many dollars have been wasted on advertising which was thought to be "catchy," but it isn't the bizarre or unique advertising that always pulls the largest percentage of returns.

The entire subject of advertising ought to be judged from the common-sense standpoint of salesmanship. It is printed salesmanship, and should be judged in its entirety by the same basis of standards and comparisons as salesmanship should be judged. If the best salesmen in the country possessed the knack of placing their oral arguments and attractive statements on paper, the results would be splendid advertisements.

Just so advertising should be considered only from its ability to persuade the recipient to do what the advertiser wants him to do, and it is seldom that this real practical object can be achieved by "stunts" either silly or amusing.

A salesman who devotes more time to telling the trade funny stories than he does in impressing the merits of his merchandise upon the man to whom he is trying to sell, is not the successful type of salesman, nor is the advertisement which does not in believable fashion bring the merits of the article advertised forcibly to the reader's mind, serve the practical purpose of selling goods.

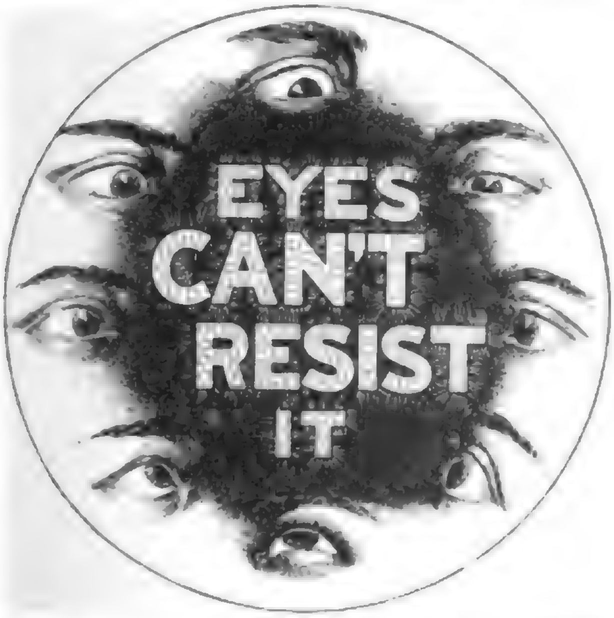
Don't write advertising that will turn the reader's mind in any direction but that direction in which lies belief in the merit of your product.

The advertising may be clothed in an attractive form, but the medium of attraction that you employ should be deftly turned to your advantage. It should tend to nothing but advantages of electric power or electric light.

You do not want the reader to think you are humorous; you do not want him merely to admire some illustration that you have in your advertising; you do not want to be remembered as a "smart" advertiser. What you really want is to print an advertisement, or send the man a letter which when read will make him believe that he can't go another day without electricity.

You can't always do this, but the nearer you come to doing it the more profitable you will find your advertising investment.

Reproduced herewith is an attractive advertisement printed in three colors by the Chicago Edison Company. A series of eyes all focused on a representation of the electric sign in the middle of the circle, involuntarily causes the reader's eye to focus in the same direction. This advertisement was particularly effective, and was sent as a folder direct to a selected list of names of merchants, fronting on, or contiguous to, the Chicago Elevated Loop. The company has secured a large number of customers as the result of a carefully prepared plan of direct mail solicitation combined with efficient personal solicitation from the list at which the advertisement was directed.



The Edison Electric Illuminating Company of Boston, in addition to a very successful plan of direct mail solicitation, is always a liberal user of space in the Boston daily papers. Herewith we present a fac-simile of a recent double column advertisement which in the original was nine and one-half inches deep. It did not tell all the story, but first presents an outline of an attractive proposition specially designed to secure new residential customers. This offer of $20 worth of electricity free is printed in large type having a clean cut face. It is known as Caslon, old

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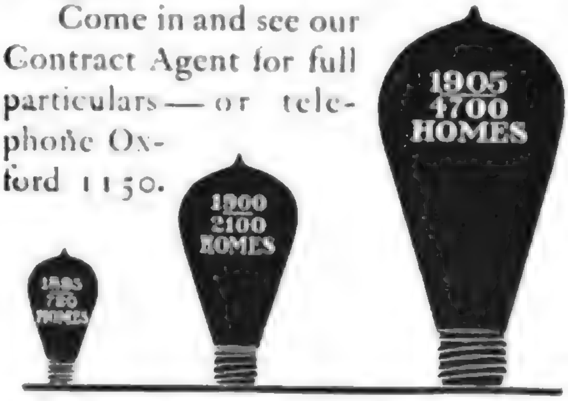
Twenty Dollars Worth of Electricity Free

If you have not yet installed the electric light in your home, we want to make it easy for you to try it.

As a Christmas offering, we will furnish you twenty dollars worth of electric current free of charge if you apply to us now.

The necessary conditions governing this offer are simple and easily complied with.

Come in and see our Contract Agent for full particulars—or telephone Oxford 1150.



The diagram shows the increase in electricity in Boston homes during the past ten years.

Remember that electric light is economical, if you manage it right—it turns on and off so easily that you burn it only when you need it.

Electric light is only one feature of electricity in residences. The electric heating pad is supplanting the hot water bottle—it does not leak—it keeps hot, but is never too hot. Then there is the chafing dish; the handy flatiron; the electric curling tongs and the coffee maker (the only real way to make coffee—always perfect); electric fans, for either distributing the heat on a cold day, or keeping you cool on a warm one. Tea kettles, waffle irons, foot warmers, nursery appliances, helps for the sick room—a thousand and one things you ought to know about—and use—every day of your life.

All shown in our Exhibition Department, rear of Masonic Temple.

The Edison Electric Illuminating Co. of Boston

style type. After the large, easily-read type comes a telling black and white illustration, showing the increasing popularity of electrically lighted residences, and this is followed by smaller type, skilfully setting forth for women the nice refinements that are available in the electric-lighted home. Plenty of white space around the advertisement adds to its attractiveness.

The particulars of the offer consisted in specifying that a certain number of outlets in a certain number of rooms be installed in order that the $20 worth of free current be given by the company. The total amount of electricity had to be taken before September 1, 1906, in order to make the offer available; that is, no electricity used after that date would apply against the $20 free offer.

THE STATUS OF THE SALESMAN.

In selling electric light and power, as in the selling of any other manufactured article, there always exists the argument as to whether it is most advisable to employ salesmen on a salary basis, a combined salary and percentage method, or on a commission basis with a drawing account.

All three have been tried and found successful or unsuccessful, depending upon the management and general policy of the local company.

A salesman can be made to do efficient work by one of two methods. Either his enthusiasm can be aroused to such a high pitch that he deeply and earnestly believes, and then he himself can make others believe; or the same means can be accomplished by engagement on a commission basis, in part or in whole, thereby securing his close attention and energy to the business in hand.

Men differ; some are by nature more avaricious than others, and some have a large fund of enthusiasm. A few have both. Do not let that few escape you. A good salesman is a distinct acquisition to any central station. Once secured, he should be kept and his interest and enthusiasm never allowed to wane. First, he will be what you stimulate or educate him to be. Second, he will only maintain a high degree of efficiency by continual stimulation and appreciation of his work.

As to whether these results can best be achieved by periodical renewal of his enthusiasm, or by the second method of appeal, can only be determined by the central station manager or contract agent in each particular locality; but whatever the method used, it is generally the case that a salesman with a distinct territory is most successful. Give him a territory that is his alone and let him take a pride in it and develop it. Meanwhile, if there are other salesmen, bring them all into a friendly rivalry. While it is generally advisable to have a distinct territory for the general solicitors where special propositions such as electric signs are promoted, a sign specialist is often employed where the size of the station permits of sufficient agents and solicitors being engaged to spend all their time in getting in sign business. Where large power deals are involved a power salesman is a paying specialist. All salesmen should have headquarters aid when they need it; but it is a nice question as to where to give aid and where not to do it. If too much help is given the salesman will not develop the initiative and strength so often necessary in his routine work.

One reason why solicitors on a commission basis have not been successful in some localities is because it has not been put with sufficient clearness to the solicitor as to how his efforts will result in his continuous profit.

If a solicitor feels that he is identified with a territory and that the growth of that territory will enable him to increase the growth of his income, such a man will be found working night and day, if he is at all the class of man that you want as a solicitor. But good men will not work continuously, and at all hours—that is, their interest will not be unflaggingly stimulated—unless the system of accounting is such as to put plainly before them the fact that it is just as much their interest to fight unceasingly for business as it is for that of their employer.

Unless some method is adopted with such a basis clearly and in definite form put before the solicitor, the greatest efficiency of the solicitor will not be obtainable.

Where a solicitor is employed upon a salary basis, it is likewise of importance to put in definite form before him, his progress, week by week, and month by month. When he knows that his employer is aware of exactly what he is accomplishing, and is keeping close trace of his work, guiding it and directing it with a helping, sympathetic, though diplomatic hand; and when he feels that his efforts to secure new business are being appreciated, then he can generally be depended upon to bring a larger measure of enthusiasm and persistent work to lighten the monotony of his daily tasks.

It requires a man with some backbone to meet rebuff after rebuff and still keep his confidence and some measure of his enthusiasm; but this is what the solicitor or agent may have to face each day.

Next month it will be shown how this problem is partially met by an advertising campaign of direct solicitation by mail.

Business-Getting Methods of the Buffalo Electric Co.

The lighting service of the city of Buffalo is furnished by the Buffalo General Electric Company, of which Mr. Charles R. Huntley is general manager. The company buys electric power from the Cataract Power & Conduit Company, which company is the distributing agent for the power service of the Niagara Falls Power Company in and about Buffalo. This Niagara power is received at the Wilkeson Street station of the Buffalo General Electric Company at a voltage of 11,000, where it is reduced to 350 volts and applied to the operation of motors direct-connected to different machines.

The company gives lighting and power service to the downtown section of department stores, office buildings and theatres by a direct-current Edison three-wire system laid underground. It has an overhead system that supplies alternating current, 60 cycles, for incandescent lighting and an overhead, 25-cycle, alternating-current system that supplies service to the entire residence section of the city. It also operates a 500-volt, direct-current system for power purposes, the company taking customers for a small service up to 50 hp, the Cataract Power & Conduit Company looking after the larger consumers.

The total load of the Buffalo General Electric Company is about 9,000 hp. It has in use 3,000 direct-current, series, enclosed arc lamps for street lighting, and it is generally admitted that the city is well lighted. It would be strange indeed if the Pan-American illumination had not created a sentiment favorable to electric lighting, and in this respect the Buffalo General Electric Company had benefitted. The effect has been to ncrease the demand for window illuminations, for electric signs, as well as for home lighting.

In order that all old customers might be properly cared for and the new business obtained, Mr. William R. Huntley about three years ago was appointed contract agent and later given the important position of assistant general manager of the company, and during this period it has been Mr. Huntley's good fortune to greatly increase the business of the company along all lines. These good results have been accomplished by good hard hustling and meeting unusual competition with arguments that have won place for electricity. While Buffalo is most advantageously situated in its relations and connections with the Niagara power development, the energy of the falls has natural gas as a competitor in Buffalo, the city being supplied from wells located in Canada, Pennsylvania and New York State, the price of natural gas in Buffalo being 30 cents per 1,000 ft. Thus for light, heat and power purposes the gas is a vigorous competitor of electricity, gas engines of one, two and five horse-power rivalling electric motors. Despite this business opposition, Mr. Huntley has been able to secure the following increase in business for his company during the three years ending August 1, 1905:

Direct-current arc lamps connected	300	per cent.
Alternating arc lamps connected	215	" "
Direct-current incandescent lamps connected	178	" "
Alternating-current incandescent lamps connected	183	" "
Motors, horse power	200	" "
Kilowatt output, incandescent lamps	338	" "
Kilowatt output, power	231	" "
Customers	200	" "

If one thing more than another has contributed to this success it is indefatigable work and persistency of purpose. The company now has seven solicitors, who report to Mr. Huntley, each solicitor looking after and being responsible for the company's interests in a certain section of the city. The assistant general manager's department keeps in close touch with the City Bureau of Buildings, and secures information as to the building permits issued. To the names thus obtained the following letter is promptly sent:

"If you have not already arranged with your architect in regard to the electric wiring of your building at No. —, —— street, we beg to call your attention to the Standard Electric Light Wiring Specifications enclosed herewith, which we believe will be of service to you, as it has been carefully prepared to meet needed requirements.

Any further information that may be desired in this connection, we shall be glad to furnish at any time."

The wiring specification is supplemented with much valuable information as to the general rules of the National Board of Fire Underwriters with which architects, engineers, builders, electrical contractors and property owners are asked to familiarize themselves. A note on the back gives the information that additional copies may be obtained without charge, and that electric power is supplied by the company in any quantity desired *satisfactorily and economically*. The suggestion is made that closet and veranda lights be specified, as they are a great convenience, and the recipient is asked to bear in mind that electric fans may be utilized wherever electric power is available for lighting. "Illuminate with Electricity—Best—Cleanest—Safest," are the closing words.

The company's information in regard to the building permit is then turned over to the solicitor in whose territory the new building is to be erected. It is this solicitor's duty to follow up the prospective new business until the place is wired and the service is installed.

The company has practically the entire city covered by its lines, but it is ever ready and willing to extend its lines to meet the needs of a new customer. This new policy has helped materially in increasing the home lighting. Customers who for any reason are dissatisfied are handled by the solicitors, who do their best to please them, frequently making concessions.

One of the company's employes looks after and sells electric signs. These signs are sold on the installment plan and are also put out on a rental basis. Up to six months ago a city ordinance provided that no sign should project more than a foot from a building, but this was changed so that now electric signs may be erected, but they must be 12 ft. in the clear above the ground or walk.

Since this change the electric sign business of Buffalo has increased 150 per cent, and one man is kept busy attending to it. The prospective business along this line is very large. Motors are sold to customers on easy payments, the installment plan having been found a help to the business. The company furnishes and maintains arc, Nernst and the new graphitized filament high-efficiency lamps.

The residence rate of the company is 10 cents per kw-hour. A sliding scale that starts at 12 cents and runs to 4 cents per kw-hour is in use for larger consumers, the rate being based on the installation. Rates for power start at 6 cents per kw-hour and run to 4 cents, while a special rate is made to users of current for heating and cooking.

The company believes in publicity. It publishes a monthly bulletin that is very neatly arranged, nicely printed, and which treats of the general progress of matters in the electrical field. Illustrations of new and prominent local installations are presented. Its paragraphs are newsy and bright. Mention is made of new contracts, and one page is devoted to directory purposes, giving the names and addresses of wiring contractors, dealers in electric fixtures, electric signs, dental machinery, elevators and supplies in general.

Now and then advertising space is taken in the leading daily papers, and the special industrial editions are patronized with display advertisements. Folders and circulars telling of the advantages of electricity for light and power purposes are sent out to prospective customers, and while circular letters have been found especially good in exciting interest in the advantages of electricity, the wisdom of following this work up with personal interviews by the solicitors has been demonstrated over and over again until it is now deemed a necessity.

For the year just ushered in, the company contemplates liberal expenditures in extending its lines and the erection of new copper, and further development of its business-getting methods.

Newspaper Advertising for Central Stations.

By FRANK B. RAE, JR.

TOO many lighting companies look upon newspaper advertising as nothing more or less than a species of blackmail. While this is rather an abrupt statement of the case, it cannot be denied that there is a solid basis of truth for the central station man's view of the methods used by the newspapers in soliciting space. However guarded the solicitor, he can never quite hide the suggestion that a contract will be "appreciated" by the paper; and once the contract is signed, the central station manager is not slow in demanding printed evidence of such appreciation.

That the purchased space has any real advertising value to the lighting company is a matter which neither party to the agreement seems seriously to consider, yet I have no hesitation in saying that the newspaper is perhaps the best medium procurable for residence lighting advertising. Wisely used, it not only proves its value in securing direct business, but is a strong force in educating the people to an appreciation and understanding of the uses and advantages of electricity, and in moulding public opinion into a condition favorable to the lighting company.

It is notorious that a major portion of central station newspaper advertising does not pretend or attempt to accomplish either of these ends. A few instances might be cited of thoroughly good copy, but for the most part it receives neither the time nor thought necessary to make it effective. Even when the station manager has become convinced that he can profit by the space which circumstances have forced upon him, he seems totally unable to apply to the filling of that space the same sound sense which has made a success of his operating and commercial departments. This failure is not due to gross ignorance, as some advertising men would have us believe, but to a directly opposite cause.

The majority of central station advertisements are bad because the man who writes them *knows too much* about electrical matters.

The field for electricity is so immense; the superiority of electricity for light and power is so immeasurable; the flexibility and cleanliness of electricity, are so many and overwhelming, that one cannot blame the engineer advertisement-writer for his failure to boil this vast material down into a single effective advertisement. It is not lack of ideas, but their staggering superabundance which leads so many writers of electric light advertising to seek refuge in futile and glittering generalities.

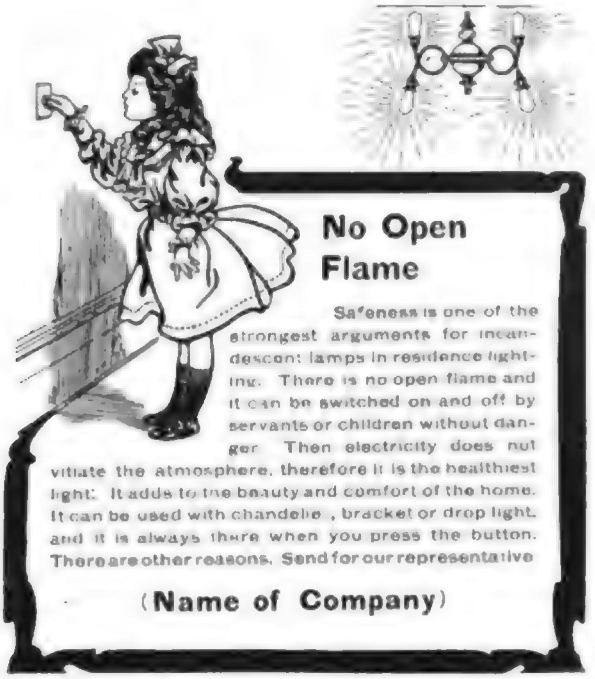
In writing a newspaper advertisement be specific. Begin by taking one solitary item—a porch light, for example—and tell why electricity is the best light, the only light, for that particular and especial purpose. Forget all about the thousand and one *other* uses for current. Forget all about the scintillating dream-talk that convinces nobody. Get right down to business and prove, beyond all shadow of peradventure, that the reader of your announcement needs, wants and must have forthwith, an electric light installed upon his porch.

It is of secondary importance if the style of writing be graceful or abrupt, whether the argument wins by soft persuasion or brute force. The task is to sell a porch light to the man who reads that advertisement—a porch light, and nothing else.

The next advertisement should follow in some sort of logical sequence and be devoted to light in the hall or vestibule. It should be written in the same vein, with the same singleness of purpose. It should leave the reader convinced of the desirability and necessity of an incandescent lamp in the place named.

Room by room, you should go through the house, from cellar to garret, from the front gate to the stables, arguing and persuading your reader to install a lamp in every dark corner. Each advertisement should supplement the last and complement the next. Each should have the same general style of typography and occupy the same position in the paper. Each should express your willingness to furnish facts and figures, and should contain an invitation for the reader to call, 'phone or write for your representative.

If possible, each advertisement should be illustrated with a dignified and artistic cut, designed not only to catch the eye, but to emphasize the salient points of your argument. Above and beyond all, the advertisements should appear in the paper regularly, and they should be short, the facts being stated in simple language and set forth in plain types.



No Open Flame

Safeness is one of the strongest arguments for incandescent lamps in residence lighting. There is no open flame and it can be switched on and off by servants or children without danger. Then electricity does not vitiate the atmosphere, therefore it is the healthiest light. It adds to the beauty and comfort of the home. It can be used with chandelier, bracket or drop light, and it is always there when you press the button. There are other reasons. Send for our representative

(Name of Company)

FIG. 1.—EFFECTIVE ADVERTISEMENT.

Perhaps the most effective way to bring these points clearly before the reader will be by illustrations. One of these (Fig. 2) is full of "ifs" and "ands," is a fair specimen of what not to do. The headline "No Disadvantages," immediately creates the impression that there *may be* disadvantages. The "possible saving" is ambiguous, to say the least; and the qualifying phrase, "if judiciously used," puts a damper on whatever slight desire the advertisement as a whole may have created. On the other hand, the specimen of Fig. 1 is clear-cut, well illustrated and written to convince.

No Disadvantage

In Using Electric Light

There is no heat, odor or dirt to offset a possible saving in cost.

Electricity gives a brilliant, clean, cool and safe light at a very

Reasonable Cost

If lights are properly placed and judiciously used results are entirely

Satisfactory

Have our representative call on you.

FIG. 2.—POOR ADVERTISEMENT.

Advertising for central stations, like advertising for the merchant or manufacturer, is nothing more nor less than salesmanship, and the same rules govern both. Your solicitors secure contracts by sane and convincing argument, by pleasing address and tactfully persistent appeal. Your newspaper advertising will secure business by the same methods.

Lamp Renewal Service in Chicago.

In view of the widely differing practice of central station companies in regard to free lamp renewals, the policy of the Chicago Edison Company is interesting. This company not only furnishes free lamp renewals to customers, but for some time has maintained a delivery service for such renewals. The extent to which the company goes in its efforts to render its services free from annoyance or trouble to its customers is shown by the following letter, which is sent to customers who send to the company's lamp renewal station for renewals instead of asking the company to call and make the renewals:

"We notice that you sent a representative to our Lamp Renewal Department yesterday for the purpose of renewing burned out lamps.

"Fearing you may not understand that we now have in service a system of lamp renewal delivery wagons, which is intended to save you the trouble of sending your lamps to us, we beg to advise you that such is the case.

"It is only necessary now that you notify us, by telephone or postal card, that you desire to have lamps renewed, stating, if possible, the number and candle-power, and we will deliver the same to you within 24 hours of receipt of your call.

"We have gone to great expense to provide a first-class equipment for this purpose, feeling that our customers would appreciate the accommodation. We are, therefore, very anxious that you should avail yourself of the service to the fullest extent."

The company furnishes free renewals on standard lamps, standard lamps being defined as the common shape of 4, 8, 16, and 32 candle power lamp. Special shapes, frosted bulbs or special lamps, such as the "Meridian" or reflector lamps, are charged extra at a price equal to the difference between the cost of a standard lamp and the special lamp required by the customer.

Incandescent lamps with frosted bulbs are 2 cents extra. This does not apply, however, to lamps frosted by the dipping process, upon which no extra charge is made. Lamps are renewed or exchanged whenever a customer wishes, without regard to whether they are burned out. Exchanged lamps brought in which apparently are not burned out are tested in a rough photometer, to determine whether they have fallen 20 per cent below the rated candle power. If so, they are rejected. If they have not fallen below the rated candle power, they are cleaned and put back into service, usually as dipped, colored lamps, where efficiency is of secondary consideration.

The work of photometering these lamps is done by a boy, and is a very rapid process. The photometer is set so that the light falling on the photometer screen is equivalent to that of a lamp burning at 20 per cent below the rated candle power of the lamps under test. As the lamps are placed in the photometer for testing, all that the boy needs to note is whether the candle power of the lamp being tested is above the candle power of the standard. If the tested lamp has a candle-power greater than that of the photometer standard, the lamp is accepted, but if the candle-power of the tested lamp falls below that of the photometer standard, the lamp is rejected. From this it is evident that the amount of time consumed in making a test is a minimum, being practically only that required to place the lamp in the photometer and take it out again. No attempt is made to obtain the exact candle-power of the lamp under test, a glance at the photometer screen being sufficient to show whether the lamp is above or below the candle-power of the photometer standard, and whether or not it should be accepted or rejected.

Letter to the Editors.

The Patent Law.

To the Editors of the Electrical World:

Sirs:—I am sorry if my letter, which you so fairly published in this week's paper, intimated that the editor has been unwarranted in making suggestions regarding the patent laws. That is not my opinion; nor does my letter "defend" the present patent laws in their entirety. I shall allow it to speak for itself, but one or two points seem to require correction.

The proposed Court of Patent Appeals would not, as you intimate, increase patent litigation. It is as to patent matters not an addition to, but a substitute for, the present nine Circuit Courts of Appeals; its decision would be final, as theirs are not. It is a matter of demonstration, not of opinion, that it would diminish patent litigation at least one-third, and probably one-half.

It would be simply impossible to get from Congress the necessary machinery for issuing patents on the lines proposed in your editorial. About six or seven per cent of patent applications go through interference; the prospect of all applications being so treated would be simply appalling, and the expense would be ruinous both to the inventor and to the Government; it would merely concentrate all patent rights whatever in the hands of a few large corporations.

New York City. T. J. Johnston.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Induction Motors.—Thomaelen.—The conclusion of his highly mathematical paper on the resolution of the magnetomotive force of a single-phase induction motor into two magnetomotive forces revolving in opposite direction. The author describes in detail a simple method for constructing the characteristic diagram.—*Elek. Zeit.*, December 14.

Single-Phase Commutator Motors.—Hoerburger.—A continuation of his illustrated serial on single-phase commutator motors. In the present installment the author discusses, with the aid of diagrams, the principles of the repulsion motor.—*Dingler's Polyt. Jour.*, December 9.

Induction Motor.—Specht.—A simple and elementary discussion of the induction motor characteristics by the vector diagram. A more elaborate dissertation on this subject was given in *Electrical World and Engineer*, February 25, 1905.—*Elec. Jour.*, December.

Armatures.—Jordan.—An illustrated article describing the various operations performed in the winding of a direct-current armature. The article is accompanied by precise directions and data. The types of armature to which the description applies are those used in direct-current railway motors, crane and hoisting motors, vehicle motors, bipolar motors, and belted generators up to 100-kw capacity. The author describes the building up of the armature core, the placing of the paper cells in the slots, the winding of the coils, taping, putting coils in the slots, pressing on the commutator and making the connections.—*Elec. Jour.*, December.

Lights and Lighting.

Street Lighting.—Harrison.—A paper read before the Manchester section of the (Brit.) Inst. Elec. Engs. The author explains that to judge correctly the illumination of a street one should state the value of the maximum and minimum illumination. The unit of illumination is cp-ft. and he recommends to measure the illumination on a screen at an angle of 45 degrees and at a height of 4 ft. from the ground. He then gives the results of a great many tests by different observers of the actual illumination obtained in British streets. One example is that of Gorton, where 25 double Welsbach mantles, each taking 4 cu. ft. of gas per hour, have recently been replaced by 22 enclosed arc lamps giving 400 cp each. The gas lighting in this case formerly cost $750 per annum; the electric lighting is done for $880. Taking an average candle-power for the gas lamps based on the figures given by Price, and measurements made by the author himself elsewhere, the candle-power works out at 80 per post, therefore it will be seen from the following figures that the minimum illumination has been increased four times at an extra cost of 17 per cent per annum: Old system: Incandescent gas, 80 cp, 90 ft. apart, minimum illumination (direct), 0.037. New system: Enclosed arc lamps, 400 cp, 100 ft. apart, minimum illumination (direct), 0.145. As the average result of all of the different data given by the author he concludes that in most English towns the minimum direct illumination is as follows:

Main thoroughfares, minimum direct illumination	0.050 cp-ft.
Side streets " " "	0.025 "
Suburban streets " " "	0.005 "

In many places where electric light has been installed these values have been exceeded, whereas the actual illumination obtained from gas mantles is generally much lower than that estimated by representatives of the gas industry. For reading purposes an illumination equivalent to 0.05 cp-ft. is necessary. With 0.005 cp-ft. one cannot recognize a face; in fact, can only just avoid running into anything. Unless the value of illumination in any street exceeds, say, 0.015 cp-ft., "it could hardly come under the head of street lighting, but should be called 'beacon' lighting."—Lond. *Elec.*, December 15.

Starting Switch for Arc Lamps.—An illustrated description of a self-acting arc lamp starter for switching in street arc lamps automatically with an interval of time between each group. The apparatus consists of two parts: A main switch proper controlled by an electromagnet, and a time mechanism which closes a secondary circuit after a predetermined interval, and thus actuates the main switch of the next starter in the series. By this means a series of lamps may be switched into circuit from any suitable point, set after set in turn with a time interval between the switching on the various sets, so that sudden variations in the other lamps on the system are avoided. The left hand illustration of Fig. 1 shows the complete arc lamp starter in "off" position; the right hand illustration shows the "on" position with the cover of the time element removed, showing the wavy spiral. The electromagnetic switch is actuated by a powerful electromagnet (*A*) Fig. 1, which rotates an armature pivoted by arms to the yoke. This armature is coupled by insulated connecting pieces at the sides to the double-pole switch which is provided with suitable carbon contacts. One of the switch-coupling pieces is fitted with an arm connected to the plunger, *C*, of the time-element mechanism. The whole apparatus is mounted on a base of insulating material with an insulating partition between the two switches, so that accidental contact between the positive, negative and middle wire terminals is impossible. The time-element mechanism consists of a wavy spiral (*B*, Fig. 1), the axis of which is verti-

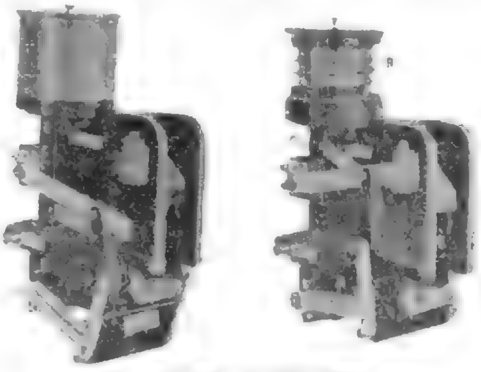


Fig. 1.—Arc Lamp Starter.

cal, mounted on a platform forming part of the insulating base. A large hole passes through the center of both the spiral piece and the base, which allows a plunger, C, to pass freely up and down. The function of this plunger is to elevate a smooth spherical ball, D, from the bottom of the base on the top of the spiral. The ball then descends by traveling round the spiral groove till it reaches the base, where it rolls on to the top of the contact spring and presses it down against the fixed contact, thus closing the circuit for the relay magnet of the next starter. The time taken by the ball to travel from the top till it closes the circuit for the next switch is about 11 seconds, which is sufficient to allow one group of lamps to be burning steadily before the next group is switched on. When the starter is switched out, the plunger drops to the bottom, and the ball rolls off the contact spring on to the top of the plunger, ready for the next operation. A clutch, F, which can be released by the electromagnet, E, holds the switch on. As soon as the "all on" lamp in the station, actuated by the last relay of the series, lights up, indicating that all the groups of lamps in the series have been switched on, the switch for the electromagnet, A, may be opened, and the switches are held on mechanically. To open the switches the main magnet or "in" switch, is first closed, thus relieving the clutches, F, which are withdrawn on closing the "off" switch, controlling the circuit for the electromagnet. A considerable saving in labor is effected by using these starters owing to the smaller number of men employed, and in outlying districts it is not necessary to start the lamps so early nor switch off as late as when men have to go the rounds of the lamps. It is claimed that in the case of a set of 850 lamps 16 men are sufficient instead of 23, and that the further saving can be effected in the consumption of power and carbons owing to the shorter hours of burning.—Lond. *Elec.*, December 8.

Miners' Lamps.—Herbst.—In a continuation of his illustrated serial on mining exhibits at the Exposition in Liege, the author describes a great many safety miners' lamps of which a few are electric. In two of them the osmium lamp is used, which has not only the advantage of giving double the light for the same power consumption, but also may be built so as to require only two volts, so that a single storage cell is sufficient in connection with it.—*Glueckauf*, November 25.

Electric Lighting and Acetylene.—Carney.—A comparison of the relative advantages of electric and acetylene lighting for a small town of not more than 1,000 or 1,500 inhabitants. The author thinks that an electric plant would not pay for such a small town and that acetylene light is preferable.—*Acetylene Jour.*, December.

POWER.

Boiler House Economy.—Bennie.—A paper in which the author points out that engineers, who spare no pains in reducing the steam consumption of their engines, often neglect to assure themselves that the steam used is generated as economically as possible. They forget entirely that almost the entire field of the saving in a modern steam plant lies behind the stop valve. Beginning at the chimney end of the plant, the author said that the height of the chimney should lie between 120 ft. and 180 ft. giving a natural draught of from 0.55 in. to 0.82 in. of water, with an average temperature of 300° F. For full-sized Lancashire boilers the chimney area should equal 6 sq. ft. per boiler up to a total of four boilers, and 5 sq. ft. more should be allowed for every additional boiler. The chimney entrance should be 10 per cent greater than this, and the flue should enter the chimney with an upward slope of 45 degrees. The area through the economizer should exceed the flue area by about 20 per cent, and the economizer walls should be 14 in. thick and particularly well built. The minimum combined area of the boiler side flues ought not to be less than double that of the main flue. The author would have a fuel calorimeter in every boiler-house equipment, and a fuel test entered weekly along with the coal and water consumption in the log book. It is often the case that a cheap fuel has more heating value than a dearer class, as the price is influenced to a considerable degree by the convenience with which it can be burned. A high-class mechanical stoker will burn coal which it is almost impossible to fire by hand, so that with such machinery a large reduction may often be made in the fuel bill. Another valuable adjunct is a CO_2 recorder for checking the firemen's work by analysis of the waste gases. The proportion of CO_2 should, of course, be as high as possible, always provided that enough air must be admitted to prevent the escape of CO. Usually there is a danger of the production of CO, if the proportion of CO_2 is above 15 per cent. The author claimed that using an economizer, superheater and mechanical stoker, as much as 85 per cent of the heat of the coal could be utilized, only 15 per cent being lost in radiation or carried away by the flue gases. He believed in working furnaces at the highest temperatures obtainable, provided the heat was kept uniform.—Lond. *Eng'ing*, December 15.

Hoisting in Mines.—Hinden.—An article showing how to calculate a hoisting installation according to the Ilgner system for a mine. Three-phase currents are supplied from a central station and the intention is to prevent the rapidly varying load of the hoisting motor from reacting on the primary circuits. The three-phase currents are supplied to an induction motor which is operated at constant load. The same is coupled on one side with a small exciter and on the other side with the direct-current "starting dynamo" and a large fly-wheel. The exciter supplies constant exciting current to the hoisting motor without any intermediary regulator, while the "starting dynamo" has in its field winding the regulating controller by means of which the numbers of revolutions of the hoisting motor may be regulated at will between zero and a positive or negative maximum without any considerable losses. The main current of the "starting dynamo" is directly supplied to the armature of the hoisting motor. The controller varies the field and, therefore, the voltage of the starting dynamo, which runs at constant speed, and it also changes therefore the voltage of the hoisting motor since the latter has always the same voltage as the starting dynamo. Further, since the hoisting motor receives constant excitation, its speed is always exactly proportional to the voltage supplied. The large fly-wheel prevents the fluctuations of the load of the hoisting motor from reacting on the primary circuit. The author gives formulas and describes graphical methods for calculating such an installation and also gives a numerical example. Although the first cost of the Ilgner system is about four times that of the ordinary equipment of motor and rheostat, yet the Ilgner system has been introduced into many important European mines. While formerly with a steam plant 30 to 40 kg. of steam were consumed per hp-hour in the hoist, now there are several Ilgner plants in which the consumption is between 14 and 16 kg. while with other electric equipment the consumption varies between 20 and 25 kg.—*Elek. Anz.*, November 30, December 3, 7, 10 and 14.

Electric Atomizers.—A short illustrated description of an electrically-driven centrifugal apparatus for sending a spray of water or other liquids into air, for keeping the air moist or for spraying a disinfecting liquid into the air in hospitals, etc. In the different types of apparatus the amount of liquid sprayed into the air varies from one to twelve liters per hour. To spray one or two liters per hour into the air 30 to 100 watts are required.—*Elek. Zeit.*, November 16.

Water Power Plants.—Crane.—Some illustrated notes on common troubles experienced in water power plants, their causes and remedies.—*Power*, December.

Gas Power.—Dowson.—The first part of a paper on the use of gas for power and heating. The author describes a Dowson gas producer plant.—Lond. *Elec. Rev.*, December 1.

Low Grade Fuel.—An article by Goodrich discusses in a general way the utilization of low grade fuels for steam generation and mentions several examples from actual practice where this has been successfully done.—*Eng'ing Mag.*, December. An article by Lakes deals with fuel substitutes and describes some of the different materials utilized for burning in regions where the ordinary fuels are unattainable.—*Mines and Minerals*, December.

Electricity on Board Ship.—Kergarouet.—The first part of an illustrated serial on applications of electricity on warships. In the present installment the author discusses the equipment of the generating station.—*L'Eclairage Elec.*, December 9.

TRACTION.

Single-Phase Traction.—Diagrams by Jackson showing the connections of standard single-phase equipment of tramway cars. One diagram shows hand control for single cars and the other diagram switch control for multiple unit operation.—Another article by Bright deals with single-phase locomotive testing.—The same issue contains some editorial notes by Stover and Scott on the subject. Three points to be noted are the high average power factor of the single-phase system, the high tractive effort of the locomotive and the high efficiency. Special attention is called to the high tractive effort obtained on the locomotive as this point has been questioned because of the pulsating character of the motor torque. The tractive effort secured in these tests is as high as could be obtained with a direct-current equipment. The tests on this locomotive show further that the single-phase system is well adapted for slow-speed freight service; and as its adaptability to high-speed service is not questioned, the indications are that a single-phase system will cover the entire railway field. —*Elec. Jour.*, December.

Philadelphia.—A well illustrated article on the opening of the Philadelphia subway which contains numerous novel features, particularly in connection with the track construction and the system of ventilation.—*St. R'y Jour.*, December 23.

Conduit Systems and Surface Contact Systems.—Two well illustrated reviews. Rider describes the various conduit tramway systems in use, while Twelvetrees deals with surface-contact traction.—Lond. *Eng'ing Rev.*, December.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Charging Small Storage Batteries with Alternating-Current.—SOULIER.—The author does not consider the aluminum electrolytic rectifier to be suitable for charging storage batteries, on account of the following two disadvantages: First, its operation is poor when the electrolyte gets hot, and second, the composition of the electrolyte changes during operation. The electrolytic rectifier is considered to be specially useful for operations over short periods, but not for prolonged service. The author has devised a rectifier for charging storage batteries from an alternating current circuit, its principle being based essentially on that of the telephone receiver. In the telephone the movement of the diaphragm is synchronous with the alternating current passing through the coil. A diaphragm of this kind, but of enlarged size, may, therefore, be used to close a certain contact during one half wave of the alternating current and to open the same contact during the opposite wave. The apparatus is shown in Fig. 2.

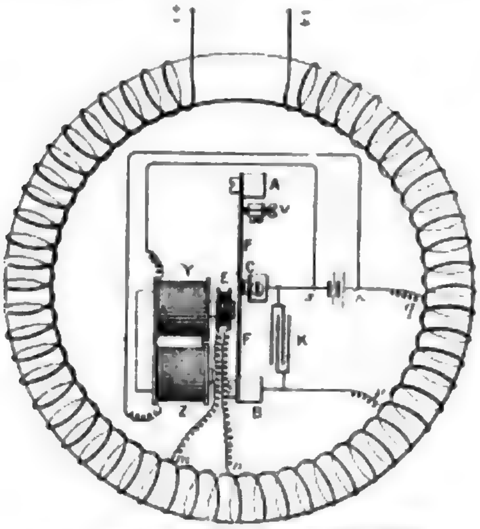
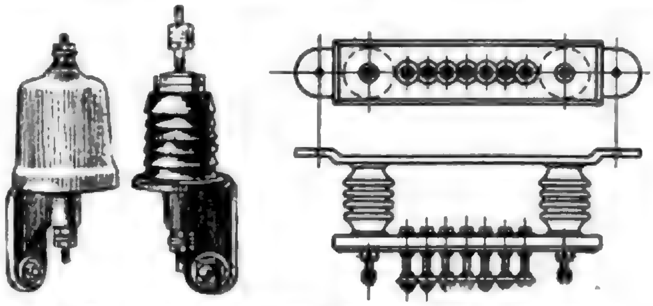


FIG. 2.—TELEPHONE DIAPHRAGM RECTIFIER.

The alternating current is supplied to an auto-transformer. The vibrating steel spring, *FF*, is mounted between the two supports, *A* and *B*, and has at its center a little piece of silver which presses slightly on a contact of the same metal mounted on the piece *C*. The pressure may be regulated by means of the screw, *V*. Before the vibrating spring the electromagnet, *Y Z*, is placed, which is excited by direct current. One of its poles is provided with a second magnetizing coil, *E*, excited by alternating current from the points, *m* and *n*, of the auto-transformer. The alternating current to be rectified for charging the batteries is taken off from the points, *p* and *q*. The number of coils of the auto-transformer between these two points, *p* and *q*, is chosen according to the number of cells to be charged. The operation is self-evident, but in order to avoid any sparks in braking the contact, it is necessary to have no phase-difference whatever. The solution of this problem has been found by the following observation: The vibrating spring is placed in the center of the transformer, and it is sufficient to turn the spring relatively to the transformer in order to get to a position where there are no sparks. The author explains this observation by taking into account the magnetic flux of the transformer.—*L'Industrie Elec.*, December 10.

Lightning Arresters.—NEALL.—An illustrated article on foreign practice in lightning arresters. "In America, designs are rugged; in Europe they are refined." The author first describes magnetic blow-out lightning arresters, suitable up to 650 volts for either direct-current or alternating-current service. In this instrument two gaps work in series, permitting a direct static discharge to ground. One of the gaps is so shunted by a magnet coil as to cause the arc in the other gap to blow out. A resistance is added to control the flow of current. A second type of lightning arrester, suitable for pressures up to 650 volts, is the "moving part by magnet torsion type" (system of Bubeck). One of the two electrodes forming the discharge-gap is movable. When the static discharge is followed by current, an electromagnet is excited which causes the movable electrode to turn on its axis and thus break the arc. After this a spring causes the electrode to resume its normal position for further operation. The whole arrester is mounted on porcelain and can, therefore, be used for outdoor as well as for indoor mounting. A third type is the "coherer type-loose" which contains a porcelain tube offering considerable resistance to the normal current, but allowing a momentary static disturbance to pass over it easily. This arrester is, therefore, non-arcing in the sense that no arc is allowed to form, although they constantly train the system on which they are placed. The author then describes several types of "multigap" lightning arresters. The first is the bell type shown in Fig. 3 (good up to 250 volts with direct-current or 600 volts alternating current). This arrester derives its name from the bell-like shape, as well as from the specially-shaped pieces of zinc which are applied one on the other, but separated by pieces of insulating material in such a way as to form many small gaps between the flaring edges of the discs. The action in suppressing the arc depends upon the use of multigaps of a non-arcing material. The porcelain cover is designed to keep out moisture, and it renders the arrester suitable for mounting outdoors as well as for station use. A second form of multigap arresters is the disc type, which may be used on transmissions up to 3,000 volts. It consists of alternating zinc discs and mica washers arranged one above the other and varying in number according to the voltage of the service for which it is designed. In operation, the static discharge to ground is expected to pass down over the surface of the discs as well as between them, while the current following takes only the gaps formed by perforation of the mica between the discs. The well-known multigap non-arcing metal principle thus comes into operation to suppress any short-circuit arc. A third form of the multigap arrester type is the cone form. It is shown in Fig. 4, and may be used up to 36,000 volts. The gaps are cone-shaped to give a maximum number of gaps in a minimum of space. This arrangement, moreover, allows for a certain individual adjustment of the gaps according to the voltage. A resistance is recommended for use with this arrester. Another form of the multigap arrester is the disc type,



FIGS. 3 AND 4.—BELL-TYPE AND CONE-TYPE ARRESTERS.

similar to the Wurts arrester. The author then discusses the horn lightning arrester. This lightning arrester is distinctly European, both in origin, development and use. Its main disadvantage is that on low voltage the opening is so small as to make it difficult to keep the gap constant; dirt, dust, bugs and even beading of the wire causing this to change. Several devices to overcome this disadvantage are described, all of which have already been noticed in the Digest. Another defect of the plain horn arrester arises from the lack of positiveness in breaking short circuits, a slight change in inclination of the horns causing a "jump back" of the arc. The magnetic blow out has been applied to meet this in the manner shown in Fig. 5. Another modifications of the horn arrester is shown in Fig. 6 where one of the electrodes is provided with a carbon facing, by means of which the gap is less affected by passing current. For this form a resistance is recommended for use in series with the gap. This arrangement of the horns permits economizing of space. Glass shields promote a draft for the operation of the arrester.—Several illustrations are also given of types of water column lightning arresters.—*Elec. Jour.*, December.

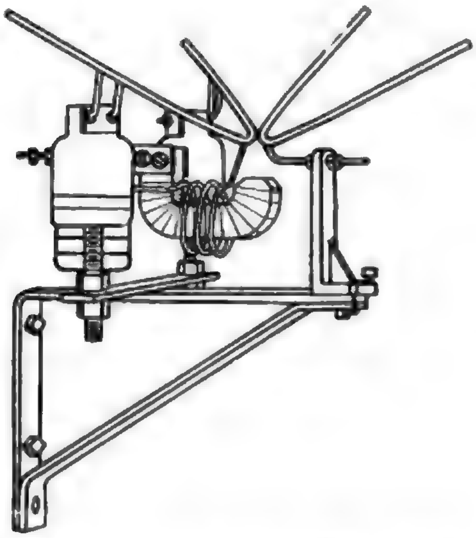


FIG. 5.—MAGNETIC-BLOWOUT HORN ARRESTER.

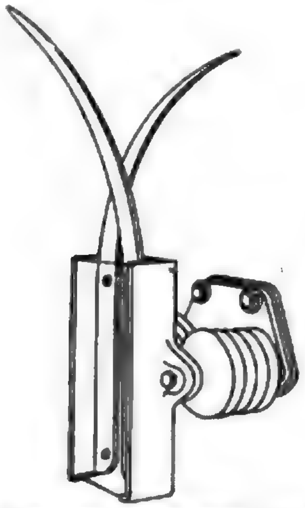


FIG. 6.—CARBON-FACED HORN ARRESTER.

Rebates in Bills for Electric Light.—A note on an amusing law case which recently came before the Faversham County Court. Faversham consumers of under 250 kw hours per quarter are supplied at the rate of 10 cents per kw-hour, but if they reach 250 kw-hours they have to pay only 9 cents. Now, a certain consumer had succeeded in using 240 kw-hours, and his bill, therefore, came to $24; but it will be noted that if the consumer had used just 10 more kw-hours his bill would have amounted to $1.50 less than it did for the 240 kw-hours, and he, therefore tendered the smaller sum. "In such circumstances, we regret that the judge was obliged to decide in favor of the electricity supply authority; even he was obliged to explain that he was only there to administer the law and had nothing to do with common sense."—Lond. *Elec.*, December 1.

WIRES, WIRING AND CONDUITS.

Fuse Standardization.—SCHWARTZ.—An article giving the exact rules and regulations in use in Germany and France on fuse construction and standardization. There is a very high degree of standardization in the fuse systems in vogue in Germany, and this is due to the fact that consumers cannot easily replace a fuse with one of their own fashioning, but must obtain a refill from the manufacturer, who is responsible for its proper rating and marking in accordance with the conditions laid down by the Association of General Electrical Engineers. This system is not a good one in so far as the various large manufacturing concerns have each developed fuse systems of their own, which are not interchangeable the one with the other. While this doubtless secures the trade in refills to the manufacturer of each particular line, it is hardly conducive to the convenience of the public or the safety of the installations, as in cases of urgency the fuses are sometimes tampered with.—Lond. *Elec. Rev.*, December 15.

Transmission Circuit.—C. F. SCOTT.—An elementary discussion of self-induction, regulation and mutual induction, partly with the aid of diagrams. The article is essentially based on a paper of the author before the National Electric Light Association in 1894.— *Elec. Jour.*, December.

Flexible Conduit Wiring.—KUHLO.—An illustrated description of a method of wiring in which the cable to be protected is surrounded immediately by a flexible conduit.—*Elek. Zeit.*, December 7.

Municipalities and House Wiring.—An editorial pointing out that it is not only illegal in most cases in England for a municipal electric station to execute house wiring in competition with local firms, but it is also wrong in principle.—Lond. *Elec.*, December 15.

ELECTROPHYSICS AND MAGNETISM.

Radio-Activity.—LORD KELVIN.—A paper describing a "plan of an atom to be capable of storing an electrion with enormous energy for radio-activity." The fundamental suppositions of the author are as follows: He proposes to consider an atom of ponderable matter intrinsically charged with concentric strata of electricity, vitreous and resinous, of equal electric density at equal distances from the center; and with an excess of the total quantity of the vitreous above the total quantity of the resinous. He further supposes that free resinous electricity consists of equal atoms which he calls electrions (called electrons or corpuscles by others). He finally supposes that each of these electrions has, besides its ordinarily defined property of electric attraction or repulsion, a property of somehow acting upon ether, and in virtue of this property quasi-inertia. The nature of this action he believes to be atraction and consequent enormous condensation of ether around the center of the electron. "My present assumption is Boscovichianism, pure and simple." It declares that between a single electrion and a single atom of ponderable matter void of electrions, a definite force exists in the line of their centers varying according to the distance. For distances greater than a radius of the atom it is attractive according to the inverse square of distance between the electrion and the center of the atom. When the electron is within the atom, the author simply assumes such laws as he pleases, with a view to trying to explain the different radioactivities which seem to be present by one and the same atom at different times.—*Phil. Mag.*, December.

ELECTROCHEMISTRY AND BATTERIES.

Accumulators Without Lead.—Two Bunsen Society papers on the Edison accumulator. One by Elbs discusses the theory of the reactions in the accumulator, the other by Graefenberg gives some results obtained by the company which manufactures the Jungner cell (which is essentially identical with the Edison nickel-iron battery) in Germany.—*Electrochem. and Met. Ind.*, December.

Resistance of Lead-Antimony Alloys.—ROSSET.—An article on the resistance of lead-antimony alloys used for storage battery grids. The determination of the resistance is not sufficient to indicate the chemical composition of the alloy, since the resistance curve has a maximum just near the concentration of 10 per cent of antimony which is generally used.—*Centralblatt f. Accum.*, November 15.

Ozone.—Kausch.—The first part of an illustrated article on new apparatus for the production of ozone by electric discharges through air, especially for the purpose of sterilizing water. The descriptions are taken from recent patent specifications.—*Elektrochem. Zeit.*, November.

Units, Measurements and Instruments.

Measuring Strong Currents.—Nesper.—An illustrated description of an instrument for measuring strong currents. The method is based on determining the torque which the magnetic flux around a conductor through which the current to be measured flows, exerts on a magnet or a coil in the neighborhood. The instrument is shown in Fig. 7. The current to be measured enters through the terminal, *A*, passes through the solid conductor, *D*, and leaves the instrument through the terminal, B. There is practically no drop of voltage between *A* and *B*. *E* are brass plates in which are inserted the stone bearings, *F*, in which the steel points, *G*, of the member, *H*, are resting so that *H* may revolve around *B*. To fix the zero position and to counterbalance the torque produced by the current, spiral springs, *J*, are provided between *H* and *G*. On the member, *H*, which has an appearance like a bow, there are mounted small curved magnets, *K*, five such magnets being shown in the illustration. The bow, *H*, is provided at the top with a needle, *L*. Instead of the permanent magnets, *K*, coils may be used, whereby the employment of iron and any hysteresis loss is completely avoided. The torque exerted on the small magnets is stated to be directly proportional to the current passing through *D*.—*Elek. Zeit.*, November 30.

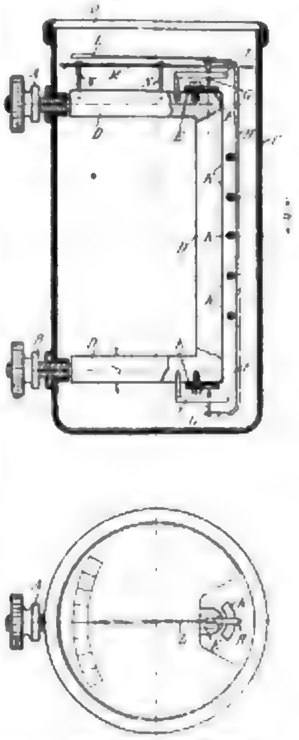


FIG. 7.—AMMETER.

Separation of Iron and Friction Losses.—Page.—An article on a modification of the Hopkinson test for separating the iron and friction losses in direct-current machines. Two machines of similar type, size and voltage, are coupled together, and the one run as a motor driving the second, which is unexcited. The speed of the motor is varied by altering the shunt excitation, and simultaneous readings are taken of the armature amperes and volts, the excitation and speed. The field coils of the two machines are now put in series across double the normal voltage of one machine, and a second test carried out exactly similar to test No. 1, with the exception that the excitation current now passes through the field coils of the second machine as well as the first. From these tests two curves are plotted connecting watts lost (exclusive of I^2R losses) with r.p.m. In the first test, at any speed in r.p.m., the loss, *w*, is equal to the friction losses of the two machines plus the iron loss in the motor. In the second test there are the same losses as before plus the additional loss in the generator. Now, as the two machines are of the same size, type and voltage, the fields in the two will be approximately the same if the same exciting current is flowing through their field coils. This condition was fulfilled by putting the two field coils in series, and consequently in the second test the increased loss is due to the iron loss being doubled. Subtracting the results obtained by the first test from those given by the second, the iron loss is obtained at any speed of the motor; and, further, subtracting the iron loss from the results obtained from No. 1 test, the friction losses of the two machines are determined. If this result be halved, the friction loss of one machine is at once obtained, and thus by two simple tests the whole separation is effected. In Fig. 8 are given curves showing the results of tests on a 30-hp motor. Curve *A* shows the total watts input (exclusive of I^2R loss in armature and field) of the motor when driving the unexcited generator. Curve *B* gives the watts input (after deducting the I^2R losses as before) in the motor when it is driving the generator with the same current passing through both generator and motor field coils. Curve *C* is obtained by subtracting *A* from *B* at several different speeds, and gives the iron loss at any speed. Curve *D* gives the friction loss of one machine at different r.p.m., and is obtained by plotting half the difference of curves *A* and *C* against speed.—Lond. *Elec. Rev.*, December 1.

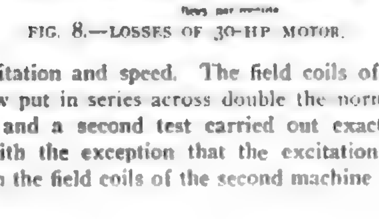


FIG. 8.—LOSSES OF 30-HP MOTOR.

Testing Small Motors.—Carter.—The first part of an illustrated paper read before the Newcastle section of the (Brit.) Inst. Elec. Eng. on the best design and equipment of a testing shop for the commercial testing of small motors up to 15 hp.—Lond. *Elec. Eng.*, December 15.

Testing Meters.—Gerhardt.—In continuations of his serial on electricity meters he describes rheostats, choking coils, transformers, storage batteries, leads, etc., for testing meters. He then describes methods of meter testing and gives diagrams of correct and incorrect testing connections.—Lond. *Elec.*, November 24 and December 8.

Electric Tachometer.—Knowlton.—An article on the electric tachometer, which in its simplest form for commercial service consists of a small direct-current magneto-generator in connection with a portable voltmeter. Since the speed of the generator is proportional to the voltage produced, the voltmeter may be directly calibrated to indicate revolutions per minute.—*Power*, December.

Standards of Weight.—Wade.—An illustrated article on the standards of mass of the United States National Bureau of Standards and the exact methods of weighing used there.—*Scient. Am.*, December 2.

Telegraphy, Telephony and Signals.

Telephone Cables.—Schmidt.—A description of various constructions of telephone cables with the purpose of increasing the self-induction according to Pupins system and thereby increasing the distance over which messages may be transmitted. Several diagrams are given showing different constructions and it appears that in Europe the most prominent cable firms are interested in the subject, and that the problem of placing the self-induction coils in the interior of a cable may be considered as solved.—*Elek. Anz.*, November 30, December 3.

Resonance in Wireless Telegraphy.—Pierce.—A paper giving an account of his continued researches on resonance in wireless telegraph circuits of the electromagnetically-connected type. In former papers the author has investigated the influence of various factors on resonance; in the present paper he discusses especially the effect of varying the "coefficient of coupling," that is, the manual inductance between the two circuits at each station. A system of wireless telegraphy with a large value of the coefficient of coupling is called by Wien a "close-coupled" system, while a system with a small value of the coefficient is called "loose coupled." The loose-coupled system of sending and receiving stations should give a sharp resonance. The author has tested the theoretical conclusions and describes an experiment which confirms the theoretical deduction that with decrease of the coefficient of coupling the sharpness of resonance is increased. The gain in sharpness of resonance is, however, paid for by a loss in energy. For with constant power at the sending station, in order to improve the sharpness of resonance two-fold, it was necessary to change the coefficient of coupling at the receiving station to such an extent that the energy received was decreased twenty-fold. But these particular numbers hold only when the receiving instrument has a very low resistance as in the case in the tests by the author.—*Phys. Rev.*, December.

An Open Letter to Mr. Westinghouse.

In these pages were given in full last week a correspondence including letters from Mr. George Westinghouse to Mr. W. H. Newman, president New York Central Railroad Company; Mr. B. G. Lamme to Mr. E. M. Herr, vice-president of the Westinghouse Electric & Manufacturing Company, and Mr. Westinghouse to the *Railroad Gazette;* the said letters dealing with the questions that have arisen in connection with harmonizing technically the single-phase equipment of the New York, New Haven & Hartford Railroad with the direct-current equipment and terminals of the New York Central Railroad Company. We have now received from Mr. Frank J. Sprague the subjoined correspondence with a request for its immediate publication, in connection with these matters:

AN OPEN LETTER TO MR. WESTINGHOUSE.

So your reference to me in your recent letter to the *Railroad Gazette* was "not intended to do Mr. Sprague an injustice"; that is probably the reason why it was written and spread broadcast. Those who have the patience to follow this subject will quite likely reserve to themselves some right of judgment, and will be able to form a correct opinion as to your real motives.

Contrary to your suggestion, I did not forget to mention anything of pertinence, or proper public interest in so far as it concerns my comments on the adoption under existing conditions of alternating-current locomotive operation on the New Haven terminal division, but in order to confine myself to that particular case, and to avoid being wrongly, even if with apparent reason, put in a position of antagonism to any rational application or development of the alternating-current system, I did omit many things which might with entire truth have been said concerning the special difficulties naturally being experienced in that development, and many other things which my official relations would not permit me to say.

But in spite of my moderation you have made references to my contracts which are incorrect as to fact and foolishly untrue in inference. Permit me to correct you as to both, for if the public is at all interested in any personal discussion between you and myself, it might as well know the exact state of affairs.

I have at present a contract with the Sprague Electric Company, an extension of one I have had for a number of years, during which time it was an active competitor of the principal electric companies. By this contract it became the owner of my patents, and it has naturally and very properly restricted me from engaging in rival manufacturing, or advising those who are so engaged.

Further, in part liquidation of a royalty agreement covering the use of the "multiple-unit" system, I agreed to accept an annual payment during the term of the patents covering that system, if living, and required a guaranty that my name should always be used as designating it, not only by the Sprague Company, but by any successor or licensee of it. But whether those patents be used or not, this payment is not affected by a penny's worth, nor by any other act of mine. The contract makes no mention of any railroad corporation, nor is any such intended, and it is a rare order of imagination which would convert the railway and power transmission companies of the country, the customers of the great electrical manufacturers, into corporations which may be classed as unfriendly to them.

This contract, under present conditions, confers upon the officials of the General Electric Company no authority whatsoever, so far as I am concerned, and no man knows better than yourself that I would brook no interference by individual or corporation with my professional opinion or action when engaged as a consulting engineer.

I have in addition a contract with the General Electric Company, a brief one, whose sole provision is a guaranty that the Sprague Company shall fulfill its obligations to me, the chief of which, in my opinion, is the use of my name in connection with all multiple-unit systems, no matter what the detail of apparatus.

Such is the legal status of my contracts, and it is in no sense altered because the General Electric Company is now the owner of the stock of the Sprague Company, or because it may become its successor in the event of that company's assignment or liquidation. I cannot, therefore, recognize your privilege to interpret these contracts in a light contrary to their spirit, or in any manner other than is mutually acceptable to the present parties to them, even if it may serve your personal purposes to do so.

But assuming, despite your forgetfulness and inaccuracy, that in place of the Sprague Company the General Electric Company becomes the principal, by whatsoever official action of the Sprague Company, with what poor grace comes your attack on me when by reason of that very fact, because of agreements between your own and the General Electric Company in force for the past ten years, you would become, under like terms, the direct beneficiary of every patent advantage thereby derived, and the indirect beneficiary by my abstention from manufacture.

You have said that I have a "particular personal interest" in my "own form of control," and thereby attempt to differentiate the apparatus built by your company. You are of course aware that I have here no monetary interest whatever in its use, and it would have been nearer the truth had you stated I had a pardonable and personal pride in a system absolutely of my creation which has revolutionized electric train operation, a system which you are widely using, and in whose adoption to your special requirements you have the active aid of my former confidential assistants. Were you as careful to recognize the rights and equities of others as you are tenacious in upholding your own, you would not let an hour pass before directing in this instance the proper recognition of my name, instead of waiting until the slow and tedious process of law may compel such acknowledgment.

The true inwardness—and the littleness—of your reference to me lies in its suggestion that I am not independent enough to pass upon the merits of a proposal submitted to me, or that the New York Central commission has not accorded your company fair treatment. So far as my friends are concerned I need no defense, for they know that my engineering instincts rise supreme above any personal interest when acting in an advisory capacity, and the New York Central can best answer whether I have maintained the standard which it exacts from all who serve its interests.

A single fact, and not the only one with which you were conversant, should have made you more cautious in your reference to me, for you well knew when you penned your letter that despite your assertion that natural inclination would lead the New York Central Railroad to award contracts, if it could do so on a sufficiently favorable basis, to a manufacturing company whose works are upon its lines, you had been awarded one of the most important contracts in its equipment, that for 27,000 kw of rotary converters, with my full accord and approval.

It is to be regretted that in gratuitously reflecting upon that commission you seem to have forgotten its composition. Permit me to remind you that as one of its members it has been my pleasure for a considerable portion of the time to be associated with the then vice-president of an organization absolutely controlled by Westinghouse interests, but although we often for a time may have disagreed, in all the deliberations which affected the New York Central interests I have done myself the honor to give him, as I believe he gave me, the credit of recognizing in the highest degree the judicial character of our positions.

As you well know, the decision affecting the present equipment of the New York Central Railroad has nothing whatever to do with future extensions. It was dictated in part by local conditions which are just as distinctive and determinate to-day as when the equipment was decided upon. These reasons have been time and again set forth, and both collectively and individually the commission has made it clear its decision was not necessarily to be taken as a precedent, that there was no antagonism to any particular system, and that when the problem of such extensions should come up ever possible advantage would be taken of electric developments of any nature and from any source. Hence the attempt to get the New York Central Railroad to abandon matured plans, to terminate its contracts, and to adopt your proposal for a change of its equipment, in so far as such proposal could be influenced by cost comparisons extending to the balance of its system, is without the slightest basis of reason, nor was it helped by estimates which being wide of the facts are utterly worthless.

I find myself, with others, wondering what has caused your somewhat rabid general denunciation. Is it a tardy realization of the importance of my letter, now ten weeks old, or appreciation of its truth, or changes in some of the original intentions of the New Haven Company, or difficulties which have manifested themselves on existing alternating-current equipments, or in the carrying out of the New Haven project? Perhaps it was the loss of the Camden & Atlantic City line to a direct-current equipment, or an important single-phase road to a rival, but these are the fortunes of war, and a saving sense of humor will prevent an attack of melancholia. Perchance some coolness in the reception of your ex-parte statements, privately circulated a month ago, and now in part made public, has made necessary an attempt to bolster them up, but in any event your position will hardly be strengthened by over zeal or misdirection of statement, even when illustrated by exceptional cases of electrolysis, easily avoided and having little bearing upon the general railroad problem.

You take personal offense because I have pointed out some of the difficulties which will naturally characterize the progress of the alternating-current development, and the special ones which it challenges in a particular case, and have essayed to make it appear that my opinions were dictated by a spirit of special friendliness to another company. Permit me to inform you that I have on frequent occasions stated that whatever excuse there may have been for the enthusiasm of your engineers—and there was much—there would have been little for those of the General Electric Company for making a similar proposal under like conditions, because they probably better than your own men knew the limiting conditions.

Had the New Haven road restricted its equipment, as seemed to many for the time wise, and for the special reasons adopted in a limited territory direct-current operation, it would not, contrary to your statement, have necessarily meant apparatus of General Electric manufacture, for, as I have already pointed out, an equal right of construction lies with your own company. Nor save on the one question of locomotive pooling was there any need for restriction in the details of apparatus.

I stood in that matter as I hope I may always stand, for what I believe to be the best interests of the public and the electric railroad development, irrespective of any personal interests or business affiliations; and had my criticisms lacked the essential elements of truth and common sense one would have supposed that in the supreme confidence which you profess you would have been content to have awaited the issue, and to have witnessed my discomfiture and the acknowledgment of the error of my ways and opinions, which I think in that event I am broad-minded enough to have made. But I have ample reason to believe that, distasteful as my criticisms may have been to some, when measured by public convenience and safety results of importance have already been accomplished, and even more are sure to follow.

The charge that the General Electric Company and myself are engaged in a conspiracy to fasten upon the railway world the direct-current system as opposed to the alternating-current or any other particular system, unduly enhances my importance, and is an amusing product of imagination, or the results of hysteria.

I must remind you that I was probably the first engineer in this country to recommend, in an official report, some fifteen years ago, the general adoption of alternating current for the transmission of power over long distances, and I have not changed my attitude since. I have also to call your attention to the fact that not only have I steadily advocated higher potentials, but several years ago I publicly expressed the desirability of the development of single-phase motors for use on electric railways. And in order that you may not unchallenged appropriate to yourself all initiation in this art, I must not forget to mention the late lamented Charles Van Depoele, whose name you may be familiar with, who in addition to much other admirable pioneer work, some sixteen years ago, advocated and patented a method of using single-phase currents on electric railways.

In instructive contrast to your assumption as to my affinities, it is a curious coincidence that at the very time of the issue of your letter I should have committed myself to a belief in the possibilities, and stated my readiness to assume the responsibility under some circumstances, of a direct-current operation at a potential three times as high as your engineers have fixed in making comparisons between the two systems, a potential which, it is proper to point out, has not yet received the endorsement of your own or the General Electric Company. I therefore can hardly be accused of speaking for either in thus taking this public stand, but rather as the representative, as I have always tried to be, of consistent advance by all lines in an art to which I have devoted my life.

You object to healthy criticism, but in your self-constituted position as universal engineering advisor and mentor, has the New York Central, or its commission or the General Electric Company been free from such? On the contrary, you have been unsparing in predictions of failure. The use of the particular turbines selected was to be followed by a frightful accident and their replacement by your own, and the locomotives were destined to absolute failure; but the former seem to function satisfactorily, and the latter has a record as yet unequaled by any like piece of apparatus. True, you made no predictions of failure concerning that admirable part of the equipment which your company is to supply, although now so energetic in condemning its use elsewhere.

Your attack on me is misjudged, and is unworthy of your own dignity, for even if your personal qualities do not appeal to the softer side of my nature, and your assumptions do not always carry conviction, I still recognize in you many elements of greatness. It will, therefore, fail in its purpose, for it will not cost me a single friendship, and will not impair the confidence of my associates, nor do I believe it will adversely impress any fair-minded man though he be a stranger to me. I will go further: it will not affect my appreciation of the many splendid products, or affect my final judgment concerning any developments or proposals, of the Westinghouse Company, which will live on even after your dominant personality in its affairs disappears.

Permit me in conclusion to remind you that my work and inventions have been among the stepping stones to your great fortune, and while others, and not I, have reaped the larger material rewards of that pioneer work, I have at least succeeded in impressing my name upon the electric railway development in such indelible fashion that you cannot erase it. It has never stood for doubt or cowardice or fear of consequences, but always for advancement—in which in many important particulars you have followed, not led me.

My engineering convictions and conclusions are my own. They are dictated by no man or corporation. I am not the advocate of the use of any particular system to the exclusion of any other, but rather of higher potentials and the greatest measure of development by whatever means, for such system as in any particular case shall, when measured by all conditions of equipment and operation, best fulfil the requirements of that case.

That attitude is one which I shall consistently maintain, unchanged by clamor, pressure or disapproval, and so long as I am given life and strength and retain the confidence of my associates, I shall help carry to success the enterprise which you have so freely criticised, and thus aid in planting another milestone to mark the advance of electrical accomplishment.

(Signed) FRANK J. SPRAGUE.

LETTER OF MR. SPRAGUE TO GENERAL ELECTRIC COMPANY.

December 29, 1905.

General and Sprague Electric Companies, New York City.

GENTLEMEN:—I call your attention to a letter signed by George Westinghouse which appears in the *Railroad Gazette* of December 22, and is repeated in other journals, in which, referring to my critical attitude concerning the adoption of alternating-current locomotives by the New Haven Railroad under existing conditions, he makes the following statement:

"Mr. Sprague forgot to inform the public, probably as he would have done had he had more time, that he is receiving a very large retainer under a contract of years' duration, whereby, though he may become consulting engineer for a railroad, yet he cannot do so if, in the opinion of the officials of the General Electric Company, such work or obligation may be in conflict with the interests of that company."

My only contract with the General Electric Company is a brief one, simply guaranteeing the fulfillment of the Sprague Company's obligations to me, and although my contract with the latter company—which bought my patents—is intended to prohibit my engaging in rival manufacture or consultation for a manufacturer engaged in a like business, I am not aware that, even if the General Electric Company has bought the Sprague Company, there is any reasonable ground for assuming that the officials of either company have the remotest right of interference with my legitimate work, for it is only proper for me to say that any such attitude would be distinctly opposed to my views.

I beg, therefore, to inquire if there is in your understanding of my contracts any justification for Mr. Westinghouse's inference, or anything which would in your opinion entitle you to such prohibition, or which would interfere in the remotest degree with such action on my part as may be dictated by the very highest interests of my clients.

An early reply will be appreciated. Very truly yours,

(Signed) FRANK J. SPRAGUE.

LETTER OF MR. W. J. WILGUS.

NEW YORK, January 2, 1906.

Mr. Frank J. Sprague, 20 Broad Street, New York City.

DEAR MR. SPRAGUE:—Referring to recent discussions in the public press, in which your name has appeared in connection with decisions of our Electric Traction Commission:

It affords me pleasure to state that the relation that you hold to other interests has always been free and open to me, and that your attitude toward the different bidding companies has been entirely unbiased and impartial, as evidenced by your advocacy of what you have considered to be the apparatus best suited to our needs, no matter by whom manufactured. Yours sincerely,

(Signed) W. J. WILGUS, Vice-President.

LETTER OF GENERAL ELECTRIC COMPANY.

NEW YORK OFFICE, 44 Broad Street, January 2, 1906.

Mr. Frank J. Sprague, 20 Broad Street, New York.

DEAR SIR:—Referring to your letter of December 29, 1905, our policy is, as you know, to refrain from entering into a controversy in the newspapers over any particular system advocated either by our companies or by their competitors.

It is solely on account of your personal relations to the various traction interests of the country that we are writing this letter.

There is no reason, so far as the General Electric and Sprague Companies are concerned, why you should not act as consulting engineer for any steam railroad or for any power company, nor any reason why you should not give such companies for whom you act as consulting engineer such advice as seems to you proper, regardless of whose apparatus is to be used.

The General Electric Company and the Sprague Company are doing their utmost to develop the electrical art along all lines instead of wasting time in personal recriminations. The General Electric and Sprague Companies give the best engineering advice of which they are capable on the various propositions which are from time to time submitted to them, and if, in any proposals which they may make for the equipment of steam roads, your judgment prompts you to decide in favor of a system which is recommended by their competitors, we feel sure that you will not hesitate for one moment to recommend such system.

The General Electric Company is in the business of manufacturing electrical apparatus and is prepared to furnish alternating or direct-current systems as may be suitable. It has perfected what it believes to be the best alternating-current railway system in the world, and wherever the circumstances make the use of such a system desirable, it recommends its adoption in preference to the direct system. The company does not, however, endeavor to force either system on the customer irrespective of the best engineering practice with reference to the special conditions under which the system is to be operated. Very truly yours,

GENERAL ELECTRIC COMPANY,
(Signed) by E. W. RICE, Third Vice-President.
SPRAGUE ELECTRIC COMPANY,
(Signed) by ALLEN BAKEWELL, President.

BOOK REVIEWS.

GAS ENGINE DESIGN. By Charles Edward Lucke. New York: D. Van Nostrand & Co. 254 pages, ills. Price, $3.00.

The author has succeeded in producing a really satisfactory treatise on the subject matter of the title of his book; that is to say, on the actual design of gas engines of the conventional internal combustion types.

The problem of the design of an engine to fill any given specification is handled in a rational, consecutive manner, starting in with the determination of the piston displacement for the required horse-power; the indicator card to be attained; how the pressures shown by this card as acting in the piston are modified by inertia effects of reciprocating parts, the angularity of the connecting rod, etc., before exerting their final rotative effect; and what strains and shaking forces are set up by these various components. Then follows a section on the determination of the dimensions of the various elements of the engine in which empirical formulas drawn from several authorities are freely cited and compared with one another, together with such analytically deduced data as may be applicable to the particular case in question.

New to the reviewer at least is the author's employment of what he terms a "standard reference diagram" in order that, as in steam engine practice, a diagram factor may, after determination by experiment and experience, be used in subsequent designs. For the standard diagram is taken a hypothetical card such as would be obtained if air passed through the same heat cycle as the combustible and burned mixture in the actual machine, receiving the same heat per unit of weight as the air and gas mixture. Diagram factors deduced from actual practice for different fuels and compressions are given for use in comparison with this card, but in this connection the author sagely remarks: "In selecting the factor to be used in any particular case, the designer must use judgment. There is, in fact, no designing possible no matter how perfect the theory or how complete the tabular results of tests that does not involve this element of personal experience with its resultant ripe judgment."

Particularly commendable is the large number of tables of ratios and constants of one kind and another which a designer must have for the intelligent laying out of his machine and which in the absence of a convenient compendium of this kind, must be laboriously figured out step by step and angle by angle. In many instances, the tabular values are presented in the form of a curve, too, and while some of these are on rather a small scale, their general value is beyond question. In each case, also, the formulas from which the tables and curves are calculated are given, thus enabling the user to check for himself any figures whose accuracy he may feel inclined to question.

While the volume as a whole is most praiseworthy and certainly by far the best treatise on its subject that has ever come to the reviewer's attention, it is impossible to refrain from a sly dig at the author's occasionally displayed tendency to let arithmetic smother common sense. Where, for instance, we read on page 15 that the horse-power of a certain machine uncorrected for the rod is 398.200638 hp, and that the power to be deducted because of the rod's presence is 6.667472 hp, giving 391.533166 hp as the corrected figure, one is inclined to feel that the process of extending decimal places has been carried out just a shade too far and that the multiplication table is entitled to overtime wages, if not even to having the perpetrator sentenced for cruel and inhuman treatment. When will some writers learn that the limit of accuracy of data is fixed by the unit of measurement employed, and that an extension of decimal places beyond the range of this unit is utter nonsense? To determine accurately the work of a gas engine of any considerable size within a horse-power requires skill, and the width of a pencil line on an indicator card would correspond to many millionths of a horse-power.

Nevertheless, it is a first-rate book.

ELEMENTARY COURSE IN MECHANICAL DRAWING. Part I. By Arthur W. Chase, B. S. Chicago: Howland Speakman. 189 pages, 97 illustrations. Price, $1.50.

The book is intended for manual training and technical schools, and is designed to be a text book for individual use. Each step of the process of producing a finished drawing is explained in detail. The treatise is complete for the purpose intended, and numerous suggestions are given as to the selection of instruments and material. The course presents a brief drill in a few fundamental geometrical problems, and orthographic projection is introduced by the use of models instead of the abstract conception. The treatment is simple and free from too technical language, so that the book should prove attractive to those having no previous knowledge of drawing.

ELEKTROCHEMIE I. By Dr. Heinrich Danneel. Leipzig: G. J. Goschen'sche. 197 pages, 18 illustrations. Price, .80 mark.

This little book is perhaps the largest value for the money (20 cents) ever offered in electrochemical literature Nicely printed, handy to read from, clearly written, it forms an excellent elementary introduction to theoretical electrochemistry as it is being taught in Germany and in many English and American universities. The writer is an experienced man, being editor of the *Electrochemisches Jahrbuch*, and the book under discussion may be accepted as thoroughly up to date. The seven chapters are: Elementary concepts of work, current strength and potential; chemical equilibrium, statics and dynamics; the dissociation theory; conductivity; electromotive force and electric cells; polarization and electrolysis; the theory of electrons. Although the entire treatment is necessarily brief, yet it is very clearly put and satisfactory. The numerous recent objections to the dissociation theory, and the (to some) more satisfactory hydrate theory of solution, are not mentioned.

Core Type Transformers for High Tension Power Transmission.

By A. H. PIKLER.

In some respects the alternating-current transformer appears not to have kept pace in this country with the general advance of improvement in electrical apparatus. It is no exaggeration to say that practically all American-built transformers from a capacity of 50 kw and upward used for power transmission, and a large percentage of smaller sizes employed in lighting work, are of the shell type, in which the laminations are built up around removable insulated units of winding (usually box shape) either in single sheets or in small bunches of sheet steel. It is interesting to note that European engineers at present are as a unit in favor of the core type of transformer. While the shell type was formerly manufactured there, this design was long ago abandoned in favor of the core type, which is held to meet best the requirements, both commercial and technical, of a high voltage transformer. That American manufacturers have adhered to the shell type up to the present time has probably been due, on the one hand, to the demand in large quantities for numerous sizes of transformers having proceeded at such a rate during the past ten years that there has been little opportunity for experimenting and the development of a new type, attention consequently having been devoted to perfecting so far as possible the original type; and on the other hand, to the apparent simplicity of the sheet steel construction and assembly of the shell type, which has doubtless rendered this type attractive to the manufacturer.

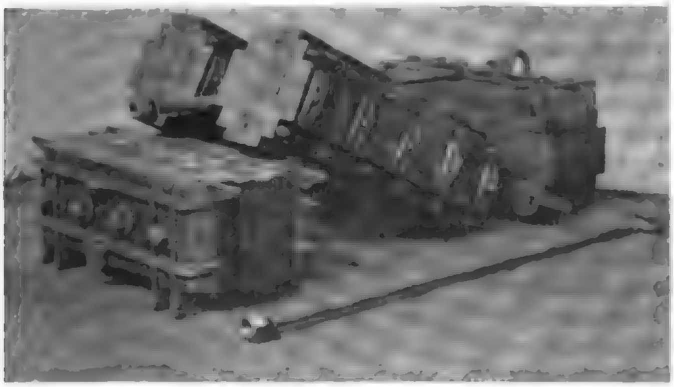


FIG. 1.—PARTS OF CORE.

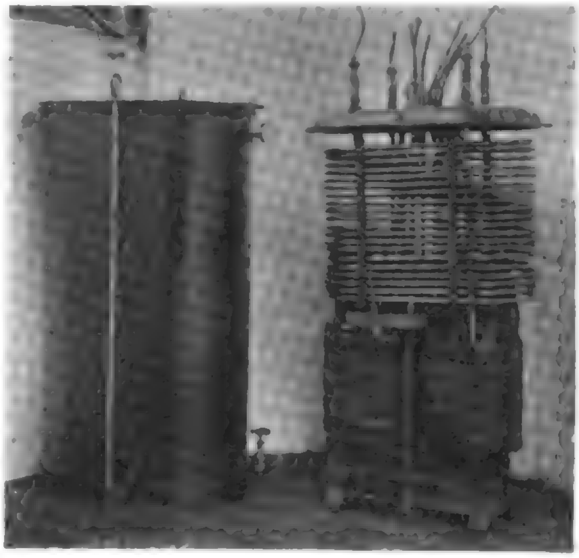
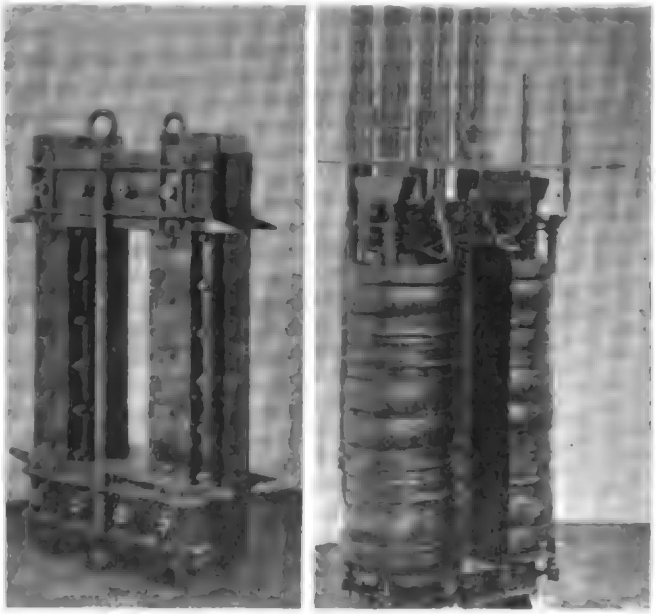


FIG. 2.—EXTERIOR AND INTERIOR OF TRANSFORMER.

Recognizing the condition above sketched, the Crocker-Wheeler Company has recently developed a line of transformers of the core type, embodying the latest thought and experience in this department of engineering design and manufacture. A description of this new transformer and some of its data follow:

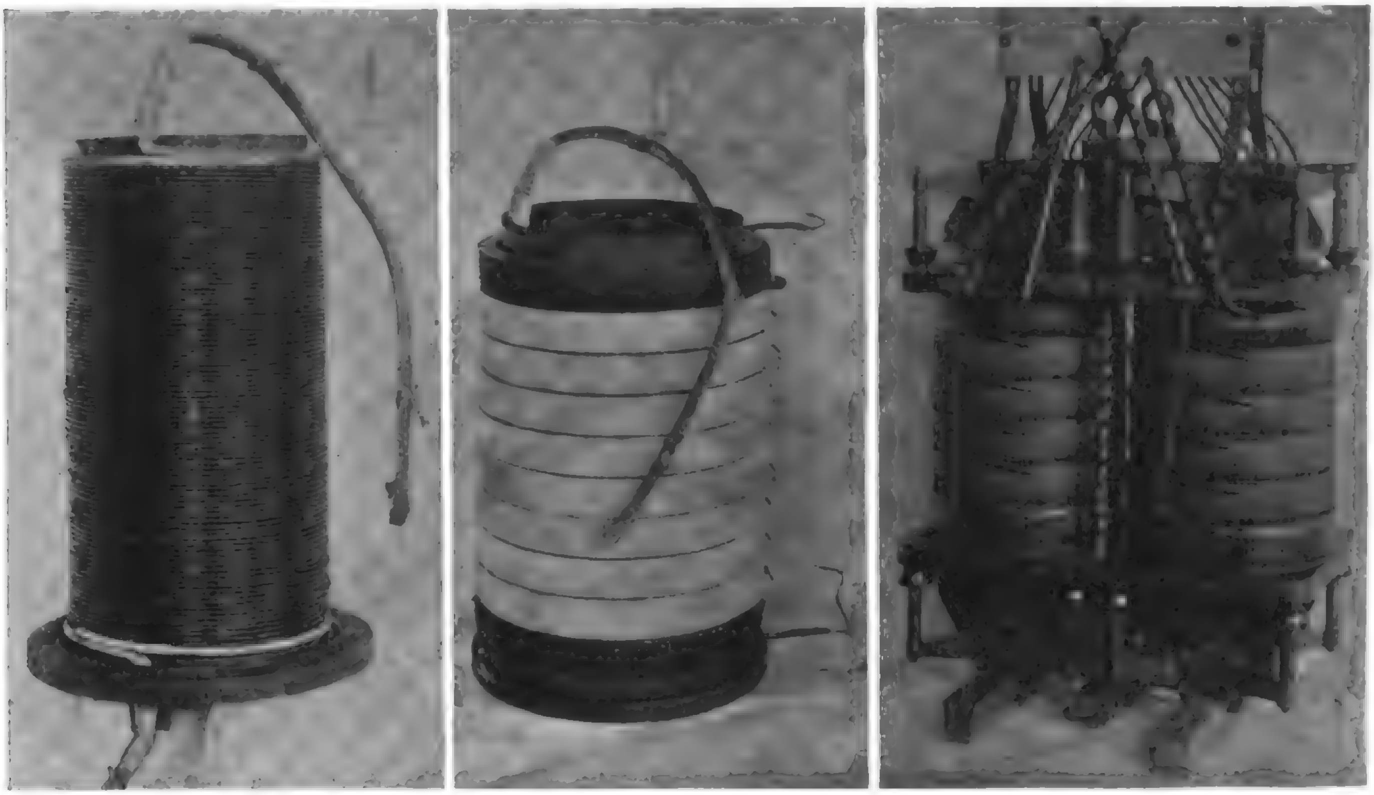


FIGS. 3 AND 4.—ASSEMBLED CORE AND COILS.

The construction of the core is shown in Fig. 1. It consists of four parts—the two legs on which the windings are placed and the two yokes which close the magnetic circuit. Each part is built up from laminated steel, every sheet being separately insulated, and the sheets bolted firmly together by insulated bolts and washers. The bulging of sheets is entirely prevented by the use of braces and heavier plates wherever an abrupt change occurs in the section of the core. To keep the core uniformly cool throughout, ventilating or oil ducts are run in the direction of the oil circulation. There are also ducts of ample size along the four corners of each leg.

The construction of the magnetic circuit in four separate parts facilitates assembling and dismantling to such an extent that it may be said that no other type of transformer permits assembling of core and coils or dismantling in such a short time and with such facility.

The surfaces at joints are milled in the Crocker-Wheeler transformers. In European practice, these joints are planed, making the work slower, more expensive and less accurate. The cutter of the milling machine is wide enough to embrace the entire surface that is to be milled, even in the largest sizes. The direction of the feed, relative to the direction of cutting, is such that adjacent plates will not come in contact on the milled surface, and hence eddy currents will be avoided. But even in the case of a contact these eddy losses are restricted to such a small area and thickness of metal that they amount as to be negligible. Another advantage is that milled joints offer a very small resistance to the magnetic flux on account of their perfect fitting, as demonstrated by the small magnetizing current of these transformers. The four parts of the core are firmly and accurately connected by means of dowel pins, clamps and bolts, as shown in the illustrations.



FIGS. 5, 6 AND 7.—VIEWS OF HIGH-TENSION AND LOW-TENSION COILS.

The core type transformer has the advantage of great simplicity in insulation. It admits of a circular core cross-section which has a double advantage. It allows the use of a circular or cylindrical winding and of cylindrical insulation; there are no sharp corners, no bends, no chance for a crack or break, and there is a resultant economy in both material and labor, the mean length of winding for a circular cross section being the minimum. As the cost of copper is about five times the cost of sheet steel, the great importance of a small mean length is evident. Low copper loss and good regulation are the natural consequences. Furthermore, there is no form of coil that is safer, easier and quicker to wind.

In order to secure durability in a transformer it is of prime importance that the temperature of the windings and the insulation be uniform throughout. Low temperature is not as important as uniform temperature in the avoidance of stresses between various parts. In a core type transformer this uniformity is obtained in a very high degree, as the entire coil system is exposed to freely circulating oil. Between high and low-tension coils and between coils and core, the oil ducts are of ample size, with smooth and cylindrical surfaces along which the oil can freely pass and maintain a uniform temperature.

It is a noticeable feature of the Crocker-Wheeler transformers that the oil insulation is supplemented by homogeneous insulating cylinders, one of which is placed between high and low-tension coils and one between the coils and core, and by ample "creeping" surfaces. No taping is necessary on the coils. The dielectric strength of tape compared with the dielectric strength of properly applied spacings, with creeping surfaces, and with insulating cylinders, is so small that it is preferable to do away with it entirely in order to get rid of the heat that is retained by the many wrappings of tape. This principle of insulation is found in Crocker-Wheeler transformers built for even as high voltages as 100,000. The taping that appears on the coils given in the illustrations, represents only one thin layer applied only for mechanical protection.

The high-tension and low-tension coils, and the high-tension coils and the core are entirely separated from each other by oil ducts and by large creeping insulating surfaces. This is illustrated in Figs. 3 and 4. The latter represents a 100,000-volt testing transformer operated with one high-tension lead grounded, up to 120,000 volts. Transformers of 667-kw. capacity at 34,000 volts built on this principle stood a 56,000 volts insulation test without oil, without any noticeable static discharge. One of the factors leading to this result is that in these transformers the high and low-tension coils and their entire insulation are subjected as one complete unit to a special vacuum treatment so that there is no fibrous material not moisture-freed and impregnated. The impregnating material is a linseed oil compound. Under the influence of the internal heat of the transformer the oil oxidizes and cements the turns and layers of the coils firmly yet flexibly and renders the entire insulation of higher dielectric strength in the course of operation than it was at the beginning.

Following are data relating to a 25-cycle, 667-kw, 34,000 to 2,600-volt, oil-immersed, water-cooled Crocker-Wheeler transformer, nine of which have been installed at High Falls and Copper Cliff, Ont., Canada, by the Huronian Company, Ltd.

Additional transformers are now being built for the same plant: Amount of cooling water with 35 C. rise of temperature after continuous run at full load, 1.42 gals. per min.; exciting current in per cent of full load current, 3.9 per cent; regulation at full load, 100 per cent power factor, .69 per cent; regulation at full load, 70 per cent power factor, 3. per cent; efficiency at full load, 98.3 per cent.

In conclusion, a short comparison between shell-type and core-type transformers may be of interest. In a shell-type transformer regulation is obtained by subdividing the windings into many coils and intermingling them. In a core-type transformer this same regulation may be obtained by choosing the dimensions of the two sets of coils properly.

In a shell-type transformer the main insulating units are numerous—as many as the number of coils—thus increasing the probability of breakdown. In a core type transformer the number of the main insulating units is virtually only two.

In a shell-type transformer the main insulation consisting of collars, channel pieces and corner pieces, the shapes of which are complicated and subject to bending and cracking the outer skin of the material. In a core-type transformer the main insulation is one single piece, a rolled-up cylinder, with smooth walls.

A shell-type transformer coil is subjected to stresses of different magnitude at different points, and mechanically it is a difficult and complicated matter to support such coils. Their corners are the weakest part. This is very serious especially in large size high-tension transformers. In a core-type transformer the stress is practically uniform throughout the entire winding; the pressure that holds the coils together is uniformly distributed and the weight of the top coils is small compared with the magnitude of this pressure, hence the bottom coils do not suffer.

In a shell-type transformer the larger portion of the coils is enclosed by the core and the circulation of oil is impeded by the complicated pieces of insulation so that artificial directing is necessary. In a core type transformer the entire coil system is exposed to free circulating oil that easily glides along the smooth cylindrical surfaces of the insulation.

In a shell-type transformer the lowest part of the transformer is the coil system, and in the case of water or moisture getting in the tank, which will settle below the oil, the insulation is endangered. In a core-type transformer the lowest part is the bottom yoke, which has a height of several inches, and above this there is a creeping surface ,and finally the coils.

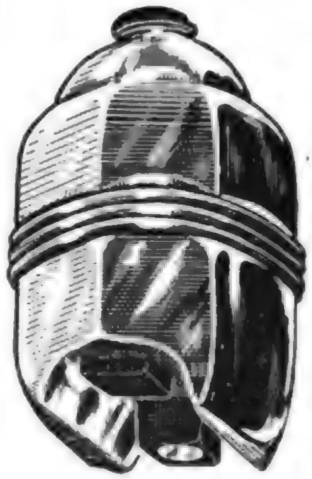
◆

Pendant Quick-Break Switch.

The switch shown in the accompanying illustration, made by the Sarco Company, New York, is especially designed for use in controlling ceiling lights, clusters and arc lamps. While rated for 6 amp. and 125 volts, it has, we are informed, in actual test, carried, without any noticeable heating, twice this amount of current at twice the voltage. These switches are made in a number of different finishes to harmonize with surroundings. The switch proper is mounted in a solid piece of porcelain, and consists of two levers working on a rocker, causing, by means of two spring triggers and a double V cam, the necessary reciprocating movement. The up-and-down movement of the two levers is guided by the construction of the porcelain holder, so that the action is that of a quick-break switch, there being, however, no movement of the switch jaws until a quick and clean make-and-break is desired, which is accomplished positively and rapidly. The contact surfaces being ample, no arcing or heating is produced.

The push buttons for operating the switch are marked for "on" and "off," one button being inlaid with pearl and the other concaved and ridged. These switches are fitted with double bushings, the larger bushing being screwed into the top of the metal cap, and the smaller bushing threaded within the larger, so that, where it is desired to use reinforced instead of standard pendant cord, the smaller bushing may be removed, and the pendant still properly be bushed by the larger one.

One of the features of the switch is the absence of side screws, which are apt to be lost, thus disabling the switch. The Sarco switch has the top and bottom shells screwed together, similar to the screwing of a lamp in a socket. The shells are locked by a special automatic locking device, and the switch can be easily taken apart by a quick twist of the locking device. Another great advantage is that the switch has top connections for the cords, and is therefore easier to connect than switches with side connections.



PENDANT SWITCH.

◆

Sectional Reflector for Incandescent Lamps.

An interesting form of window and art room reflector is shown in the accompanying illustrations. The device is a trough reflector constructed in sections, each 14 in. in length and complete in itself (see Fig. 1). These units can be combined to give any desired length, but the light from them is so great that they can be placed at intervals instead of being used as a continuous trough, thus effecting a saving of one or more lights every three feet (see Fig. 2). Each section, being separate and independent, can be adjusted to any desired angle to throw the rays of light where they are most needed. When used in the window, they can be placed in the front, back, top or end. Each reflector may be used as a separate lighting fixture, and may easily be installed by anyone. The adjustable mechanism on the stem furnished with each reflector is so designed that any desired angle may be obtained.

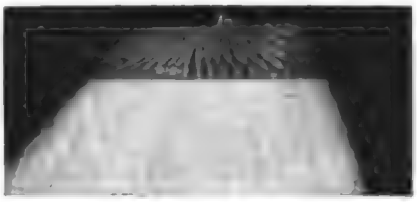


FIG. 1.—SECTIONAL TROUGH REFLECTOR.

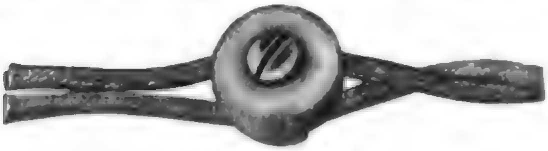
FIG. 2.—TWO REFLECTORS IN PLACE.

The reflecting surface is made of heavy glass, with spiral corrugations, plated with sterling silver, which provides the highest reflective surface known; on account of its whiteness and brilliancy, it is far superior to quicksilver or German silver plating. The corrugations break the rays of light, and there is absolutely no shadow thrown by the filament of the lamps. On account of the fact that these reflectors turn into a useful direction certain light rays which would otherwise be absorbed, it is found that by their use the expense for illumination is decreased by about 33 per cent. This illuminating device is being placed upon the market by the National X-Ray Reflector Company, 126 Franklin Street, Chicago, Ill.

◆

Blake Compressed Cleats.

The type of cleat shown in the cut herewith has been designed to meet the demand for a suitable support for low-voltage wiring in places where the Blake insulated staples could not be used, as over plastering, etc. These compressed cleats form a neat and effective wiring support and possess advantages over the more usual types of porcelain or fibre cleats. These cleats are being placed upon the market by the Blake Signal & Manufacturing Company, 246 Summer Street, Boston.



COMPRESSED CLEAT.

◆

Liberty Boiler-Tube Cleaners.

The characteristic feature of the boiler tube cleaners shown in the accompanying illustrations resides in the fact that the moving part of the cleaner is driven by a miniature water turbine. The body of the turbine is made in one casting, and within the casing is a spider which forms a bearing box containing a journal for the shaft. In one arm of the spider is an oiling chamber closed at one end, while the other end is provided with a ball valve through which oil is supplied to the bearing. The revolving part, or turbine wheel, is screwed into the rear end of the shaft, so that its weight will have a tendency to balance the weight of the cutting tool on the other end of the shaft. The vanes of the revolving part are all cut by patented processes, and being perfectly smooth, develop the highest efficiency. Both the forward and the rearward thrusts of the revolving part are taken up by special, frictionless, fibrous material, which runs in contact with metal washers and is practically indestructible to wear.

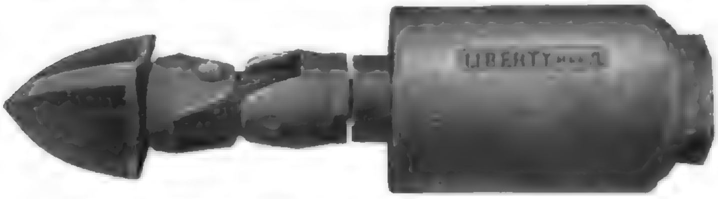


FIG. 1.—BOILER CLEANER FOR VERY HARD AND HEAVY SCALE.

Back of the turbine wheel is placed the stationary nozzle part, which admits water to the vanes. On machines for straight tubes there is used either a special hose coupling or a coupling having standard pipe threads. Where tubes are bent a universal coupling is interposed between the shaft and the freely swinging arm head, thus permitting the machine to work equally well in either straight or curved tubes. This type of boiler tube cleaner is built by the Liberty Manufacturing Company, 6409 Susquehanna Avenue, Pittsburg, Pa.

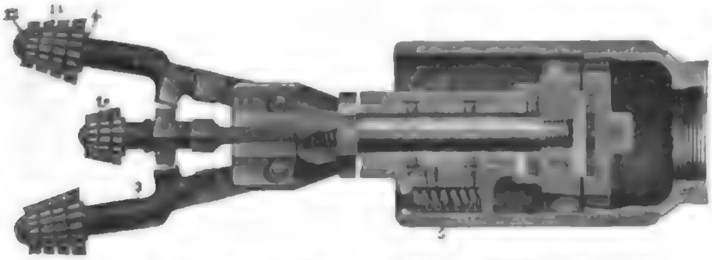


FIG. 2.—BOILER CLEANER FOR LIGHT OR MEDIUM SCALE.

◆

Small Direct-Current Motors.

The accompanying illustrations are intended to convey some idea of the symmetrical design and mechanical excellence of the line of direct-current motors which the Sprague Electric Company, 527 West Thirty-fourth Street, New York, is now putting on the market. These new motors range in size from 10 to 105 hp, and are built either entirely enclosed, semi-enclosed or open. The small sizes are of the bipolar type, but those of 20 hp and larger are multipolar machines.

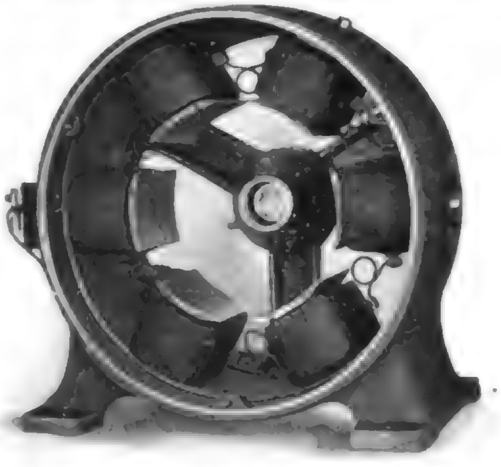


FIG. 1.—FRAME AND POLE PIECES OF MULTIPOLAR MOTOR.

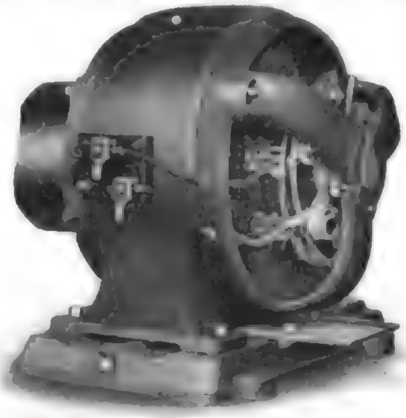


FIG. 2.—MULTIPOLAR MOTOR, OPEN FRAME.

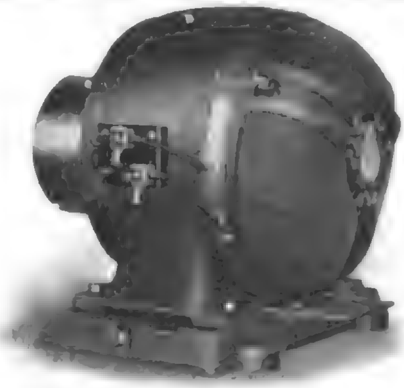


FIG. 3.—MULTIPOLAR MOTOR, SEMI-ENCLOSED FRAME.

North Mountain Power Company's Hydro-Electric Plant.

Among the power transmission systems of the Pacific Coast, that have been constructed with an eye to the future, rather than the present needs of the communities which they serve, is that of the North Mountain Power Company. This plant is located in the central part of Trinity County, California, two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity River. Weaverville, the county seat, is twelve miles distant by road. The nearest railroad point is Redding on the "Shasta Route" of the Southern Pacific R. R., Humboldt Bay, on the Pacific Ocean, while Eureka, the chief coast city of nothern California, lies in an almost due westerly direction at a distance of 59 miles in a straight line.

The altitude of the plant is about 1,400 ft. All material, cement and machinery were hauled in over 60 miles of the severest mountain roads, across three distinct divides or summits, viz.: Trinity Mt., Brown's Mt., and Oregon Mt. It required 18 to 20 animals to pull each of the larger pieces, weighing 18,000 lbs., up the grades, and when mud was encountered it was necessary to hitch 18 animals to the fall of a block and tackle fitted with steel cables. Despite these difficulties, however, no mishap occurred to any of the machinery.

The water used at the plant is diverted from Canon Creek, which has a drainage area of 52 sq. miles above the diverting dam. The upper part of the basin is a rugged, glaciated granite country, extending up to an altitude of from 9,000 to 10,000 ft. above sea level, where some snow remains throughout the year. The higher parts of this basin are in the nature of an immense amphitheater, lying on a flank of a peak, which is a characteristic feature of all elevated glaciated topography. And, as is so often the case, the converging and descending glaciers have scooped out immense holes with almost perpendicular sides, which now form the beds of two lakes. These lakes have been pressed into service as storage reservoirs.

Part of the watershed is heavily timbered, and lies within the boundaries of a government forest reserve. This will insure the preservation of the forests, which are so effective in steadying the run-off. The average rainfall for the last thirty-three years at Weaverville, twelve miles from the plant, has been 42.50 in. At the higher levels of the watershed the precipitation is much greater, but no records are available for that region because the country is absolutely uninhabited, and without even trails, except for the one to the above-mentioned lakes, which now form the storage reservoir for the North Mountain Power Company.

The dam is small and serves merely for diverting the water. It is of the usual rock-filled crib form, which type has been used for many years in mining operations on the Pacific Coast. The ditch system consists of alternating sections of ditch, flumes, and one tunnel. Part of the ditch is cut in solid rock, but the most of it is dug in the side-hill soil, which stands well and puddles well. The flumes are 19 in number and vary in length from 30 to 1,200 ft. Those immediately below the dam are laid upon a solid bed-rock bench, and are equipped with adequate spill-ways, waste-gates and sand boxes. The total length of the flumes is 5,250 ft., almost exactly one mile.

A tunnel 1,821 ft. long has been driven to replace a temporary flume which was unavoidably built upon treacherous sliding ground. This tunnel is heavily timbered throughout its entire length, and tightly lagged except where the rock is unusually hard. The dimensions of the main tunnel are 4 ft. 9 in. by 5 ft. 10 in. in the clear. The total length of the ditch, flumes and tunnel is 7¼ miles. The average grade of all is 9.73 ft. per mile. The ditch is provided with waste gates and sand boxes at suitable locations.

The capacity of the ditch is 80 cubic feet per second, which is sufficient to operate at full load three units like the two which are now installed. Near its lower end the ditch passes through a gap in the narrow ridge separating Canon Creek from Trinity River, and terminates in a forebay on the river side of the divide. Thus is secured a head due not only to the fall in Canon Creek in the seven miles through which the Creek and ditch parallel each other, but also to the additional fall in a further course of two miles to the Creek's junction with the Trinity River, and to the added fall in two miles of the river's course between the junction and the plant.

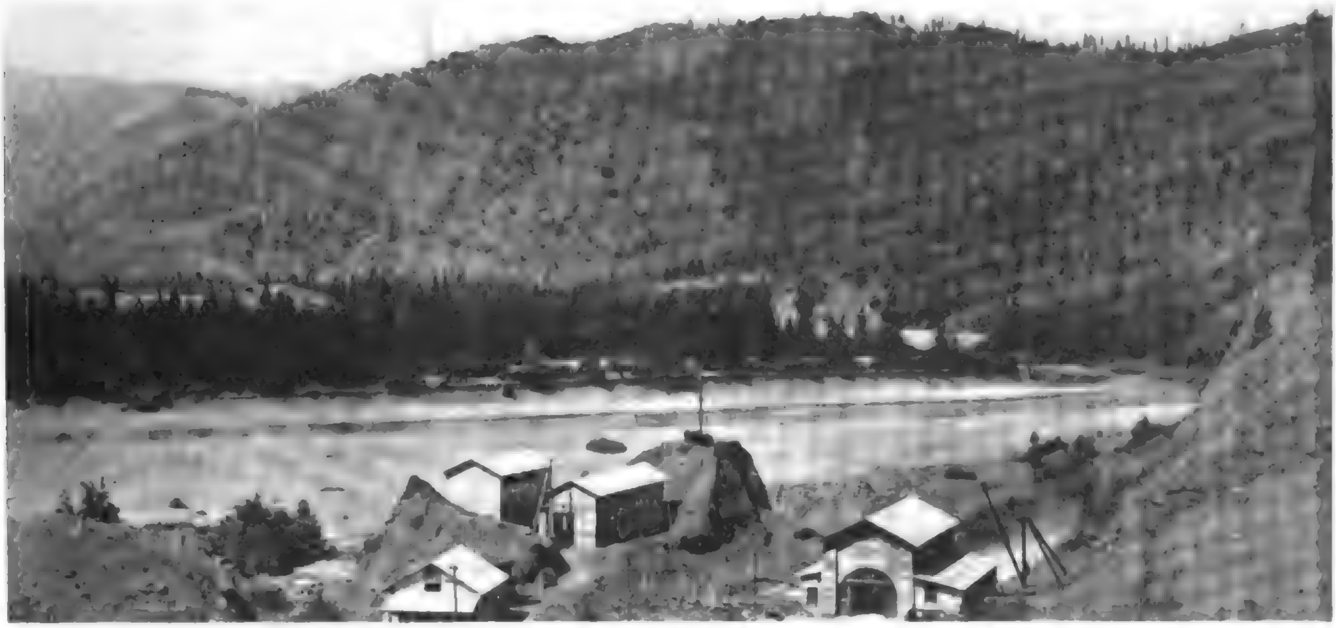


FIG. 1.—GENERAL VIEW OF TRINITY RIVER PLANT OF THE NORTH MOUNTAIN POWER COMPANY.

A telephone line extends from the power house along the entire course of the ditch to the head dam. Instruments are placed in the station, the forebay tender's cabin, the head-gate tender's house, and at several other points along the line. Portable telephones can be readily connected at any point, and, as a result, any place along the ditch can have prompt communication with the power house.

The forebay is excavated out of the solid rock of the hillside, 10 ft. deep, 14 ft. wide and 60 ft. long. The ditch is provided with a gate at its entrance to the forebay, and the latter contains a gate and grizzley at the intake of each of the two penstocks. Provision has been made for a third penstock when a third unit shall become necessary in the plant. Suitable trash-racks are provided just above the forebay.

Each penstock is 1,165 ft. long. Under a total head of 604 ft.

there is an effective head of 600 ft., giving a working pressure of 260 lbs. per square inch.

There is one complete independent penstock for each of the two units. Each penstock consists of a line of 36-in. and 28-in. pipe, and at the lower end two lines of 18-in. all riveted steel pipe of various gauges according to its position in the line. At the points where the single 28-in. pipe branches into two 18-in. lines, the penstocks are enclosed and anchored in a massive block of masonry laid up with imported Portland cement mortar. At their lower ends just before entering the power house they are secured by a similar form of construction, and at various points they are held by bands and anchor bolts leaded and sulphured into the bed-rock. Throughout their entire length they are laid in trenches and covered by back filling, except at their lower ends where the profile of the hill is such that it was best to lay each in a separate tunnel. After completing and testing the penstocks, the tunnels were walled up and back-filled.

Each penstock is provided with an 18-in. standpipe just outside the forebay walls to allow air to enter when the forebay gates are closed, and thus prevent collapse of the pipe. The penstocks are also provided with air-valves and manholes at suitable points.

The plant proper consists of the power house, the transformer house and the high-tension switch house. In addition, there are the shop, the operator's dwelling and the stable. At the forebay is the forebay tender's cabin, and at the dam is a house for the tender of the head gates.

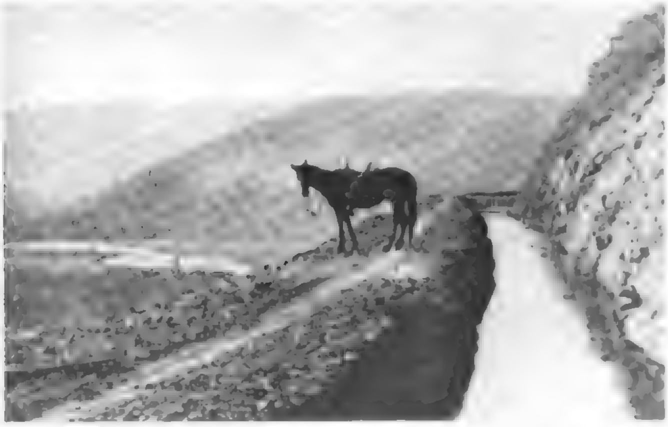


FIG. 2.—DITCH THROUGH WHICH WATER IS DIVERTED TO THE HYDRAULIC TURBINES.

Each of the two hydraulic units consists of a pair of 44-in. Pelton wheels under one sheet-steel housing, provided with ring-oiling, self-aligning bearings, coupled to the generator through flexible leather-link couplings. The nozzles are of the deflecting type. With the largest tips in service the wheels are capable of driving the generators at 25 per cent overload.

The wheels are controlled by type "F" Lombard governors using oil. The pressure and vacuum are maintained by oil pumps belt-driven from the wheel shafts. The governors are not fitted with any form of switchboard speed control mechanism, but a single operator has no difficulty in synchronizing a generator under the load conditions which exist in the plant.

The tail race is 6½ ft. wide and excavated for 280 ft. through bed-rock to the Trinity River.

The generators, two in number, are of the Bullock type, furnished by Allis-Chalmers Company, of Milwaukee. Each is a 750-kw, revolving-field, three-phase machine designed for 500 r.p.m., 2,200 volts, 25 cycles.

Two Bullock 45-kw, 125-volt exciting dynamos are driven by belts from the generators. The switchboards are of marble and have Wagner instruments.

The power house, 36x51 ft., is built of concrete made up with sand and gravel, taken from the river bars a few rods from the site of the plant, and with imported Portland cement. A special bay or alcove has been provided to give ample space behind the switchboard. The roof is of corrugated iron supported on steel trusses.

A "Cyclops" hand-operated crane spans the main part of the building, and is fitted with a 2,000-lb. "Triplex" block. This easily handles the heaviest piece of machinery.

The leads between the generators, exciters and switchboard are lead-covered cables laid in conduits within the concrete and cement floor.

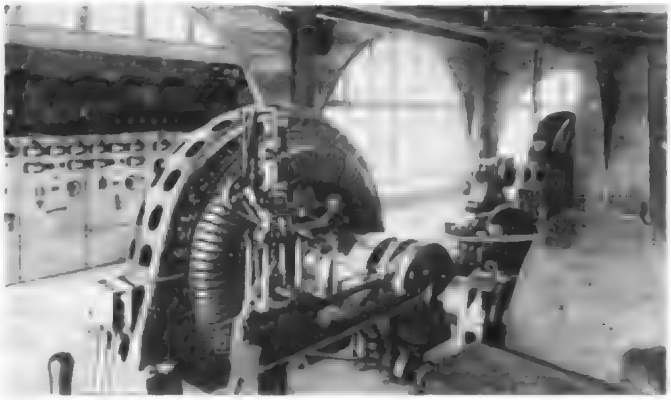


FIG. 3.—VIEW IN POWER HOUSE, SHOWING ALTERNATORS AND WATER WHEEL GOVERNORS.

The transformer house is 13 ft by 51.5 ft. in outside dimensions, and is also built of concrete. It is 50 ft. distance from the power house. It contains seven step-up transformers, viz.: two banks of three each and one in reserve. They are of Bullock make, 300-kw, water-cooled, oil-insulated, 2,200 to 19,050 volts. Each bank is located in a separate room, and the seventh or spare transformer is in a third room. They stand upon rollers which in turn rest upon tee rails set into concrete piers. The spaces between the piers are filled with gravel and provided with sub-drainage so as to allow any oil rapidly to escape in case of leakage or accident. The water piping is connected up with unions and so arranged that every transformer is interchangeable with every other one, as far as water and electric connections are concerned.

A track runs the entire length of the building and at such an elevation that the floor of a car is at the same height as the rails which are imbedded in the concrete piers. Thus any transformer can be quickly rolled out upon the car, removed, and another reconnected in its place with the minimum of delay in case of accident.

Each penstock is tapped in the power house, and after passing through shut-off and throttling valves under the control of the operator, water is delivered into a cylindrical steel tank, 36 in. diameter by 24 ft. long. This storage tank is set upon a little knoll about 20 ft. above the level of the transformers. From this tank the water circulates through the cooling coils of the transformers by gravity.

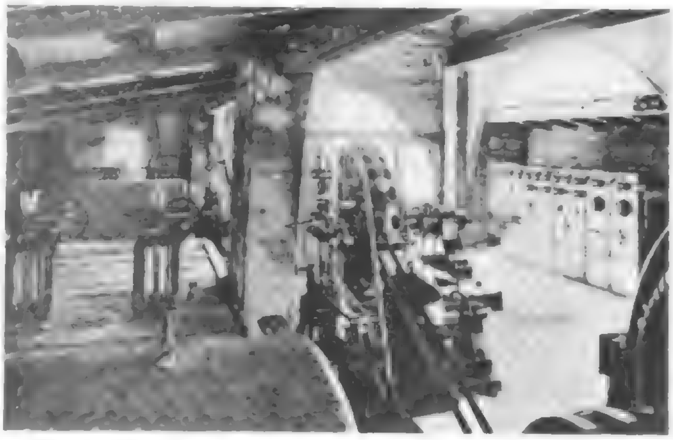


FIG. 4.—VIEW IN POWER HOUSE, SHOWING WATER WHEEL HOUSINGS, GENERATORS AND SWITCHBOARD.

The transformers are connected in delta on the low-voltage side, and in star on the high-voltage side, giving a line pressure of 30,000 volts.

The high-tension switch house is 16x36 ft. in outside dimensions; a frame structure covered with corrugated iron; 20 ft. distant from the transformer house.

In it are two banks of "M-T" single-throw air-brake switches, and G. E. alternating-current multiplex lightning arresters, connected up for the three-phase circuit.

The pole-line extends almost due west from the plant to the sub-station in Eureka. The length is 65 miles. Fifty-five miles of the route are over a severely rugged mountainous country; the altitude of the plant is only 1,480 ft. and Eureka is at sea-level, but the line passes over several summits ranging from 4,500 to 5,500 ft. in altitude. Fifty miles of its length lie in a heavily timbered country, requiring a tremendous amount of clearing, the trees ranging from 2 ft. to 4 ft. in diameter. It was necessary to construct a trail over nearly the entire length of the line.

The route deviates from a straight line only slightly and only where the topography made it unavoidable. It is a "thorough" transmission, so to speak, there being no taps on the line anywhere between the plant and the sub-station at Eureka.

The line is a single three-phase circuit. Each conductor is a No. 4 copper wire, except on some long spans where stranded cable is used. There are about 35 poles to the mile. The poles are redwood at the western end; in the inaccessible stretches the native red fir was the only wood available. Insulators are Locke two-piece single-petticoat porcelain, 8.5 in. in diameter. In the fog-belt a larger insulator of a similar design is used. Pins are of sun-dried eucalyptus, oiled, 1.5 in. in diameter.

The spread of wires on the standard length spans is 40 in.

The length of spans varies from 50 to 100 ft. according to the conditions and topography of the country. The telephone circuit is No. 10 B.B. galvanized wire, carried on glass petticoat insulators.

Telephones (Stromberg-Carlson) are connected to the line at several of the cabins which have been built for the accommodation of the patrolmen, and at frequent intervals are "pole-boxes" consisting of magneto-generator and batteries into which the patrolmen plug their pocket sets and thus have long-distance loud-talking instruments.

The sub-station at Eureka includes an auxiliary steam plant as follows:

Two B. & W. water-tube boilers fitted with Peabody patent oil burning furnaces, duplicate oil pumping system; Goubert auxiliary feed-water heater; Wheeler "Admiralty" surface condenser with self-contained steam-driven air and circulating pumps, cooling water being taken from Humboldt Bay, and a McIntosh and Seymour tandem-compound engine of nominal rating of 700 hp. A jackshaft running at 500 r.p.m. is connected to engine by rope-drive.

A Bullock 500-kw. 550-volt rotary converter is arranged for direct connection to this jackshaft by a jaw clutch and so driven by the engine. This arrangement permits of carrying the load by steam when necessary to shut down the transmission line for repairs.

The clutch has a synchronism indicator in the nature of a lamp, so that the engine may be connected to the rotary while it is running at full speed on the power transmitted from the Trinity River plant.

For the rotary converter there are three Bullock 150-kw. water-cooled transformers. For the local distributing system are three G. E. 400-kw. water-cooled transformers.

For furnishing power to the 60-cycle incandescent and arc lighting circuits of the city of Eureka, a three-phase, 60-cycle generator is driven by the rotary acting as a synchronous motor.

A fuel oil tank 54 ft. in diameter by 25 ft. deep holding 10,000 barrels has been built near the sub-station, and is connected to a dock on Humboldt Bay by a pipe-line.

The load at present consists chiefly of lights in the city of Eureka. Some motors are already connected to the circuits, and the motor load is being rapidly developed.

Local transmission lines are being constructed about the shores of Humboldt Bay, and in a very short time the company will be supplying power to the local companies in Eureka's suburbs, not only for lamps but for motors to the various industries of that rapidly developing region.

Standard Insulator Clamps.

Fig. 4 below shows a type of clamp brought out by the Clark Electric and Manufacturing Company, of New York City, and designed for use with standard insulators. The clamps grip the conductor firmly on each side of the insulator and the projecting lips engage the groove of the insulator, transferring the end strain to the porcelain in an effective manner. The wire loop surrounding the neck of the isulator holds the clamps in position and prevents the conductor from being lifted from the groove. An interlocking clamp is shown by Fig. 1. With this clamp is required an insulator having an undercut recess on either side of the groove in the center of the insulator top, so that when the clamp is in position it is interlocked under the projecting portion in such a way that the wire cannot be removed or the clamp separated from the insulator without unlocking it. Sufficient clearance is allowed so that the cable and clamp together may move freely, thereby avoiding the hinge action which takes place when the wire is rigidly held in place in the insulator.

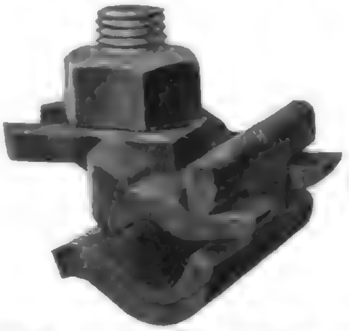


FIG. 1.—INTERLOCKING INSULATOR CLAMP.

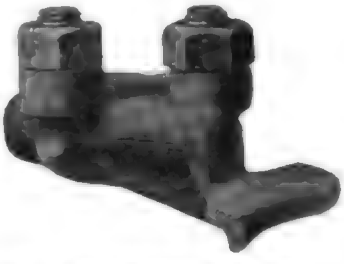


FIG. 2.—INTERLOCKING INSULATOR CLAMP.

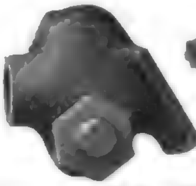


FIG. 3.—ANGLE LOCKING INSULATOR CLAMP.

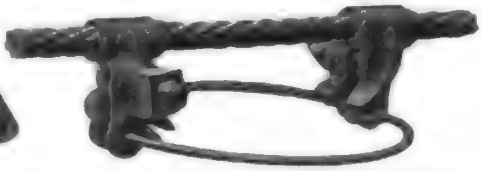


FIG. 4.—STANDARD INSULATOR CLAMP.

An interlocking clamp is shown in Fig. 2. The cable is held firmly on each side of the insulator, the projecting lip engaging a deep circular groove in the neck of the insulator so as to prevent the wire from being lifted. The end strain is distributed so that there is no excessive pressure at one point. This type of clamp is used on the transmission lines of the Rio de Janeiro Tramway, Light & Power Company. An interlocking clamp designed for use on No. 0 and smaller sizes of wire is shown by Fig. 5. A recessed insulator is required for this clamp, in the recess of which the two halves of the clamp are placed. The wire is then dropped in position, and by seating the nut the clamp is tightened on the wire and locked within the insulator. There is sufficient play to enable the swing of the wire to be transmitted from one span to the next so as to avoid bending strains on the conductor. An angle and a ball-socket clamp are shown by Figs. 3 and 6, respectively.

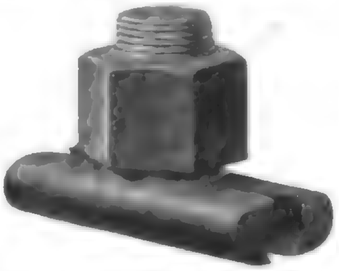


FIG. 5.—INTERLOCKING INSULATOR.

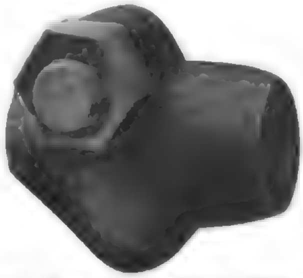


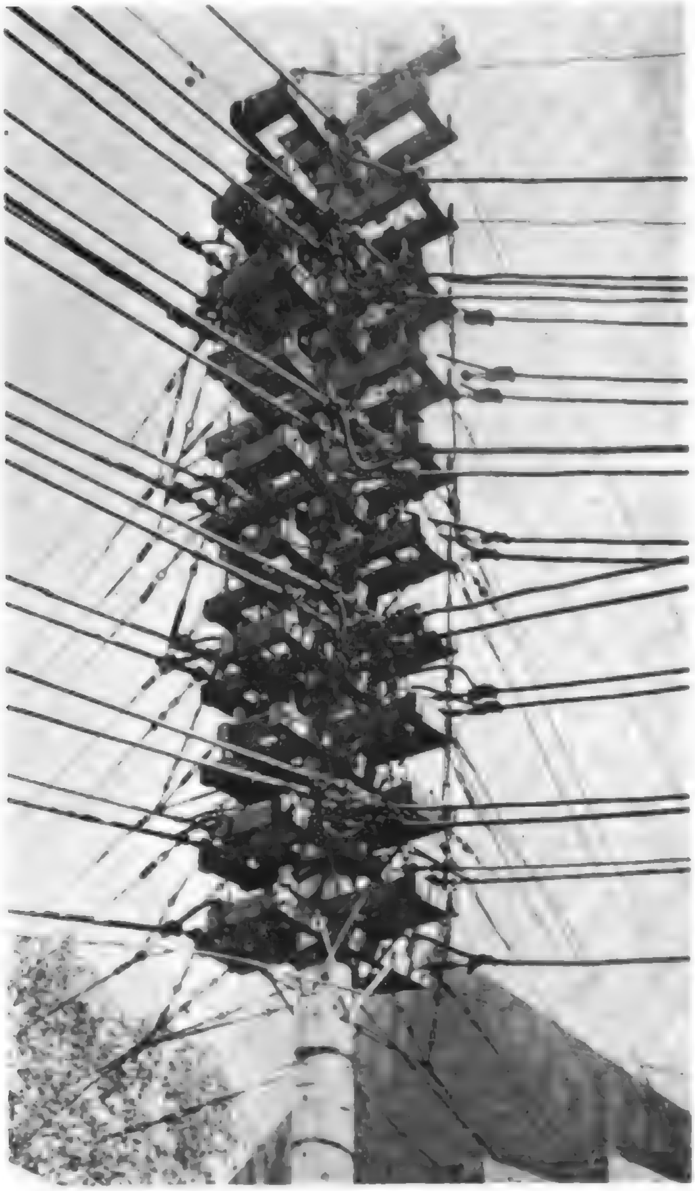
FIG. 6.—BALL SOCKET INSULATOR CLAMP.

The former is designed to be fastened firmly on the conductor, the angle of the clamp fitting into an angular recess in the insulator and above the groove. One clamp is used on each side of the insulator, and vertical or horizontal swings may be transmitted from one span to the next without any undue strain being thrown on the conductor. The clamp shown by Fig. 6 may be used on curves without concentrating the strain upon a small area of porcelain. The ball-shaped ends of the clamp fit into sockets in the insulator, and while holding the conductor firmly in position, permit the transmission of motion from one span to the next. All clamps intended for use with copper conductors are made of copper bronze.

◆

Cable Clamps.

We show herewith a picture of a pole in Topeka, Kansas, belonging to the Edison Illuminating Company of that city. It shows very clearly the use and the great saving made by the Kearney cable clamp, forty of which are used on this pole. Mr. C. R. Maunsell, the superintendent of the company, states that $250 was saved on this one pole by the use of the clamp. This includes the saving in labor, material and cable. The Kearney cable clamp also makes a much neater and stronger job than could be had by the ordinary method of splicing. W. N. Matthews & Bro., of 227 North Second Street, St. Louis, are the manufacturers of this device.



CABLE CLAMPS.

Westinghouse 1906 Electric Fans.

For the season of 1906 the Westinghouse Electric & Mfg. Co. will present a largely increased assortment of electric fans for both direct and alternating-current service, and in forms known as the desk type, the bracket type, the ceiling type, the floor column type and the counter type.

The 1906 desk and bracket fans are substantially designed and are of attractive appearance. The body and base present smooth surfaces which effectually prevent the accumulation of dirt, which so easily attaches to irregular outlines. They are finished in polished black enamel with guards and fans of buffed and lacquered brass.

The blades of the 1906 model are a departure from the ordinary design formerly employed, and are the result of the careful study and investigation which have been given to this important question by the Westinghouse Company. They are constructed upon exact mathematical principles and their angles are theoretically correct, with the result that the fan will give an even breeze across its entire front—as there is an absence of that tendency to project a hollow cone of air which is found in all fans whose blades have not been correctly designed. The breeze is sent out from the fan in the shape of a solid cylinder of air, and there is little tendency to set up eddy currents with their attendant losses. The determination of this correct blade angle has resulted in an extremely high air delivery while the total watt consumption has been decreased, though the volume of air has been increased. The fan guard is of graceful design, pleasing appearance and substantial construction, and is secured in position by arms so rigid that the entire weight of the motor may be supported by the guard without injury.

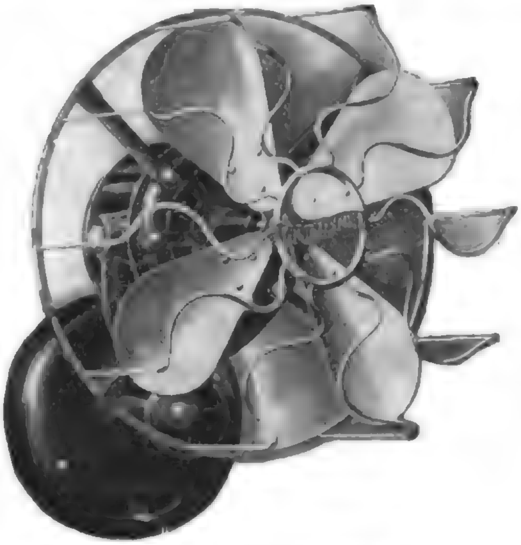


FIG. 1.—BRACKET FAN.

The motor is mounted upon trunnions whose line of support passes through its center of gravity and is therefore balanced at any angle. There is therefore no tendency to turn over when the thumb screw is loosened—a point of great advantage. It is secured in any position by two thumb screws; one holds it at any angle in a horizontal plane and the other at any angle in a vertical plane. The thumb screw which secures the motor in a vertical position passes through the trunnion support a little below the axis and bears against a boss on the side of the motor, affording a rigid and secure means of clamping the fan in any position. The thumb screw which retains the fan at any angle in a horizontal plane is a recent modification, greatly superior to former methods in which friction washers were employed. All fan motors have, when running, a tendency to shift from the position in which they are adjusted, but these clamping screws hold it secure when once adjustment has been made.

The Westinghouse 1906 fan motor consumes a very small amount of energy, as is illustrated by the fact that it costs only about ¼ as much to run a 12-inch fan as to burn an ordinary 16-cp incandescent lamp on the same circuit, while a 16-inch fan can be operated at less than the cost of burning two such lamps.

By means of a simple adapter, the 12-in. and 16-in. desk and bracket types of fans are interchangeable. This provision makes it unnecessary for dealers to carry two types in stock, and also makes it possible for the user to attach the fan to the most convenient location without disconnecting lead wires, giving him all the advantages of the two styles of mounting.

The motor used in the alternating-current desk and bracket fans is of the induction type wtih stationary primary and rotating secondary, and has a secondary made up of solid rods of copper inserted through the partially closed slots of a laminated core and short-circuited by metallic end rings. There are no moving contacts and no electrical connection between the rotating part and the outside line. The motor has accordingly no wearing parts except the bearings, and is durable and exceedingly simple, both in construction and operation. The primary is wound for either 110 or 220 volts and for 60 or 133 cycles. The 60-cycle motor is made with two bearings, which are of ample dimensions and automatically lubricated. In the 133-cycle motor the shaft carries the fan at one end and the secondary of the motor at the other, the two parts nicely balancing each other on one bearing. The switch employed is of simple design and made of moulded insulating material of such form that it cannot easily be damaged or thrown out of alignment. The handle projects through a slot in the motor base at the most convenient and accessible point, so that the fan can readily be placed in operation.

One of the characteristics of the alternating-current fan is the ease and quickness with which it starts. The start is made as readily when the switch is in the slow as in the high-speed position, so that there is no danger of burn-out because of failure and sudden restoration of power when the switch is set on the slow-speed contact. These excellent starting qualities have been secured by careful design of the motor combined with the use of a centrifugal device which cuts out the starting winding as soon as the fan has obtained sufficient speed and by means of which a large amount of energy is saved which would otherwise be wasted.

The 1906 alternating-current fans are arranged for operation at two speeds of approximately 1,625 and 1,300 r.p.m. The slow speed is obtained by the insertion of a choke coil connected to the switch contacts and in series with the motor—an ideal arrangement, as it eliminates unnecessary losses of energy and the complication of switch mechanism which is characteristic of other methods.

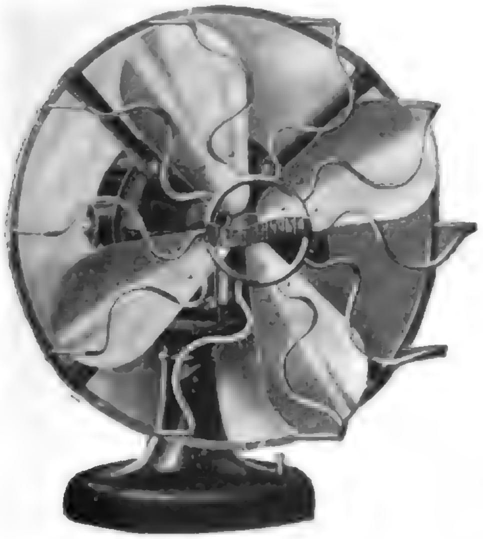


FIG. 2.—DESK FAN.

The field coils of the direct-current motor are rectangular in shape, are machine wound, and are insulated by special treatment which reduces to a minimum liability of break-down. The armature is of the drum type with slotted laminated core and carefully insulated winding. The commutator is so constructed and protected that wear is inappreciable, and the troubles so often found in this, the most vulnerable portion of a fan motor, are practically eliminated. It is completely enclosed, but an easily removable dust shield makes inspection possible. The brushes are of carbon of the highest quality and do not "chatter" or cut the commutator. The brush holders maintain an even pressure and perfect contact. The shaft is of the best hardened steel and runs in bushings of bearing metal which give a long service, but can be easily renewed. There are two bearings provided with an automatic oil return which insures abundant lubrication at every point and which is so designed as to prevent all throwing of the oil.

The switch is designed and constructed to withstand considerable hard usage without getting out of alignment. A handle of insulating material moulded to the end of the blade projects through the base. The switch and contacts are covered with an insulating disc which prevents danger of short circuit when the fan is placed on a radiator or any uneven conducting surface. The regulating resistance is made of wire of a low temperature coefficient wound on the outer edge of the enclosed porcelain switch base and afterward enameled—a construction which gives a large radiating surface with consequent minimum rise in temperature. Three different positions of the switch handle give three different operating speeds, with a maximum of 1,650 r.p.m., a medium of 1,300 r.p.m. and a minimum of 1,000 r.p.m.

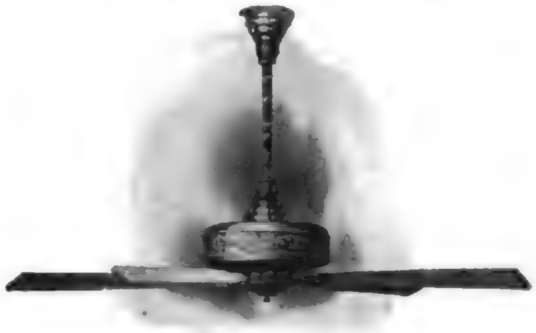


FIG. 3.—CEILING FAN.

The Westinghouse fans for 1906 for ceiling and floor mounting have cases of graceful design and ornamental appearance, with a standard finish of black enamel and mottled copper. The fan is made with four blades which are set at angles calculated to give the highest possible movement of air for the lowest possible consumption of energy. The blades are securely attached to the moving element by screws which effectually prevent them from turning from their normal position. The fans are designed for operation at three speeds, controlled by means of resistance wound about the bearing cup; 200, 150 and 100 r.p.m. may be obtained. The switch is placed centrally in the under side of the fan body. As there are no live parts outside of the case, there is no danger of shock from coming in contact with the electric circuit during handling or cleaning.

Fans of this type are made for operation from either alternating-current, 60-cycle, or direct-current circuits. The alternating-current motor is of the single-phase induction type with stationary primary, and short-circuited secondary which has no connection with the outside line. It therefore possesses no moving contacts or wearing parts except the bearings. The direct-current motor is substantially constructed with rectangular field coils and a drum type armature. The commutator is especially well made, embodying as it does all the high-grade features of other Westinghouse motors. The brushes are of the finest quality of carbon and are so mounted that perfect contact and good commutation are maintained at all times. These motors are strong and reliable and are noiseless in operation. The rotating element is supported upon noiseless ball bearings which reduce friction to a minimum. A stationary shaft is provided with a spiral groove through which oil from the reservoir is forced upward by the rotation of the armature.

The counter type fans are exactly similar to those designed for floor column mounting with the exception that the shaft is made short.

High Vacuum Condensing Outfit.

The C. H. Wheeler Condenser & Pump Company, Philadelphia, has brought out a new "High Vacuum" condensing outfit, which comprises its improved surface condenser with a Mullen suction valveless air pump. Fig. 1 illustrates the complete outfit, the air pump here shown being steam driven. These pumps are also built in the multi-cylinder vertical geared type for driving by electric motors, belt or steam. The condenser is of the series-parallel type, as will be evident from the sectional view, Fig. 2. The water enters the top group of tubes first, passes thence to the middle section and finally through the bottom section of tubes, connecting chambers being provided at the ends of the shell, as clearly shown in the engraving. The makers call particular attention to the arrangement of water chambers; this arrangement keeps the condenser completely filled with cooling water at all times, the water entering and leaving at the top. The inlet is at the bottom, but the water is carried up through the annular chamber shown in the cross-section view and enters the tubes from the top.

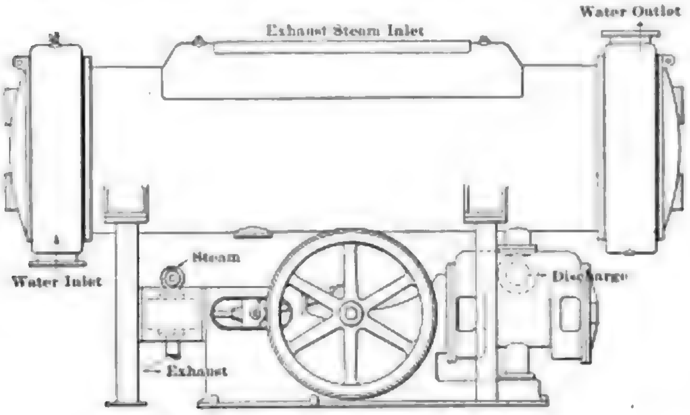


FIG. 1.—COMPLETE CONDENSING OUTFIT.

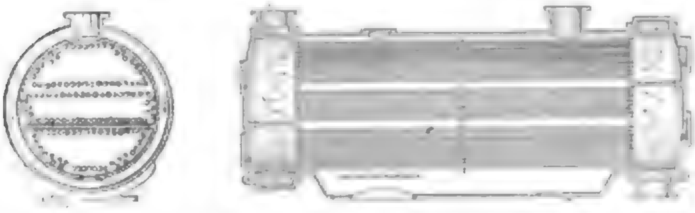


FIG. 2.—SECTIONAL VIEW OF CCONDENSER.

The air pump is double-acting and devoid of suction valves. The cylinder has a central port which is uncovered by the piston at each end of the stroke and covered at all other positions; discharge valves of the familiar spring-seated poppet type are located in both heads of the cylinder. As the piston moves from one end of the stroke to the other, it forms a vacuum behind it and forces the gases and water ahead out at the discharge valves at the end; when it reaches the end of that stroke the central inlet port is uncovered, and the vacuum behind the piston draws in the condensation and gases from the condenser. This operation is repeated, of course, on the return stroke (see Fig. 3.)

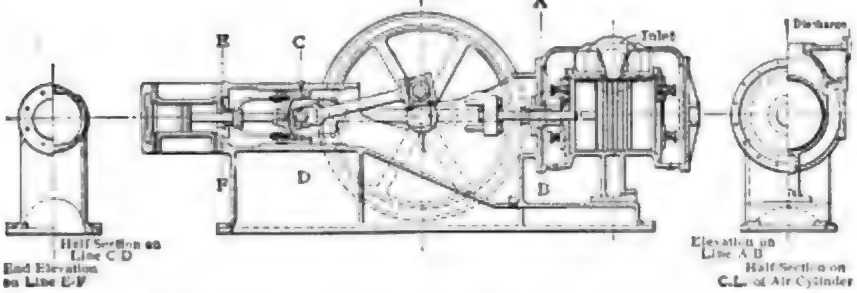


FIG. 3.—SECTIONAL VIEW OF AIR-PUMP.

The makers claim that the pump will separate, under shop test conditions, within ½-in. of the barometer, enabling them to guarantee a vacuum within 2 in. of absolute under full-load conditions of steam turbine operation. Owing to the improved condenser design, the discharge from the pump is within a few degrees of the temperature due to the vacuum in the condenser. The design also obviates the use of a third pump ordinarily required by a wet-and-dry air pump system.

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Mechanical Sparker for Gas Engines.

The accompanying illustrations show a new type of spark generators for gas engines, which does away with the usual commutator and magnetic vibrator. In the mechanical vibrator (Fig. 1), which is the principal feature of the generator, there are two platinum contacts, one at *D* and the other on the end of the screw *F*. Although the engine may be turning very slowly and the spiral spring, *A*, brought to a tension very slowly, no contact is made until the spring is released. All of these parts are very light, which allows for a very quick release of the spring, and as the duration of contact can last no longer than the time taken for the release of the spring, and as the time is always constant no matter how low the intervals between each release, it will readily be seen that a quick make and break is

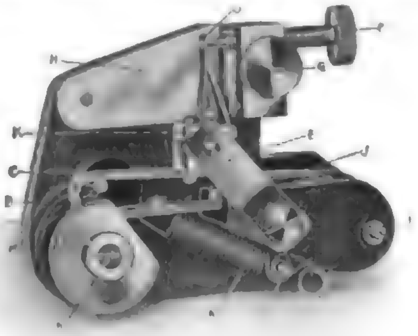


FIG. 1.—MECHANICAL VIBRATOR.

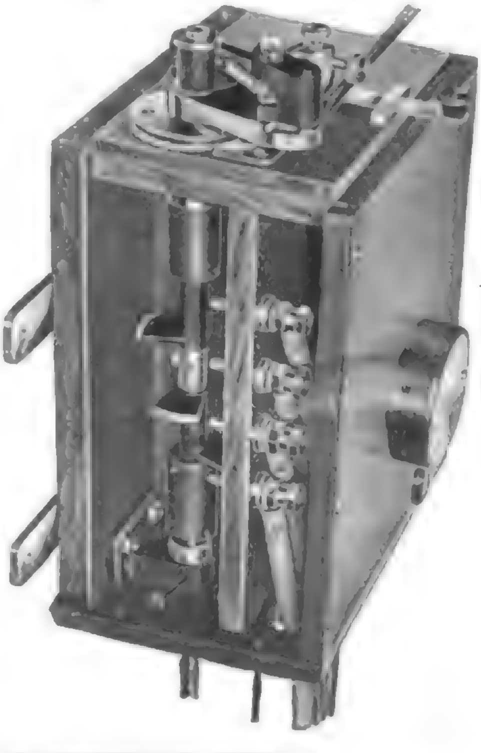


FIG. 2.—GENERATING SYSTEM.

always accomplished, making a spark of a constant size for all speeds of the engine.

Fig. 2 shows the generating system complete, with the exception of the batteries. The advantages claimed for this system are many-fold. The mechanical vibrator is a very simple piece of apparatus. It is made of light weight, and although not foolproof, it is durable and not liable to get out of order or adjustment. Practically the only places to wear are the platinum contacts, but these should last even longer than the contacts on a vibrator coil. The vibrator being mechanical is worked by the power of the engine, and consumes no battery current to move it.

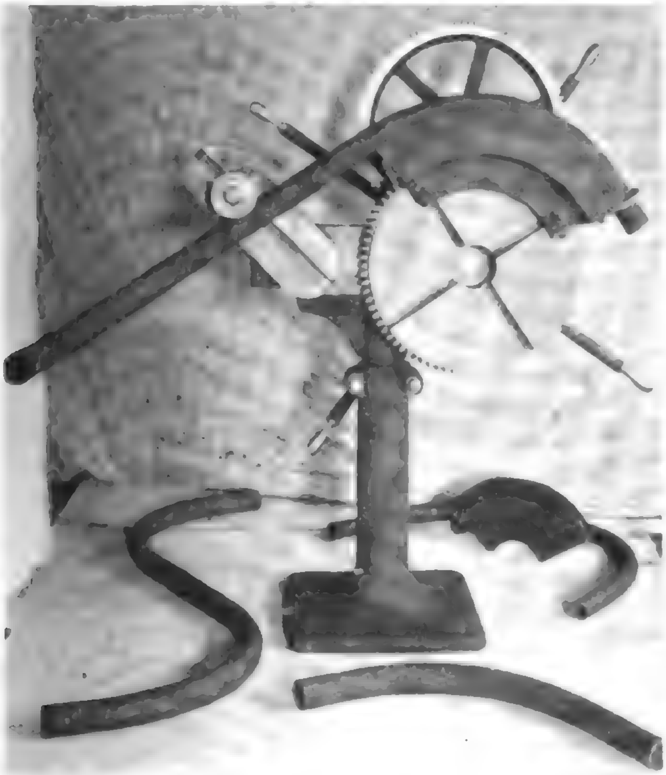
This sparking device, which is being placed upon the market by the Atwater Kent Manufacturing Works, 112 North Market Street, Philadelphia, concentrates into one unit the entire ignition system, except batteries and plugs, and is placed upon the dash of an automobile in a neat box the size of an ordinary coil box.

◆

Pipe Bending Machine.

The accompanying cut illustrates a machine perfected recently for bending pipe cold. Piping of steel, iron, brass, copper or other material can be bent cold up to and including 2 in. in diameter. The machine is also adaptable by means of special formers for bending light angles, flats or tee bars, and should be very useful on conduit work. The gearing is compound with a ratio of 25 to 1, thus giving the machine a powerful leverage. A boy can bend 2-in. pipe with little effort.

The machine is operated by a hand wheel consisting of four handles, which by means of the compound gearing engages the face plate upon which the bending quadrants are secured. The pipe is held in the quadrant at one end by a steel plate, while the resistance stud on the movable arm engages the other end. The various curvatures are obtained by adjusting the arm, which has a swing of three-quarters of a circle supplemented by the movement of the resistance pin in the "T" slot on arm.



PIPE BENDING MACHINE.

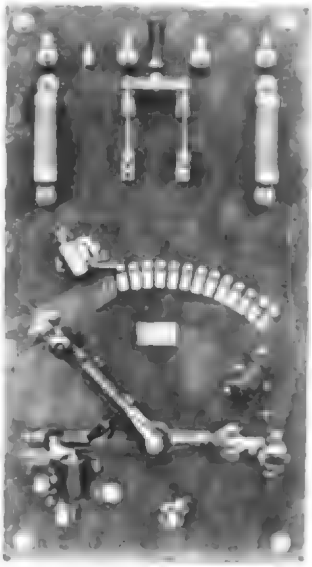
The machine is mounted on a telescopic stand which can be raised or lowered to any suitable height. When the base is fastened, the upper part swivels. A universal arm or section for the stand is furnished so that if desired the face plate can be placed in a horizontal position at any height from the floor. Quadrants are furnished with the machine for 1-in. pipe with a radius of 6 in., for 1¼-in. pipe with a radius of 9 in., for 1½-in. pipe with a radius of 12 in. and for 2-in. pipe with a radius of 14 in. The small size pipes can be readily bent in the larger size quadrants very satisfactorily; in fact, few workmen will take the time to change the quadrants unless they desire a shorter radius than the larger quadrants will give them. This machine is manufactured by Pedrick & Smith, of Germantown, Philadelphia.

◆

Overload and No-Voltage Release Motor Starter.

The accompany illustration shows a face view of an overload and no-voltage release motor-starter built by the Ward Leonard Electric Company, of Bronxville, N. Y. The action of the overload magnetic circuit-breaker is entirely independent of the no-voltage device, and the former will operate whenever the current exceeds a predetermined amount, either while the operator is starting the motor or after it has attained full speed. The circuit-breaker is arranged so that it cannot be closed except when the starting arm of the starter is in its open circuit position. An auxiliary final break is provided on which the arc is broken.

The resistance material is surrounded and mechanically held in position by insulating material so that the conductor cannot move even though it be melted by excessive current. A metallic alloy having a temperature coefficient not greater than German silver is used for resistance. The starter is designed to withstand a current 50 per cent in excess of the full-load motor current passed through the entire resistance when cold for one minute, and a current double that of the full-load motor current for 20 seconds under the same conditions. The starting arm of the motor-starter is provided with a retractile spring which has a tendency to insert resistance and open the circuit, which result obtains when the arm is released by the automatic no-voltage release device. The arm is held in its full-speed position by the no-voltage release device, the action of which is entirely independent of the current in the armature or field coils. To prevent arcing at the initial contact there is provided an independent, spring-operated, renewable circuit-closing switch, which opens the circuit with a quick break. In starters above 10 hp this quick break is supplemented by a magnetic blow-out. The stationary contacts are in the form of segments, readily removable and renewable from the face of the slate. For each 40 amperes of full-load current there is provided a self-aligning, renewable contact shoe upon the resistance controlling arm. All of the parts on the face of the starter are readily removable from the face.

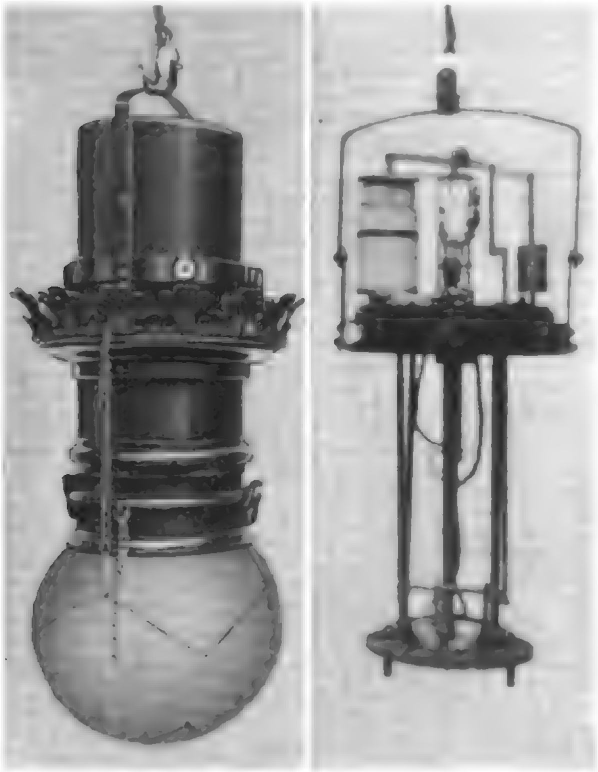


OVERLOAD AND NO-VOLTAGE RELEASE MOTOR-STARTER.

Siemens Flame Arc Lamps.

One of the most interesting exhibits at the recent New York Electrical Show was the several Siemens flame arc lamps which assisted in the illumination of the building. The lamps shown in operation produced a golden-yellow, red or brilliant white light according to the carbons used. When it is known that the candle power of each of two of these lamps connected in series on a 110-volt, direct-current circuit is from 4,000 to 5,000, and that the current used is only 11 amperes, it will be appreciated that the lamps are of more than usual interest.

The main feature of the lamps, and that which gives to them their high luminous efficiency and characteristic color effects resides in the "carbons"—pencils which are of the impregnated type. The mechanical details of the lamps, however, possess numerous features which serve to distinguish them from the more usual forms of arc lamps. The arc is formed at the lower ends of the two pencils which are placed at a certain inclination from the vertical position. The pencils pass through two openings in a disk of refractory material which serves to deflect the upward rays to a useful downward direction. Since there are no side braces and retaining mechanism in the path of the rays, and no "lower" carbon to obstruct the light, the lamp gives forth an illumination exceptionally free from shadows.



FIGS. 1 AND 2.—FLAMING ARC LAMPS.

The pencils are fed downward by gravity automatically, according to the rate of consumption. The two pencils of each lamp are lowered at the same longitudinal rate, even in the direct-current lamps. The positive and negative pencils are made of different sizes, so that the lineal consumption of each is the same as that of the other. Although the compensation for the consumption is made by allowing the remaining portions to be lowered by gravity, the actual regulation of the current taken by the lamp is accomplished by separating the points or bringing them nearer together, according to whether the current is too strong or too weak. When the lamp is just trimmed the points of the pencils are in contact so that the circuit through the lamp is complete. The current taken by the lamp when the switch is closed passes through a series coil on a compound-wound electromagnet which serves to separate the points of the pencils in a horizontal direction until the current reaches its normal value. The shunt coil of the magnet is connected across the pencils of the lamp and its magnetomotive force serves to draw the pencils together if the voltage is above normal.

When the electromagnet has drawn its core to that end of its travel corresponding to the minimum separation of the pencils, a clock-work escapement device is operated, and the pencils are allowed to descend gradually under the force of gravity. The electromagnetic regulator is provided with the usual air dash-pot, and the feeding of the pencils and the adjustment of the distance between their ends is so regular that the illumination is remarkably steady. When the feeding mechanism to which the pencils are attached has reached the end of its travel in a downward direction, a catch, which holds the main line switch closed, is tripped, and a spring causes the switch to open at a rate to rupture any arc that may be formed.

The mechanism of the lamps is provided with adequate insulation to insure that no defect will develop from this cause. That portion of the mechanism which is subjected to the heat of the arc is insulated with asbestos and fire-resistive tape. The stationary parts are insulated with mica, while the cables connected to the moving pencils are threaded through insulating and protecting glass beads.

The glassware surrounding the arc is provided at its lowest point with a brass cap which serves both as a ventilator and as a point of support for a wire netting which encircles the globe.

The length of time during which a lamp will operate at a single trimming depends upon the length of the carbons. Those exhibited at the Electrical Show are provided with 10-hour carbons. The company also builds lamps using 17-hour carbons.

These lamps are being placed upon the American market by Felix Hamberger, 90 William Street, New York City, who also exhibited for the first time in this country the Siemens "Liliput" arc lamps which are designed for operating at 120 watts, 160 watts or 240 watts. In addition to being of remarkably small size, these lamps possess the distinction of using the Siemens impregnated "carbons" of high luminous efficiency which burn for about 14 hours at one trimming.

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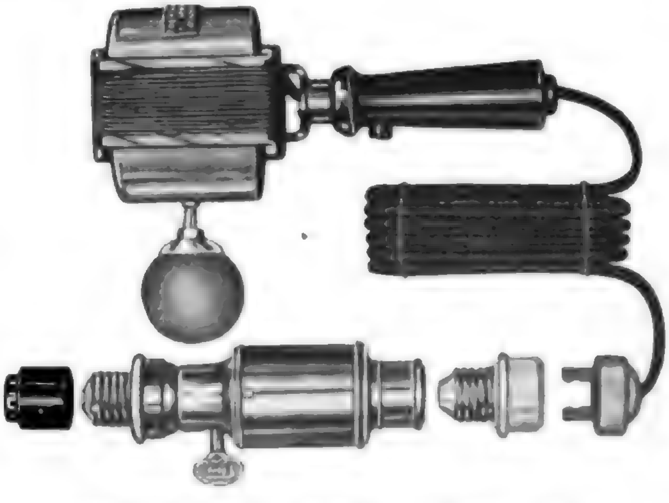
Physician's Vibratory Motor.

The apparatus shown in the illustration herewith indicates one of the numerous small uses to which electricity is being put by the modern physician. The equipment comprises an Ideal vibratory motor for mechanical massage, designed especially for physician's use, together with the necessary oscillatory accessories and electrical attachment plugs. The motor is of the self-starting single-phase type and operates on 60-cycle current. The mechanical arrangement is such that the device makes 14,400 complete vibrations per minute. A control button which is placed in the handle serves for conveniently placing the motor in operation when desired. When only direct-current is available, a small rotary converter is operated inverted in order to obtain the 60-cycle current. This vibrator outfit is made by the R. Haas Electric & Manufacturing Company, Springfield, Ill., which has developed a complete line of auxiliary devices for use with it.



VIBRATOR EQUIPMENT WITH ATTACHMENT PLUGS.

Automatic Notching Presses.

The accompanying half-tones illustrate two new automatic armature disk notching presses which have recently been brought out by the E. W. Bliss Co., Brooklyn, N. Y. Simplicity is a noticeable feature of these two machines, yet the design is such as to secure high speed and great accuracy, both of which are essential features in presses of this class. The smaller press is for cutting the notches in disks from 3½ in. to 6 in. in diameter, with any number of notches, although a different index plate is required for each different number of notches. The machine is positive in its movements, thereby securing great accuracy. The fly-wheel is run at 150 to 200 r.p.m. The total weight of the machine is 350 pounds.

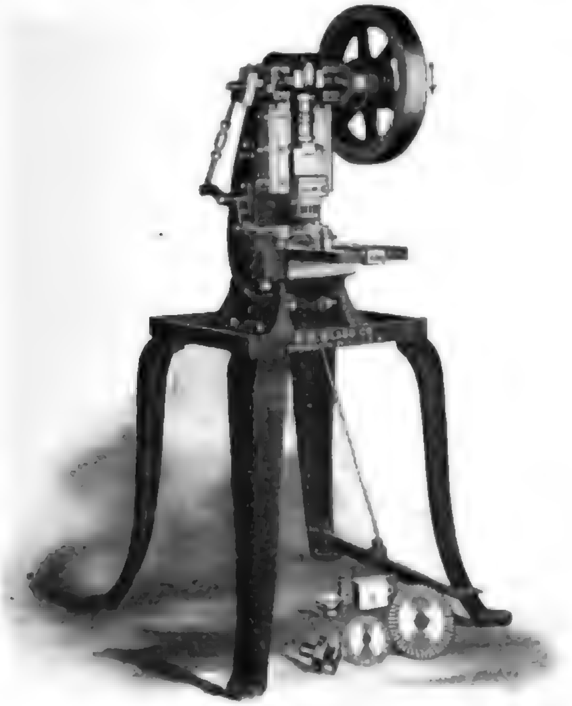


FIG. 1.—NOTCHING PRESS.

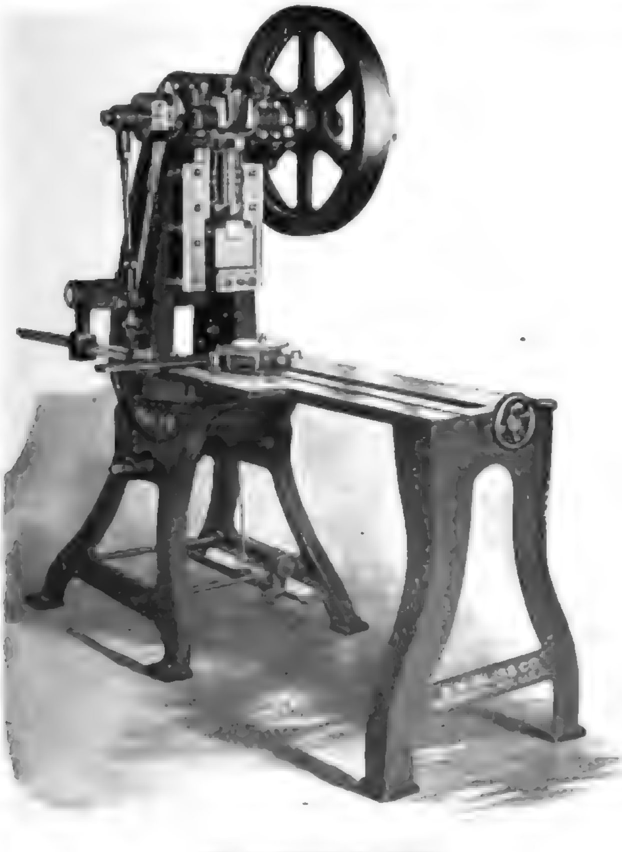


FIG. 2.—NOTCHING PRESS.

The larger machine operates in the same general manner as the other, but is intended for larger work, handling disks from 3¼ in. to 24 in. in diameter, although much larger disks may be cut by simply lengthening the bed. Adjustment for different diameters of disks is effected by means of the hand wheel shown, which regulates the distance of the rotating table from the center of the slide. In addition to the usual index plate for the different number of notches, the press is fitted with a positive checking pawl which prevents any error in feeding, and thereby secures great accuracy. The weight of this machine is 1,600 pounds.

Single-Phase for British Steam Railroad.

Advices from England state that the British Thomson-Houston Company, Ltd., is associated with the Allgemeine Elektricitäts Gesellschaft in the latter company's tender to the London, Brighton & South Coast Railway for the electrification of certain of its lines. It is proposed to use the Winter-Eichberg system, the British patents for which are owned by the Thomson-Houston Company; and a large amount of work for the Brighton road including all the switch gear, will be carried out in its factories at Rugby.

After the first few equipments the motors and control apparatus also will be manufactured at Rugby. The reason that the first equipments are to be made in Germany is not because of any lack of experience on the part of the British engineers, but because the equipments which it is proposed to use, being duplicates of those which have already been so successfully built by the Allgemeine Company, can be furnished at earlier dates than would otherwise be possible. Mr. Philip Dawson is the consulting engineer for the railway. The whole of the overhead construction work, a class of work which has not yet been seen in Great Britain, will be done by Robert W. Blackwell & Company, of London, and it is also understood that the cars will be manufactured by the Brush Electrical Engineering Company. It will therefore be seen that, after all, a very small portion (about $100,000) of the total amount of the work, which will amount to about $1,250,000, will be done out of Great Britain.

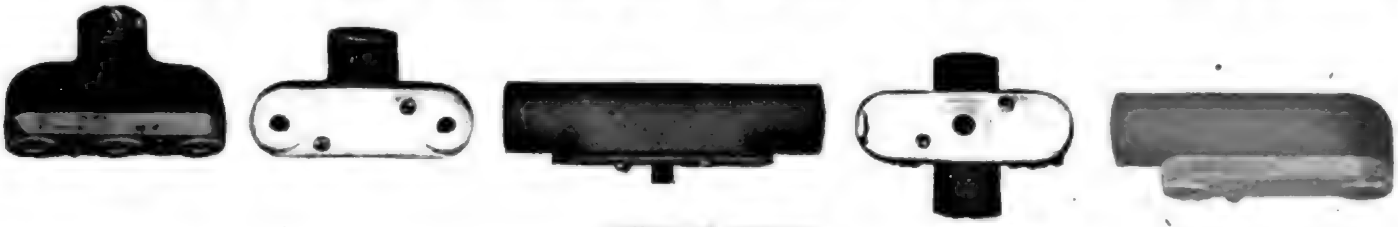
It is interesting to note this further success of the Thomson-Houston Company, as it has already carried out a very large amount of heavy traction work in England. Beginning with the Central London Railway, it has also furnished all the control equipments and motors for the Great Northern & City Railway, the North Eastern Railway, the District Railway, and has contracts for all the motors and control equipments for the various tube railways controlled by the Underground Electric Railways of London, Ltd., and also for the Great Western and Metropolitan Railway for the equipment of the Hammersmith, and certain other lines.

Rectifier Equipment for Garages.

An interesting example of mercury arc rectifier equipments for garages is furnished in the establishment just opened by the Cook & Stoddard Company, at Washington, D. C. The installation has been made by the General Electric Company, and is the largest of its kind. The building in which it has been placed has a ground area of about 10,000 square feet, one-third of which is devoted to electric automobiles. The plant comprises five sets as an initial installation.

Each of these five charging units consists of a 40-amp. mercury arc rectifier tube mounted upon a dull black slate panel with the necessary switches, instruments and fittings grouped neatly below. The combination of terminals is such that from one to ten vehicles can be charged at one time, each vehicle being equipped with from twelve to fourteen cells, having a normal maximum charging rate of 20 amp.. Any combination of vehicles having these limiting capacities may be charged simultaneously.

The rectifier tube is so mounted that the shake, necessary to start the tube in operation, can be easily given by a pull-button on the section below. On this lower section of the panel are also mounted the instruments and switches. Three instruments are provided, two voltmeters and one ammeter. One voltmeter, having a 30-volt scale, indicates the total direct-current voltage across the direct-current load while the other, a 75-volt instrument, measures the voltage across each set of batteries as they are charging. This is accomplished by means of a dial switch, the points of the switch being numbered to correspond with the charging plug terminals. The ammeter is so arranged that it will indicate the current in either of the two sets of charging terminals or in both, being provided with a flexible connector for this purpose which taps into suitable plug terminals which are so constructed that the circuit is not broken on the insertion or withdrawal of the plugs. They are arranged in two series of five each, these two sets of five being connected in multiple across the direct current terminals of the rectifier tube. It is therefore evident that one set of cells, requiring a maximum charging current of twenty amperes, may be plugged in, or any combination of plugs may be used, provided the total charging current does not exceed the maximum load (40 amp.) of the rectifier tube.


CONDULETS FITTINGS.

In this way it will be possible to charge from one to ten 12-cell carriages at one time by the simple process of plugging into the terminals and adjusting the voltage by the proper switches which control the alternating current supply. Moreover, as the plug terminals are designed, the operator can connect or disconnect any carriage at any time without breaking the circuit or stopping the charging of the remaining vehicles. The complete equipment of five units will thus permit the Cook & Stoddard Company to charge as many as fifty 12-cell electric automobiles at one time.

The Connecticut Spark Coil.

One of the most important details entering into the construction of a successful gasoline engine is the electrical sparking equipment. The success which has been met in the design of spark coil and appliances may be learned from the fact that a gas-driven automobile recently traveled more than 12,000 miles without requiring any change of adjustment of the electrical sparking equipments. This record was made with the Connecticut type of spark coil, a brief description of which is given below.

SPARK-COIL FOR 4-CYLINDER ENGINE.

The coils are constructed upon the unit system; each coil is in no way connected to its neighbor, there being one unit for each cylinder of the engine. The units are interchangeable and self-contained, and the disconnecting of wires and the use of tools are unnecessary in removing a unit. The vibrator, which is shown in the illustration herewith, is adjusted by simply turning the adjusting thumb screw, which is self-locking up or down as desired.

This spark coil is manufactured by the Connecticut Telephone & Electric Company, Meriden, Conn.

Condulets Fittings.

The line of conduit fittings shown in the accompany illustrations will appeal to all electrical men interested in the installation of conduit for surface interior wiring. These fittings have been designed to meet the requirements of the National Electrical Code, which state that wires for pressures not exceeding 300 volts must be rigidly supported on non-combustible, non-absorptive insulators, which will separate the wires from each other by 2.5 inches and from the surface wired over by ½ inch.

The appearance of these fittings will also appeal greatly to those desiring to install a neat and complete system of conduit wiring, and the many places where "condulets" can be used to advantage and where there is nothing else that will meet the requirements will be readily seen by those familiar with conduit construction. This line of fittings is being rapidly developed by the Crouse-Hines Company, Syracuse, N. Y.

Lamp Receptacle for Signs.

In the building of signs, the electrical contractor finds that he cannot confine himself to one style of receptacle. Where the use of a certain type would be advisable under some conditions, it would not be under others, and hence the demand now is for different syles of receptacles to meet different circumstances. In the building of signs faced with metal, or with metal letters, in which the receptacle must be mounted directly on the metal at the rear, the necessity of making the contact joints weather-proof has frequently arisen, and to meet this condition Pass & Seymour, Inc., of Solvay, N. Y., have placed on the market their receptacle illustrated herewith. It is provided with wings recessed over the terminals to receive a filling of weatherproof compound such as gas fitters' cement; and in this way the joints are entirely covered and made weatherproof. The recesses in the wings, which also serve as paths for the wires, hold the latter in a position that permits of a minimum strain at the terminals, and, in addition, they serve as guides in shaping the wires to conform to the contour of the letters.

SIGN LAMP RECEPTACLE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of trade for the year 1905 indicate that the year has been a record-breaker alike in agricultural, speculative, financial and industrial circles. As a whole, however, first place must be given to manufacturing industry, which shows largest gains over all preceding years. The outlook as to the future is full of promise and the advent of the new year is met with a confidence unsurpassed in recent years. Retail business was quiet by contrast after the unprecedented holiday activity, and the unseasonably mild weather affects trade in heavy wearing apparel. The weather conditions, however, favor outdoor industry, especially building, which is still very active. Manufacturing operations are likewise facilitated by uninterrupted passage of raw materials to centers of consumption. Staples generally are still strong. Iron and steel lead the industries in strength of demand and prices, finished steel being particularly active for this season. Prices for pig iron are high and imports of foreign iron ore are increasing. Sales of rails were large, 57,000 tons being reported sold at Chicago to Southwestern roads. Reports as to winter wheat are good, and the crop so far maintains a high condition. Unprecedented activity in building is reported from all parts of the country with a favorable outlook for 1906. Railway earnings continue satisfactory, figures thus far available for December showing an average gain of 6.9 per cent over 1904, and foreign commerce at the port of New York last week was remarkably favorable, exports gaining $2,063,129 and imports increasing $4,361,897, as compared with the corresponding week last year. The market for copper was dull at the close of the week. For immediate requirements the quotations are: Lake and electrolytic, 19¾ to 20c.; casting stock, 18⅝c. For January, February and March deliveries of large lots of Lake and electrolytic copper, quotations seem to be governed somewhat by the amount of stock which the larger electrical apparatus and brass working manufacturers hold in copper mining and refining works. The future quotations that are official in the domestic markets are: Lake and electrolytic, 18⅞c. for February and March delivery and 18¾c. for April and May. The high price of copper, as reflected in electric generators and line material, is causing the temporary indefinite postponement of many Southern and Western power transmission projects, which were incorporated early last year, with capital requirements based upon estimates of material at last year's prices. One important Southern project for transmitting electric drive power for cotton mills will be built this year as planned, but the increased cost for metal conductors and power house machinery will be $500,000 in excess of the original estimates for copper products. For a fifty-mile electric road to be built this year in southern New Jersey the present prices of copper products will cost the builders almost a million dollars more than was estimated two years ago. The General Electric Company is reported to have used in its product and plants last year some 60,000,000 pounds of copper. *Bradstreet's* reports 212 business failures during the week ending Dec. 28, against 235 the previous week, and 218 the corresponding week last year.

THE STAR ELECTRIC CO.—The officers of the Standard Electrical Manufacturing Company of Niles, Ohio, announce the organization of a new concern, the Star Electric Company, which will be located in Niles, Ohio. It is the intention to finance this company by the stockholders of the Standard Company. Mr. James P. Gilbert, who is secretary of the latter company, will occupy a like position with the new organization. Mr. H. H. Albert, sales manager of the Standard Company, will also occupy a like position with the Star Electric Company. It is the intention of the new firm to engage in the manufacture of dry batteries and fan motors. After spending several years in experimenting, Mr. Gilbert has perfected a dry battery which it is thought by those interested will soon command a leading position in the market. By the assemblage of special ingredients heretofore unused in work of this kind and by employing the celebrated Henrion carbon, a battery of exceptionally long life, high amperage and recuperative powers has been secured. It is expected that this battery will command a higher market price than the ordinary battery, but that it will also fill a long-felt want. It is intended to make two types, one for gas engines and automobiles and the other for telephone and bell work. Exhaustive tests have demonstrated the excellence of the battery. The fan motor line will consist of a regular type of direct-current motors. A swivel, a swivel and trunnion, and an oscillating fan in 12 in. and 16 in. sizes will be marketed. The company will shortly issue data setting forth the qualities of this apparatus. No efforts will be spared to attain a success as great as that which has attended the Standard Electrical Manufacturing Company in the manufacture and sale of Star lamps.

LUDLOW-STURGESS CONSOLIDATION.—A consolidation has been effected between the Ludlow Valve Mfg. Company, of Troy, N. Y., and the Sturgess Governor Engineering Company, of Watervliet, N. Y. The latter company's factory in Watervliet will be closed down, and it will occupy more commodious quarters in the newly built extensions of the Ludlow Valve Mfg. Company. The facilities and equipment will be greatly enlarged in order to meet the rapidly growing demand for its water wheel governors, relief valves and other specialties. The business will henceforward be carried on in the style of the Sturgess Engineering Department, Ludlow Valve Mfg. Company. No changes will be made in the management or personnel, and the work of this department will be maintained independently of the regular standard business of the Ludlow Valve Mfg. Company. Coincident with the above consolidation the Sturgess Engineering Department will introduce a new style of vertical water wheel governor, which will combine the points of merit of American and European practice. This governor is stated to be free from all the objections inherent in other forms of hydraulic governor.

STEADY COPPER YIELD.—A well-known copper authority is quoted as follows: "The theory that the percentage of copper grows less or runs into iron the deeper we go underground, is exploded by the Anaconda strike. The impression of some people has been that it would not be many years before the mines of the Butte copper camp could not produce copper at a profit. I have talked with certain Amalgamated people and there is no question that the Anaconda strike is important, and that the vein is unusually high in copper. This seems to set at rest the statement that the life of the property was limited. The strike means a great boom for the Butte district which, it seems, is destined to produce copper more rapidly in the future than in the past. They will be able to go 5,000 or 6,000 ft. underground, and the present generation need not worry about a possible falling off in production."

SINGLE-PHASE LOCOMOTIVE.—The Westinghouse Electric & Manufacturing Company has received from the Baldwin Locomotive Works the first of the 25 single-phase locomotives ordered by the New York, New Haven & Hartford Railroad last October, and Vice-president Osborne states that its equipment is far advanced. The locomotive will be ready to test about the end of January. The testing of the first two gearless motors will be conducted on lines adjacent to the works, in order to conform to the conditions which will prevail on the New York, New Haven & Hartford and the New York Central lines.

MARBLE FINISHING MOTORS.—The Westinghouse Electric & Manufacturing Company are finding an extensive field for their motor equipments in the marble finishing industry. They lately completed the equipment of a large marble yard in the South. The operation of this plant by means of electric drive has been eminently satisfactory, resulting in a marked increase in the product and a decrease in the operating cost. The electrification of the plant has further eliminated the many objectionable features of belting and shafting, so much in evidence under the old conditions.

NIAGARA CURRENT.—The Niagara Falls Hydraulic Power and Manufacturing Company has contracted to furnish the Pittsburg Reduction Company, manufacturer of aluminum, with 27,000-hp by January, 1907, the largest single contract for electric power ever made. The power is to be used to operate a new plant at Niagara Falls.

EQUIPMENT WANTED.—The Conway Light Plant, operated by the city, Mr. G. H. Burr, manager and electrical engineer, expects to install a new engine of 200 hp during next summer, and probably a 150 kw generator at the same time. Mr. Burr will be glad to receive communications on the subject.

CONDITIONS IN FRISCO.—The California Gas & Electric Corporation is again fairly well supplied with power water for its various generating plants. There is now a good deal of snow in the Sierras along some of the transmission lines. While the big gas engines at the reserve plant in Visitacion Valley near this city will not be ready for operation for a few weeks, a moderate amount of power will be supplied the United Railroads at the beginning of the twenty-year contract. The frequency changers are already in operation at the new plant and 2,000 kw and 60-cycle of power from the Electra water power plant, 147 miles distant, was supplied at 25 cycles to the Bryant Street sub-station of the United Railroads the last two weeks in December. There are two 1,000-kw General Electric rotary converters in use and three more are yet to be installed in this sub-station, current being transformed from 13,200 volts alternating current to 600 volts direct. It is understood that the North Beach steam power generating station of the United Railroads will not be dismantled but will be utilized as a reserve station by either the present owners or the California Gas & Electric Corporation after the new contract takes effect. The gas works which are to supply the three 5,000-hp gas engines now have a capacity of 4,000,000 cubic feet per day and will be increased to 8,000,000 cubic feet. Illuminating gas made from crude oil will be used, the oil having to be pumped only a short distance from vessels lying at the wharf.

PARSONS MARINE TURBINES.—We are advised by the Allis-Chalmers Company as follows, as to the marine turbine business in the United States: "The rights to build Parsons marine turbines in the United States are held only by the Allis-Chalmers Company of Milwaukee, Chicago, Cincinnati and Scranton, Wm. Cramp & Sons, Philadelphia; W. A. Fletcher Co., Hoboken, N. J.; The Quintard Iron Works, New York, and the Bath Iron Works, of Bath, Me. The Allis-Chalmers Company are not only licensees under the Parsons marine turbine patents, but they also hold the rights for manufacturing the Parsons turbine blowers and compressors, and have recently formed an alliance with the Hon. Chas. A. Parsons, the eminent turbine inventor, for a full co-operation and interchange of data on steam turbines for land operations. They are at the present time practically doubling their immense plant at West Allis, Milwaukee, Wis., the greater part of the new shops being intended for an extension of their steam turbine work and the electric generators to be driven by the same. They will, at their West Allis works, build marine steam turbines for the great lakes and for the Pacific Coast, and both there and at their Scranton works will build marine turbines for the Atlantic trade."

SINGLE PHASE TO NEWARK, N. J.—It is said that the various plans for a high-speed electric line between this city and Newark have been narrowed down to a single project in which the Pennsylvania Railroad Company will be the leading factor. All the other projects, it is said, are to be abandoned. According to a report which had its origin in Philadelphia the road will run from Park Place, Newark, to Jersey City, passing through the McAdoo tunnels under the North River to Manhattan. The road will connect with the Subway and surface lines and with the Pennsylvania line to Long Island. The proposed system has, it is said, the backing of the Pennsylvania Railroad, the Public Service Corporation and the Belmont and McAdoo tunnel syndicates.

WIRELESS SERVICE.—The Atlantic De Forest Wireless Company has consummated arrangements with the J. M. Guffey Petroleum Company for the installation of the De Forest wireless system on its steamers and barges, plying between New York, Boston and Texas. The steamer *Lorimer* will leave New York Saturday with the wireless apparatus on board and same will be installed en route. The steamer *J. M. Guffey* is to be equipped on her arrival in New York. The New York & Porto Rico Company's new steamer *City of Savannah* left New York, Saturday, December 30, equipped with the De Forest system.

NEW YORK EDISON ORDER.—The New York Edison Company have just placed orders for a large amount of apparatus, inclusive of over 27,000 kw capacity in rotary converters and motor generator sets, with static transformers and auxiliary apparatus, with the Westinghouse Electric & Manufacturing Company. About the same time they closed also a large contract with the General Electric Company for lead covered paper cable and switchboard apparatus for the new No. 2 Waterside station on the East River.

ELEVATOR MOTORS.—The Westinghouse Electric & Manufacturing Company has recently renewed an annual contract covering the requirements of the Moline Elevator Company, Moline, Ill., so far as their motor needs are concerned. The renewing of this contract is due to the performance of Westinghouse elevator motors under the most trying conditions, their design and construction rendering them peculiarly adapted to the requirements of the severest elevator work.

OUTFIT OF WIRE.—It is noted that the demand for iron and steel wire products continues brisk, and the only drawback is a scarcity of steel, particularly basic. The American Steel & Wire Company has been forced to suspend operations in certain departments owing to its inability to secure steel. A big demand for wire products exists in the East, and the demand for export shows no signs of a falling off. An advance in prices is expected in January.

SUPPLIES FOR THE NAVY.—Bids will be received until Jan. 16 at the Bureau of Supplies and Accounts, Navy Department, Washington, to furnish at the navy yards at New York, League Island, Pa., Annapolis, Md., Washington, D. C., and Norfolk, Va., naval supplies as follows: Arc lamps, incandescent lamps, panel board, conduit cable, electrical supplies, electric hoist, etc. Address H. T. B. Harris, Paymaster-General, U. S. N.

TROLLEY BRIDGES.—President T. D. Rhodes, of the City & County Contract Company, states that the construction company building the New York, Westchester & Boston Railway has let contracts to the Terry & Tench Company for about 4,000 tons of bridges for the Westchester road within the limits of the Bronx. The work is to be begun at once.

JONES & COMPANY, the electrical contractors, of 547 Washington Street, Portland, Ore., have bought out the interest of Mr. H. Jones in the partnership, and he will have no further connection with the concern. The members of the firm who will carry on the business are Messrs. G. H. Lathrop and A. W. Parks.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call ranged from 5 to 100 per cent in the market. Stock market borrowers were obliged to pay anywhere from 30 to 60 per cent for funds with which to carry stocks. The behavior of the loan market is, of course, explained by the low state of the New York bank reserves, and it is noteworthy that no such violent fluctuations have been seen in other cities as have happened before in times of financial stress. The situation is, to some extent, complicated by the fact that both cotton and grain are being held back from the market, and the inability of the railways to transport the agricultural yield to market with sufficient dispatch furnishes some reason for the retarded return flow of funds from the West and South to New York. In some quarters, however, there is a disposition to attribute the behavior of the money market to manipulation. The stringency of money only temporarily checked the bullish tendency of the stock market. A moderate decline in the middle of the week, due to this cause, was arrested and stock values in many cases were advanced by manipulative pools, the features being Amalgamated and other copper stocks, United States Steel shares, New York Central and certain specialties, both railways and industrials. The announcement of the deal whereby the Metropolitan Street Railway is to be absorbed by the subway organization through a new holding com-

NEW YORK

	Dec. 28	Jan. 2		Dec. 28	Jan. 2
Allis-Chalmers Co.	21¾	22¼	General Electric	177	177¾
Allis-Chalmers Co. pfd.	61	61½	Hudson River Tel.	..	
American Dist. Tel.	37	37	Interborough Rap. Tran.	[illegible]	231
American Locomotive	70¼	72¼	Mackay Cos.	56¼	[illegible]
American Locomotive pfd.	117⅝	118	Mackay Cos. pfd.	73¼	73¾
American Tel. & Cable	80	80	Marconi Tel.	..	
American Tel. & Tel.	130¼	136	Metropolitan St. Ry.	120¼	120¾
Brooklyn Rapid Transit	89	89⅜	N. Y. & N. J. Tel.	..	.
Electric Boat	28	28	Western Union Tel.	[illegible]	
Electric Boat pfd.	70	70	Westinghouse com.	172	172
Electric Vehicle	15	15	Westinghouse pfd.	.	..
Electric Vehicle pfd.	20	20			

BOSTON

	Dec 28	Jan. 2		Dec 28	Jan. 2
American Tel. & Tel.	140	137½	Mass. Elec. Ry. pfd.	59	
Cumberland Telephone	..	...	Mexican Telephone	3¼	.
Edison Elec. Illum.	240		New England Telephone	131¼	132
General Electric		.	Western Tel. & Tel.		12
Mass. Elec. Ry.	15	17¾	Western Tel. & Tel. pfd.	91¼	91¾

PHILADELPHIA

	Dec. 28	Jan. 2		Dec. 28	Jan. 2
American Railways	52	52	Phila. Electric	9⅝	9⅝
Elec. Co. of America	11	11¼	Phila. Rapid Trans.	31	30¾
Elec. Storage Battery	80	80¼	Phila. Traction	.	...
Elec. Storage Battery pfd.	..	.			

CHICAGO

	Dec. 28	Jan. 2		Dec. 28	Jan. 2
Chicago City Ry.	107	107¼	National Carbon	78	80
Chicago Edison	.		National Carbon pfd.	116¾	117
Chicago Subway	..	.	Union Traction	..	..
Chicago Tel. Co.	..		Union Traction pfd.	.	...
Metropolitan Elev. com.	26¾	27			

pany caused a moderate decline in the traction group after the terms were made public. Of Metropolitan Street Railway, 123,400 shares were sold during the week at prices ranging between 123½ and 127¾, ex-div., the closing quotations being 125, which is a decline of 1. Interborough Rapid Transit fluctuated between 228, the lowest, and 239, the highest, and closed at 235¼, a loss of 1¾ points. Brooklyn Rapid Transit was moderately active at prices between 86⅛ and 90⅜, the closing quotation being 88⅝—a drop of ½-point. There was little business done in electric securities and the market for them was devoid of feature. Allis-Chalmers common closed at 22¼, a net advance of ¼-point, and preferred at 61⅝, a net loss of ⅜. General Electric's closing quotation—177—was a fractional gain over that of the previous week, but a loss of 6 points is recorded against Westinghouse common and 2½ points in preferred. Western Union scored a gain of 1⅝, closing at 93⅜, and American Telephone & Telegraph advanced 2½ points, closing at 140. American Locomotive common closed at 75⅞ and preferred at 117, ex-div., these quotations being advances of 6⅞ and 2⅛ points, respectively. The curb market, on the main, followed the lead of the Stock Exchange market, with early recessions, followed by an all-round rally. The copper group again led, United Copper being the active issue. The closing quotations on the Stock Exchange on Jan. 2 were as given in the table on the preceding page.

TRACTION MERGER FINANCE.—The directors of the Metropolitan Securities Company have issued a call of $25 a share on the company's stock, payable on or before January 30. So far, 50 per cent has been paid, and this additional call will make the stock 75 per cent paid. This step is taken in accordance with the plan for the consolidation of the Metropolitan Securities Company and the Metropolitan Street Railway Company with the Interborough Rapid Transit Company. The payment is to be made at the Morton Trust Company. As a result of its guarantee of 7 per cent dividends on the stock of the Metropolitan Street Railway Company, the Metropolitan Securities Company has run up a large debt in its profit and loss account. The call for $25 a share, it is understood, is for the purpose of settling this account in anticipation of the merger of the two traction systems. Counsel for the Metropolitan and Interborough interests are still at work on the details of the merger. They are engaged at present in the preparation of the necessary legal papers. It was said recently that this work will probably be completed early this month.

CENTRAL MASSACHUSETTS ELECTRIC.—The stockholders of the Central Massachusetts Electric Company at their annual meeting received the following report showing total income of $42,480 as compared with $46,235 in 1904. The net was $1,450 as compared with $8,397. The balance sheet follows:

Assets—		
Land, water-power and buildings	$120,227.68	$120,227.68
Machinery steam and electric	74,867.72	74,806.00
Street lines and wires	128,018.78	125,944.95
Cash and accounts receivable	20,261.87	12,659.63
Manufactures material, etc.	8,434.62	4,546.78
Franchise	30,000.00	30,000.00
Total	$387,830.67	$374,187.04
Liabilities		
Capital stock	$150,000.00	$150,000.00
Bonds	150,000.00	150,000.00
Notes payable	61,000.00	40,720.77
Accounts payable	5,599.14	6,143.16
Accrued taxes and interest	1,550.75	4,193.10
Profit and loss	18,680.78	14,130.01
Total	$387,830.67	$374,187.04

RANGE OF PRICES.—The year 1905 was an extraordinary one in many respects as to industrial and electrical development. The ups and downs of the stock market were extreme and surprising, and it would exceed the ability of any expert to explain them in all their details and vicissitudes. For example, the highest point of the American Telephone & Telegraph Company was 147, but it closed the year at 140. The highest point of General Electric was 192, but it closed at 177. The highest point of Allis-Chalmers was 68 and it closed at 61⅝. The highest of Westinghouse Electric preferred was 197 and it closed at 187½. The highest of Western Union Telegraph was 95½ and it closed at 93¾. These are typical electrical securities, and the range indicated would show that there is no undue expansion or inflation, and that 1906 might easily see every one of these low quotations forgotten and every one of the high points made firmly good.

DIVIDENDS.—The directors of the New York & New Jersey Telephone Company have declared the regular quarterly dividend of 1½ per cent and 1 per cent extra. Directors of the United Traction Company of Pittsburg have declared a dividend of 2½ per cent on the preferred stock, payable, January 20. The Philadelphia Company directors have declared the regular quarterly dividend of 1½ per cent on the common stock, payable February 1. Directors of the Garvin Machine Company have declared the usual dividend of 3½ per cent on the preferred stock, payable January 1. Directors of the E. W. Bliss Company have declared the regular quarterly dividends of 2½ per cent on the common stock and 2 per cent on the preferred stock, payable January 2. The directors of the Hudson River Telephone Company have declared a regular quarterly dividend of 1½ per cent, payable January 15, 1906.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company reports for November and 11 months, as follows:

	1905.	1904.		Changes.
November gross	$426,305	$362,043	Inc.	$64,262
Expenses	246,593	209,581	Inc.	37,012
November net	$179,712	$157,462	Inc.	$27,250
Charges and taxes	30,673	25,821	Inc.	4,852
November surplus	$149,039	$126,641	Inc.	$22,398
Eleven months gross	$4,222,761	$3,654,356	Inc.	$568,405
Expenses	2,587,207	2,177,217	Inc.	409,990
Eleven months net	$1,635,554	$1,477,139	Inc.	$158,415
Charges	264,284	240,733	Inc.	$23,551
Eleven months' surplus	$1,371,270	$1,236,406	Inc.	$134,864

BELL TELEPHONE OF BUFFALO.—The Bell Telephone Company of Buffalo has decided to increase its outstanding stock to the extent of $1,210,000. The new stock will be issued to stockholders at par in the proportion of one share for every five shares of their present holdings. The right to subscribe for this new stock expires on January 20, 1906. Payment for stock subscribed for is to be made on February 20, 1906. The company has 43,812 stations as compared with 36,611 in 1904 and for eleven months shows a gross of $1,279,136, as compared with $1,239,212 for the whole of 1904. The present stock outstanding is $6,050,000, which is more than represented in the plant and real estate.

NATIONAL LEAD STOCK.—The offering of $3,000,000 in the new preferred stock of the National Lead Company for subscription is regarded as part of the plan for the purchase of the United Lead Company. This stock, which is offered to stockholders of record at par in the proportion of one share for every ten of their holdings, is part of an issue of $10,000,000 common and $10,000,000 preferred authorized last June. The $3,000,000 cash obtained by the sale of the stock will be used as additional working capital. There will remain in the treasury available for the purchase of the United Lead Company, $7,000,000 more of the preferred stock and $10,000,000 in common stock.

MEXICAN POWER & LIGHT.—The second annual general meeting of the Mexican Power & Light Company showed that the company was now delivering power from its big electrical plant at Necaxa into the City of Mexico. The report of the general manager stated that the demand for power in Mexico would always be in excess of the company's supply. The old board of directors was re-elected with James Ross, president; J. H. Plummer, F. S. Pearson, New York, and F. L. Wanklyn, vice-president. The plant at Necaxa and in the City of Mexico was recently described and illustrated in these pages.

MICHIGAN TROLLEY SYSTEM.—It is announced that a syndicate composed of James R. Elliott, of Lansing, Mich., and Myron W. Mills and George T. Moore, of Port Huron, has acquired a controlling interest in the Battle Creek-Kalamazoo Interurban Trolley Line, as well as in the lines in Battle Creek and Kalamazoo City. This gives the syndicate control of 103 miles of city and interurban lines in the interior of the State. The lines now connected by a number of projected extensions are to be reorganized as the Michigan United Railways Company. Lansing will be the center of the new system.

B. R. T.—The earnings of Brooklyn Rapid Transit show a gain in five months in the net of $730,000 and $720,000 in the surplus. The lighting and power business in Brooklyn has also been very good during the fall and Christmas season.

KINGS COUNTY STOCK.—The New York State Lighting Commission has approved of the increase of the capital stock of the Kings County Electric Light & Power Company from $5,000,000 to $8,200,000.

CHICAGO EDISON is growing very rapidly, and it is reported that an early addition of 15 per cent to the present capital stock will be made for extensions and improvements.

General News.

SAN FRANCISCO, CAL.—The negotiations for the purchase of the Mutual Electric Light Company by the consolidation to be known as the Pacific Gas & Electric Company have not been successful, there being a strong element in the smaller company that is disposed to hold out for $30 more a share instead of the $20 offered.

LOS ANGELES, CAL.—The Pacific Light & Power Company has awarded the Allis-Chalmers Company the complete contract for its Rodondo steam-driven electric plant, which is to be constructed from the foundations up and turned over ready to run, the price being $[illegible]00,000. There will be two twin vertical-horizontal cross-compound Reynolds-Corliss engines, of the Manhattan type, direct-connected to two Bullock 5000-kw, three-phase, 16,500-volt, 50-cycle generators of the fly-wheel type. Stirling water-tube boilers aggregating 10,000 hp., a salt-water condensing system, and all the latest steam refinements will be included. Fuel oil will be supplied to storage tanks by a short pipe line from steamers. Electric power will be furnished to the sub-stations of the extensive Huntington system for lighting and railway purposes.

SAN FRANCISCO, CAL.—A contract has been made between the California Gas & Electric Corporation and the Northern California Power Company providing for the purchase by the corporation of all the surplus power which the power company may have up to 5000 hp. The contract provides for the construction by the power company of a 66,000-volt line from its Volta power house, near Shingletown, to Chico, some 70 miles in length, at which point delivery of power will be made to the corporation. Although the country served by the power company is developing a good market for electric power, which is rapidly increasing, the plants of this company can supply a considerable amount of power in excess of the present demand in its immediate territory. The inauguration of new enterprises of various kinds will, without doubt, before long cause a demand for all of this power, but in the meantime a source of income is being lost. The territory covered by the California Gas & Electric Corporation is so large and its industries so varied that the power market has developed very rapidly, so rapidly that even the large productive power of that corporation have been taxed to the utmost, and new plants are now being built to provide for the increasing demand for power in that territory.

ROCKVILLE, CONN.—There is a probability of the utilization of the Rockville and the Stafford Springs electric light plants to provide both day and evening service. The plan is to have the plant at Stafford Springs provide the day service for both places, as there is an excellent water power available there for that service, and the Rockville plant for both during the night. Orders have been placed for new equipment to improve the latter plant, and it is believed that the double service will be inaugurated before long.

STREATOR, ILL.—The Illinois Light & Traction Company has voted to increase its capital stock from $400,000 to $1,500,000.

EAST ST. LOUIS, ILL.—At the Council meeting, held December 26, the Mayor was authorized to have an ordinance drawn up annulling the franchise of the Illinois Illuminating Company. This company was granted a franchise over the streets two years ago, and has tried to hold the privilege by keeping five arc lamps lighted in various parts of the city.

CHICAGO, ILL.—Mayor Dunne, in forcing his fight for a reduction in the price of electric light and power, has detailed City Electrician Carroll to collect information regarding the selling price of electric light in other cities, and also the cost of production and distribution. He will also investigate the cost of the erection of a plant and the installation of equipment.

NEW ORLEANS, LA.—The Board of Trade has had in hand an investigation of the subject of deficient electric wiring, and will make a report on the subject soon, with recommendations as to supervision and control.

LACONIA, ME.—The work of wiring the Pepperell and Laconia mills for electric illumination in place of gas, which has been used for many years, is well on towards completion, and soon the entire plant of the big Pepperell concern will be lit up by hundreds of incandescents. The wiring in the Pepperell division has been completed and the crew of the York Light and Heat Company, which will furnish the electricity, is now at work in the Laconia division.

LEOMINSTER, MASS.—The switchboard for the Leominster Electric Light & Power Company has arrived and an electrician from the Fort Wayne Electric Company, Fort Wayne, Ind., is erecting it.

WEST MEDWAY, MASS.—The electric light company has practically completed its work of construction. Many of the back streets which have never had the benefit of lights are now brilliantly illuminated.

BOSTON, MASS.—At the final meeting of the City Council for 1905 the order to refer to the people the question of whether or not the city should own its own electric lighting plant was rejected by a vote of 42 to 10.

NORTH BROOKFIELD, MASS.—The electric light plant recently installed in the factory of the Indian Orchard Flax Company has been put in operation, and it is probable that the service will be extended to several private residences.

WARE, MASS.—The Ware Electric Light Company is running its plant night and day for one week in order to determine the cost of a 24-hour service as compared with a night schedule only, and to get some idea of the business necessary to support a continuous service.

WORCESTER, MASS.—One of the problems which will confront the new City Council during the year 1906 will be the question as to whether the city shall continue to pay $22,000 a year to the Worcester Electric Light Company as is done now for the lighting service.

MARLBORO, MASS.—On and after January 1 the machinery at the power station of the Marlboro Electric Company will run 24 hours per day. Notices to this effect will soon be transmitted to customers. Since October 10 the company has found it necessary to operate its equipment continuously.

SUNDERLAND, MASS.—The Sunderland Electric Light Company has made arrangements to purchase power of the Amherst Gas Company, of Amherst. The Sunderland Company has been in operation for a year and now finds it more economical to procure current from Amherst than to maintain its own generating plant.

WEST SPRINGFIELD, MASS.—The citizens at a recent town meeting voted not to make a new five-year contract with the United Electric Company for street lighting, and as the matter now stands lights will be furnished under the terms of the three-year contract, which was renewed last year with the understanding that the same rates could continue if the town so chose until December, 1906.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company has announced that a discount of 10 per cent is to be allowed to subscribers who have monthly bills of $1.50 or over, beginning with bills for December service, if bills are paid before the 10th of the following month. The rent of meter, which has been 41 cents per month, will only be charged where the bills are under $1.50 per month.

STONEHAM, MASS.—The People's Gas & Electric Company, of which M. A. McElroy is treasurer, has filed its certificate showing the following statement for the year 1905:

Real estate	$5,000	Capital stock	$10,000
Cash and debts receivable	1,772	Debts	2,186
Manufactures and merch.	3,205		
Profit and loss	2,209		
Total	$12,186	Total	$12,186

HAVERHILL, MASS.—Superintendent of Street Lights Moore has submitted his annual report to the city council, the report covering the year ending Nov. 30. The report shows that the street lighting department cost $35,079.28 for the year. There are at present 203 arc lights in the city, 252 naphtha lights and 228 gas lights. The electric lights cost the city $20,657.99, the gas lights $4,103.74, and the naphtha lights $8,798.55. During the 12 months ending Nov. 30, four new arc lights were added, five new naphtha lights and three new gas lights.

MINNEAPOLIS, MINN.—In investigating the proposition of establishing a municipal lighting plant at the old pumping stations, the City Engineer has found that the city really owns or controls nine mill-powers, and thereby controls enough water power to operate 540 arc lights and many more incandescent lights. Three of the mill-powers belong to the East Side station and six to the West Side station.

BOWLING GREEN, MO.—The Pike County Electric Light & Power Company has increased its capital stock from $7,400 to $10,000.

LONG ISLAND CITY, N. Y.—Comptroller Grout has paid to the New York & Queens Electric Light & Power Company half of its claim against the city for light supplied in Queens borough in 1903 and 1904. The amount paid was $167,888 to the Queens Company and on the same terms $16,242 was paid to the Bronx Illuminating Company. The New York City lighting companies have been treated with equal indifference and injustice.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has completed the construction of the new headgates which have been under way the past five months. This improvement has been made at an expenditure of nearly $50,000, but renders possible an almost absolute control of the water flow above the generating plant. Each gate, of which there are nine, is a massive steel dam in itself, and is raised or lowered by means of a windlass which runs over a track laid at the top of the headworks.

SYRACUSE, N. Y.—The assessments committee of the Common Council has decided to report favorably upon the petitions of the Syracuse Electric Light and Power Company and the Syracuse Gas Company for the remission of a portion of the franchise taxes paid during the last five years. The amount to be remitted is about $13,000, including interest. The courts decided some months ago that these corporations, like others, were entitled to a 15 per cent reduction because they were assessed at 100 per cent on franchises, while other properties were assessed at about 85 per cent.

ROCHESTER, N. Y.—There is a dispute over the lighting contract for the twenty-first ward, which comprises the village of Brighton annexed to the city last spring. The village Board previous to the annexation having let a contract to the Eastern Monroe Lighting Company to light the village for five years beginning January 1, 1906, at which time the village's old contract with the Rochester Gas & Electric Company expired, a franchise was granted to the former company to supply electricity for heat, light and power purposes. The Rochester Company, however, claims that its contract with Brighton does not expire until July 25, 1907. The matter will probable be brought before the courts.

SPRINGFIELD, OHIO.—The committee on lighting streets shows an appropriation of $70,000, receipts of $348 and a balance of $680. Forty-two arc lights have been installed and four discontinued. Twenty series incandescent lights have been installed. The department now has 987 arc and 63 series incandescent lights. Of the arc lights, 100 are fed from the underground service. The department has bought a Knox automobile, which has covered a total distance of 2513 miles since its purchase. Appropriations and receipts have increased since 1897 from $53,003 to $70,340. The report gives a list of the new arc lights installed and an inventory of the property and stock in the hands of the committee.

ASHLAND, ORE.—The Ashland Electric Light & Power Company, which supplies Ashland with light and which is owned by California capitalists, has made a proposal to dispose of its entire holdings to the city, including franchise, poles, lines, machinery, etc., for a sum approximating $65,000, and has given the city a 15-day option to accept or reject.

ELIZABETHTON, TENN.—The Elizabethton Lighting & Power Company has applied to the secretary of state for permission to increase its capital stock, and to change its name to the Doe River Lighting & Power Company.

READSBORO, VT.—A plant is being installed here by the Berkshire Electric Company, of North Adams, Mass., which will furnish current for lighting the streets, stores and some of the residences of the town. The plant will be operated by a gasoline engine.

RITZVILLE, WASH.—Philip Rowe, of Seattle, has completed a deal for the purchase of the Ritzville Electric Light & Power Company's plant for Seattle capitalists, the consideration being $50,000. Contracts have been placed with the Hallidie Machinery Company, of Seattle, for a complete steam power plant, embracing the most modern apparatus, for electric lighting purposes. It is designed to double the present capacity of the plant, and then enlarge it in accordance with the growth of the town. Contracts for a new brick power house were let in Ritzville.

MONTREAL, QUE.—From the shareholders' standpoint, the recent meeting of the Mexican Light & Power Company in this city was a very satisfactory one. Mr. F. L. Wanklyn, the vice-president, was enthusiastic over the success of the electrical plant at Necaxa and gave the shareholders present all the information he could concerning the operations of the company. He explained that the new plant has been subjected to the severest tests, which terminated satisfactorily. While only one unit is now in operation, two additional units of 6,000 hp each will in all probability be running by February 1. The entire board of directors was re-elected, with Mr. James Ross as president, F. L. Wanklyn, J. H. Plummer and F. S. Pearson, vice-presidents.

THREE RIVERS, QUE.—An important deal has been concluded in this city, by which the North Shore Power Company has sold its electric power plant and privileges to the Shawinigan Power Company. The consideration for this valuable franchise is $300,000. The North Shore Company has been in operation for many years and furnishes all the electric light used by the city and power is also furnished to manufacturers. The power house is situated on the Batiscan River, 18 miles from the city. The city gave this company exclusive right for twenty years to furnish electric light and power to Three Rivers. Ten years of this franchise have expired. The Shawinigan Company will bring its power from the plant at Shawinigan Falls, about 21 miles distant.

Construction News.

ENSLEY, ALA.—The Birmingham Railway, Light & Power Company has purchased a site and will erect a new station here.

PRESCOTT, ARK.—The Prescott Power & Light Company has sustained a heavy fire loss, but the exact extent of the damage has not been ascertained as yet.

FORREST CITY, ARK.—At the plant of the Forrest City Ice & Power Company the foundation has been laid for a new 100-hp boiler, and additional machinery will also be installed. The plant will probably be enlarged materially during the coming year.

as the Globe Electric Light & Gas Company. It will have $200,000 capital.

GLOBE, ARIZ.—A new corporation has been formed by N. L. Amster, of Boston; J. N. Porter, president, and S. F. Sullenberger, cashier, of First National Bank, and N. C. Cottee and D. James, the latter two being the present owners of the electric light plant, which proposes to manufacture gas and increase the capacity of the present plant. Mr. Amster is president of the new company, which is called the Globe Electric Light & Gas Company.

ESCONDIDO, CAL.—The Council has granted a franchise to Hugh T. Duff to operate an electric plant.

CRANE VALLEY, CAL.—It is expected that the large power plant which is being constructed at this point by the San Joaquin Power Company will be ready to furnish electric power by February 15. A. G. Wishon is manager of the company. The power will be principally utilized for irrigation purposes.

LOS ANGELES, CAL.—Plans are under consideration for the erection of an electric plant at Needles. An electrical engineer named Monteverde has been engaged on the project. The plant is to be operated by steam power. Oil will be shipped from Bakersfield or Los Angeles, and it is said that the Santa Fe has agreed to deliver it for $1 a barrel.

MARYSVILLE, CAL.—The Marysville-Nevada Development Company, composed of prominent men of Yuba, Nevada County, San Francisco, San Jose and Sacramento, has surveyors in the field running lines for a large canal from the "Narrows" of the Yuba River to a point 15 miles distant. In connection with this scheme a power plant and dam will be built.

YREKA, CAL.—The Siskiyou Electric Power Company has completed the purchase of 1,500 acres of land, securing the riparian rights at the Horseshoe Bend, on the Klamath River, 12 miles above Klamathon, on the Southern Pacific Railroad. A survey of the ditch line has just been completed, with the result that there will be secured 142 ft. fall with 100,000 ins. of water, which will develop some 10,000 additional horse power.

LOS ANGELES, CAL.—H. E. Huntington will invest $3,500,000 in electric power plants. This will include the $800,000 plant at Redondo, which will go up at once. Two others will follow at different places on the coast, one of which will probably be at Long Beach. The three plants will give approximately 50,000 horse-power, almost doubling what Mr. Huntington has at his disposal now in his various plants in this city, at Kern River and the San Gabriel.

NEVADA CITY, CAL.—The South Yuba Water Company, which is a subsidiary corporation of the California Gas & Electric Corporation, has made arrangements to install immediately a new electric power plant on Deer Creek, which will take the water from the big tunnel in the You Bet ditch to a point near the old Cooper sawmill, where the water can be used under a pressure of 600 feet and a large amount of electric power generated. The company has arranged to purchase the timber lands formerly known as the F. & H. L. Cooper property of 800 acres for a power site and rights of way. All of the water used at the mines of Nevada City and Grass Valley will first be used for electric power at this new plant, as well as a portion at the Rome power house.

PAONIA, COL.—It is reported that the citizens propose establishing an electric light plant.

FORT COLLINS, COL.—The City Council has passed an ordinance granting permission to the Citizens' Electric Light, Power & Manufacturing Company, represented by J. W. Gillespie, of Denver, to construct a plant here and do a general electric business.

TORRINGTON, CONN.—The Torrington Electric Light Company is planning to make sundry additions to its plant on East Branch Street.

GROTON, CONN.—Work has been commenced on the foundation of the two buildings for the new power house and boiler house to be constructed on the borough property on the river front.

WEST CANAAN, CONN.—The Berkshire Power Company has been putting in a larger transformer. Ives & Peirce and C. H. Pease expect to put in electric motors.

DANBURY, CONN.—The Danbury and Bethel Gas and Electric Light Company is installing 17 electric motors in the new factory of the Peck Fur Company. Fourteen of these motors are now in place, and besides the other three which are to be set up immediately, there will be two more, and possibly four, a little later. Each large machine in the factory will be run by a separate motor, direct connected.

SUFFIELD, CONN.—The Consolidated Railways Company has under consideration the advisability of changing the power house of the village water company at Suffield from a complete generating plant to a substation. The proposed change involves a high-tension line from the power house of the Springfield Street Railway Company to the Suffield Company's power house, the elimination of the steam-generating facilities and engines of the Suffield plant and the installation of a rotary converter at the Suffield end.

EDGEWOOD, GA.—The authorities are considering the feasibility of floating $15,000 worth of bonds for municipal lighting purposes. It is the intention of the town to build an independent lighting plant.

SANDPOINT, IDAHO.—D. W. Cassedy, of Spokane, Wash., is about to petition the City Council for an electric light franchise and also for a franchise for a water system for Sandpoint. It is also reported that T. J. Humbird of the Humbird Lumber Co., of Sandpoint, is about to petition the city council for an electric light franchise.

MACOMB, ILL.—A committee of three has been appointed to confer in the matter of building and installing a lighting plant for the city.

COFFEEN, ILL.—C. F. Edwards will present to the village board at its next meeting a petition asking for a 20-year electric light franchise.

CHICAGO, ILL.—The Citizens' Gas & Electric Company, of Chicago, has been incorporated with a capital stock of $800,000, to acquire gas and electric light plants and to furnish heat, light and power from same to corporations and municipalities.

CHAMPAIGN, ILL.—Articles of incorporation have been filed by the Edwardsville Light & Power Company, with a capital of $5,000. George Mattis is among those interested in the company, which purposes establishing a plant for light, heat and power.

MOLINE, ILL.—A rumor arising from the construction of the ditch and dyke along Rock River is to the effect that the reported purchasing of farmland is for the purpose of securing a site for the erection of a power plant which shall furnish power for operating an interurban system in this vicinity.

ARCADIA, IND.—John Allen Shunk has been granted a franchise for the establishment of an electric light plant here.

WALKERTON, IND.—At a recent election held in this town it was voted to construct and install an electric light and power plant. Bids will be asked as soon as the plans are approved. The Town Clerk has the matter in hand.

AURORA, IND.—The Indiana Public Service Company has been incorporated to build and operate an electric light and water works plant in Aurora. The capital stock is $200,000. The directors are O. M. Hubbard, D. J. Hauss, R. W. Nelson and F. B. Shults.

LOGANSPORT, IND.—The Andrews town council has granted a 25-year franchise to the Andrews Light & Water Company for the construction and operation of an electric line from the middle of that village to the station on the Fort Wayne Valley Traction Line across the Wabash River.

ATOKA, I. T.—The capacity of the local electric light plant is to be increased, which will necessitate the installation of new machinery.

TAHLEQUAH, IND. TER.—The Tahlequah Light & Power Company has been incorporated with a capital of $30,000. The incorporators are: R. E. Cook, J. H. Dill and C. W. Turner.

WELEETKA, I. T.—The plant of the Weleetka Electric Light & Power Company has been destroyed by fire, entailing a loss of $30,000. Preparations are being made for rebuilding the plant at once.

ANADARKO, I. T.—The council is considering the proposition of issuing $5,000 bonds to extend and improve the present electric light system. The question will probably be submitted to a vote of the people for decision.

COUNCIL BLUFFS, IA.—C. S. Scburigg, in charge of the Omaha office of the Nebraska Electric Company is negotiating for a franchise to install a lighting system in Council Bluffs.

KEOKUK, IA.—Plans for the proposed water power dam, lock and dry lock have been submitted to River Engineers Col. C. S. Riche, of Rock Island, and Maj. M. Meigs, of this city. If they approve the plans, they will then be placed before the War Department for final approval.

HAYS CITY, KAN.—The Hays City Electric Light Company has been incorporated with a capital stock of $12,000.

BELLEVILLE, KAN.—It is probable that a municipal electric lighting plant will be installed here at a cost of about $20,000.

LOUISVILLE, KY.—City officials are making a thorough investigation of the lighting system. Without the semblance of a contract, the city pays the Louisville Gas Company $84 a year for each of its arc lights, numbering from 1,888 to 1,900 and amounting in all to over $150,000 annually. A. E. Richards, City Attorney, has been assigned to an investigation of a contract and to draw up plans for the lighting system next year.

DEXTER, ME.—N. Curtis Fletcher is planning to erect a new plant for furnishing this village with lights.

DEXTER, ME.—The Dexter Electric Company has completed the purchase of a site for a new power plant. A spur track can easily be built so as to deliver coal in the bunkers to be erected in connection with the power house.

FORT FAIRFIELD, ME.—The proposition of utilizing the power at the Aroostook Falls, to be developed by the Maine & New Brunswick Electrical Power Company, was discussed at a recent citizens meeting of the Board of Trade.

PATTEN, ME.—The members of the Patten Hotel Company, Messrs. Carpenter, Quincy, Curan, Smith and Kellogg, have decided to erect an electric lighting plant to furnish lights for the Patten House, and their own private residences in the village.

DEXTER, ME.—A committee has been appointed to investigate the electrical situation and determine what would be best, to purchase power or establish a plant for furnishing electric lights. The committee comprises F. J. Gerry, Edwin Bunker, W. L. Fay, L. W. Jose and A. J. Cobb.

PRESQUE ISLE, ME.—The prospect of the early success of the scheme for the development of the Aroostook Falls water power is every day growing brighter. More than $10,000 has been subscribed to the stock of this enterprise. The chances are that but little difficulty will be met with in getting the desired subscription, the limit of which is but $50,000.

BREWER, ME.—A hearing will be granted the Bodwell Water Power Company by the Brewer City Council on the company's petition to erect poles and string wires over the Lambert and Green Point roads in the back part of the city to deliver current from the new plant now being erected in Milford and Old Town to Ayer's mill in South Brewer.

PORTLAND, ME.—To meet the demands of a rapidly increasing business the Portland Lighting and Power Company, is making plans for the erection of a large up-to-date power plant to be built in Portland or in the suburbs. The company has engaged a Boston architect and engineer to prepare the plans and as soon as the frost is out of the ground in the spring will commence work. The power station is to be operated by steam and is to serve as an auxiliary for the water power plant which the company has operated at North Windham for several years. At the time the company commenced business the steam electric lighting plant at Woodfords owned by the Deering Light and Power Company was purchased by the Portland Company, and has ever since been used as an auxiliary to the North Windham plant. It is planned to have a building just four times as large as the Woodfords auxiliary station, to build a two-story brick building, 90 x 100 feet, and to equip it with all the most modern apparatus. When completed the station will be equipped with sufficient machinery and dynamos to develop 1,000 hp. The General Electric Company is to furnish the machinery.

BALTIMORE, MD.—Preparatory work has been commenced on the project for harnessing the Susquehanna Falls and River for an electric generating plant to supply power to various towns and cities. A dam is to be constructed across the river at McCall's Ferry. It is stated that the cost of the work will be about $8,000,000. J. T. Allen, of New York, N. Y., is general manager and engineer in charge of the construction. Bertron, Storrs & Griscom, of New York, N. Y., and Lee, Higginson & Co., of Boston, Mass., are reported to be among the parties interested in the project.

GREENDALE, MASS.—Contract has been awarded for an addition to the power house of the Morgan Spring Company in Greendale.

PITTSFIELD, MASS.—The Pittsfield Street Railway Company is arranging to erect a new power house, the plans for which are nearly completed.

SUNDERLAND, MASS.—The electric light company has decided to stop generating its own current and buy it of the Sunderland and Amherst electric road.

LOWELL, MASS.—Municipal lighting was favored by the Board of Aldermen at the last meeting, and an order of inquiry on street lighting was transferred to the next city council.

SPRINGFIELD, MASS.—Efforts are again being made by the Hampden Electric Company to incorporate for the purpose of utilising the water power of Little River, which is claimed by both Springfield and Westfield.

CHICOPEE, MASS.—Among the Mayor's recommendations are that the cities and towns of the State unite to repeal certain sections of the municipal lighting law and secure a more liberal law in regard to municipal bonding.

CARYVILLE, MASS.—The Medway Electric Light & Power Company has petitioned for the privilege of installing electric light systems in Caryville and Bellingham, and it is probable that the service will also be extended to North Bellingham.

LEOMINSTER, MASS.—Among other improvements under way by the Leominster Electric Light & Power Company is the erection of new poles for almost its entire system. Two carloads of poles have already arrived from North Carolina and the poles are being set.

PITTSFIELD, MASS.—Judge Slocum, trustee for the Wendell hotel property, has bought the discarded electric plant of the Eaton-Hurlbut Paper Company, which has given way to the system just established by that corporation. The hotel elevator is to be overhauled by the Otis company and the changes will represent an outlay of about $2,000.

DUXBURY, MASS.—The town of Duxbury is soon to have its streets lighted by electricity. A company of local men has been formed, and the selectmen will grant the location for poles and wires in a short time. A power plant will be erected in the town, but it is understood that for the first few months the current will be furnished by a Plymouth company.

NORTH ADAMS, MASS.—The recent petition of the Hoosac Valley Street Railway Company for authority to furnish power to and make an operating contract with the proposed Bennington and North Adams road will probably mean extensive changes in the local power plant. The road at present is operated on direct current. It is probable that an alternating-current system will now be installed.

HADLEY, MASS.—The Connecticut Valley Street Railway Company contemplates establishing a new power plant at this place. The plant will be equipped with high-tension machinery and the old one will be retained as an auxiliary. The work of erecting the new wires between Northampton and Hadley and Greenfield is progressing rapidly. It is planned to obtain a great deal of the power for the cars from the Greenfield electric light plant, which is run almost entirely by water, thus lessening the cost of power.

SHEPHERD, MICH.—R. E. Shotwell, of Linden, has been in Shepherd recently looking over the prospects for an electric lighting system. He made a proposition for street lighting on the basis of twelve lights at $60 per light per year. The lights now in use cost about $50 each per year and are unreliable and unsatisfactory.

PIPESTONE, MINN.—The Council is talking of establishing a municipal electric light system.

ST. PAUL, MINN.—The West Side Power, Heat & Light Company has been incorporated with a capital of $50,000.

DULUTH, MINN.—It is stated that an ordinance has passed the first reading in the Council appropriating $200,000 for improvements to be made to the water and light service in the second, third and fifth wards. This sum includes $75,000 for supplemental pumping machinery and minor needs.

BURLINGTON JUNCTION, MO.—Henry Williams is interested in installing an electric light plant here.

OZARK, MO.—S. S. Bronson, with others, has filed articles of incorporation for the Water Power-Light Company, the capital stock being given as $15,000.

GRAND ISLAND, NEB.—This city contemplates establishing an electric light plant in connection with the water works.

GRAND ISLAND, NEB.—The Grand Island Electric Light Company is considering the matter of installing an entirely new plant.

ALLIANCE, NEB.—The Alliance Electric Company, having a capital of $50,000, has been organized by R. J. Walker and others, and articles of incorporation have been filed.

SEARCHLIGHT, NEV.—Francis Ormond intends installing a pumping plant for the water system, an ice and cold-storage plant and a power plant.

RENO, NEV.—The Northern Electric Company, of which Henry A. Butters is president, has decided to issue $6,000,000 bonds for construction purposes.

WEST POINT, N. Y.—Bids will be received by the Quartermaster at West Point until February 1 for the erection of a power house.

ST. JOHNSVILLE, N. Y.—Roth & Engelhardt, proprietors of the Peerless Piano Player Works, are interested in the establishment of an electric light plant here.

THERESA, N. Y.—It is reported that the Theresa Light Company has been granted a franchise to establish an electric light plant to be owned and operated by the village.

BROOKLYN, N. Y.—The State Commission of Gas and Electricity, at Albany, on Dec. 29 authorized the Kings County Electric Light & Power Company to increase its capital from $5,000,000 to $8,000,000, a portion of this increase to be used to equip and make improvements in its plant during the year 1906.

GREENWICH, N. Y.—Bids will be received until February 7 by the Village Board of Trustees for furnishing material and lighting the streets and two engine houses for a period of either one or five years from July 1, 1906; the streets to be lighted with 50 electric arc lamps of 2,000 cp each from sundown to sunrise. S. J. Tefft, Village Clerk.

SARANAC LAKE, N. Y.—The Paul Smith's Electric Light & Power Company of Saranac Lake, which has pending before the State River Improvement Commission application for authority to build reservoirs on the Saranac River to flood 400 acres of State lands, has applied to the State

Gas Commission for authority to transact business and to issue $100,000 stock. The company offers to build the dams to store water without expense to the State. The directors include: Phelph Smith and Arthur B. Baker, of Paul Smiths, and John M. Cantwell, of Malone.

DUNN, N. C.—The new electric light plant, owned and operated by the town, has recently been put into successful operation.

NILES, OHIO.—The Star Electric Company, of Niles, has been incorporated with a capital of $10,000 by James P. Gilbert, W. H. Pritchard, and others.

XENIA, OHIO.—The Citizens' Light & Power Company was recently organized and incorporated by P. H. Flynn, F. B. Drees, Walter L. Koch, J. M. Dillon and A. W Tresire. The company is capitalized at $20,000.

COLUMBUS, OHIO.—William Wilcox, superintendent of the electric light plant, has recommended to the Board of Public Service improvements to the plant, including the installation of a turbo generator, at an estimated cost of $83,000.

MARYSVILLE, OHIO.—The Marysville Light & Water Company expects in the near future to add a new engine to it's equipment, which may be of the turbine type. The company will also install a direct-connected dynamo to supply a commercial lighting circuit.

GEARY, OKLA.—The Geary Light, Power & Ice Company has been incorporated with a capital of $15,000 by J. J. Robb, Charles F. Dyer, and others.

BAKER CITY, ORE.—The Eagle River Electric Power Company has been incorporated with a capital of $500,000, by Frank W. Paine, James K. Romig, John E. Bingham and others. The company's principal place of business will be at Baker City.

PORTLAND, ORE.—The Cascade Power Company is seeking to secure an electric lighting franchise from this city, and as an evidence of good faith in the undertaking has invited the two committees of the Council to visit and inspect its new power station which has recently been completed.

PHILADELPHIA, PA.—Mayor Weaver is instigating an investigation of the city's expense for electric lighting, and it is probable that the question of establishing a city plant wil be brougght before the people before the time comes for opening bids for electric lighting in 1907.

HARRISBURG, PA.—The Central Pennsylvania Traction Company is excavating for its new power plant, which will be located adjacent to its old No. 1 plant on South Cameron Street. The new plant will be of ample capacity to take care of all the power requirements of the company for the immediate future and will replace three plants which the company now has in service. The building will be 175 feet long, 102 feet wide and about 40 feet high. It will have a steel frame with walls of concrete. The equipment will consist of three horizontal cross compound condensing Corliss engines of 1,000 hp. each direct-connected to a 650-kw generator, all to be furnished by the Allis-Chalmers Company. These units will have a capacity of 50 per cent overload for short periods, thus giving a maximum capacity for the entire plant of about 4,500 hp. The engine room will be 50 ft. x 170 ft. A traveling crane, operated by electric motors, will serve the entire engine room floor and will have a capacity of 30 tons. The boiler room will be 45 ft. wide and extend the entire length of the building, and will contain for the present five 327-hp boilers, manufactured by E. Keeler Company, of Williamsport, Pa. Ample space has been provided for installing additional boilers and engines, as the plant will have an ultimate capacity of 9,000 or 10,000 hp. An interesting feature of the new plant will be the water-supply tunnel. Plans have been drawn and the work will shortly be started on the boring of a 5-ft. tunnel in the solid rock 30 ft. below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron & Steel Company to the river. From the river bank a 36-ft. cast-iron pipe will extend nearly to the island, at which point in the river the best quality of boiler water is to be obtained. The total cost of the plant will approximate $250,000. All of the work is being carried out from plans prepared by and under the dirrection of Mason D. Pratt, consulting engineer of this city, and W. C. Gotshall and C. O. Mailloux, of New York City, acting as advisory electrical engineers.

BELTON, S. C. The town is now lighted by electricity furnished by its own plant, which has recently been put into operation.

BARTLETT, TEX.—The Bartlett Electric Light & Motor Company has just been incorporated, with a capital stock of $10,000.

PRICE, UTAH.—The Green River Canal Company has decided to make extensive improvements in the spring on the dam and canal. It is proposed to raise the dam 3 ft. in order to get sufficient fall to put in a power plant for raising the water to the first benches.

PORT TOWNSEND, WASH.—H. M. Bennett and E. A. Simms are asking for a franchise to establish and maintain an electric light plant.

PRESCOTT, WASH.—Roberts & Henderson, of Waitsburg, Wash., proprietor of the Waitsburg electric light plant, are about to apply to the Council for permission to extend their system to Prescott.

BLUEFIELD, W. VA. Wm. E. Fowler has petitioned for a franchise to operate an electric light plant.

BELOIT, WIS.—W. G. Wheeler, of this city, has applied to the Council for a franchise to construct and operate an electric light system in the city.

KILBOURN, WIS—Philip L. Spooner has applied for permission to construct a dam across Wisconsin River at the Dells to furnish power for an electric light plant to be constructed here.

MONROE, WIS.—The Sheboygan Light, Power & Railway Company has completed the purchase of the Elkhart Interurban Line and the lighting plant in that city, and will immediately perfect plans to run a line from Plymouth to Elkhart Lake. It is expected that the line will be running in time for the opening of the summer season.

ST. JOHN, N. B.—The city government will place at the disposal of an expert engineer a sum of money sufficient to investigate the subject of the development of power at the Reversible Falls at the mouth of River St. John, at the north end of that city. The name of Mr. Vogel, of Ottawa, is mentioned as the hydraulic engineer for that purpose. It is estimated that 20,000 horse-power, now going to waste, could be developed at these falls.

PETROLIA, ONT.—The Petrolia Gas Company has been incorporated with a capital of $50,000 to manufacture gas and electricity for light, heat and power purposes. The provisional directors are: W. C. Nixon, Chas. Swabey, Toronto, and J. W. McCutcheon, Petrolia, Ont.

OTTAWA, ONT.—It is believed that the United States Government will appoint three commissioners from Maine to act with the Canadian Commissioners in the adjustment of the dispute as to the diversion of water from the River St. John, N. B. Upon the return of the minister of public works to Ottawa the Dominion Government will probably decide upon the subject of co-operation with the United States authorities in the protection of Niagara Falls.

ENSENADA, MEX.—W. A. Vernon, who recently bought the water and electric light plants of this town, has begun to repair them, as they were greatly in need of alterations when he took hold of them. Under his contract with the City Council, duly authorized by the Governor, he is obliged to put up an entirely new plant and, as it is understood that his time for beginning such an improvement is soon to expire, he is now preparing to start up the construction of the new plant. It is also stated that after the completion of the improvements contemplated, Mr. Vernon will undertake the establishment of a gas plant for fuel purposes and the installation of a telephone system within the town limits.

New Industrial Companies.

THE PRINCETON ELECTRIC COMPANY, Princeton, Tex., has been incorporated with a capital of $6,000, to deal in electric supplies. E. C. James is one of the incorporators.

THE TELEPHONE CARBON COMPANY, of New York City, has been incorporated with a capital stock of $1,500. The directors are I. T. Madsen, M. J. Lellis and F. Neilson, New York.

THE WASHINGTON ELECTRIC COMPANY, of Washington, N. J., has been incorporated with a capital stock of $50,000. The incorporators are William H. Houston, William W. Severing and William P. Greene.

THE ILLUMINATING ENGINEERING PUBLISHING COMPANY, of New York City, has been incorporated with a capital stock of $10,000. The directors are E. L. Elliott, Edgar Beekman and C. C. Beekman, New York.

THE NEW YORK & WESTCHESTER AUXILIARY FIRE ALARM COMPANY, of Yonkers, N. Y., has been incorporated with a capital stock of $50,000. The directors of the company are J. Devitt, W. J. Cardigan and J. F. Benson, Yonkers.

WESTERN CONDUIT CONSTRUCTION COMPANY.—It is reported from Salt Lake City that the Western Conduit Construction Company has filed articles of incorporation with a capital of $100,000 and that the officers are: P. H. Donahue, president; T. D. Pitt, vice-president; G. R. Cleaveland, secretary and treasurer. These, with W. R. Hutchinson and Frank Hines, comprise the board of directors. The company will manufacture, sell and otherwise operate a certain patent called the "Combined Curbs and Electric Wire Conduit.

Legal.

NEGLIGENCE OF LIGHTING COMPANY.—The Supreme Court of Pennsylvania in the case of Miller vs. Lewistown Electric Light, Heat & Power Company, on the appeal of the defendant, affirmed the decision of the lower court. It held as follows: (1) Where defendant, an electric light company, suspended an arc light at the intersection of several streets, and one of its employees lowered the lamp and left it under charge of a boy, and a sleigh driven around the corner struck the wires of the lamp, which then struck plaintiff, who was crossing the street, the question of the negligence of the light company was for the jury. (2) Whether a pedestrian was negligent in attempting to cross a street at a place other than the regular crossing is for the jury, in an action for injury caused by a live electric wire. The court remarked: "As to the plaintiff's alleged contributory negligence, a pedestrian is not necessarily negligent if he leaves the sidewalk and crosses the street at other than the regular crossings. In so doing he may encounter risks that he would not on the sidewalk; but, unless they are manifest, it is for the jury, not the court, to say that his act was negligent."

LIGHTING CORPORATION'S POWERS.—In the appeal of the defendant in the case of Brown vs. Gerald et al., the Supreme Judicial Court of Maine has sustained the judgment with costs, with a decree, for a perpetual injunction to issue. Under its charter a corporation (the Sebasticook Manufacturing and Power Company) was empowered to manufacture, generate, sell, distribute and supply electricity for lighting, heating, traction, manufacturing or mechanical purposes in Benton and Albion, or for any or either of such purposes. It was authorized to build and maintain a dam or dams on the Sebasticook River in Benton; also to take, as for public uses, any water rights or land, and to flow any lands or other privileges, for the purpose of constructing and maintaining its dams and the establishment of its plant, but not to flow any mill privilege upon which a dam was then built without the consent of the owners thereof. It was also empowered specifically to transmit electric power within said towns, for lease or sale, "in such manner as may be expedient," and, subject to the general laws, to erect poles and wires for that purpose. The towns and the corporation were authorized to make contracts for public lighting. Prior to the bringing of this bill the corporation had constructed a dam, erected a station, and was installing an electrical plant, to be connected with the water wheels. It had contracted to deliver to a manufacturing corporation in Winslow (the Hollingsworth & Whitney Company) the entire electrical current or energy developed by water power on the dam for a period of 10 years. The current was to be delivered by the electric company at a point in Benton near the Winslow line, where the other party was to take it and transmit it by lines of its own to its own mills in Winslow for use as power in manufacturing pulp and paper. By a supplemental agreement the right was reserved by the electric company to take from the wires so much eletricity as might be required to enable it to perform it's duties as an electric light company. The proposed line of poles and wires from the electric station to the point of delivery of the current at the Winslow line was nearly 6 miles long. It did not follow the roads, but crossed 24 farms, including the plaintiff's. The company under its charter had by regular proceedings taken a strip of the plaintiff's land for the purpose of erecting thereon its line of poles and wires. On a bill brought to enjoin the company and its agents and servants from erecting such poles and wires on plaintiff's land so taken, it was now held that the company had not such powers of eminent domain, and could not make itself a genuinely public service corporation or "quasi-public corporation" by voting that it intended to perform duties as one.

Obituary.

C. T. YERKES.

MR. C. T. YERKES.—One of the great dominating personalities in the street and electric railway field passed away last week in Mr. Charles T. Yerkes, who died in New York City at the Waldorf-Astoria, soon after his arrival from London. The end came on December 29, and was not unexpected, as Mr. Yerkes had been a sick man for some time. Mr. Yerkes was born in Philadelphia, June 26, 1837, and entered business life in a commission house, becoming in 1859 a stock broker on the local exchange. Forced into bankruptcy by the panic of 1871, he speedily recovered and with a new fortune went into Philadelphia railways. Still speculating, and losing heavily, he went west, and finally settled in Chicago, where he established a bank and entered the Chicago traction field in 1886. From control of 64 miles of track he soon built up a system embodying 207 miles of track and cross town lines, 205 miles of suburban line, and 73 miles of single-track elevated service. In 1901 the Yerkes system was sold and its owner then transferred his interests and energies to London, whose rapid-transit facilities were seriously underdeveloped and, to his keen foresight, presented great possibilities under an electric régime. In London he formed the Metropolitan District Traction Company, Ltd., which was privately subscribed, and made plans for the building of some 140 miles of underground and surface tracks at an expenditure of at least $85,000,000. The systems which he succeeded in taking over and consolidating into the Underground Electric Railways Company, Ltd., were the Metropolitan District Railway, Metropolitan Railway; Great Northern, Piccadilly & Brompton Railway; Charing Cross, Euston & Hampstead Railway; Baker Street & Waterloo Railway. His plans for these systems comprised the conversion of the Metropolitan District Railway from steam to electricity, the building of the Baker Street & Waterloo Railway from the Waterloo station to the London & South Western under the River Thames to Victoria Embankment, thence to Trafalgar Square, thence to Piccadilly Circus, to Regent Park, terminating near the Baker Street station of the Metropolitan Railway Company. The Metropolitan Railway Company Mr. Yerkes purchased from the London & Glove Finance Corporation for 25 per cent of the amount that had been expended on the part of the road completed. From Waterloo this road has been extended by Mr. Yerkes to the Elephant and Castle and from Baker Street to Paddington, the London terminus of The Great Western Railway. The Great Northern, Piccadilly & Brompton Railway, which Mr. Yerkes acquired, runs from Finsbury Park to Earl's Court. Included in the system of the Underground Electric Railways Company, Ltd., is the system of surface lines of the London United Tramways, which starts from Shepherd's Bush and Hammersmith and runs to Hampton Court and Southall. In its obituary notices the London press has been warm in its eulogy of the service rendered by Mr. Yerkes to that city. The deceased has left a fortune estimated at from $10,000,000 to $15,000,000, or more, and by his will has given some $5,000,000 in property, pictures, etc., to the Metropolitan Museum of Art in New York City, after the life interest of Mrs. Yerkes. Mr. Yerkes has also left $100,000 to the University of Chicago for the maintenance of the splendid telescope and observatory given by him and known by his name, at Lake Geneva, Wis. Mr. Yerkes left a widow, son and daughter, between whom the estate is divided, except liberal legacies to some friends, relatives and employees. In the end the great residue of the estate is to go to the foundation and maintenance of a hospital in New York City, which will thus get an endowment of possibly $10,000,000. As a matter of fact, New York appears to be recipient of all but about $1,000,000 in the final settlement.

MR. J. K. PERRY, of Lockport, N. Y., one of the city's oldest and best-known business men, and an original director of the Niagara, Lockport & Ontario Power Company, died recently at his home on Waterman Street. For several years he had been a sufferer with Bright's disease and had taken trips to California, Cuba and Florida for his health.

Personal.

MR. RENE LIONAIS, the electrical contractor of Montreal, Canada, has entered the electric fixture and supply business and has opened a fixture and show room at 1160 St. Lawrence Street, Montreal.

MR. FRANK S. HASTINGS, the financier, once prominent in the Edison Lighting field, is a director in the new Columbia Trust Company which has begun business in New York City, with a capital of $1,000,000 and a surplus of the same amount. Mr. Hastings is president of the Indianapolis Gas Company.

MAJOR GENERAL A. E. BLISS, who has been for many years general superintendent of the Malden Electric Company, has now been made general superintendent also of the Malden and Melrose Gas Light Company, the Suburban Gas and Electric Company, the Haverhill Electric Company and the Springfield Gas Company.

MR. HARRY W. BOWEN, who has been for two years past an examiner of telegraphy in the U. S. Patent Office, has resigned that position and associated himself with Messrs. Chapin & Co., patent attorneys, of Springfield, Mass. Mr. Bowen is a graduate in electrical engineering from the Worcester Polytechnic Institute. He has had about ten years in the Patent Office as an examiner.

MR. A. E. POTTER, superintendent of transportation of the Rhode Island Company, of Providence, R. I., has been appointed general manager of the company to succeed Mr. R. I. Todd, who has become general manager of the Indianapolis Traction & Terminal Company. Mr Potter's successor as superintendent of transportation is Mr. Samuel Riddle, who has been connected with the transportation department of the company since 1904.

MR. FRANK TOWNSEND, chief engineer at the South Street station of the Narragansett Electric Lighting Company, Providence, R. I., was given a pleasant surprise on Christmas Eve, when the employes of the steam department presented to him a handsome gold chain and charm. The charm bore on one side the inscripition: "Presented by the Employes of the Steam Department of the N. E. L. Company, 1905," and on the reverse side was the Masonic emblem.

MR. H. ANDREWS.—It is understood that Mr. Horace Andrews, president of the Cleveland Electric Railway Company, will accept in January the presidency and active management of the syndicate, owning and controlling a large number of traction lines tributary and contingent to the lines of the New York Central. Mr. Andrews has decided to decline the offer of Mr. Yerkes, of the management of the lines of the London system, on the ground that the American field is a broader one.

MR. G. WESTINGHOUSE.—A special telegram from Pittsburg, of December 24, says: "George Westinghouse, Jr., is regarded as the Santa Claus by his army of workingmen in Pittsburg. They received their pay envelopes yesterday and all salaried employees found one month's additional pay therein. A nice note telling of the good work they have done in the past and wishing them a merry Christmas was enclosed. The company paid out yesterday $150,000. About $25,000 of that amount was given by the corporation as a Christmas gift. The year 1905 is a record breaker in the history of the Westinghouse business."

MR. VINTON A. SEARS, of Boston, Mass., who some months ago resigned from the various automatic telephone companies in Massachusetts, has moved to the Sears Building, Boston, where he will continue to engage in independent telephone work. Mr. Sears organized the Automatic Telephone Companies at New Bedford and Fall River, Massachusetts, and is the author of "Telephone Development, Scope and Effect of Competition," of which a large number of copies have been issued. He will pay attention to telephone investments.

MR. A. EUGENE MICHEL is now with the Geo. H. Gibson Company, advertising engineers, Park Row Building, New York City, having resigned as assistant advertising manager of the Standard Paint Co. Mr. Michel is a graduate of Rose Polytechnic Institute and his professional experience includes two years in the engineering department of the Diamond Chain Works of the Federal Manufacturing Company, charge of the testing department of the Ewart Manufacturing Company, and the assistant managership of the department of publicity of the International Steam Pump Company under Mr. Gibson.

PROF. A. G. BELL.—A special dispatch from Sydney, N. S., of December 29, says: "After experimenting for a number of years at Cape Breton with flying kites, Prof. Alexander Graham Bell succeeded yesterday in having his latest designed kite, the Frost King, rise in the air and carry a weight of 227 pounds, this including a man weighing 165 pounds and ropes and lines weighing 62 pounds. The kite itself weighs 61 pounds, making a total weight of 288 pounds. The kite rose to a height of thirty feet and remained there steadily until photographs were taken of it. It rose gracefully and descended just as easily, remaining under perfect control the entire time. Prof. Bell expressed himself as being greatly pleased with the result of his experiment."

MR. HENRY C. EBERT, assistant to the third vice-president of the Westinghouse Electric & Mfg. Company, Pittsburg, Pa., has resigned his position to become the president of the Cincinnati Car Company and vice-president of the Ohio Traction Company. Mr. Ebert's connection with the Westinghouse Electric & Mfg. Company dates back about fifteen years. After having been promoted to the position of superintendent of construction, which he occupied for some years, he was made chief of the correspondence department, later assistant to the manager of works, and lastly assistant to the third vice-president. It was while Mr. Ebert occupied the position of superintendent of construction that the ten 5,000-hp field generators made by the Westinghouse Company were installed and put in operation in the power plant of the Niagara Falls Power Company. The officers of the Westinghouse Electric & Mfg. Company gave a dinner in his honor at the Hotel Schenley just before he left, and as a token of the esteem in which he had been held during his long association with the company, he was presented with a beautiful bronze electric stand lamp. Mr. Ebert enjoys a wide acquaintance among electrical men in this country, all of whom will be glad to know that in recognition of his ability he has been called to fill these two important positions.

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Trade Publications.

TELEPHONE SWITCHBOARDS.—Folder No. 8 of the Dean Electric Company, Elyria, Ohio, is devoted to an illustrated description of the No. 2 type common-battery telephone switchboard.

FRICTION CLUTCH.—Bulletin No. 1202 of the Allis-Chalmers Company, Milwaukee, Wis., gives sectional and assembly views of the Reliance friction clutch, and outlines the characteristic features of this device.

ELECTRICALLY-DRIVEN AIR COMPRESSORS.—The General Electric Company, Schenectady, N. Y., uses bulletin No. 4427 to outline the constructional features of the type MC governor for electrically-driven air compressors.

CIRCUIT-BREAKERS.—Circular No. 1107 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., gives a complete description of automatic circuit-breakers with carbon breaks for both direct-current and alternating-current circuits.

"COLONIAL DAYS" is the title of a pretty calendar issued by the Eck Dynamo & Motor Works, Belleville, N. J. It shows in a gilt panel a young man and woman skating in Continental costume, and in the lower corners are views of the Eck apparatus.

STUDENT'S ELECTRIC ENGINE.—The Denison Manufacturing Company, Warren, Ohio, has issued a circular calling attention to the student's electric engine, which is an electro-magnetic device which operates similarly to a reciprocating steam engine. It is designed for the purpose of amusement and instruction.

CEILING AND DESK FANS.—A recent publication of the Dayton Fan and Motor Company, Dayton, Ohio, gives interesting information concerning the design, construction and operation of direct-current fans for ceiling and desk use. Descriptions are also given of large ventilating exhaust fans for removing heated air, dust, moisture, steam, impure air and smoke.

PIPE THAWING.—A very neat little pamphlet, with appropriate winter scene in colors on the cover, has been issued by the Westinghouse Electric & Manufacturing Company in regard to its pipe thawing outfits. The booklet illustrates and describes this equipment in detail. Central station readers north of the frost line will do well to look into the pipe thawing business as a source of income.

TELEPHONES.—A recent booklet of the De Veau Telephone Manufacturing Company, New York City, contains numerous timely talks on subjects connected with telephones, especially of the De Veau type. This booklet calls attention to the De Veau pocket size catalogue, which contains a complete set of wiring diagrams, and gives explicit directions covering every known requirement in telephony.

ELECTRIC DAY LIGHT.—The Moore Electric Company, 52 Lawrence St., Newark, N. J., in a booklet recently issued, presents in an attractive manner the advantageous features of the Moore "electric day light," which "comes in long tubes." A list is given of some of the larger installations of these tubes. It is interesting to note that three of the tubes now in use have a combined length of 462 feet.

ALTERNATING-CURRENT SWITCHBOARDS.—Bulletin No. 4423 of the General Electric Company, Schenectady, N. Y., deals with 1,150 and 2,300-volt alternating-current switchboard panels which have been designed to meet the demand for a high-grade but low-priced switchboard for medium and small capacity central stations. The most prominent feature of the boards, which are well illustrated in the bulletin, is their simplicity.

RAILWAY MATERIALS.—Catalogue No. 50 of the Ernst Wiener Company, 66 Broad Street, New York, is a well-illustrated 45-page publication devoted to railway material for all industries. This catalogue not only covers the industrial railway field and allied subjects, but it contains tables and other data which should prove of interest to engineers, shop superintendents and others who may be present or prospective users of this class of material.

CRANE MOTORS.—Bulletin No. 32 of the Northern Electric Manufacturing Company, Madison, Wis., gives an exceptionally complete description of its steel crane motors. The field frame of this type of motor, which is cast in one solid piece, is rectangular in form without joints of any kind. The end pieces are formed by bearing bonnets which, in addition to supporting the armature, render the motor dust proof, so that it can be operated with perfect safety and certainty under any condition.

STEAM SPECIALTIES.—The latest general catalogue of the Schaeffer & Budenberg Manufacturing Company, 66 John St., New York, is an extremely well illustrated publication containing 52 9 x 12 in. pages devoted to steam specialties of every description. Among the relatively new devices shown may be mentioned vacuum and pressure recording gauges, hydraulic pressure indicators, draught gauges, recording tachometers, differential revolution counters and petrol depth gauges for the dash boards of motor cars.

MR. C. R. UNDERHILL, electromagnet specialist, 55 Liberty St., New York, has issued a new illustrated catalogue, showing the various types of plunger electromagnets, solenoids and other coils designed and supplied by him, and he has also revised and published a new edition of his booklet, "Facts About Electromagnets." This little booklet gives much information regarding electromagnets and solenoids and contains a very interesting table for magnet windings. Both the catalogue and booklet will be sent free to any address, upon request.

GEARS.—The R. D. Nuttall Company, Pittsburg, Pa., is distributing a well-executed pamphlet giving an abbreviated description of its large and completely equipped gear manufacturing plant. This plant, which is stated to be the largest of its kind in the world, is electrically equipped throughout. The power is furnished by four 125-hp direct-connected and one 85-hp belted Westinghouse gas engines. In addition to its gear departments, the company maintains a fully equipped department devoted exclusively to the manufacture of Union standard trolley poles and appliances.

OIL-BREAK SWITCHES.—Bulletin No. 4425 of the General Electric Company is devoted to a detailed description of 4,500-volt oil-break switches. The compactness of design and mechanical construction are clearly shown by means of numerous illustrations. The oil-vessel, contacts and operating mechanism are all supported from a common frame; the stationary contacts are supported separately by this frame, and are insulated by porcelain bushings. The oil vessel is lined with laminated wood, and is furnished with barriers of the same material, which are held securely in position between the poles of the switch.

STORAGE BATTERIES.—The General Storage Battery Company, 42 Broadway, N. Y., has issued as bulletin No. 3 an interesting description of the exhibit of Bijou high-duty storage batteries at the recent New York Electrical Show. This company exhibited twelve distinct pieces of storage-battery apparatus, each of which is described in detail in the bulletin. The operation of fluctuating loads, such as electric elevators, electric hoists, electric railway cars or trains, was illustrated on a miniature scale. Violently fluctuating currents produced by opening and closing the electric switch were absorbed by a storage battery operating in conjunction with a booster which fed a practically steady current to the battery of value equal to the average of the violent fluctuations.

DIRECT-CURRENT GENERATORS AND MOTORS.—The Allis-Chalmers Company, Cincinnati, Ohio, has issued bulletin No. 1046, devoted to Bullock multipolar motors and generators of the direct-current type. Among the numerous views given of machines actually constructed, a most interesting one illustrates a 425-hp double motor built for direct connection to a 60-inch circular saw which runs at 900 r.p.m. The machine is built with two separate field frames mounted on the same bed plate, and two separate armatures mounted on a common shaft, there being only two bearings for the whole equipment. The brushes on the two commutators which face each other are mechanically interconnected so that they may be moved simultaneously.

ARC LAMPS.—The Adams-Bagnall Electric Company, Cleveland, Ohio, has issued bulletin No. 19, describing arc lamps for use in series on alternating-current circuits and the regulator which is designed for maintaining the current at a constant value. The essential parts of the regulator are an M-shaped iron element and a movable coil, partly counter-balanced by a weight working over a knife-edge bearing. The mechanism of the lamps consists of double solenoids and U-shaped cores so related to each other that the voltage at the arcs is always the same whether the lamps have only just started or are at nearly the end of a run. The alternating-current type of constant-potential enclosed arc lamps of this company are treated at length in bulletin No. 16. Bulletin No. 30 of the same company deals with direct-current, constant-potential enclosed arc lamps for electromotive forces of 100 to 130 volts, while similar lamps designed for electromotive forces of 220 to 250 volts are described in bulletin No. 31.

ON CONTROLLERS.—Bulletin No. 10056 of the Ward Leonard Electric Company, Bronxville, N. Y., is devoted to its controllers for printing press duty and machine tool duty. Type "RRIL" controllers are reversing, having both armature and field control on the forward speeds and armature control on the reverse speeds, with "no-voltage" release and "overload" circuit breaker and remote control by push button. The "RIL" type differs from the other in that it is suitable for controlling the speed in one direction only. A main feature of the design of these controllers, in order that they shall be as nearly indestructible as it is possible to make them, is that the circuit "closing" and circuit "breaking" device consists of a rugged, carefully designed solenoid switch of the laminated double-break type, with two independent, self-aligning auxiliaries for each brake, two of these auxiliary brakes being equipped with powerful magnetic blow-outs. As a result, when the circuit is broken, any arc is immediately snuffed out by the magnetic blow-outs. There are many other new and interesting features of this apparatus fully described in this catalogue.

News of the Trade.

ROBB-MUMFORD BOILER COMPANY, the successor to Edward Kendall & Sons, has moved from Cambridge, Mass., to its new plant at South Framingham, Mass.

DE VEAU TELEPHONE MANUFACTURING COMPANY, of New York City, will have an exhibit of its telephonic apparatus at the electrical show in Chicago this month.

SHEAFF & JAASTED, the well-known consulting engineers of Boston, Mass., have recently moved into new offices in the Broad Exchange Building, New York City, where they will have larger quarters and better facilities for their draughting rooms. Their offices are on the top floor, allowing more light.

THE B. F. STURTEVANT COMPANY, Boston, Mass., has just sold for export a complete apparatus for drying oak staves, consisting of an engine-driven fan and steam heater through which the air is drawn and forced to the kiln, in which the staves are so arranged as to give opportunity for thorough circulation of the air.

THE CENTRAL ELECTRIC COMPANY, whose recent large and destructive fire will be fresh in the minds of our readers, announce that on and from January 1, it will be at home again at 264-6-8-70 Fifth Avenue, Chicago. In a short time it will be in a position to give out details as to extensive plant and equipment.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, will have an exhibit at the electrical show held at the Chicago Coliseum, January 15 to 27. The exhibit will be in charge of the Chicago representative, Mr. William P. Crockett. The Keystone Electrical Instrument Company, as is well known, manufactures a line of switchboard instruments and these will be shown at the exhibit.

MR. W. G. WILLIAMS, who for several years represented the Nernst Lamp Company in Pennsylvania and other Western territory and previously was connected with the Manhattan Electrical Supply Co., of New York City, has accepted a position with the Columbia Incandescent Lamp Co., of St. Louis, and will be connected with the New York and Philadelphia branch offices of that company, covering Northern Pennsylvania and New York State.

SCHAEFFER & BUDENBURG MANUFACTURING COMPANY, 23 Dey Street, New York, has purchased at Foxboro, Mass., a new plant equipped with all the modern machinery so necessary for manufacturing a uniform product in the most economical manner. No expense has been spared to make the new plant a model in it's line, and the facilities enable the company to execute without delay all orders intrusted to it and to meet the most exacting demands of the trade. The Brooklyn plant will be run in full force as formerly.

THE DAVID BELL ENGINEERING WORKS, Buffalo, N. Y., have advised us that owing to the growing business in specialties it has become necessary to incorporate under the title given above. The officers are as follows: H. T. Dunbar, president; David Bell, vice-president and general manager; F. C. Slee, secretary, and George B. Bell, treasurer. This firm builds a complete line of steam hammers covering the following: single-frame open-style steam hammers, single-frame standard guide steam hammers, double-frame steam hammers, and steam drop hammers. The firm has recently greatly increased its facilities for the manufacture of steam hammers and heavy machinery.

THE STANDARD UNDERGROUND CABLE COMPANY has leased the exclusive use of an all-copper line to connect its general offices and the factories at Pittsburg, branch offices at New York and Philadelphia, and its eastern factories at Perth Amboy. This private line will be available for either telegraph or telephone service. There could be no better evidence of the large aggregate volume of business and the growing condition of this important manufacturing company; for so far as known this will be the longest exclusive wire owned or operated by any company confining itself to the manufacture of copper wire and cables. This service will be in effect January 1, 1906, and while without doubt of great convenience and value to the company in facilitating communication between its offices and factories and the important market centers of New York, Philadelphia, and Pittsburg, it is installed primarily to enable it to place itself in closer touch with its customers, giving them the quickest possible service.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electrical Salesmen Association. Secretary, Geo. H Erich, 218 North Court Street, Rockford, Ill.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York.

Association of Edison Illuminating Companies. Secretary, W. S. Barstow, 50 Pine St., New York City, and Portland, Ore.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electrical Contractors' Association of New York State. Secretary, F. Fish, Rochester, N. Y. Next meeting, Buffalo, Jan. 16, 1906

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa

Electrical Trades Association of Canada. Secretary, J. A. Mann, Royal Insurance Building, Montreal, Can

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electric Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Ottawa, Ill.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Annual meeting, second Thursday in January, 1906. Monthly meetings, second Thursday of each month.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia. Next meeting, Des Moines.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, second Thursday in March, 1906

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich.

Missouri Independent Telephone Association. Secretary, Frank S. Leach, Sedalia, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

Northwestern Electrical Association. Secretary, T. R. Mercein, 1142 Wells Building, Milwaukee, Wis. Next meeting, Milwaukee, Wis., third Wednesday in January, 1906.

New York State Independent Telephone Association. Secretary, T.

S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Elmira, N. Y., June, 1906.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D.L. Gaskill, Greenville, O.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, O.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, O.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, second Tuesday in May, 1906.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, H. B. Hartwell, Irene, S. D. Next annual convention, Sioux Falls, S. D., second Wednesday in January, 1906.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

WESTERN SOCIETY OF ENGINEERS, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED DECEMBER 26, 1905.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N.Y.]

808,064. COMMUTATOR-MOTOR; Engelbert Arnold, Karlsruhe, Germany, and Jens L. LaCour, Edinburgh, Scotland. App. filed Dec 16, 1904. A single-phase alternating-current motor having a commutator with three brushes at angles of 120° apart, two of which are short-circuited, while the third serves to take off the magnetizing current.

808,065. ELECTRIC SWITCH; Samuel H. Beck, New York, N. Y. App. filed Apr. 22, 1905. A cylinder having a spring-pressed piston therein is pneumatically operated to move the piston so as to contact eventually with a pin on the switch lever so as to impart a sudden movement to said switch lever.

808,066. PROCESS FOR THE PRODUCTION OF METALLIC CALCIUM; W. Borchers and L. Stockem, Aachen, Germany. App. filed Oct. 24, 1902. Fused anhydrous calcium salts are electrolyzed with a small cathode, which is artifically cooled. Metallic calcium is obtained in spongy form.

808,086. THERMO-ELECTRIC BATTERY; Albrecht Heil, Frankfort-on-the-Main, Germany. App. filed Oct. 31, 1904. A thermo-pile having a central flue through which the heat passes and upon the exterior wall of which are attached radial wires, the outer ends of which are attached to cooling plates so as to secure the requisite difference of temperature for generating the requisite electro-motive force.

808,095. MANUFACTURE OF ORGANIC COMPOUNDS BY OXIDATION; Salther Lang, Salbke-on-the-Elbe, Germany. App. filed Aug. 28, 1902. Manganous-oxide salts are oxidized by electrolysis to form manganic-oxide salts. These are made to react with the organic substance to be oxidized, whereby the manganous-oxide salts are regenerated. The process is applicable for the production of alhehydes, ketones and quinones.

808,096. DETACHABLE ELECTRICAL CONNECTION; Augustine N. Lawrence, Jr., New York, N. Y. Filed Oct. 3, 1903. An insulating plug has a smooth exterior cylindrical wall upon which is wound a spiral spring having a pitch corresponding to the usual screw thread. The ends of the spring are attached to the insulated support.

808,097. DETACHABLE ELECTRICAL CONNECTION; Augustine N. Lawrence, Jr., Philadelphia, Pa. App. filed Apr. 15, 1905. A modification of the above in which the smooth cylindrical wall of the plug is recessed and spring blades are disposed therein with projecting extremities to engage the usual threads of the socket.

808,100. PROCESS OF MAKING CHLORIDES OF CARBON; Florentine J. Machalske, Brooklyn, N. Y. App. filed June 1, 1905. Produces chlorides of carbon by heating a mixture of oxides, chlorides and carbon, so as to form oxychlorides of carbon, and by subsequently decomposing the latter.

808,103. ART OF GALVANIZING METALS; Guy L. Meaker, Evanston, Ill. App. filed June 18, 1902. For electroplating with zinc an electrolyte of zinc chloride, zinc sulphate and a small proportion of a vegetable acid is used.

808,109. TROLLEY POLE; James F. Osburn and William T. Coad, Pasadena, Cal. App. filed June 21, 1905. A pair of uprights are rigidly supported from the roof of the car and serve to guide an "equi-poise frame" upon which the trolley pole is fulcrumed and spring pressed upward. The equi-poise frame is normally drawn upward by springs, but may be depressed at will by an air cylinder.

808,115. ELECTRIC METER; Henry W. Sayles, Peoria, Ill. App. filed Mar. 13, 1905. A meter having the usual series field, shunt armature, and a permanent damping magnet, and having in addition an electro-damping magnet in the meter-pressure circuit so that the combined effects of the damping magnets cause a meter speed proportional to the current flow regardless of the pressure.

808,135. ANNUNCIATOR; Leonidas G. Woolley, Kenton, Ohio. App. filed July 17, 1905. Details of an annunciator system in which a frame has a movable signal door and a latch to hold said door in normal position. The latch is released by a clutch controlled by the electric circuit.

808,140. ELECTRIC-TROLLEY HEAD; John T. Cherry and Edward H. Clive, Plymouth, England. App. filed Mar. 23, 1905. A pair of fingers are pivoted adjacent to the upper edges of the trolley wheel and have link connections by which they are thrown up to guide the wheel upon the wire when the trolley or other attached cord is put under tension.

808,159. ELECTRIC SIGNAL FOR RAILWAYS; Burton A. Karr, Omaha, Neb. App. filed Aug. 28, 1905. A shaft having a tappet is supported adjacent to the track rail so as to have a rocking movement when a train passes and compound lever connections are provided by which a pair of arms are rocked into contact with fixed contacts within a casing adjacent to the track so as to make the alarm circuit.

808,162. ELECTRIC TROLLEY-WHEEL; John Miller, Jr., Amesbury, Mass. App. filed Mar. 17, 1905. The hub is made of skeleton construction with thin edge flanges so as to dissipate the heat quickly. The trolley wheel is also thin at its central portion where it engages the bearing hub.

808,187. METALLURGICAL FURNACE; George H. Benjamin, New York, N. Y. App. filed April 27, 1903. Finely-divided ore is passed first through a calcining chamber, then through a reducing chamber, then through a series of electric arcs. While within the zone of action of the arcs the ore is mixed with a finely-divided combining material.

808,163. TROLLEY-HARP FOR ELECTRIC RAILWAYS; John Miller, Jr., Amesbury, Mass. App. filed Apr. 10, 1905. The trolley wheel is quite heavy at its tread portion and is supported from its central hub by thin oppositely-coned webs. The bearing of the wheel on its supporting hub is at the two apexes of the conical webs.

808,182. ELECTRIC SIGNAL SYSTEM FOR ELECTRIC CARS; Edwin J. Adams, Waco, Tex. App. filed Mar. 6, 1905. In addition to the usual third rail, and track return of an ordinary electric system, the patentee has a third or signal trolley divided into sections. Signal lamps on the cars are in circuit with the signal conductor and means are provided whereby their other terminal may be interchangeably connected to the trolley and to the track return.

808,198. VALVE-GOVERNOR FOR TROLLEY-POLE CONTROLLERS; Martin O. Dolson, Los Angeles, Cal. App. filed Feb. 20, 1905. The usual trolley pole fulcrumed upon the car roof has a link connection with a pneumatic cylinder by which it may be retrieved. The valve of the pnuematic cylinder is operated by an "inertia" ratchet connected with the pole by a cord, and so arrranged as to only engage and open the retrieving valve when a sudden pull is imparted to the cord.

808,213. CONTACT-SHOE FOR THIRD-RAIL ELECTRIC RAILWAYS; William B. Potter, Schenectady, N. Y. App. filed July 25, 1901. A thin triangular conductor is hinged in a horizontal plane from the usual support so as to be spring pressed downward upon the top surface of the third rail. Serves as a scraper as well as collector.

808,200. FUSE; John E. Graybill, York, Pa. App. filed March 22, 1905. An inclosed fuse kept under tension by two members, held in engagement by the fuse, a spring giving longitudinal motion to one member when the fuse blows.

808,220. POWER TRANSMISSION MECHANISM FOR AUTOMOBILES; Charles G. Simonds, Schenectady, N. Y. App. filed June 22, 1904. A transmission system employing two dynamos within a casing and interconnected by planetary or differential gearing so as to rotate together, or to have a differential movement through said gearing when it is desired to vary the power or speed factor.

808,221. SPEED-CHANGING GEAR; Charles G. Simonds, Schenectady, N. Y. App. filed Aug. 27, 1904. Relates to modifications of the above in which the dynamos are disposed in a single-plane transverse to the transmission shaft and in concentric relation with one another.

808,222. THIRD-RAIL INSULATOR; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed July 23, 1903. Insulating blocks are supported along the roadway and have vertical recesses on their upper faces which engage depending ears upon a pair of hooks or clamping members, which latter engage the base of the rail at opposite sides thereof.

808,223. RAILWAY SIGNALING; Samuel D. Strohm, Philadelphia, Pa. App. filed Aug. 29, 1891. A signal system applicable to drawbridges, comprising contact plates along the railway with which brushes upon the train make contact so as to close signal circuits indicating the position of the switch or drawbridge. Magnetic means are provided for automatically throwing predetermined contact plates into use, depending on the forward or backward movement of the engine.

808,226. CONTROLLER FOR MAGNETIC CLUTCHES; Edward H. Anderson, Schenectady, N. Y. App. filed July 20, 1904. In order to avoid injurious effects of the extra currents when the clutch magnets are broken, the controller has contacts for momentarily reversing the currents through the clutches at the instant when they are thrown out of action.

808,231. AUTOMATIC SWITCH; Joseph M. Comer, Seattle, Wash. App. filed Apr. 27, 1905. A box or casing beneath the switch contains a vertical shaft with a crank pin having a link or pitman connection for throwing the switch point to its alternate position. The shaft is rotated through a geared-down connection from a magnet-operated ratchet.

808,232. ELECTROLYTIC METER; Alvarado L. R. Ellis, Lynn, Mass. App. filed June 22, 1904. There are two receptacles for the electrode deposited material, and two scales so related that the registration is transferred one scale to another.

808,241. END CONNECTION FOR DYNAMO ELECTRIC MACHINES; Frank H. Jeannin, Schenectady, N. Y. App. filed May 25, 1904. The conductors are slotted at their ends and are riveted through said slots with the end connections.

808,259. MEASURING INSTRUMENT; Ernest Schnatter, Schenectady, N. Y. App. filed Feb. 3, 1905. The ordinary meter has a centrifugal device which registers the maximum rate of current consumption during a given period by registering the maximum rate of rotation of the meter at any time during that period as indicated by the furthest movement of the centrifugal device.

808,263. POWER-TRANSMITTING MECHANISM; Elihu Thomson, Swampscott, Mass. App. filed Nov 26, 1902. A transmission system in which a dynamo with two relatively movable members transmits the power by the reactive force exerted between said members, and has means for transforming a portion of the electrical energy into mechanical energy so as to vary the torque of the prime mover.

808,268. CONTROLLING SYSTEM; Thorsten von Zweigbergk, Lancaster, England. App. filed Apr. 23, 1904. A complete motor control system having a number of features, among others an automatic controller, and a master controller for the automatic controller having a ground connection for the motor at zero or off position.

808,271. EMERGENCY CONTROL SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed June 24, 1904. A controller handle has a button thereon with compound lever connections to the trip of the usual air brake so that the motorman may press the button and set the air brakes at the same instant he returns the arm to off position.

808,275. APPARATUS FOR EXPLODING MINE CHARGES; Charles L. Dodson, Pittsburg, Kan. App. filed Apr. 29, 1905. The various cartridge circuits are completed at contact points annularly arranged in the path of a single rotating arm which thereby makes successive connections to ignite the cartridges.

808,270. MULTIRATE METER; Walter C. Fish, Lynn, Mass. App. filed June 23, 1904. The meter has clockwork mechanism which is geared by a Geneva motion to a switch which serves to cut out a fixed resistance when the clock mechanism runs down so that the meter registers at a higher rate as a penalty in case the clock mechanism is not regularly wound up.

808,303. DIRECT INTERMITTENT CURRENT ELECTRIC MOTOR; Chester M. Palmer, Aurora, Ill. App. filed Dec. 17, 1902. The armature has a single coil and constitutes a rotor. The field coils are annularly spaced around the armature and are connected in a series multiple circuit with intermediate condensers, whereby the current within certain coils is displaced or retarded.

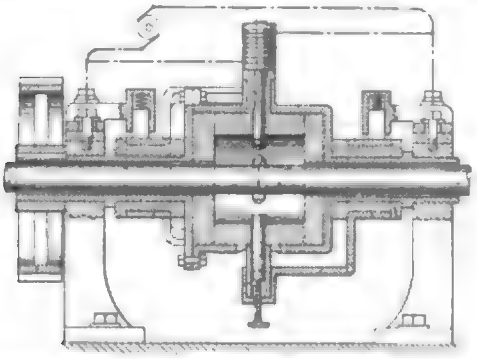
808,331. METHOD OF SEPARATING THE GALVANOPLASTIC DEPOSITS FROM METAL MATRICES; Eugen Albert, Munich, Germany. App. filed June 21, 1905. Separation is produced by sudden heating in a metallic box.

803,351. DEVICE FOR CONTROLLING THE FLOW OF FLUIDS AND OTHER MATERIALS; Leon Dion, Wilkesbarre, Pa. App. filed Mar. 25, 1905. A controller having a rotatable drum with contacts engaged by brushes and also having valve ports so as to simultaneously vary the electric current and the flow of fluid through said valve ports.

808,364. ELECTRIC SWITCH; William S. Horry, Niagara Falls, N. Y. App. filed Mar. 20, 1905. A switch for circuits having a heavy inductive resistance, includes an electrolytic cell shunted across the switch terminals of a character to absolutely check or resist the ordinary circuit potential when the switch is open, but which allows a temporary passage of current during the moment of the inductive break. The switch is arranged to successively open the main and this shunt circuit.

808,366. TELEGRAPH-TRANSMITTER; Benjamin P. Hayes and Sigel H. Gill, Topeka, Kan. App. filed June 17, 1905. A typewriter transmitter having a drum with segments or contacts thereon which is released to move by the various keys. The purpose is to give a more uniform distribution of the transmitting impulses.

808,371. PROTECTIVE SHUNT FOR ELECTRIC CIRCUITS OF HIGH INDUCTANCE; William S. Horry, Niagara Falls, N. Y. App. filed Jan. 26, 1905 A circuit containing a heavy inductance and a switch is provided with a shunt circuit across the terminals of the switch, said shunt circuit containing an electrolytic cell which resists the normal working pressure but yields to the momentary pressure when the switch is opened.



808,186.—Art of Heating Pipes, Rods, or Similar Bodies.

808,383. RECORDING APPARATUS FOR MEASURING TELEPHONE SERVICE; James A. Kenney, Chicago, Ill. App. filed Mar. 1, 1902. A system of recording telephone calls including a registering device at the various sub-stations and a central recording device which is adapted to record the register of the local instruments whenever desired. The local instruments are simultaneously reset to zero position.

808,386. TELEPHONY; Isidor Kitsee, Philadelphia, Pa. App. filed Oct. 14, 1905. A telephone call system, including a transmitting telegraph key at the calling station and a telegraph relay at the receiving station included in a circuit with a local current source. Connections are provided by which the telegraph key can be manipulated to effect the call at the distant relay over the telephone wires.

808,392. ELECTRIC SWITCH; William W. Lathrop, Bridgeport, Conn. App. filed Aug. 31, 1904. A cylindrical casing has a transversely movable plunger with buttons at its extremities which alternately project through the casing and may be pressed for moving the switch. The plunger is notched to receive an arm on the switch lever and communicate motion thereto.

808,416. ELECTRIC STOP-MOTION MECHANISM FOR LOOMS; Joseph B. Whitney, Brooklyn, N. Y. App. filed Feb. 28, 1905. Means are provided for maintaining a lease in the warp and a switch arm projects into the space occupied by the lease.

808,417. ELECTRIC STOP-MOTION MECHANISM FOR LOOMS; Joseph B. Whitney, Brooklyn, N. Y. App. filed Feb. 28, 1905. This patent and the three following ones all relate to a faller for stop-motion mechanisms for textile machinery and have a thin sheet-like body with a thread aperture in various different relations to the warp.

808,418. ELECTRIC STOP-MOTION MECHANISM FOR LOOMS; Joseph B. Whitney, Brooklyn, N. Y. App. filed Feb. 28, 1905.

808,419. FALLER FOR STOP-MOTION MECHANISMS FOR TEXTILE MACHINERY Joseph B. Whitney, Brooklyn, N. Y. App. filed Sept. 5, 1905.

808,420. FALLER FOR STOP-MOTION MECHANISMS FOR TEXTILE MACHINERY; Joseph B. Whitney, Brooklyn, N. Y. App. filed Sept. 5, 1905.

808,438. TELEPHONY; Albert G. Davis, Washington, D. C. App. filed Apr. 22, 1897. A calling system for telephone lines employing differently tuned receivers at the various subscriber's stations and a plurality of sources of intermittent current of different frequency at the transmitting station, any one of which may be connected to the line by a switch so as to resonate with the attuned instrument at a particular station.

808,451. SIGNALING SYSTEM; Maynard W. Hamblin, New York, N. Y. App. filed May 31, 1904. Complete fire alarm system, also adapted to messenger calls employing various detail arrangements in the receiving relays and circuits.

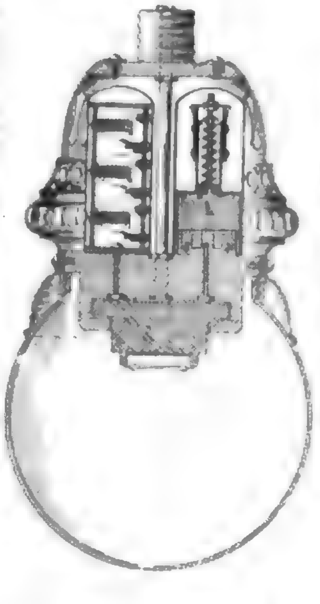
808,454. TELEPHONE ATTACHMENT; Paul Kammerer, Pittsburg, Pa. App. filed Feb. 24, 1905. A small register or counter having an actuating button is adapted to be clamped upon the usual transmitter so that the button may be pressed to make a tally of the number of calls.

808,525. ELECTRIC WATER-HEATER; James P. Erie, Los Angeles, Cal. App. filed Sept. 8, 1898. A casing having a tortuous water pipe with duplicate sections which also constitute resistances, a greater or less number of which may be included in the fluid circuit and in the electric circuit.

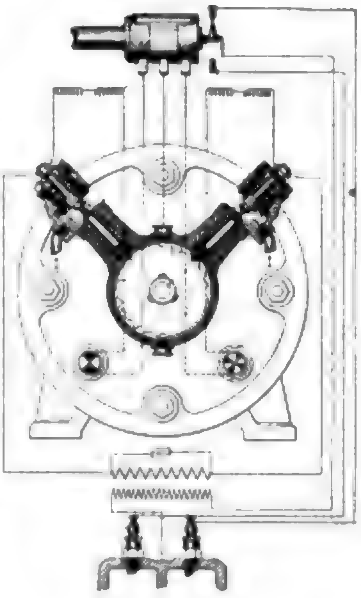
808,532. INDUCTION-METER; Alphonse J. Frager, Paris, France. App. filed Oct, 31, 1903. Has a shunt or potential coil and a series or current coil, and phase adjusting means in inductive relation to the current coil for producing a flux in advance of the main current

808,543. ELECTRIC-RAILWAY SYSTEM; William G. Keeler, Philadelphia, Pa. App. filed June 16, 1905. The car has a depending metallic cable or belt passing over pulleys at each end of the car which is adapted to sag into contact with fixed conductors or plates along the track, at the same time having a rearward motion which compensates for that of the train.

808,551. IGNITION DEVICE; Leon L. Le Pontois, New Rochelle, N. Y. App. filed Nov. 7, 1903. This patent and the four following relate to a polyphase ignition system for motor vehicles employing a polyphase magneto generator and special spark plugs with one grounded and two independent terminals in circuit with the branches of the three-phase current.



808,085.—Electric Glow Lamp.



808,553. Method of Igniting Combustible Mixtures.

808,552. MAGNETO-ALTERNATOR; Leon Jules Le Pontois, New Rochelle, N. Y. App. filed September 24, 1904. The rotor of a polyphase alternator consists of a permanent magnet annular in shape and having two consequent poles at opposite ends.

808,553. METHOD OF IGNITING COMBUSTIBLE MIXTURES; Leon J. Le Pontois, New Rochelle, N. Y. App. filed Sept. 24, 1904.

808,554. APPARATUS FOR GENERATING AND UTILIZING POLYPHASE ALTERNATING CURRENTS FOR THE IGNITION OF EXPLOSIVE MIXTURES; Leon J. Le Pontois, New Rochelle, N. Y. App. filed Oct. 7, 1904.

808,555. SELF-EXCITING ALTERNATOR; Leon Jules Le Pontois, New Rochelle, N. Y. App. filed February 3, 1905. A partially self-exciting alternator comprises a field-magnet consisting of a permanently magnetized ring with stationary windings surrounding its poles and a dissymmetric inductor-rotor.

808,562. ELECTRIC WATER-METER; Richard H. Milton, Reidsville, N. C. App. filed Feb. 14, 1905. The pressure or flow of the water is effective to step in resistances which vary the speed of a motor connected to the registering mechanism so that the latter registers more or less rapidly.

808,571. ELECTRIC SIGNALING-SYSTEM; Charles G. Otwell and [illegible]a H. Melvin, Laurel, Del. App. filed Feb. 24, 1905. A signal system employing a special or contact rail connected into an alarm circuit on the train and annunciator devices at the despatcher's office.

808,580. TROLLEY-FINDER; James Wilhelm, Philadelphia, Pa. App. filed June 20, 1905. A pair of arms project upward from the journals of the trolley wheel and are curved in a special way to help guide the pole when the trolley is replaced on the wire.

808,594. APPARATUS FOR THE TRANSMISSION OF ENERGY THROUGH SPACE; Alessandro Artom, Turin, Italy. App. filed Feb. 20, 1905. Details of a wireless transmission system having a three-phase current and a specially arranged three-phase air transformer.

808,600. TELEPHONY; Albert G. Davis, Schenectady, N. Y. App. filed Apr. 22, 1897. Method of tuning a receiving apparatus of a telephone line to different calls by connecting the transmitting circuit to different sources of alternating current See No. 808,438.

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ELECTRICAL EXPORTS IN 1905.

There is every probability that the electrical export trade of the United States reached a mark well over $12,000,000 in 1905. The full returns for last year are not yet available, December being still unreported, but the eleven months reached a total which at the same ratio would bring the figure for the year up to about $12,551,370, of which $5,411,550 would be in general electrical apparatus and instruments and $7,139,820 in heavy electrical machinery and motors. The eleven months showed in apparatus and instruments a notable gain over 1904, being $4,963,010, against $3,930,311, while electrical machinery also exhibited a gain, being for the eleven months not less than $6,568,950, against $6,071,920.

Such statistics, already noted in these pages, from month to month, are very gratifying to all of us who have sought to promote and develop this electrical export trade, and must be encouraging to manufacturers who have been seeking new outlets for their productions. We had feared that the enormous development of the home market during the past year would have checked exports by rendering the manufacturer indifferent to foreign demand; but evidently this is not the case, or else the customer abroad with his taste cultivated for American electrical goods would not be denied by delay nor deterred by price. As a matter of fact the gain of the year seems to be pretty well distributed, although growth is shown more particularly in the exports to the United Kingdom, Japan, Mexico and British North America.

If the production of electrical apparatus be taken, as it must, at about $200,000,000, or slightly over, then the export is not more than 5 or 6 per cent of the total. This is surely susceptible of increase, and a business of $1,000,000 per month affords an excellent foundation for larger trade. In this respect we desire to call attention to the article by Mr. Geissel in this issue, in which he analyzes export conditions and offers many suggestions as to new channels and fresh fields.

THE GAS TURBINE.

The success of the steam turbine has quite naturally brought forward consideration of the possibility of a similar development in the means for transforming the heat of gas into mechanical energy, and the discussion of the broad outline of the problem thus presented may not be without interest. Putting the matter briefly, we may split up the efficiency of any form of heat prime mover into four factors: (a) The ideal thermal efficiency, dependent primarily on the cycle employed and on the operative range of temperature. (b) The operative efficiency, or fraction of this ideal which can be realized in practice. (c) The conversion efficiency, or ratio of available molecular energy resulting from the combination of (a) and (b) which is finally transformed into mechanical work and embodied in the moving part of the prime mover. (d) The mechanical efficiency or fraction of energy converted which reaches the point of delivery, at the engine shaft. Now for the gas engine, the factor (a) is the highest of any present known type of prime-mover. The factor (b) is moderate to low; the factor (c) is high, practically 100 per cent in all piston prime movers; and the factor (d) whatever the mechanical construction may determine, but usually not below .85. The gas turbine, on the other hand, has a lower value of (a) simply because it cannot be operated under a continuous intake temperature as high as the intermittent values reached at the instants of explosion in the reciprocating type. The (b) factor is also moderate to low; the (c) factor, representing the efficiency of conversion by the vanes from jet energy to mechanical work at the rotor, is also moderate or low, probably not above .75; while the (d) factor may be somewhat higher than for the reciprocating type.

Detailed discussion of these points is aside from present purposes, but it may be said that these differences seem to be inherent in the nature of things, and it is difficult to see how the gas turbine can be made to rival in final efficiency the present standards realized by the reciprocating type. Various combinations are also held in view by engineers and inventors—steam and gas; gas and steam, reciprocating; gas engines and gas-steam turbines in tandem. In varying combinations these elements are being passed in review in the hope that some combination may spell success. It seems indeed probable that some such combination may show reasonably good efficiency, but it seems very unlikely that it will rival that of the reciprocating internal combustion motor. At the best, therefore, we may have a choice, so far as these two are concerned, between a reciprocating engine of high efficiency and a turbine combination of low or moderate efficiency. It would seem well assured, therefore, wherever the mechanical conditions are such as to permit the use of a reciprocating prime-mover, that the gas engine will not be displaced by the gas turbine, either in its simple form or in any of its possible complex or combination forms.

The Flaming Arc.

This new illuminant is becoming a somewhat common sight in the larger cities, although it is still enough of a rarity to cause picturesque comment. The wonder is that the lamp has taken so long a time to make its way in this country, it having been pretty well known abroad for several years. The whole subject was thoroughly aired in an admirable paper by M. Blondel at the International Electrical Congress of 1904, and perhaps this introduction more than anything else served to call attention to the importance of the innovation. Be that as it may, the flaming arc is now with us and probably to stay. Its appearance is somewhat startling, even to a hardened technologist. It looms up from the street like a compressed conflagration, making the ordinary arcs look like blue candles, while the gas lights and ordinary incandescents have beside it about the apparent luminosity of a white bean. The splendid pale golden hue of the light looks queer at first to the eye that has gradually become accustomed to the bluish light of the enclosed arcs, but the effect, save for the unpleasantly great brilliancy, is altogether good. The common globe is totally unfitted for dealing with a source of so enormous brilliancy and should be replaced by a very strongly diffusing globe of at least double the ordinary diameter.

The loss of light thus incurred is a very trivial matter, considering the enormous efficiency of the flaming arc. To put the facts conservatively it gives five to ten times as much light per watt as the common enclosed arc. Blondel for the naked flaming arc gives figures down to 0.125 watt per candle—not mean horizontal candles, either, nor again that uncanny thing devised to hide bad distribution, the downward hemispherical candle-power—but good, unequivocal, mean spherical candles. For the first time in the history of electric lighting one sees in commercial use on the streets lamps that can be rated at 2,000 candle-power without the need of any photometric apologies. It is not to be assumed that the flaming arcs as we see them are working at the tremendous efficiency cited by Blondel, but they completely outclass any other illuminant of human devising so far as efficiency is concerned.

Unhappily, all of the flaming arcs as yet devised give off fumes in sufficient quantity to make them undesirable for ordinary use indoors. For street use, however, they are well adapted, save for the extra care required. Just what this will in practice amount to is at present uncertain. The consumption of electrode amounts to from three-quarters of an inch to an inch per hour, which permits all-night burning comfortably enough, but demands daily trimming. This puts them in the class of the old open arcs as regards attendance, and the carbons themselves, as well as the lamps, are just now relatively quite expensive. The greatly reduced energy required for a given light goes so far to compensate these expenses, that the flaming arc is quite certain to take rank as the cheapest known illuminant. Up to the present time that distinction has belonged to the so-called gas arc, the cost of which, however, is sufficiently near to that of the electric arc as to render it certain that the flaming arc will form a class by itself.

The flaming arc must undoubtedly be the subject of a great deal of experimentation before its idiosyncracies are as well understood as those of the ordinary arc. Much work has already been done on it abroad, and if this is not neglected, as it too often is, by our countrymen, the experimental period here will not, we think, be very burdensome. The central stations have not taken up the matter very vigorously, and there will certainly be some hesitation in pushing it on account of its enormous efficiency, which is enough to make any self-respecting meter look for another job. As a defence against the inroads of the gas arc, however, it has an immediate value to the central station, which will be greatly enhanced if it can be, as will probably happen, adapted for indoor use. It would be hard to imagine any more economical or effective illumination for large interiors than diffusive lighting with the flaming arc for a radiant. Capable as it is of considerable variation in color, the resulting effects would be of great beauty and interest. As the situation now appears, indoor lighting is the goal toward which the flaming arc should be forced. Once there the present competition with gas would take on a very different phase. The business of electric lighting is at present in a condition that does not warrant the shelving of improvements. A group of new illuminants is arriving and should be treated with becoming courtesy. It is no time to sit down and figure out devices for screwing up the charges against improved illuminants. That policy will inevitably prove a boomerang which no agility will enable the thrower to dodge. If the users of light had no other sources of information, the gas companies would see that they did not remain in ignorance despite the danger of competition. How many Welsbachs would be in use to-day if the gas companies schemed devious ways to double the price of gas when used in them, or insisted on furnishing them and ate up the economies in their replacement charges? In the long run improvements pay, and the issue must be squarely met.

THE CATHODE RAY OSCILLOGRAPH.

The last number of the *Physical Review* contains a paper by Mr. R. Rankin upon the "Use of a Magnetic Field with the Ryan Cathode-ray Oscillograph." A remarkable and interesting phenomenon is described in the paper. The cathode-ray oscillograph consists, as is generally known, of a special form of cathode-ray vacuum tube made in Germany. In shape it is something like a bottle with a long neck; but, having a hemispherical base, it has to be side supported. In the long neck there is a cathode disc, at the end which would correspond to the cork of a bottle, and about fifteen centimeters down the neck, in a little side pocket, is placed the wire anode. Where the neck joins the bulb there is a metallic diaphragm, with a small hole in the center. When the tube is excited by connecting it to a suitable high-voltage source, cathode rays are thrown out by the cathode, down the neck of the bottle, and a large number of them strike the diaphragm. Here they are absorbed, or reflected, except at the small hole, where they project down into the bulb of the bottle. The diaphragm serves, therefore, to direct a small beam of parallel cathode rays unimpeded down the axis of the bottle to the middle of the base. The bulb contains at the base a transverse screen of calcium sulphide on mica, which in a darkened room lights up by phosphorescence at the central spot where the beam strikes. The beam is about eighty centimeters in length, the pierced diaphragm being placed at about the middle of that length. So long as no transverse magnetic or electric forces act upon the beam, the spot of phosphorescent light remains stationary at the center of the translucent screen. If, however, an alternating electromagnetic flux passes across the neck of the bottle below the diaphragm, the beam will be alternately deflected to the right and left, without sensible inertia or loss of time, and will appear to form a luminous straight line on the phosphorescent screen. By combining the actions of two separate alternating magnetic fluxes at right angles to each other, acting successively on the axial beam, the beam can be made to execute a closed curve or loop on the screen. From the shape of the curve the wave forms of the two electromagnetic fluxes can be inferred. Thus, if both fluxes are sinusoidal, the loop formed by the beam will be some ellipse. If one is made sinusoidal, while the other is irregular, the wave shape of the latter is deducible from the shape of the loop.

It is found that when a short solenoid or coil is placed on the neck of the bottle, with its axis coincident with the bottle axis, the spot of light on the screen is intensified and steadied. Consequently, three magnetic fluxes are used in the most recent form of the apparatus, one parallel to the axis, and applied behind the diaphragm to straighten and collimate the beam of cathode rays incident on the diaphragm; while the other two are applied across the beam, and mutually perpendicular, like the cross hairs of a telescope, but not in the same plane, the beam first being deflected by one and then by the other. It was observed that when the first or axial and collimating flux was applied, the voltage across the tube was markedly affected. The effect has been noticed by several observers, in cathode-ray tubes not designed for oscillographic purposes. It was supposed that the axial magnetic field altered the character of the discharge in the tube and thus altered the voltage. When a tube is exhausted to the high degree necessary for the production of cathode rays, the voltage which must be applied in order to excite the discharge becomes considerable. The continued use of a cathode-ray tube, moreover, tends to perfect the vacuum and to call for a yet higher voltage. In the case of the tube described in the paper, the initial e.m.f. was 17.5 kilovolts. When the solenoid on the neck was excited to 500 ampere-turns, the e.m.f. was still sensibly constant at 17.5 kilovolts; but when the m.m.f. of the solenoid was increased gradually to 1,000 ampere-turns the e.m.f. on the tube fell steadily to 10 kilovolts. During this change neither the current strength of the discharge, nor the character of the discharge, as apparent to the eye, underwent any sensible modification. In other words, turning on the axial field reduced the c.e.m.f. offered by the tube to the discharge and, therefore, reduced the power consumed by the discharge. The effect was found to continue beyond, until 7,000 ampere-turns was applied to the coil, the maximum reported. At that m.m.f. the tube voltage had fallen, by irregular steps, to 7 kilovolts, or to considerably less than half the initial value, which was restored on removing the m.m.f. Similar experiments were tried at a time when the initial tube voltage was 24 kilovolts. This also fell to 7 kilovolts on applying the full 7,000 ampere-turns to the solenoid. The effect was substantially the same with either direction of the exciting current and magnetic flux.

The explanation of this remarkable effect has not yet been made clear. The writer of the paper attributes the effect to a secondary influence. When the axial magnetic field is applied, the cathode rays are prevented from diverging laterally, and are lined up into a parallel beam along the tube, so that the great majority hit the diaphragm placed across the neck. When the axial field is removed, the cathode rays are more dispersed, or scatter, and large numbers hit the sides of the tube. It is supposed that these scattered rays produce in some way a marked c.e.m.f., which has to be overcome by the discharge. The straightening of the stream into a parallel bundle, in preventing the walls of the neck from being struck by large numbers of the cathode-ray projectiles, serves, according to the suggestion, to eliminate this secondary c.e.m.f. The idea is also suggested that the scattered rays which hit the walls of the neck rebound and return upon the main stream, in such a way as to increase the c.e.m.f., or make an increase necessary in the e.m.f. in order to carry on the discharge. The explanation thus offered seems incomplete and unsatisfactory. The fact remains that although the maximum field strength produced by the solenoid is inside its length, and, therefore, at a distance of about 15 centimeters from the anode, or 30 from the cathode, yet there would be a very appreciable axial magnetic field at each of these electrodes. That is to say, the two electrodes in the experiment were exposed to a certain lesser strength of axial magnetic field. The effect may have been due, therefore, at least in part, to actions on the magnetized surfaces of the electrodes. It would seem that only when the two electrodes are completely shielded from the field produced by such a solenoid, can the effect be clearly confined to secondary actions of cathode rays, as distinguished from the action of the field on the electrodes. On the other hand, however, an experiment, mentioned in the paper, with a small horseshoe magnet which, when acting above the diaphragm so as virtually to occlude the central hole, perceptibly increased the tube voltage, certainly favors the suggestion of indirect action. It is to be hoped that the matter will be fully investigated experimentally by many observers. It has both theoretical and practical importance.

Westinghouse Single-Phase Equipment for the Sarnia Tunnel

An important contract has just been made between the St. Clair Tunnel Company and the Westinghouse Electric & Manufacturing Company for a complete single-phase installation to operate freight and passenger trains through the Sarnia tunnel, which connects the American and Canadian divisions of the Grand Trunk Railway system of Montreal, Canada. The plans and specifications were prepared by Mr. Bion J. Arnold, of Chicago, whose pioneer work in single-phase, alternating-current traction is well known, and the work of installation will be conducted under his supervision.

The equipment includes a complete power station with steam turbines, bridge and pole lines for catenary trolley construction, overhead work, transformers for power and light, round house motors, motor-driven pumps, drainage and sewer systems for buildings and yards, electric locomotives, etc. Interest centers, of course, largely in the locomotives equipped with the series-wound single-phase motors developed by the Westinghouse Company. There are to be six similar units designed to meet the requirements of the tunnel service of the Grand Trunk Railway. Each will exert a drawbar pull of 25,000 lb. on a 2 per cent grade at a speed of 10 miles per hour. The locomotives may be operated from either end, and two or more may be coupled together and controlled in multiple from a single unit, so that there is practically no limit to the size of train which may be taken through the tunnel by the electrical equipment—other than that imposed by the limited mechanical strength of the coupling which joins car to car.

These locomotives are of the rigid frame type, with driving axle boxes and draft gear mounted on the same frame. Each unit will have three pairs of 62-in. driving wheels with a motor on each axle connected with a gear reduction of 18 to 95. It will weigh approximately 62 tons, all of which is on the driving wheels. Equalizer beams similar to those used in standard steam locomotive practice will distribute the weight among the six drivers. The frames will be made of cast steel and will be placed outside the wheels. The locomotives will be equipped with the Westinghouse friction draft gear. The power equipment of each unit comprises three 250-hp. single-phase, series-wound motors of the same general type as those recently adopted by the New York, New Haven & Hartford Railroad for their terminal operations in New York. Pneumatically-operated trolleys of the pantagraph type will collect the current from the overhead trolley line outside the tunnel.

The Sarnia tunnel of the St. Clair Tunnel Company passes under the St. Clair River and connects the divisions of the Grand Trunk Railway system which terminate at Port Huron, Mich., and Sarnia, Ont. The tunnel proper is 6,032 ft. long. A single track leads through the tunnel, but the approaches are double track to a point about 300 ft. from each portal. From terminal to terminal, a distance of 19,348 ft., will be electrically equipped. At the present time passenger and freight trains arriving from either direction are hauled through the tunnel by steam locomotives. Almost all of the freight trains must on arrival be divided, as they are too heavy for a single locomotive. The result has been that traffic is congested at the terminals and the entire service of the system impaired. It is expected that the electric locomotives will greatly relieve this congestion, as their greater capacity and flexibility will eliminate or largely reduce the necessity of dividing trains.

Alternating current at 3,000 volts, 25 cycles, will be delivered to the locomotives. Outside the tunnel the current will be fed through a No. 0000 grooved trolley wire and pantagraph trolley to the locomotive equipment. The trolley wire will be hung by a catenary suspension from steel towers which span the track or from bracket arms mounted on lattice-work poles of steel.

The application of the single-phase system to the St. Clair problem was considered to provide an effective solution of the difficulties encountered. By its adoption, the company is enabled to eliminate chances of electrolytic troubles of every kind, and to secure an effective speed control with economical starting and rapid acceleration.

Indiana Independent Telephone Meeting.

A special meeting of independent telephone representatives of companies constituting the fourth district of the Indiana Independent Telephone Association was held in Lafayette on January 5. About twenty-six companies were represented. The principal question for discussion was that of entering into a sub-licensee agreement with the Bell Company for long-distance business. The companies in the fourth district and a number of independent companies in Vermillion, Fountain and Parks Counties are said to be anxious to make long-distance contracts with the Bell Company at Danville, Ill. The representatives in attendance at the Lafayette meeting opposed this. The discussion resulted in the appointment of a committee to go to Danville and make arrangements with the city authorities and the Commercial Club to include independent long-distance lines in the matter of toll line business, as well as the Bell Company. The members present insisted that local independent companies must elect to remain independent or go entirely over to the Bell Company. No satisfactory division of the business can be made, they declared. Mr. William Vesey, of Indianapolis, gave a talk on the latest phases of the independent telephone situation in the State. He explained what the syndicate proposed to do in the matter of improvements and extensions and assured the representatives present that in a very short time all local independent companies in the State would have independent long-distance facilities at their command.

Governor Higgins on Electrical Topics.

The subjoined passages from the annual mesage of Governor Higgins, of New York State, to the Legislature, deal with questions of interest in the electrical field, one being the "preservation" of Niagara, and the other the regulation of public utilities. In regard to the first named topic he said: "This State and the Dominion of Canada have in the past been engaged in an unworthy rivalry in granting franchises of incalculable value to power development companies, permitting them to take water from the Niagara River above the Falls for commercial purposes. The privileges granted to these companies now constitute a real menace to Niagara. The State of New York cannot carry on the work of preservation effectively without the aid of an international agreement to protect the cataract and the river from spoliation. It can, however, in some degree, repair the mischief already done (1) by limiting the amount of water which may be taken from the river by the New York companies now engaged in developing power, (2) by repealing all undeveloped charters, of which several remain on our statute books, dormant if not defunct, and (3) by instituting legal proceedings for the forfeiture of the charters of any companies which may be guilty of misuse of their franchises or abuse or usurpation of powers. I earnestly desire to impress upon the Legislature a due sense of the responsibility of this State for the protection and preservation of the grandeur and beauty of Niagara Falls."

Dealing with the subject of the regulation of public utilities, the Governor remarked: "Private companies control our railroads, telegraphs, telephones, gas and water supplies, and other services which have become necessary to the daily lives of many of our citizens. Such companies are quasi-governmental agencies, vested with the sovereign power to condemn private property for their uses. They are permitted to exist because the State delegates to them its own functions for convenience and economy, and to promote industrial development. Such corporations should be tolerated only so long as their rates are reasonable and their service prompt and efficient.

"It has been suggested by a learned Justice of the Supreme Court of the United States that such companies have not even the constitutional right to a profit on their investments, and that, while they cannot be required to do business at a loss, they may be compelled to content themselves with a return equal to the cost of operation and maintenance. So radical a theory has not been adopted, but that it should be declared from the bench of our most eminent and conservative tribunal is a significant suggestion of the power of the people to regulate public service companies, or, failing therein, to exercise their functions directly through Government, State or local officials.

"In Great Britain the rate for gas in municipal plants averages 64 cents per 1,000, while in a number of the cities it is as low as 50 cents. In the United States the average charge is $1.25 per 1,000. It ill becomes the State to protect public service companies in extorting unjust charges from the consumer. Corporations are but associations of individuals. The act of incorporation does not make them outlaws nor deprive them of natural rights; nor, on the other hand, does it set them above the law. A careful investigation of the gas problem in New York City by a competent and conscientious legislative committee resulted in the recommendation of an eighty-cent rate to be established by law. A prima facie case was made out. The action of the Legislature was subject to judicial review. Yet relief was refused. I urge a further consideration of this question on your part."

Power from Blast Furnace Gases.

In a paper read by Mr. H. Freyn before the Western Society of Engineers on December 20, much valuable information was given concerning the available power and cost of operation of a power station by waste gases from a blast furnace plant. The author deduced figures to show that a power plant having a capacity of 10,500 hp, complete in every detail and installed in connection with a blast furnace plant, would be capable, when running at full load capacity, of producing one hp-year at the low cost of $17.88, no value being placed on the blast furnace gas. It was shown that one kw-hour at full load capacity of the plant could be produced at .295 cents, which is considerably below the best results ever obtained with a steam engine power plant. When the power plant is running on an average of only 50 per cent of its total capacity, the cost of producing one kw-hour is only .55 cents.

In order to show that his deductions are of practical as well as theoretical value, the author relates the experiences of the John Cockerill Company, in Belgium, which has in operation at present seven blast furnaces of about 1,200 tons daily capacity, in addition to numerous other industries, necessitating the employment of 15,000 workmen. In 1900 the Cockerill Company had 86 electric motors in use, while in 1905 there were 333. The lighting equipment consisted in 1900 of 450 arc and 4,500 incandescent lamps, whereas in 1905 the corresponding figures are 660 arc and 5,600 incandescent lamps. In 1900 the power was produced by 1,000 kilowatts in steam engines; in 1905 only 800 kilowatts in steam engines have been in operation, 2,900 kilowatts of gas engines being used. The output in kw-hours produced per year increased from 1,789,281 in 1900 to 9,099,216 in 1905. The cost per kw-hour fell from 1.67 cents in 1900 to .412 cents in 1905. The author states that the reduction in the cost of power per kw-hour has been due almost exclusively to the installation of gas engines.

The Municipal Plant at Holyoke, Mass.

Mr. W. H. Snow, the manager of the Holyoke, Mass., municipal lighting department, reports as follows, to the city authorities: The chief item of moment to be called to your attention is the increased and increasing volume of business transacted from the gas works and the electric station. From the former there has been sold 13,103,300 cu. ft. more gas than during 1904, an increase of 12 6/10 per cent; while from the latter there is being sent out about 40 per cent more current than at this time a year ago. During the year at the station there have been installed one 500-kw. turbo-generator with ample condensing apparatus, and three 300-hp boilers, practically doubling the steam capacity of the plant. The plant, at the rated capacity of the generators, is now equipped to furnish 2,200 hp in electric current, with water and steam power run together, but it can furnish only 1,733 hp in current with steam power alone. When the turbo-generator was purchased last winter it was thought that the equipment would be large enough to take care of the growth of the business for some years, but the station has already almost reached the limit of its capacity, it being able to take on only about 20 per cent more business with its combined water and steam power, and has reached the rated capacity of the steam plant. During the past fall the four remaining mill powers of the 16 appurtenant to the plant were taken, but the business has increased so much that some steam power has to be used every day in addition to the water power, as the water wheels do not furnish power enough for the daylight load alone.

All this leads up to the fact that the situation at the station is this: When the night and the day loads lap, as they do from sunset until 6:30 p. m., 80 per cent of the combined water and steam power is being used, and in case of the water being shut off by any cause, the whole of the rated steam power is being used. This means that within a comparatively short time the department will have to refuse to take on new business, through its inability to handle it, unless more generating apparatus is added to the station. In my opinion, the department should be given the necessary authority to add to the equipment at the station one 1,000-kw or 1,333-hp unit, including the steam power and electric generators. I would also respectfully suggest that action upon this extension be taken as early in the year as possible, as the electric machinery manufacturers are so crowded with orders, that to meet our needs the coming fall, it is necessary to order this machinery as early in the season as possible. Another matter of pressing importance to be considered in connection with the addition to the power at the station is coal storage. To be in a position to handle whatever demand for current that may come, a sufficient lot of land that is conveniently situated with regards railroad facilities and the station should be acquired to give storage ample for a winter's supply of coal.

Power on the Stanislaus.

Further data come from San Francisco as to the financing in New York and Boston of a large hydro-electric enterprise to be developed by the Stanislaus Electric Power Company in the central portion of California, the power plant being located in Tuolumne County, on the Stanislaus River, at Subletts Crossing, about six miles from the town of Murphys, Calaveras County. Mr. Beach Thompson, of San Francisco, has been getting control during several years past of the water rights and other properties that will be acquired by the Stanislaus Electric Power Company, and has interested the Eastern capital that is now undertaking their development. These properties consist of a number of water rights on the Middle Fork of the Stanislaus River, complete rights of way for all the necessary canals, pipe lines, etc., several thousand acres of land for storage reservoirs, and several thousand acres of land to supply lumber for flumes and for other purposes.

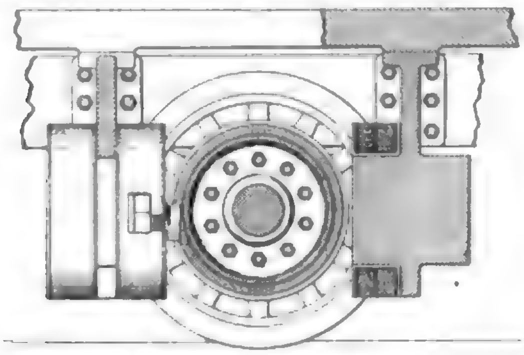
The proposed construction includes storage reservoirs at the head waters of the river, a diverting dam near Sand Bar Flat, in Tuolumne County, a flume and ditch system 15½ miles long, with a capacity of 300 cu. ft. of water per second, a large equalizing reservoir above the power house site, a system of pipe lines which will deliver water to the power house under a head of 1,500 ft., a power station with water wheels and electrical apparatus having a capacity of 20,000 kw, and a very extensive transmission system which will make it possible to deliver power throughout the entire central portion of the State.

It is said the transmission system will be of a type of construction superior to any now installed on the Pacific Coast. High steel towers with cement foundations will be utilized on all the main lines instead of wooden poles, and a number of other usual provisions will also be made both in the hydraulic and electrical installations, to insure reliability and freedom from interruptions of service. Sanderson & Porter, of New York, are the engineers in charge of the construction work, which is to be undertaken by the Union Construction Company, a corporation formed for the purpose of building the system. The work of construction has already been commenced and will be pushed to completion as rapidly as possible.

Tucker, Anthony & Co., of Boston, who have financed and managed a large number of electric railway and power enterprises in various parts of the country; Frederick Eldridge, first vice-president of the Knickerbocker Trust Company, of New York, and Cornelius C. Cuyler, of the banking house of Cuyler, Morgan & Co., New York, are the managers of the underwriters' syndicate, which has subscribed for the bonds. The Knickerbocker Trust Company, of New York, are the trustees for the bond issue, which is $10,000,000. Beach Thompson, Howard P. Veeder and James K. Moffitt, of San Francisco, and Harvey P. Goodman, of Napa, are among those largely interested in San Francisco. The bonds have been placed principally in New York and Boston. Beach Thompson and Howard P. Veeder are the California representatives of the Stanislaus Electric Power Company.

Direct-Current Locomotive.

The accompanying illustration shows a method of constructing heavy electric locomotives as disclosed in a patent issued January 2, to Mr. A. S. Batchelder. The frame of the truck constitutes the field-magnet structure of the motors. The motor-armatures are mounted directly on the axles, and the frame of the truck is spring-supported from the axle-boxes. The pole-pieces are located in the plane of revolution of the motor-armatures and are cut away at the pole-tips so as to permit a free movement of the pole-pieces with reference to the motor-armatures as the axle-boxes play up and down in their bearings, and the axles are removable from their bearings in a downward direction and the pole-pieces are provided with substantially plane faces or at least are cut away sufficiently to permit the removal of the axles, with the wheels and armatures mounted thereon, by lowering the complete elements from the truck-frame without disturbing the field-windings or any other parts of the locomotive.



DIRECT-CURRENT LOCOMOTIVE.

Our Foreign Trade in Electrical Machinery.

By Henry L. Geissel.

The exports of the United States, which never touched the billion-dollar mark until 1895, and had not until 1905 in any calendar year, been as much as a billion and a half dollars in value, exceeded that figure last year considerably, and approximated 1,600 million dollars. The total figures for the month of December are not yet at hand, and therefore the amounts given in the following account may be subject to slight corrections upon the final balancing of the statistical returns for the past year.

The expansion in our foreign commerce makes itself apparent in our trade relations with nearly all of the principal countries of the world, and the most gratifying feature of our export trade is the considerable increase in our exportation of manufactured goods. These exports exceeded those of 1904 by about 55 million dollars. As close as it can be figured, manufactures form over 38 per cent of the total exports of domestic products. The total exports of electrical machinery last year exceeded $7,000,000, an increase of nearly one million dollars over the preceding year. This does not include electrical instruments of any kind, worth several millions.

In any city in any part of the world where the progressive steps of civilization demand the institution of economies and labor-saving devices, it is only a matter of time to find a means of obtaining money for their first cost. Telephones, electric lamps and railways are now being introduced into the remotest parts of the world. The demand for electricity is increasing the world over. The writer visited last year several countries on the northern coast of Africa and sixteen of the leading countries in Europe. He had made the same tour three years ago and was surprised to see the progress which had been made in the many different lines of electricity. Even in the south of Europe, in countries which are lamentably slow in the adoption of modern ideas, the electric current has made a wonderful showing of late.

In the town of Lund it is now proposed to utilize some of the waterfalls on the Laga River, not only for lighting Lund itself, but also for several other towns in the south of Sweden. During the negotiations made with the owners of these falls it was stated that a syndicate in Denmark would also make offers for the falls with a view to using them as a source of electric energy. The Laga River comes from the Smaaland uplands, runs for three miles through the Province of Halland, and has two large falls, the "Majefos" and "Catefos." This latter is about one mile from the river mouth and here the Danish Syndicate proposes to erect power stations, the electricity being transmitted by cable to the coast of Helsingborg, and thence, by means of submarine cables, to Denmark.

Several strong companies and syndicates are now being organized in Stockholm; they are backed by Scandinavian and German capital, and their object is to harness all the streams of Sweden with a fall of water sufficient to generate electricity.

Our two best customers of electrical machinery last year were Canada and Japan, the former having bought nearly two million dollars worth—or about 35 per cent of our total exports—and Japan over one million dollars. The third place is occupied by Mexico, to which country we shipped electrical machinery to the value of one million dollars.

In Europe, the United Kingdom leads the list with over $800,000. Then follow France, Germany, Italy, Holland, Russia, Scandinavia and Spain. Our total shipments of electrical machinery to Europe average in value $1,500,000, those to Central and South America, $500,000; to Asia, $1,400,000; to Africa, $150,000, and to Australia, $250,000.

Of the South American countries, Brazil and Argentina are our best customers. To the former we exported electrical machinery to the value of about $210,000, and to the latter $165,000. Smaller quantities went to Chile, Peru, Uruguay, Colombia, Venezuela, Ecuador and Bolivia. The total exports to Central America were valued at only $13,000, and those to the West Indies $88,000, of which nearly $85,000 worth was exported to Cuba. It is very much to be regretted that our trade with South America is so insignificant. Germany and the United Kingdom practically control the trade in electrical machinery in those countries.

But South America is not a negligible quantity by any means. It is, indeed, astonishing to see how the nations of Europe have outdistanced us of the United States right on our own western hemisphere. The large German electrical manufacturing companies have had for years their branches in almost every republic to the south of us. It was only recently that the Peruvian Government decided to install a great system of wireless telegraphy throughout the country, and the contract went to Berlin, the German house securing therewith the exclusive right of establishing wireless telegraphy within the boundaries of Peru.

Great strides ahead are also being made in the electrical industries of Brazil. The Rio de Janeiro Tramway, Lighting & Power Company, capitalized at $25,000,000, proposes the development of water power and the utilization of it in the form of electric energy in Rio de Janeiro and other cities. According to a recent report, the company has already acquired two large waterfalls, one on the Parahyba River, a distance of about 80 miles from Rio de Janeiro, capable of producing about 100,000 hp; others on the Rio das Legas and streams in the vicinity about 50 miles from Rio de Janeiro, capable of producing 40,000 hp. The latter plant the company is now developing and expects to have power from it in Rio de Janeiro within six months. It is estimated by the company that there is a present demand for 25,000 hp. This, it is expected, will be considerably increased as the advantages of the use of electric power become fully demonstrated. The same company has acquired a number of suburban street car lines now operating with animal traction, the electrification of which will soon begin.

The greater part of the electric plant equipments and practically all the electric traction machinery used in Argentina are from the United States. Small electric motors and their fittings are also chiefly American, but the bulk of the electrical trade is still in the hands of European concerns. It is estimated that the total imports of electric materials in 1905 amounted to over $3,000,000, of which over $1,000,000 worth came from Germany. The same proportions prevail in Chile and other South American countries.

It was stated previously that Japan is one of our largest customers of electrical machinery. Of our total exports to Asia of about $1,400,000, Japan received nearly $1,100,000, or nearly 80 per cent. The Japanese electrical industry centers around the city of Osaka, the seat of the great manufacturing industries of the Empire. The Japanese Government has appropriated large amounts for enlarging and repairing arsenals, shipbuilding yards, harbors, Government railway shops and general engineering works operated by the Government, and the demand for modern electrical machinery will, in all probability, continue to increase during the present year. Electricity has also been introduced to a large extent in the Japanese mining industries: the Hokkaido Collieries, the famous Ashio copper mines and a number of other mining enterprises are equipped with large and up-to-date electric plants, the machinery being chiefly of American origin. In connection herewith it may be said that there is quite a brisk demand for electric motors to drive machinery in factories. The use of electric lighting is also spreading. In all probability the equipments of electric traction will be of considerable importance in the exports of American manufacturers to the Japanese market.

In China there is as yet little demand for electrical machinery, with the possible exception of telegraph equipments. Electric launches for use in navigating rivers and harbors might perhaps find a slight sale if properly pushed. Electric lighting plants are in use to some extent in the treaty ports. The use of electric power and traction machinery is confined to foreign establishments. The telegraphs and telephones, though sharing in the prejudice of the Chinese against all foreign innovations, have been adopted to a considerable extent. Not only foreign firms, but many Chinese merchants also, have their telephones, and several thousands of miles of telegraph lines have been built and others are projected.

The popularity of American electrical appliances and machinery in India, notwithstanding the protests made against their introduction by the British press appears to be growing. It seems, however, that no serious efforts have been made on the part of American manufacturers to secure a firmer foothold in the Indian market. The same is the case in the Dutch East Indies, where German firms are doing considerable trade in electrical machinery and appliances.

More attention should also be paid to the South African markets. The city of Johannesburg is planning to spend millions of dollars for improvements. An immense generating plant is now being installed there which will have one of the most extensive networks of conductors, the contract for which was awarded recently to a British firm. Some idea of the magnitude of this contract will be gathered from the fact that about 3,000 tons of cable and material will have been shipped from England before the completion of the undertaking is within sight. The present contract will amount to about $600,000, and it will include the furnishing of some 270 miles of cables for electric undertakings.

In conclusion it may be said that the problem of supplying electric power for industrial purposes is daily receiving more serious attention in most parts of the world. The demand for modern electrical machines and appliances is steadily increasing, and American manufacturers should spare no time or effort to secure a firmer and permanent footing in the various markets of the world.

Electrical Engineers of the Times.—XLIV.

DR. N. MONROE HOPKINS.

Nevil Monroe Hopkins was born September 15, 1873, in Portland, Maine. He received his early education in private schools in Washington, D. C., in Dresden, Germany and in Paris, France. Upon his return from abroad he entered the Corcoran Scientific School of the Columbia University at Washington, D. C., and specialized in electricity in a four-year course, taking the degree of Bachelor of Science.

After graduation in 1895 Mr. Hopkins engaged in the practice of applied electricity and electrical engineering, commencing by wiring for lamps, generators and motors, and line construction work. In 1896 he started a research and testing laboratory and equipped it for electrical measurements, calibrations and general electrical testing work where laboratory methods are basic. Subsequently he was appointed in the Expert Department of the General Electric Company at its principal Schenectady works and was engaged in assembling and testing generators and motors, conducting laboratory and efficiency tests. During the Spanish-American War he was engaged in experimental torpedo work.

Dr. Hopkins, in connection with his private practice, has made extensive investigations on the economy and performances of electric power plants. He is the inventor of a system for preventing the bursting of water pipes and mains by freezing and has carried on experimental work in thawing out pipes and other conduits through the application of electricity. He was granted a series of United States and foreign patents and was awarded the "John Scott Medal" by the City of Philadelphia, on the recommendation of the Franklin Institute of the State of Pennsylvania, in recognition of the merits of his invention, and was retained for a year by the company purchasing these patents as designing and consulting engineer, during which time the system was installed in many factories and plants throughout the country, as well as in many Government buildings and reservations.

DR. N. MONROE HOPKINS.

In the fall of 1898 Dr. Hopkins arranged to carry on further work in the Columbian University and in 1899 was appointed assistant in the Laboratories, pursuing a post-graduate course also, during instruction duties, and was granted the degree of Master of Science. In 1901 he was appointed instructor, and lectured upon applied electricity, electrochemistry, and electrochemical engineering. Upon receiving the degree of Master of Science he undertook further post-graduate work at Columbian and Harvard Universities in applied electricity, advanced physics and electrochemistry and was granted the degree of Doctor of Philosophy.

Dr. Hopkins has acted in an expert capacity for the Smithsonian Institution, the Germania Electric Company, and many other private corporations, when he was a partner of the expert firm of Monroe, Hall & Hopkins, chemists, assayers and engineers, of which Professor Charles E. Monroe, the well known expert in chemical matters, and formerly professor in the United States Naval service, is senior partner. During Dr. Hopkins' connection with this firm a most varied chemical and electrical practice was enjoyed. During the summer of 1904 he traveled abroad, making a study of German, French and English electrical installations. His extensive knowledge of chemistry and electricity secured for him in the fall of 1904 an appointment of assistant professor in the George Washington University, where he was placed in charge of the courses of electrochemistry, electrochemical engineering and advanced research work in the application of electricity to chemical purposes. Recently he received the appointment of chief electrical engineer, Bureau of Yards and Docks, U. S. Navy, in charge of electrical and mechanical work in connection with consolidation of power plants at various navy yards.

Dr. Hopkins is the author of several technical text-books and has in preparation at the present time a treatise on "Alternating-Current Phenomena." He is a member of the American Institute of Electrical Engineers, the American Electrochemical Society, and after election as a member of the American Association for the Advancement of Sciences, was subsequently chosen a Fellow of the association. He has written over two hundred technical articles for the various engineering and electrical journals. His recent appointment by the secretary of the navy to the position, placing him in charge of the consolidation of navy yard power plants, is of general interest, since it is the first appointment as electrical engineer in this service.

CURRENT NEWS AND NOTES.

CIVIL SERVICE EXAMINATION.—The United States Civil Service Commission will hold examinations at Washington, D. C., on January 24 for the position of electrical engineer and instructor at the Washington Barracks, D. C.

TELEPHONING PRESS NEWS.—The Associated Press news in a large section of Michigan, including most of the State, is now being handled over the service of the Michigan State Telephone Company, with telegraphy and telephony over the same wires.

SPANISH CABLE.—A Madrid despatch of January 5 states that the government is inviting tenders for a new cable from Cadiz to Teneriffe. The competition is open to the world. The firm offering the best guarantees will be chosen. The conditions have not been settled finally.

NEW STYLE TROLLEY BRIDGE.—A "trolley" bridge, estimated to cost $175,000, is to be built by New York City over Dutch Kills Creek, in Long Island City. The bridge will be a new type. It will not lift or turn, but will roll off on car trucks to one side, the power used being electricity. The bridge will cross the creek at Borden Avenue.

A. I. E. E. PITTSFIELD BRANCH.—At the meeting on January 5 at Pittsfield, Mass., of the local branch of the American Institute of Electrical Engineers, Mr. Samuel G. Colt read a paper on "Lubrication," and Mr. Gilbert Wright presented abstracts from Mr. H. W. Buck's paper on "The Duplication of Electrical Apparatus to secure Reliability of Service."

ILLUMINATING ENGINEERING.—The growing recognition of the value of illuminating engineering as an art is indicated by the recent establishment by the General Electric Company of a department of illuminating engineering in charge of a specialist. It is announced that among other purposes will be coöperation with central station managers in submitting attractive lighting plans to prospective customers.

A MUNICIPAL CONGRESS.—Sir Edwin Cornwall, chairman of the London County Council, has issued to the press a proposal for an international congress of representatives of capitals having over 500,000 population, to meet annually for the discussion of municipal methods. In conjunction with this congress Sir Edwin proposes an exchange of pupils between the schools controlled by the municipalities holding membership in the congress.

PROF. BELL'S GIFT TO VOLTA BUREAU.—A Washington dispatch of January 5 states that a gift of real estate and bonds aggregating $75,000 to the Volta Bureau was on January 5 announced by Dr. Alex. Graham Bell as a memorial to his father, Prof. Alex. Melville Bell. The bureau was established by Dr. Bell with the object of increasing the diffusion of knowledge relating to the deaf and dumb, and with the endowment the scope of its work can be greatly extended.

CIGAR LIGHTERS.—To show where the electric cigar lighter comes in, we quote the following passage from a letter received recently from Pittsburg as to an accident at the Fort Pitt Hotel: "The cigar lighter in question was a small affair, of a very neat and handsome design and contained alcohol. A small wicking was used and there was a light at the top on the order of a torch; then, in the side of the little lighter was a small wire which was dipped in alcohol, and then you made use of this little handle in lighting the cigars. I thought so much of the pattern that I decided to order a few for Christmas, but upon going down to the hotel to find out who made the lamps, I was told those in use at the Fort Pitt had been discarded entirely, as one or two of them had exploded and one of the waiters was quite seriously hurt, and for this reason I decided not to use any of these lighters at all. I might furthermore say that the lighters in question were used directly on the table and after the dinner might be over. I believe that something of this kind made to use with electricity would be a very taking article." Such electrical devices exist and are very handy.

TWO AUTOMOBILE SHOWS will open in New York City this week on January 13, one in Madison Square Garden, under the management of the Association of Licensed Automobile Manufacturers (licensees under the Selden patent), and the other under the auspices of the Automobile Club of America in the magnificent new armory of the Sixty-ninth Regiment. In spite of this rather unusual rivalry both shows promise to be great successes, and great preparations have been made. The Armory exhibit will include aeroplanes. While the automobile in all its advancement will be contained somewhere in the mammoth structure, space has been found in the gymnasium for the Aero Club of America which will prove a surprise. It is probable that the "Aero Club No. 1," the dirigible balloon which Leo Stevens, the famous aeronaut, designed, will be suspended from the top of the curved roof in the big drill hall. What should prove another attractive object in the airship department will be Prof. Alexander Graham Bell's kite, which, though of enormous size, is by its peculiar tetrahedral principle of construction, literally as light as a feather and is still so strong and substantial that it has recently supported in flight for a long time, a man weighing 165 pounds and tackle weighing 62 pounds.

NORTHWESTERN ASSOCIATION.—Mr. T. R. Mercein, secretary, advises us that as already noted, the fourteenth annual convention of the Northwestern Electrical Association will be held at the Great Northern Hotel, Chicago, commencing at 9:30 on Wednesday morning, January 17. An electrical show, the finest ever held in the West, will be in progress at the Coliseum at that time. The management of the Show has set aside Thursday, the 18th, as "Northwestern Electrical Association Day." An unusually fine programme has been arranged, and an interesting and instructive time is assured to all who attend this meeting. The Western and Central Passenger Associations have granted a one and one-third round trip rate from all points in their respective territories. The hotel has made special rates for the occasion from $1.50 per day upward. During the week the American Electrical Salesmen's Association will hold its first regular meeting at the Grand Pacific Hotel, Chicago, when an interesting programme will be taken up. The meeting will be opened by President Vinton Gray, on January 20, at 9 a. m. Mr. E. E. Rines will present a report, Mr. J. Robert Crouse, Jr., will deliver an address, and some important topics will be discussed.

CLEVELAND TRACTIONS.—The ever restless Mayor Johnson, of Cleveland, is now in favor of the formation of a holding company to take over all the traction properties in the city, to be operated by the company in behalf of the city.

DISINTEGRATION OF GOLD.—Prof. F. Soddy, of Glasgow University, whose radium investigations have attracted so much attention, holds the theory that gold is gradually disintegrating into other materials. As a matter of fact we have ourselves already had practical experience of this alarming phenomenon.

NEW YORK SUBWAYS.—The transit committee of the New York Board of Trade and Transportation has issued a call for a public meeting to be held at the organization's rooms, 203 Broadway, January 25, to consider the question of future subways and their control. The Board believes it essential that effective city control over future lines should be reserved, and through its transit committee it has submitted to Mayor McClellan, the rapid transit commission and the board of estimate and apportionment a memorial, in which is set forth its views. The purpose of the meeting to be held is to ascertain if possible the best method of securing this control.

THE YERKES HOSPITAL.—It is stated that the widow of Mr. C. T. Yerkes will at once take legal steps necessary to enable her to see the erection of the Yerkes Hospital willed by him to the borough of the Bronx, New York City, during her own life, instead of allowing it to be built after her death, as is provided by her husband's testament. Should the courts grant the desired permission, she will make the building and maintenance of the hospital her life's work. Under the directions of Mr. Yerkes' will $800,000 is to be expended for the ground and the buildings of the hospital which is to be erected in the Bronx. For its maintenance the income from one-half of the estate, which was left to the widow during her life, is to be employed. It has been estimated that this will amount to a sum in the neighborhood of $15,000,000. As the will is to be probated in Illinois, it will be necessary to obtain the consent of the courts of that State for the change.

LIFE AND CURRENT.—A special dispatch from Berkeley, Cal., of January 8, says: "Dr. Jacques Loeb, who is engaged in extensive experimentation concerning the phenomena of the generation of animal life, announces that he has discovered the reason for the electrotonic effects of the galvanic current upon nerve and muscle tissue. It is due, he says, to physical causes in the tissue itself. In previous investigations Dr. Loeb had discovered that sodium and potassium in solution stimulated nerve and muscle fibres, and that the subsequent administration of solutions of calcium and magnesium neutralized the stimulating action of the other two substances. Dr. Loeb now says that his last set of experiments has demonstrated that this phenomenon is due to the fact that when the galvanic current is applied these chemical substances migrate and concentrate in the region of application of the electrodes, or poles of the battery. The oleates and stearates, which are normally in the nerve and muscle tissue, precipitate the calcium from the solution under the action of electricity, and in this way the calcium, or lime, is prevented from interfering with the stimulant action of the sodium and potassium."

STREET SIGNS.—New York, like other large cities, is badly in need of signs for designating streets, as legible by night as by day. Last week, there was a meeting at the Bar Association of representatives of various associations and business clubs to see what could be done in the way of placing signs that could be read at the street corners and numbering houses so that the numerals could be seen from the sidewalks in the day time or with the ordinary street lamps at night. J. L. Brower, president of the Street Sign Conference of Municipal Organizations, presided. He recalled the past work of the organization that seeks to make it possible for the stranger to find his way about in New York and New Yorkers in unaccustomed localities, which resulted in the appropriation of $30,000 for the placing of legible street signs. He said that Borough President Ahearn had been very courteous, and had promised to soon have the signs completed and installed. He then read a list of some five typewritten pages giving important points of the city which had no designations in the way of signs. Among them were the entrances to Central Park, the Grand Central Station, and Union Square. A resolution was adopted that the chair appoint a committee of seven to ask the Borough President whether the appropriation of $30,000 was used up, and if so to see to it that there should be a further appropriation. Nearly 7,000 signs are still needed, and about 1,400 have been placed. It was also resolved that an ordinance should be drawn making it mandatory that every residence and place of business in New York should have numbers that could be distinguished at night as well as in day time. Some very interesting and effective types of electrical street lamp signs have been placed on the thoroughfares of Manhattan.

LONDON UNDERGROUND.—At a meeting of the board of the Underground Electric Railways Company in London, on January 3, Mr. Edgar Speyer was elected chairman of the company in succession to the late Charles T. Yerkes. Sir George Gibb, general manager of the Northwestern Railroad, was elected deputy chairman and managing director of the Underground Company and also chairman and managing director of the Metropolitan District Railway Company, vacated by the death of Mr. Yerkes. The board passed a resolution recording its deep regret at the death of Mr. Yerkes. It is stated that Mr. Edgar Speyer will have charge of the general financial interests of the company and Sir George Gibb will have the executive direction of its technical operation. Sir George Stegman Gibb, LL.B., is 55 years old and an Aberdeen Scotchman. He is accounted one of the most successful and up-to-date railroad officers in England. His railroad experience began in the legal department of the Great Western Railway Company in 1877. He was later solicitor and then general manager of the North Eastern Railway Company, which office he now leaves to enter the service of the London Underground. He has held various political appointments of importance and was knighted in 1904. He is a man of wide attainments and has been noted in England for his progressive policies in railroad affairs. As manager of the North Eastern Railway he introduced the American system of ton and passenger mile statistics, and during five years effected an increase of 52 per cent in the freight train loads of his road. The autocar system for branch line passenger traffic, now being taken up in this country, was another of his innovations in England. He visited America this year for the International Railway Congress.

ELECTRICITY IN SWEDEN.—U. S. Consul Bergh, at Gothenburg, notes the plans already discussed in these columns to equip the government railroads electrically, and adds: The Helsingborg-Raa-Ramlösa (5 miles) is now being changed to electric power. A power station is under construction in Helsingborg. The power is obtained from three suction gas engines, with peat as fuel. The power station is built by a Swedish firm which has the patent rights on the engines, which are said to be very economical. The owners of the Gothenburg-Särö Railroad (14 miles) have received plans for the adoption of electric power for that road. The intention is to take current from Yngeredsforsen, near the city of Falkenberg, with a transforming station about 6 miles from Gothenburg. Three or four new short electric railroad lines near Gothenburg are also planned. It is reported that the cities of Skara and Lidköping and certain companies are negotiating for electric power from Vargöns Aktiebolag at Trollhättan. The plant will initially have a capacity of 1,500 hp. The board of finances for the city of Lund has recommended the building of an electric power station in that city, and the committee on electricity has recommended that the city should build electric street railways to take the necessary power from the power station. Since the property of the Trollhattan Canal Company was purchased by the government the new board of managers was instructed to investigate plans for a large electric power plant at Trollhattan. Three engineers are working on plans which are not expected to be finished and submitted to the Riksdag before 1907. It is calculated that it will require three or four years to build the power station, and that the cost will not exceed $38 per effective horse power. As the water power at Trollhättan is large it is considered that many Swedish industries will derive great benefit from the plant.

POSTPONEMENT OF MARCONI LECTURE.—Cable advices from England report Mr. Marconi as seriously ill with influenza and under imperative orders from his doctors not to undertake a sea voyage for some time to come. Mr. Marconi's lecture before the New York Electrical Society, which was arranged for January 16, has accordingly been postponed. Mr. Marconi, however, will be here in March and has pledged himself to give the society this lecture in the third or fourth week of that month.

TELEPHONE SITUATION AT EVANSVILLE, IND.—After years of litigation the United States Court of Appeals has affirmed the decisions of the U. S. District Court of Indiana in the case of the Cumberland Telephone Company against the city of Evansville, holding that the Cumberland Company is in the streets of Evansville as an absolute trespasser and without any rights under the law. The injunction to prevent the city from disturbing the company's property and ousting it from the streets, has been dissolved.

A JUICY FALSEHOOD.—In *Everybody's Magazine*, a writer named Russell is publishing some wildly incorrect articles in favor of municipal ownership. This is the way, moreover, that the publication is advertising them: "In Boston, unlimited telephones are $162 a year. In Glasgow, $26.25—the city owns the telephones: and makes $108,000 a year for the public purse. We have much to learn from the old world and Russell is teaching it in his interesting and wonderful fact-stories in Everybody's. See January." See it by all means as a sample of very "light" literature.

WESTERN SOCIETY OF ENGINEERS.—The Western Society of Engineers elected officers and held its annual banquet at Chicago, January 2. Electrical interests are unusually well represented among the new officers. The presidency went to Mr. Bion J. Arnold. The first vice-president is Mr. W. L. Abbott, chief operating engineer of the Chicago Edison Company. The second vice-president is Mr. Andrews Allen, and the third vice-president is Prof. Dougald C. Jackson. The other officers elected were: Treasurer, Mr. A. Reichman, and Mr. F. H. Bainbridge, trustee for three years.

EFFECT OF TROLLEYS.—The effect of trolleys is clearly brought out in the statistics of steam railroad construction. It is stated that 4,070 miles were added last year, an increase of 727 miles over 1904. It was generally expected that more new mileage would be built in 1905 than during 1904, when construction work was suspended owing to unfavorable money conditions. The figures do not compare with the period of competitive railway building in the early 80s, or even with construction work considered normal only a few years ago. In spite of all the prosperity of the year 1905, its new railway construction has been the smallest but one of any calendar year since 1900. This may not all be the effect of the trolley, but it certainly had a great deal to do with it.

A. I. E. E. BUILDING FUND.—The General Electric Company in view of the great importance and utility of the United Engineering Building, as a home and center for the engineering professions and arts, has made a contribution of $25,000 to the land and building fund of the American Institute of Electrical Engineers. President C. A. Coffin, who takes a warm personal interest in the matter, has also sent his own check for $5,000. The committee, which had already received gifts and pledges amounting to nearly $70,000, is greatly encouraged by this generous support of its work. The fund is now with other new subscriptions well over $100,000, and with renewed energy the committee has begun its canvass of the field with the object of securing the second necessary $100,000. About 600 members have already subscribed to the fund, and the committee expects to have no difficulty in at least doubling this number. It has just issued to the whole membership a handsome pamphlet, illustrating and describing the new building in course of erection in New York City, and detailing the steps that have been taken by the associated engineering bodies to give effect to Mr. Carnegie's original gift.

FATAL IMPATIENCE.—At Hoxie, Ark., on December 29, because he did not receive a reply to a telegram as quickly as he wished, Frank Browning, of Batesville, shot and killed T. W. Midkiff, a telegraph operator here. Browning despatched a message to Dexter, Ark., and on being told he might expect a reply by 4 o'clock, returned at 1.50 and demanded the answer. On being informed that it had not been received, he drew his revolver and shot Midkiff through the head. He was arrested and taken from this city to prevent a mob from lynching him. A less tragic case occurred recently in a New York hotel, where a domestic became so violent in her abuse of the telephone operators, and the hotel manager because the telephone answer was slow in arriving, that she was put under arrest.

TRIAL BY TELEPHONE.—Last week at Kingston, N. Y., Judge Betts sitting in chambers, conducted court in Albany by telephone, in a case of negligence and damages. After the hearing of the case in Albany the jury retired and Judge Betts left for Kingston after securing the consent of Judge Fitts to receive the verdict. The jury was out all night and entered the courtroom next morning and asked for further instruction. Judge Fitts was not familiar with the case and Judge Betts was called up at Kingston. Over the telephone he made clear the point in the evidence which the jury wanted explained. The attorneys on both sides argued over the telephone with Judge Betts. The jury reported later that it was unable to agree and it was discharged by Judge Fitts. Legal proceedings of this nature are believed to be unique.

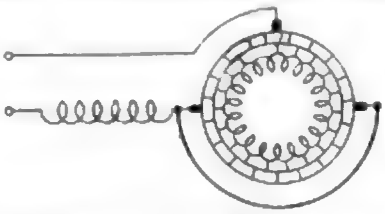
PUBLIC UTILITIES BOARD.—At Albany, on January 2, in the State Legislature, and, it is said, embodying the views of Tammany Hall, Senator Grady introduced in the Senate a bill for creation of a Board of Public Utilities in the City of New York. The bill was introduced, he explained, with the idea of redeeming pledges which the Democratic organization made to the people at the last city election. The body practically would absorb the powers of the Rapid Transit Commission. The Grady bill proposes a board of five members appointed by the Mayor—a civil engineer of not less than ten years' experience, one member who has at least ten years' experience in practical operation of street, elevated, or subway railways in the city; one wage earner of ten years' experience in some mechanical occupation, one lawyer of ten years' experience, and one business man of ten years' experience. The salary is to be $7,500 a year each. The board is to regulate car and ferry services, to require and compel efficient telephone service at reasonable rates, and an honest, efficient and adequate service of all other public utilities. It is to devise, lay out, and, with the approval of the Board of Estimate, contract for such new public utilities as may be determined by the board to be for the interest of the city, or acquire existing utilities, and to act as arbitrator, when requested, of any dispute between owners or operators of any public utility and employes.

NEW ENGLAND TROLLEYS had a good year, but were not all of them profitable, the rural lines in some instances failing to pay dividends or operating at a loss. The dividend returns from all the street railway companies in the State, for the year which ended September 30, 1905, show a decidedly better year than the previous one, but still go to prove in spite of the general prosperity of the country, that the development of the electric railway service is much in advance of the needs of the territory served. There are 101 companies which made returns, only 38 of these declared dividends, while 35 reported a deficit. There were 48 in all which carried something to their surplus account; 24 which paid dividends and had a surplus; 10 which paid dividends and had no surplus; 2 where the dividend declared was more than the net divisible income reported for the year, and therefore they had to draw on a surplus previously accumulated, and 6 where the dividend declared was exactly the same as the net divisible income reported. The total of dividends declared by all the street railway corporations for the year was $3,174,505. As the total capital stock of all the companies is $70,326,984, and their funded debt is $55,780,500, or a total of stock and bonds of $126,107,484, it appears, not counting the floating debt, that the rate of dividend upon the investment was considerably less than 3 per cent.

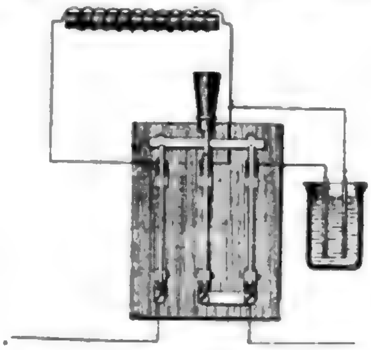
N. E. L. A.—Secretary Eglin has just issued the new membership list of the association brought up to date. A cursory glance shows considerable growth during 1905, and the fact is mentioned that already this year two new applications came in during the first week. The list is in neat pamphlet form.

MUNICIPAL FERRIES.—The New York-Staten Island ferry service broke down again last week, on January 3. Meantime the system is running behind $536 per day, or $195,640 per annum, charging off nothing for depreciation. The annual loss to the city is estimated at $300,000. The operating expenses are 40 per cent higher than under private ownership.

COMPENSATED SINGLE-PHASE MOTOR.—In order to avoid the great number of brushes and the great higher harmonics of the compensated type of repulsion series motor, Messrs. E. Arnold and J. L. La Cour, according to a patent issued December 26, 1905, would make use of three brushes set at angles of 120 electrical degrees to one another as shown in the illustration herewith. Two of the brushes are short-circuited and are so arranged that when the rotor is stationary the total stator field is destroyed. The current enters the rotor through the third brush and leaves by way of the two short-circuited brushes. The current which passes through the third brush causes a magnetic field perpendicular to the field which the stator current tends to produce, and it is this field which gives torque to the rotor due to the current which flows locally by way of the short-circuited brushes.



ELECTROLYTIC SWITCH.—Two patents were issued December 26 to Mr. W. S. Horry and deal with the use of an electrolytic cell in parallel with a switch in order to prevent the formation of an arc when the switch is opened. The anode of the cell, which consists of aluminum or an aluminum alloy, has the well-known property of offering an abnormally high resistance to the flow of current therefrom to the electrolyte, this resistance being sufficient to substantially prevent the flow of current under an applied electromotive force of one hundred and ten volts. The high electromotive force resulting from the action of the inductance temporarily breaks down the resisting property of the aluminum, and the current is thereby shunted around the switch-break and through the cell. The potential difference at the terminals of the cell immediately falls to normal, and the anode resumes the condition in which it tends to obstruct and prevent further flow of current. The accompanying illustration shows a special switch which has been constructed to successively open the main and the protective shunt circuits. The switch comprises three movable blades, two of which control gaps in the main circuit, while the third controls a gap in the shunt circuit. One of the main circuit blades and the shunt-circuit blade are arranged to move in unison, while the second main circuit blade is arranged to both open and close its gap before either of the other blades is operated.



THEATRE TELEPHONES.—New York suburban theatre-goers will benefit by a new arrangement between Charles Frohman and the New York Telephone Company, which was completed last week. Frohman theatre telephone stations will be opened in a large number of suburban communities, connecting directly with the Empire, Criterion and Herald Square Theatres. Each station will have an operator provided with seating plans, who will keep informed of the location of unsold seats. Patrons may order seats at the local station, pay the operator and get a receipt, entitling them to have the tickets mailed to their homes or held at the theatre. The plan has been put in operation with the new year at New Rochelle, Mount Vernon and Newark, and if successful will be extended to Brooklyn, Flushing, White Plains, Yonkers, Staten Island, Montclair, Morristown, the Oranges, Elizabeth, Plainfield, Westfield, Summerville and Jersey City.

LIGHTING AT PROVIDENCE.—The city lighting contract at Providence, R. I., referred to in an item in our last issue, was adopted by the Board of Aldermen, and on December 22 was executed between the Mayor of the city, and Mr. Marsden J. Perry, on behalf of the Narragansett Electric Lighting Company. As noted, it runs to 1912 and when completed will represent 29 consecutive years of city lighting done by the Narragansett Company. The first contract for lighting the streets of Providence by electricity was placed with the Rhode Island Electric Company, using the old United States system. It was for ten lights at $1 per light per night. The Narragansett Company came into active business life early in 1883, and for that year the contract for city lighting was awarded to it for $200.75 per lamp per year. The city now uses about 2,100 arc lamps and about the same number of 32-cp incandescent lamps for its streets, supplemented by 600 Welsbach gas lights. The new contract begins on a sliding scale at 28.7 cents per night, all night. This is for the first three years. The rate for the next three is 27.4 cents. Midnight arcs will be 55 per cent of these prices. All night incandescents will be $24 per year.

FRANKLIN'S VERSATILITY.—In the *Forum* for January-March, anent the Franklin celebration this month, Prof. W. P. Trent says: "Everywhere we touch him he is the human and therefore the fascinating Franklin. This statement is, to be sure, an exaggeration—one of the sort at which he would have smiled with deprecating modesty or else, with a malicious twinkle of the eye, would have told an unsavory anecdote with disenchanting results. There were sides of Franklin's character—well remembered, it would seem, in Philadelphia—that were not at all attractive. Prof. Smyth calls attention in a paragraph to the 'smudgy trail' the facetious printer left behind in the *Pennsylvania Gazette*, to the grossness of some of his letters, to the effect of his strong animal instincts upon his conduct. It is this, combined with his comparative insensibility to poetry and to spiritual religion—which Prof. Smyth does not emphasize—that puts Franklin, in the final analysis, below such men as Johnson and Washington, to whom he was vastly superior in many intellectual respects and who may themselves be justly taxed with æsthetic deficiencies. But when his limitations have been duly considered, it remains true that Franklin, like Defoe, and for much the same reasons, is one of the most fascinating of mortals, at least to students who examine minutely every phase of his character by means of his self-revealing writings. Both men had in its fullest development what may be called the genius for the prose of life. In both this genius is fused with a sort of plebeian spirit, with the result that they do not greatly appeal to over-sensitive souls. Other souls less squeamish, more robust, more catholic, if you will, take a special delight in watching the effects of this combination of democratic and aristocratic elements upon the lives and writings of these two great sons of the people, whose masterpieces will not cease to be read until the precious style affected by numerous moderns becomes an eternal possession of the English-speaking masses. When that delectable day comes, 'Robinson Crusoe' and Franklin's 'Autobiography' may be banished from whatever substitute the æsthetic world shall have devised for homely book-shelves. Pending this consummation, it is to be hoped that Franklin's writings will remain in broad circulation."

The Electrical Distribution System of the Public Service Corporation of New Jersey—I.

By G. U. G. Holman.

As a striking example of the tendency of public utility enterprises to get together for the benefit of single management, and what might be termed as single engineering, that of the Public Service Corporation of New Jersey is the most prominent in the Eastern section of America.

On the continent many central electricity supply stations have been succeeded by one large plant and it is more and more being deemed profitable to unify the scattered systems in this country.

The benefits to the public have been many, resulting in lower rates for light and power, better facilities and longer traction rides for the same amount of money, and a far more dependable service.

HISTORICAL.

The Public Service Corporation of New Jersey was organized under the laws of the State of New Jersey in June, 1903, for the purpose of controlling the following corporations by purchase of the majority of their stock:

North Jersey Street Railway Company, Jersey City, Hoboken & Passaic Street Railway Company, Elizabeth, Plainfield & Central Jersey Railway Company, Orange and Passaic Valley Railway Company, United Electric Company of New Jersey. Additional properties were leased as follows, in May, 1904, for 999 years:

South Jersey Gas, Electric & Traction Company, which in turn controlled the Camden & Suburban Railway Company, which in May, 1896, was the merger of the Camden Horse Railroad Company, organized in 1889, and the West Jersey Traction Company, organized in 1894. Additional companies subsequently were leased as follows: Essex & Hudson Gas Company, Hudson County Gas Company, Paterson & Passaic Gas & Electric Company, South Orange & Maplewood Traction Company, Plainfield Gas & Electric Company, January, 1904; Central Electric Company, Middlesex & Somerset Traction Company, May 1, 1904; Raritan Traction Company, May 1, 1904; Carteret Electric Light & Power Company, March, 1905; Gas & Electric Company of Bergen County.

The development of the properties leading up to some of the companies now but one member of the family now called the Public Service Corporation of New Jersey, is interesting. Some of the railways had their beginning in the 60's, but as the scope of this article is more on the electrical development side, the growth of the light and power business in and about Jersey City and Newark is presented.

Historically, the earliest in the electric lighting field of all the constituent companies now comprising the Public Service Corporation of New Jersey was the Newark Electric Light & Power Company. This company was organized February 21, 1882, and began business as the licensed agent of the United States Electric Light Company, manufacturers of arc and incandescent apparatus.

The company first began business by running a few machines in the United States factory. Power was subsequently leased in the engine building shop of the Hewes & Phillips Iron Works, from which place a few arc lights were operated until the first station was completed on Mechanic Street sometime in the winter of 1882-3.

FIRST STATION.

The first installation in this station was a Watts-Campbell Corliss engine of 400 hp and four horizontal tubular boilers. All of the earlier business was in arc lighting, the dynamos consisting of a miscellaneous lot of machines, ranging from 2 to 10 lights each in capacity. Soon after the completion of this station an order was placed for a 20-light shunt-wound United States machine.

It was not until 1886 that the first incandescent lamps were supplied with current from this station. The dynamo was a 70-volt machine of the United States type, having a capacity sufficient to deliver power to 125 lamps. The first lamps to be used were in the house of the Essex Club on Park Place.

The station building was enlarged and improved and new apparatus started in the winter of 1886-7. The company began operating at this time a day service for incandescent lighting, using for this purpose an engine of 30 hp, which was sufficient capacity for the day load of the year 1887. From this small beginning developed the Public Service Corporation of New Jersey, with its 75,000 kw capacity, and present increase in the new Marion Station on the Hackensack meadows of 13,000 kw in turbo-generators.

Beginning with 1887 the business grew steadily, but very slowly. All kinds of inducement, arguments and guarantees had to be made to secure a customer, and even then electric light was considered the height of luxury by the consumer.

During 1886 two rival companies started an arc lighting business in Newark. The first was the Newark Schuyler Electric Light Company, which was started as an offshoot of the Waterhouse Electric Manufacturing Company, afterwards merged into the Schuyler Company; the second company was the Thomson-Houston Electric Company, started as a sub-company to the parent concern manufacturing Thomson-Houston dynamos. The two newer companies immediately started in to secure business at any price. Competition was strenuous and at one time prices were reduced so that arc lights were supplied at $1.50 a month on yearly contracts, a rate never since equalled under any condition of power in the electric lighting business. Such ruinously low prices during a period of over six months forced both of the smaller companies out of existence, and they were subsequently bought in by the Newark Company, the Schuyler Company being taken in during September, 1889, and the Thomson-Houston Company in June, 1890.

Shortly before the acquisition of these two companies the Central Power Company was organized in the city of Newark for the purpose of supplying power solely for manufacturing purposes. This company was promoted by interests identified with the Daft Electric Company, which took on a business of about 200 hp, and was sold out under foreclosure with the old Daft Company, which owned a majority of the business, some time in 1893. The assets of the local company were purchased by a few gentlemen in Newark and operated independently until the end of the year 1896, at which time they concluded to give up the business and sold out to the People's Light & Power Company.

The People's Light & Power Company, while organized in 1894, did not begin operations of any kind until the early summer of 1895. At that time a majority interest in the Newark Electric Light & Power Company, having been previously acquired by New York capitalists, was offered for sale and was purchased by the People's Light & Power Company and immediately reorganized.

In the fall of 1895 the People's Company bid for the public lighting of Jersey City, which at that time had but 163 arc lights on its streets, operated in about equal proportions by the Jersey City Electric Light Company and the Hudson County Electric Company, two corporations which were doing a small amount of business in Jersey City and Bayonne. The People's Company, acquiring the street arc lighting in the central section of Jersey City by virtue of the lowest bid, forced the two other companies to build a large amount of new line on the outskirts of the city to carry the lighting acquired under their respective bids, the Jersey City officials having determined upon an extension of its street arc lighting. Under these forced conditions the Jersey City Electric Light Company and the Hudson County Electric Company each soon negotiated with and sold its properties to the People's Company, for each had been seriously hurt financially by the loss of the profitable section of the city's lighting.

A similar method to that in which the Jersey City Electric Light and the Hudson County Electric properties had been acquired was followed in the case of Harrison, and in like manner the plant and property of the Excelsior Electric Company was acquired. In Orange the plant and property of the Essex County Electric Company and in East Orange the plant and property of the Suburban Electric Light & Power Company were voluntarily offered to and purchased by the People's Light & Power Company. Other plants were acquired from time to time; in 1896 the Montclair Light & Power Company, Consumers' Electric Light & Power Company, Edison Electric Light & Power Company and in 1898 the Kearney Electric Light & Power Company.

In 1897 the People's Company bid on the lighting of the town of Irvington in competition with the Newark Gas Company. The refusal of the gas company to extend its mains for private consumers, except in the event of their securing the municipal contract, necessitated an offer on the part of the People's Company to supply gas to such residents of Irvington as desired to use gas for private lighting, and whom the local gas company declined to serve. For this purpose the People's Gas Company was organized and a franchise secured for the manufacture, distribution and sale of gas throughout Irvington and the adjoining townships; but in the meantime the old gas company decided to extend its mains and supply such customers as applied for the use of gas.

It was in 1899 that the People's Light & Power Company was merged with the United Electric Company of New Jersey with other neighboring light, power, railway and gas companies, and then in 1903 this resultant company became merely a part of the larger corporation. The Central Electric Company erected its central plant at Metuchen for the supply of current to Metuchen, Highland Park, New Brunswick, Perth Amboy, Rahway, Woodbridge, Bound Brook and Dunellen.

This company was a consolidation of the Middlesex Electric Company, Edison Electric Illuminating Company of New Brunswick, Raritan Electric Light & Power Company, of Perth Amboy, Rahway Electric Company and Bound Brook Electric Light, Heat & Power Company.

The equipment of the generating stations replaced by the new central plant consisted entirely of small belted units and the plants were so situated that coal had to be carted at a cost of 28 to 40 cents a ton and in every case except Bound Brook, water had to be purchased for the boiler supply. Sub-stations superseded the plants and modern units were installed in the central plant, as given later on.

The Gas & Electric Company, of Bergen County, in 1899, brought in under one management the lighting companies of Hackensack, Rutherford, Richwood and Englewood and plans were carried out to operate everything from the Hackensack plant. The old plants were abandoned and sub-stations fitted up in their stead, each of which handle the street and commercial lighting over a territory allotted to them, and a reduction from the prevailing price invariably has meant increased consumption. With, for example, a cut in rate, the consumer feels he can use more current, and not merely an increased amount to make up for the decrease in rate, but an additional amount as well.

The organization and the affairs of each constituent company are kept separate. The book-keeping and costs and income of each are separate just as much as though the concern were independent, and separately owned and governed.

The great resultant advantage to the people served with light, power and railway is better assurance of continuity of service, practically universal transfers and readjustment of rates for light and power to a more equitable basis. History has shown that the readjustment of rates for light and power, though sometimes reluctantly given by the companies, result in increased income. It is a singular fact that people want light.

ELECTRICAL DISTRIBUTION.

The electrical distribution problem confronting the Public Service Corporation of New Jersey after its acquisition in June, 1903, and subsequently, of what were fifty odd plants supplying electric light, power and railways, is enormous. Twenty central stations and twenty-four sub-stations comprised the list of active plants, and some of these had previously replaced a multitude of others since the history of applied electricity began.

The capacity and equipment of the present active stations and sub-stations is given in the following pages, but the newly completed plant of 13,000 kw capacity, with its provision for enlargement to 64,000 kw, described in a separate article, is an earnest of the units of high economy to be located at tidewater points. Thus the future will develop the further abandonment of the comparatively inefficient smaller stations and the increase of sub-stations for the supplying of electric light, power and railway energy.

An outline map of the State of New Jersey is given in Fig. 1, upon which the territory served by the electric lighting and power station is divided into three groups. For convenience these groups are designated Northern Jersey, Central Jersey and South Jersey. The generating stations and sub-stations are located on the separate maps of each group represented in Figs. 2, 3 and 4.

The stations are represented by solid circular spots and square spots, the sub-stations by hollow squares and by circles. The solid spots are stations in use now and which are to be retained. The solid squares represent abandoned stations or stations to be abandoned. The circles represent present sub-stations and the outline squares represent sub-stations abandoned or to be abandoned. The circles with a center line are sub-stations in course of erection. The letter *P* signifies power, *R* and *L* signify railway and light, respectively. Thus when *R* and *L* are indicated, the station or sub-station is for railway and light.

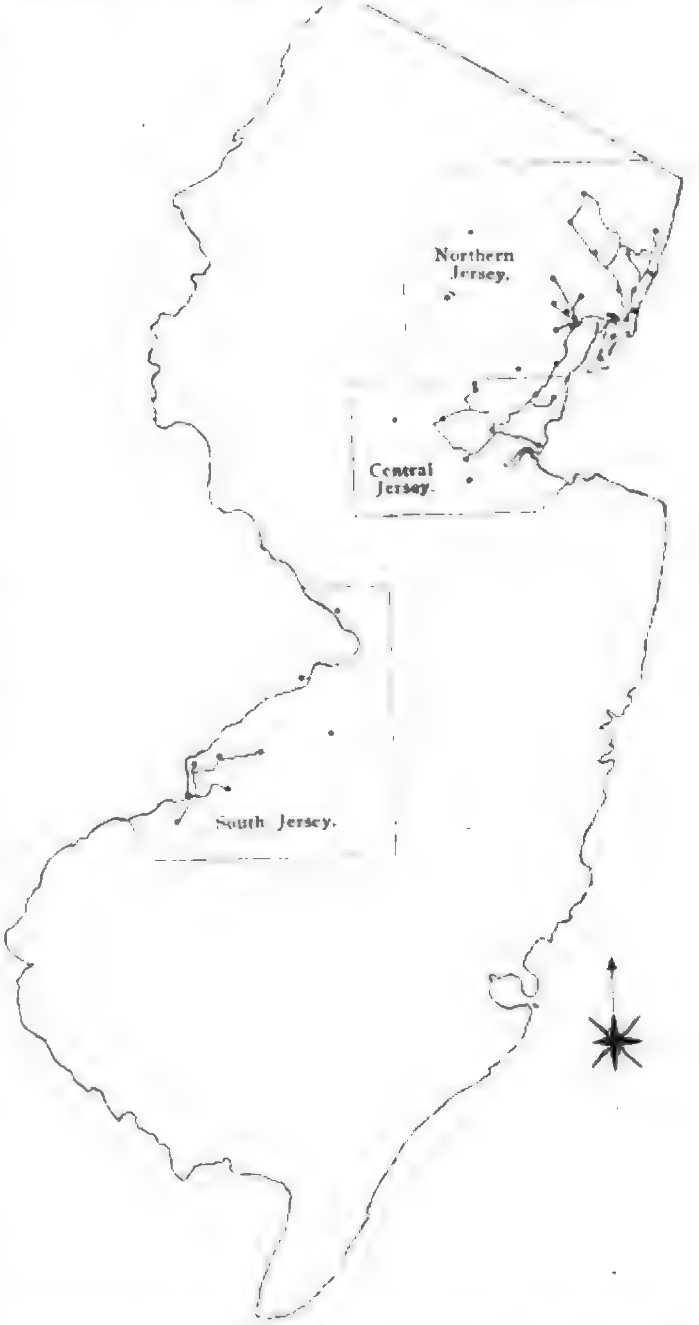


FIG. 1.—MAP OF TERRITORY COVERED BY PUBLIC SERVICE CORPORATION OF NEW JERSEY.

It will be noted from an inspection of these district maps that many generating stations are being replaced by sub-stations, and in some instances present sub-stations are being substituted by new sub-stations in better locations. This, of course, is to place them in the centers of distribution occasioned by the readjustment of load as planned by the engineers.

NORTHERN NEW JERSEY.

In the Northern Jersey group are comprised the new Marion station on the Hackensack River, between Jersey City and Newark;

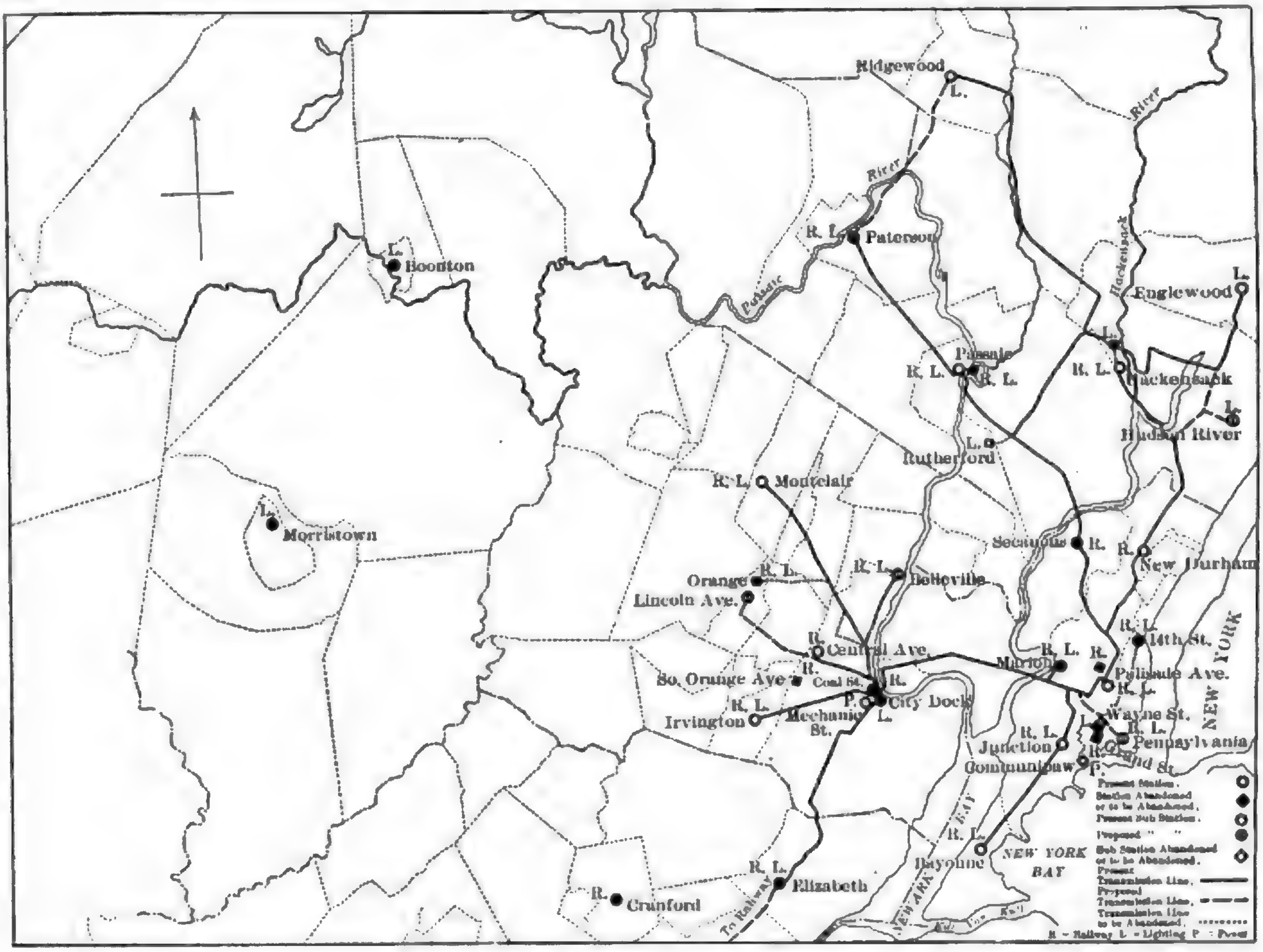


FIG. 2.—MAP OF NORTHERN JERSEY DISTRIBUTION.

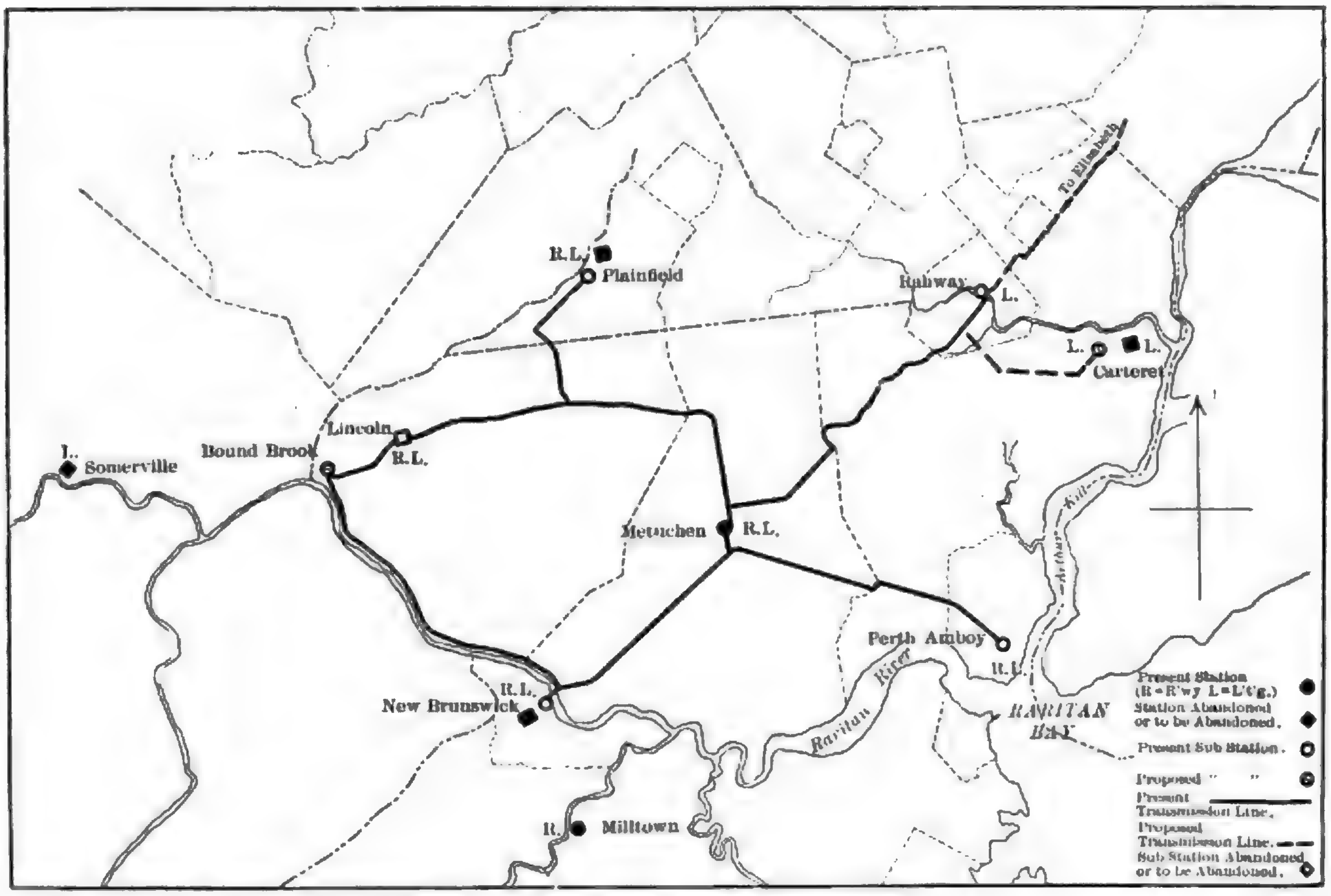


FIG. 3.—MAP OF CENTRAL JERSEY DISTRIBUTION.

ELECTRICAL DISTRIBUTION SYSTEM OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY.

Coal Street and City Dock stations, on the Passaic River, in Newark; the Fourteenth Street station in Hoboken, on the Hudson River; the Secaucus station, near the Hackensack River; the Paterson station, on the Passaic River; the Elizabeth station, at Elizabeth, and two small independent stations at Morristown and Boonton. It will be noticed that all these stations except the two last and Hoboken are tied together by virtue of line connections each to the other, so that it would actually be possible to supply energy from Paterson to Elizabeth through the sub-station at Passaic, the Secaucus station, the Pallisade Avenue sub-station in Jersey City, Marion station and the Newark stations at City Dock and Coal Street. This tying in of these stations has proved highly useful and guarantees practically continuous service by eliminating interferences in service from breakdowns in any of these stations.

In general the system of lighting circuits is 60-cycle alternating. The direct-current railway system is fed direct by 550 volts direct current, and by transformation from 13,200 volts, 25-cycle, alternating-current generators. This diversity of the generating supply was determined by the large investment in both classes of apparatus, about $2,000,000 having been invested in 25-cycle machines for railway distribution just prior to control of the various companies by the Public Service Corporation. Therefore, it was determined to carry in future plants and extensions both 60-cycle and 25-cycle apparatus. Thus in the new plant at Marion is 10,000 kw capacity of 25 cycles and 3,000 kw capacity in 60 cycles, the former for railway and the latter for lighting and power work.

The Coal Street station at Newark contains the following generator and engine units:

Three 850-kw Westinghouse, 550-volt, direct-current generators, direct-connected to a Watts-Campbell cross-compound engine. One 350-kw Westinghouse, 550-volt, direct-current generator, direct-connected to an Allis cross-compound engine. Five 1,800-kw General Electric, 13,200-volt, 25-cycle, three-phase generators, each direct-connected to vertical cross-compound Brown Corliss engines. One 3,000-kw General Electric Curtis turbo-generator, 6,600-volt, 60-cycle, three-phase. There is one 1,000-kw General Electric, 25-cycle rotary supplied by step-down transformers and providing 600 volts direct current. All the engines operate condensing. The boilers are Babcock & Wilcox, there being 15 of 250 hp and 12 of 500 hp each, run at 155 lb. pressure.

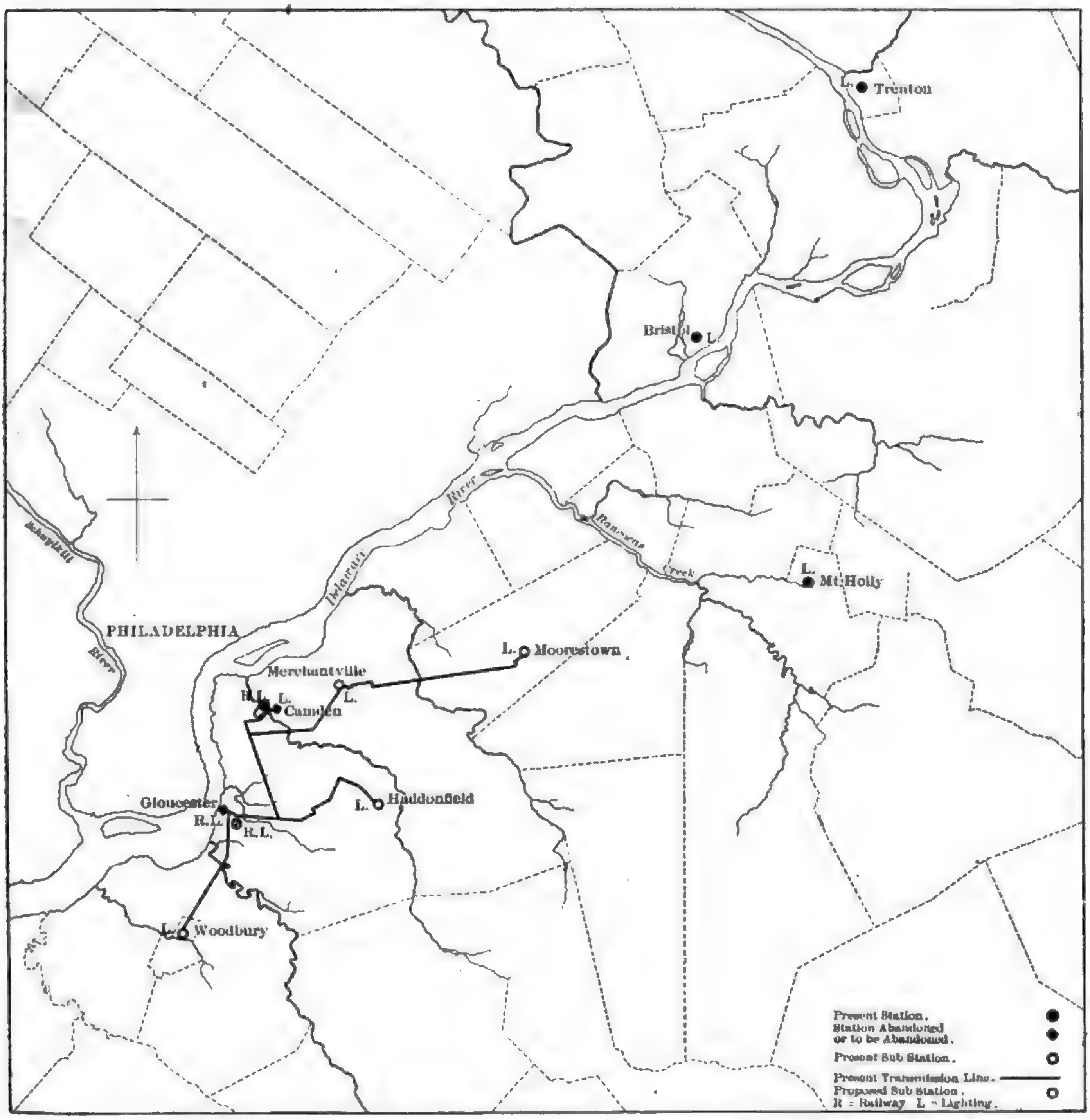


FIG. 4.—MAP OF SOUTH JERSEY DISTRIBUTION.

The First British Hydro-Electric Power Transmission.

MANY circumstances have conspired to hinder the advance of the hydro-electric principle of power transmission in Great Britain. Perhaps the first of these is that in many industrial districts where the demands for power are great, the supply of coal is also ample. Lancashire, the great textile district, for example, is also a great colliery district, and in Newcastle, coal shares the position of principal industry with iron and shipbuilding works, while Glasgow, the enormous center of iron and shipbuilding work, is adjoined by innumerable collieries. These three serve as examples of the way in which the principal power-using industries in Great Britain are served as regards fuel, and the progress, which is already becoming marked, of the larger power distribution companies in England and Scotland, is not in the majority of cases owing so much to actual economy in prime cost due to reduction in fuel consumption as to the greater advantages which electricity offers from other points of view. In the textile industry, for instance, steadiness of drive and cleanliness are advantages which tend to turn the scale in favor of the use of motors.

In North Wales, however, the above considerations do not hold. Clustering round the great mountain (that is, great from an insular point of view, being the highest mountain in Wales) of Snowdon is an industry which utilizes a great amount of power, namely, that of slate quarrying. The slate outcrops on the mountains in enormously thick veins, and in some places the whole side of the mountain is actually hewed away in working it. In other places it is impossible to hew away the side of the mountain in this manner, and, in consequence, enormous weights of slate have to be hoisted to the top or else hauled through galleries outwards to the side of the mountain. As on an average only one ton of actual roofing slate is obtained from every 28 tons of material worked, and as in some of the larger quarries as much as 40,000 tons of slate per month are handled, it will be seen that the power requirements are great, thus providing an excellent occasion for the establishment of a power distribution scheme. Another factor is that coal or fuel of any kind is extremely dear owing to the difficulties of transport, the conditions in this connection being almost analogous to those prevailing in Western United States.

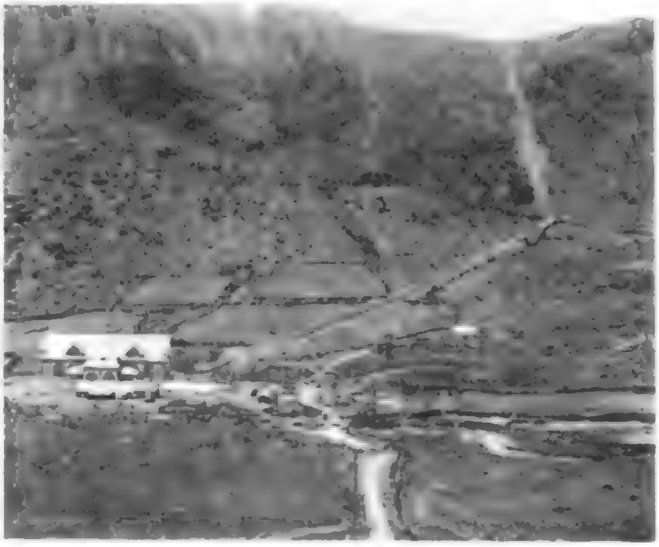
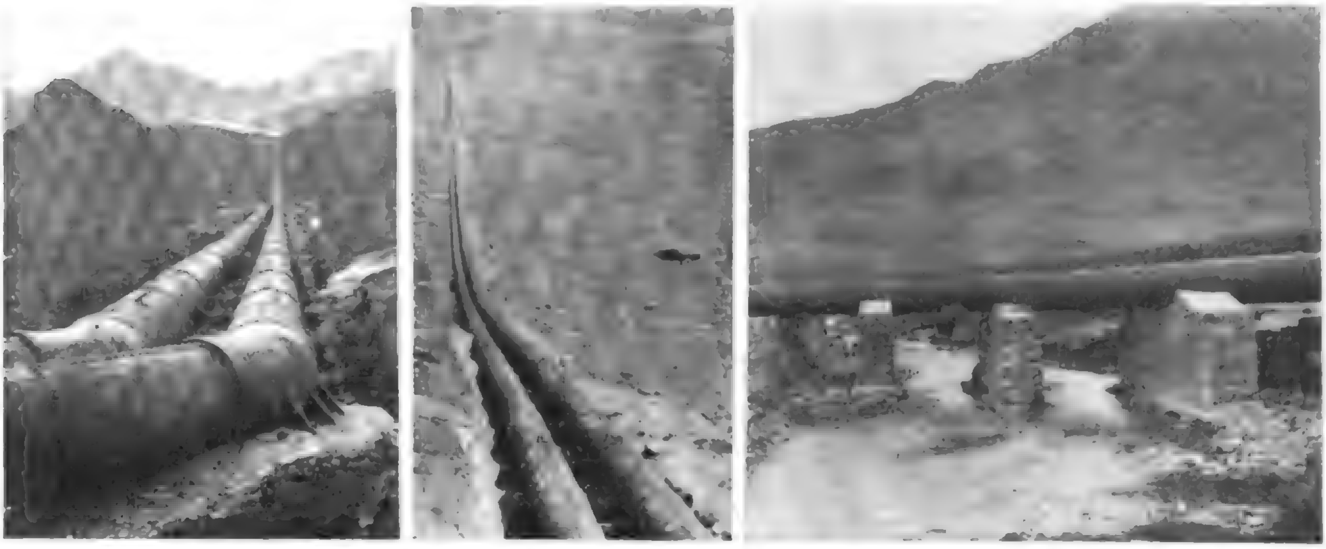


FIG. 5.—VIEW OF PIPE LINE.


FIGS. 1, 2 AND 3.—VIEWS ALONG THE PIPE LINE.

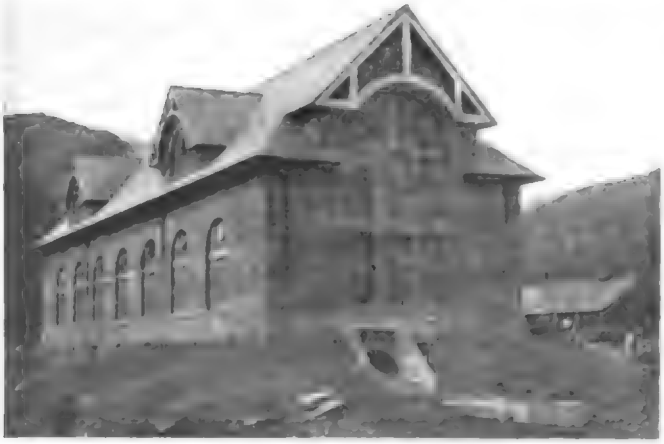


FIG. 4.—POWER HOUSE.

The slate producing area covers nearly 200 square miles, so that the case for high-tension transmission is obvious. As to the generation of power, the Snowdon region constitutes the center of what is known as the Atlantic depression, in which the rainfall attains the extraordinarily high average figure of over 200 in. per annum, thus furnishing ideal conditions for the establishment of a hydro-electric power plant, which furnishes the subject of this article.

The water supply is drawn from Lake Lyddaw, which stands some 1,400 ft. above the sea level, and is conveyed by a pipe line about two miles in length, to the power station in the Gwynant Valley, the effective head being between 1,100 and 1,200 ft. Owing to the boggy nature of the soil in many parts and to the almost entire absence of roads worthy the name, the difficulties of conveying the heavy steel pipes, penstock parts, etc., to position and of anchoring them, have been very great. The work, however, is now approximately complete.

The power station contains four 1,500-kw Peebles high-tension, three-phase alternators, each driven by a Pelton wheel, and accommodation is provided for two additional sets before it will be necessary to extend the building. An ample further supply of water power is also available, as, should Lake Lyddaw not provide all that will be later required, Lake Glaslyn, standing some 550 ft. higher, can be tapped.

Another feature in which the scheme is unique in Great Britain is that it is the first example of the extensive use of high tension overhead conductors, the Board of Trade having previously imposed very severe restrictions on this method of transmission, but has shown a reasonable and progressive spirit throughout in connection with the North Wales plant. At present there are some 30 miles of transmission line of 10,000 volts completed, and the total length of lines will eventually approach 140 miles. The difficulties of running the line, as in the case of the pipe line and mains, were great for similar reasons, bog being one of the worst conditions to be contended with.

It is interesting to note that already before the power supply has commenced, several of the largest quarries, including the Oakeley and Darbishires, have contracted for electric power, and the power company will open operations with a load of 4,000 hp on its mains, it being a unique record with British power companies. In addition to supplying quarries, mills and other users of power in the neighborhood, the company will run a three-phase electric railway some 20 miles in length, which will eventually connect Portmadoc, on the southern side of the northern promontory of Wales, with Carnarvon, a prominent junction on the north, where it will join the main line running from England to Ireland by Holyhead. This railway will not only supply a great want in furnishing a means of transport from the quarries down to the coast for shipment of their material, but it will also, in the summer especially, attract a large passenger traffic, as the Snowdon range is rightly regarded by beauty lovers as one of the finest in the United Kingdom in point of view of scenery, and the new railway should do much to open it up to the public.

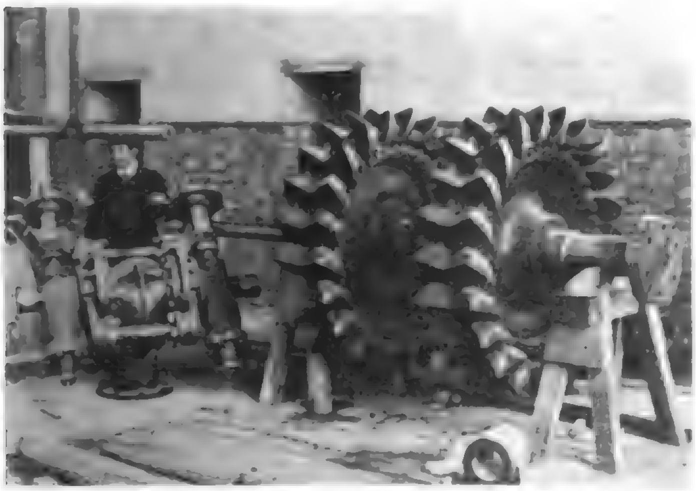


FIG. 6.—PELTON WHEEL.

The contractors for the entire plant were Bruce Peebles & Co., Ltd., of Edinburgh.

Electro-Optic Properties of Carbon.

The electromagnetic theory of light suggests that certain specimens of carbon, possessing a high electric conductivity, might possess a high reflective power for rays of great wave length, provided the passage of electricity through them takes place in the same manner as in metals. In a recent issue of *Physikalische Zeitschrift*, Mr. E. Aschkinass states that he has found that certain carbons possess a reflective power of 100 per cent for waves of the Hertzian order. But the influence of the good conductivity is already sufficiently apparent in the infra-red spectrum. In gas carbon, Siemens arc lamp carbon and graphite, the curve of reflecting power rises immediately on leaving the visible spectrum and continues to do so until the Hertzian waves are reached. Thus for polished gas carbon the reflective power is 4.4 at 0.589 μ, and 56.5 at 51.2 μ. Anthracite also exhibits considerable reflective power in the infra-red, but this never goes beyond 14, even for Hertzian waves. This anomaly is to be expected in consideration of its comparatively low conductivity. It, therefore, also transmits some of the waves, and its refractive index for infinitely long waves, as calculated from the reflection, comes out at 2.2.

An Ice-Making Electric Light Station in Florida.

By James F. Hobart.

The Plant City Electric and Refrigerating Company, which has been in business about two years, operates a load of 1,000 lights all night and every night, using a 37-kw two-phase alternator of a somewhat old type. This machine is badly overloaded and a new 90-kw, direct-connected, three-phase revolving-field generator is to be installed in the near future.

A 150-hp boiler of the locomotive type furnishes steam to a 150-hp automatic, high-speed Harrisburg engine, connected by belt direct to the generator. Water is supplied to the boiler from a number of surface wells, as the water from a driven well 600 ft. deep, on the premises, is so impregnated with lime and other substances, that it cannot be used in the boiler. The only use made of this fine source of water supply is to cool the ammonia after compression has taken place, the water for freezing being obtained from driven wells which form the source of the city service.

For refrigeration a straight absorption system is used, a 100-ton Henry Voght machine being installed, necessitating the running of nothing more than a pump to handle the ammona and another pump to deliver the cooling water from well to tower.

Wood is used for fuel, which has to be hauled by teams from two to four miles. The exception, however, must be made to considerable refuse from a crate mill nearby, the refuse being very light stuff, shavings and pine veneer, which burns quickly and works well with the heavy pine cordwood and slabs from wood lot and mill.

With the present electric load, the lighting plant just about pays expenses, a considerable portion of the load being street lamps and most of the remainder are house and store lamps, which are left burning all night, no matter whether they are useful or not. The new generator ordered will greatly increase the profits of the electrical end of the business, as at present additional customers cannot be connected up and many are waiting with their buildings already wired.

The source of profit, therefore, is at present solely in the ice-making end of the business. It is estimated that during the ice season, extending from February to October, the income from ice is three times that from electric light. The part of the year named is when vegetable and fruit shipments are made to the north and west, requiring a great deal of ice. Every crate of strawberries and every package of perishable fruit receives its complement of ice before leaving the shipping platform. The market for ice is thus steady and uniform and does not depend much upon variations of local temperature.

During the ice season above mentioned, no part of the machinery in the station is used in common for light supply and ice making, except the steam boiler. Even the attendance is separate and distinct, and aside from the very small saving of first cost of a boiler, there is in this case little saved by the combination of ice and electricity, as separate crews have to be maintained to handle both sets of machinery and output.

From October to February a different arrangement is followed and a very profitable one too for the owners of the plant. During the months named only about 10 per cent of the ice required in the summer months has to be made, and the ice-making is turned over to the night gang; in the daytime only a fireman is required, who keeps the temperature at the proper point in the freezing tanks and incidentally generally looks after things.

Probably no better summing up of the situation can be had than to quote the words of Mr. C. E. Stuart, the general manager of the plant, when he remarked to the writer that the advantages of combining two such enterprises in a small place is about as follows:

"In case it is desired to run the ice plant at night, the same force of men can run both that would be required to run the light plant only, and the same manager or superintendent of business can just as well attend to both as to one. So far as the running expenses are concerned, if it is not desired to run the ice plant simply in the day time, there would be no special advantage in the combination; but when we do not wish to run it day and night, we run it at night while we are fired up for the lighting plant. There is no special mechanical arrangement that is common between the two plants except that we use the same boiler. You can form your own conclusions from the above what the advantages of such a combination are. If the two plants in Plant City were owned by separate people there would probably be required at least two more men than now employed in the combination; and at such times as the demand for ice requires the running on only half time there is very little additional expense in the way of fuel, as it requires little more fuel at night to run both plants than it would to run the electric plant alone."

The superintendent of the plant, Mr. A. E. Ellis, a mechanical and electrical engineer, assumes control of the power machinery daytimes, thereby rendering the use of a day engineer unnecessary except when the ice plant is running full capacity. The day watchman is a fireman, who attends to the steam supply when the full capacity of ice making is needed; therefore the services of a day engineer and the necessary men to handle the ice and water, are all the extra help needed for day running and this practically doubles the night force, leaving out the services of the superintendent, which are regarded as an overhead charge.

ICE AND ELECTRIC STATION, PLANT CITY, FLA.

From the foregoing, the following deductions are made: Consider the earning capacity of the lighting plant as 100, and the expenses of operating also as 100; the full earning capacity of both ice and electric plants is 400 and the expense being doubled by the day force, extra fuel, etc., becomes 200. Taking this view of the situation, the following table expresses the profit of running the plant under various conditions:

	Output.	Expense.	Profit.
Electric plant alone	100	100	000
Electric plant and ¼ ice capacity	175	100	75
Electric plant and ½ ice capacity	250	100	150
Electric plant and full ice capacity	400	200	200

From the foregoing, it is evident that, while ice making is a benefit to the small electric plant owner, it is not a cure to all his ills, and he is still in the market for something which will keep his machinery busy during the day. As far as ice-making is concerned, it is good for the electric man only as far as it gives full employment to the engineering force, and in the case of larger plants, where the engineer is fully occupied in taking care of the electric machinery and engines, there would be necessary an extra force to take care of the ice making; therefore the 150 profit for half ice capacity would be cut down to 50 or even less by the employment of the ice makers necessary to run the plant.

It is evident from the above figures that the ice making should be encouraged to the extent of the night engineer's capacity to look after that portion of the business. For instance, could the ice-making capacity be increased one-half, and the night engineer still be able to take care of it, the tabulation would read:

	Output.	Expenses.	Profit.
Electric plant and ice capacity increased one-half	325	100	225

It will, therefore, pay to increase the ice-making capacity to the limit of operation by the present engine-room and boiler house force, also to increase the electric output, provided there is a market for the same.

For the central station the ideal requirement is a day load which will require the use of the same machinery employed at night in producing light. It is in many cases not desirable to have to put in a second plant consisting of entirely different machinery. Taking this view of the case, it is in order for the lighting company to create a demand for day current, both light and power. In case of the plant above described, the current is turned on about 4:30 p. m., and is cut off as soon as it is light in the morning. Thus there can be no demand created for day current as long as the present method of shutting down daytimes, is followed. Add to the day ice-making, a small generator and keep alive certain circuits in house and factory, and very soon a demand for considerable day current will be the result.

The conditions call for an all-electric day load, therefore the electric light man should look to electrolysis for his salvation. In that direction he can apply as great or as small a load as he pleases and by the addition of one machine, a rotary transformer, he can fully equip for the work. Failing to find other business, the manufacturer of soda, sodium and chlorine from common salt, might offer a commercial success and the manufacture of artificial mineral waters by electrolysis may also afford a field. In many parts of the country, waters highly charged with various salts might profitably be handled as a day load. In this State (Florida) almost any kind of water, from that containing magnesia, to lime and sulphur, can readily be obtained by drilling wells of various depths, and the substances to be obtained therefrom by electrolysis present possible sources of profit.

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The London Power Situation.

By T. H. Minshall.

Attention has already been directed to the question of the electrical supply of London which in the forthcoming session of Parliament is about to engross public attention. It will be remembered that a number of schemes for consolidating the supply which at present is given from over seventy generating stations, were brought forward last session, and the most important of these, that known as the Administrative Power Company, after passing the committees of both Houses, just failed to become law owing to the close of the session. The evidence given in support of that bill, to which allusion was made in these columns at the time, was a revelation to engineers of the enormous saving of capital and working expenses which could be brought about from concentration; whereas the plant and buildings at present installed in London for electrical purposes stands at £51 per kilowatt, it was shown that this power company was in possession of actual tenders enabling it to erect a station of 90,000 kilowatts at a cost of £8.4 per kilowatt. Another startling fact was brought out regarding the working costs, for it was shown that instead of 14 shillings and 15 shillings a ton for coal, which is the price paid by the present electric lighting companies, coal could be delivered on site in the lower reaches of the Thames for 8 shillings per ton. The net result of this concentration was that the company undertook to supply current at an average price of ¾d. per unit, the present rate being 4d. But it must be remembered that at the present time the bulk of the supply is for lighting purposes—in fact so little is used for power that 96 per cent of the power used in the factories of London is derived from private installations on the users' premises, while the existing companies and municipalities only sell about 5 per cent of their output for power purposes. These facts and figures made such an impression that a crop of rival proposals are being brought before Parliament next session.

The London County Council has decided to promote a bill for the purpose of supplying energy in London, and raises the cry of "No Monopoly." The Administrative Power Company's bill comes up again for confirmation by Parliament in the form in which Parliament left it last year. The County Council's scheme is for supplying electricity in bulk, but, with a view to securing the support of the present lighting authorities, it does not propose to give any detailed supply. A start is to be made by supplying from the large tramway station which the Council already owns at Greenwich and a second station is to be built at Battersea. The scheme is meeting with violent opposition, more especially in financial circles, the finance committee of the Council itself under the chairmanship of Lord Welby, a leading English financier, having strongly recommended the abandonment of the proposal, while commercial circles in the city look with alarm upon the increase of the debt of London which is already approaching £100,000,000. Whatever may be thought broadly about municipal trading and the advantages of having street railways and water supply in municipal hands, it is felt to be a very serious step in advance when the municipality undertakes to go in for the supply of electric power, in competition with other bodies, at a time when developments in the methods of production are taking place so rapidly.

Another interesting scheme is one with a powerful financial backing, which proposes to erect a generating station at St. Neots, about 51½ miles from King's Cross in the neighborhood of the Nottingham coal fields, although, strange to say, it is not proposed to build actually in the coal fields, presumably in order to get plenty of water. The current will be generated and transmitted by means of private right of way along the Great Northern Railway up to London, where it is to be taken along the towing paths of the canals. It is proposed under this scheme to give a supply in bulk to the present authorities.

Then, in addition, two of the existing companies in London —the Charing Cross Company and the London Electric Supply Company—seek large powers of supply on the north and south of the Thames respectively; whereas the West End electric lighting companies of London also seek powers to associate with each other. It should be explained that under the present acts of Parliament, all the companies and municipalities supplying electric light are confined to the areas of their own district and are expressly prohibited from giving or taking a supply to or from their neighbors. This, of course, dates from the time when the area of a parish was supposed to be the most economical area, and the bills now being promoted have, many of them, for their object the removal of this restriction, which is no longer of any advantage to anybody.

In addition to the above schemes, several of the municipalities in London who own electric light undertakings are promoting bills enabling them to give or take a supply of electricity from each other. It is difficult to see what will be the net result of all these bills, but it is generally expected that the House of Lords will throw out the bill of the County Council. It may be that Parliament will grant quite a number of them, as they are not necessarily exclusive of each other. The English love of compromise would quite approve of a municipality and a company scheme, both being sanctioned in order that the constant competition should keep them both efficient and insure the customer getting a low price.

One thing is certain, the London situation is very interesting, and it has great possibilities in it, for it is often forgotten that London is one of the largest manufacturing cities in the world, having in its factories over 600,000 employees. Moreover, the supply of electricity for the suburban services in London on the great railways would provide an enormous field. Altogether the supply in London at the present time per head is very much less than in other cities as the above table, which is believed to be fairly accurate, will show.

COMPARISON OF LONDON WITH VARIOUS CITIES.

Name of City	Population.	Horse-power connected per 1,000 head of population.	
		All purposes.	Power only.
Boston	541,700	123	52
Newcastle	377,047	115	49
New York	2,525,000	73	35
Frankfurt	300,000	80	29
Berlin	2,285,000	82	22
Hamburg	700,000	77	13
London (Industrial area)	3,723,770	26	4

The difficulty is that on the one hand the municipalists would prefer to go on with their present inefficient systems and high prices, rather than permit concentration to take place under a company, while, on the other hand, the commercial community and Parliament generally is not inclined to favor the municipalities in embarking upon an enormous expenditure which, in a few years' time, will amount to many millions in an enterprise which is rapidly developing and requires the greatest commercial push to obtain good financial results. The need for concentration is similar to that which existed in Chicago and Boston, and to some extent in New York a few years ago, and the result will be watched on this side with much interest.

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Central Station Economics in Massachusetts.—II.

PITTSFIELD ELECTRIC COMPANY.

Electric lighting in Pittsfield began to be carried forward on a substantial basis in 1890. The Pittsfield Electric Company, operating in Pittsfield and Dalton, serves a population of slightly over 28,000. The officers of the company are: President, Alexander Kennedy; treasurer and manager, W. A. Whittlesey; clerk, W. L. Adam.

The company has one power station, one sub-station and one auxiliary generating plant. The main power house is located at Cottage Row, Pittsfield; the sub-station is at Dalton and the auxiliary station is known as the Van Sickler Water Power, owned by the Berkshire Life Insurance Company. The first-mentioned power plant contains seven 200-hp Bigelow boilers having 33 sq. ft. of grate surface and 1,758 sq. ft. of water heating surface each; two 500-hp Rice & Sargent engines, direct-connected to two 330-kw Stanley, inductor, two-phase, 1,200-volt, 60-cycle, 162-r.p.m. alternators; one 250-hp Harris-Corliss engine arranged for driving two Westinghouse 500-volt, direct-current generators; one Westinghouse, 250-hp engine, driving a 150-kw alternator and a 50-kw, direct-current, 500-volt generator; one Westinghouse 150-hp engine, driving a 50-kw, direct-current, 500-volt machine, and two Knowlton & Kelley engines driving 550 kw of 500-volt generating machinery. Argand blowers of 7 in. size are used under three of the boilers, and the water is measured by Worthington hot-water meters, whose readings furnish a check upon the amount consumed.

A special feature of the power plant is the absence of condensing equipment. The Pittsfield Electric Company heats the buildings in the business section of the city from the railroad station, using exhaust steam at 3 lb. pressure for the purpose. The heating district has a radius of about one-fourth mile from the plant and the work is carried out by the American District Steam Heating Company through two 12-in. mains insulated in wooden logs. The charge is the flat rate of 30 cents per 100 cu. ft. of building per year.

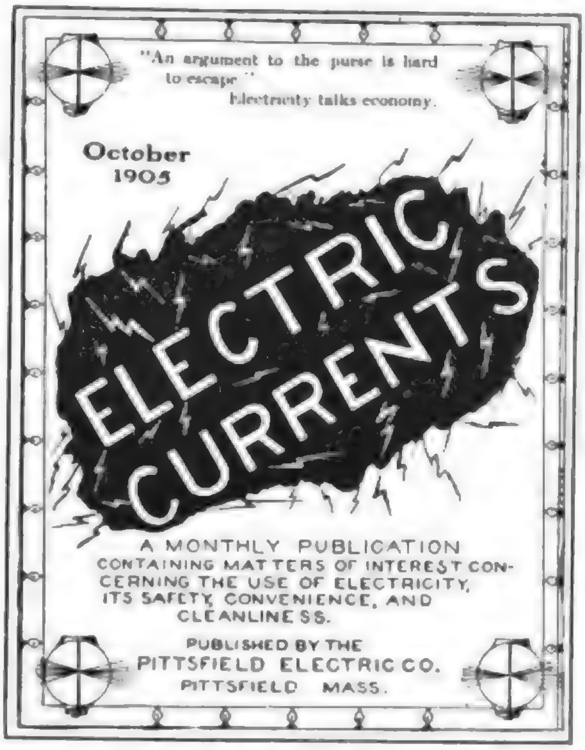
The fires of idle boilers are ordinarily kept banked, but usually one boiler is out of service and cold for the purpose of cleaning. About every seven weeks each boiler is cleaned out. At any time of day the flues can be cleaned by a Vulcan steam-driven soot cleaner. Compressed air is used in cleaning the generators and an oil and waste saving machine of the steam turbine centrifugal pattern is in use. Coal is at present carted from the Boston & Albany Railroad to the plant, but the prospects are that before a great while a sidetrack will be laid and a conveying system installed. Ashes are weighed in test about once a year. Occasionally the fuel is subjected to chemical tests for calorific power. Regular records are kept of the coal consumption per kw-hour, which averages about 5.15 lb.

Of late years the cost of manufacture has been lessened somewhat by the improved load factor resulting from increased output at the main power plant. During the year ending June 30, 1905, the total output was 3,602,232 kw-hours. The operating economy of the station is followed through meter readings at the switchboard, water records, coal, oil and supply accounts.

The card catalogue is used in keeping transformer and meter data, the location, size, make and capacity of each piece of apparatus being listed on the individual cards. A separate card index is maintained for tests and each meter is tested at least once in six months. Westinghouse portable recording wattmeters are used in making service tests.

Drawings and data are filed alphabetically at the main office. The service furnished by the company is delivered over the following kinds of circuit: Commercial lighting, 1,200 volts; single-phase, 60-cycle, alternating; street lighting in Pittsfield, alternating-current, enclosed-arc lamps, 6.6 amp. each; residence lighting, 1,200-volt and 2,200-volt; Dalton lighting, 2,200 volts; power service in Pittsfield, 500-volt, direct-current; power for Pittsfield Street Railway, 500 volts. Circuits are tested daily for grounds and crosses. Large transformers are replacing scattered units on the group loading plan, the largest transformers at present in use having a capacity of 600 lights each. The maximum distance served in this way is set at about 600 ft. Three-wire secondary distribution is largely used. The power house fire protection scheme includes stands of hose and chemical extinguishers in the boiler and engine rooms.

The economy of distribution is promoted by the use of large transformers, which are placed in brick houses in the rear of blocks in the center of the town, with meters and cut-outs inside these shelters. This permanent construction offers many advantages over the older plan of mounting large transformers more or less inaccessibly upon poles, sometimes of great height and always of much inconvenience when emergency work has to be done. The smallest size of wire used on the overhead system is No. 6 B. & S. Primary lines leading to emergency transformers at mills are equipped with oil switches at the mills, to save idle losses.



"An argument to the purse is hard to escape."

Electricity talks economy.

October 1905

ELECTRIC CURRENTS

A MONTHLY PUBLICATION CONTAINING MATTERS OF INTEREST CONCERNING THE USE OF ELECTRICITY, ITS SAFETY, CONVENIENCE, AND CLEANLINESS.

PUBLISHED BY THE
PITTSFIELD ELECTRIC CO.
PITTSFIELD MASS.

FIG. 1.—PITTSFIELD ELECTRIC COMPANY.

During the past three or four years a great deal of work has been done in the way of replacing air-cooled by oil-cooled transformers, the better regulation of the latter being an important reason for the change. Ultimately the commercial lighting circuits will have their potential raised to 2,400 volts all over the system. At present booster transformers raising the pressure from 1,200 to 2,400 volts are in use in the outlying districts.

The telephone is largely used by the company, and the chief engineer of the power house has an instrument maintained in his home at the company's expense. In case power is desired by a party located outside the main lines of distribution, the new customer pays the cost of extending the line, complete. He is then credited with the cost of power used until the line has been liquidated, when the circuit belongs to the company. In other words, the customer is given free power until the cost of the line has been met by his current consumption.

Standing advertisements are used in the local press. With the monthly bills the company mails a publication of its own called "Electric Currents" (Fig. 1), the purpose of which is to acquaint customers with new departures in the use of electricity. During the Christmas season a neat folder pointing out the advantages of electrically-lighted Christmas trees was distributed. New business is canvassed by two solicitors and the foreman of interior wiring. The company does not advertise on poles or billboards, but a Maltese cross of galvanized iron is placed on each of its poles for the convenience of employes. The company uses an electric sign at its offices, with fixed name.

Bills are rendered monthly to customers. For any month that the meter does not register at least 5 kw-hours, no bill for current is rendered, but a net charge of 50 cents is made for maintenance. For electric arc and incandescent service the rate varies from 20 cents per kw-hour up to 50 kw-hours, inclusive, falling gradually to 10 cents per kw-hour for a consumption of 750 kw-hours or over. Ordinary lamp renewals are made free to all customers, but "Hylo" lamps are supplied at 25 cents each. A discount of 15 per cent is allowed on all bills paid before the 15th of each month. When electric signs consume not less than 480 watts each, a charge of 8.3 cents per kw-hour is made, provided the signs are owned by the customers. A special contract is made when the sign is supplied by the company.

The rate for power for motors varies from 10 cents per kw-hour below 50 kw-hours, to 3.2 cents for 2,000 kw-hours. A discount of 20 per cent is allowed from the above rates to users of power purchasing their own motors, and a discount of 5 per cent is allowed on all bills paid before the 15th of each month. When a customer uses a motor belonging to the company a minimum charge of $5 per month is made. If the meter registers in any one month less than $5 worth of current, the meter reading is billed and the difference between this amount and $5 is added. When a customer uses his own motor, an investment charge of 50 cents is made per month in case the meter does not register at least 10 kw-hours. In the case of very large customers using electric signs a time switch is installed. Between 5 p.m. and 9 p.m. the full rate is charged, with half rate at all other times. For electric heating service a flat rate of 4 cents per kw-hour is charged, with separate metering.

Gas competition is met by the Nernst lamp, the high efficient incandescent and the "Meridian" lamp. Small arcs of 6.6 amp. size are used to a considerable extent in store lighting. In renewing lamps free the bulbs of the old ones must be unbroken and the customer pays for the first installation. Every three months the customers are supplied with complaint postal cards which serve to keep the company in touch with the condition of the equipment. The solicitors also freely advise customers how to get the best results from their apparatus. In the offices labor-saving devices are used to facilitate the work of the accounting department.

Notes on Central Station Business at Galesburg, Ills.

The Galesburg Railway & Light Company, which also controls the gas plant in Galesburg, built recently a large, economical generating station, with a view of taking care of the electric lighting load in Galesburg and supplying projected interurban roads promoted by the McKinley syndicate, which also controls this company. With the abundant capacity which the new station afforded, the company started out recently with an excellent opportunity to increase business, and this was the more true because the former management of the gas and electric company had been rather indifferent to the possibilities in the development of the electrical end of the business.

What great strides have been made in the past year in the way of increasing the electric load without hurting the gas business can be judged from the statement of the general superintendent, Mr. R. A. McLaughlin, that the power load is now double that of a year ago. Twenty months ago there were only 6,000 16-cp equivalent incandescent lamps connected. There are now 14,000. The number of customers has increased from 800 to 1,100

In the getting of new business it is notable that the company finds it necessary to push much harder on the gas end of the business than on the electric end. The electric business seems to come easier and costs less in the shape of soliciting and advertising to secure. The gas campaign is, of course, being concentrated mainly on gas stoves and ranges. The company employs one solicitor, and Mr. McLaughlin himself, as he has opportunity, works up new power business, as that class of work frequently requires considerable engineering and technical knowledge. This is in a city of about 20,000 inhabitants.

At the office, a set of cards is kept, each card showing the name and address of a customer, the kind of service, gas and electric, that he is now taking and indicating the possibilities of securing additional business. When a customer has been secured for all the busness that is considered possible, the card is marked complete and filed away, only those cards being kept out which apply to customers upon whom it will pay to do some soliciting.

One of the best advertisements the company has is its office, which is also a waiting room for the street railway system. It is brilliantly lighted at night with frosted bulb lamps studded around the edges of the ceiling and large, high-efficiency incandescent lamps in the center. The effect is very pleasing and gives a wealth of illumination without glare, which cannot but favorably impress any one entering the room and remind him that he is in the office of an electric lighting company. Electric and gas appliances are on display. Around the sides of the room, on an advertising rack about the size of that employed in street cars, are placed rows of signs advertising gas and electric business in short terse sentences. A white metal ceiling is employed in this room, which adds to the general effect of cheerfulness and good illumination.

The company gives occasionally demonstrations of cooking by gas at a room in the rear of its office. These demonstrations could, of course, if local conditions seemed to justify it, be extended also to electric heating devices. Sometimes at these demonstrations the company gives out some kind of souvenir advertisement. One of these which we have in hand bears the inscription on the cover: "Forty Complimentary Pointers from the Galesburg Gas & Electric Light Company." Inside this folder is some advertising matter for gas ranges and the forty pointers in the shape of forty needles of assorted sizes, which the housewife is sure to take home and use.

The rate for customers signing a three-year contract is 10 cents per kw-hour, with a minimum rate of $1. The old rate in force before the present company took hold was 20 cents per kw-hour with discounts, many customers being still on the old rates.

The power station is located on a block of land adjoining the Santa Fe Railroad, on which block the gas works are also located. The station is equipped with alternating-current generaors, three-phase, 60-cycle, of Bullock manufacture. The current used for railway purposes is put through motor generators. Both lighting and railway loads are supplied from the same generator bus-bars. This is made possible by the use of a voltage regulator of the General Electric Company operating on the exciter, which maintains constant bus-bar pressure in spite of the variations in railway load.

There are some unusual features worthy of note in the lighting distribution system. The business part of the town is served by three-phase secondary 110-volt mains located in alleys. Outside of the business districts the distributing circuits are single-phase. Taking, for example, an alley back of one of the principal streets, the lines are led at different points with three large transformers, one on each phase. The only wires running the length of the alley are the secondary mains. The high-tension, 2,200-volt wires supplying these transformers are tapped off from a high-tension pole line, which runs on a residence street parallel with the alley. These taps off the high-tension pole line to supply the transformer are led down cross streets for the half block from the pole line to the transformer, which is located at the intersection of the alley and the cross street. The three-phase secondary mains cover a business district of about 3x5 city blocks.

Getting New Central Station Business.

At the annual meeting of the Colorado Electric Light, Power & Railway Association, Mr. R. L. Goodale presented a paper entitled "Getting New Business," in which he treated of central station management from the business getting end.

In commencing he said there should be a systematic canvass of the commercial and residence districts, including every house that can be reached in any way by the company's lines. Information should be secured as to whether the houses are wired or have the fixtures, and all other information that may lead to securing new consumers, or if already consumers, selling them some additional current-using device. This information can be kept on cards filed in very inexpensive drawers or cabinets, and should be kept up to date.

For additional business one must look largely to current-using devices and appliances—that are new to the prospective consumer. The general field for work along this line may be divided for convenience into a few general heads, as follows:

1. Commercial power business, including large and small installations of motors for varied purposes.
2. Sign, window and decorative lighting.
3. Residence lighting and appliances.

As a general thing the start is often the most difficult part of introducing any special device, and is often the only time when a central station management need make any special concession to a consumer.

A consumer using other methods of power is often a little slow about adopting an electric motor in exchange for his old method, even if he is not getting the best results out of it and it is not entirely satisfactory to him. In nearly every town are small printing establishments operating small job presses by foot power, and the owners often can only be convinced in one way, and that is to install and make a demonstration with a motor. This is productive of good results, even if a motor is not sold every time one is installed. Often the first motor installed is the only thing necessary to open up a small or possibly a large field for the consumption of current. Any appliance installed and giving satisfaction is a better advertisement than any paid advertisement one can devise. There is another opening at blacksmith and carriage shops in motors for forge blowers. They are not expensive to run, and any blacksmith will appreciate the saving of labor. The motor-driven blower is a good wedge to start the blacksmith with, and if he is at all progressive it will be found easier to sell him motors to operate his drill press and other small power-using tools and machines.

In putting out special appliances of this kind it is well to deal with the more progressive man in a special line of work, for there will not be much difficulty in getting him to try an appliance, and he will be apt to try it, keep it, and not only that, but boost it for all there is in it.

The original cost, even if it is high, does not always stand in the way of the sale of an appliance. In certain cases a man in a well-established business will pay a big sum for an appliance, simply because it will bring him big results. A case in point is a barber in Colorado Springs who is very slow to take up with anything new. He was approached by a traveling man from a barber supply house who induced him to buy a facial massage machine. This machine cost him $125, paying for it on the installment plan, and it represents a pretty good outlay for a slow man to make on a new appliance. Now that he has it, it would be hard to induce him to part with it, and he says he gives an average of about ten treatments a day at 35 cents a treatment. The power for this number of treatments will not run more than 8 to 12 units a month, and so he thinks he has a good thing. This item is not a large amount in itself for the company, but it is one of the many ways that in the aggregate mean more business.

The subject of sign and window lighting opens up an immense field for the use of current, and if presented in the right way will take with almost any merchant. Provided a town has saloons, there is a good basis to start a sign campaign. The saloon men don't advertise much, if any at all, but the electric sign furnishes a method by which they can advertise and at a time when it will do them the most good and bring them the most trade. Advertising offers a new field for the consumption of power, and if presented to the customer along absolutely advertising lines will be one of the easiest methods of getting new business. A consumer must not be allowed to believe that he is spending his money for lighting when you sell him a sign. Compare a sign costing him $15 a month to the amount of space that the same money will buy him in the papers and he will readily see that he has a cheap and most effective method of advertising.

The man who keeps open his place of business at night is not the only one to profit by a sign. The next man is the merchant who closes at, we will say, 6 o'clock. Why should he not keep his windows well lighted, as a pedestrian will look in at a well-lighted window at night when he will pass it by in the day time? Add to that an attractive sign, well lighted and hung across the sidewalk, and he will have something that will draw the people. His windows will show them what he has, and his window lighting, if properly arranged, will make his store appear so attractive that they will seek this place when they wish to make a purchase at some future time.

Sooner or later one will get up against the merchant who says he does not light up because there is no one on the streets; but he will know, if he stops to think of it, that the people will not walk on dark streets. It makes no difference whether the city is New York or a village, the people will walk up the well-lighted streets and "pass up" the dark ones. The merchants are the ones to make the start with. One of the ways is to light a sign for a certain number of hours per night, controlling the turning on and off by a patrolman or time switch, making a flat rate, and, if necessary, putting the sign on a weekly basis and sending a collector to collect the bill on Monday morning before the banks are open.

The general sign rate is about one-half the regular gross rates for current, and when the current is used in an entirely new field and in a new demand it is well worth getting at that price. There are many sign companies ready to make signs on their own or your designs, but one can build a sign, or have it done by local supply houses, cheaper than he can ship it in. The matter of sign design and construction will not take very much time for study, and the catalogues of the various manufacturers of signs will show what other cities are doing in the way of using electricity as an advertising medium.

Many central station managers, representing both large and small plants, who have taken time to analyze the value of sign advertising have come to the conclusion that it is a good thing to boost, and as the original cost of a sign often stands in the way of a merchant installing one, they have reached the conclusion that it is well worth the money spent to furnish free signs and make a two years' contract with the merchant.

How many line extensions will give you the return that the investment in a sign will bring? The sign that brings in $15 a month means $180 a year. The sign will cost not to exceed $60. It is worth hustling for, and is usually not so hard to land as a residential extension that will give you $60 income for a $180 line cost. Don't overlook your window lighting, but boost it along the lines of advertising and not lighting. A merchant will sometimes pay $100 a month for newspaper advertisements and kick at a $5 bill for lighting his windows, when his windows well lighted will bring him more business.

A good laundry iron of from five to six pounds can be bought now for from $4 up, and manufacturers are now working along the lines of heating units that can be renewed without sending the iron back to the factory. The laundry iron can be used for general laundry work in a residence, and a family of from two to four will only use from ten to fourteen units per month. They appeal at once to the men, as well as the women, as an economy, not an expense, and they will sell rapidly when they have once been properly introduced.

If you have a show room, you may find it rather difficult to get people to come and look at an iron; but just take the iron out on ironing day and install it, and tell the people that you want them to try it for thirty days. Explain to them the economies of an electric laundry iron, and at the end of the thirty days show them their bill, and unless it has gone up more than a couple of dollars you will find that you won't have 5 per cent of your irons returned. Sell them at cost and install them at cost, but get the irons in commission. They will be used the year 'round, and any single appliance that you can put out that will bring in from $18 to $24 worth of income a year is a good thing.

A certain central station in Colorado has sold a good many small motors for family washing machines, but has not sold an electric laundry iron. It would seem that you could sell more laundry irons at $5 than washing machine motors at $20 to $40, and the iron would bring in more income in a year. The sewing machine motor, however, has a field of usefulness to the consumer.

As to publicity, keep your business before the people as much as you can, and in as many ways as you can afford. Don't let your newspaper announcements get dead, but change them frequently. They may not be all of the best quality, but you will find that the contrast between the good and the poor will draw attention to them. If you want new business and more business you must give it as much publicity as you can. Business does not come to many of us; it is necessary for us to go out and get it.

New Telephone Patents.

NEW OPEN SPACE ARRESTER.

For a long time in telephone practice the standard material for the terminals of open space cut-outs has been rough ground carbon blocks. These have given continual trouble from the accumulation of carbon dust, but nevertheless the regularity of action and the freedom from welding has outweighed all other considerations. G. W. Pickard, of Amesbury, Mass., has advanced the theory that the carbon dust itself may be eliminated by impregnating carbons with a suitable adhesive substance to bind the particles tightly together. He has obtained patents covering this device which he has assigned to the American Telephone and Telegraph Company.

TRANSMITTER ARM.

A patent has been granted to E. E. Yaxley, of Chicago, for a hollow transmitter arm designed to carry a particular style of transmitter. This transmitter carries a rearward stud which is integral with the transmitter casing, and which carries in its center an insulated terminal. The hollow arm has a split end with clamping screws so that the transmitter stud may be chucked within it. It also carries an insulated contact device which contacts, with spring pressure, with the insulated terminal within the stud. Mr. Yaxley's invention has been assigned to the American Electric Telephone Company.

COMBINED MESSENGER AND TELEPHONE SYSTEM.

An improved combined messenger and telephone system has been invented by G. Babcock, of Chicago, wherein an ordinary messenger call box may be associated on the same line with a telephone, and either may be used at will. A printer at the central office receives the messenger call in the usual way, the arrival of the call being indicated to the operator by a flashing line lamp. For a telephone call a steady burning of the lamp occurs. The differentiation between signals is controlled by limit relays, which respond or fail according to the resistance in circuit at the subscriber's station.

PARTY LINE APPARATUS.

G. H. Manners has patented the use of a push-button switch for party line telephones, which connects the signal devices either in metallic or grounded relation to the line. In the one instance the exchange becomes signalled to the exclusion of the stations, and in the other the stations are signalled to the exclusion of the exchange.

E. A. Buell has patented a step-by-step system by which in the case of a call toward a line all stations save those called are excluded from the line. In the case of a call originating from a line, the exchange operator may seek for interlopers by testing for their respective stations. It is not quite evident why this testing does not effectually bar conversation while it is proceeding.

An arrangement of relays suitable for the foundation of a party-line system has been patented by W. M. Bruce, Jr., of Springfield, Ohio. The relays are arranged, one off each side of the line to ground, the circuit of each being carried through the contact points of the other, so that either will respond to currents on its own side of the line, while one only responds to currents on both sides.

LETTERS TO THE EDITORS.

Starting Rotary Converters.

To the Editors of Electrical World:

SIRS: That part of the editorial in your issue of December 23d on "Converter Substations" which refers to the methods of starting synchronous converters, evidently favors starting from the direct-current ends. While this method (as your editorial points out) gives considerable precision in speed control during the period of synchronizing, yet it presupposes the presence of either a starting set composed of an induction motor and a direct-current generator or a storage battery.

If the former method is used, it means the introduction of a relatively costly auxiliary as a part of the substation equipment, and, in any case of starting from the direct-current end, it necessitates added complexity to the switchboard equipment, such as field-changing switches and relays for freeing the direct-current end from the starting source, when the alternating-current end is connected with the source of supply.

The scheme of throwing the alternating-current end directly on the alternating-current supply at reduced voltage, is somewhat simpler than the above method, but has the disadvantage of seriously disturbing the system, owing to the heavy magnetizing and therefore lagging currents drawn by the rotary armature under these conditions. The use of this method also reduces the usual simplicity of the shunt-field wiring—it being necessary to have the coils so wired to a multiple point switch, that the individual bobbins may be disconnected from each other to avoid the heavy induced voltage that would result, were this precaution not observed. This method has the one advantage, however, that the rotary is, so to speak, automatically synchronized, it only being necessary to apply full voltage after the proper speed has been reached.

The method which seems preferable to those cited above, is the one employing a starting induction motor, the rotor of which is mounted on an extension of the rotary armature shaft. This motor should be of a type having a relatively high secondary resistance, and therefore possessing the property of having a high starting torque per ampere, with a corresponding reduction in the disturbance created on the system when starting. It should also have a fewer number of poles than the rotary (usually one pair less than the latter) in order that the speed of the starting motor, including the slip, will just nicely bring the rotary to synchronous speed at normal voltage.

Good results are obtained by this arrangement when the capacity of a motor of this type bears the proper relation to the total no-load rotary losses at normal speed and voltage when synchronizing with the low-tension side of the lowering transformers, and to the total no-load rotary losses at normal speed and voltage plus the iron loss in the lowering transformers at normal voltage, when synchronizing with the high-tension bus bars. Under these conditions the starting motor takes the rotary above synchronous speed on weak field charge, and as the latter is increased the speed falls, the operator having ample time to throw in his machine when passing gradually through synchronism.

This method, although it does not permit of such refinement in speed control as with the direct-current starting, serves well the intended purpose, and has the paramount advantage of simplicity—a rare jewel in modern substation design.

TORONTO, CANADA. CLARENCE P. FOWLER.

Efficiency of Lighting Balancers.

To the Editors of Electrical World.

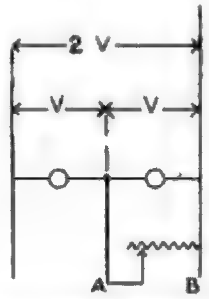
SIRS: Referring to Mr. Budd Frankenfield's interesting article on "Regulation and Compounding of Lighting Balancers" in your issue of December 23d, I note that on page 1067 the writer states that "balancer efficiency = *eg* × *em*," where *eg* is the generator efficiency and *em* the motor efficiency. The good regulation obtained by a balancer set would have a serious counter consideration if the efficiency of a balancer set were as low as here stated. The over-all efficiency of a balancer set is considerably higher than the product of the efficiency of the two units composing it. This may be shown as follows, referring to the accompanying sketch:

$$\text{Efficiency of this apparatus} = \frac{\text{output of set}}{\text{input of set.}}$$

$$= \frac{\text{Watts wasted in resistance “A B”}}{\text{Watts supplied by mains.}}$$

$$= \frac{V\ (\text{gen. current} + \text{motor current.})}{2V\ (\text{motor current.})}$$

the motor current being main line current at $2V$ volts. Using Mr. Frankenfield's symbols, the several currents being distinguished by subscripts, we have



BALANCER DIAGRAM.

$$\text{Efficiency} = \frac{V(I_g + I_m)}{2VI_m}$$

$$= \frac{1}{2} + \frac{I_g}{2I_m}.$$

The efficiency as motor-generator set is, assuming the voltage balanced,

$$= E_g \times E_m = \frac{I_g}{I_m}.$$

On page 1068 Mr. Frankenfield gives an actual example and obtains a combined armature efficiency of 55.6 per cent. What is meant by combined armature efficiency is not stated, but it is apparently the same thing as the efficiency as a motor generator set when "motor voltage = generator voltage."

The efficiency as a balancer set is as follows:

$$\text{Efficiency} = \frac{1}{2} + \frac{I_a}{2I_m}$$

$$= .5 + .278 = 77.8 \text{ per cent.}$$

This value, it will be noted, is very close to the efficiency of each unit of the set when run as motor generator.

The whole problem of balance on three-wire or multi-wire systems, and the amount of energy actually transmitted from one part of an unbalanced system to another in the attempt to obtain electrical equilibrium, is of great interest and one on which the writer at least, and doubtless many other readers, would be glad to hear from Mr. Frankenfield again.

SCHENECTADY, N. Y. C. T. WILKINSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS

Induction Motor.—BRUNSWICK.—An illustrated article on the Boucherot induction motor which has, as is shown in Fig. 1, two stators, a_1 a_2, and a common squirrel-cage armature, b_1 b_2 in the middle point of which are inserted resistances, r. These resistances are active only when the e.m.f's. in the two stators are not in phase. The value of these resistances is so chosen as to yield the desired starting torque. At starting there is an artificial phase difference between the two stators which is gradually removed when the motor runs up to full speed. The phase difference is produced in one type of the Boucherot motor by mechanically displacing one stator. But this construction is possible only when the motor is easily accessible. For other purposes the phase difference is produced by electrical means and an arrangement is described which is used mainly for motors driving centrifugal pumps and large ventilators. Fig. 2, indicates the connections as they follow each other from starting to full speed. The lowest diagram in Fig. 2 shows the connections in the moment of starting. Each stator is star connected, but the windings of the two stators are opposite to each other. The middle diagram shows the connections shortly after starting. Here only one stator is active, the other is short-circuited. With these connections the resistances, r, in Fig. 1, are rendered less effective. The diagram at the top in Fig. 2 shows the connections at regular running, the two stators being in phase.—*L'Industrie Elec.*, December 10.

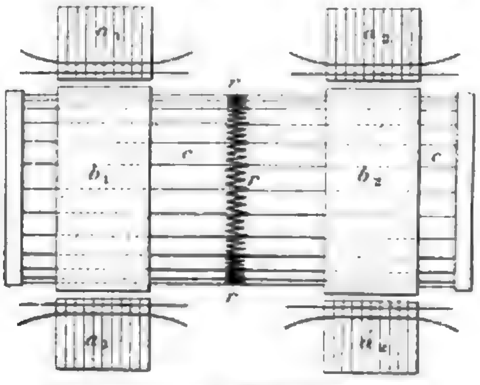


FIG. 1.—DIAGRAM OF INDUCTION MOTOR.

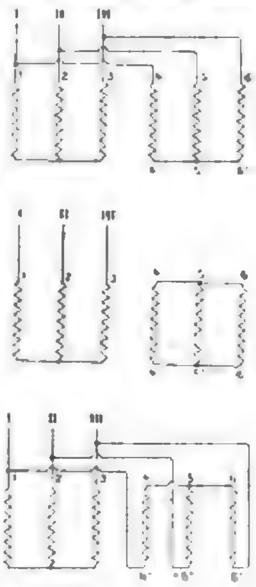


FIG. 2.—DIAGRAM OF CONNECTIONS.

Liege Exposition.—REYVAL.—An illustrated description of several electric machines exhibited by the Allgemeine Elektricitats Gesellschaft-Union Company. Detailed drawings and dimensions are given of a 210-kw, steam-driven, direct-current dynamo supplying directly a three-wire system with 500 volts between the outers by the Dobrowolski system.—*L'Eclairage Elec.*, December 9. A steam-driven, 60-kw, 440-volt, direct-current Jaspar dynamo, running at 725 r.p.m., is described in detail in *L'Eclairage Elec.*, December 16.

LIGHTS AND LIGHTING.

Miners' Lamps.—SCHMERBER. An account of practical tests of modern miners' safety lamps at the official testing station in Belgium.—From *Le Génie Civil*, in *Eng'ing Mag.*, January.

POWER.

Mechanical Coal-Handling Plant and Boiler House Economy.—An article giving examples which show the effect of a mechanical coal-conveying plant on boiler house economy. The installation of the Coventry municipal station is first described. The fuel for the six boilers is brought to the works by a canal adjacent to the boiler house, thence in the old days of manual labor it was raised by hand and wheeled into a space in front of the boilers. Now mechanical apparatus, driven by electric motors has been installed for barge unloading, conveying, storing, elevating, distributing and stoking. The mechanical stokers are of the Bennis type, with pneumatic gear and self-cleaning compressed-air furnaces, and are specially adapted for burning a low-grade fine slack. By the recent addition of the compressed-air bar, into which the air is forced by the aid of a minute steam blast in each bar, to the Bennis system of stoking, a combination of the chief benefits of mechanical firing with forced draught is obtained. By a regulation of the steam blast the quantity of steam raised can be increased or decreased as required. A comparison of costs between the old system and the new shows that considerably over 60 per cent is saved in the course of transit from barge to boiler. As another example, is given the coal handling plant of the City Road station of a London company. Here an hydraulic crane with a nominal lifting capacity of 2 tons removes the coal from the barges on the Regent's canal by means of a 15-cwt grab, and raises it to a hopper on the roof of the coal store. Sixty tons of coal are raised in 2½ hours by this means. The entire work is conducted under the superintendence of two men with the assistance of a boy who acts as trimmer.—Lond. *Elec.*, December 15.

Cranes Driven by Single-Phase Motors.—An illustrated description of an installation of wharf-cranes in Cologne, Germany, driven by single-phase alternating-current. The frequency is 50. The voltage for the cranes is transformed from 2,100 down to 500 volts. The 40-hp lifting motor is an induction motor of 10 poles. Armature and collector resemble those of a continuous-current motor. There are ten sets of carbon brushes, "two of which serve for the induction of a separate current, which, being out of phase with the main current, produces a rotating field." The motor runs as a two-phase motor at starting. The auxiliary current is interrupted as soon as full speed has been reached. "The speed variation of the motor is secured by changing the primary voltage impressed on the motor by means of transformers which perform the service of controller resistances." The operating mechanism for each motor consists of controller and transformer.—Lond. *Eng'ing*, December 22.

Electrically-Driven Air Pump.—CORSEPIUS.—An illustrated article on an air pump in a German electric station, driven by a single-phase motor without commutator. The same is of the author's design which has been mentioned before in the Digest. Although it has no commutator, it starts under load. The principle of the motor is the application of the Arno phase splitter. The motor has two rotors, one of which is loosely mounted on the axle and is started unloaded by some well-known method. This auxiliary rotor produces an armature reaction and the main rotor is then started as in a two-phase motor. Characteristic curves of the motor are given.—*Elec. Bahnen*, November 24.

Low-Grade Fuels.—GOODRICH.—A second article on the utilization of low-grade fuels for steam generation. The author deals especially with the adaptation of the boiler furnace and other appliances to the burning of low-grade combustibles. He shows that many low-grade and cheap fuels are well worth burning for steam generation if properly handled. A really first-class fireman, not a mere thrower in of fuel, is a valuable servant. The average fireman, however, prefers expensive fuel because it requires the minimum of exertion on his part.—*Eng'ing Mag.*, January.

Power Chart.—CAREY.—A chart for finding the power of an engine and showing the relation between the cylinder dimensions, point of cut-off, initial pressure, speed and horse-power. The application of the chart is described.—*Power*, January.

Storing Energy.—HERZOG.—The first part of an illustrated description of the Olten-Aarburg electric station in Switzerland in which the power developed during the night is stored and thus made available for use during the hours of maximum load. For this storing purpose, centrifugal pumps have been installed, which during the night hours raise water to a reservoir on top of a mountain near the station.—*Zeit. f. Elek.* (Vienna), December 17.

TRACTION.

Alternating-Current vs. Direct-Current Railways.—LAMME.—A long article on the relative advantages of direct-current and alternating-current for heavy railway service. The present direct-current traction system has accomplished wonderful results. There are, however, limits to its application, the most important of which is the low voltage which has been used heretofore. About 15 years ago, 500 volts was the usual pressure, while at the present time 650 volts is rarely exceeded in regular service. While there has been good reason for years for going much higher, it is evident that something more than mere adherence to a standard has prevented the use of higher direct voltages. The difficulties in designing direct-current railway apparatus for higher voltages are due not to lack of ability to construct a railway motor which can be wound for 1,500 volts, but largely to certain operating conditions found principally in railway service. The questions of high-voltage control systems, high-voltage rotary converters, or motor-generators, as well as high voltage on the motors themselves must be considered. Experience tends to show that when the voltage across the motors is raised to 1,500, the difficulties due to flashing would practically prohibit their use if the present types of construction are retained. There are certain ways in which this flashing tendency in high-voltage motors could be suppressed, but these involve very radical changes in the design. For example, they could be made entirely with laminated magnetic circuits with no closed secondary paths and no low resistance secondary circuits in the armature winding. The field would be provided with neutralizing or so-called "compensating" windings, which practically neutralize the magnetizing effect of the armature. This ideal type of direct-current motor is, however, the one which has been developed for use with alternating current, and such a motor, with relatively small expense, could be designed to make a rather good machine for operating directly on alternating-current circuits of low frequency. In discussing the use of high-voltage direct-current generators, the author states that a 1,500-volt direct-current generator may represent a permissible design, but a high-voltage rotary converter presents some problems which are not found to the same extent in the present low-voltage machines. Experience has shown that the possibility of flashing increases rapidly with increase in voltage. With a voltage of 1,500 on rotary converters, the flashing tendency would be enormously increased, and might even prohibit the use of this class of machinery. In regard to high-voltage direct-current generators, it may be stated that the design of a first-class direct-current, 1,500-volt railway generator with one terminal grounded presents such possibilities for trouble that those designers most able to construct such a machine are the ones who would raise the greatest objection to doing so. The true merit of the single-phase system lies not in any inherent superiority of the motor itself, but in the fact that any desired voltage may be used on the trolley system, while the voltage delivered to the motor system can be varied economically. The alternating-current commutator type motor is necessarily built along lines which would make a very superior direct-current type of machine, and, therefore, in comparing the alternating-current motor with the direct-current motor, it is only fair to compare it with what could be obtained from the same material and construction properly applied in a direct-current machine. Under such condition the direct-current motor will undoubtedly show extremely good characteristics. In fact, certain types of single-phase alternating-current motors now in the market are in reality very fine direct-current machines, and will operate on direct current in many ways more perfectly than any purely direct-current motor now on the market. It has been a question with the manufacturers, whether, instead of going to the refinements necessary to obtain a limited increase in voltage on direct current, with the accompanying high-voltage control, high-voltage direct-current generating plants, etc., it would not be advisable at once to wind the motor for alternating current, and thus open the way for the use of much higher voltages and at the same time obtain a low-voltage control system which is of the most efficient known type, namely, variable e.m.f. from transformers. On account of the comparative newness of the system, the question has been raised from time to time whether single-phase alternating motors of suitable size and capacity can be built for heavy railway service. But as such motors have been built and given severe tests, and are being built in comparatively large quantities, and as those manufacturers with experience in the design of such machinery state positively that they can build such motors, there should be no further question on this point. The question seems to be turning now to the comparative economy of the single-phase system and the direct-current system with rotary-converter sub-stations. As a rule it has been found that the total first cost of the single-phase system is considerably lower than that of the standard rotary-converter system, the difference depending upon individual conditions. Not considering the power house, in some instances this difference may amount to as much as 30 per cent. while in others it may be as little as 10 per cent. In any condition where the direct-current system requires any considerable use of the rheostat for regulating the speed, the single-phase syster has the advantage in economy of operation as far as the equipment itself is concerned. But under conditions where the direct-current equipment does not require a rheostat, the advantage is in its favor. Such conditions, however, would be the exception rather than the rule, in service corresponding to that of the present steam roads.—*St. R'y Jour.*, January 6.

Single-Phase Locomotive.—On the Swedish railways experiments are being made at present with single-phase alternating current of 25 periods per second. These tests are made with a view of introducing later on single-phase traction in general on the Swedish railways, since Sweden is rich in water power but not in fuel. Two locomotives and two motor-cars have been ordered partly from the Allg. Elek. Ges. and the Siemens-Shuckert Works in Berlin and partly from the British Westinghouse Company. Single-phase commutator motors are used throughout. In the present article the locomotive furnished by the Siemens-Schuckert Works is described. It has a weight of 36 tons and is intended for freight trains with speeds up to 45 km. per hour on a level road and about 24 km. per hour on grades of one per cent. By changing the ratio of gearing it is intended to increase the speed later on to 65 km. per hour. The locomotive has three driving axles, each being driven by a compensated series motor of a design similar to that of those used on the Murnau-Oberammergau single-phase road. The normal capacity of the 320-volt, 25-period motors is 110 hp, and with the ratio of gearing of one to five, which is used at present, the maximum tractive effort of the three motors is 6,000 kg. at the wheels. In the front of the locomotive a transformer is placed with a normal capacity of 300 kilovolt-amperes, the primary of which consists of a series of windings the connections of which may be changed so that the voltage supplied to the primary may be varied between 5,000 and 20,000 volts. One of the chief purposes of the tests is to find the highest voltage with which a safe and satisfactory traction service can be maintained. The voltage of the secondary of the transformer can be varied between 160 and 320 volts. The controller contains 10 positions, the first one of which is intended for very slow speed, and a special device for blowing out magnetically the spark due to the short-circuiting of coils. The motors are artificially cooled with air. The locomotive has two aluminum bows for taking off the current from the trolley wire.—*Elek. Anz.*, December 17.

Single-Phase Motor Car.—DIETL.—A very full and profusely illustrated description of the first motor car completed for the single-phase railway from Blankenese to Ohlsdorf, near Hamburg. The car has six axles and is really a double car, only one-half of it taking current from the trolley wire. The length of the whole car is 29.55 meters, the total weight without passengers 71 tons. A single-phase current of 6,000 volts and a frequency of 25 will be used, the voltage not to increase beyond 6,800 and not to fall below 5,200. The rails will be used for the return current. The motor car is driven by three Winter-

Eichberg motors of the same type as used on the Niederschoenweide-Spindlersfeld road, the only new features being stronger construction and ventilation. On the commutator side of the motor, fresh air is sucked in through the hollow axle and is passed through the motor in such a way that neither the windings, the commutator nor the brushes come in direct contact with it. The equipment is described in detail and illustrated by diagrams.—*Elek. Bahnen*, December 4.

Indian Tramway.—An illustrated description of the electric railways of the city of Singapore, which has a population of 250,000. The total length of the roads is 16 miles of route, the length of the single track being about 26 miles 4 furlongs. The track is laid to a gauge of 1 metre, with rails of the girder type weighing 95 lb. per yard. The rail joints are welded by the thermit process, so that the track forms one continuous length, and in addition, a 6-0 S.W.G. copper bond is supplied at every joint, ensuring perfect electrical conductivity. The trolley wires, which are not necessarily over the center of the track, the possible variation being about 10 ft., are divided into ½-mile sections by means of section insulators. There are two main engines in the power house each of 927 hp, which may be worked either condensing or non-condensing. They drive 500-kw, 500-volt direct-current generators running at 100 r.p.m. The lighting sets consist of one 150-kw generator and a 50-kw motor-generator. Two balancers are also installed.—Lond. *Elec.*, December 15.

British Tramway.—An illustrated description of the Falkirk tramway in Scotland. The complete length is 7 miles. For transmission 4,300-volt, two-phase currents at 50 periods are used. The sub-station is equipped with two "Peebles-LaCour motor converters" and with negative boosters. There is no storage battery.—Lond. *Elec. Rev.*, December 22.

Steel for Third Rails.—Wales.—An account of experiments on the electrical conductivity of steel as affected by chemical composition and physical treatment. The best obtainable results by use of steel rails of standard composition, show a resistance of between 10 and 11 times copper of the same section with direct-current, while values of resistance as high as 70 times copper have been obtained in some experiments with alternating current at 40 cycles. The best iron third rail material in use to-day as to electric conductivity is that used by the London Underground Railway which has the following composition: Carbon, .05; manganese, .19; phosphorus, .054; sulphur, .03; or a total contained elements not iron, of .373; its electric resistance is 6.4 times that of copper of the same section. From the tests made by the author the following general conclusions may be drawn: The resistance increases with the total amount of dissolved impurities, or what is known as the "total content not iron." Of all the common impurities found in steel, *Mn* has the most powerful effect in increasing the resistance. Annealing and tempering of the very soft specimens is of practically no value. The effect of the water hardening on the resistance of the higher-carbon samples is quite marked, but the annealing appears to return the steel to its former condition electrically, and nearly so physically.—*Rose Technic*, December.

Supervision of Motormen.—An article stating that a proper supervision of motormen should be based on the ratio of the time of running with current to the total running time. The smaller this ratio, the more efficient the motormen. For this purpose a watch may be used which gives only the time during which current was consumed. The essential part of it is an electromagnet which, when the car runs with current, attracts an armature and starts the watch.—*Elek. Bahnen*, November 24.

Regenerative Control.—Feldmann.—An article illustrated by diagrams on the regenerative control system of Johnson-Lundell which has already been noticed in the Digest.—*Elek. Bahnen*, November 24.

Street Railway Apparatus.—Rakestraw.—An article of a general nature on the erection and operation of street railway apparatus.—*Sibley Jour.*, November.

INSTALLATIONS SYSTEMS AND APPLIANCES.

Protection of Alternating-Current Circuits.—An illustrated article on inductive-balance devices for the protection of alternating-current circuits. The application of the principle of the maintenance of an inductive balance between two oppositely-wound sections of a transformer or reactance coil presents many advantages over other systems for the operation of the relays and protective devices employed in the control of high-tension switch-gear, especially in cases where "discriminating" devices are required. The author first describes an inductive balance relay as applied to generator circuits and shown in Fig. 3. A potential supply from the bus-bars is connected to the center of the secondary winding, *XY*, of a small series transformer. As this winding is wound entirely in one direction, and as there are an equal number of turns on each side of the point of potential connection, the current from the bus-bars will be divided equally between the two halves, and these currents will have an equal and opposite magnetizing effect upon the core of the transformer. A perfect inductive balance is by this means established. The outer connection of the secondary winding referred to are connected to two solenoids, *A* and *B*, and so long as the current in these solenoids is equal, the magnetic pull on the swinging armature will be equal and opposite. This armature is, however, normally held in the position shown by a small adjustable weight. The main current flowing from the generator into the bus-bars will induce a secondary current in the local circuit, *X, A, B, Y*, in the direction indicated by the full arrows, and this will so disturb the inductive balance as to cause a greater current to flow through the branch, *X, A*, than through the branch, *Y, B*, with the result that the pull due to gravity, tending to hold the relay in the open position shown, will be supplemented by a magnetic pull approximately proportional to the amount of current flowing from the generator to the bus-bars. Should the generator break down, current will tend to flow from the bus-bars into the generator, thus reversing the direction of the current through the series winding relatively to the direction of the current due to the potential supply. The series current will now induce a secondary current in the opposite direction to the full arrows around the local circuit, *Y, B, A, X*, and as this will cause more of the potential currents to flow through the side, *Y, B*, than through *X, A*, the magnetic pull in the solenoid, *B*, will overcome the pull of *A* and will cause the armature, *C*, to move into such a position as to close the local circuit through the tripping coils, operating the main circuit breaker. There are examples of the same principle here described and illustrated.—Lond. *Elec.*, December 15.

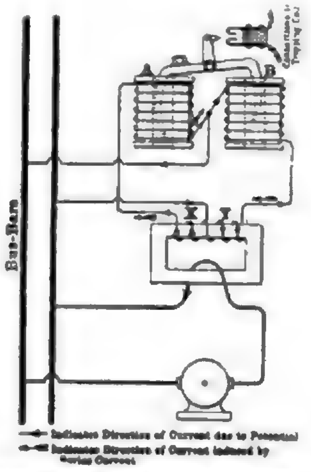

Connections to Tripping Coil
A
B
Bus-Bars
X
Y
Indicates Direction of Current due to Potential
Indicates Direction of Current induced by Series Current

FIG. 3.—PROTECTING ALTERNATING-CURRENT CIRCUITS.

Municipal Trading.—Swinburne.—In an address on efficiencies (abstracted separately in the Digest) the author makes some pointed remarks on municipal trading and municipal electric supply undertakings. "If a station is run by a town, the accounts must be kept by an absurd system." Towns are generally concerned with such things as sewage systems, in which there is no profit and loss account. To build a sewage system the town borrows money and pays it off in a number of years out of taxes. "The town, therefore, does not save money like the private individual and then buy what it can afford. I do not think it would be allowed to do such a rational thing; it has to borrow money for everything and pay it back over a term of years.

The length of the term has no reference whatever to the nature of the work done, as the work is not in any way security for the loan, the local rates are the security. There is an epidemic of outcry just now about municipal indebtedness, but it is apt to give a totally wrong impression to the average reader, as he does not realize that the municipalities must be in debt owing to the way these things are arranged. For a private individual always to be in debt would be bad; for a town it is another matter; the only question is how much the town ought to be in debt." But local authorities are now taking up such businesses as electric supply and tramways, which have profit and loss sides; but they are obliged to work the business on the same lines as town improvements, "which is absurd. A municipal electric light scheme is thus worked under absurd difficulties. It is like a public company that has a negative capital; that is to say, all its money is borrowed. The shareholders are the taxpayers. They hold shares depending on the tax assessments. The dividends are generally negative. All the shareholders are so by compulsion if they live in the place. The only thing they can do if they do not want to be shareholders in such undertakings is to move off to another town; but then they become shareholders in another set of ventures. I believe the only way to avoid being shareholders in these compulsory undertakings is to live in a barge on a canal. Be this as it may, the undertaking, though a profit and loss concern, must keep its accounts on the same principle as if it were a sewage system. To begin with, the town may only borrow enough money to put down the plant. This has to be paid off by the sinking fund, which returns all the borrowed money, in say, 20 years. The plant may last ten years, or it may last 50 years, that has nothing to do with the case." A private concern would start business with enough capital to put down the station, and to run it at a loss for a year or two until it turned the corner. The municipality may not do anything as sensible as that; it may only borrow money enough to put down the station, and the first few years losses must be paid for out of the taxes for these years. This sometimes excites the taxpayers. Almost any business has to be run at a loss at first, and enough capital must be provided to meet the deficit, and when the business pays it ought to pay on the whole capital. No one would think of starting, say a factory with no working capital at all, and distributing a negative dividend during the next few years to pay the losses. This is one of the many absurd conditions under which municipal work has to suffer." In one case a lovingly solicitous gas company felt that it was hard that a municipality should lose during the first years, so it got a clause inserted to the effect that if there were a loss the price should be raised and raised until there was either no loss or no customers; it did not matter which, though in its heart of hearts the gas company preferred the latter. This clause was solemnly inserted in one or two acts by the collective wisdom of the country. It may interest you to realize that the large commercial interests of this country are controlled by a set of people who think that if a manufacture does not pay the simple expedient of raising the price will put things right."—Lond. *Elec.*, December 1.

Electric Installation in the West Indies.—Moses.—A description of an electric power plant in a West India island for supplying power for irrigation, for a sugar mill and for lighting purposes. For irrigation, rotary pumps are used, operated by three-phase motors, the voltage of transmission being 6,600. For lighting the district a three-wire alternating current system at 240 volts is used. For power purposes and for lighting the sugar mill a 120-volt direct-current system is used.—*Eng'ing Mag.*, January.

Paris.—A reprint of an official report of the Prefet de la Seine concerning projects of the future electricity supply in Paris. No definite conclusion has yet been reached.—*L'Industrie Elec.*, December 10.

Wires, Wiring and Conduits.

Feeders and Cables.—Rhodes and Watson.—Two papers read before the Manchester section of the (British) Inst. Elec. Engs. The paper of Rhodes gives mathematical formulas for the calculation of electric feeders and deals with the following problems: To find the cross-sectional area of a uniform circular cylindrical feeder of given length to carry a maximum current with a given fall of potential; to find the fall of potential along any portion of an electric feeder in which the current varies as in the foregoing problem; to find the fall of potential along a conical feeder in which the current is proportional to the distance measured from the end furthest from the generating station, having given the maximum current and the specific resistance of the material. Finally the author shows how to calculate the watts lost in the feeders under the different conditions. The paper of Watson is a discussion of the comparative advantages of the different methods of street cable systems giving comparative figures for the cost of installation under British conditions. "The most encouraging direction for improvement appears to lie in the use of a mechanically strong insulating and absolutely water-tight duct or trough, so that bare copper rod or tape can be used, surrounded with a suitable filling. The expense of stranding conductor and of cable insulation, which is at present considerable, will then be saved. The materials at present on the market most suitable for the purpose suggested are the asphalt trough and the patent fibrous material used for the construction of pipes for drawing-in purposes."—Lond. *Elec. Rev.*, December 22.

Electrophysics and Magnetism.

Roentgen Rays.—Bumstead.—An illustrated article on the heating effects, produced by Roentgen rays in different metals, and their relation to the question of changes in the atom. The author's experiments indicate that when Roentgen rays are equally absorbed in lead and in zinc, approximately twice as much heat is generated in the lead as in the zinc. It does not appear possible to attribute this result to errors in the measurements or in the theory underlying the experimental method. To account for this effect the writer has been able to think of only one hypothesis which is not in more or less direct conflict with experimental facts. This hypothesis is that, by means of Roentgen rays, the atoms of certain elements may be artificially broken up and that the energy thus liberated forms a part (and perhaps the greater part) of the energy which appears when the rays are absorbed by matter.—*Am. Jour. of Science,* January.

Magnetic Alloys from Non-Magnetic Metals.—Guillaume.—Some notes on the theory of the Heusler magnetic alloy made from non-magnetic metals, manganese, aluminum and copper. The explanation of the author is based essentially on the supposition that manganese and chromium, which belong chemically to the same class as iron, nickel and cobalt, are essentially magnetic metals, but have a very low "transformation temperature." In the alloys the transformation temperature is raised.—*L'Industrie Elec.*, December 10.

Mechanism of Electric Current.—Langevin.—The first part of a summary of recent researches on the mechanism of the electric current and on ionic and electronic theories.—*L'Eclairage Elec.*, December 9.

Electrochemistry and Batteries.

Measuring Speed and Acceleration.—Owens.—Some notes on a method described by the author in a former paper on measuring both the speed and acceleration of a revolving machine. Fig. 4 shows the arrangement. *S* is the revolving machine to be tested. Its shaft is mechanically coupled with the armature, *A*, of a small magneto-generator or constantly excited direct-current dynamo wound so as to have a negligible reaction within the limits of its use. *R* is a variable non-inductive resistance and *I* is a zero center direct-current ammeter. The reading of *I* will be proportional to the speed of *S* and, by adjusting *R*, can be calibrated in revolutions per minute, feet per second, or miles per hour, as desired. As the current through *I* is proportional to the speed, it is only necessary to determine the rate at which

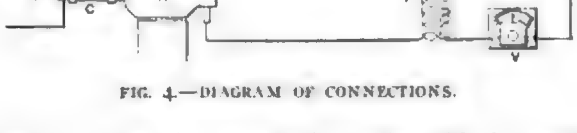


FIG. 4.—DIAGRAM OF CONNECTIONS.

the current varies in order to have a measure of acceleration. This is done by inserting in the circuit with I a transformer, T, with its secondary connected, for purposes of adjustment, through a non-inductive resistance, R_1, to a zero center direct-current voltmeter, V. The reading of the voltmeter, V, will then be proportional to the acceleration, positive or negative, of the shaft, S. The transformer must have a straight line saturation curve and a large transformation ratio as the secondary induced voltage is necessarily small, and the voltmeter, V, must be sensitive.—*Machinery*, January.

Meter.—An official report of the Reichsanstalt concerning alternating-current induction meters, made by the Siemens-Schuckert Company and admitted by the Reichsanstalt for calibration. The instrument consists of an induction motor, braked magnetically and connected with a counting device. The movable part is a metal disc, the stationary part a three-leg iron core having the main current winding on the two side legs and the shunt winding on the middle leg. The construction is described and illustrated in detail.—*Elek. Zeit.*, December 14.

Testing.—Rowe.—A continuation of his illustrated serial on alternating-current laboratory testing. In the present installment he deals with the exciting current load losses, efficiency losses, polarity, test regulation, heat test and pumping back method.—*Jour. of Electricity, Power and Gas*, December. An illustrated article by Foote on commercial testing of electrical machinery by the loading-back method is found in the *Sibley Jour.*, October.

Definitions of Electrical Terms.—Emde.—A highly mathematical article giving exact definitions of electric tension, tension difference, potential, potential difference and e.m.f. For instance, "tension is the line integral of the electric field strength," etc.—*Zeit. f. Elek.* (Vienna), December 10.

Telegraphy, Telephony and Signals.

Transmitting Pictures.—Korn.—An illustrated article on his method of transmitting photographs, handwritings, etc., over electric wires. He states that by his latest improvements he is able to transmit within 10 to 20 minutes portraits of the size of 13 by 18 centimeters over lines which have a resistance of 12,000 ohms. The transmitter is shown in Fig. 5. The photograph to be transmitted is placed in form of a transparent film on a glass cylinder, Q_1, and the light of a lamp, J, is concentrated through a lens, 1, upon a point of the surface of the film. The light rays fall upon a selenium cell, *Se*, through which an electric current is sent from a storage battery of 110 volts to the line connected with the receiver. The more transparent the point of the film through which the light passes at the moment, the greater is the current which is transmitted from the sender to the receiver. The glass cylinder revolves and by means of a screw it is arranged that with each revolution it passes forward (in direction of the axis) by, say, one mm. In this way each point of the photograph to be transmitted is gradually brought between the lamp and the selenium cell. At the receiving station the author uses vacuum tubes of a length of a few centimeters and a diameter of one cm., almost completely covered with black paper and having one small window (1/16th sq. mm.) from which the light of the tube falls upon the sensitive paper of the receiver. The receiving sensitive film is also wound around a cylinder revolving synchronously with the transmitting cylinder. The arrangements for producing synchronism and for causing the light of the vacuum tube to change with the current transmitted over the line are described in detail and illustrated. The author finally makes some remarks on seeing at a distance. For this purpose it would be necessary to reduce the time of transmission of a picture from 10 minutes to about 1/5th second.—*Elek. Zeit.*, December 14.

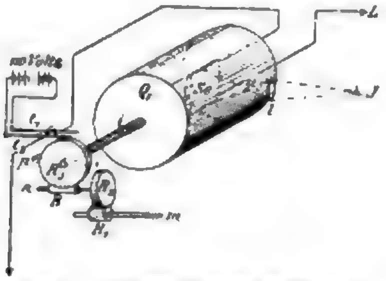


FIG. 5.—TRANSMITTING PICTURES.

Miscellaneous.

Efficiencies.—Swinburne.—An address to the students of the Manchester local section of the (Brit.) Inst. of Elec. Engs. The term "efficiency" is used to denote the rate of useful part of the energy or power obtained, to the energy or power put in. The term efficiency may also be stretched to cover questions of money, although "in the case of a well conducted bargain, each of the parties, to use a legal word, gives what he prefers to part with for what he wants more; so that both are satisfied." A trader who looks upon buying at $3 and selling at $4 as making a profit of 33 per cent "really deceives himself, because in such cases it is not really a question of how much is made over and above the apparent purchase price, but of what profit is made per annum on his trade capital." "In making any bargains with nature, we always lose in a sense; and we are so accustomed to it that we take it quite contentedly, and merely try to lose as little as possible in the transaction. The relation of what we do not lose to the whole is termed the efficiency." The author includes into the term of heat not only sensible heat, but also latent heat and chemical energy. He thinks "it is not realized that chemical energy is necessarily low-grade energy, only partially convertible into work." He introduces the idea of chemical temperature. For instance, the chemical temperature of carbon and oxygen is given as of the order of 3,000° C. or more, and it is defined by the statement that above this temperature the reaction goes on in such a direction that the oxide of carbon dissociates into carbon and oxygen, absorbing sensible heat, while below the chemical temperature the reaction goes on in the opposite direction, carbon and oxygen combining and giving out sensible heat. At the chemical temperature therefore, "under the pressure and quantitative relations of the carbon, oxygen, and carbon monoxide, sensible heat and chemical energy are interchangeable." If the burning coal, containing, of course, other constituents, such as hydrocarbons with other chemical temperatures, could hand over its heat at 3,000° C., nearly all of it would be available. As the heat is finally rejected at condenser temperature of 100° or so (3,000 — 100) ÷ 3,000, or about 97 per cent of it would be available. But we cannot run a boiler and engine between 3,000 and 4,000° C. In practice the boiler takes the heat up at less than 500° C., so that ⅚ is degraded or rendered unavailable right off. The real loss is between the fuel and the boiler and it is not loss of energy but loss of availability. The author gives a diagram (Fig. 6) illustrating the losses of the Metropolitan system supplying several London areas. The losses given on the right of the diagram are the averages for the year. Since they alter from time to time, the wastes are shown black to the left of the diagram for three representative times. The author then discusses municipal trading. He finally speaks of the comparative costs of different artificial illuminants. In comparing gas and electric lighting one may compare the money paid for gas or for electric energy, but to make a real comparison many other factors are to be taken into account. "In addition to the cost of lamps, mantles, etc., we

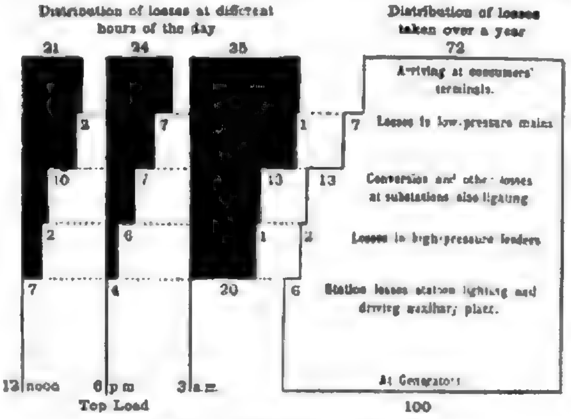


FIG. 6.—EFFICIENCY DIAGRAMS.

must remember that if an illuminant spoils the decorations, the extra cost of redecorating should be charged against it. Gas blackens the ceilings and destroys paint and so on; and the extra cost of decoration may be as heavy as the whole cost of electric light, in which case it does not pay to employ gas at any price. This argument annoys the gas industry, but it is sound and good."—Lond. *Elec.*, December 1.

Hertz.—A French translation of posthumous notes by Herman von Helmholtz on the life and work of Heinrich Hertz. These notes were originally published as an introduction of the German edition of the collected works of Hertz.—*Rev. Gen. des Sciences,* December 15.

Export Business.—PRENTISS.—An article giving hints on how to start a foreign trade. The author says that four steps are required: getting a lay of the land and a knowledge of the situation, creating a demand among consumers—best by personal solicitation—sometimes by advertising or other means, appointing agents and teaching them the goods and selling methods, learning to please the foreign customer and consumer. Foreign commerce takes time to build; it grows slowly; it requires the expenditure of much money.—*Am. Machinist,* December 28.

Drawings.—RONDINELLA.—A paper on the reproduction of drawings of great length or number by photographic methods.—*Proc. Eng's Club of Phila.*, October.

Foundry.—An illustrated description of the foundry department of the Olds Motor Works, of Lansing, Mich., which furnishes castings for the Olds Motor Works, for the Olds Gas Engine Company and for the American Suction Gas Producer Company. The equipment of the foundry and the method of shop management are described.—*The Foundry,* November.

Electromagnetic Separation.—An illustrated description of various types of electromagnetic separators, made by German firms, for iron ore concentration.—*Elek. u. Polyt. Rundschau,* November 15.

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BOOK REVIEWS.

DIE AUFGABEN DER PHOTOCHEMIE. By Dr. R. Luther. Leipzig: Johann Ambrosius Barth. 18 pages, Price, .80 mark.

This may be characterized as an immoderate, poorly balanced eulogy of photochemistry, by an enthusiast whose enthusiasm outruns scientific decorum and good sense. The occasion was the taking of a chair at the University of Leipzig, by Dr. Luther, and he certainly "let them have it." The body of the address deals in somewhat inconclusive glittering generalities, from which little real information can be gleaned, while the peroration of over a page deals out such stuff as:

"Eyes up! Observe with all five senses, so that nothing escapes our attention. Complain not, let us all rejoice! We will rejoice over the immeasurable field for work, over the inexhaustible scientific domain. We will collect each experience, utilize every scientific and technical advance for our purposes, extend our researches to the highest and the lowest temperatures, into the extremest ultra-violet and far past ultra-red to the longest electromagnetic waves," etc., etc.

ELEKTROLYSE GESCHMOLZENER SALZE. By Richard Lorenz. Vols. I and II. Halle: Wilhelm Knapp. Vol. I, 217 pages; Vol. II, 257 pages. Price, 8 marks.

These two remarkable monographs are deserving of the best attention of everyone interested in electrolysis, purely scientific and applied. Prof. Lorenz and his students have given their especial attention during some years to the electrolysis of molten salts, and in this work we have a compilation of all that has been published by others, with numerous illuminating criticisms, and a very complete account of the contributions which have emanated from the Zurich Polytechnicum. Part I deals simply with the facts concerning the phenomena observed when various salts of the various elements are electrolyzed. The treatment is systematic, complete and will be the standard work of reference in this line. Part II deals with the conductivity of melted salts, the question of movement of ions in them and the application of Faraday's law. In this splendid treatise of 250 pages Prof. Lorenz lays bare the scientific foundations of the subject. He proves that Faraday's law applies absolutely and that solutions of metals in their own fused salts, analogous to colloidal solutions, play an extraordinary important rôle in electrolysis. Every electrochemist should buy and study both these monographs; they are unique in electrochemical literature.

Growth of the Demand Indicator Business in the United States.

By J. S. CODMAN.

The Wright Demand Indicator was invented by Mr. Arthur Wright, of Brighton, England, for use with the Wright Demand System of Charging for electricity. This system was introduced in Brighton in 1893 and was promptly followed by increased sales and income, by greatly improved load factor and by a large increase in the number of long-hour customers.

The first Wright Indicator in the United States was brought over from England in 1896 by Mr. R. S. Hale. In 1897 Mr. Wright himself read before the National Electric Light Association at Niagara Falls a paper entitled "Profitable Extensions of Electricity Supply Stations," in which he outlined his system in detail. This served to focus the attention of central station managers on the rate question, and the principles enunciated by Mr. Wright rapidly gained recognition. At the present time a demand system of some form based on these principles is in use in the more prominent cities of the Union, such as New York, Chicago, Boston, Detroit, Cleveland, Cincinnati, St. Louis, Topeka, Denver, St. Paul, Minneapolis, Seattle, Rochester, N. Y., and Springfield, Mass., as well as in a large number of the smaller cities.

VIEW OF TESTING AND ASSEMBLY ROOM.

The manufacture of Wright Demand Indicators in this country was begun in 1898 by the General Incandescent Arc Light Company, of New York, which purchased the right from the English company. The business grew rapidly and was transferred to Pittsfield in 1903, where improved facilities were obtained and the present capacity of the works of the Stanley General Incandescent Manufacturing Company is 1,000 indicators per week. The business continues to grow and for the first ten months of the present fiscal year, which dates from February 1, is already 34 per cent ahead of last year's total.

The accompanying illustration gives a general view of the testing and assembly room at the factory with three testing racks in the center and in the background to the left the zero-setting benches. After the zeros of the tubes are determined the instruments are assembled complete and then submitted to final test.

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Turbo-Alternator for Glasgow, Scotland.

Although the electrical details of turbo-alternators necessarily demand close attention, the most serious problems encountered in their design are those of a mechanical nature, on account of the high rotative speed. We are able to give below a description of a few of the mechanical and electrical features of a 3000-kw turbo alternator built by Dick, Kerr & Company, of London, for the Glasgow Corporation. The alternator has been designed to deliver three-phase currents at 6,600 volts, and having four-pole and operating at 750 r.p.m., it is a 25-cycle machine.

The stator completely wound is shown in Fig. 1. The frame is made of strong cast iron, and supports the stator laminations. The winding is embedded in slots, and insulated by means of pure mica. Special ventilating ducts are provided in the frame, and stiffening fingers clamped on the outside of the laminations obviate danger of vibration. The feet of the alternator frame are bolted to a special bed plate which is so arranged that the stator may be moved in a direction parallel to the shaft so as to uncover the rotor for easy inspection. Perforated shields protect the outside windings against accidental contact or mechanical injury, and are furnished with open spaces for ventilation. The outside of the high-tension windings is covered with sufficient insulation for the full voltage.

A view of the rotor is given in Fig. 2. The body is built up of a central solid steel casting cast under pressure with four projecting poles. This central body is machined and bored out to a diameter larger than the shaft. Two cross-shaped pieces are built at each end of the central body, and carry the rotor on the shaft. These parts are so arranged in reference to the shaft as to leave an annular space all around for ventilation. On the central body radially drilled passages are provided, which correspond to air ducts in the laminated pole tips, these being in line with openings left in the stator iron. The pole tips are laminated, and are dovetailed on the steel casting of the central body. Special end pieces, also dovetailed on the steel casting, retain the laminated tips in position and at the same time act as checks against centrifugal force to keep the spools in position. To guard against centrifugal force which would tend to spread the field coils, laterally wedged pieces are inserted between adjacent coils, pressing against them and the laminated pole tips. The field winding is built up of solid copper strip wound on edge, insulated between turns by means of paper and mica, and supported in a special copper spool with heavy insulated flanges. The spools, after being formed and insulated, are subjected to hydraulic pressure in the axial direction of about 50 per cent over the pressures to which they would be subjected from centrifugal action in normal running. The copper winding of the field bears flat on the insulation, thus avoiding any danger of cutting. The terminal leads of each spool are carried out on the bottom of the spool, and are composed of very thin and flexible copper strips. Between the spools, special wedges are provided against the horizontal component of the centrifugal force, which tends to open the spools. The spools, after being assembled and connected up, are finished on the outside surface, where otherwise the copper would be bare, by means of a special varnish, which is oil and waterproof, and presents a very hard and glossy surface, making it easier to clean the machine. The shaft is special pressed steel and finished all over, and the rotor is pressed over it with about 100 tons pressure.

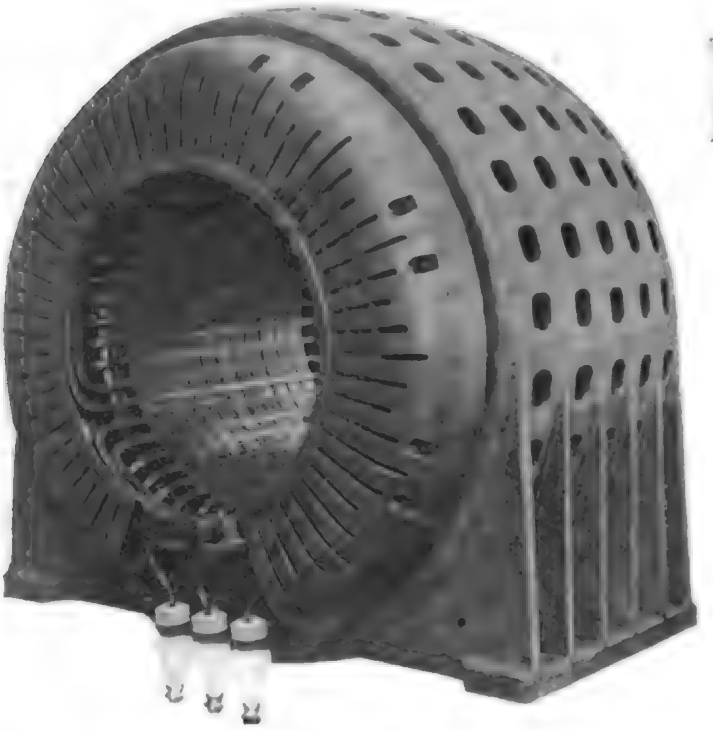


FIG. 1.—STATOR OF TURBO-ALTERNATOR, SHOWING FIELD WINDINGS.

The collector rings are of manganese bronze, fixed over a solid steel sleeve, and of special construction so as to make it impossible to be subject to deformation under working conditions; the collector rings are shrunk hot over special micanite rings, which are built up directly on the steel shell of the collector rings. The leads from the field coils are carried to the collector rings and are protected by means of special metallic caps which are fitted over the shaft and to the end of the rotor body. The connection of the leads to the collector rings is also protected by a special cap, which is easily removable for inspection if necessary. The finished appearance of the collector rings and rotor body is such as not to have any loose connection or projecting part, making it possible to keep the machine clean when running.

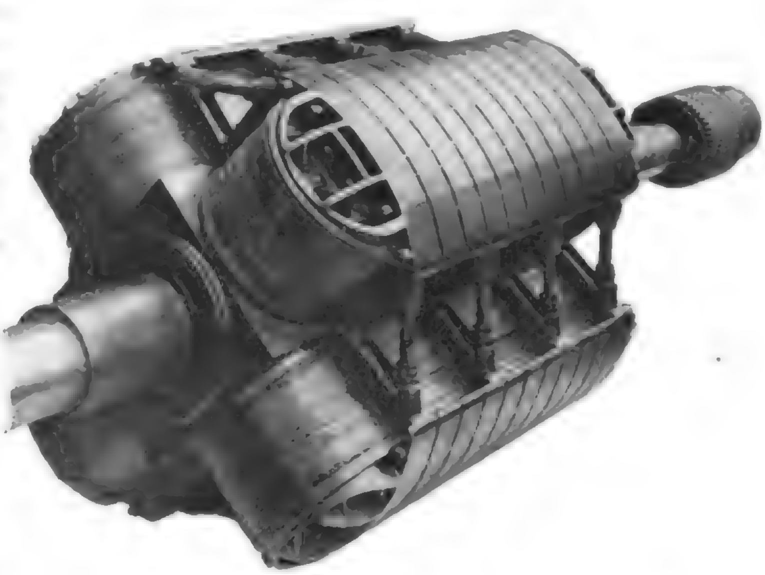


FIG. 2.—ROTOR SHOWING ARRANGEMENT OF FIELD WINDINGS.

Fig. 3 shows the performance characteristic of the turbo-alternator when operated at 6700 volts. The losses shown include also those due to the exciting dynamo. The exciter is connected to the alternator shaft by means of a flexible coupling.

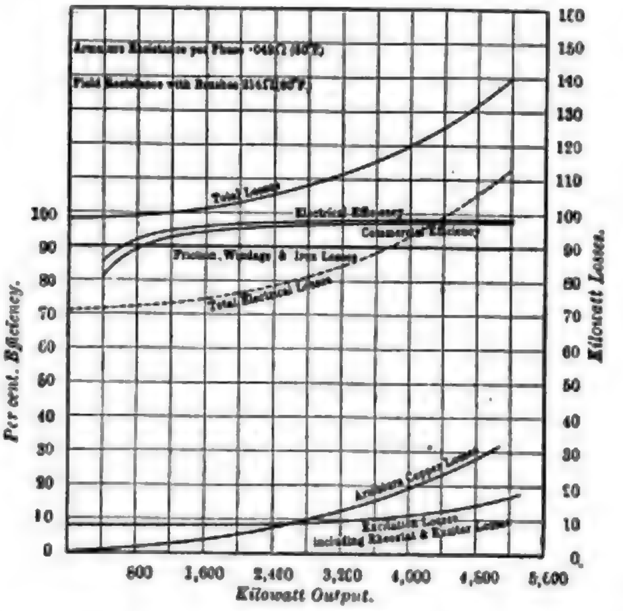


FIG. 3.—TEST OF 3,000-KW ALTERNATOR AT 6,700 VOLTS, 750 R.P.M.

Improved Telephone Transmitter.

A telephone transmitter which the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is just putting on the market, possesses several features which serve to distinguish it from the usual form of transmitter. In the transmitters now in use only one of the electrodes is vibrated with the diaphragm, and in the better forms this one electrode takes up the same amplitude of vibration as the central point of the diaphragm, which, of course, is the point of maximum movement. In the new transmitter both of the electrodes are attached to the central point of the diaphragm and thus produce a variation in the distance between the electrodes of twice the amplitude of vibration of the central point of the main diaphragm. It is evident that a transmitter constructed along these lines will produce a greater volume of transmission than if only one of the electrodes is movable.

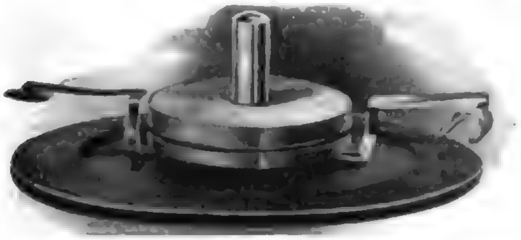


FIG. 1.—DIAPHRAGM WITH CONNECTORS AND CUP.

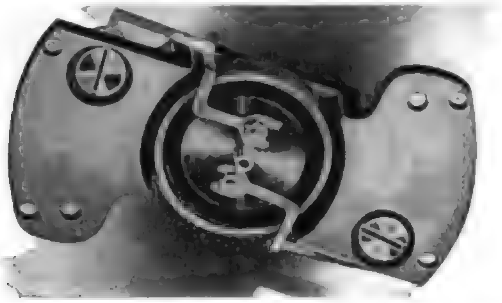


FIG. 2.—ROTOR, SHOWING ARRANGEMENT OF FIELD WINDINGS.

The mechanical construction of the transmitter follows out the practice that has been found to be the most satisfactory for high-class appaartus; that is, the use of highly-polished carbon electrodes and irregularly formed carbon granules enclosed in a practically moisture-proof case, using no absorbent material whatever, so that the transmitter when once assembled should be entirely free from any bad effects due to atmospheric changes, and should be equally efficient in any climate. The transmitter is made durable, particularly in damp climates, by the use of an auxiliary moisture-proof diaphragm over the main diaphragm, thus preventing any chemical action of the main diaphragm, due to moisture of alkali from the breath.

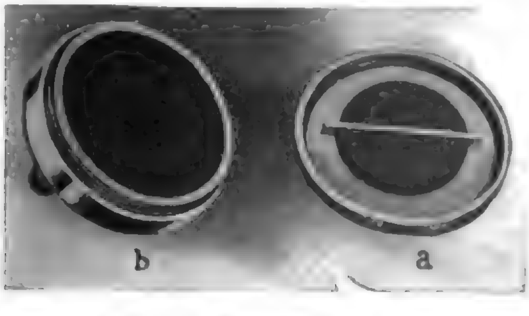


FIG. 3.—TRANSMITTER CUP.

The construction of the instrument is clearly shown by the accompanying illustrations. It will be noted that what corresponds to the front electrode in the ordinary transmitter, is divided into two halves, each forming a terminal. The back disc with highly polished carbon is used only as an electrical connection between the two halves of the transmitter. Fig. 1 shows the diaphragm with the connectors and cup attached. Fig. 2 shows the front view of the cup with the diaphragm removed, and the method of fastening the connectors to the electrodes. Fig. 3 shows the cup dismounted with the granular carbon removed; *a* shows the front of the cup with the electrodes fastened to the auxiliary mica diaphragm; *b* shows the cup with the back carbon disc. Fig. 4 illustrates the parts of the cup; *c* is the back or neutral carbon disc; *d*, the cup; *e*, the separating ring; *f*, the electrodes and mica diaphragm; *g*, the clamping ring.

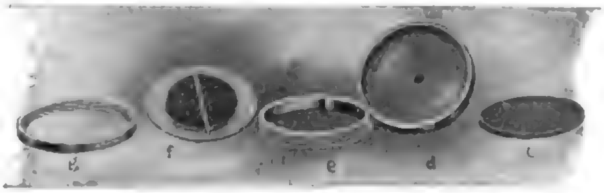


FIG. 4.—PARTS OF TRANSMITTER CUP.

The carbon electrodes used in this transmitter are manufactured of a special grade of very dense carbon properly treated, so that it is of exceedingly low resistance, and they are securely soldered to the connecting discs without the use of any salts or acid. The diaphragm is made of extra hard aluminum, and is protected by a celluloid disc. The auxiliary diaphragm for sealing the carbon cup is made of selected India mica, and is securely held in place by the clamping ring. No metal whatever is used in the construction of the transmitter excepting brass, thus insuring against the warping which may occur when composition parts are used.

Central Station Employees and the Company.

Believing that the relations between the employees of a corporation and those directly responsible for the success of its business could be cultivated and developed in a manner inuring to the benefit of all concerned, the Edison Electric Illuminating Company of Brooklyn made a very interesting essay in this direction last month, when it invited 1,200 of its employees and members of their families to participate in an entertainment at the general offices and to witness an exhibit of apparatus applied to purposes of the home, the office, the family, etc. The idea was cleverly worked up and the programme was carried through admirably. The musical programme, for example, included exhibits with talking machines and by the electric piano. In addition to these, exhibits were made of electric cooking and heating apparatus, of Christmas tree illuminations, of Cooper Hewitt lamps, of electric sewing machines, of electric massage outfits, of Gray writing telautographs, of wireless telegraph out-

BROOKLYN EDISON EXHIBIT.

fits in actual operation, of heavy electromagnets for surgical and other uses, of the Poulsen speech-recording telegraphone, of the Autarith calculating machine, of the Edison business phonograph and of modern office appliances. This was supplemented by a display of meters under the care of the meter department. The idea was to give emphasis to apparatus requiring central station current for its operation and to familiarize the employees in all departments with the opportunities of the most diversified kind that existed for pushing the business of the company in their own homes as well as those in the thousands of customers.

It is interesting to understand that a direct and perceptible impetus was given to the work of the company by this admirable entertainment just before Christmas, and the vice-president, Mr. W. W. Freeman, is to be congratulated upon the scheme. An illustration of the company's methods is further afforded by the fact that quite recently Mr. Freeman organized a class of sixty at the Pearl Street headquarters who are undergoing a practical business training and education through one of the correspondence schools, the company paying the entire expense of the work, as it is considered a profitable investment in improving the effective status and ability of the employees in the business department. The electric cooking and heating exhibit, in charge of Mr. Max Loewenthal, and with Miss Helen Tovell, as demonstrator, is herewith illustrated.

Westinghouse Electrostatic Voltmeter.

The Westinghouse Electric & Mfg. Co. has placed on the market a new form of electrostatic voltmeter in which the obstacles met heretofore in the design of an instrument of this type for general commercial work have, it is claimed, been entirely overcome. This instrument, which is illustrated herewith, is stated to require for its operation a negligible amount of energy, and to be free from the effect of variation of wave form.

The operating elements are immersed in a special grade of oil contained in a metal-lined wooden case with an insulated cover. The metal lining acts as a screen to prevent outside fields or influences from affecting the meter. As the insulation is one of the most important parts of an instrument of this type, a few of the advantages derived from the use of oil may be summarized as follows:

(1) The distance between the operating elements may be greatly lessened, thereby reducing the size of the instrument. (2) The actuating forces are greatly increased, due to the smaller distances between active parts and the high specific inductive capacity of the oil. (3) The reduction in distance between working parts of the meter makes possible a better form of scale. (4) The oil acts as a damper and makes the instrument nearly dead beat and easy to read. (5) The oil buoys up the moving element, thus removing practically all weight from the bearings.

The arrangement and relative position of the parts of the meter are shown in the diagrammatic sketch. The curved plates, B_1 and B_2, are of such a shape and so arranged with respect to the moving element that a deflection in a positive direction shortens the gap between it and the plates. The charges induced on the two extremities of the moving element are of such a nature that they exert forces of atraction on the charges on the plates, which bring about such a movement. The turning of the moving element is restricted by a spring and the deflection of the pointer is read on the scale. The condensers, C_1 and C_2, are in series with other parts of the instrument, one plate of each being metallically connected to a curved plate, and the other to a terminal.

The curved plates, with the condenser plates attached are supported from the insulated cover by means of grooved posts of able insulating material. The separate condenser plates are supported in a similar manner. As all parts are firmly fastened to the same base, they are held in constant relation to each other, and no error can result due to disarrangement of parts. The height of the oil in the case, together with the long paths over the suspension posts, prevent leakage between the plates. The horn-shaped terminals extend to the same distance below the oil as the suspension posts and are also grooved to prevent leakage over their surface.

The bearing springs and adjustments are similar to corresponding parts of Westinghouse standard indicating instruments.

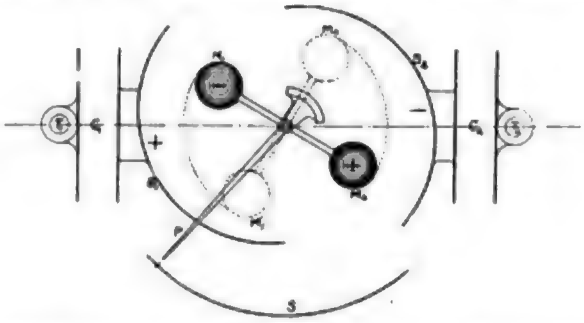
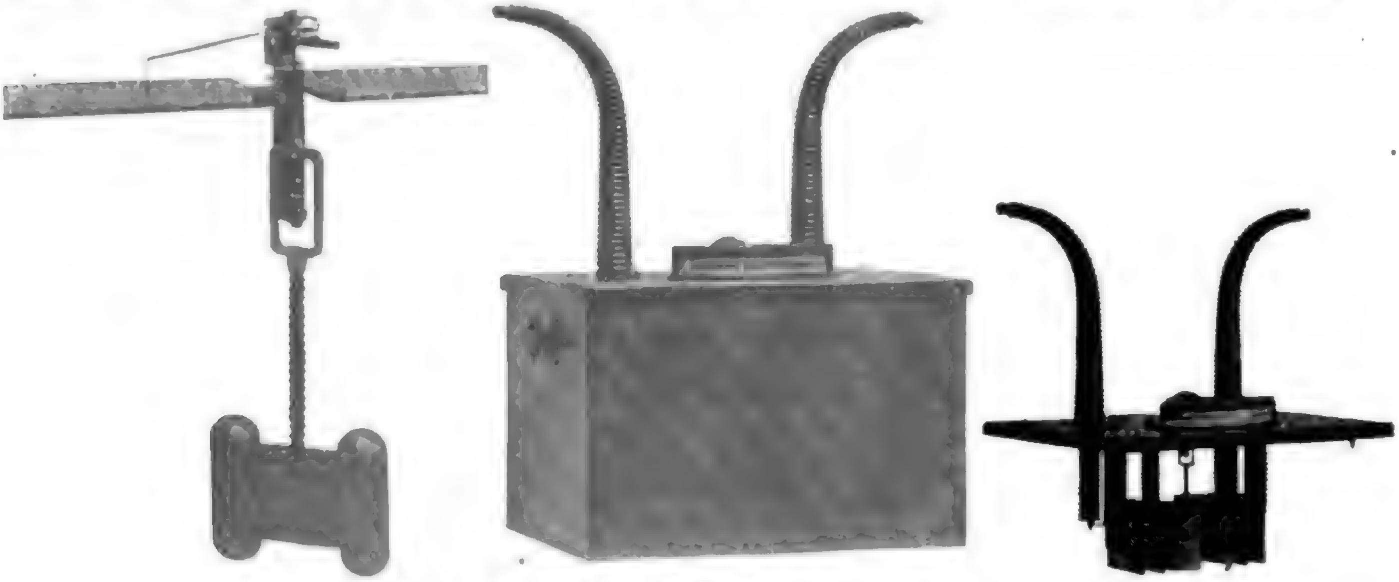


FIG. 4.—DIAGRAMMATIC SKETCH OF ELECTROSTATIC VOLTMETER.

The cylindrical parts of the moving elements are hollow, and so proportioned that the buoyant effect of the oil removes almost all weight from the bearings, thereby eliminating friction and wear. The scale over which the pointer passes is placed on an edgewise cylindrical form similar to the scale of an edgewise switchboard instrument, and the reading may be taken from a safe distance. With the exception of the glass window through which the scale is read, the cover over the pointer is all metal, and acts as a screen to prevent external static fields from affecting the pointer. Instruments of this type may be obtained for potentials as high as 200,000 volts. The one shown in the illustrations may be used for voltages up to 100,000 volts with the condensers in circuit, or for approximately 50,000 or 25,000 volts with one or both condensers short-circuited. The case is 22 in. long. 18 in. wide, and 15¼ in. high, with terminals projecting, as shown, 18 in. above the case.



Figs. 1, 2 and 3.—Electrostatic Voltmeter.

Nernst Lamps vs. Gas Arcs.

Many valuable suggestions for central station managers are contained in a recent issue of the *Nernst Central Station Bulletin,* which calls attention to a few instances demonstrating what can be done with the Nernst lamp in anti-gas campaigns. It is said that in the State of Massachusetts alone Nernst lamps have replaced at least 3,000 gas arcs within the year ending November 30, 1905. A few of the cities are treated specifically. At Lowell the Electric Light Corporation sells electricity on a sliding scale at from 18 cents to 8 cents per kw-hour, in competition with gas at 90 cents per 1,000 cu. ft. This company has recently put in about 600 glower units, replacing two, three and five-burner gas arcs. With electricity at 15 cents per kw-hour and gas at $1.20 per 1,000 cu. ft., the Pittsfield Electric Light Company has installed about 400 three-glower lamps, each of which replaced a four-burner gas arc.

The Salem Electric Light Company, which sells electricity at 10 cents in opposition to gas at $1.20, has installed 600 three-glower Nernst lamps, which have replaced about the same number of gas arcs. It is stated that the cost for maintenance of these Nernst lamps averages about 7 mills per kw-hour. At Cambridge there have been installed 51 six-glower and about 400 three-glower Nernst lamps, which have replaced gas arcs in almost every instance. The lamps are furnished on contract for one year, electricity being supplied at the rate of 20 cents per kw-hour for the first 400 hours per year and 10 cents per kw-hour for all succeeding hours. Each rate is subject to a discount of 15 per cent. The gas consumer at this place owns his gas arcs, paying $1.00 per 1,000 cu. ft. for gas and 50 cents per lamp month for maintenance. The Cambridge Electric Light Company is maintaining all Nernst lamps and it has publicly stated that the cost has as yet not exceeded 5 mills per kw-hour.

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Automatic Time Switch.

The Hartford Time Switch Company, 97 Warren Street, New York, is placing on the market a new type (Type F) of automatic switch which is the result of a number of inquiries received from central stations for a switch that could be located inside of the hollow electric light poles that are now coming into general use in the larger cities. The switch is made extremely compact, and will fit into any pole having an inside diameter of 6¾ in. and an opening of 3½ in. by 10 in.

AUTOMATIC TIME SWITCH.

A Seth Thomas eight-day lever movement is used to operate the switch, and is so arranged that it is entirely separated from the switch proper. By this means the quick operation of the switch in making and breaking does not in any way bring any strain upon the time train or affect the accuracy of the clock. The company states that for a considerable period a number of these switches have been in successful operation on street circuits in different cities, and in every case the trials have resulted in its adoption for permanent service.

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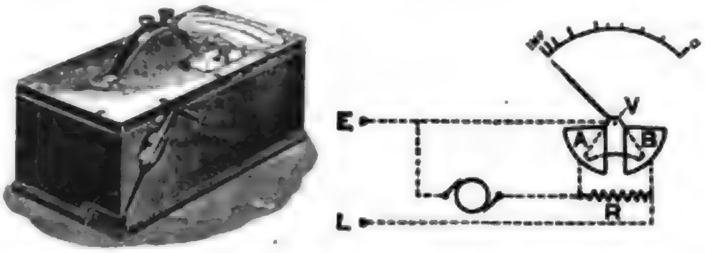
Insulating Testing Set.

The accompanying illustrations show an insulating testing set which possesses several unique features. The complete equipment consists of a direct-current magneto-generator and an electrostatic ohmmeter combined in one case. The ohmmeter consists of a vertical needle with 15 parallel vanes about .3 of an inch apart. These work into sets of fixed inductors of specially calculated shape.



FIGS. 1 AND 2.—TESTING SET AND DIAGRAM OF CONNECTIONS.

The method of working can be learned from Fig. 2. The generator has one of its terminals attached directly to one quadrant, *A*, of the electrostatic ohmmeter, and the same terminal attached through a resistance, *R*, to the other quadrant, *B*, of the ohmmeter. The other terminal of the generator is connected to the vane, *V*. The quadrant, *B*, is attached to the line to be tested and the vane, V, is attached to earth.

When the insulation between the earth and the line is infinite, there is no current flowing through the resistance, *R*, and the vane, *V*, takes up the position shown on the diagram. When a current flows from *E* to *L*, there is a drop of potential due to the current flowing through *R*; the quadrants, *A* and *B*, are then at different potentials, and the vane, *V*, takes up a new position, which position is determined by the difference of potential and the shape of the vane.

This testing set is manufactured by Nalder Bros. & Thompson, Ltd., 34 Queen St., Cheapside, London, E. C.

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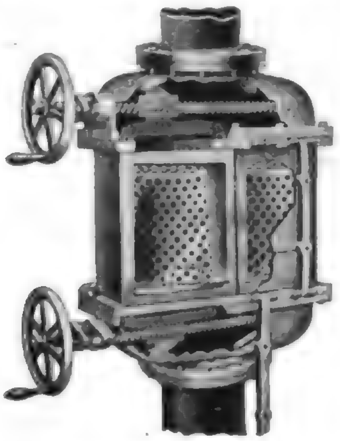
Vertical Shaft Frequency-Changers for Chicago.

The Commonwealth Electric Company of Chicago has placed orders with the General Electric Company for some motor-generator frequency changers with vertical shafts. These units will have step or thrust bearings at the lower end of the shaft similar to the step bearings perfected for use on the Curtis turbine. In fact, the machine is a direct result of the development of the vertical shaft steam turbine in which the weight of the shaft and revolving parts is taken by fluid pressure in the step bearing. The units ordered are each of 1,000 kw capacity, and will run at 300 r.p.m. They consist of a synchronous motor taking three-phase, 25-cycle current at 9,000 volts and driving a three-phase, 60-cycle, 2,200-3,800-volt star connected generator for supplying the Commonwealth three-phase, 4-wire distribution system.

The advantage obtained by the use of a vertical shaft machine with a fluid step bearing is that the machine occupies less space; and the friction losses are less than with a horizontal shaft. The low friction losses on the Curtis turbine have been a matter of note among those operating them for some time. If left free to run with steam shut off, they will run for hours. The construction of vertical shaft rotary converters of this type has not been attempted because of the absence on a vertical shaft machine of the end play which is apparently necessary to give good commutator wear. On a motor-generator frequency changing set this objection does not exist. The low friction loss in this vertical shaft type of machine is, of course to be accounted for by the fact that most of the weight floats on the fluid of the step bearing.

Feed-Water Strainer.

The "Twin" strainer illustrated herewith is, as its name implies, two strainers in one, which are alternately thrown in and out of action by simply operating a pair of valves, the one not in use being accessible for cleaning. The apparatus consists of a casing having two passage ways, each containing a basket shaped strainer removably secured in the side of the casing forming perforated pockets which catch and retain the dirt in the water. By a simple arrangement of the valves the flow of the water (or any other liquid to be strained) is caused to pass through one basket while the other being out of service can be cleaned and replaced without interrupting the flow.


FEED-WATER STRAINER.

Access to the basket for cleaning is had through doors in the front of the casing, and, as the idle basket is not under pressure, or suction, as the case may be, it can be removed, cleaned and replaced in a few minutes, the door replaced, when this basket is again ready for service. On account of the ease and rapidity of manipulation, it is stated that the strainer will handle water containing any amount of solid matter.

This apparatus is built by the Liberty Manufacturing Company, 6910 Susquehanna St., Pittsburg, Pa.

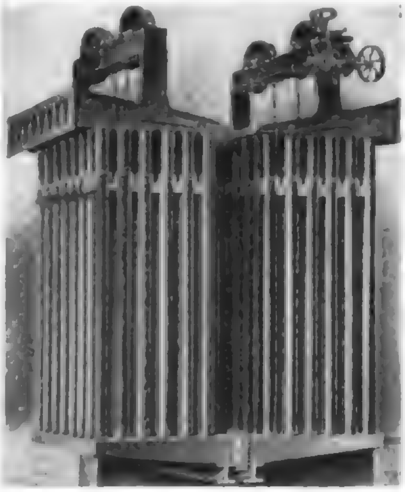
Air Heater.

Small boiler plants waste a large proportion of the heat of the fuel, and any device which would make it possible to save a considerable part of this should be of interest to many. Air may be heated and dried, in the same way that water is heated in an economizer, by the waste heat in the flue gases, and the Green Fuel Economizer Co., Matteawan, N. Y., has recently introduced a device for this purpose.

As seen in the accompanying illustration, the air heater is constructed substantially like an economizer, with the exception, however, that, while in the economizer all the water enters at the bottom header and passes out from the top header, in the air heater the air is forced by a fan first down through one set of tubes and up through another set, and then down again, and so on until it leaves the heater to be distributed by pipes to drying chambers, work rooms or other places where it is to be used.

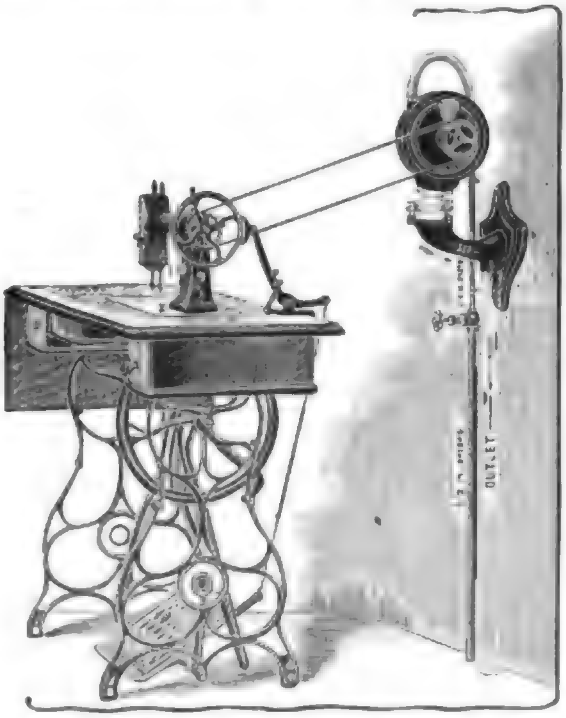
The cold air from the blower enters the heater at the end where the flue gases leave to pass the chimney, while the heated air is taken out at the end nearest to the boiler, where the flue gases are the hottest. In this manner a uniform and high difference of temperature is maintained between the flue gases outside the tubes and the air inside the tubes, a condition required for the most rapid transfer of heat through a given amount of conducting surface.

These heaters have for some time been in successful operation in steam laundries, textile mills and hospitals. In laundries, the heater and the economizer can be worked together very nicely, the economizer furnishing the hot water for washing, etc., and the heater, the heated air for drying the clothes.


AIR HEATER.

Water Motors.

The accompanying illustration shows a small water motor put to domestic use. The motor is mounted on a hollow bracket through which the water flows from the wheel to the outlet. The ball joint is made of brass accurately turned, so that it forms at all times a perfectly water-tight union and yet permits adjustments readily to be made. The wheel is of the impulse type, numerous buckets being riveted to the outer edge of the disc of the wheel. The admission nozzle, which extends into the casing, is of a size such as to use from six to ten cubic feet of water per hour for driving a fan motor, and a proportionately larger amount is required for power motors. These motors are built by the A. Rosenberg Motor & Manufacturing Company, Baltimore, Md.



WATER MOTOR DRIVING SEWING MACHINE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Business in commercial lines lagged somewhat, merchants being in the midst of stock-taking and therefore not disposed to secure fresh supplies. As a rule, however, prices had a higher tendency. The unseasonable weather had an adverse effect upon retail trade and on reorders from wholesale, but, on the other hand it favored outdoor activities and facilitated railroad transport. More activity is shown in spring trade and requests for prompt shipment are being received earlier than usual. The month of December last was perhaps the best month of the year for railroads, the gain in gross earnings over those of the same month in 1904 being 12 per cent. The railroads have still six months of large business in sight. As to general trade and industry, the general belief seems to be that 1906 will be very active. Manufacturers entered the year with a heavy volume of business booked and with excellent prospects for a continuance of activity. In iron and steel business is of an excellent character for a period that is usually dull. Pig iron shows strength, and a heavy buying movement is expected shortly. Leaders in the industry predict a great scarcity of pig iron within the next three months. Steel-rail makers announce additional orders, and indications are that 1906 will exceed all previous years in this line. Bridge builders report a goodly volume of business, and makers of structural shapes are actively engaged. Within the past fortnight or so foreign mills have made additional sales in this country. Wire products are very strong. The copper market at home and abroad is firm. The London metal market's story about immense reshipments of ingot copper from China is discredited by copper buyers in Europe and America. For three months large metal users here and in England have been trying through agents in China to buy copper so as to depress prices in the Occident, and they have found that the bulk of the copper shipped to China has gone into consumers' hands. European copper manufacturers have already taken nearly all the copper that was on the market in China and Japan. The domestic copper markets are quiet with fully sustained high level prices for immediate delivery. That there is a legitimate shortage of copper for immediate delivery hereabouts is shown by the fact that several copper and brass rollings mills in the Middle and Eastern States which usually start up after the holidays are still shut down. The managers of these plants say that they are waiting for copper on contracts soon to expire and that they expect to pay not less than 18½c. to 18¾c. per lb. through this year. Local quotations for lake and electrolytic copper are 18⅞c. and 19c.; casting copper, 18⅝ and 18⅞c. For immediate delivery, in lots of 10,000 to 15,000 lbs., buyers are paying 20c. per lb. at Eastern and Middle Western distributing points. The market for aluminum is active under orders from electrical apparatus makers, who are substituting it for copper. The output of domestic aluminum has increased tenfold in as many years. Last year's domestic production was 9,250,000 lbs. *Bradstreet's* reports 220 business failures in the week ending January 4th, against 212 the week previous, and 278 the corresponding week in 1905. Failures for 1905 were slightly below the average of the past six years, numbering only 9,970, as against 10,422 in 1904, a decrease of 4 per cent. from the latter year, an increase of 3 per cent. over 1903, about the same number as in 1902, and only 3.4 per cent. more than in the year 1899, which saw the smallest number for a generation. Liabilities aggregated $121,770,000, a decrease of 15 per cent. from 1904, of 21 per cent. from 1903, and an increase of only 15 per cent. over 1902. Large failures were less numerous and damaging than in 1904, but the decrease was entirely in commercial and manufacturing lines, as bank failures, though not quite as numerous, were just as hurtful as regards liabilities as in 1904. The South alone showed any important increase in the number failing as compared with 1904, and the Northwest and South, owing to bank failures, showed only increase in liabilities.

TRADE IN MANUFACTURES.—It is encouraging to note that manufacturers participated to the extent of more than a billion dollars in the two and a half billion dollars' worth of commerce of the United States during the eleven months ending with November, 1905. Figures just supplied by the Department of Commerce and Labor, through its Bureau of Statistics, show that the value of manufacturers' materials imported in the eleven months ending with November was 513 million dollars, and of manufactures exported, 520 million dollars, speaking in round terms. This by far exceeds in both imports of material and exports of manufactures the figures of any earlier year and suggests that the total for the full calendar year 1905 will be approximately 550 million dollars' worth of material imported for use in manufacturing and 570 million dollars' worth of manufactures exported. It will exceed by far that of any preceding year both in the imports of material for use in manufacturing and in exports of manufactures. In exports of manufactures the figures for the eleven months were 520 millions, against 459 millions in the same months of last year. It was not until the calendar year of 1904 that manufactures exported ever reached a total of 500 million dollars, but in the calendar year 1905 they seem likely to approximate 570 millions, since the exports of the single month of November were over 48 million dollars, and suggest that December will probably add about the same amount to the eleven months' figures of 520 millions already recorded. In the calendar year 1904 the value of manufactures exported was 502 millions, having for the first time crossed the 500-million line, and it is thus quite apparent that the figures of the calendar year 1905 will be at least 10 per cent. in excess of those of the record year 1904. Imports of manufacturers' material increased 81 million dollars during the eleven months and exports of manufactures increased 60 millions.

TRADE WITH GERMANY.—Trade between the United States and Germany in the fiscal year 1905 aggregated over 300 million dollars. The imports from Germany were 118 million dollars in value and exceeded imports from that country in any earlier year. The exports to Germany were 194 million dollars in value and exceeded our exports to that country in any earlier year except 1904, in which the total was a little over 214 millions, this decrease in 1905, compared with 1904, having occurred in raw cotton and being due altogether to a fall in price, since the quantity in 1905 was greater than in 1904. Comparing conditions in 1905 with those of a decade earlier, it may be said that our imports from Germany have grown from 81 million dollars in 1895 to 118 millions in 1905, while out exports to that country have grown from 92 million dollars in 1895 to 194 millions in 1905. Thus our imports from Germany increased 37 million dollars in the period from 1895 to 1905, and our exports to that country increased 102 millions in the same time. In the more advanced grades of manufactures, such as scientific instruments, typewriters, and sewing mamchines, our exports to Germany show considerable growth as compared with a decade ago, but no material change in recent years. Typewriters, for instance, which amounted to but $228,710 in 1897, were $454,625 in 1900 and $846,601 in 1905; sewing machines, in 1895, $472,203, and in 1905, $982,558, and scientific instruments, in 1895, $135,333, and in 1905, $539,309.

RAILWAY REBATES.—It is stated that agents of the Interstate Commerce Commission have discovered evidence that the General Electric Company has for seven years received a rebate of 20 cents a ton on all freight shipped out of Schenectady over the New York Central and the Delaware & Hudson. Last year's rebates on shipments from all the company's plants are said to have been $200,000. Secretary Westover, of the electric company, admits the 20-cent reduction, but points out that it is only an allowance because the company switches its own freight in the yards and turns over full carloads. Anyone who has visited Schenectady has had opportunity to see how the locomotives of the great works there relieve the steam lines of all switching.

MATERIAL FOR URUGUAY.—La Comision de Luz Electrica, of Monte Video, Uruguay, South America, F. C. Boutell, technical engineer, would like catalogues and price lists of electrical machinery, steam plant, turbines, arc lamps, carbons, incandescent lamps, fittings, instruments, cables, etc. Mr. Boutell informs us that the present supply station erected in 1887-8 with a present capacity of 3,500 kw in steam alternators is to be entirely reconstructed. At the same time a plant is being put in for street railway work and cables are being laid underground.

BALTIMORE AFFAIRS.—Baltimore has recovered magnificently from the great fire and her industries thrive. As to electrical developments, correspondence says: "The Consolidated Gas Company has been joined with the United Electric Light & Power Company under the name of the Consolidated Gas, Electric Light & Power Company. Both concerns were doing an excellent business before the consolidation, and are understood to be equally prosperous now. Opposition has developed in the Maryland Telephone Company, which has formed a rival electric lighting company that is making a strong bid for business. At present the topic uppermost in the minds of Baltimore financiers is the refinancing of the United Railways Company. The property needs improvements badly and is receiving them from funds that would otherwise be used to pay the interest on the income bonds, which are cumulative. A strong faction is opposed to the policy of the management, which controls the majority of the common stock, and all manner of plans have been suggested to be discarded."

GENERAL ELECTRIC SINGLE PHASE.—The Toledo & Chicago Interurban Railway Company has been equipped with the General Electric single-phase system and will soon be operating about 50 miles around Fort Wayne, Ind. The power house at Kendallville has two 800-kw, 25-cycle Curtis turbine generators and will supply current to the trolley at 3,300 volts at the power house, while sub-stations will receive 33,000 volts from transmission lines supplied by step-up transformers in the power house. For the rolling equipment for the 50 miles, ten four-motor General Electric 75-hp single-phase alternating-current compensated type equipments are being furnished, operating eight passenger and two package freight cars. Each car equipment is furnished with a trolley, air compressor and air brake. The air compressor is driven by a compensated motor operating on both alternating current and direct current. The line equipment is 000 catenary construction trolley and three No. 2 copper high-tension line.

POWER AT LEWISTON, ME.—The large masonry dam, which has been in course of construction near Sanford and Springvale for some time, has been completed. The power developed will be utilized by the Goodall industries at the two towns mentioned, and by the Atlantic Shore Line Company and the Sanford Power Company. The Alfred Light & Power Company is also controlled by the Atlantic Shore Line. The dam was built at a cost of $100,000; it is 950 feet long, 60 feet wide at the bottom, 8 feet wide at the top and has a spillway of 470 feet. One of the two penstocks will supply the turbines at the power house, which will be erected directly below on the western shore, while the other will feed the pond at Old Falls. This reservoir will comprise 106 square miles and will have an average depth of 18 feet.

ENLARGING LOCOMOTIVE WORKS.—The American Locomotive Company, of Schenectady, associated with the General Electric Co. in the production of electric locomotives, in addition to its steam product, will spend $500,000 in further improving its plant in that city. Concrete foundations are being laid for a mammoth erecting shop, 160 by 360 ft., which will contain pits for thirty-four locomotives. When the new building is completed the old erecting shop, containing seventeen pits, will be used as a running shed for locomotives. The new carpenter shop is also well under way. The improvement will mean employment for many more men, as well as a substantial increase in the output of the local works.

CONVEYOR ORDERS.—The Robins Conveying Belt Company, of New York, has recently secured an order from B. Altman & Co., of New York City, for conveyors for handling packages at their new store on Fifth Avenue. One of the requirements of this conveyor system is that it can be operated without the least noise. Among other work that the Robins Co. now has on hand is an order for a large system of conveyors for the Caucasus Copper Company, of Russia, and an order from the Bethlehem Steel Company for a belt conveyor for handling sand at their foundry at South Bethlehem, Pa.

RAILROAD TELEPHONY.—The American Telephone & Telegraph Co. is at present installing for the Illinois Central Railroad a through telephone line from New Orleans to Louisville. Some time ago the railroad company put in a telephone system. This line was equipped with small wire and the result was that it could never be used over more than half the distance on account of resistance. The present move is practically a reconstruction of the old line, and full-sized long distance wire will be used.

LAMP REFLECTORS.—In a decision by Thaddeus S. Sharretts, the Board of United States General Appraisers has overruled a claim made by Leo Popper & Sons, New York, it being held that reflectors for lamps are properly dutiable under the Dingley tariff at the rate of 45 per cent, under the provision for manufactures of glass and metal. The importers contended for lower duty, but the board found their claims to be without merit.

NORTHERN TRAVELING CRANES.—The new Robb Mumford Boiler Works, of South Framingham, Mass., have installed four electric traveling cranes and riveter hoists manufactured by the Northern Engineering Works, Detroit. One of 25 tons capacity, 50-ft. span, 4-motor design, one 5 tons 28-ft. span, 3-motor, and two electric riveter cranes of 20 and 15 tons capacity, with 50-ft. lift.

THOMPSON-STARRETT COMPANY, 51 Wall Street, New York City, in a new year announcement state that among a lot of other work they now have under construction four power houses.

Financial Intelligence.

THE WEEK IN WALL STREET.—A bullish tendency prevailed in the stock market early in the week, and new high records were established in various prominent speculative stocks. The high money rates, however, exerted a quieting influence on the market, which was also affected by heavy breaks in Anaconda mining shares. At the end of the week there was more strength on easier money. The United States Steel issues retained their prominence, common selling up to 43½ and preferred to 107, the support being due to the satisfactory condition of the steel trade and the earnings of the corporation. The industrials generally were firm. American Locomotive common, of which 198,700 shares were sold, closed at 77⅜, which is an advance of 1½ points, and preferred closed at 117½, a net gain of ½. The electric group of stocks were all strong and active, and closed at advanced figures. Allis-Chalmers common's final quotation of the week was 23⅛, a net gain of 1⅛, and preferred 63, an advance of 1⅛. General Electric made a net gain of 2½ points, closing at 179½, and rights sold at 9⅞, an advance of ⅜ on the week's business. Westinghouse made a net gain of 4½ points, the last quotation being 174½. The traction list was weak in tone, and prices of all the principal stocks reflected this condition. Brooklyn Rapid Transit closed at 88¾, and Metropolitan Street Railway at 124, the latter quotation being a loss of 1 point. Interborough Rapid Transit declined 3½ points on the curb market, closing at 232. Western Union is quoted at 93⅛. The curb market during the week underwent a variety of movements, with an uplift at the beginning, followed by general declines on profit-taking sales, and another bidding up at the end of the week. Compared with a week ago, quite a number of stocks are lower. This is the case with the contracts for new Metropolitan Street Railway shares, and in the case of Interborough. A number of copper stocks are also lower. Trading was on a somewhat smaller scale than in the previous week. There was some demand for bonds, particularly of the new Metropolitan Street Railway Company, these being much more active than the contracts for the shares. Following are the closing quotations of January 9:

NEW YORK

	Jan. 2	Jan. 9		Jan. 2	Jan. 9
Allis-Chalmers Co	22¼	23	General Electric	177¼	178¾
Allis-Chalmers Co. pfd	61½	62	Hudson River Tel	..	..
American Dist. Tel	37	37	Interborough Rap. Tran	231	232½
American Locomotive	72¾	76	Mackay Cos	58¾	58½
American Locomotive pfd	116	117	Mackay Cos. pfd	73¼	73
American Tel. & Cable	90	90	Marconi Tel	..	..
American Tel. & Tel	136	136	Metropolitan St. Ry	126¼	124¼
Brooklyn Rapid Transit	87⅞	88⅝	N. Y. & N. J. Tel	..	[illegible]
Electric Boat	28	28	Western Union Tel	..	93¾
Electric Boat pfd	70	68	Westinghouse com	172	172
Electric Vehicle	15	15	Westinghouse pfd	..	..
Electric Vehicle pfd	20	21			

BOSTON

	Jan. 2	Jan. 9		Jan. 2	Jan. 9
American Tel. & Tel	137½	136¼	Mass. Elec. Ry. pfd	..	63¾
Cumberland Telephone	..	...	Mexican Telephone	..	..
Edison Elec. Illum	..	...	New England Telephone	132	134¾
General Electric	..	...	Western Tel. & Tel	12	13
Mass. Elec. Ry	17¾	18¾	Western Tel. & Tel. pfd	81½	84

PHILADELPHIA

	Jan. 2	Jan. 9		Jan. 2	Jan. 9
American Railways	52	52	Phila. Electric	8¾	7¾
Elec. Co. of America	11½	12	Phila. Rapid Trans	30½	32
Elec. Storage Battery	80½	82	Phila. Traction	..	...
Elec. Storage Battery pfd	..	..			

CHICAGO

	Jan. 2	Jan. 9		Jan. 2	Jan. 9
Chicago City Ry	167¾	168	National Carbon	80	79
Chicago Edison	...	...	National Carbon pfd	117	115
Chicago Subway	...	..	Union Traction	..	..
Chicago Tel. Co	...	...	Union Traction pfd	..	...
Metropolitan Elev. com	27	27			

DENVER GAS & ELECTRIC.—The Denver Gas & Electric Company has decided to retire all outstanding bonds other than its 5 per cent general mortgage 5s. The holders of underlying bonds will be offered cash for their bonds or they will be permitted to exchange them for the general mortgage 5s and a cash premium, which varies with the different underlying issues. This operation will make the general mortgage 5s an absolute first lien on all the property and assets of the company. The stockholders of the company of record January 20, 1906, will be given the right to subscribe for the general mortgage 5s issued to provide the cash premiums on the retired underlying bonds and for the purchase for cash of such as are not exchanged for general mortgage 5s and a cash premium. The price of the general mortgage 5s to the stockholders is 95 and interest, but the bonds will be pooled under an arrangement by which they may not be sold for less than par and interest for twelve months. The following bonds will be retired: Denver Gas & Electric 6 per cent, due 1910. This issue will be retired April, 1906, and holders have option of exchanging on or before February 1, 1906, for Denver Gas & Electric general mortgage 5s at par and 5 per cent cash. Western Electrical Construction 6 per cent, due 1915. This issue will be retired on April 4, 1906, and they may be exchanged before February 1, 1906, for general mortgage bonds at par and 7 per cent in cash. Denver Consolidated Gas 6 per cent, due 1911. These may be exchanged before February 1, 1906, at par and accrued interest for general mortgage 5s and 10 per cent in cash. Denver Gas & Electric prior lien 6 per cent. These may be exchanged before February 1, 1906, at par and interest for general mortgage 5s and 8 per cent in cash. Denver Gas & Electric 7 per cent collateral notes, due 1907. These may be exchanged before February 1, 1906, at par and accrued interest for general mortgage 5s and 8 per cent in cash.

ST. LOUIS LIGHTING.—Three-year collateral trust notes bearing 5 per cent. interest, totaling $4,000,000, have been issued by the Union Electric Light and Power Company of St. Louis, one of the subsidiary companies of the North American Company. The notes, which are placed on the market at 98, are secured by $4,000,000 of the stock of the Union Company. The North American Company pledges itself to purchase the stock at par upon the expiration of the notes. The returns will be used in improving the company's power plants. The collateral for the notes raises the issue stock of the Union Company to $8,000,000, out of an authorized capital stock of $10,000,000. The balance is still in the Treasury. In addition the company has a bonded indebtedness of $25,000,000. Mr. Patrick Calhoun, it is reported, will be elected president of the company. He is largely interested in the United Railways Investment Company. Mr. Frederick Brown will be given a place in the directorate and will undertake the improvement of certain of the company's properties.

NIAGARA POWER.—The New York State Gas and Electric Commission has received the application of the Niagara Falls Electrical Transmission Company for permission to increase its capital stock from $1,000,000 to $5,000,000 and to purchase certain obligations of the Albion Power Company and capital stock and obligations of the Niagara Falls Gas & Electric Light Company, and to pay off and retire its own bonds to the amount of $59,790. The Niagara Falls Electrical Transmission Company was organized for selling and distributing in the counties of Niagara, Erie, Orleans, Monroe and Genesee, current generated by the Electric Development Company of Ontario, Limited, a Canadian corporation. It is proposed to construct transmission lines sufficient in capacity for at least 50,000 electrical horse power. The capital stock is to be classified as $2,500,000 preferred and $2,500,000 common stock.

PITTSBURGH TROLLEYS.—A special meeting of the stockholders of the United Railways Investment Company, of San Francisco, has been called for January 31, to act on an increase in the company's common stock from $10,000,000 to $25,000,000. This new stock, it is said, is to be used partly for the purpose of acquiring a controlling interest in the Philadelphia Company of Pittsburgh, owner of the traction interests there, the negotiations for which were announced some time ago, and partly to provide funds with which to pay off the back dividends on the company's preferred stock. These dividends amount to about $900,000. The balance of the $15,000,000 new stock, after provision has been made for these two requirements, will be available for general corporate purposes.

AMERICAN LIGHT & TRACTION.—The executive committee of the American Light & Traction Company has increased the company's stock to the extent of 7,180 shares. Shareholders of record at the close of business January 10, 1906, will have the right to subscribe for the new stock to the amount of $1.25 par value of common stock and $3.75 par value of preferred stock for each share of their holdings of either common or preferred stock or both. The new stock will be offered at par ($100 per share), and will be issued in full shares only. All stock not subscribed for by stockholders by 3 o'clock on January 25, 1906, will be disposed of as the company's directors may determine. Subscriptions will be payable at the office of the president, 40 Wall Street, on February 5, 1906.

DIVIDENDS.—The Bell Telephone Company of Canada has declared a regular quarterly dividend of 2 per cent, payable January 15, 1906. The Pacific States Telephone & Telegraph Company has declared a regular dividend of 1¾ per cent. (quarterly), payable January 1. Directors of the West Pennsylvania Railways Company have declared a quarterly dividend of 1¼ per cent on the preferred stock, payable February 1. The directors of the Rocky Mountain Bell Telephone Company have declared a quarterly dividend of 1½ per cent, payable January 20, 1906. Books close January 10 and reopen January 20.

MANILA RAILROAD & LIGHT.—The operating department of J. G. White & Co., reports that the gross railway earnings of the Manila Electric Railroad & Light Company, Corporation, for the week ending December 14, 1905, were $11,100. The receipts for all departments for the month of November were as follows:

	Gross.	Net.
Railway	$42,250	$21,250
Electric	30,750	16,000
Trucking	2,250	451

KINGS COUNTY LIGHT.—The Kings County Electric Light & Power Company, of Brooklyn, N. Y., is to increase its capital stock by $3,200,000. The new stock will be offered to shareholders of record on January 15 in proportion to their holdings. At present the outstanding stock of the company amounts to $5,000,000. The proceeds derived from the sale of the new issue will be used for extensions and improvements of the company's properties. The company is doing an excellent business.

STANISLAUS POWER BONDS.—The new issue of $5,250,000 forty-year 5 per cent bonds of the Stanislaus Electric Power Company and $2,750,000 preferred stock of the Stanislaus Water Power Company, a holding corporation, have been underwritten by a New York syndicate managed by Tucker, Anthony & Company, F. L. Eldridge, of the Knickerbocker Trust Company, and C. C. Cuyler, of Cuyler, Morgan & Company. The securities were issued to secure a loan to finance an extension of the company's plant in California.

AMERICAN GRAPHOPHONE COMPANY, in its annual report, for year ended September 30, 1906, shows a total net income of $803,643, with charges and depreciation of $174,094; preferred dividends of $117,210 and common stock dividends of $54,067. The surplus carried forward for the new fiscal year is $1,027,854 as against $729,481. Dividend payments are on a conservative basis. The company is earning 16 per cent on its entire capital stock and is paying dividends of less than 5 per cent.

MAINE TELEGRAPH COMPANY.—The stock of the Maine Telegraph Company was transferred at Bangor, Me., on January 5, to the Western Union Telegraph Company, 2,221 shares being transferred at $57.50 a share, the par value being $50. The Maine Telegraph Company has been under lease to the Western Union Company fifty years, the lease having just expired.

DAVENPORT, IA., CONSOLIDATION.—St. Louis and New York capitalists are negotiating to form a $10,000,000 consolidation of gas, electric light, power and traction interests, of Davenport, Rock Island and Moline, a community of 100,000. Mr. George Kobusch is engineering the merger. The Mississippi Valley & Commonwealth Trust Company, of St. Louis, is assisting. It is understood that the plans are practically complete.

UNION SWITCH AND SIGNAL.—Union Switch & Signal stockholders of record have the right to subscribe on or before January 25, at $75 per share (par $50) for new stock to the extent of 12½ per cent. of their respective holdings.

KEYSTONE TELEPHONE.—There has been listed on the Philadelphia Stock Exchange $4,000,000 first mortgage 5 per cent 30-year gold bonds of the Keystone Telephone Company of Philadelphia due July 1, 1935.

MILWAUKEE ELECTRIC.—The Milwaukee Electric Railway & Light Company shows for November a net total income of $150,903, an eleven months net of $1,534,886 and a surplus after charges of $686,961.

General News.

SAN FRANCISCO, CAL.—An interruption of the supply of current at the sub-station at Kennett, Shasta County, caused the Mammoth smelter to close down recently, allowing the furnaces to "freeze." The town was left without lights, which are ordinarily supplied by the Northern California Power Company.

SAN FRANCISCO, CAL.—The General Electric Power Company, of California, has filed a certificate with the county clerk, announcing that it has voted to create a bonded indebtedness of $7,500,000. The certificate is signed by the directors, Kent J. C. Seymour, Guy C. Calden, W. E. Cashman, Harry C. Allen, Albert H. Elliott and Joseph P. Lucey.

BRIDGEPORT, CONN.—The Challenge Cutlery Co., Bridgeport, Conn., has finished the installation of a 250-horse-power electric plant, with a direct-connected engine and motors in each department.

WOODBURY, CONN.—The Woodbury Electric Company has just made provision against a scant water supply by installing a new boiler and engine to furnish the necessary power when the water is low.

ROCKVILLE, CONN.—The new mayor of the city, Mr. G. Forster, has come out with a strong plea for municipal ownership in his message, which includes a sneer at his predecessor as being in the service of the local lighting company.

ATLANTA, GA.—City Electrician Fred Miles, in his annual report, states that during the past year 76 new arc lights and 19 series incandescent lights have been installed, making the total number now in use 981 arc lamps and 462 series. Two complete tests of the street lights were made during the year, results showing a very efficient service. His report on interior wiring showed new installations of 35,304 incandescent lamps, 203 electric fans, 297 arc lights and 111 motors. Mr. Miles also recommended that some action be taken looking to the separation of telephone and high-voltage wires.

EAST ST. LOUIS, ILL.—At the East St. Louis City Council meeting Mayor Silas Cook was authorized to have an ordinance drawn up annulling the franchise of the Illinois Illuminating Company. This company was granted a franchise over the streets two years ago, and has tried to hold the privilege by keeping five arc lamps lighted in various parts of the city.

FREEPORT, ILL.—William Waterstadt, city clerk, writes that the contract for lighting the city for five years has been awarded to the Freeport Railway, Light & Power Company at the following bid: 125 to 149 lights at $70 per year; 140 to 174 lights at $67 per year, and 175 to 200 lights at $64 per year; 50 to 74 60-cp. incandescent lights at $26 per year, and 75 to 100 at $25.50 per year.

SCAMMON, KAN.—W. Milburne, of Jackson, Tenn., is constructing a $100,000 electric light plant in this city.

RICHMOND, KY.—Mr. H. M. Case, an electrician of Cleveland, Ohio, has been appointed superintendent of the Richmond Electric & Power Company and has already entered upon his new duties.

PALMER, MASS.—At a recent meeting of the directors of the Central Massachusetts Electric Company the following officers were elected: President, Charles E. Fisk; vice-president, G. C. Flynt; executive committee, G. C. Flynt, A. W. Paige, M. J. Warner; superintendent, F. N. Carpenter.

WEST SPRINGFIELD, MASS.—The United Electric Light Company will supply the town on the same terms as hitherto, by running on the two years' option, which was one of the clauses of the old contract, and which will run nearly to the end of 1906. The Selectmen desired to make a new five years' contract, but this did not go through at the town meeting.

WEST SPRINGFIELD, MASS.—The electric lighting tangle at West Springfield is somewhat cleared through the signifying on the part of the officials of the United Electric Light Company, of Springfield, that the company will be willing to make a lighting contract with West Springfield which will expire when the contract now in force with Springfield expires. This contract will expire in May, 1909. One of the arguments brought up in the West Springfield question was that if a contract was made for five years it was possible that Springfield might make better rates at the time of her renewal and that thus West Springfield would for a year or more by paying higher rates than necessary. Manager Walter Mulligan has stated that the United Electric Light Company was perfectly willing to make a contract for less than five years, to expire when the Springfield contract does.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston, continues to report a steady growth of business, with the result that it is said there will be no issue of new stock this year. The company's operations in Newton and Watertown have been extended, a sub-station for that purpose having been erected on Massachusetts Avenue, in Newton. The property of the Medway Electric Light Company, operating in Medway and Bellingham, was recently taken over, and within the next few days the Medfield Electric Light & Power Company, which supplied the Medway Company with power, will also be taken over by and merged with the Edison company. The Medfield company, in addition to supplying power to Medway and Bellingham, has operated in the towns of Sharon, Medfield, Walpole, Norfolk and Millis. Another contract which the Edison company is about to execute is one for seven years with the town of Wellesley, providing for supplying that locality with all the power required for municipal and commercial lighting. All told, the Edison is now supplying power over more than 400 miles of territory, including a population of almost 900,000.

PORT GIBSON, MISS.—At a recent special meeting of the Board of Aldermen Mr. Hershell Brownlee was appointed superintendent of the Port Gibson electric light and water works, to succeed Joseph E. Craig, resigned.

ST. LOUIS, MO.—Thomas B. Carter, supervisor of city lighting, has prepared a report showing what his department accomplished during the calendar year ending December 31. During 1905, the reports shows, St. Louis expended $407,708.20 to light its streets—$109,761.09 for electric lamps in the business district and $387,947.11 for mantle gas lamps in the residence sections. These figures are for that portion of the city north of Keokuk Street. For street lighting south of that thoroughfare, maintained under a separate contract, the city paid $44,868.87 for mantle lamps. Under the contract for lighting public buildings north of Keokuk Street in 1905 the city paid $20,544.04 for electricity and $442.50 for gas, a total of $20,986.54; south of Keokuk Street, $547.09 for electricity and $5,448 for gas, a total of $5,995.09. The cost of gas used for fuel in buildings used by the city was $2,226.70. Among the items of the report are the following: Electric lamps erected, 29; building lights installed, 847; number of poles erected: telephone, 2,736; electric light, 1,359; street railway, 65. Trench-feet of conduit constructed: Telephone, 57,600; telegraph, 13,060; electric light, 25,775. Total number of lights: Electric arc, 1,000; electric incandescent, 800; mantle, 18,000; in public buildings, 10,000.

MEREDITH, N. H.—The electric light line from Laconia to this place is now completed, and power for the Meredith street light service is supplied from the power station of the Laconia company at Lakeport. The Laconia Electric Lighting Company purchased the Meredith plant sometime since, and now that the new line has been completed the latter will probably be abandoned.

NEW HAMPTON, N. H.—The annual meeting of the New Hampton Electric Light & Power Company has been held and the following officers elected: President, George A. Emerson; vice-president, M. H. Merrow; secretary and treasurer, C. D. Thyng; directors, George A. Emerson, M. H. Merrow, I. E. Gray, A. S. Bronson, F. P. Morrill, Carrie R. Morrill, Marshall Ballou; general manager, C. D. Thyng. It was voted to pay a dividend of 5 per cent this year; no dividend was paid last year.

OGDENSBURG, N. Y.—Plans are being perfected for the development of power at the falls in Trent River for the operation of an electric railway along the St. Lawrence and Lake Ontario from Cornwall to Toronto, as well as a projected road from Brockville to Ottawa.

NEW YORK CITY.—The American Light & Traction Company has purchased the properties of the Lacomb Electric Company, of Denver, Col., and the Muskegon Traction and Light Company, of Muskegon, Mich. The system of the latter property consists of gas and electric light plants and a street railway system.

PASSAIC, N. J. The Public Service Corporation is reported to have secured the contract for lighting the city for five years at $85 per light per year for arc lights, $15 per year for incandescent lights, $17 per year for street gas lighting, 10c. per kw-hour for public building incandescent service, $1 per 1000 cubic feet for gas, and 13c. per kw-hour gross for private incandescent service.

COLUMBUS, OHIO.—The Cincinnati Gas & Electric Company has filed an amendment to its charter with the Department of State to cover the natural gas phase brought about by the franchise granted by the City Council a few days ago.

MECHANICSBURG, PA.—The secretary of the Town Council has been authorized to receive bids until January 20 for lighting the borough with electricity during the year beginning July 1, 1906. At present there are in use 48 arc lights and 35 incandescent lights.

PHILADELPHIA, PA.—Mayor Weaver is beginning to talk about $60 a year as a possible price for city lights next year, and says: "I believe if a new corporation were formed in this city to compete with the present company the expense of public and private lighting could be reduced by almost one-half and yet have a handsome profit for the corporation."

ROCK HILL, S. C.—The Carolina Water Power Company, controlling water and light franchises in Florence, Darlington and Marion, has absorbed the Rock Hill Water, Light & Power Company and taken possession of its plant. Messrs. R. T. Fewell and J. M. Cherry, formerly the largest stockholders, retain a small interest in the property. Mr. S. T. Frew, who has been the manager here for the company, will go to Florence with the new concern.

MILWAUKEE, WIS.—The joint committee on street lights and judiciary has decided to recommend to the Common Council the making of a contract with the Milwaukee Electric Railway & Light Company for five years at $65.00 per lamp per year.

WENATCHEE, WASH.—The City Council at its last meeting granted Arthur Gunn, manager of the Wenatchee Electric Company, a new franchise, to expire January 1, 1950. The franchise formerly held contained a clause giving the city an option to buy the plant in 1915 at its appraised value. The new franchise is identical with the old one, except for the elimination of the clause specified and that the city has been given a reduction of 25 per cent in the price of light furnished it by the company.

VANCOUVER, B. C.—The British Columbia Electric Street Railway Company has secured the contract to light the city for $38 per arc light per year for a period of ten years from June 10 next. The city has heretofore paid $90 per light. The agreement stipulates that the number of lamps shall not be less than 400. The lamps are to take 7.5 amperes at 60 cycles, consuming 48 volts at the lamp terminals. All lamps are to burn every night all night throughout the year. The City reserves the right to establish at any time its own plant for lighting the city streets and public buildings upon furnishing a one year's notice in writing to the company.

Construction News.

MOBILE, ALA.—Contract has been awarded to E. J. Fike for the construction of a fireproof two-story and basement structure for the Home Telephone Company, to be used as an exchange, on South Conception Street.

GADSDEN, ALA.—Articles of incorporation have been filed by the Coosa River Electric Power Company, with a capital of $100,000. Officers have been elected as follows: President, Robert D. Johnson; vice-president, R. H. Cobb, of Anniston; secretary and treasurer, Henry K. White; engineer and general manager, Robert R. Zell, of Birmingham. The intention of the company is to build a dam and electric power plant at Ten Island Shoals, at the point where the Seaboard Air Line crosses the Coosa River. This power will be transmitted to Anniston, 14 miles distant, to Gadsden and other points. The dam will be constructed of reinforced steel and concrete and will be 600 feet long by 22 feet high. The company has opened an office in the National Bank Building, Birmingham.

SAN BERNARDINO, CAL.—C. M. Graw, general manager of the San Bernardino Gas & Electric Company, writes that it is proposed to rebuild at once the power plant recently burned.

LOS ANGELES, CAL.—The Board of Supervisors has been asked to grant a franchise for an electric railway to begin at Maubert Avenue and run to a point in the Los Feliz Road, there connecting with the Mount Hollywood incline railway.

LOS ANGELES, CAL.—Right of way has been given by the McCarthy Company to the Los Angeles Railway Company for a crosstown line in the southwestern part of the city along 54th Street and connecting the Rodondo line of the Los Angeles & Rodondo Railway Company with the Maple Avenue line of the Los Angeles Railway Company.

SAN FRANCISCO, CAL.—The Petaluma & Santa Rosa Railway Company's surveyors have run lines for an extension from Santa Rosa to Healdsburg through Dry Creek Valley. This and several other branch lines will be completed during 1906. It is expected that a new line running south to connect Petaluma with San Francisco Bay points will be decided upon in the near future.

SAN DIEGO, CAL.—It is announced that the San Diego Electric Railway, one of the Speckels properties here, will be extended to La Jolla, a well-known summer resort on the ocean front, about 14 miles north of the city. The extension will be from Old Town, to which place the company is preparing to build. A narrow-gauge steam road now connects the two places, but it is desired to give the people a fast electric car service.

FLORENCE, COL.—The City Council has voted to grant to F. S. Granger the San Diego capitalist, a 20-year franchise to maintain and operate a street railway system in this city.

LEADVILLE, COL.—Col. James A. Shinn, of Leadville, says he has been in communication with the Westinghouse Electric Company regarding a plan to build an electric railway to connect Leadville with Twin Lake and the Horshoe District.

FLORENCE, COL.—Thomas Robinson, president of the Florence Electric Street Railway Company, says that his company is about ready to commence construction of the first 21 miles of the proposed line. The road will do a passenger, express and freight business, and will run from Florence to Canon City, the outlying coal camps and the Portland Cement Works. It will be built on the most modern methods and will cost about $500,000.

ROCKVILLE, CONN.—In the Mayor's annual message attention was called to the need of an improved lighting service and the recommendation of the municipal ownership of the gas and electric lighting plants, if necessary, to obtain this result.

RIDGEFIELD, CONN.—The Ridgefield Electric Company is preparing to construct a new power house of reinforced concrete. The building will be 70 x 24 and 20 ft. high, divided into engine and boiler rooms by concrete partitions. The mechanical and electrical equipment has been contracted for, and it is expected that the plant will be in operation in the early summer.

NAUGATUCK, CONN.—The Naugatuck Valley Electric Railway Company, which is to build an electric railway from Naugatuck south through the Naugatuck Valley to Beacon Falls and thence to Seymour, has acquired the last piece of land which is needed as a right of way in Naugatuck. The work of clearing the land for the roadbed has begun and structural operations will now be pushed.

SUFFIELD, CONN.—The Consolidated Railway Company has under consideration the advisability of changing the power house of the village water company at Suffield from a complete generating station to a sub-station. The proposed change involves a high-tension line from the power house of the Springfield Street Railway Company to the Suffield Company's power house, and the installation of a rotary converter at the Suffield end.

WILMINGTON, DEL.—President U. G. Glick, of the Kent County & Delaware Bay Traction Company, is becoming active in the preliminaries for the construction of the proposed electric railway in Kent County. As soon as the machinery is shipped and the construction equipment arrives Mr. Glick says they will positively begin work, and will not only construct the line from Smyrna to Woodland Beach, but will build from Smyrna to Dover. The traction company may also purchase the Smyrna electric lighting plant.

TAMPA, FLA.—The Tampa Electric Company has a force at work preparing to extend the lines of the company from Lafayette Street, near the bridge, to the power house.

JACKSONVILLE, FLA.—George W. Clark, who recently purchased Panama Park, is reported to have under consideration plans for building an electric railway from Bay Street, Jacksonville, through Springfield, touching at Woodlawn Cemetery and extending to Panama Park.

WAYCROSS, GA.—The Waycross Electric Light & Power Company, C. W. Sexton, superintendent, is going to change and remodel its electric plant, and will be in the market for new machinery.

MARIETTA, GA.—The Georgia Manufacturing & Public Service Company has been organized here, with Moultrie M. Sessions, president, and William Burckel, secretary, to take over the water works, electric light plant and paper mills. It is proposed to expend about $25,000 in enlarging the water works, installing a filter plant and completing the paper mill. J. H. Wallace, New York City, has been selected as consulting engineer in charge of the proposed work.

SCOTTSBURG, ILL.—The Scottsburg Telephone Company has been incorporated with a capital of $1,200, by O. T. Hoyt, O. M. McElvain and C. R. Paul.

VICTORIA, ILL.—Amel Harms has taken up the matter of establishing an electric light plant here and it is believed that the project will be successfully carried through.

DONGOLA, ILL.—The Dongola Home Mutual Telephone Company has filed articles of incorporation. B. F. Crabtree, Thomas R. Baugh and J. F. Karraker are the interested parties. The capital is stated to be $2,500.

GRANITE CITY, ILL.—The Kinloch Telephone Company is to erect a new exchange at Granite City, Ill., and St. Louis, and local capitalists have been in conference as to the organization of a local company to conduct the business.

FREEPORT, ILL.—The Freeport Railway, Light & Power Company is about to develop another water power on the Picatonica River, about five miles below Freeport, to operate in conjunction with the company's present water and steam plant at Freeport.

WAUKEGAN, ILL.—The North Shore Electric Company, which has already spent $50,000 for a site for its power plant, is making preparations to spend half a million more in the erection and equipment of the plant itself, which is to be completed within the year.

EDWARDSVILLE, ILL.—At a special meeting of the City Council January 4, a franchise was granted the McKinley Traction Company, to construct and operate a gas and heating plant and an electric light plant. The duration of the ordinance is fifty years and the McKinley Company is to assume the contract of the Edwardsville Electric Light plant, which at present furnishes light for the city. The contracts now in force have about four years to run, when a new schedule will be prepared. The transfer will be made within ten days.

JACKSONVILLE, ILL.—The Jacksonville Railway & Light Company was recently incorporated under the laws of Maine with $500,000 authorized capital stock, as a consolidation of the Jacksonville Railway Company and the Jacksonville Gas, Light & Coke Company. The details of the bond issue of the new company have not yet been arranged, but it is proposed to retire the bonds of the old company as fast as they can be taken up. The officers of the company are: President, W. B. McKinley; vice-president and manager, L. E. Fischer; secretary and treasurer, G. M. Mattis.

CANNELTON, IND.—Fire has partially wrecked the city's electric light plant, entailing a loss of $2,300.

NEW CARLISLE, IND.—George Cadogan Morgan, 808 Royal Insurance Building, Chicago, Ill., is designing and consulting engineer for an electric power plant to be constructed at this place.

FORT WAYNE, IND.—Engineer L. P. Huntoon, of this city, is assisting in the survey of the new traction line from St. Marys to Defiance, Ohio. Fort Wayne capitalists are said to be interested in the road.

CANNELTON, IND.—The city electric light, heat and power plant has been destroyed by fire, and it is reported that bids will be received at once by the City Auditor for rebuilding the plant.

SEYMOUR, IND.—The Indianapolis, Columbus & Southern Traction Company and the Louisville & Indianapolis Traction Company have asked for a franchise to enter this city. The former will build new car barns here and the latter will build an east and west line to connect Brownstown and North Vernon.

PERU, IND.—The City Council has granted a franchise to the Winona Interurban Company to use and lay tracks on Broadway. This action grew out of the refusal of the Indiana Union Traction Company to permit the Winona Company the use of its tracks in Broadway. The latter company will now begin the construction of a line from Peru to Warsaw, and the Union Traction Company will build from Wabash to Warsaw.

INDIANAPOLIS, IND.—The Capital Circuit Traction Company has been incorporated with a capital of $10,000. The promoters propose to build an electric railway between Danville, Lebanon, Greensburg, Martinsville, Noblesville, Franklin and Shelbyville, connecting these towns, all of which are touched by interurbans out of Indianapolis. Charles E. Overill, James N. Crabb and others are among the incorporators.

OSCEOLA, IA.—Plans are being discussed for the construction of an interurban road from this city to Des Moines, via Liberty Center.

ELLIOTT, IA.—Lester Malony is undertaking to organize a stock company with a capital of $2,000, to construct and operate an electric light plant in this city.

SCOTT CITY, KAN.—The City Council has granted to J. B. Loughran and H. E. Nicholson, a 21-year franchise to construct and operate an electric light plant in Scott City.

COLUMBUS, IND. The City Council has authorized Mayor McCormack to take the necessary steps for the construction of a municipal electric light plant.

KANSAS CITY, KAN.—The City Council has adopted a resolution asking the Metropolitan Street Railway Company to build a double-track street railway on Thirteenth Street between Minnesota and Stewart Avenues.

ARKANSAS CITY, KAN.—The proposition to issue $22,000 bonds for the aid of the Kansas-Oklahoma Interurban Railroad has carried by a large majority. The road is to extend from Chilocco, O. T., to Arkansas City and thence to Winfield, with street car systems in the two towns. Later the road will be extended to Geuda Springs and may connect with the proposed line from Newkirk, O. T., to Guthrie.

LOUISVILLE, KY.—The Cumberland Telephone Company is to spend $525,000 immediately on improvements, and at Nashville, Tenn., will erect a new $75,000 plant.

BUCKFIELD, ME.—Preliminary steps have been taken to install an electric light plant in the machine shop of Arlington Damon for supplying lights to the village.

WATERVILLE, ME.—Plans are before the Railroad Commissioners for the extension of the Portland & Brunswick Electric Railway through Freeport, Cumberland and Yarmouth.

DEXTER, ME.—Henry P. Dexter, architect, is at work upon plans for the new power house to be erected near the Maine Central station by the Dexter Electric Company for furnishing power to operate the electric lights of this village. As soon as the plans are completed they will be submitted to local contractors for bids on the construction.

PRESQUE ISLE, ME.—The Maine & New Brunswick Electrical Power Company, Ltd., which is promoting the development of Aroostook Falls, has secured a Canadian charter to distribute and sell electric power in the counties of Victoria, Carleton and Madawaska and other localities adjacent thereto. The Maine charter gives the company the same rights in the towns of Fort Fairfield, Presque Isle, Limestone, Easton, Mars Hill, Blaine, Bridgewater, Monticello, Littletown and Houlton. The company recently purchased the plant of the Presque Isle Electric Light Company and now owns all the land on both sides of the Aroostook River at the Aroostook Falls, controlling thereby all necessary riparian rights for the development of water power. The plant will have an initial capacity of about 1,000 horse-power, to be increased later to 2,000 horse-power, part of which has been contracted for by the Aroostook Valley Railroad Company. The latter concern has made surveys and filed plans for the construction of 16 miles of road between Presque Isle and Washburn, which will be built as soon as this plant is completed and ready to furnish the power for operating the road. The company is capitalized at $250,000. Its officers are: N. M. Jones, president; L. G. Crosby, treasurer; James D. Seeley, secretary; A. R. Gould, managing director; Hon. H. M. Heath and Hon. William Pugsley, corporation counsel.

BALTIMORE, MD.—It is stated that the Municipal Lighting Commission, consisting of Edwin J. Baetjer, Subway Engineer Phelps and City Engineer Fendall, proposes investigating the city lighting conditions, and will report on the feasibility of establishing a municipal plant. If such a plant is recommended there is a loan of $1,350,000, which only needs the approval of the City Council and the ratification of the people to become available.

PITTSFIELD, MASS.—Plans are being prepared for the new power plant of the Pittsfield Street Railway Company, which is soon to be erected in this city.

HADLEY, MASS.—The contract for the building of the new substation power house to be built by the Connecticut Valley Street Railway Company, at Hadley, has been awarded to former Mayor John L. Mahter, of this city.

WORCESTER, MASS.—A petition looking towards the development of the idle water power in Massachusetts will be presented to local residents for signatures through President Lonergan, of the Merchants' Association, within a short time.

BALDWINVILLE, MASS.—Herbert G. Lowell, of East Templeton, is soliciting business for electric light, claiming that if he can obtain subscribers for 2,000 lights a Providence company stands ready to install an electric lighting plant here and have it in operation by September 1, next.

WESTFIELD, MASS.—Manager Pettibone, of the municipal electric light and power plant, is figuring on installing additional equipment that will materially increase the output of the plant. This has been made necessary by the increased demands for power from manufacturing concerns.

NEWBURYPORT, MASS.—An order has been introduced by Councilman Morrison to appoint a committee consisting of two councilmen and one alderman to be instructed to confer with the Gas & Electric Company, to find out the cost of all-night street lighting and to report back at the next meeting.

HOLYOKE, MASS.—The Gas and Electric Department has had added to it a 500-kw steam turbine which when contracted for was considered ample provision for three or four years to come. So fast, however, has the volume of business increased that the city must this year install another turbine.

LOWELL, MASS.—At a meeting of the Board of Aldermen an order providing for a municipal gas and electric plant for lighting and heating was introduced by Alderman Carmichael. He hoped this one would be acted upon at once. The city had had enough of free franchises to companies. The order was unanimously adopted.

BOSTON, MASS.—The Massachusetts Interurban Street Railway Company, with a capital of $5,000,000, is seeking incorporation. The company proposes to build a high-speed street railway from Boston to Fall River and New Bedford and Providence. The incorporators include Thomas J. Milvahill, Daniel J. Toomey, John J. McNamara, James J. Connelly, Bernard J. McCarron, William S. Haverty and James T. Cox.

FALL RIVER, MASS.—The Old Colony, Dartmouth & Westport and the Providence & Fall River Street Railway companies have been given franchises to run cars through the city for baggage and light freight. The petition of the Old Colony Street Railway Company for permission to extend its tracks to connect with the Enterprise Transportation Company's line of steamers to New York has been referred to the new city government.

LEOMINSTER, MASS.—The Selectmenn and the officials of the Leominster Electric Light, Power & Heating Company have come to an understanding regarding the street lights of the town and both parties agree that the lights at the present time are in a most deplorable condition. There is, however, a disposition on the part of the company to give the town just as good lights as money can provide and all they need is time to get them installed.

MARLBORO, MASS.—It is announced that the Marlboro Electric Light Company will hereafter furnish a 24-hour service, including Sundays and holidays. The company will add largely to the equipment of its plant on Florence Street, and the fixtures in use about the city will be replaced with new ones. With the continuous service the company will be enabled to install lamps and furnish lighting for vaults, closets and such places, and a complete line of cooking utensils and household appliances will be carried at the company's office.

AMESBURY, MASS. It is understood that the new stockholder of the local electric light company, who has secured a controlling interest, has requested that the present directors and management remain in control of the affairs of the company. It is said to be his desire that a large amount of new bonds be issued to take care of the floating indebtedness and secure enough funds to make large and extensive repairs to the plant. Among these latter are the purchasing of new machinery and the placing of all machinery upon one floor.

PITTSFIELD, MASS.—Referring to electric lighting, the Mayor in his address says: "Our contract for street lights will expire early in 1907 and it may be wise to take the matter up during this year. I had hoped to be able to make some definite recommendation regarding this matter, but find it a subject where figures would be of no value at this time, for while one set of figures would be of use in some other city they would be useless here. I would recommend that when a new contract is considered the moonlight system be discontinued; that an all-night system be seriously considered and that many lamps that are now obstructed by the foliage be relocated.

PITTSFIELD, MASS.—The Stanley-G. I. Electric Company during 1905 nearly doubled its working force, having at the first of 1905, 866 persons on its payroll and now there are 1400. In addition to increasing the working force, new buildings of the saw-tooth variety have been erected and a few extensions to other buildings have been made. These additions cost about $25,000 and their floor space is approximately 30,000 square feet. During the coming year the company plans to put up a number of new buildings, although their erection is dependent upon the grants and privileges allowed the company by the city. Even though these buildings do not go up, it is expected that 200 or 300 new employes will be added.

NEW MARLBORO, MASS.—H. K. Bloodgood, of New York City, who has a 2,000-acre estate in New Marlboro, and who is building a handsome residence here, has just bought, through Frank H. Wright, of Great Barrington, three water-power privileges on the Konkapot River, at this point. The three properties will develop a total of 250 horsepower. Mr. Bloodgood proposes to develop enough power to light his house and grounds, which will require 500 lights, and also furnish light for the town. Mr. Bloodgood is also interested in the project to build an electric railway from New Marlboro to Great Barrington, a distance of nine miles, and it is probable that part of the power generated at the proposed plant will be furnished to operate this line.

PITTSFIELD, MASS. Architect and Engineer C. K. Stearns, of Boston, who prepared the plans for the power plants of the Berkshire Street Railway Company, will shortly complete plans for the new power house of the Pittsfield Street Railway Company. As soon as the plans are ready they will be offered to the contractors for figures. Should the open winter continue, the plant would be started at once, as the company is desirous of completing it at the earliest possible date. If the weather prevents building at this season the work will be started as early as possible in the spring. The plant will be of the most modern construction throughout. The company has decided to generate its own power and has given up the idea of purchasing power from several companies.

HOLYOKE, MASS.—Manager W. H. Snow, of the City Gas and Electric Department, has filed his third annual report, in which he calls attention to the increasing volume of business transacted from the gas works and electric plant. From the former there has been sold 13,103,300 cubic feet more gas than during 1904, an increase of 12.6 per cent; while from the latter, there is being sent out about 40 per cent more power than at this time a year ago. During the year, at the station, there have been installed one 500-kw turbo-generator with ample condensing apparatus and three 300-hp boilers, practically doubling the steam capacity of the plant. The plant, at the rated capacity of the generators, is now equipped to furnish 2,200 electrical horsepower with water and steam power run together, but it can furnish only 1,713 electrical horsepower with steam power alone. When the turbo-generator was purchased last winter, it was thought that the equipment would be large enough to take care of the growth of the business for some years, but the station has already almost reached the limit of its capacity, it being able to take on only about 20 per cent more business with its combined water and steam power, and has reached the rated capacity of the steam plant. During the past fall, the four remaining mill powers of the 16, appurtenant to the plant, were taken; but the business has increased so much, that some steam power has to be used every day in addition to the water power, as the water wheels do not furnish power enough for the daylight load alone. Mr. Snow recommended that the department be given the necessary authority to add to the equipment at the station one 1,000-kw, or 1,333-hp unit, including the steam power and electric generators. He also called attention to the lack of adequate coal storage facilities in case the output of the plant is increased and stated that in order to be in a position to handle whatever demand for power that may come, a sufficient lot of land conveniently situated as to railroad facilities and the station should be acquired to give storage ample for a winter's supply of coal, recommending that the department be authorized to purchase such a lot of land.

DETROIT, MICH.—The Common Council has adopted resolutions requesting Commissioners of Works and Parks to include in their estimates appropriations sufficient to construct a trackless trolley system around Belle Isle and over the bridge. It is estimated that the entire equipment, including cars, overhead construction and power house, will cost about $52,000. When the commissioners of the two departments have submitted their estimates, the appropriations will come regularly before the Council again and then to the Board of Estimates.

MUSKEGON, MICH.—Muskegon Heights will shortly have an electric light plant, to be erected at a cost of $15,000, and water works which will cost $35,000, if the action of the City Council is sustained by the citizens at a special election to be held January 29.

ANN ARBOR, MICH.—The latest reports concerning the electric railway between Ann Arbor and Toledo are to the effect that A. S. Foster, of the latter city, has been securing extensions of franchises and options on right of way for the proposed extension of this line from Petersburg to Britton, Ridgeway and other towns.

KALAMAZOO, MICH.—At a recent meeting of the directors of the Kalamazoo, Elkhart & South Bend Railroad, it was announced that the organization had been incorporated in both Michigan and Indiana. The capital of the concern is placed at $55,000. The following officers were elected: A. D. Harris, president; H. C. Morgan, vice-president; Edward C. Vincent, secretary; Adam Hunsberger, treasurer; John A. Bowman, auditor. Mr. Vincent states that this company was organized to carry on the work started by another company about two years ago. The company has taken over all the old franchises and proposes to push the enterprise through. The line when completed will run from Kalamazoo to Vicksburg, thence to Parkville and Three Rivers, Constantine, Mottville, Union, Elkhart and South Bend. The road is intended to be a connecting link between lines diverting to points in Michigan from Kalamazoo and from South Bend to points in Indiana. It will be built upon a private right of way and a force of engineers will at once begin the surveys.

MINNEAPOLIS, MINN.—Plans are being perfected for additional development of 6,000 horse-power at St. Anthony Falls. The Pillsbury-Washburn Company, which controls the power, will make the development and market the power. The work will be in charge of William de la Barre, chief engineer of the St. Anthony Falls Water Power Company. The site for the new power station has not been selected as yet. It is proposed to utilize the water that has been going to waste over the falls. It is stated that the market for the additional power is practically assured in plans that are under way for the establishment of one or more large industries and in contracts for certain amounts as soon as the development is completed.

HATTIESBURG, MISS.—Business men of Hattiesburg have bought the interest of the Meridian men in the proposed Hattiesburg Gas & Electric Railway Company. According to the terms of the franchise, three miles of the road must be in operation by June 1.

NEWTON, MISS.—Kirkpatrick & Johnson, of Jackson, are preparing plans for enlarging the electric light plant. A new direct-current outfit will be installed and additional pole lines will be constructed.

MISSOULA, MONT.—Senator W. A. Clark is reported to have purchased the plant of the Missoula Light & Water Company. It is stated that it is proposed to construct irrigation ditches; also a new electric railway, and to complete the dam at Bonner.

BURLINGTON JUNCTION, MO.—Henry Williams is said to be interested in the construction of a local electric light plant.

CAMDEN, N. J.—The City Council has requested the City Solicitor to inform the Council what legal steps are necessary for the establishment of an efficient municipal lighting plant before the expiration of the present lighting contract, and the probable cost of such a plant.

PLEASANTVILLE, N. J.—The Atlantic City & Suburban Trolley Company will double track its line across the meadows and make other improvements.

BUFFALO, N. Y.—The franchise granting the International Railway Company the right to lay 6½ miles of double track in Fillmore Avenue was signed by Mayor Knight, December 29.

NEW YORK, N. Y.—The New York Telephone Company will build on Gold Street, an eight-story brick exchange building, to cost $[illegible] in construction. Eidlitz & McKenzie, [illegible] Broadway, are the architects.

BROOKLYN, N. Y.—A railway company is said to be in process of organization for the purpose of bidding for the franchises of the routes laid out by the Rapid Transit Commission on the west and east sides of Manhattan and Brooklyn.

ITHACA, N. Y.—The survey has been completed for the Ithaca & Horseheads Electric Railway. The line as drawn will extend between Ithaca and Elmira, passing through Enfield Falls, Mecklenburg, Odessa and Horseheads. J. L. Marshall, prominent in the affairs of Ithaca, is interested in the company.

ALBANY, N. Y.—The Niagara Falls Electrical Transmission Company has made application for permission to increase its capital stock from $1,000,000 to $5,000,000; also to purchase certain obligations of the Albion Power Company and the capital stock, etc., of the Niagara Falls Gas & Electric Light Company.

BINGHAMTON, N. Y.—President G. Tracy Rogers, of the Binghamton Railway Company, is reported to be negotiating with the Ontario Power Company, of Niagara Falls, N. Y., for supplying power to the Binghamton Company. The power line to Binghamton would come by way of Watkins, Corning, Elmira, Waverly and Endicott.

TROY, N. Y.—N. R. Holmes, of Troy, attorney for the Ticonderoga Light & Power Company, writes that the proposed plant will cost about $50,000 and that bids for the construction will be received in about 30 days. F. B. Gridley and N. R. Holmes, of Troy, and F. T. Locke and A. B. Adkins, of Ticonderoga, are also interested.

DAYTON, OHIO.—The Dayton Citizens' Electric Company has been incorporated with a capital of $100,000 by Cyrus E. Mead, F. T. Griest, H. B. Arnold and others.

WOOSTER, OHIO.—Pugh & Hubbard, Real Estate Building, Philadelphia, Pa., are making surveys for an electric railway from Wooster to Mansfield, a distance of 40 miles. Work will be begun in the spring.

NILES, OHIO.—Bids will be received until January 24 at the office of B. L. Hogan, City Auditor, for $4,000 bonds, the proceeds of which will be used for enlarging, repairing and equipping the electric light plant.

CINCINNATI, OHIO.—According to reports, this city is to have a new power plant, to be erected at the southeast corner of Pendleton and Danridge Streets. The improvements, together with the land, will, it is estimated, cost $300,000.

MARYSVILLE, OHIO.—Articles of incorporation have been filed for the Union County Telephone Company by N. E. Liggett, Wallis C. Fullington, W. O. Shearer, George P. Whitney and H. E. Courtright. The company is capitalized for $200,000.

CAMBRIDGE, OHIO.—The Consolidated Company, which operates a road from Cambridge to Byesville, is planning to extend the line to Pleasant City, Derwent and Buffalo, and possibly to Caldwell. The property is owned by the Cameron Company of Marietta.

DELAWARE, OHIO.—The Richwood & Magnetic Springs Railway Company has been organized. It is being promoted by the same interests that own the Delaware & Magnetic Springs Railway now operating to Magnetic Springs from Delaware. W. M. Galbraith, of Pittsburg, is at the head of the company.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company, it is stated, has secured the contract to supply arc lights to the city during the year 1906 at $69.72 per lamp. Director Springborn has decided to ask the Council for $10,000 with which to purchase poles and wires so that extension plans can be carried out at the municipal lighting plant in South Brooklyn.

COLUMBUS, OHIO.—The Central Ohio Traction Company, with a capital stock of $5,000,000, has been formed by W. T. Young, B. M. Jennings, D. F. Swanson and others of New York. According to newspaper interviews these people contemplate the building of an extensive system of electric railway in central and northern Ohio. It is claimed that one line will extend from Lorain to Columbus with a branch to Cleveland. Another branch will extend to Canton, Youngstown and Pittsburg.

STROUD, OKLA.—The proposition to bond the town for $4,000 for the construction of an electric light plant will be submitted to the people.

WATONGA, OKLA.—This city will receive bids until February 9 for furnishing material for, and constructing complete, an electric light plant and water main extensions. Bids will be received on each item and on the work as a whole. There will be required pipe, dynamo, hydrants, steam engine, lamps, meters, poles, wire, boilers, feed pump, heater, etc. Address M. A. Earl, Consulting Engineer, Muskogee, Ind. Ter.

SANGER, ORE.—At a recent meeting held in Pendleton, the Eagle River Electric Power Company elected the following named officers: President, F. W. Paine, of Baker City; vice-president, Dr. J. E. Bingham, of Walla Walla, Wash.; secretary and manager, J. K. Roming, of Baker City. It is the intention of the company to establish a power system on Eagle River, near Sanger. The capital stock is placed at $500,000.

TECUMSEH, OKLA.—Prof. F. Perrine, who has been investigating the feasibility of an electric railway between Tecumseh and Shawnee, has reported favorably to the Shawnee Lighting Company, which proposes to build the line. Dennis T. Flynn is president of the company, which is owned largely by Eastern capital. If the interurban plans are approved, it is stated that the company will also purchase the property of the Shawnee Traction Company which is now in the hands of a receiver.

PORTLAND, ORE.—The Portland General Electric Company contemplates making improvements in this city to the extent of $1,000,000. These improvements will include the erection of an office building at 7th and Alder Streets, to cost $200,000, a distributing plant from which power for the lighting and car service for the entire East Side will be supplied, and a sub-station at Sellwood to receive power from the plant on the

Clackamas; also the installation of new equipment, including 1200 street lamps to take the place of those now in use.

PINEGROVE, PA.—The citizens will vote at the election to be held in February on the proposition to issue bonds for the purpose of erecting an electric light and power plant at a cost of about $8,000. The power will be derived from the water works, erected by the borough ten years ago.

DELAWARE WATER GAP, PA.—C. J. Young, of Philadelphia, is engineer for the Delaware Water Gap Power Company, which proposes constructing a power plant at this point. A dam will be put across Brodheads Creek and it is proposed to tunnel through the mountain and form a lake in Cherry Valley. A canal will also be built. It is estimated that from 2,500 to 7,200 horse-power can be developed here, and the work of construction will cost about $800,000.

PROVIDENCE, R. I.—A deed filed at the Town Clerk's office in East Providence shows that another strip of land on Pawtucket Avenue has been purchased by the Rhode Island Company for the purpose of installing a second track along that stretch of roadway beyond St. Mary's Seminary and extending to the switch or resumption of double tracking at the Ponham Club grounds.

BERESFORD, S. D.—The electric light plant, owned by A. B. Mason, was destroyed by fire on December 30.

BERESFORD, S. D.—Fire destroyed the Beresford electric light plant, owned by M. M. Doyle & Son. The city is without other public lighting facilities.

PIERRE, S. D.—An interesting source of power is about to be developed here, the city having decided to put in an incandescent electric light plant to be driven by waste water from the artesian wells. Tests show that this water coming under pressure will develop more than enough power to operate such a plant.

PIERRE, S. D.—Ordinances have been introduced in the City Councils of Pierre and Fort Pierre, on the west side of the Missouri River, for an electric street railway franchise to be granted to Noah Newbanks, of this city, and Frank Fischer, of Fort Pierre. The proposed line calls for about ten miles of trackage and is intended to give the towns joint service with local service for each of them. It is the intention of the parties interested to begin work in the spring if they can complete their arrangements by that time.

PULASKI, TENN.—The Mayor and Board of Aldermen have contracted with the Fort Wayne Electric Supply Company to install an electric light plant.

GIDDINGS, TEX.—Local parties are discussing the installation of an electric lighting plant.

RISING STAR, TEX.—The Rising Star Electric Light Company has been incorporated with a capital of $10,000, by H. E. Anderson and W. A. McSpadden.

VERGENNES, VT.—The construction of an electric railway from Vergennes to Fair Haven by way of Whitehall, N. Y., was the subject of discussion at a meeting held here recently, which was attended by about 100 representatives from the town through which the road would pass. A resolution, presented by R. W. McCuen, favoring the organization of a stock company to agitate the project and construct the road was unanimously adopted.

WAITSBURG, WASH.—Roberts & Henderson, owners of the electric light plant, contemplate enlarging the plant and extending the service to Prescott, Wash.

WALLA WALLA, WASH.—R. E. Allen, assistant secretary of the Northwestern Gas & Electric Company, writes that it has been decided to increase the capital stock of the company.

SEATTLE, WASH.—The Kern-Rand Company has been incorporated with a capital of $25,000, to sell and rent water and electric power. The company's principal place of business will be in this city, with a branch office at Los Angeles, Cal.

POST FALLS, WASH.—The Washington Water Power Company, it is said, has taken over the contract of Bennett & Bihler and will complete the extensive improvements the company is making here in connection with its large power plant.

ELLENSBURG, WASH.—The organization of the Ellensburg Traction Company has been practically effected. It will haul sugar beets to the dump for a radius of ten miles. It has contracted to haul the product of the 10,000 acres that will be planted by the growers' association.

PULLMAN, WASH.—The Moscow Electric Light Company, of Moscow, Ida., has secured a 20-year franchise in Pullman, subject to the vote of the citizens. The contract provides that the company shall purchase the plant owned by the city. Mr. M. J. Shields, of Moscow, is president of the company.

SEATTLE, WASH.—Articles of incorporation have been filed with the County Auditor by the Hanford Irrigation & Power Company, having a capital stock of $250,000. Among the incorporators are E. S. McCord, C. J. Smith and M. B. Haynes. The company intends engaging in a general irrigating and electrical power business, with headquarters in this city.

DANVILLE, W. VA.—The Danville Improvement Company proposes in the near future to install water works and an electric light plant. H. L. Carter is secretary and treasurer of the company.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has decided to issue bonds to the amount of $20,000,000 to be used in making improvements and extensions and for refunding purposes.

CRANBROOK, B. C.—The East Kootenay Power & Light Company has been incorporated with a capital of $250,000, and will develop a water power on the St. Marys River.

PICTON, ONT.—The citizens have voted to issue $15,000 bonds for installing a new street lighting system.

BOBCAYGEON, ONT.—The citizens have voted to appropriate $25,000 for the purchase of M. Boyd Company's water power and to establish an electric light plant for the village.

PORT ARTHUR, ONT.—The taxpayers have endorsed a by-law approving the expenditure of $7,000 for improvements to the municipal power plant, and also one providing for the appropriation of $14,000 to be expended in completing the electric lighting system.

WELLANDPORT, ONT.—James A. Ross, of this place, will apply to Parliament for the incorporation of a company to build on electrical railway from Port Maitland, on Lake Erie, to Beausville on Lake Ontario. Others interested are S. D. Lake, of St. Catharines, and George Arnold, of Ridgeville.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Railway Company is seeking authority to make extensions from Thorwold to Port Colborne, Fort Erie to Niagara Falls, from Niagara Falls to Niagara-on-the-Lake, from Niagara Falls, Thorold or Welland to Brantford, from St. Catharines to Niagara-on-the-Lake.

New Industrial Companies.

THE WOODS ELECTRICAL COMPANY, Houston, Tex., has been incorporated with a capital of $50,000.

THE HILL-WRIGHT ELECTRIC COMPANY, Newark, N. J., has been incorporated with a capital of $6,000, by Franklin T. Hill, Emeline Wright and Alfred A. Wright.

THE REDD & VOLK ELECTRIC COMPANY, Norwalk, Conn., has been incorporated with a capital of $19,000, for the purpose of conducting an electrical supply business.

THE MODERN INSULATOR COMPANY, San Francisco, Cal., has been incorporated with a capital stock of $100,000, by John Moss, R. A. Falkenberg, S. S. Simon, E. F. Bert and Augustus Waterman.

WESTERN ELECTRIC COMPANY, Indianapolis, Ind., has been incorporated with a capital stock of $50,000, and will buy and sell electrical goods, etc. Charles G. DeBois and F. W. Bennis are interested in the new company.

EASTERN ELECTRIC LAMP COMPANY, New York, N. Y., has been incorporated, with a capital of $5,000, for the manufacture of electric lamps, etc. Morris Leight, Maurice J. Katz and Edward Dinkelspiel are named as the directors.

THE ELECTRIC CABLE COMPANY, Bridgeport, Conn., has filed a certificate of incorporation. It has an authorized capital stock of $500,000 and its incorporators are Edwin W. Moore, of New York; F. H. Cowles, of Greenwich, Conn., and J. N. Shreve, of Scarsdale, N. Y.

THE FAIRBURY TELEPHONE COMPANY, Fairbury, Ill., having a capital of $20,000, has been organized and articles of incorporation filed. The company is composed of George C. Monk, Charles E. Monk and E. A. Agard, and will carry a stock of telephone service supplies.

THE GENERAL MANUFACTURING & SUPPLY COMPANY, Camden, N. J., has been incorporated by John A. McPeak, F. R. Hansell and George H. B. Martin. The company has a capital of $250,000 and will engage in the manufacture of lamps, globes, gas and electric fixtures, etc.

THE SCOTT ELECTRICAL EQUIPMENT COMPANY has been organized at Portland, Me., for the purpose of manufacturing and dealing in electric motors, machinery, instruments and electrical devices of all kinds. Officers: President, Millard W. Baldwin, of Portland, treasurer, James J. Hernan, of Portland.

THE GORDON MANUFACTURING COMPANY, Chicago, Ill., has been incorporated for the purpose of manufacturing electrical and mechanical appliances. Those interested in the concern are Gordon G. Burdick, Charles Ford and Alvena L. Burdick. The company has a capital stock of $2,500.

Obituary.

DR. OTTO A. MOSES.—We regret to note that Dr. Otto A. Moses, electrical expert, geologist, chemist and inventor, prominently identified with many Hebrew charities, died on Wednesday, January 3, of oedema of the lungs, followed by erysipelas. He was a son of Aaron J. Moses, of Charleston, S. C., where he was born in 1846. He was graduated from the University of Leipsic. On his return he became State Geologist of South Carolina. Coming to New York about thirty years ago, he entered business as a mechanical engineer and electrical expert. He was associated in early life with Mr. Thomas A. Edison. In 1880 he represented Mr. Edison in Paris at the electrical exposition. Later he was connected with the Westinghouse Electric Company, and was one of the earliest advocates of the adoption of the alternating-current system in this country. He was a founder of the Hebrew Technical Institute, and was also associated with the Montefiore Home and the Hebrew Benevolent Orphan Asylum. He leaves two sons, one of whom is Walter Florian, a painter, and a daughter. The other son, Julian, is a rising young electrical engineer. A portrait of his father by Walter Florian appeared in the exhibition of the National Academy of Design last year.

Personal.

MR. J. H. ASHBEY, of New Orleans, La., has been appointed local selling agent there for the line of materials of Albert & J. M. Anderson Manufacturing Company, of Boston, Mass.

MR. HENRY L. DOHERTY, the electrical central station manager and expert, is also very prominent in the gas field and has just organized in New York city the Gas Securities Company, to promote gas and electric operating companies, with a capital of $1,000,000.

MR. W. B. ELLISON has been appointed by Mayor McClellan Commissioner of Water, Gas and Electricity for New York, succeeding Mr. Oakley. Mr. William C. Cozier, of the New York *Sun*, has been appointed Deputy Commissioner for the Borough of Brooklyn.

MR. JOHN M. BRUCE, of Bruce & Johnston, 42 Broadway, New York City, publicity experts, has taken into partnership Mr. Kendall Banning, who until recently was managing editor of "System." Mr. R. H. Johnston has retired from the firm in order to devote his entire time to automobile advertising.

MAJOR G. O. SQUIER, U. S. A., of the Signal Corps, stationed at Leavenworth, Kan., was a recent visitor to New York City, after an absence of many months. As noted in these columns, the Signal Corps is conducting special courses in wireless telegraphy, etc., at the army training college at Leavenworth, and is also carrying on some very interesting and successful experimental work.

MR. S. C. SCHENCK, who has been connected with the New York office of the Westinghouse Electric & Mfg. Company in its street railway detail department, has resigned his position to accept the position of general manager of the Sterling Varnish Company, of Pittsburgh, Pa. He will be located permanently in Pittsburgh and will be happy to see and to receive any of his old friends in the electrical field at any time.

MR. C. A. COFFIN, president of the General Electric Company, accompanied by members of his family, sailed on the White Star liner, "Celtic," on Saturday, January 6, for the Mediterranean cruise, landing in Egypt, where he proposes to spend a few months of hardly-won rest and recreation. There is said to be a possibility that Mr. Coffin may extend the trip, as the last few years of tremendous electrical development have deprived him practically of all opportunity of a long vacation until now.

MR. B. K. HOUGH has been appointed New York representative of the Mayer & Englund Co., of Philadelphia, succeeding the late Mr. Beach, whose death was recently noted. Mr. Hough was graduated from Cornell in 1897, after which he became associated with the Boston Electric Light Co., and Stone & Webster, for a period of four years. In 1901 he came to New York City as sales engineer for the local office of the Stanley Electric Co., later occupying the position of chief sales engineer of the company. More recently he has been connected with the New York Edison Co. and Ford, Bacon & Davis.

News of the Trade.

THE NATIONAL SWITCHBOARD COMPANY, New York, announces the removal of its factory and office to the northeast corner of 58th Street and 11th Avenue, New York, the premises formerly occupied by the Switchboard Manufacturing Company, where the two shops have been combined and will be operated by the National Switchboard Company.

BIJUR BATTERIES.—At the coming Chicago Electrical Trades Exhibition, the General Storage Battery Company will show, in addition to a full line of Bijur "High-Duty" plates and batteries, a working booster system handling violently fluctuating loads while maintaining a steady load on the generator. This is accomplished by a "Bijur" automatic regulator working on a new principle with striking results.

SHEAFF & JAASTAD, the well-known consulting engineers in the mechanical and electrical field, with headquarters, Boston, Mass., have moved into new offices in the Broad-Exchange Building there—not the building of same name in New York as previously reported. In their new home they will have much larger and better space and facilities for their draughting rooms. Their offices are located on the top floor, allowing much more effective light in the day.

DEAN ELECTRIC COMPANY, Elyria, Ohio, has been authorized to increase its capital stock from $300,000 to $1,000,000. For the present only $150,000 of the new stock will be issued. The new stock is being offered to the present stockholders on the basis of par to the extent of one-half their present holdings. The increase of capital is made necessary by the rapid growth of this institution. A large part will be employed as working capital, although some improvements in the way of buildings and equipment are in contemplation.

DOUBLEDAY-HILL ELECTRIC CO.—The manufacturing and repair department of the Doubleday-Hill Electric Co., Pittsburg, has grown to such large proportions, that it has been found necessary to devote the entire top floor of the company's building to the work of this department. Mr. F. J. Lindeman, who was formerly connected with the winding department of the Westinghouse Company, has accepted the position of manager of this important department. Under his supervision new machinery has been installed, so that the department is fully equipped to do all kinds of repair work in a most satisfactory and prompt manner. Armatures and other parts of electrical machinery can be repaired, irrespective of the particular make of machines. This point is of especial advantage to central stations and other electrical plants whose equipment consists of machinery made by a number of different manufacturers. An entirely new departure in the construction of armature and magnet coils is the fireproof and indestructible type which the Doubleday-Hill Co. is now putting on the market. These coils, it is said, cannot be burned out or destroyed by even careless usage.

Weekly Record of Electrical Patents.

U. S. PATENTS ISSUED FOR WEEK ENDING JAN. 2, 1906
[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

808,641. WIRELESS TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed May 14, 1903. A system for detecting wireless emanations. The impulses are received through a vibrating contact, which thereby varies the resistance and qualities of resonance of the receiving circuit.

808,642. TELEGRAPHIC KEYBOARD APPARATUS; Patrick B. Delany, South Orange, N. J. App. filed Apr. 11, 1904. Typewriter keys are furnished with sliding rack sections thereon which are depressed into contact with a continuously rotating pinion which serves to draw the depressed rack sections forwardly and make the required contacts against a fixed blade or brush.

808,669. TABLET-BOARD; Charles B. MacFarlane, Waltham, Mass. App. filed Feb. 28, 1905. Can be used either as a two-wire or three-wire panel board. A pair of bus bars is connected with two of the terminals and a bus bar on the opposite side of the tablet connects with the other terminal.

808,717. ELECTRIC LOCOMOTIVE; Asa F. Batchelder, Schenectady, N. Y. App. filed Nov. 12, 1903. The frame of the truck on which the superstructure is mounted is utilized as the field-magnet structure for the propelling motors.

808,718. REGULATING TRANSFORMER; Henry J. Blakeslee, Hartford, Conn. App. filed April 8, 1905. The transformer has only stationary coils and a magnetic circuit of constant reluctance so arranged that the total magnetic flux is at all times inclosed by one coil, while from the minimum to the maximum flux is inclosed by the other coil automatically, or at will, according to the required conditions.

808,723. ANNUNCIATOR; Albert Carliss, Chicago, Ill. App. filed May 25, 1901. A drop or shutter is combined with a pivot pin having a central upward bend. A lever to actuate the drop or shutter extends beneath the upward bend.

808,729. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Maxwell W. Day, Schenectady, N. Y. App. filed May 15, 1905. The series winding of a compound-wound motor is divided into halves, which when the motor is hoisting assist the shunt winding to excite the field. When the motor is lowering a light load the windings oppose each other, but in the aggregate assist the shunt winding, and when the motor is overhauled by the load and becomes a generator the series windings assist the shunt-winding.

808,740. TRANSFORMER; John J. Frank, Schenectady, N. Y. App. filed March 27, 1905. The transformer core is formed of three main sections, each comprising two or more groups of laminæ. The laminæ in each of the different bundles are successively displaced so that each bundle is an oblique prism. The opening through the body is not straight but is inclined at an angle to another portion. The length of turn of conductor is thereby reduced.

808,753. VAPOR ELECTRIC APPARATUS; Alexander M. [illegible], Schenectady, N. Y. App. filed June 24, 1904. In connection with the usual mercury vapor apparatus, the non-volatizable anode is hollowed and surrounded with a body of mercury. A high-resistance material is arranged to connect electrically the two electrodes before the starting operation takes place; this is cut out when the apparatus is in operation.

808,755. ELECTRICAL BATTERY; Carl Jager, Rock Island, Ill. App. filed Feb. 27, 1904. A dry cell with a zinc cup and a carbon pencil, the latter being surrounded by a compound of manganese dioxide, iron-filings and powdered graphite, with a filling of flour and plaster-of-paris between cup and pencil.

808,773. SURFACE CONTACT ELECTRIC RAILWAY; George H. McFeaters, Johnstown, Pa. App. filed Aug. 15, 1904. Relates to details of construction of a circuit closing shoe for railways employing spaced contact plates. The movable contact is carried by a flexible conductor, and an insulating diaphragm prevents arcing from points on flexible conductor.

808,774. PIANO PLAYING ATTACHMENT; Hugh McPhail, Visalia, Cal. App. filed Apr. 18, 1903. The usual continuously moving perforated band has spring contacts bearing there against, which complete the circuits of power magnets for the individual notes or keys. The magnets are energized with varying strength depending on the composition played.

808,777. TELEGRAPH KEY; Addison E. Peterman, Repton, Ala. App. filed Oct. 13, 1905. The telegraph key is supported on a "turn table" so as to automatically make contact with different transmitting circuits when moved to different angular positions.

808,778. MOTOR CONTROL SYSTEM, William B. Potter, Schenectady, N. Y. App. filed Aug. 10, 1904. Relates to a system of operating trolley cars from 500-volt circuits, and high potential alternating circuits at different times. Transformers are employed for stepping down the high potential to about 200 volts, at which it may be utilized on the ordinary series motor.

808,779. ELECTRIC GENERATOR; Benjamin P. Remy and Frank I. Remy, Anderson, Ind. App. filed May 27, 1905. A magneto generator having supplemental pole pieces soldered into the form of a tube concentric with the usual pole faces. In this way they are rotarily adjustable so as to vary the time of the spark.

808,798. APPARATUS FOR THE AGITATION OF SOLUTIONS USED IN ELECTRODEPOSITION OF METALS; William Charles Wood and Bertie Oaksford, London, Eng. App. filed Aug. 31, 1905. The bottom of the tank contains troughs in which perforated plungers slide up and down and thus produce circulation of the electrolyte.

808,812. RECEIVER AND RECORDER FOR WIRELESS AND OTHER TRANSMISSIONS, Fred E. Gallagher, San Francisco, Cal. App. filed June 15, 1905. A printing telegraph arrangement in which a motor rotated printing wheel is stepped around by a magnet controlled escapement established by the local receiving circuit.

808,834. RELAY; Charles Lane Goodrum, Rochester, N. Y. App. filed Nov. 11, 1905. Details relating to the mechanical arrangement of parts.

808,849. METHOD OF TREATING MOLTEN MATTE; Walter E. Koch, Pittsburg, Pa. App. filed Feb. 19, 1903. The molten matte passes slowly along an inclined trough between a series of hollow electrodes through which water gas is blown into the matte, the sulphur being thereby removed. With a copper-iron matte the electrolytic action causes the iron to be drawn to one electrode and the copper to the other one, so that at least partial separation of the metals is obtained.

808,852. TROLLEY DEVICE; Frank J. Ludolph, Rochester, N. Y. App. filed July 18, 1905. The spokes of the trolley wheel are formed by stud bolts which can be screwed inward so as to remove and replace the tread portion of the wheel. An additional feature relates to the journal boxes or bearings, which are in two parts and adjustable for wear.

808,868. TELEPHONE SIGNALING APPARATUS; Karl H. Poyas, Los Angeles, Cal. App. filed July 24, 1905. Two normally-closed manually operated make and break switches are mounted on the base of a telephone receiver, and form a part of the instrument circuit. A ground plate is secured to the base at a point to be engaged by the switches when they are moved to open the circuit.

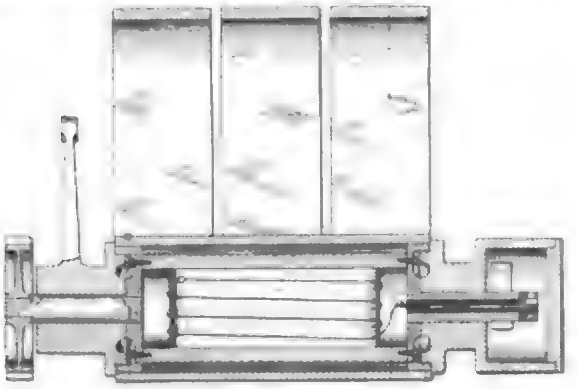
808,882. LIGHTNING ARRESTER; Frederick A. Stafford, Chariton, Iowa. App. filed April 3, 1905. Designed for telephone use. Excessive current bridges the space between two plates and escapes to ground. Switches are provided for connecting the contact plates and also the ground plates and the contact plates.

808,929. AUTOMATIC GAS DANGER SIGNAL; Preston A. Kettering, Cadiz, O. App. filed May 31, 1904. The gas burner has a piston which is spring pressed to close the pipe and only opened by the gas pressure therein. The movements of the piston establish an alarm circuit to indicate when the gas is turned off.

808,944. ALTERNATING CURRENT-MOTOR REVERSER; Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. App. filed Mar. 29, 1905. In the circuit to be reversed two equal opposing electromotive forces in series are provided. By weakening either one of the electromotive forces or short-circuiting it entirely the other e. m. f. is left to supply the circuit in the desired direction.

808,597. CIRCUIT CONTROLLER; Richard Varley, Englewood, N. J. App. filed Oct. 31, 1904. An arrangement to secure a constant energy in the ignition spark regardless of whether the engine is moving fast or slow. Ordinarily the circuit closure is for a smaller time in case of high engine speeds, but the patentee overcomes the difficulty by having the vibrator worked by a magnetic pole of predetermined strength, which gives a uniform actuation under all circumstances.

808,958. SPARK IGNITION SYSTEM FOR EXPLOSIVE ENGINES; Richard Varley, Englewood, N. J. App. filed Mar. 28, 1905. A system to give a single spark in case of low engine speeds and a torrent of sparks at high speeds. The operating cam has a low part with a comparatively high projecting terminal. The low part is effective to close the ignition circuit directly through the primary so as to give a single spark, while the high projecting terminal closes the ignition circuit through a vibrator at high speeds. In this way the number of sparks is made to accord to the needs and requisites of the system.



808,779.—Electric Generator.

809,060. RINGER FOR TELEPHONES AND THE LIKE; Elbert Radolph Hobbs, Lamar, Col. App. filed Nov. 10, 1904. The mechanism, which is connected with a supporting plate and adjusted relatively thereto, is provided with brackets to which springs are connected. The armature is mounted on these springs, and is free to rock by the resilience thereof.

809,083. AUTOMATIC ELECTRICAL CONTROLLER FOR AIR COMPRESSORS; Fred D. Ackerman, Kendallville, Ind. App. filed May 17, 195. Details of a system having a pressure controlled piston or diaphragm directly connected to the switch for the compressor motor.

809,085. ELECTROLYTIC APPARATUS; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed July 22, 1903. By the electrolysis of fused sodium chloride a lead-sodium alloy is produced, which is displaced by gravity and associated with a metal hydroxide. The resulting sodium oxide is removed and exposed to the action of steam and a portion of the sodium hydroxide, thus produced, is returned to the chamber containing the lead-sodium alloy.

809,088. PROCESS OF PRODUCING CAUSTIC ALKALI; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed May 10, 1905. Covers the process for which the apparatus is patented in 809,085.

809,089. PROCESS OF MAKING CAUSTIC ALKALI; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed May 10, 1905. An aqueous solution of sodium chloride is electrolyzed with a mercury cathode. The sodium amalgam formed is caused to overflow into a separate oxidizing cell through carbon tetrachloride, whereby the metallic contact of the mercury in the two cells is broken. The mercury from which the solution is separated by electrolytic oxidaton in the oxidizing cell flows off by gravity and is then returned to the sodium chloride cell.

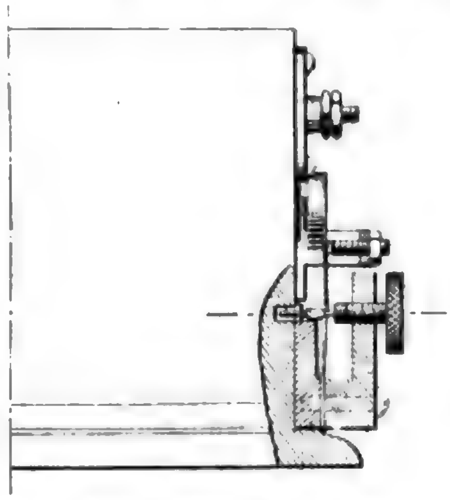
809,116. METHOD OF PRODUCING CIRCULATION IN ELECTROLYTIC PROCESSES; Hugo Koller, Vienna, Austria-Hungary, and Paul Askensay, Nuremburg, Germany. App. filed Oct. 29, 1903. In a diaphragm cell the electrolyte is caused to flow toward and into the cathode compartment in a direction at right angles to the lines of diffusion.

809,120. ELECTRIC RAILWAY. Charles Levinson, New York, N. Y. App. filed July 8, 1905. A safety device for preventing the starting of a train of cars prematurely, which consists in locating a plurality of switches in the driving motor circuit of every car of the train, said switches being operated by the gates.

809,126. ELECTRIC-LIGHT-FIXTURE INSULATOR; Louis McCarthy, Boston, Mass. App. filed Feb. 2, 1905. An insulator for the ordinary canopy used with electric light fixtures. A ring of insulating material is provided with two ribs, the inner one being higher than the outer one, and the canopy is set in the depression between the ribs.

809,183. CURRENT-TAP; William D. Harris, Philadelphia, Pa. App. filed Mar. 24, 1905. A combined plug and socket having means for the convenient attachment of conductors whereby electrical energy may be delivered to any desired apparatus.

809,186. TELEPHONE SYSTEM; Henry A. Judge, Washington, D. C. App. filed Sept. 9, 1905. In series with the battery and the transmitter is an electro-magnet of low ohmic resistance, around which is placed a shunt so arranged as to be practically opaque to continuous currents but transparent to periodic currents.



809,235. Induction Coil Vibrator.

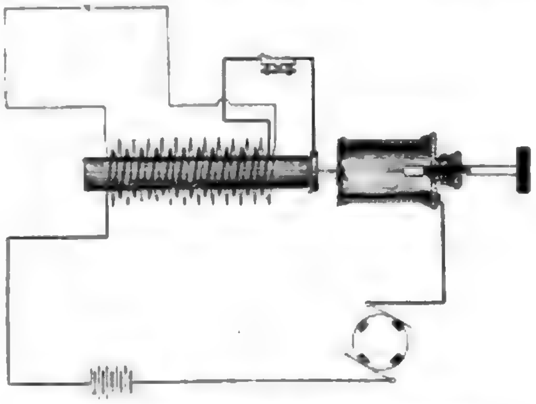
809,220. COLLECTOR-RING; Henry G. Reist, Schenectady, N. Y. App. filed Apr. 22, 1904. A form of collector-ring and means for securing it so that it will not work loose under the stress of operating conditions. The ring is cut away to form a flexible part and supporting studs to engage and hold the flexible portions under tension.

809,226. WIRE CARRIER; Frank L. Sessions, Columbus, Ohio. App. filed July 17, 1902. The hanger has pivoted clamping levers thereon which engage the wire sections and tighten them into alignment with one another when the clamping levers are spread apart.

809,232. SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEM; Arthur T. M. Thomson, London, England. App. fild Oct. 6, 1905. A subscriber's latent-signal set includes a signal-transmitter arranged to send signals in groups with a prolonged current change between the groups.

809,235. INDUCTION-COIL VIBRATOR; Richard Varley, Englewood, N. J. App. filed Feb. 25, 1905. In order to provide means for regulating the tension of the spring vibrator of an induction coil, which shall insure a uniform tension or strain for any adjustment, which shall permit the insertion and removal of the tongue without varying its tension, and which shall preclude overstraining the tongue beyond its elastic limit, the patentee makes use of a special construction having a rectilinearly guided yoke with a threaded stem adjustable to and fro by a left-handed screw.

809,236. ELECTRO-MAGNETIC SWITCH SETTING APPARATUS AND ELECTRIC RAIL HEATER; Bruno O. Wagner, Swissvale, Pa. App. filed Mar. 9, 1905. The switch rod projects into a casing in which is contained a plurality of iron-clad magnets supported so as to reciprocate the rod and throw the switch point to its alternate positions.



809,261.—Contact Device for Induction Apparatus.

809,237. SEMAPHORE MECHANISM; Bruno O. Wagner, Swissvale, Pa. App. filed Mar. 9, 1905. An enclosed motor having its armature directly secured to the semaphore arm. The armature circuit is made by flexible leads from the walls of the casing.

809,262. CONTACT DEVICE FOR INDUCTION APPARATUS. Ralph O. Hood, Danvers, Mass. App. filed Apr. 11, 1905. A stem upon the usual vibrator of an induction coil projects through a flexible diaphragm into a hermetically closed box so that the free oxygen will be exhausted and the life of the contact points prolonged

12,431. (Reissue.) INDUCTION MOTOR; Abe L. Cushman, Concord, N. H. App. filed Apr. 14, 1903. The secondary winding consists of several separate elements, one of which is connected in closed circuit star fashion, and means are provided for connecting other of the elements in parallel with the first as the rotor gains speed

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Changes of advertising copy should reach this office one week in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the Electrical World 16,000 *copies are printed. The total circulation of the* Electrical World and Engineer *for the year* 1905 *was* 712,500 *copies, an average of* 13,702 *copies per issue.*

NEW YORK, SATURDAY, JANUARY 20, 1906.

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BENJAMIN FRANKLIN.

On January 17 of this week two centuries elapsed since the birth of the greatest American who has yet lived—Benjamin Franklin, the many-sided and myriad-minded, philosopher, statesman, diplomatist, politician, social economist, philanthropist, educator, writer, republican, courtier, wit, man of affairs, inventor, electrician. To commemorate the occasion we print in this issue several articles treating of that part of Franklin's work of more special interest to our readers. The remarkable article by Brother Potamian gives the result of researches made with a view to bringing out all the facts having a bearing on the matter of priority of the celebrated kite and lightning rod experiments. In France the claims for Franklin have been contested, and for a century and a half the controversy at intervals has cropped up. Brother Potamian has made an exhaustive study of contemporary printed records, and his conclusions in favor of Franklin will be difficult to contest, notwithstanding that they rest largely on what may be termed *ex parte* evidence. Franklin himself did not record the circumstances of the kite experiment as actually performed; his biographer and intimate friend, Dr. Stuber, and his friend Priestley, did not offer any independent evidence; his son, an eye witness, who lived until 1813, apparently remained ever silent on the subject and a grandson, of whom Franklin was extremely fond and from early youth kept at his side, contented himself in preparing his great ancestor's works for publication, with quoting the account of the experiment written by Stuber. We set forth these considerations, not to throw doubt on the claims for Franklin, but to mark the singular absence of corroborative evidence in a case where one would expect it to be abundant.

In the article by Dr. Houston an account is given of the several scientific and educational foundations due in part or in whole to Franklin, through which his direct influence extends to to-day and will continue on through ages. The University of Pennsylvania and American Philosophical Society are national in scope and known to all. In this day of lavish library endowment one cannot so well appreciate the importance of the Philadelphia Library foundation, which for more than a century served as an object lesson and model for other cities. When, however, we come to the history of the Philadelphia and Boston legacies, there is a discordant note. Franklin undoubtedly had the fondest hope that these foundations would serve as his greatest monument and his greatest material contribution to posterity. Instead they stand as a warning to others who would confide a similar trust requiring the most cherishing care, to unborn generations. Perhaps the outcome would not have been so lamentable if in his testament Franklin had allowed more latitude in the management of the funds, but as in the case of the Girard foundation, the conditions existing in one generation were unfortunately imposed on succeeding generations. As a writer has recently pointed out, much of the great strength of Franklin lay in his "contemporaneity," but in the case here considered this characteristic proved a weakness. The Philadelphia Franklin fund at the end of a century amounted to only $87,600.29, though some decades previously it had received an addition by legacy from John Scott, the founder of the Franklin Institute John Scott prize and medal. Franklin had calculated that the value of the fund at the end of a century would be $655,000, and in his will he directed that of this amount $155,000 was to be placed at compound interest for another century, and the final proceeds, which he estimated at $20,000,305, be divided between the citizens of Philadelphia and the Pennsylvania State government. And the end of all this will be—a wing of an art building in Fairmount Park! The fate of the Boston fund was somewhat better, amounting at present more than $400,000, which will be increased by Mr. Carnegie, and a "Franklin Union" founded along the lines of Cooper Union of New York City.

THE ILLUMINATING ENGINEERING SOCIETY.

The organization in New York last week of the Illuminating Engineering Society with an initial membership little short of one hundred and the prospect of an additional enrollment of several hundred names during the next few months, indicates the rapid growth of interest in illumination as an art. While the scientific principles of artificial illumination are well established, until quite recently little systematic attention has been given to their application. The degree of illumination desirable for different purposes, the disposition of light sources for the best effect, artistic or otherwise—these and other points have in the past either been entirely ignored, or lacking exponents, have not been accorded the attention which less important details of lighting work, accepted as within the direct province of the architect and engineer, have received as a matter of course. In many cases recourse has been had for effect to barbaric lavishness of light, and it is rare, even when attempts are made at good illuminating effects, that full consideration is given to the side of the problem involving the physiology of human vision, as those subject to distressing effects on the eye from glare can testify. The new society can accomplish an admirable purpose, both indirectly by giving to illuminating engineering a recognized status, and directly through its papers and discussions by bringing together and co-ordinating the knowledge on the subject now so widely scattered, and extending it by recording data and by furthering the systematization of practice.

Whether the progress of the art of illumination will finally give rise to a distinct profession, or whether the illuminating engineer will remain an electrical engineer or gas engineer, an architect or fixture designer, with illuminating engineering as a specialty, can only be determined by the future. In view of this indefiniteness the Society has acted wisely in declaring its desire to co-operate with, and in no manner antagonize, other bodies which share with it an interest in furthering the economic, effective and artistic use of artificial light. None has a greater interest in these objects than those connected with the lighting department of the electrical industry. The electric light is ideally adapted for producing refinements in illumination of a kind impossible with other sources, and the development too long neglected of its superiority in this respect will be assisted by seconding the purposes and encouraging the work of the Illuminating Engineering Society.

TENTATIVE THEORY OF THE HEUSLER MAGNETIC ALLOYS.

Hitherto, we have not seen any theory suggested for the remarkable behavior of the copper-aluminum-manganese alloys discovered by Heusler about a year ago. The only significant circumstance suggested has been that copper and manganese are the two elements which lie nearest on each side to the group of the magnetic metals, iron, nickel and cobalt, in a table of ascending atomic weights. A tentative theory has, however, been published recently by M. C. E. Guillaume in *L'Industrie Electrique.* It is pointed out that, in general, the melting point of temperature for an alloy is less than that of the component metals. Thus, taking the metals, copper and bismuth, copper melts at 1,050° C., bismuth at 630° C. and alloys of these two metals, in some proportions, melt at a temperature as low as 490° C. Three series of binary alloys have, however, recently been discovered in which this rule is disobeyed. That is to say, the melting point of the bath containing the two metals is higher than that of either component. These alloys are aluminum-gold, aluminum-bismuth, and tin-sodium. It is suggested that, judging from these facts, aluminum and tin may possess the property of raising the temperature of fusion when alloyed with other metals. In other words, if copper be alloyed with a metal, it tends to depress the melting point of the alloy; but if either aluminum or tin be alloyed with a metal, it seems as though they tended the other way, or to raise the melting temperature. It is a curious and, perhaps, a significant circumstance, that the new magnetic alloys are two—namely, aluminum-manganese, and tin-manganese. The first discovered was aluminum-manganese, dissolved in copper in order to increase the malleability or softness of the alloy. The copper is said not to influence the magnetic property except as a mere diluent. The magnetic properties are said to depend wholly upon the amount of manganese-aluminum alloy present in constituent proportions of the formula $Mn\text{-}Al$; i. e. two parts by weight of manganese to one of aluminum. More recently, the tin-manganese magnetic alloy has been discovered, corresponding in proportions to the formula Mn_2Sn.

It is suggested by Mr. Guillaume that manganese is the essentially magnetic element in both these cases, but that this metal loses its magnetic properties at ordinary temperatures. Iron and nickel, perhaps also cobalt, lose their magnetic properties at relatively high temperatures. In iron the loss occurs at about 890° C. and in nickel at about 340° C., although the loss is less complete in the latter. The loss of magnetic properties is attributed to a change in atomic grouping. The melting point signifies also a change in atomic grouping. Above the melting point, the liquid substance is amorphous; while below the melting point the solid substance is crystalline. Now, although the change in grouping which occurs at the melting point is not that which accompanies the loss or gain of magnetic properties, yet they are perhaps associated in some manner. It may be that the property of aluminum and tin seemingly to raise the melting point of the substance with which they are judiciously alloyed is connected with the development of the magnetic properties of manganese.

INDUCTIVE BALANCES IN POWER DISTRIBUTING SYSTEMS

The tendency of the present time in electrical engineering is clearly to collate the various principles employed in diverse applications, so that the apparatus used in one branch, say telegraphy, becomes adapted to use, under structural modifications, in a very different branch, such as electroplating. An instance of this correlation is presented in the double-wound induction coils generally employed in telephony. These coils are connected across the circuit in such a manner that the two parts coact as a single inductive winding. A tap to ground between the parts places them, however, in mutual opposition, or in the balanced inductive state, so that the inductance of the device is practically nil in this ground-return circuit. Essentially similar apparatus is now being applied to the control of alternating-current distribution circuits. The *Electrician* of London recently described some of these inductive-balance devices, as noted last week in the Digest. A small magnetic circuit is overwound by a pair of similar potential coils and also by one turn of a large conductor or current-carrying main. The potential coils are connected in parallel opposition through a pair of alternating-current relay coils. The potential circuit from the bus-bars thus supplies two like branch circuits in parallel, each branch containing a coil on the small transformer and a coil on the relay. The relay coils pull upon core plungers, and the pull is normally equally strong on both; so that when the plungers are strung on a balance beam, the beam has no tendency to tilt in either direction.

If now the current in the main linked with the magnetic circuit becomes powerful, it applies an m.m.f. to the magnetic circuit and establishes thereby an induced e.m.f. in both the potential coils in the same direction. This e.m.f. sends a current through both the relay coils in series, in such a manner as to strengthen one branch current and weaken the other. The assisted relay coil preponderates in its pull upon its plunger core and tilts the balanced supporting beam, thereby closing the circuit of a switching or tripping coil. This apparatus may be used in a reverse-current cut-out by allowing the working direction of current in the bus-bar to tilt the plunger beam against an insulating stop; but if the generator in circuit with the bus-bar should fail, so that the current backs up from the system into the generator, the plunger beam will tilt in the opposite direction and close the circuit of a tripping coil operating the circuit-breaker of the generator, and cutting it off the system. The apparatus is also used for disconnecting extra transformers from secondary bus-bars at a distant sub-station when the peak of the load has passed. The strength of the method lies in the great power of a relatively small differential m.m.f., when superposed upon a pre-existing stationary m.m.f. in two relay coils. The electromagnetic pull upon the plunger is substantially proportional to the squares of the respective vector resultant m.m.f's. The difference between the squares of the augmented and diminished m.m.f's in the relay coils may readily be many times greater than the squares of differential m.m.f's alone.

Electrical Combinations.

The papers which we are now publishing regarding the work of the Public Service Corporation are worth careful study as showing a striking type of the usefulness of judicious combination. In these days of disquieting exposures of the putative just, the very name of combination may call up unpleasant mental images, but the fact is that in the present instance, as in others, there is a physical advantage in combinations which is inevitably shared by the public. It is only when combinations are formed with fundamental reference to their aqueous capacity and without due comprehension of the operative gains, that they properly may be looked at askance. So long as the public gets better or cheaper service, or both, the public ought not to grumble at the consolidation that brings this result. Primarily in the present case the object of consolidation was to prevent needless competition with its inevitable reduplication of service, and thereby to put the various operating companies on a safer financial footing. On the face of things, one may be disposed to think that the abolition of competition implies putting the thumb screw upon the public, and such is sometimes the case. There is, however, a kind of competition which hurts the competitors without helping the public, as every business man knows to his sorrow.

Combinations like the one we are here considering nearly always tend to better service by substituting uniformly good methods for a mixture of good and bad, by dealing with operative problems as a whole instead of in dissociated fragments, and by giving the whole system a financial stability and relieving it from the hand-to-mouth existence that has been the fate of many a small company. Every electrical plant for lighting or for traction has to a greater or less extent been pursuing the policy of capitalizing its blunders, and when this has been accompanied by poor general management, the result has been a constant struggle to make both ends meet. In such cases a consolidation means salvation to the service. Again, through a given territory plants have sprung up responsive to local necessities and have grown with these necessities. Presently their "spheres of influence" touch and more or less costly competition follows, seldom benefiting the consumer to any extent, but injuring the parties to it. Looking at the area as a whole, it is generally evident that the stations are located in the wrong places, the several networks are not so disposed as to help each other, the railway lines do not transfer at the right places, if at all, and the fares are both high and ill adjusted. Now it is possible, as in this case of the Public Service Corporation, for a consolidated company to step in, put the heterogeneous plants into touch with each other, replace the inefficient ones, lay out the feeder system for the whole territory, unify the transportation systems so as to get efficient transfers and through lines, and in general to give better service while itself gaining from lower operating costs and smaller general expense.

The present articles show this process still in its formative period, but yet after much has been accomplished. We are not here concerned with the financial adjustment of the system, which must stand upon its own legs, but with the results as they appeal to the consumer. Of the advantage of welding a group of local distributions into a network there is little need to speak. It secures generally a higher efficiency of security against breakdown, both of lights and traction lines. By generating current on a large scale and distributing it efficiently, the cost can be greatly reduced and the price lowered without injuring the system as an investment. The natural tendency in a small and inefficient station is the policy of small sales and high prices, while if a large system is well administered large sales and lower prices are the rule. A fine example of this is to be found in the recent great extension of telephone business at greatly reduced rates. By this trying to make the instrument a general necessity and putting it within the reach of everyone, the chance of competition is greatly reduced and the system gains enough in financial stability more than to offset the lowering of rates. Such is the really beneficient side of wise consolidation. That some consolidations are not wisely administered or organized cannot be denied, but these will bring their own punishment. It is not sufficient to bring properties under a common ownership, they must be brought under a unified system of management without losing touch with the local interests on which their prosperity depends. We could mention cases in which a central organization has been a dismal failure, merely because it has lost sight of local conditions. But, as in the case in hand, a really progressive management can work wonders in operative economy without in any way losing local support, but rather gaining it. Year by year the economical radius of electrical distribution is lengthening and at each step the advantage of unified control increases. In many regions consolidation is economic salvation.

The Illuminating Engineering Society.

We recently referred to the movement toward the organization of a national society having for its object the advancement and dissemination of knowledge relating to the science and art of illumination. At a meeting held in New York, January 10, the society was formally organized, a constitution and by-laws was adopted, and officers elected. The attendance at the meeting was about 75 and the remarks of the various speakers indicated much enthusiasm on the subject of the new society, its aims and its future. Eighty-nine members were enrolled at the meeting, at which it was decided that all those enrolled prior to February 10 will be called charter members.

According to the constitution, any person interested in the object of the society is eligible for membership, no professional qualifications being necessary. The present membership is distributed among electrical engineers, architects, gas engineers and representatives of the gas and acetylene interests, central station companies, fixture houses, etc. The next meeting will be held Tuesday evening, February 13, at the Hotel Astor, New York City, at which President L. B. Marks will deliver his inaugural address, the subject of which will be the Illuminating Engineering Society and its relation to other bodies, such as the American Institute, American Gas Association, National Electric Light Association, etc. It will be pointed out that one of the purposes of the society will be to co-operate with all other bodies having an interest in securing the best results from the various illuminants. Following is a list of the officers elected:

President, Mr. L. B. Marks; vice-presidents, Dr. C. H. Sharp and Mr. A. A. Pope; managers, Dr. A. H. Elliott, Messrs. W. S. Kellogg, E. C. Brown, F. N. Olcott, W. D'A. Ryan and W. D. Weaver; secretary, Mr. E. L. Elliott; treasurer, V. R. Lansingh.

Applications for membership may be addressed to Mr. E. L. Elliott, secretary, 25 Broad Street, New York. There will be no initiation fee for the first year and the annual dues are $5.

New York Automobile Shows.

Two great automobile shows opened to the public in New York city on Saturday evening, January 13, and will continue until the close of the evening of the 20th. At the Sixth National Automobile Show at Madison Square Garden are displayed all types of cars manufactured by members of the Association of Licensed Automobile Manufacturers operated under the George B. Selden patent; while the exhibit made by the Automobile Club of America in the new 69th Regiment Armory, about a stone's throw distant, is open to all manufacturers not operating under the Selden patent. At the Garden show the main floor is devoted exclusively to gasoline pleasure vehicles, electric and commercial vehicles being displayed in the exhibition hall and basement. A somewhat similar system obtains at the Armory show. At both shows automobile accessories are displayed in the galleries.

The decorations of the shows are extremely successful. The confusing and generally unsatisfactory jumble of decorations which has characterized previous exhibitions is entirely lacking, and a serious effort has been made in both shows to carry out an artistic and uniform decorative scheme. The result is a dignified and effective setting which brings out the exhibits to the best advantage.

At the Garden show the color scheme is white and gold. Staff columns spaced ten feet apart support classic cornices containing signs of each exhibitor. From end to end the roof is hidden by blue cloth through which concealed lights send rays down into the space below. From the upper galleries the same color scheme leads down in terraces to the main floor, banners of white and gold and pilasters and columns being interspersed. The 69th Regiment Armory is tastily embellished with a green and white decoration which harmonizes well with the industrial display.

Few radical departures from previous accepted types are to be found. Four-cylinder cars predominate; but eight, six, five, three, two and one-cylinder cars are also to be found, the latter among the low-priced cars. Most of the engines are water-cooled, but numerous methods of air cooling are also on exhibition. The water-jacket on at least one car is deposited electrically. The engine cylinder is given a thick coating of wax and on this is deposited a laying of copper. The wax is then removed by heating, leaving a water-jacket of copper the proper distance from the cylinders to permit the free passage of the cooling water. Ignition by means of the spark coil and battery still holds its own, but in the higher price cars, magnetos of the low-tension and high-tension type are fast displacing the coil and battery.

While the shows are taken up mostly with gasoline automobiles, there are at least eight electric automobiles shown at the Garden and two at the Armory, the commercial vehicles being for the most part electric. In strong contrast to the marvelously complex mechanism of the gasoline cars is the utter simplicity of the electrically propelled machines; but unfortunately the grouping of the machines does not greatly facilitate comparisons except between gasoline vehicles. Something out of the ordinary is the motor battery wagon loaned by the Ordinance Department of the U. S. Army and exhibited in the Armory show. The wagon is provided with a lathe, forge and necessary equipment for almost any kind of emergency on the battlefield.

The automobile industry can only be partly indexed in such exhibitions, yet there are almost five hundred exhibitors in the combined shows. All records for attendance have been broken.

The New York Central-General Electric Rebate Case.

At Utica, N. Y., on January 10, the New York Central and Delaware & Hudson Railroad Companies were indicted by the United States Grand Jury for giving rebates to the General Electric Company. Both corporations are charged with giving a rebate of 20 cents a ton to the General Electric Company at Schenectady on all shipments of freight, incoming and outgoing. It is asserted that this practice has been in operation ever since the General Electric shops were established at Schenectady, and that it has continued since the enactment of the Elkins law. The interesting feature of the indictment is that apparently no case lies against the General Electric Company. Indeed it is said that the question was referred direct to the Interstate Commerce Commission by the parties themselves, over two years ago, when a ruling was asked for, but no adverse decision was made.

Albert H. Harris, the general attorney of the Central, made this statement of the railroad's position:

"The General Electric Company has paid full tariff rates upon its freight over the Central and the Central, on its part, has paid the General Electric Company, on account of railroad terminal work done by it, an amount not more than sufficient to reimburse it for that expenditure. The company claims that what was done was in no sense the giving of a rebate.

"Before the finding of the indictment, and before the matter was called to the attention of the Federal Grand Jury, the railroad companies gave the Government information as to what was being done, and suggested that if there was any question as to whether this was a violation of the Elkins law, the companies would be very glad to have that question tested by a suit in equity for an injunction, and offered to co-operate with the Attorney-General to that end. Earlier still the matter was discussed with the Interstate Commerce Commission, and an informal request made for a ruling on it, but no action was taken on the request.

"Under the Elkins law a complaint of this nature can be determined in one of two ways—by an indictment or by suit in equity for an injunction. The Central is entirely willing to have the matter reviewed, but it feels, in view of the course which it has taken with the Government, that the matter might better have been tested in a civil action rather than that the aid of the criminal courts should have been invoked. As it is, the Central will submit all the facts to the court upon the trial of the indictment, and a ruling can then be had as to whether anything has been done by it which violates either the letter or the spirit of the law."

Electric Wiring in Indiana.

Frank Daniel, electrical inspector for the Indiana State Board of Underwriters, has just made a report of his inspection of twenty or more of the principal cities of Indiana and from what he discovered the electrical conditions are in imperative need of improvement. Mr. Daniel says the low standard of equipment is due to lack of knowledge and skill on the part of electrical workers. In many instances he found the chief fault was due to honest intentioned but unskilled workmen, to whom the National Electrical Code is unknown. The poor conditions are the outgrowth of a hap-hazard development marked by inharmonious additions and patchwork. In rare cases only have the electrical systems for lighting and power in the cities of Indiana had the advantage of intelligent direction from the start. Mr. Daniel said he found many cases of wiring that are the work of men or boys equipped only with nippers and a screw driver and a desire to become electricians. As a result there are many cases of wiring and electrical installation that are truly "fearfully and wonderfully made." Mr. Daniel, who is an electrical inspector of a technical college education backed by years of experience as an electrical engineer, in his report says:

"I was dumfounded by the many hazardous conditions discovered and often wonder how these faulty systems continue to distribute chained lightning to its appointed tasks with only an occasional outbreak on the part of the mysterious force."

Mr. Daniel says that large sums of money will, of necessity, be expended in Indiana in electrical betterments. Mr. Daniel cited cases where he found wooden rosettes strung like incendiary beads on a run of 80 ft. of weather proof wire which was supported by winding around iron gas cap outlets. This wire was pieced out at the feeding end with three feet of lamp cord which had a maximum capacity of two amperes. This piecing could not have been done safely with anything less than No. 8 wire which has a capacity of 33 amperes, and the lamps should have been in regulation rosettes. In the same store he found in the cashier's office and under a counter a busy fire-spitting motor. The floor under it was thick with grease and pieces of paper were ready to get busy with the first spark that should happen to fall. By all the rules of the game this store should have burned out at least ten times a day.

"I took a wooden fuse box from a millinery store. It controlled the main line carrying all lights in the store. There were fifty of these and the sole protection was the single-pole fuse there shown. All wiring was supported on wooden cleats. Wood rosettes were used and wood base stretcher. The whole equipment was blissfully in violation of the National Code," said he.

Mr. Daniel said the Badger furniture store fire in Indianapolis last month was of electrical origin and emphasizes a number of points for which professional inspectors are contending. Here a 5-hp motor was installed in a house on the roof directly over the elevator shaft. Some sort of a fault existed in the motor which caused the fuse to burn out. Instead of finding the fault and remedying it, the man in charge of the motor finally got tired of replacing fuses and to make himself less trouble put in a fuse large enough to carry the objecting current. This did the work and saved the man further annoyance, but the irritation in the motor coils of mechanism continued, causing the current to seek another avenue of escape. It finally found a weak place in the wire connecting field and armature coils and here it broke bounds and grounded. The sparks resulting fell on the oily floor under the motor and started the fire.

A recent fire in Terre Haute was started from a home-made rheostat, the arm of which was controlled by a rope passing over a window sash, the pulley of which moved the contact arm. The rheostat was constructed of small pieces of broom wire spliced together, the whole being supported in direct contact with a frame partition. Mr. Daniel closes his report by saying that competent electricians are needed. Conditions in Indiana show conclusively that most of the defects in wiring are due to ignorance on the part of local workmen. There is need for more technical knowledge among the electrical inspectors and workmen to bring conditions up to a standard.

Moving Platform for Passenger Traffic.

A dinner was given at the Waldorf-Astoria on January 15 when Captain Max E. Schmidt described and illustrated by lantern slides the application of the moving sidewalk to the passenger traffic of New York and Brooklyn Bridges, as well as to other purposes of arterial travel in Greater New York. Captain Schmidt was the inventor and engineer of the well-known successful moving platform of this character installed on the long pier at the Chicago World's Fair in 1893, pictures and data of which were brought to the notice of the audience. Views were also shown of the highly successful elevated traveling sidewalk at the Paris Exposition of 1900 and the traveling freight roadway at Cleveland, Ohio, at the present time.

The subject was discussed in its various relationships by a number of those present, including several well-known engineers and such prominent city officials as Comptroller Metz and ex-Comptroller E. M. Grout. There was a consensus of opinion that while it might be difficult to apply the system to the old Brooklyn Bridge until such time as it is taken in hand for renovation and double-decking, it could be adopted immediately for such structures as the Williamsburg Bridge and the still incomplete Manhattan Bridge. The extraordinary carrying capacity of the moving platform as compared with a train of cars, as well as the smaller amount of current needed to haul the load, were matters of great surprise to those who had not studied the subject.

Among those present, several of whom participated in the discussion, were General Eugene Griffin, Mr. L. B. Stillwell, consulting engineer of the Interborough Railroad, and Messrs. Edward D. Adams, James C. Bayles, Stuyvesant Fish and T. C. Martin. Captain Schmidt is to deliver his lecture again at an early date before the New York Electrical Society.

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Carnegie Technical Schools.

The appreciation of the educational facilities afforded by the Carnegie Technical Schools of Pittsburg is shown by the fact that no less than 7,000 applications were made for admission to the several departments of instruction. Of these, about 1,700 were for the Day School of Applied Science, nearly 4,000 for the Evening School of Applied Science, about 1,100 for the Trade School and approximately 800 for the Woman's School. The two latter have not yet been opened. Of the applicants for the two former, 623 for the Day School and 2,200 for the Evening School were found eligible to try the competitive entrance examinations. Those rejected were ineligible either on account of their youth, sixteen years being the lower limit, or on account of insufficient preparation in preparatory schools as determined by personal interview or correspondence.

The courses in the Day School of Applied Science extend over three years and comprise architectural, civil, chemical, electrical, railway motive power, foundry and mechanical practice. During the first year all students, irrespective of the course they may select, must pursue the same studies, this preliminary course being arranged to give a broad fundamental knowledge of the principles underlying the applied sciences. Only those can enter the specialized courses who during the first year give satisfactory evidence of their capacity. Those entering this school must pass satisfactory examinations in three of the four following subjects: English—ability to express thought in clear, concise and accurate English; mathematics—arithmetic and algebra as far as quadratics; science—elementary physics or chemistry; drawing—plain geometry or mechanical drawing. Certificates from high-schools or preparatory grades are accepted without an entrance examination, but no student is admitted who does not give evidence of a natural aptitude for technical work. The tuition fee is $20 per year for residents of Pittsburg, and $30 per year for all others.

The Night School of Applied Science was opened November 14, 1905. Sessions are held three evenings a week from 7:30 to 9:30 p. m.

Prof. A. J. Wurts has charge of all electrical instruction in the Carnegie Technical Schools.

The Convention and Exhibition in Chicago.

By Special Telegram.

Chicago, January 17.—This is a busy and eventful week in electrical history in this city as it witnesses the opening of the electrical exhibition and the holding of the Northwestern Electrical Convention. From the central station standpoint interest converges in the convention which was opened at 10 o'clock this morning at the Great Northern Hotel. There was the best attendance and the largest interest shown by central station men for many years past. The association appears in fact to have reached an important turning point in its history, from which new developments and advances will date.

All the papers presented are by central station men and are devoted to live central station topics. Moreover the papers are lively and interesting in their character and well prepared by their authors, while the discussion has so far reflected great credit on the efforts of President Williams and the executive committee to stimulate the participation of members and elicit valuable experiences.

After the routine business at the morning session, President Williams in his address called attention to the character of the programme this year. He also took occasion to point to the great opportunity that existed for developing and increasing the business of the majority of stations in the territory embraced by the Northwestern Electrical Association. A paper was then read by Mr. George H. Barrett, of La Crosse, on "The Proper Handling of Consumers' Meters." This was read for the author by Mr. Lord, and a good discussion in which many participated was opened up by Mr. Dinius, of Zion City.

At the afternoon session Mr. W. D. Burford, also of La Crosse, read a valuable and interesting paper full of practical data dealing with costs and details of modern underground construction. This was illustrated by stereopticon views of the new work just completed at the city of La Crosse. The paper was followed by a long discussion, also illustrated by lantern slides, by Mr. George B. Springer, of the Chicago Edison Company, on the work of that progressive corporation. Further discussion of the paper was contributed by Mr. Lukes, of Evanston; Mr. Gear, of Chicago; Mr. Almert and Mr. George Cutter.

A paper was then presented bristling with good points by Mr. G. H. Korst, of Janesville, Wis., on "Suggestions for Increasing the Power Output of Central Stations." This was well received and brought forth a brief lively discussion. The next paper—a short one—was that presented by Mr. John Williams, of Madison, Wis., on the "Organization and Development of New Business Departments." This elicited one of the best, most specific and practical discussions ever had at a central station convention on this vital topic. Mr. Almert scored the average central station manager for lax and backwoods methods, handling his victims quite severely, and outlining a specific plan of campaign for a small company. Mr. Frank R. Rae, Jr., commercial engineer, who, as is well known, has given considerable time and thought to the exploitation of central station advertising methods, gave a long talk full of good points dealing with the same question. Mr. Thomas G. Grier also discussed the subject from a very practical and pertinent standpoint. Others followed along the same line, and all of the discussion dealt with the practical side of the subjects and was extremely interesting.

For this evening theatre parties and entertainments are planned, but to-morrow the convention will get down to hard work again early in the morning. Among the papers and discussions laid out are those on the "Successful Application of New Business Methods," by Mr. John S. Allen, of Beloit; "Economies of Combined Railway and Power Plants," by Mr. Ernest Gonzenbach, of Sheboygan; "Effect of the Load Factor on Station Costs," by R. N. Kimball, of Kenosha.

Meantime the electrical show is commanding the attention and energy of practically all electrical Chicago, and the convention is to attend the show officially in a body on Thursday evening. The central station industry is to be congratulated on the vitality and interest displayed by the central station men of the West at this meeting, which augurs well for the future of the art.

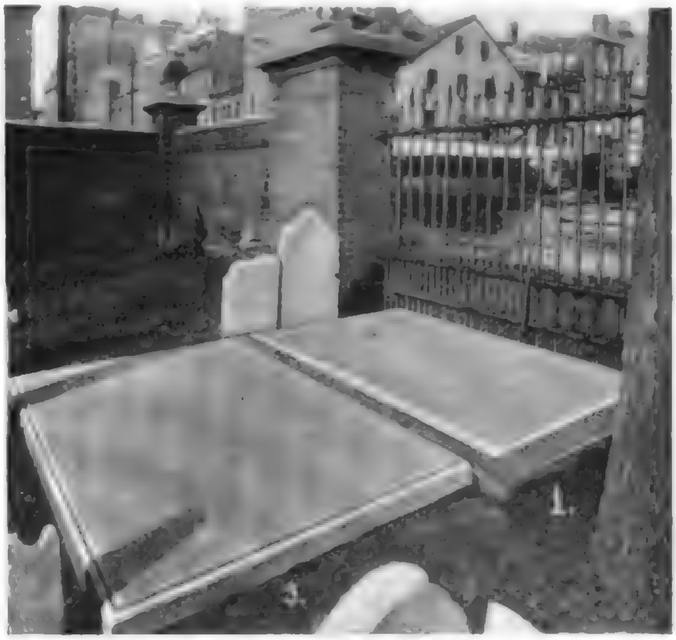
The Grave of Franklin.

On several occasions during the past dozen years there has appeared in the press severe comment on the neglected state of Franklin's tomb in Christ Church graveyard, Fifth and Arch Streets, Philadelphia. That this reproach no longer applies is indicated by the accompanying reproduction of a photograph of the grave taken a few months ago. The railing shown was substituted in 1858 for a section of the high wall enclosing the graveyard, thus allowing the tomb to be seen from the sidewalk.

The grave is located in the corner of the graveyard at the intersection of Fifth and Arch Streets. That of Franklin is the one nearest to the rail covered by a slab (1) and bears the inscription:

Benjamin
and } Franklin, 1790.
Deborah

The trunk of a stately elm which shadows the grave is shown to the right. Of the upright stones at the head of the grave, that to the left is to the memory of John Reid, the father of Mrs. Franklin, and the other (2) bears the inscription "Francis F., son of Benjamin and Deborah Franklin, deceased Nov. 21, 1786, aged four years, one month and four days. The Delight of All Who Knew Him." The large slab to the left of Franklin's grave is inscribed:



VIEW OF FRANKLIN'S GRAVE IN PHILADELPHIA.

Richard
and } Bache, 1811.
Sarah

the daughter and son-in-law of Franklin. Some years ago when excavating a part of the graveyard, a tombstone was discovered which bore the name of Dennis Franklin, a child of the great philosopher, who died at an early age.

Franklin in his will expressed the wish to be buried "with as little expense or ceremony as may be" by the side of his wife, who was interred Dec. 22, 1774; that "a marble stone be made by Chambers 6 ft. long, 4 ft. wide, with only a small moulding around the upper edge and this inscription:

Benjamin
and } Franklin, 178 —
Deborah

to be placed over us both." It would thus appear that Franklin lived longer than he had anticipated, his death taking place April 17, 1790. It is interesting to note the difference between the inscription which in his will he designated to be placed over his grave, and an epitaph he wrote for himself in 1728, when he was twenty-two years of age, as follows: "The body of Benjamin Franklin, printer (like the cover of an old book, its contents torn out and stripped of its lettering and gilding) lies here, food for worms. But the work shall not be lost, for it will (as he believed) appear once more in a new and more elegant edition revised and corrected by The Author."

Franklin was buried April 18, 1790. Muffled bells were tolled and minute guns fired, and 20,000 people formed the cortége to the grave. Mirabeau, in announcing his death to the Constituent Assembly, spoke of him as "The sage whom two worlds claimed; the man whom the history of empires and the history of science alike contend for. Antiquity would have raised altars to his mighty genius."

Village-to-Village Transmission Lines in Illinois.

In view of the present interest in the subject of supplying several country villages over transmission lines from a central station located in one of the larger towns of the group, the following list of such transmission lines now in operation in the state of Illinois is of interest:

Hillsboro to Raymond, single-phase, 16,500 volts, 15 miles, 50-kw transformers; Elmwood to Brimfield, single-phase, 6,600 volts, 6½ miles, 30-kw transformers; Fairbury to Forrest, single-phase, 4¾ miles, 6,600 volts, 50-kw transformers; Amboy to Sublette, 10¾ miles, single-phase, 6,600 volts, 30-kw transformers; Gilman to Onarga, single-phase, 2,300 volts, 4 miles; Alpha to Rio, 6 miles, 2,200 volts, also Alpha to New Windsor. North Shore Electric Company, three-phase, 10,000-volt transmission lines connecting a number of stations and sub-stations in suburban districts around Chicago.

A Tremendous Foreign Trade.

The Bureau of Statistics, Department of Commerce and Labor, reports the foreign commerce of the United States for December and the twelve months ending December, as follows:

Merchandise— December—	1905	1904.	1903.
Imports	$101,155,363	$96,564,539	$77,768,634
Exports	199,709,068	145,287,264	174,819,566
Excess exports	$98,553,725	$48,722,725	$97,050,932
Twelve months ending December—			
Imports	$1,179,358,846	$1,035,907,370	$995,494,327
Exports	1,626,962,343	1,451,352,745	1,484,753,083
Excess exports	$447,603,497	$415,445,375	$489,258,756

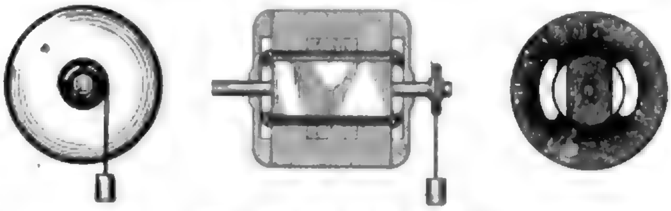
Electrical Opportunities in Massachusetts Towns.

A valuable pamphlet has just been issued by the Bureau of Statistics of Labor in Massachusetts, entitled "Industrial Opportunities not yet Utilized in Massachusetts." The pamphlet gives both in detail and in tabulated form the results of a circular letter which was forwarded to each of the 321 towns of the State, containing inquiries relative to land, water power, tax rebate, raw materials, natural products, available "help," railroad facilities, kind of business best suited to the town, water supply, light, electric railways and summer resorts. Returns were received from 231 towns, and as far as electrical opportunities are concerned it is evident that the expressions "overdeveloped East," "overcrowded New England," etc., so often heard in the newer parts of the country are still far from justified.

Of 206 towns replying to the question regarding electric light service, 104 are provided with electric lights, leaving 102 which are without central station current. In other words, nearly half the towns of the State are not yet provided with electric illumination. The electric railway facilities are much more extensive Out of 214 towns reporting to the Bureau on the transportation question, 144 are served by trolley lines, leaving but 70, or approximately one-third, without this service. In 36 towns undeveloped water power of from 100 hp upward exists. Machine shops are desired in 15 towns. While many of the towns listed in the report are small rural communities, there is no doubt that the situations in some of them are well worth investigating.

Constant-Current Transformer.

An alternating-current regulator which possesses the distinguishing feature of employing no moving coils forms the subject of a patent issued January 2 to Mr. H. J. Blakeslee. The regulator consists of a transformer having stationary, primary and secondary coils wound on a cylindrical laminated frame. The primary coil is located in an annular recess in the middle of the frame, so as to encircle the core. The secondary coil is wound upon polar projections which extend inwardly from each side of the middle of the cylindrical frame. Within the frame is placed a movable core, so mounted upon a shaft that a greater or less amount of flux from the primary threads through the secondary according to the position of the core. The current in the secondary is kept at practically a constant value by the use of a counterbalance fastened to a cord which passes around a pulley on the shaft of the core. The pull of the counterbalance tends to bring the core to the position giving maximum secondary current, and the torque due to the current in the secondary tends to bring the core to the position giving minimum secondary current. Therefore, the core being provided with a properly designed and adjusted counterbalance, the secondary coil can be made to deliver a current of constant value to a circuit of widely varying impedance.



CONSTANT-CURRENT TRANSFORMER.

Electrical Engineers of the Times.—XLV.

MR. A. PRESS.

Abraham Press was born in London June 5, 1877. He attended the Wesleyan Day School at Canterbury, Kent, and later received a scholarship at the Simon Langdon Middle Schools of the same town. From there he went to Beaufort College, St. Leonards-on-Sea, Sussex, and in 1892 came to America, where he attended the Cooper Institute Night Schools of Science and Art and graduated in 1899 with the degree of Bachelor of Science. Upon graduation Prof. William A. Anthony, of the Cooper Union,

MR. A. PRESS.

proffered Mr. Press the position of honorary assistant in electrical measurements and general physical laboratory work.

Mr. Press assumed his first position in practical work with the F. A. La Roche Company, of New York. From there he went to the Otis Elevator Company, of Yonkers, and in 1892 returned to England, where he became connected with Messrs. Siemens Bros. & Co., Ltd., at their Woolwich works. While with this great firm of international reputation Mr. Press recognized the value of acquiring a knowledge of technical German and he applied himself to the acquisition of this language as well as to the study of French and Italian. With a bent for pure mathematics, he studied vector and harmonic analyses, calculus of variations and other branches of higher mathematics. Mr. Press has applied his knowledge of mathematics to a number of interesting technical problems, such as to the theory of commutation and other complex subjects in electrical engineering. With his ready and facile comprehension of intricate mathematical subjects, Mr. Press has been enabled to make many interesting contributions to electrical engineering literature, and it may well be said that his papers invariably show some distinctive feature of value. Of the articles published in British and American technical periodicals, the following illustrate the character of his work:

"The Approximate Minimum Flux Distribution Function for Iron Loss," "The Physical Interpretation of the Design Coefficient," "The Effects of Flux Distribution in Transformers and Solenoids," "The Leakage Coefficient of Induction Motors," "Electrical Heating Time Constants and the Theory of Commutation." Mr. Press is the author of a book on "Dynamo Design," recently published. Since his recent arrival in America from Europe, Mr. Press has accepted a position in the engineering department of the Bullock Electric Manufacturing Company under the direction of Mr. B. A. Behrend.

CURRENT NEWS AND NOTES.

NEW JERSEY FRANCHISES.—In his annual message, Governor Stokes, of New Jersey, recommends the limitation of the power of municipal officers to grant franchises for public utilities. He recommends the passage of a law making it impossible for communities to grant franchises for a longer period than twenty-five years. This, he contends, would enable a readjustment of terms according to the new conditions existing at the end of this period, and would ediminate the opportunity to grant concessions other than upon strictly business and legitimate conditions.

A. I. E. E. MEETING.—The two hundred and third meeting of the American Institute of Electrical Engineers will be held in the Assembly Room of the New York Edison Company, No. 44 West Twenty-seventh Street, on Friday, January 26, at 8.15 p.m. The following papers will be presented and discussed: "Central Station Economics," by Henry G. Stott, superintendent of motive power, Interborough Rapid Transit Company; "A Self-Exciting Alternator," by E. F. Alexanderson, electrical engineer with the General Electric Company, Schenectady, N. Y.

OPENING OF SIMPLON.—U. S. Consul Keene, of Geneva, reports that the opening of the Simplon Tunnel, which was fixed for April 1, has been postponed to May, by action of the Swiss authorities. The consul says: "The official opening of the new international line through the Simplon Tunnel, after having been advertised for April 1, 1906, is now reported as being postponed until May 1. After having been for a considerable time under discussion, the mode of traction between Brigue and Domo d'Ossola—i. e., on 40 kilometers (about 25 miles)—is reported to be electrical, in accordance with a decision recently made by the Federal Department of Swiss railroads."

NEW YORK ELECTRICAL SOCIETY.—The Society's "Franklin Night" for the celebration of the bi-centenary of the birth of America's first great electrician, which was arranged for January 16, when Mr. Marconi was to lecture before the Society, and had to be postponed until March in consequence of Mr. Marconi's illness, will be given at the Edison Auditorium, 44 West 27th Street, Wednesday, January 24, at 8 p. m. Dr. M. F. O'Reilly (Brother Potamian), Professor of Physics in Manhattan College, New York, will read an address on "The Electrical Work of Benjamin Franklin." After Professor O'Reilly's address, Mr. R. R. Bowker, will speak on "Franklin as a Statesman and a Man of Letters."

PRESERVING LOCAL INTEREST.—Many large service corporations get out of touch with the communities they operate in and thus lose local support and friendliness. In the circular for the special meeting of the stockholders of the United Railways Investment Company the stockholders are requested to ratify an arrangement to give the right to subscribe to the stock at not less than par to the directors, officers and higher employes of the companies in which the Investment Company may acquire an interest. The idea is to reward these officers and employes of the subsidiary companies by giving them the right to subscribe for the stock of the controlling company. The plan is useful in arousing a certain local interest in and support of the holding company and its subsidiary in case of agitations and "strikes."

WIRELESS IN SOUTH AMERICA.—United States Consul O'Hara, of Montevideo, reports that a company has been organized for the purpose of acquiring the right to use the Marconi system of wireless telegraphy in the Argentine Republic and in Uruguay. The capital stock is placed at $6,750,000 Argentine gold, or $6,413,750 American gold. It is divided into two series. Series A has 1,200,000 shares of $5 each, and Series B 150,000 of $5 each. The prospectus further announces that all the shares included in Series B have been delivered to the English companies in exchange for benefits obtained from the use of Marconi stations already constructed or in course of construction all over the world and in payment for the patents. These shares, so contributed, will be entitled to 80 per cent of the net earnings of the company. The shares that are offered to the public are 120,000 of Series B, 30,000 having already been subscribed.

ELECTRICAL TRADES ASSOCIATION.—The annual meeting and dinner of the Electrical Trades Association of Chicago will be held in the Coliseum Annex, Chicago, on the evening of January 24. Unusual interest is being manifested at this time and the anticipation is the largest meeting of credit men in the electrical trade ever held. Many electrical manufacturers and jobbers from Cleveland to Denver and from Detroit to New Orleans will be in attendance. At the dinner Mr. James Wolff will act as toastmaster, and the programme includes responses to be made by representative manufacturers and jobbers from the Central, Western and Southern territories. The Chicago Association numbers 155 members and the records for the past year will show remarkable work accomplished for its members through co-operative protection of credits. Mr. Frederic P. Vose, Marquette Building, Chicago, secretary and general counsel for the association.

TELEGRAPHY IN YUCATAN.—Belize, the capital of British Honduras, is now connected with the United States by the telegraph. U. S. Consul Avery explains that formerly messages were sent to New Orleans, then carried every Thursday by mail to Belize, requiring three days, or ten days if the weekly mail was missed at New Orleans. No tariff has yet been fixed, but the probable through rate from the United States will be $1 per word. The new telegraph lines connect with the Mexican system. The Mexican department of war erected the line from Payo Obispo, via Santa Cruz, to Peto, Yucatan, about 225 miles—in 1901, solely for official purposes. Last November it was transferred to the department of public works and its use granted to the general public. Payo Obispo, Mexico, is across the Rio Hondo, 6 miles from Consejo, British Honduras. This gap in the telegraph line requires a boat as yet to carry the messages, but as soon as Mexican authority is granted a cable will be laid under the river. There will then be an unbroken line established from Belize to Galveston. The new line means much for American commercial interests in that region.

A ROYAL PRIZE.—In connection with the Milan International Exhibition of this year the King of Italy has offered among other prizes one of $10,000 for a simple and manageable apparatus to protect electrical mechanics from danger incurred in the performance of their duties.

NO CABLE, NO FLAG.—The London *Chronicle* says: "The novelty of a sale by auction of a British island is announced, the "lot" being the Fanning Island, and the auctioneer the Registrar of the British High Commissioner's Court at Fiji, who has issued advertisements in true auctioneer's style. The island contains only 150 inhabitants, and was seized by the British in 1888 as lying in the path of a possible submarine cable between Canada and Australia. The purchaser may turn his bargain to account by trading in mother-of-pearl, coral and guano."

COMMON SENSE NEEDED.—In commenting on a recent incident, the *Baltimore American* says: "The overconscientiousness of the Philadelphia telephone girl who refused to make connection with the Fire Department because the man at the other end of the line had not the necessary nickel to put in the slot nearly cost a life, and was another striking instance of the scarcity of common sense in the places where it is most needed. Ordinarily it is this ability to exercise common sense in an emergency that makes a human being more desirable in positions of responsibility than a mechanical contrivance. If it were otherwise the preference would be given in every instance to the automaton."

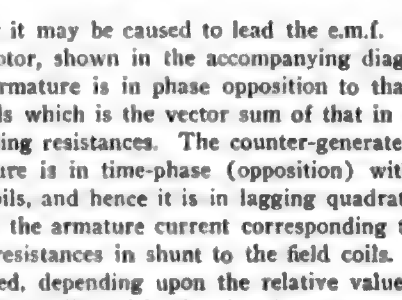
DEFECTIVE PARIS SUBWAYS.—A cable dispatch from Paris of January 13, says: "Investigation by members of the Paris Municipal Council has revealed serious defects in the Metropolitan underground railway, now in course of construction. Walls and pillars were found to have been constructed of a thickness much less than that specified by the contracts, and in many places the material used was too old to be lasting. At one point where the subway crosses a large stream, it was found that the supporting pillars were only 6 in. in diameter, instead of 50. The engineers in charge of the work and the contractors say the workingmen have disregarded their instructions received."

A STATUETTE OF MORSE, the gift of the Dutchess County Society of New York State, has been adopted by Sir C. P. Clarke, art director for the Metropolitan Museum of Art. It is supposed to be of French origin, and made in the early fifties. It is in bronze. In presenting the statuette at a public dinner last week Major F. H. E. Ebstein dwelt upon the career, with its hardships and ultimate triumphs, of Morse, claiming him as a citizen of Dutchess County, because he spent many years of his life there and died there. He added: "Before me is a statuette of Prof. Morse. It was discovered by William F. Kanerberg in the cellar of a London dealer in objects of art. He had bought it twenty years ago with other objects belonging to the estate of an English nobleman. It came into the possession of Mr. Charles Anthony Fowler, who was born in Dutchess County, who presented it to us. Believing that it ought to be in the Metropolitan Museum of Art, we present it to that organization through Sir Caspar Purdon Clarke."

AN INSURANCE GLOSSARY.—Announcement has been issued by the National Fire Protection Association, through Mr. W. H. Merrill, Jr., secretary, that the Committee on Uniformity of Requirements is prepared to compile a glossary of words, terms and phrases used in connection with the insurance business or the various trades, arts and sciences with which that business has to deal, and which are more or less commonly used or referred to in the reports and standards of the association. To that end the committee will undertake to list and define any words, terms or phrases that may be sent for that purpose to its chairman. The committee will also be glad to receive suggestions of definitions along with the words in cases where members have already made research and determined the same. Words having a special meaning in connection with trades and manufactures different from that commonly given them; or words having a meaning in one section of the country different from that attaching in another section; or words given a meaning different from any set forth in the dictionaries; along with special terms and phrases of similar character are of the kind that, if furnished, the committee will be glad to work upon. The committee, however, cannot undertake to hunt up this material for itself and, unless members co-operate by furnishing it, a glossary cannot be prepared. The assistance of every member is, therefore, earnestly requested. The chairman of this committee is Mr. H. E. Hess, 32 Nassau Street, New York City.

CORNELL UNIVERSITY GROWTH.—The 1905-6 register shows that the total number of regularly enrolled students in the University, exclusive of the students in the summer session and the short winter course in agriculture, is 3,385, an increase of 155 over last year. The total number of professors, assistant professors, etc., on the instructing staff is 473, an increase of 44. The requirements for the A.B. degree, the only degree awarded by the College of Arts and Sciences, have been made to include not only the satisfactory completion of a specified amount of elective, but also the completion of a four-year course of resident study. The University thus gives effective expression to its disapproval of the proposed shortening of the A.B. course. The College of Arts and Sciences will hereafter occupy the Goldwin Smith Hall, now nearing completion, at a cost of more than $300,000. The Rockefeller Hall of Physics, which is also to be completed for the opening of the year 1906-7 at a cost of $250,000, will give the University what is stated to be one of the finest and best equipped physical laboratories in existence. The College of Civil Engineering and the Sibley College of Mechanical Engineering both show large increases in attendance, the former now registering 418 students and the latter 1,086. Only the one degree of M.E. is now awarded in Sibley College, though students are allowed to specialize during their senior years in electrical engineering, railway mechanical engineering, naval architecture, etc., for which special certificates are given.

COMMUTATOR MOTOR WITH HIGH POWER-FACTOR.—A patent issued January 9, to A. S. McAllister relates to the improvement of the power factor of single-phase commutator motors. A non-inductive resistance is placed in shunt across the field winding of the machine, so that the field flux will lag behind the main circuit current. Under speed conditions the e.m.f counter generated at the armature by its rotation through the field flux will be in electrical time phase with the flux, and hence will lag behind the main circuit current. When the counter generated speed e.m.f. forms a sufficiently large part of the total circuit e.m.f., the main circuit current will be in phase with the circuit e.m.f., or it may be caused to lead the e.m.f. In the induction-series motor, shown in the accompanying diagram, the current in the armature is in phase opposition to that in the compensating coils which is the vector sum of that in the field coils and the shunting resistances. The counter-generated speed e.m.f. at the armature is in time-phase (opposition) with the current in the field coils, and hence it is in lagging quadrature with that component of the armature current corresponding to the current through the resistances in shunt to the field coils. At a certain armature speed, depending upon the relative values of the currents in the field coils and in the shunting resistances, the armature current is in phase with the circuit e.m.f. and the power factor is unity. At a higher speed or with a decrease of the shunting resistance the machine takes a leading current from the supply system.



MONORAIL.—The Behr Monorail Co. has applied to the Rapid Transit Commission for a route from the subway terminal in Brooklyn to Coney Island. The cars of this system rest upon a single raised rail and are shaped like an inverted V.

THE HIGHEST RAILWAY STATION, it is said, is that on Eismeer, at the Jungfrau electric railway. It is more than 10,000 ft. above sea level, and part of it is hollowed out of the rock of the mountain. This may be the highest electric station, but we are under the impression that there are one or two higher on steam railroads on the American continents.

BROOKLYN WIRES.—Borough President Coler has informed the public service corporations of Brooklyn, N. Y., that no more permits will be issued for the erection of poles along the streets, except those necessary for street lights. He said it is his purpose to compel the corporations to use underground conduits for all new work, and, if he finds he has the power, he will insist that all poles now standing be taken down and the wires strung upon them placed underground. A great deal of work has been done by the corporations in recent years in laying underground wires and cables.

SETTING ELECTRIC FIRES.—A special telegram from Delaware, O., of January 13, says: "An apparent plot to destroy the Carnegie Library here was discovered to-day. The library building, the $20,000 gift of Andrew Carnegie, is nearly completed. It was found that electric wires had been disconnected, cut, wrapped, and then sunk head in in wood about the building. These places were covered by highly polished ornaments. With the current of electricity turned on, as it will be the opening night, the building certainly would have been set afire. The work was done by an expert electrician."

GENERATING SINE-CURVE ELECTROMOTIVE FORCES.—In order to eliminate the upper harmonics from the curve of electromotive force of an alternator, K. A. Lindstrom, of Vestrias, Sweden, according to a patent issued January 9, would so arrange poles of different polarity of the magnetic field in relation to the halves of the windings of the armature that the harmonics generated in the one half will be practically displaced half a period in relation to the harmonics generated in the other half, so that the harmonics will nullify each other and the curve of electromotive force will be free from distortions.

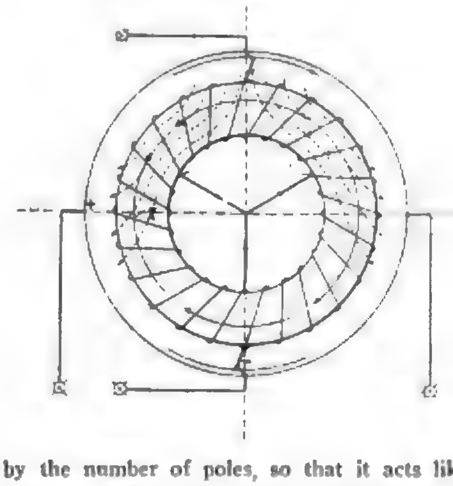
WIRES WEATHER-WISE.—According to a dispatch from Berlin, Germany, Dr. Eydam, a noted meteorologist, has discovered a new and extremely simple kind of barometer. It consists of the telegraph wire which is strung from pole to pole along the roadsides. Dr. Eydam declares that by listening closely to the sound made by the wind blowing across the wires any one can tell exactly what the weather is likely to be several days in advance. If the wires emit a deep, mellow and sustained note, like that of an organ, it means that the weather will be showery, with possible gales. A sharp, high note foretells cold, stormy weather, with, in winter, snow and sleet.

THOUSAND-MILE SPEECH.—As an incident of the printers' strike in New York and other cities, the Typothetæ or organizations of master printers are keeping in close touch by novel means. Between New York and Chicago, the long-distance telephone and the phonograph combined are used. In the office of the Chicago Typothetæ there is a megaphone which is connected with the long-distance telephone. The megaphone is placed in the room where the meetings of the Typothetæ are held daily. It acts as a receiver for the telephone transmitting to New York the speeches of the members of the Typothetæ, thus allowing the New York employers to learn exactly what their friends in Chicago are doing. In the same way the members of the Chicago Typothetæ are able to keep track of the progress of the New York fight, and the members of the two associations are as well informed as to each other's doings as though they were meeting in the same room, instead of hundreds of miles apart. The results are satisfactory

VIBRATIONITIS.—A cable dispatch from London of January 13 says that the increasing heavy underground traffic, in addition to the vibration caused by the underground railways, threatens Londoners with new troubles. "Vibrationitis" is said not only to cause disordered nerves, but it also affects structures. Dr. Winter Blyth, medical officer of health for the St. Marylebone Council, reports that the vibration from the heavy traffic and from the underground railways is having serious effects in St. Marylebone and St. John's Wood. "There have been so many instances of absolutely new drainage, namely earthenware pipe, embedded in concrete, in St. Marylebone, becoming defective in consequence of this excessive vibration, that I have been compelled to recommend iron in the place of earthenware pipes. The best built houses are also liable to be affected, and building accidents great and small have greatly increased of late years. In our own office in Upper Gloucester Place, Baker Street, I have found it impossible to put up a simple scientific instrument, such as a spectroscope, for photographic purposes, while at times the vibration is so great that it sets the telephone bell ringing." Nothing of this kind is known in connection with the New York subways.

POWER IN GERMANY.—U. S. Consul-General Richard Guenther, of Frankfort, reports as follows regarding the utilization of waterways in Germany for the production of electric power: "In the Prussian department of public works a monograph has been prepared with reference to the utilization of the water power created through the canalization of the rivers Moselle and Saar. It states that at the dams of the Moselle in Prussian territory about 35,000 horse-power and in the territory of Lorraine about 5,000 horse-power, and at the dams of the Saar about 10,000 horse-power will be available, a total of about 50,000 horse-power. This power will not at once be utilized at all the dams, and if so not to the full extent. For supplying larger amounts of power to the existing iron furnaces in Lorraine and in the Saar district, it is unfavorable that the furnace gases developed in the process are already used for generating power. For the larger cities, as Coblenz, Trier and Metz, however, the power of the dams in the vicinity could be profitably used, and the existing steam-electricity works could be utilized as a reserve and supplement for the water power created by the new dams."

SELF-STARTING SINGLE-PHASE INDUCTION MOTOR.—In a patent issued January 9, to M. Deri, of Vienna, Austria-Hungary, is disclosed a method for introducing special currents into the secondary of a single-phase induction motor for the purpose of giving to the rotor a starting torque and of supplying the exciting magnetomotive force during normal operation. The rotor winding is short-circuited at a number of points divisible by the number of poles, so that it acts like a short-circuited secondary when the rotor is at full speed. The rotor winding is provided with a commutator the brushes on which are joined in series with the primary circuit either directly or by means of a transformer. The current introduced through into the rotor by way of the brushes, serves to give a starting torque to the rotor and assists in exciting the machine when full speed is reached.



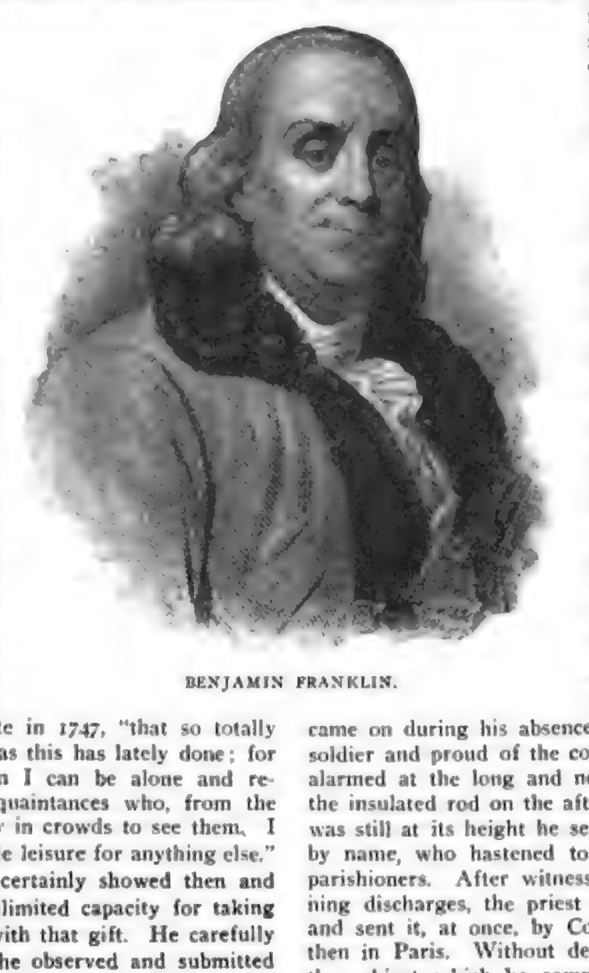
Franklin and de Romas; or the Lightning Kite.

By Brother Potamian, Sc.D., *Lond.*
Professor of Physics in Manhattan College, New York.

I.

ANECDOTES relating to the pioneers of science have a peculiar fascination, especially for the youthful mind. A trivial occurrence, a quixotic performance, eccentricities of every kind are circumstantially remembered even when the achievements which made the men famous are often but dimly recollected. It is thus with the Eureka of Archimedes, Newton's apple and Franklin's kite. These incidents seem so natural that the delighted tyro refuses to consider them otherwise than authentic facts, as well established, forsooth, as the principle of upward pressure, the theory of universal gravitation or the identity of lightning and electricity with which they are severally connected.

Not so, however, experts in the "higher criticism," who are wont to announce their findings with statuesque unconcern for cherished traditions and pet theories alike. At one time it is the feat of the Syracusan philosopher that is branded as insane; at another, the falling apple is dismissed as too trifling to suggest a law of nature; while to-day it is the kite of the Philadelphia printer that is to be robbed of its charm and relegated to the limbo of myths.



BENJAMIN FRANKLIN.

The doubt concerning the kite performance was raised in an editorial note of the Electrical World and Engineer for April 1, 1890, in which it was asked whether Franklin ever made the experiment with which his name is associated; and, if so, whether he was not anticipated by M. de Romas in France. An attempt will here be made to answer both these queries, the writer drawing liberally on the Franklinana of the Wheeler collection of the American Institute of Electrical Engineers for the purpose.

Franklin was in his fortieth year when his attention was first drawn to electrical matters by a lecture which he happened to attend in his native town of Boston in the summer of 1746. Forthwith, glass rods and silk handkerchiefs were eagerly sought; and energetic rubbing became a serious occupation with the former journeyman printer. "I never before was engaged in any study," he wrote in 1747, "that so totally engrossed my attention and my time as this has lately done; for what with making experiments when I can be alone and repeating them to my friends and acquaintances who, from the novelty of the thing, come continually in crowds to see them. I have during some months past had little leisure for anything else."

If Franklin was not a genius, he certainly showed then and afterwards a good amount of the unlimited capacity for taking pains which is said to be associated with that gift. He carefully analyzed the new phenomena which he observed and submitted his explanations to the test of repeated experiment, knowing intuitively that experiment must be the touchstone of all theory. In this safe, practical way he soon discovered a number of facts about Leyden jars, then a novelty,[1] and the properties of points which subsequently proved of great importance both in electrical theory and in practical work. Some of these he communicated to Peter Collinson, of London, who had business relations with some merchants in Philadelphia. Collinson recognized at once their originality and importance, and hastened to make them known to fellow-members of the Royal Society. By these letters Franklin's name became noised abroad; and by association, that of Collinson was saved from oblivion.

In communicating Franklin's letters to the Royal Society, Collinson sought to have them accepted by the council for publication in the *Philosophical Transactions* of the year; but in this he was disappointed, as the electrical gropings of an uneducated colonial did not commend themselves, at the time, to the officials of that learned body! Even Franklin's memorable letter on the identity of lightning and electricity was dismissed with derisive remarks. Collinson regretted very much the action of the society; and, without waiting for a change of views, proceeded to publish Franklin's letters under the title of *New Experiments and Observations on Electricity made at Philadelphia in America.* The pamphlet appeared in 1751 and was almost immediately translated into French by M. d'Alibard, an academician, at the request of Count de Buffon. Unlike the original, the translation was eagerly bought up, a fact which shows the widespread interest in the new order of phenomena that had already been awakened in France by the experiments of Dufay and the brilliant demonstrations of Abbé Nollet. The Royal Society recognized, at last, the mistake that had been made, and condescended to offer a three-fold reparation for its contemptuous treatment of Franklin (1) by inserting in the *Phil. Trans.* a comprehensive account of his electrical discoveries drawn up by the celebrated Dr. Watson; (2) by electing him a member of the society, and (3) by awarding him the Copley medal in 1753.

Franklin's experiments were taken up in Paris with great enthusiasm by Count de Buffon, the naturalist; by M. de Lor, an instructor in physics; and by M. d'Alibard, a botanist of distinction. All three agreed to experiment independently with pointed conductors in accordance with the instructions given by Franklin; and all were finally able to report success; d'Alibard, on May 10; de Lor, on May 18, and de Buffon, on May 19, 1752. De Buffon erected his rod on the tower of his château at Montbar; de Lor, over his house in Paris, and d'Alibard, at his country seat at Marly, a little town eighteen miles from Paris. D'Alibard was not at home on the eventful afternoon of May 10; but before leaving Marly, he had drilled a certain Coiffier as to what he should do in case an electric storm came on during his absence. Though a hardy and resolute old soldier and proud of the confidence placed in him, Coiffier grew alarmed at the long and noisy discharges which he drew from the insulated rod on the afternoon of May 10. While the storm was still at its height he sent for the Prior of the place, Raulet by name, who hastened to the spot, followed by many of his parishioners. After witnessing a number of brilliant and stunning discharges, the priest drew up an account of the incident and sent it, at once, by Coiffier himself to d'Alibard, who was then in Paris. Without delay d'Alibard prepared a memoir on the subject which he communicated to the Académie des Sciences three days later, viz.: on May 13. In the concluding paragraph, the polished academician pays the following graceful tribute to the philosopher of the Western World:

"Il résulte de toutes les expériences et observations que j' ai rapportées dans ce mémoire, et surtout de la dernière expérience faite à Marly-la-ville que la matière du tonnerre est incontestablement la même que celle de l'electricité; la voilà devenue une réalité; et j'ose croire, que plus on approfondira tout ce qu'il (Franklin) a publié sur l'electricité, plus on reconnaitra combien la physique lui est redevable."[*]

This reads: "It follows from all the experiments and observations contained in the present paper and more especially from the recent experiment at Marly-la-ville, that the matter of lightning is, beyond doubt, the same as that of electricity; it has become a reality, and I believe that the more we realize what he (Franklin) has published on electricity, the more will we acknowledge the great debt which physical science owes to him."

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[1] Credit is given for the discovery of what came to be called the "Leyden Jar" to Dean von Kleist of Cammin in Pomerania, October, 1745. It is also attributed to Musschenbroek of the University of Leyden, January, 1746. The claim of Cunæus, a friend of the distinguished Dutch professor, is debatable. Franklin gave the theory of the jar in September, 1747. The reader will recall his "fulminating pane" and that most ingenious device his jar with movable coatings, as well as the terms positive and negative which he introduced to replace the terms vitreous and resinous of his French contemporary, Dufay.

[*] The works of Dr. Benjamin Franklin, Vol. III, p. 86. Philadelphia, 1809.

We may, in passing, correct the error of those who credit French physicists with having originated the idea of the pointed conductor. Such writers should read the words of d'Alibard in the beginning of his memoir, where he says: "En suivant la route que M. Franklin nous a tracée, j'ai obtenu une satisfaction complète;[2] that is, "In following the way traced out by Franklin, I have met with complete success." To Franklin, therefore, belongs the idea of the pointed rod of 1750, which became the lightning conductor of subsequent years; to the Parisian savants belongs the great distinction of having been the first to make the experiment and verify the Franklinian view of the identity of the lightning of our skies with the electricity of our laboratories.

This leads to the focal point of the present inquiry, for it was while awaiting the erection of a public building in Philadelphia on which to raise his rod that the thought of the kite occurred to Franklin. Here is his letter anent the matter, written to Collinson on October 19, 1752.[3]

"As frequent mention is made in public papers from Europe of the success of the Philadelphia experiment for drawing the electric fire from clouds by means of pointed rods of iron erected on high buildings, it may be agreeable to the curious to be informed that the same experiment has succeeded in Philadelphia, though made in a different manner, which is as follows:

"Make a small cross of two light strips of cedar, the arms so long as to reach to the four corners of a large thin silk handkerchief when extended; tie the corners of the handkerchief to the extremities of the cross, so you have the body of a kite, which being properly accommodated with a tail, loop and string, will rise in the air, like those made of paper; but this being of silk is fitter to bear the wet and wind of a thunder-gust without tearing. To the top of the upright stick is to be fixed a very sharp-pointed wire, rising a foot or two above the wood. In the end of the twine next the hand is to be held a silk ribbon and where the silk and cord join a key may be fastened. This kite is to be raised when a thunder-gust appears to be coming on, and the person who holds the string must stand within a door or window, or under some cover, so that the silk ribbon may not be wet; and care must be taken that the twine does not touch the frame of the door or window. As soon as any of the thunder clouds come over the kite, the pointed wire will draw the electric fire from them, and the kite with all the twine will be electrified, and the loose filaments of the twine will stand out every way, and be attracted by an approaching finger. And when the rain has wetted the kite, so that it can conduct the electric fire freely, you will find it stream out plentifully from the key on the approach of your knuckle. At this key the phial may be charged, and from electric fire thus obtained spirits may be kindled, and all the other electric experiments be performed which are usually done by the help of a rubbed glass globe or tube, and thereby the sameness of the electric matter with that of lightning completely demonstrated."

Here we have the electric kite and manner of using it fully described without, however, any direct statement that the author himself actually experimented with it, although he does say that the experiment was successfully carried out. This is strictly true, but it may be safely contended that the precautions enumerated, the observation about the fibres of the cord, its improved conductivity when wetted by the rain and the like, all bespeak a knowledge of practical conditions that could be obtained only by way of experiment.

But if Franklin is not outspoken on the matter, some of his contemporaries are. Here is the kite incident as related in the *Continuation of the Life of Dr. Franklin,*[4] by Dr. Stuber, a Philadelphian and intimate friend of the Franklins:

"While Franklin was waiting for the erection of a spire, it occurred to him that he might have more ready access to the region of clouds by means of a common kite. He prepared one by fastening two cross-sticks to a silk handkerchief, which would not suffer so much from the rain as paper. To the upright stick was affixed an iron point. The string was as usual of hemp, except the lower end, which was silk. Where the hempen string terminated, a key was fastened. With this apparatus, on the appearance of a thunder-gust approaching, he went out into the commons accompanied by his son to whom alone he communicated his intentions, well knowing the ridicule which, too generally for the interest of science, awaits unsuccessful experiments in philosophy. He placed himself under a shed to avoid the rain. His kite was raised. A thunder cloud passed over it. No sign of electricity appeared. He almost despaired of success, when suddenly he observed the loose fibres of his string move toward an erect position. He now presented his knuckle to the key and received a strong spark. Repeated sparks were drawn from the key, the phial was charged, a shock, and all the experiments made which are usually performed with electricity."

This testimony of a man who enjoyed the unlimited confidence of Franklin, has a very matter-of-fact ring about it; there is not a note of uncertainty, not a word indicating doubt that his friend and neighbor went out to the fields accompanied by his robust son, carrying along with them a queer assortment of electrical impedimenta. This son, William by name, was twenty-two years of age at the time; and, as he died in 1813, eleven years after the publication of Dr. Stuber's biographical sketch, he had ample time to contradict the kite story if instead of being a fact it were a mere romance. Nor is this all, for Dr. Stuber's narrative, given above, appears textually in the "Memoirs of the Life and Writings of Benjamin Franklin," edited by his grandson, William Temple Franklin. The Doctor, be it remarked, was very fond of this grandson, whose "faithful service and filial attachment" he warmly commends in several of his letters, and whose regard for the memory of the statesman led him to undertake the task of preparing his works for publication. On page 211, Vol. I, he tells us that "As Dr. Franklin mentioned his electrical discoveries only in a very transient way, and as they are of a most important and interesting nature, it has been thought that a short digression on the subject would be excusable and not void of entertainment. For this purpose the following account of the same, including the first experiment of the Lightning Kite, as given by Dr. Stuber, is here given."

In these concluding lines we have the testimony of Franklin's grandson to the authenticity of the "Lightning Kite" story. Moreover, the account as given by Stuber evidently meets with his cordial approval since he transcribes it verbatim; and, as if to invest the quotations with unimpeachable authority, he tells us in the preface, p. viii, that "they deserve entire dependence because of the accuracy of the information imparted."

A word now from Priestley, also one of Franklin's intimate friends. In his *History of Electricity*, fourth edition, p. 171, he says that "Dr. Franklin, astonishing as it must have appeared, continued actually to bring lightning from the heavens by means of an electrical kite which he raised when a storm of thunder was perceived to be coming on." Then follows a description taken almost word for word from Dr. Stuber, whom he styles "the best authority on the subject."[*]

If, perchance, the above testimony should not be deemed conclusive and final, all lingering doubt must be removed by Franklin's own words, for in his autobiography, after briefly referring to the experiments made in France with pointed conductors, he adds: "I will not swell this narrative with an account of that capital experiment (the pointed conductor) nor of the infinite pleasure which I received on the success of a similar one I made soon after with a kite at Philadelphia, as both are to be found in histories of electricity."

Here, at last, we have Franklin's own word for it that he made the kite experiment and that he made it "soon after" the demonstration of his electrical discoveries which M. de Lor gave, by request, before Louis XV and his court.

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[2] The Works of Dr. Benjamin Franklin. Vol. III, p. 82, Philadelphia, 1809.

[3] The Works of Dr. Benjamin Franklin. Vol. III, page 110, Philadelphia, 1808.

[4] The Complete Works in Philosophy, Politics and Morals of the Late Dr. Benjamin Franklin. Vol. 1, p. 108, London, 1806.

[*] One of the earliest books on electricity published in the United States, *An Epitome of Electricity and Galvanism*, by two gentlemen of Philadelphia (Green and Hazard), 1809, has the following words: "Dr. Franklin made the assertion (of the identity of lightning and electricity) in 1750 and afterwards demonstrated its truth by undeniable experiment in 1752. This discovery is almost the only one in the whole science which has not been the result of accident." p. 42.

II.

As to when this demonstration was given before the court, a letter from Abbé Mazéas, a distinguished physicist, will enable us to form some idea. Writing to Dr. Stephen Hales, the English philosopher, on May 20, 1752, he says that the "Philadelphia experiments which Mr. Collinson was so kind as to communicate to the public, having been universally admired in France, the King desired to see them performed. Wherefore the Duke d'Ayen offered His Majesty his country house at St. Germain, where M. de Lor, demonstrator of experimental philosophy, should put them into execution. His Majesty saw them with much satisfaction and greatly applauded Messieurs Franklin and Collinson. The applause of His Majesty having excited in Messieurs de Buffon, d'Alibard and de Lor a desire of verifying the conjecture of Franklin upon the analogy of lightning and electricity, they prepared themselves to make the experiment."

From this we infer that the electrical performance before the court must have taken place in the beginning of May, if not earlier, as some days must have intervened between the excitement it created in the mind of d'Alibard and the phenomenal success which he subsequently achieved on May 10.

It must be conceded that Franklin's adverbial phrase "soon after," as recorded above, is provokingly indefinite. Stuber, however, is a little more satisfactory; for after saying with exasperating rhetoric that "It was not until the summer of 1752 that Franklin was enabled to complete his grand and unparalleled discovery by experiment," he adds further on that it was made in the month of June. But why did not the Doctor, who was Franklin's neighbor and friend, state the day as well as he states the month and the year? Nor is Priestley any more precise; although he lived on terms of intimacy with Franklin during the philosopher's long residence in London, he volunteers no other information on the chronology of the electrical kite, save that the experiment was made "in June, 1752."

There can be no doubt that Franklin saw Priestley's account of his memorable experiment when the *History of Electricity* came out in 1767, if indeed, he did not see it in manuscript. What is certain is that he never found fault with the illustrious chemist and historian of electricity for exhibiting him to the world in the rôle of a kite-flyer; nor did he say a word in criticism of the time assigned for such a frolic. As we cannot impugn the veracity of Franklin or question the accuracy of Priestley or Stuber, we must conclude that June was the month of the year 1752 in which Franklin raised his kite to the sky and "drew lightning from the clouds."[*]

III.

We have now to see whether Franklin was anticipated in the idea of the kite or in its use for electrical purposes. There are some who hold that he was anticipated by M. de Romas as to the idea, but not the actual experiment; while others credit the French magistrate with both. Let us examine the evidence which there is for these opinions.

M. de Romas lived in Nérac, a small town some seventy-five miles south of Bordeaux. He was a member of the bar; and at the time of the Franklinian furor in Europe was a judge of the district court. He took an interest in scientific matters quite unusual for men of his profession, proceeding, as soon as he had read of the efficiency of pointed conductors, to study their behavior for himself. His experiments met with surprising success, and were as much admired by the local savants as they were dreaded by the common folk. Letters containing his observations were daily sent to the Academy of Bordeaux, where they were read with lively interest on account of their character and novelty. From the published *Actes* of that body we learn that the first kite used by de Romas was raised by him on May 14, 1753. Disappointment, however, attended this attempt, no electrical manifestation being observed, although rain fell and wetted the hempen cord. The magistrate of Nérac attributed his failure to the resistance of the string; and, like a good electrician, surprisingly good for the time, determined to improve its conductivity by wrapping a fine copper wire round its entire length. When this long and tedious operation was completed he went out again to the fields on a stormy day, when assisted by two of his friends, he raised the kite and soon got torrents of sparks from the wire-wound cord. This was on June 7, 1753. The experiment was repeated from time to time, both for his own satisfaction and that of his assistants, as well as for the entertainment of his ever-growing class of admiring spectators. Kites 7½ ft. long and 3 ft. wide were raised 400 and even 550 ft. above ground when flashes nine feet long and an inch thick were drawn, so the account says, with the report of a pistol. The effect must have been truly spectacular. The kite was held by a silk ribbon fastened to the end of the hempen cord.

It is then a matter of history vouched for by the *Actes* of the Academy of Bordeaux that May 14, 1753, is the day on which the first use of a kite for electrical purposes was made in France; on the other hand, it is to be remembered that Franklin flew his "lightning kite" in June, 1752, almost a year earlier. As far, then, as the *fact* is concerned, the Philadelphia philosopher was not anticipated by the Justice of Nérac.

From facts let us pass to writings. Franklin's letter to Collinson, in which he describes the electric kite, is dated October 19, 1752, while that of M. de Romas, on which the claim for priority is founded, was addressed by him to the Academy of Bordeaux on July 12, 1752, three months earlier. After a lengthy and interesting account of his experiments with pointed conductors, he concludes his communication as follows:

"C'est là, Monsieur, ce qu' il y a de plus important, car j'aurais bien d'autres particularités à vous communiquer; mais ma lettre, devenue d'une excessive longueur, m'avertit de finir. Je me réserve de mettre au jour la dernière (quoiquelle ne soit qu'un jeu d'enfant) lorsque je me serai assuré de la réussite par l'expérience que je me propose d'en faire et que je ne negligerai pas."

In English this would read: "Such, Sir, are the more important points which I have to communicate, and to which many others might be added, were it not for the excessive length of this letter, which warns me that it is time to bring it to a close. I will, however, give publicity to the last one of all (though it is only a child's plaything) as soon as I shall have assured myself of its success by an experiment which I have devised and which I shall not fail to make."

The words in brackets—"though it is only a child's plaything"—are all important, for it is on them and on them alone that the claim for priority has been put forth and maintained. It will be seen that the word kite (*cerf-volant*), does not occur in the letter, so that there can be no absolute certainty as to the nature of the *jeu d'enfant* which the author had in mind, though it is very likely that the kite was meant. In his *Mémoire sur les moyens de se garantir de la foudre dans les maisons*, he says, after describing some experiments that he had made with pointed rods: "Néanmoins toujours plein du désir d'augmenter le volume du feu électricque, il fallut chercher le moyen pour y parvenir. En conséquence, je me plongeai dans de nouvelles méditations. Enfin une demi-heure après, tout au plus, le cerf-volant des enfants se présenta tout à coup à mon esprit, et il me tardait de la mettre à l'épreuve. Par malheur, je n'en avais pas le temps." In English: "Being anxious to augment the quantity of electric fire, I began to think of some means to effect my purpose, and soon became quite absorbed with the subject. Not more than half an hour elapsed before the idea of the kite suddenly occurred to me, and I longed for an opportunity to try it; but unfortunately I had not sufficient leisure at the time." The work in which this passage occurs was published at Bordeaux in 1776, shortly after the death of the author. De Romas always maintained that he did not borrow the idea of the kite from any one, but that it occurred to him while pursuing his experiments with pointed conductors.

It must be admitted that de Romas could not have been acquainted with Franklin's performance of June, 1752, when he sent to the Bordeaux Academy his letter of July 12 of the same year, for we cannot suppose that in an age of sailing vessels such news would cross the Atlantic and reach an obscure provincial town in the southwest of France in the space of a month. On the other hand, it is equally improbable that a vague allusion to the electrical use of a kite made at Nérac on July 12 by a man entirely unknown to fame as was de Romas, should be talked of on the banks of the Schuylkill before October 19, the date of Franklin's memorable letter to Collinson. Moreover, the "*jeu d'enfant*" allusion, as well as the very use of the kite by de Romas failed so completely to attract the attention of scientific men of his own country that he frequently and bitterly complained down to the end of his life in 1776 of their persistent neglect of his claims to recognition.

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[*] Every schoolboy knows that the electricity which passed down the kite-string was not drawn from the clouds at all, but was due to their inductive action on the pointed conductor attached to the kite. Kant calls Franklin the "Modern Prometheus."

III.

A summary of this paper shows:

(*a*) That Franklin's "lightning kite" is not a myth, the experiment having been made by him in June, 1752, and fully described by him in a memorable letter written to Peter Collinson of London, dated October 19 of the same year;

(*b*) That de Romas independently had the idea of using a kite for electrical purposes as early as July 12, 1752; but that he did not carry out his idea until May 14, 1753; and, furthermore, that he did not succeed in getting any electrical manifestations until June 7, 1753, his success then being due at least in part to the clever idea which he had of entwining the cord with a fine copper wire. Therefore, *suum cuique*.

ADDENDA.

The Lightning Kite.

Fully described by Franklin in a letter to Peter Collinson, of London, dated October 19, 1752.

Stuber in his "Continuation of the Life of Dr. Franklin," and Priestley in his "History of Electricity," affirm that Franklin made the experiment in June, 1752.

Franklin's son, William, never denied the story, although he figured in it as an active character.

William Temple Franklin, who prepared for publication the first edition of his grandfather's works, gives the kite story almost verbatim from Stuber.

Finally, Franklin himself states that he made the experiment: Memoirs, Vol. I, p. 164.

Franklin and de Romas.

June, 1752: Franklin raises his kite in a field near Philadelphia.

July 12, 1752: Letter of de Romas to the Academy of Bordeaux, in which a probable reference is made to the kite as *un jeu d'enfant*.

October 19, 1752: Franklin describes the "lightning kite" in a letter to Peter Collinson, of London.

May 14, 1753: First use by de Romas of the electric kite in the fields around Nérac; no result.

June 7, 1753: First success by de Romas with his electric kite.

Pointed Conductor.

Suggested by Franklin in letter to Peter Collinson, of London, dated July 29, 1750.

D'Alibard, following Franklin's instructions, gets torrents of discharges from his iron rod 40 feet high at Marly, May 10, 1752.

De Lor gets good results from his conductor 99 feet high erected over his house in Paris, May 18, 1752.

De Buffon succeeds with his rod on May 19, 1752.

Franklin erected the first rod over his house in Philadelphia in September, 1752. It was made of iron with a sharp steel point rising seven or eight feet above the roof, the other end being sunk five feet in the ground. Franklin charged a Leyden jar from his rod in April, 1753. Professor Richman, of St. Petersburg, was killed by a flash from his apparatus on Aug. 6, 1753.

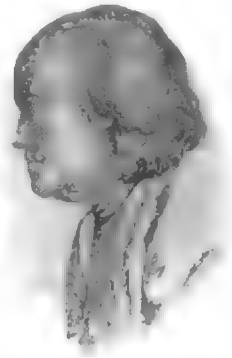
In Memory of Franklin.

The master printers' association celebrated the 200th anniversary of Franklin's birth by a dinner at the New Grand Hotel in New York on January 16. Several prominent persons made remarks extolling Franklin not only as one of the great Americans but as an American pioneer in printing. In speaking on "Our Debt to Franklin," Rev. Dr. S. Parkes Cadman praised the overwhelming personality of Franklin. The great trait in Franklin's character, he said, was humanness. Mr. John R. Dunlap, editor of *Engineering Magazine*, spoke of Franklin as a politician. Franklin's great characteristic, he said, was "his everyday, ordinary kind of common-sense." The Pennsylvania Society on Wednesday placed a wreath on the statue of Franklin in Printing House Square, New York.

Benjamin Franklin, Electrician.

Any proper estimation of the electrical work of Benjamin Franklin should take into consideration both the state of electrical science at the period when the great philosopher contributed to it, and the verdict of the day on the value of his contributions. Without such aid, the immense gulf which separates scientifically the middle of the eighteenth century from the beginning of the twentieth century would tend to dwarf the proportions of his achievements, however great they loomed up at the time.

In sketching electrical development up to the day of Franklin, only six names need be cited: Gilbert, Guericke, Hawksbee, Gray, Dufay and Musschenbroek. Gilbert (1540-1603) founded the science of magnetism, and was the first to apply what may be called the modern scientific method to the investigation of physical phenomena. Guericke (1602-1686) made the first electrical generator, and by its means was the first to produce light by electricity; he was also the first to assert, otherwise than in pure speculation, the identity of electricity and lightning. Francis Hawksbee (—-1713) discovered that by means of an electrical charge a vacuum tube may be caused to give forth light. Stephen Gray (—-1736) discovered the properties of electrical conduction and insulation, and some of the phenomena of static induction. Charles Francois Dufay (1698-1739) took up the work of Gray, which he greatly extended. He discovered that all bodies, solid or liquid, could be electrified; that substances most easily electrified by friction are the worst conductors, and vice versa; and was the first to use the terms conductor and nonconductor. He was also the first to draw a spark from the human body and to establish the principles of electrostatic induction, the phenomena of which had been faintly recognized by Guericke and Gray. His greatest achievement, however, was in evolving the first theory of electricity—in his own words, the discovery of "two distinct kinds of electricity, very different from one another; one of which I call vitreous electricity and the other resinous electricity." This was the beginning of the theories of fluid electricity which, though receiving a death blow at the hands of Faraday, lingered until within recent years, and are yet useful for illustrative purposes.



BENJAMIN FRANKLIN.

By permission of Mr. John Wanamaker.

The work of Gray and Dufay ended about 1735 and the next epoch commences with the discovery of the Leyden jar in 1745 and extends through Franklin to the time of Volta, who stands as sponsor for modern electricity. This discovery was announced by Musschenbroek (1692-1761) in 1746, though it has been claimed that Dean von Kleist, of Cammin, Pomerania, had experimented with a Leyden jar arrangement the previous year.

While the work of Gilbert, Guericke, Hawksbee, Gray and Dufay has more or less intrinsic value from the scientific point of view, and though it formed the foundation upon which others built and furnished inspiration that led to wonderful advances, it was left to Benjamin Franklin to make the first real practical application of electrical knowledge. With Franklin was first brought into electrical investigation the modern practical spirit which is not satisfied with mere brilliant experiment and lofty speculation, but has for its final aim the adaptation of nature's phenomena to the service of man.

The impression which the work of Franklin produced in Europe was remarkable. Referring to the several letters of Franklin to Collinson, of the Royal Society, published between 1747 and 1754, which cover the period of his great electrical investigations, Priestley, in his "History of Electricity," published in 1767, says:

"Nothing was ever written upon the subject of electricity which was more generally read and admired in all parts of Europe than these letters. There is hardly any European language into which they have not been translated; and, as if this were not sufficient to make them properly known, a translation of them has lately been made in Latin. * * * Though the English have not been backward in acknowledging the great merit of this philosopher, * * * to form a just idea of the great and deserved reputation of Dr. Franklin, we must read the foreign publications on the subject of electricity; in many of which the terms Franklinism, Franklinist and Franklinian system occur on almost every page."

When we consider this was written by a great European scientific authority concerning a man previously unheard of in science, and living in a new world, less known to Europe than Argentine is to us at the present day, its full import can be appreciated.

Franklin's first important experiments were with the Leyden jar to charge which he constructed a glass static machine of his own design. He discovered, by a beautifully scientific series of experiments, that the power of giving a shock lies in the glass itself and not in the metal coatings. As a deduction from his theory of electricity, he concluded that jars might be coupled together and thus produce an effect in proportion to the number used, and upon this principle he constructed batteries of such power that he was led to write "There are no bounds to the force man may raise and use in the electrical way; for bottle may be added to bottle and the greatest known effects of common lightning may, I think, without much difficulty, be exceeded in this way."

Franklin held that there is but one electric fluid, which ordinarily exists in a body in a state of equilibrium; if some of the fluid is drawn off the body exhibits negative properties, or positive properties if added to. While this theory of electricity did not prevail over that of Dufay, it nevertheless had supporters for more than a century, though both theories were untenable from the day of Faraday.

Franklin, however, is best known through his experimental identification of lightning with electricity. Though there had been many speculations on this subject, notably by Guericke, and, in some detail, by the versatile Abbe Nollet, none was so definite as that put forth by Franklin in 1749; and finally, in 1750, he proposed in detail an experiment to determine the question whether clouds that contain lightning are electrified or not, and at the same time laid down the principles of the lightning rod which were held up to within a very recent period. A full account of this phase of Franklin's work is given elsewhere in the admirable article by Brother Potamian, which study promises to settle definitely the century and a half old controversy as to priority in actually drawing lightning from the clouds.

According to Franklin's celebrated theory of the lightning rod, a pointed rod gradually draws off the electricity in the atmosphere, thus dissipating a charge before it becomes formidable. Some distinguished European savants disputed the superiority of pointed rods, which gave rise to the famous "points vs. knobs" controversy. Franklin defended his views with the remarkable skill which he invariably displayed, whatever the occasion, and emerged from the controversy an acknowledged victor. As a lightning discharge is now considered to be due to the breaking down of the air between the object struck and a charged cloud, through the existence of an enormous dielectric stress, this theory has now only a historic interest.

In Portsmouth, N. H., a lightning rod put up under the direction of Franklin, consisting of an iron rod about a half inch in diameter, was still in use a few years ago. The Franklin Institute of Philadelphia has a static machine made by Franklin and a Leyden jar battery made by him is still in use in Dartmouth College.

It is remarkable that little or no contemporary corroborative evidence exists relating to the remarkable experiments which have earned for Franklin the popular title "Father of Electricity." It is partly for this reason, but more largely from the singular form of Franklin's own accounts of his experiments, that the fact of their actual performance has been challenged. As to the kite and lightning rod experiments, the reader is referred to the article elsewhere by Brother Potamian. We print below the account of the celebrated "Electrical feast," together with the note which accompanies it on the use of an earth return. No corroboration that the feast took place has up to the present been discovered, yet the note might lead the reader to believe that at some time the suggestion of an electrical dinner had been carried out. Did Balzac have the "electrical feast" in mind when he wrote "Franklin invented the lightning rod, the hoax and the republic"? The account appears in Franklin's "Experiments and Observations on Electricity," published in 1751, of which other editions, in each case with new matter added, were printed in 1752, 1754 and 1766. Later editions are dated 1769 and 1774. The editions of 1751, 1754, 1769 and 1774 are in the Wheeler Gift in the library of the American Institute of Electrical Engineers, which also includes English reprints dated 1760 and 1765, copies of French translations dated 1752 and 1756, and of a German translation dated 1758. The account closes a letter to Peter Collinson, Esq., F.R.S., London, dated "Philadelphia, 1848," which relates in detail the celebrated experiments with an "electrical phial" (Leyden jar) above referred to:

"Chagrined a little that we have been hitherto able to produce nothing in the way of use to mankind; and the hot weather coming on, when electrical experiments are not so agreeable, it is proposed to put an end to them for this season, somewhat humorously, in a party of pleasure, on the banks of the Schuykil. Spirits, at the same time, are to be fired by a spark sent from side to side through the river, without any other conductor than the water; an experiment which we some time since performed, to the amazement of many.[*] A turkey is to be killed for our dinner by the electrical shock, and roasted by the electrical jack, before a fire kindled by the electrical bottle; when the healths of all famous electricians in England, Holland, France and Germany are to be drank in electrified bumpers[†] under the discharge of guns from the electrical battery."

The original from which the accompanying portrait of Franklin is reproduced was drawn in pencil by Benjamin West. It formed part of the Pennypacker collection of Franklinana recently sold at auction in Philadelphia, and was purchased by Mr. John Wanamaker, through whose courtesy we are enabled to present the reproduction.

Franklin's Grave.

A telegram to the New York *Sun* reports that while societies of various kinds, schools and other institutions in Philadelphia and other cities were holding exercises on Wednesday in honor of Benjamin Franklin's birthday the grave of the philosopher and his wife, in the old burial ground, at Fifth and Arch Streets, remained forsaken and neglected. There was not a flower, not a wreath, on the great slab. Only above the head of the grave waved a tattered, discolored little flag which some veteran placed there last Decoration Day.

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[*] "As the possibility of this experiment has not been easily conceived, I shall here describe it. Two iron rods, about three feet long, were planted just within the margin of the river, on the opposite sides. A thick piece of wire, with a small round knob at its end, was fixed to the top of one of the rods, bending downwards, so as to deliver commodiously the spark upon the surface of the spirit. A small wire fastened by one end to the handle of the spoon, containing the spirit, was carried across the river, and supported in the air by the rope commonly used to hold by, in drawing the ferry boats over. The other end of this wire was tied round the coating of the bottle, which being charged, the spark was delivered from the hook to the top of the rod standing in the water on that side. At the same instant the rod on the other side delivered a spark into the spoon, and fired the spirit, the electric fire returning to the coating of the bottle, through the handle of the spoon and the supported wire connected with them. That the electric fire thus actually passes through the water, has been satisfactorily demonstrated to many by an experiment of Mr. Kinnesley's, performed in a trough of water about ten feet long. The hand being placed under water in the direction of the spark (which always takes the straight or shortest course) is struck and penetrated by it as it passes."

[†] "An electrified bumper is a small thin glass tumbler, near filled with wine, and electrified as the bottle. This when brought to the lips gives a shock, if the party be close shaved, and does not breathe on the liquor."

Some Important Foundations of Benjamin Franklin.

By Dr. Edwin James Houston.

AMONG other examples that might be given of great public works undertaken by Benjamin Franklin for the good of the City of Philadelphia in particular, and of the world in general, perhaps none are so worthy of mention as the foundation of the great Philadelphia Library, the University of Pennsylvania and the American Philosophical Society. These public institutions, although differing markedly among themselves, yet are nevertheless in accordance with the principles that so eminently characterized this great man. Franklin was a pronounced utilitarian, and may properly be regarded as the apostle of thrift in early provincial times. He was eminently a self-educated man, a man who understood the influence of the proper combination of industry and economy. It is, therefore, natural that he was desirous of securing for others the advantages that are to be derived by companionship with books, by intimate contact with bright minds, and would naturally desire to establish some place where a proper education could be insured for all capable of acquiring it.

The three public institutions above named were founded by Franklin in the following order: The Philadelphia Library, the University of Pennsylvania, and the American Philosophical Society, the approximate dates of their foundations being respectively 1732, 1740 and 1743. We use the phrase approximately intentionally for reasons since in some cases the exact dates are uncertain.

Since Benjamin Franklin was born in 1706, it will be seen that he was quite a young man when he started what afterwards became the great Philadelphia Library, and was far from being advanced in life when he founded the other two great institutions.

Before briefly relating the circumstances under which the above-named work was accomplished, it may be well first to call attention to such other institutions as the Franklin and Marshall College, the Franklin Institute and other institutions that have been founded along the lines that were at this early date laid down by Benjamin Franklin; for, while these institutions cannot strictly be regarded as having any direct connection with Benjamin Franklin, yet their foundation can, to a great extent, be regarded as having been greatly influenced by the prior work undertaken by this practical philosopher.

The origin of the great Philadelphia Library—or, as it is more exactly called, the Library Company of Philadelphia—is to be traced to the need experienced by young Franklin and some of his intimate friends for books. In these early days books were quite different things from what they are to-day. Instead of the attractive and readily handled duodecimos of to-day, books consisted then for the greater part of heavy, ponderous folios, that were too expensive to be possessed by hardly any but the fairly prosperous, and even by them in but comparatively small numbers. Such books did not readily lend themselves to circulation.

Before the time when Franklin conceived the idea which resulted in the birth not only of the Philadelphia Library, but also of practically all circulating libraries in America, he had formed a little coterie or society called the "Junto." The membership in this society was strictly limited to 12. As originally constituted, the society met on Fridays. The Junto constituted in fact a debating club, and was based on rules that required every member in his turn to prepare one or more queries on various points in morals, politics or natural philosophy, which were to be discussed by the club at its meetings. Once every three months each member was to read an essay, composed by himself, on any topic that he chose to select. The debates were under the direction of a president, and in order to prevent quarrels, all expressions of positiveness in opinions, or direct contradictions, were prohibited under small pecuniary penalties.

An examination of the membership of this early society shows that no little tact had been exercised in its selection. Some of the more important members of this society included such names as Thomas Godfrey, a self-taught mathematician and the inventor of what was afterwards known as Hadley's quadrant; Nicholas Scull, a surveyor; William Parsons, bred a shoemaker, but afterwards acquiring considerable knowledge of mathematics; Wm. Maugridge, a joiner, and an excellent mechanic; Robert Grace, a young gentleman of some fortune, and Wm. Coleman, a merchant's clerk. This last member was more nearly of Franklin's age than the others, and continued in close friendship with him up to the time of his death, some 40 years afterwards.

The dearth of books experienced by the members of the Junto suggested to Franklin's ingenious mind the advisability of arranging some plan by which the books accessible to the members would be increased. As Franklin says in his Autobiography:

"At the time I establish'd myself in Pennsylvania, there was not a good bookseller's shop in any of the colonies to the southward of Boston. In New York and Philad'a the printers were indeed stationers; they sold only paper, etc., almanacs, ballads, and a few common school-books. Those who lov'd reading were oblig'd to send for their books from England; the members of the Junto had each a few. We had left the alehouse, where we first met, and hired a room to hold our club in. I propos'd that we should all of us bring our books to that room, where they would not only be ready to consult in our conferences, but become a common benefit, each of us being at liberty to borrow such as he wish'd to read at home. This was accordingly done, and for some time contented us.

"Finding the advantage of this little collection, I propos'd to render the benefit from books more common, by commencing a public subscription library. I drew a sketch of the plan and rules that would be necessary, and got a skillful conveyancer, Mr. Charles Brockden, to put the whole in form of articles of agreement to be subscribed, by which each subscriber engag'd to pay a certain sum down for the first purchase of books, and an annual contribution for increasing them. So few were the readers at that time in Philadelphia, and the majority of us so poor, that I was not able, with great industry, to find more than fifty persons, mostly young tradesmen, willing to pay down for this purpose forty shillings each, and ten shillings per annum. On this little fund we began. The books were imported; the library was opened one day in the week for lending to the subscribers, on their promissory notes to pay double the value if not duly returned. The institution soon manifested its utility, was imitated in other towns, and in other provinces. The libraries were augmented by donations; reading became fashionable; and our people, having no publick amusements to divert their attention from study, became better acquainted with books, and in a few years were observ'd by strangers to be better instructed and more intelligent than people of the same rank generally are in other countries."

Speaking for himself, Franklin calls attention to the fact that the establishment of this library offered him means for self-improvement by constant study. He says: "Reading was the only amusement I allowed myself. I spent no time in taverns, games or frolics of any kind, and my industry in my business continued as indefatigable as it was necessary."

The books of this early library were at first kept at the house of Mr. Robert Grace, one of the members of the Junto before referred to. They were afterwards placed in a room in the old State House building.

In 1742 a charter was obtained from the Proprietaries for the library. In 1790 the library was removed to Carpenter's Hall, from which building it was subsequently removed and placed in quarters erected for the purpose near Fifth and Chestnut Streets. The books remained in this building until they were removed to the present quarters of the library at Locust and Juniper Streets.

The size of the library on its removal to Fifth and Chestnut Streets was only 8,000 volumes. At the present time, according to a report of the Library Company of Philadelphia for May, 1905, it contains no less than 216,946 books.

The Ridgeway Branch of the Philadelphia Library Company was founded on a legacy left by Dr. James Rush, in 1869. This legacy amounted to nearly one million dollars. The money was left on the condition that the library building should be erected on the square of ground bounded by Broad and Thirteenth Streets and by Christian and Carpenter Streets. Owing to an effort made by the authorities of the Library Company of Philadelphia to prevent the erection of the library on this ground, the building was not completed until 1878. The name Ridgeway Branch of the Philadelphia Library was given to this branch in memory of Dr. Rush's wife, who was the daughter of Jacob Ridgeway.

The Philadelphia Library contains a number of almost priceless books. Among other gems of this collection are to be found:

(1) A number of exceedingly rare manuscripts, together with fine specimens of early illuminated manuscripts of Caxton, Fust & Schaeffer, Pynson, Wynkyn de Worde, Sweynheym & Pannartz.

(2) A copy of the Praeparatio Evangelica, printed in 1470.

(3) A commentary on the Psalms printed on vellum in 1470.

(4) A copy of the Holy Bible printed by Sweynheym & Pannartz in 1471, and many others.

Among some of the rare books belonging to the Ridgeway Branch of the Library Company of Philadelphia, is a small work entitled "A Catalogue of Books Belonging to the Library Company of Philadelphia, Philadelphia (Franklin), 1741." This book is a small duodecimo, containing 56 pages. On the last page is found a short account of the library, concluding as follows: "Tho' 'tis composed of so many persons, of different Sets, Parties and Ways of Thinking, yet no differences relating to the affairs of the Library have arisen amongst us."

Some idea of the general use of this library may be gained from the fact that, according to the above-mentioned report, during 1905 the Library was open for 310 days, and during this time more than 34,000 books were taken out. The number of visitors to the building was 64,083, an increase since 1904, when the number only reached 53,075. The amount expended for new books and binding during this year was $6,029.

The foundation of the great University of Pennsylvania may be regarded as having had its origin in an English Charity school founded by Benjamin Franklin in 1740. This school was established on Fourth Street in Philadelphia. The school thus founded did not take on the collegiate form until 1751.

In 1749 Franklin published his famous treatise on "The education of Youth in Pennsylvania." He adopted this plan of calling the attention of the community to the needs for the education of youth so as to make it easier for him to obtain the necessary subscriptions for the foundation of the school. As soon as this had been accomplished the old school building on Fourth Street was rebuilt, a board of trustees elected and a school known as "The Academy of Philadelphia" was founded in January, 1751. This school achieved great success, and had enrolled on its list over 100 students. The "Academy of Philadelphia" included three different departments: i. e., the Department of Latin, the Department of English and the Department of Mathematics.

In May, 1755, the Academy of Philadelphia received an additional charter, and became "The College and Academy of Philadelphia." The college elected as its first rector the Rev. Wm. Smith, of the University of Edinburgh.

Some time after the establishment of the College and Academy of Philadelphia, the Assembly of the State of Pennsylvania revoked the charter of the college and gave it to a new institution that was styled "the University of the State of Pennsylvania." The trustees of the old College and Academy of Philadelphia, however, maintained their organization and succeeded, in 1789, in regaining their old charter. Finally the two rival institutions were consolidated in 1791 under the name of "The University of Pennsylvania."

The great University of Pennsylvania is too well known to need any description.

Franklin may also be regarded as being the founder of the American Philosophical Society. This was in the year 1743. This society had its origin in a paper published by Franklin, dated May 14, 1743 (Old Style), entitled "A proposal for Promoting Useful Knowledge among the British Plantations in America."

This paper calls attention to the great extent of the Colonial possessions, with their marked differences in climate, soil and natural products. It then says:

"The first drudgery of settling new colonies, which confines the attention of people to mere necessaries, is now pretty well over; and there are many in every province in circumstances that set them at ease, and afford leisure to cultivate the finer arts, and improve the common stock of knowledge. To such of these who are men of speculation, many hints must from time to time arise, many observations occur, which if well examined, pursued and improved, might produce discoveries to the advantage of some or all of the British Plantations, or to the benefit of mankind in general. . . . . But as, from the extent of the country, such persons are widely separated, and and seldom can see and converse or be acquainted with each other, so that many useful particulars remain uncommunicated, die with the discoverers, and are lost to mankind; it is to remedy this inconvenience for the future, proposed—

"That one society be formed of virtuosi, or ingenious men, residing in the several colonies, to be called the American Philosophical Society, who are to maintain constant correspondence.

"That Philadelphia, being the city nearest to the centre of the continent colonies, communicating with all of them northward and southward by post, and with all the islands by sea, and having the advantage of a good growing library, be the centre of the Society.

"That at Philadelphia there be always at least seven members, viz., a physician, a botanist, a mathematician, a chemist, a mechanician, a geographer, and a general natural philosopher, besides a president, treasurer and secretary.

"That these members meet once a month, or oftener, at their own expense, to communicate to each other their observations and experiments; to receive, read and consider such letters, communications, or queries as shall be sent from distant members; to direct the dispersing of the copies of such communications as are valuable, to other distant members, in order to procure their sentiments thereupon."

The society was apparently founded some time during the year 1743, since Franklin, in a letter to Cadwalader Colden, dated April 5th, 1744, refers to the society as already formed, and as having had several meetings.

The original membership in this society included Dr. Thomas Bond as physician, Mr. John Bartram as botanist, Mr. Thomas Godfrey as mathematician, Mr. Samuel Rhoads as mechanician, and Mr. Wm. Parsons as geographer. Dr. Phineas Bond was general natural philosopher. Mr. Thomas Hopkinson was elected President, Mr. Wm. Coleman Treasurer, and Benjamin Franklin Secretary.

About the beginning of the year 1769, the American Philosophical Society and another society known as the American Society, held at Philadelphia for Promoting Useful Knowledge, were merged into a single society.

The first meeting of the combined societies was held January 2, 1769. The first president of this society was Benjamin Franklin. The vice-presidents were Dr. Thomas Bond, Dr. Thomas Cadwalader and Joseph Galloway. This society was incorporated by the General Assembly of Pennsylvania on the 15th of March, 1788.

At the present time the society occupies quarters in a portion of Independence Square, the site for this purpose having been granted to them by the State in 1785.

Subsequently, an act was passed by the Legislature permitting the society to rent out such portions of its hall as were not required for the purposes of the association. In this manner the society receives a sum which goes far towards paying its expenses.

The two trust funds left by Franklin for the benefit of the cities of Philadelphia and Boston have an interesting history. In his will, dated July 17, 1788, legacies of £1,000 were left to each of these cities, which, with accumulations, were to be loaned under certain specified conditions at 5 per cent interest, and the amount accrued at the end of a century devoted to specific purposes. This fund became available on Franklin's death, April 17, 1790. The growth of the fund, however, fell far short of the founder's expectations, as set forth in his will. Franklin calculated that at the end of the first one hundred years the £1,000 would have increased to £131,000. Of this amount £100,000 was to be devoted to purposes specified and the remaining £31,000 was to be loaned under the original conditions for another one hundred years. Franklin estimated that at the end of this second term the sum would amount to £4,000,061, which amount was then to be finally disposed of for specified purposes.

In the case of Boston, the amount available at the end of the first one hundred years was to be expended in public works, such as fortifications, bridges, aqueducts, public buildings, baths, pavements or whatever might make living in the town more convenient to its people and render it more agreeable to visitors. Of the great sum anticipated at the end of the second century, £1,000,061 was to be placed at the disposal of the inhabitants of the city of Boston, and £3,000,000 at the disposal of the government of the city.

As to the city of Philadelphia fund, at the end of the first one hundred years the sum of £100,000 was to be expended for bringing the waters of the Wissahickon Creek into the city to supply the inhabitants with pure water, and the sum of £4,061,000 anticipated to be available at the end of the second century was to be divided between the inhabitants of the City of Philadelphia and the government of Pennsylvania.

The actual outcome fell far short of the anticipations of Franklin. The value of the Philadelphia legacy at the end of one hundred years, namely, April 1, 1890, was only $87,600.29. In March, 1895, the city of Philadelphia appropriated the proceeds for the erection of an art gallery to be located in Fairmount Park, "that portion of the building so paid for to have the name of Benjamin Franklin connected with it in such a manner as to serve to perpetuate his memory." This appropriation was accepted by the park commissioners in 1895, but up to the present date there has been no further action and the funds remain with the city invested and drawing income. In the meantime the fund has increased to $159,000, its present value.

In 1892 Albert D. Bache, a great-great-grandchild of Benjamin Franklin, instituted suit in Philadelphia to have the Franklin trust fund declared invalid, but the petition was dismissed. A similar suit was instituted December 2, 1892, on behalf of the heirs of Elizabeth D. Gillespie and Richard Bache for the same purpose, but this was also dismissed.

It is interesting to note that the Philadelphia Franklin Fund received an addition of $3,000 from John Scott, chemist, of Edinburgh, Scotland. This same Scott also left a sum of $4,000 to Philadelphia to be placed with the same management as the Franklin legacy, the proceeds to be devoted to awarding annually a premium not exceeding $20 and a copper medal with an inscription "to the most deserving." The Franklin Institute now awards annually the John Scott premium and John Scott Medal.

The Boston Franklin Fund now amounts to about $400,000, and its final disposition has been a matter of considerable controversy. A strong effort was made to have the fund applied to the purchase of real estate for an institution somewhat after the lines of the People's Palace of London. Another plan proposed was to devote the fund to the purpose of a trade school modeled after Cooper Institute of New York City. Dr. Pritchett, chairman of the Boston committee, interested Mr. Carnegie and, it was reported, secured an offer to duplicate the fund if devoted to this purpose. The trade unions have opposed this use of the fund and its disposition is yet unsettled, though the indications are that it will be devoted in some manner to the cause of popular education.

Electric and Gas Decisions.

By ALTON D. ADAMS.

A number of typical decisions by the Gas & Electric Commission of Massachusetts were quoted recently, and analyzed by the writer, in the pages of the ELECTRICAL WORLD. Below will be found a synopsis of a few cases dealt with in 1905, by various courts throughout the country:

1. Greenfield Gas Co. vs. Trees, Supreme Court of Indiana, June 28, 1905. 75 Northeastern Reporter 2. This was an appeal from an award of damages in the lower court for turning off the supply of natural gas from the residence of Trees. In the complaint there was no direct statement that Trees had complied, or offered to comply, with the reasonable regulations of the gas company at or before the time that his supply of gas was shut off, and a demurrer to this complaint for want of such statement was overruled. This ruling of the lower court was the ground of the appeal. It appeared that after the supply of gas to the residence of Trees was turned off he brought an action to have the supply renewed, and that this action had resulted in a final judgment awarding a writ of mandamus against the gas company. The present action for damages then followed. As to the duty of a natural gas company occupying the streets of a city or town with its mains, the court said that it is bound to supply houses on such streets when the owners or occupants comply with the reasonable regulations of the company. But the failure to allege compliance with reasonable regulations was fatal to the complaint, and the demurrer should have been sustained.

2. Mahan vs. Newton & B. St. Railway Co. Supreme Judicial Court of Massachusetts, Sept. 7, 1905. 75 Northeastern Reporter 59. This was an action by the administration of the estate of J. P. Mahan to recover for the suffering and death of the latter, said to have been caused by electric current from a trolley wire. At the time of the accident Mahan was in the employ of an electric light company, and was at work on a pole that carried several circuits belonging to that company. There was evidence tending to show that no lighting current was in the circuits on the pole where Mahan was at work, and the electric shock that caused his death occurred just as an electric car of the railway approached the scene. It was also in evidence that when the car reached a point near the pole where Mahan was at work the trolley wire was lifted up into contact with the lighting circuits carried by the pole. Near the spot of the accident there were no guard wires over the trolley wire, but it was shown that such guard wires are used on some railways. Mahan did not have on rubber gloves at the time of his injury, though the electric light company for which he worked provided such gloves for linemen, and had a rule that all wires should be treated as live wires. Evidence was admitted to show that with the usual construction a trolley wire would be lifted three or four inches by the passage of a car. After a verdict for the plaintiff in the trial court, the defendant railway appealed on exceptions to the failure of that court to rule that the plaintiff was not entitled to recover, and to the admission of the evidence as to the use of guard wires and the usual lifting of a trolley wire by a passing car. On the appeal it was held that the evidence covered by these exceptions was properly admitted, and that there was no error in the refusal to rule that the plaintiff was not entitled to recover. Whether Mahan was killed by current from the trolley wire, whether it was negligence on the part of the railway company to omit guard wires, and whether Mahan was negligent, were all proper questions for the jury, and the exceptions were overruled.

3.4. Shover vs. Home Telephone Co. Appellate Court of Indiana. October 6, 1905. 75 Northeastern Reporter 288. Shover sued the Telephone Company in the lower court for an injury sustained while unloading a car of telephone poles, and this appeal was brought from a judgment sustaining a demurrer to his complaint. It appeared that the poles were piled eight feet high on a flat car, and were held in position by three standards on each side of the car, and by stay wires that ran between the tops and between points about half way down on each pair of standards, across the car. After the two end standards on the west side of the car had been cut off, and also all of the stay wires except the one attached to the middle of the center standard, and after this center standard had been cut into so as to weaken it near the floor of the car, one Ramsey, who was in charge of the work for the Telephone Company, ordered Shover, who was in the employ of this company, to go to the west side of the car and cut this remaining stay wire. The center standard broke as soon as Shover had cut the stay wire, and the poles fell upon him. Shover was 20 years of age and of average intelligence, but had had no experience in handling telephone poles. On these facts the court remarked that under the employer's liability act an employee asking damages for an injury must have been in the exercise of due care, and held that Shover could not recover because it was negligent for him to execute the negligent order of Ramsey.

The Electrical Distribution System of the Public Service Corporation of New Jersey.—II.

BY G. U. G. HOLMAN.

THE turbine unit in the Coal Street Station in Newark is controlled in the adjacent City Dock station, the generator being classed as belonging to the City Dock station. Thus all units controlled at the Coal Street station are for the railway needs. The sub-stations are fed from this station by 13,200-volt, three-phase cables run in conduits. Central Avenue sub-station has two 1,000-kw, General Electric, 25-cycle, three-phase rotaries, two and one-half miles away from Coal Street, supplying 550 volts direct current.

Railway 550-volt current is supplied by the Coal Street station to the sub-stations at Irvington and Montclair, four miles and seven miles away, respectively. Conduits in the streets of Newark carry 13,200-volt cables to the outlying district and thence the energy is taken overhead on 70-ft. poles. The pictures in Figs. 8 and 9 show the style of conduit and manholes. Lead-covered, paper-insulated, three-conductor cables are used, laid in conduits built up of 3-in. fibre tubes, spaced 4½-in centers in concrete. The manholes and catch basins are rectangular in section, also of concrete. The tops are arched with railroad iron to support the cover and traffic.

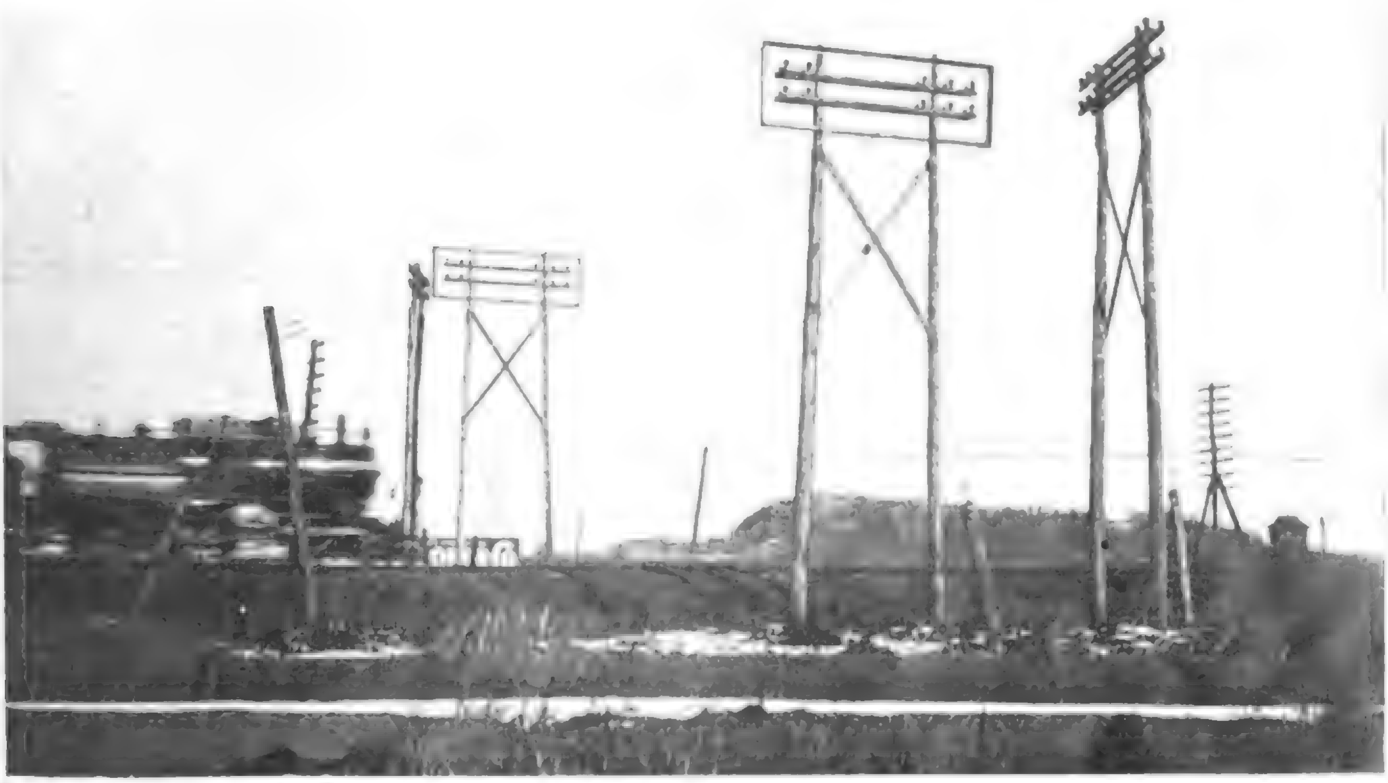


FIG. 5.—SHOWING WIRE CAGE GUARD ON THE SIDES OF AND BENEATH THE 13,000-VOLT TRANSMISSION LINES AT A PENNSYLVANIA RAILROAD CROSSING.

The Irvington sub-station contains one General Electric, 1,000-kw, three-phase, 25-cycle rotary and one 500-kw, General Electric, three-phase, 25-cycle rotary, both for railway 550-volt, direct-current. This sub-station contains five 17½-kw, constant-current transformers used for incandescent street lighting distribution, receiving its energy from the City Dock station at 2,200 volts, 60 cycles.

Montclair sub-station contains three 500-kw, General Electric, three-phase, 25-cycle rotaries, receiving their energy from Coal Street station at 13,200 volts alternating current and supplying 550 volts direct current for railway use. In this sub-station is also 2,500 kw in General Electric, two-phase, 60-cycle, air-blast transformers, 13,200-6,600; 2,400 volts for lighting.

The City Dock station in Newark is a lighting and power station. The apparatus consists of seven Westinghouse 850-kw, 2,300-volt, two-phase, 60-cycle generators, each direct-connected to a Pennsylvania Iron Works horizontal, cross-compound, condensing engine, and one Westinghouse 500-kw, 550-volt, direct-current generator, direct-connected to a Watts-Campbell horizontal cross-compound condensing engine. There are seven 500, two 600 and four 800-hp Climax boilers at 150 lb. pressure. This station up to a year ago contained arc lighting machines that were thrown out by the present use of alternating-current arc lamps. The City Dock station, besides supplying the Irvington and the Montclair sub-stations in common with Coal Street, supplies Mechanic Street sub-station, which is solely used for power supply, and the following street lighting transformer stations: Bloomfield Avenue, two and one-half miles away; Bergen Street No. 1 and Bergen Street No. 2, 8,000 ft. apart and three and two miles from the station; East Newark, two miles away; Belleville, four miles away, and Lyndhurst, eight miles away from the station.

The Mechanic Street sub-station contains three 300-kw Westinghouse, 2,300-volt, two-phase and one 300-kw, Westinghouse, 2,300-volt, three-phase transformers, all 60-cycle and used for commercial power circuits.

The Bloomfield Avenue sub-station contains three General Electric, 71-kw, 60-cycle, single-phase, 2,400-volt, tub transformers for supplying 7½ amp. street arc lights.

Bergen Street No. 1 and No. 2, respectively contain three and four General Electric 100-light, 2,400-volt tub transformers, supplying 7½ amp. to street arc lamps. The East Newark and the Belleville sub-stations each contain three General Electric, 100-light, 7½-amp., 2,400-volt tub transformers used for both arc and series incandescent street lighting. Lyndhurst sub-station contains one 17½-kw, 2,200-volt, General Electric tub transformer used solely for series incandescent street lighting.

An examination of the map (Fig. 2, last issue) of the district supplied by Coal Street and the City Dock stations with both light, power and railway service, reveals the fact of the present abandonment of the generating stations at Orange and South Orange, and the installation of two sub-stations; one at Lincoln Ave., to take the Orange station load, and one at Belleville, to fill the increased requirements for railway and lighting in that section. The South Orange station's load is to be divided between the present two sub-stations at Central Ave. and at Irvington. The apparatus in the to-be-discarded Orange station consists of a line shaft belted to one horizontal, cross-compound, Watts-Campbell, high-pressure engine, and one Hewes & Phillips horizontal, cross-compound, low-pressure engine. The boilers are three 600-hp Climax, run at 140 lb. The shaft is belted to three Westinghouse generators and one General Electric generator of a total capacity of 690 kw supplying 500 volts for power and railway; two two-phase Stanley, 2,600 volts, 60-cycle, 275 kw each for lighting, and 256 kw of arc lighting generators, Brush and Thomson-Houston. As a present temporary sub-station supplied by City Dock station there are installed 6,600-volt transformers consisting of eight 100-kw, two to three-phase, 60-cycle, Wagner oil type; three 50-light, General Electric, 2,200-volt, 6.6-amp. tub transformers; two 17½-kw, General Electric tub transformers for series incandescent street lights, and three 21½-kw, General Electric voltage regulators, used for series incandescent street lights.

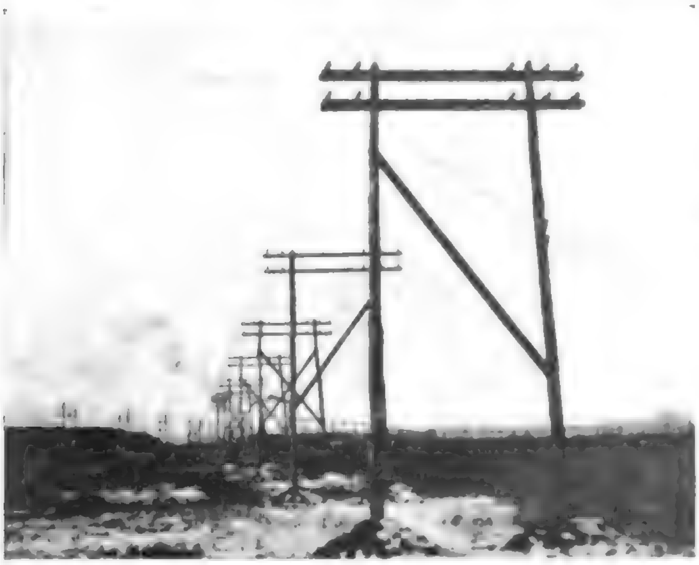


FIG. 6.—TRANSMISSION 13,000-VOLT LINES ACROSS THE JERSEY MARSHES, CONNECTING MARION STATION WITH NEWARK PLANTS.

By a further examination of the map showing the Northern New Jersey distribution it will be readily seen what an important part the new Marion station will play in the more economical supply of light, power and railway energy in this section. Grand Street and Wayne Street stations, two old, small unit stations, and one sub-station (Communipaw), are to be replaced by the new sub-station (Pennsylvania) in this same district, and the present tie feeders connecting the three sets of apparatus with the Hoboken Fourteenth Street central plant will be taken out.

The Grand Street station contains nothing but railway generators of 500 volts direct current. There are six Westinghouse, 175-kw generators, each belted to Ball & Wood high-speed compound condensing engines; one General Electric 525-kw generator and two Westinghouse 375-kw generators, each direct-connected to an Allis horizontal cross-compound condensing engine. There are five Heine and six Babcock & Wilcox boilers of 250 hp each run at 125 lb.

Wayne Street is also an old plant, consisting mainly of slow-speed engines belted to a jack shaft and operating about 1,195 kw in four units at 2,600 volts of Stanley generators; 400 kw emergency railway generators of two 200-kw Westinghouse each; 620 kw of 550-volt power generators in three units, and about 1,200 kw of direct-current Brush & Wood arc lighting machines. The engines are Watts-Campbell and George H. Corliss horizontal cross-compound and two tandem compound Mackintosh & Seymour, to which some of the generators are belted direct. The boilers are three 500 and two 600-hp Climax, run at 150 lb. pressure.

Until the Marion station and the new Pennsylvania sub-station are actually in service, Wayne Street station contains also one Westinghouse 300-kw, 6,600-volt, 550-volt, 60-cycle rotary, used for power service and fed from the City Dock station at Newark through the feeder across the Hackensack meadows, built over a year ago in anticipation of future use by the new Marion plant. This tie consists of three feeders, each of three 2-0 copper, stretched across the Hackensack marshes on two cross arms supported by two poles, as shown in Fig. 6. Where the feeders run under the Passaic and Hackensack Rivers three-conductor, lead-covered, iron-armored and paper-insulated cables, are used. There are cable and lightning arrester houses, as shown in Fig. 7, on both sides of the Hackensack River and on the east side of the Passaic. Three-conductor, 2-0, lead-covered, paper-insulated cables, are run underground from the east cable house to the Marion power house. There are also in Wayne Street eight 100-kw Wagner, oil-cooled, 6,600-2,400-volt transformers, used for commercial incandescent lighting as step-down transformers from the Newark station. The concentration of service supply for railway and lighting to the Pennsylvania sub-station and the abandonment of the comparatively uneconomical plants of Wayne Street and Grand Street will make for economy in copper and in kw-hour cost.

The discarded Communipaw sub-station contained one Westinghouse 300-kw, 6,600-volt, 60-cycle, two-phase rotary, giving 550 volts direct current for power purposes fed from Wayne Street station. The Grand Street plant did not feed any substation.

Two new sub-stations, "Junction" and "Bayonne," will be fed from the Marion station and will contain rotary units of 1,000 kw for railway supply and step-down static transformers for lighting.

The Palisade Avenue plant has been shut down since last spring and consisted of small generators belted to jackshaft and slow-speed engines. The Palisade sub-station, temporarily fed from Coal Street and Secaucus, will be fed entirely by the Marion plant and consists of three 1,000-kw, three-phase, 25-cycle, General Electric, 13,200-volt-550-volt, direct-current rotaries for railway and two 500-kw, three and two-phase, 60-cycle, 13,200-2,600-volt, oil Westinghouse transformers, fed from City Dock station, Newark.

The Secaucus plant is temporarily connected with four substations—Palisade Avenue, New Durham, Hackensack and Passaic—with 13,200-volt, 25-cycle energy for railway distribution. The plant contains one three-phase, 25-cycle, 13,200-volt, General Electric, 1,800-kw generator direct-connected to an horizontal compound Brown Corliss condensing engine; two three-phase, 25-cycle, 13,200-volt General Electric 400-kw generators, each direct-connected to an horizontal compound condensing Watts-Campbell engine; three direct-current, 550-volt, Westinghouse railway generators, driven by a Pennsylvania Iron Works horizontal cross-compound, condensing engine; and a 300-kw, General Electric, 13,200-volt, 25-cycle rotary. The boilers are two 500-hp and four 250-hp Babcock & Wilcox, at 200 lb. pressure, and four 320-hp Climax at 200 lb. pressure, run at 125 lb.

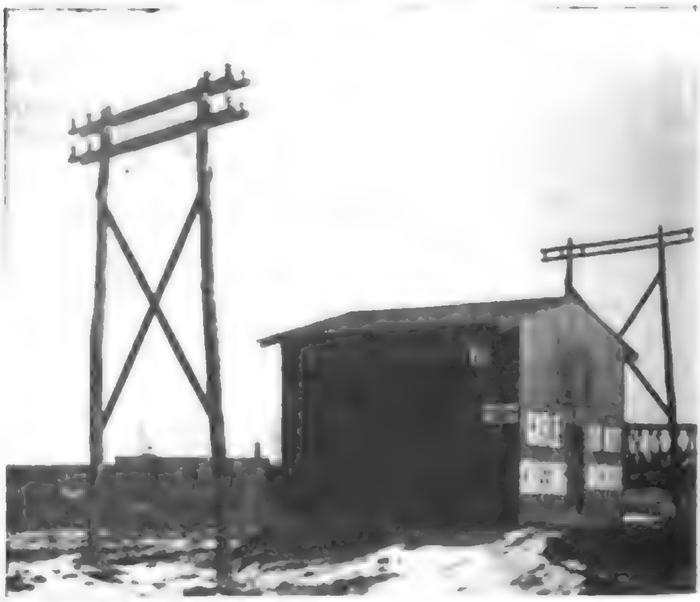


FIG. 7.—AËRIAL 13,000-VOLT TRANSMISSION LINE CONNECTING WITH HACKENSACK RIVER CABLE WITHIN CABLE BUILDING.

The Palisade Avenue sub-station is fed also from Coal Street station and has previously been described. The New Durham sub-station contains two General Electric, 1,000-kw, 13,200-volt, 25-cycle rotaries giving 550 volts direct current. The Hackensack sub-station contains two 300-kw, General Electric, 13,200-volt, 25-cycle rotaries feeding 550 volts direct current. This sub-station can also be fed from the Marion and the Coal Street plants by way of Secaucus station and Palisade Avenue sub-station, as the Secaucus bus can be tied in to the Coal Street plant. The Passaic sub-station contains one 1,000-kw and one 300-kw, General Electric, 13,200-volt, 25-cycle rotary, giving 550 volts direct-current for railway service. Passaic sub-station, feeding from Secaucus, can also be fed from the Marion and Coal Street plants. The capacity in 13,200-volt, 25-cycle generating apparatus given by the Marion station permits the shutting down of the Passaic generating plant, as the Passaic sub-station contains also step-down lighting equipment supplied from the Paterson plant as follows: Two Wagner 100-kw, 6,600-2,600-volt, two-phase, 60-cycle, oil-cooled transformers; two General Electric transformers of like capacity and style, and one Stanley 2,000-1,000, 60-kw, single-phase, 133-cycle transformer used for incandescent street lighting.

The Paterson plant, as soon as changes can be made, will naturally go the way of small unit plants, but cannot be spared for some time to come. It contains many small units as follows: One pair of 100-kw and four pairs of 200-kw, General Electric, 135-volt, direct-current generators, feeding a direct-current incandescent service, and four pairs of 225-kw, 550-volt, direct-current and one pair of 235-volt, direct-current generators for railway supply. Each of the ten pairs of the foregoing sets is direct-connected to a vertical Ball & Wood condensing engine. Two vertical Ball & Wood condensing engines drive a line shaft to which is belted three 100-kw, General Electric, 500-volt, direct-current generators for railway service; one 150-kw, 1,200-volt and one 300-kw, 2,400-volt, Stanley, two-phase, 133-cycle generators, and twelve Brush arc generators of 100 lights each. The boilers are ten 500-hp Stirling at 160 lb. pressure. Three 100-kw, Wagner, 60-cycle, 6,600-2,400-volt, and two 100-kw, one, two and three-phase, 60-cycle, 6,600-2,400-volt, General Electric transformers are in use, stepping up to the 6,600-volt line to the Passaic sub-station.

The Hackensack plant consists of two Stanley inductor type, 1,000-kw, 2,500-volt, 66-cycle, two-phase generators, and one Stanley, 825-kw, 66-cycle, two-phase generator, each direct-connected to a vertical cross-compound Mackintosh & Seymour condensing engine. There are four 300-hp Stirling and two Hogan water-tube, 350-hp boilers at 150 lb. pressure. This station will be shut down and at present has as sub-station apparatus eight General Electric Company 100-kw, 60-cycle, 2,200-6,600-volt transformers, one pair as a spare unit and each of the other pairs supplying the present lighting sub-station at Rutherford (which will be abandoned), and Englewood and Ridgewood. The lines for the eastern section of this territory are cabled under the Hackensack River in submarine cables. Cable houses supplied with cable switchboards are at the points where the cables enter and leave the river. As extra cables are laid, damaged cables can be readily cut out and perfect ones cut in. The cable house switches make it convenient for the testing of grounds. The transmission line to Ridgewood is eleven miles in length, the Rutherford line six miles and the Englewood line seven miles.

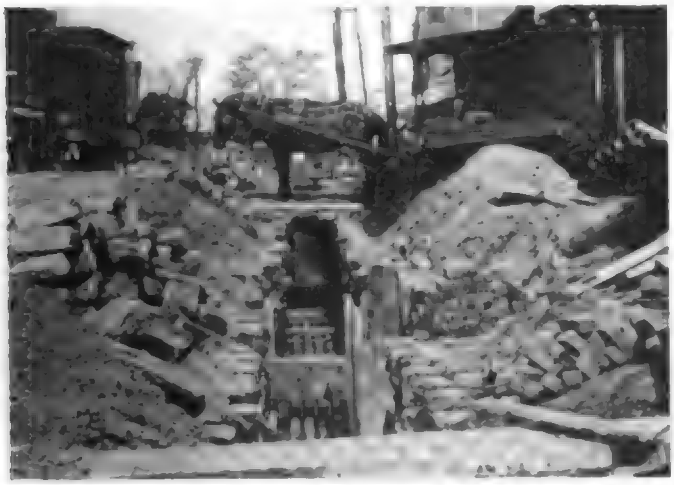


FIG. 8.—DUCT CONSTRUCTION, STREETS OF NEWARK.

The Ridgewood sub-station contains three 75-kw, General Electric, single-phase, 60-cycle, 6,600-2,200-volt transformers, one being a spare. Commercial lighting and street series incandescent circuits are fed over a wide suburban district. The Rutherford sub-station contains five 75-kw, General Electric, single-phase, 60-cycle, 6,600-2,200-volt transformers, one being a spare. They supply commercial and incandescent street lighting. Two General Electric tub transformers of 14 kw each supply series arc lights. The Englewood sub-station contains three Stanley, 6,600-2,200-volt, 60-cycle, 50-kw transformers and one General Electric of like capacity and type, which with one Stanley transformer is reserved as a spare unit. There are also two General Electric, 30-kw, 6,600-3,000-volt, tub transformers for arc street lighting. These three sub-stations will be fed from the Marion plant and a new sub-station called the Hudson River is to be erected part way between Englewood and New Durham, which will give a better distribution of circuits.

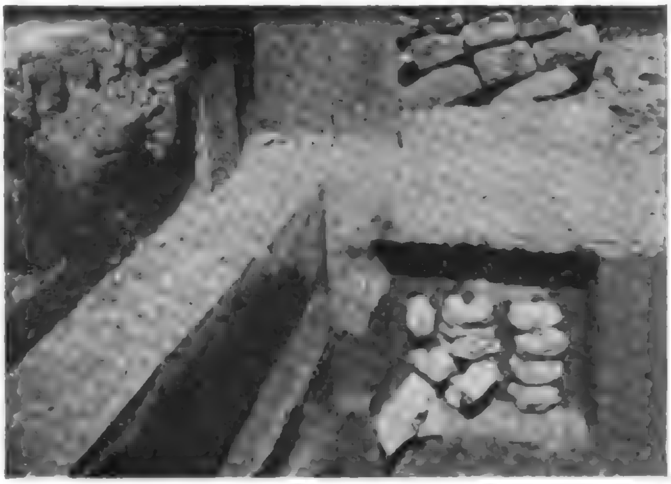


FIG. 9.—CONCRETE MANHOLE CONSTRUCTION.

The Hoboken plant at Fourteenth Street and the Hudson River will be retained, as all its capacity is required in the immediate vicinity. The district is rich in possibilities for power distribution. The present tie line with Jersey City at the Wayne Street station is to be dispensed with and the Hoboken plant relieved of this portion of its load, will permit the plant to better care for its own requirements for several years to come. The plant contains three Stanley inductor type, 750-kw, 60-cycle, two-phase, 2,600-volt generators. Two are direct-connected, each to a Providence Corliss cross-compound, horizontal, condensing engine, and one to a Pennsylvania Iron Works cross-compound, horizontal, condensing engines. There are three 850-kw, direct-current, General Electric, 550-volt generators, each direct-connected to a Pennsylvania Iron Works cross-compound condensing engine. There is one Westinghouse 300-kw, 2,600-volt, two-phase, 60-clcle rotary, giving 560 volts for power work. Four alternating-current Stanley, two-phase induction motors of 200 kw each are connected on the same shaft with a pair of Brush 100-light, alternating-current arc machines. There are eight 520-hp Babcock & Wilcox boilers at 150 lb. pressure.

There are two small independent plants in this Northern New Jersey section which are planned to remain owing to the difficulty in securing right of way for the necessary high-tension pole line. These are Morristown and Boonton, each situated about sixteen miles in an air line from the nearest central station at Newark, and about eight miles from each other. Both are lighting plants. Morristown contains two 120-kw and two 150-kw General Electric, 60-cycle, single-phase, 1,100-volt generators, belted to three Ball & Wood cross-compound, non-condensing engines. There are three 250-hp Hazelton vertical tubular boilers at 130 lb. pressure. At the Boonton station are two Stanley 90-kw, 1,200-volt, two-phase, 60-cycle generators, each belted to a Ball & Wood simple non-condensing engine. There are two Bigelow horizontal boilers of 125 hp each at 100 lb. pressure.

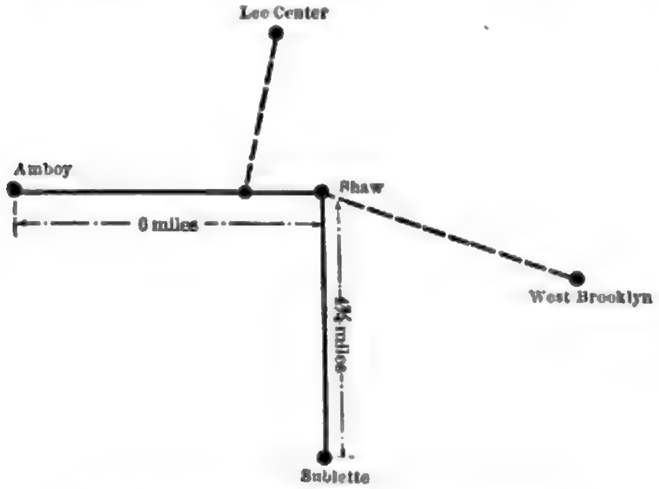
The Elizabeth plant is six miles from Newark and contains two General Electric 525-kw, 550-volt, direct-current railway generators, both direct-connected, one to a Watts-Campbell and the other to a Providence Corliss horizontal cross-compound condensing engine. There is also one 120-kw and two 300-kw, one, two and three-phase, 60-cycle, General Electric, 2,300-volt generator, belted to a line shaft; one 225-kw, General Electric, 550-volt, direct-current railway generator, also belted to the line shaft and sometimes used as a motor to drive the line shaft; two 25-kw and two 45-kw Edison bipolar generators, 125 volts, belted to the line shaft, and about 225 kw of Brush and Thomson-Houston arc machines belted to this same line shaft. This shaft is driven by a 400-hp Pennsylvania Iron Works, horizontal, compound condensing engine. This station also contains four Wagner, 6,600-2,400-volt, single-phase, 60-cycle, self-cooled, 250-kw transformers, used for stepping down from the City Dock station, Newark. There are also two Stanley, 25-kw, 2,400-500-volt, single-phase, 60-cycle, transformers used for a teaser connection. The boiler capacity consists of six 250-hp Babcock & Wilcox boilers and two 150-hp horizontal tubular Stewart boilers, all at 150 lb. pressure.

The Elizabeth plant is having a tie line installed connecting with the Rahway sub-station and through this to the Metuchen plant. The Cranford plant is wholly for railway supply, is about 4½ miles from Elizabeth and contains two Westinghouse 800-kw, 600-volt generators, direct-connected to a Williams vertical cross-compound condensing engine. There are nine 150-hp horizontal tubular Stewart boilers at 160 lb. pressure.

There is a 600-amp. storage battery at Orange for railway feed built by the National Storage Battery Company, one at Paterson of 700 amp. capacity, built by the Electric Storage Battery Company, used to supplement direct-current incandescent lighting, and a power battery of 500 volts of 1,000 amp. capacity, at Mechanic Street.

District Supply Near Amboy, Ill.

The Amboy Lighting & Power Company recently placed in operation a transmission line 10¾ miles long between Amboy, Ill., and Sublette. Amboy is a town of about 2,200 population and the population of Sublette is about 800. The company at Amboy recently rebuilt the electric lighting plant there. The lighting distributing system at Sublette which was recently put in is operated at 250 and 125 volts on a three-wire secondary system directly off the terminals of the step-down transformer, the primary of which is supplied over the transmission line at 6,600 volts. The transmission line and distribution system in Sublette called for an investment of about $6,000.



MAP OF DISTRICT SUPPLY LINES NEAR AMBOY, ILL.

The transmission line on the way to Sublette passes through the village of Shaw, as indicated by the accompanying map, at which point a small amount of lighting is done. It is the intention to build a branch line to Lee Center and also to continue the line now running through Shaw to West Brooklyn, thus supplying in all four villages besides Amboy. The pole line is constructed with No. 8 hard-drawn copper wire on 30 ft. poles, having 6-in. tops. Standard 2-pin cross-arms, double braced, were employed. The step-up and step-down transformers are 30-kw Kuhlman.

No regular employee is maintained at Sublette. Arrangements are made with a telephone man at Sublette to switch the street lighting circuit on and off and to answer minor trouble calls. The street lighting in Sublette is done with 20-cp. multiple incandescent lamps.

The station at Amboy which has been reconstructed is a substantial little building containing two Warren alternators, one of 65-kw capacity and one of 80-kw. These are both 60-cycle machines, driven by high speed engines. There are two 100-hp horizontal return flue boilers. The building is of brick with asbestos composition roof and cement floors in the boiler room, making it practically fireproof.

The engine room floors are hard wood. Most of the lines in Amboy have been rebuilt and the transformer system has been thoroughly overhauled, replacing small with large transformers and bunching as many customers as possible on each transformer. The service was formerly very unreliable and unsatisfactory, owing to the run-down condition of the plant. Since the present owners took hold of the property and rebuilt it, there has been an increase of nearly 100 per cent in the gross income. Most of this has been due simply to the better service given. The rates are 15 cents per kw-hour.

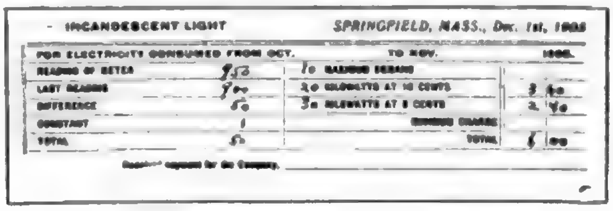
The transmission line is located on the highway, for which the consent of abutting property owners and a franchise was secured.

Central Station Economics in Massachusetts.— III.

UNITED ELECTRIC LIGHT COMPANY, SPRINGFIELD.

This company was organized in 1886, and it does a general power and lighting business in Springfield, West Springfield and Long Meadow, serving a population of about 75,000, according to the State census of 1905. Its officers are: President, Robert W. Day; treasurer, W. A. Lincoln; general manager, W. L. Mulligan. The company's general offices are at 133 State Street, Springfield, and there are three power stations, one being located at Indian Orchard, a second at Birchem Bend and the third at the foot of State Street in Springfield, on the east bank of the Connecticut River. These plants have been described in detail in these columns and a mere résumé of their equipment will be given below.

The Indian Orchard plant was one of the first hydro-electric stations to be placed in commercial service in Massachusetts. It is located about seven miles east of Springfield on the Chicopee River and at present contains five McCormick turbines, one Westinghouse, 600-kw, direct-connected, revolving-field alternator, four Stanley, 400-kw alternators of the inductor type; eleven Brush arc machines of 140 lights each, and two Westinghouse, 500-kw rotary converters for railway or power service. The alternators are all built for 60 cycles and generate current at 5,500 volts, which is transmitted to Springfield by two two-phase circuits. The Brush arc machines are employed in the street lighting service, the current for this work also being transmitted to Springfield. Recording ammeters are used on the arc switchboard at the Springfield end of the line to enable the attendants to keep a closer watch upon the performance of the machines than is possible with ordinary indicating ammeters, and to provide a convenient and reliable record of the condition of the circuit at


INCANDESCENT LIGHT SPRINGFIELD, MASS., Dec. 1st, [illegible]

FOR ELECTRICITY CONSUMED FROM OCT. TO NOV. [illegible]

READING OF METER	950	10 [illegible]	
LAST READING	900	20 KILOWATTS AT 10 CENTS	[illegible]
DIFFERENCE	50	30 KILOWATTS AT 5 CENTS	[illegible]
CONSTANT	1	[illegible] CHARGE	
TOTAL	50	TOTAL	[illegible]

FIG. 1.—RECORD OF CONDITION OF CIRCUIT.

all times. These records are often of use in checking up outage claims from the city after fires or other casualties, and it has frequently happened that by their use the attendants at Springfield have discovered operating irregularities before the Indian Orchard attendants have noticed them on the spot, so that a telephone call has sufficed to remedy the situation.

The Birchem Bend plant contains two Westinghouse, 475-kw, 5,500-volt, 60-cycle, two-phase alternators, direct-connected to McCormick turbines. It is located about two miles from Indian Orchard and is connected with the latter plant by a tie line. From Birchem Bend to Springfield a five-mile line extends, completing the triangle of connections, so that both Indian Orchard and Birchem Bend can supply Springfield directly or through each other. This flexible arrangement is of great value in insuring reliable service.

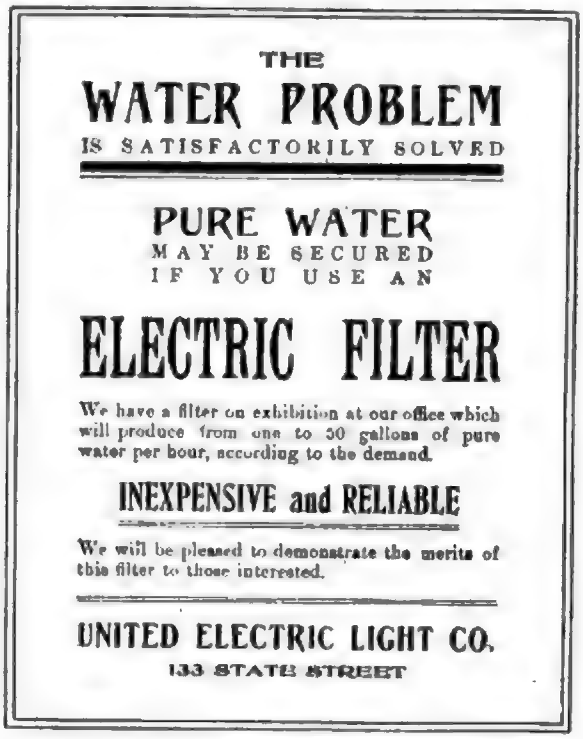
The Springfield plant is used in part as a generating station and in part as a sub-station, depending upon the amount of water available at the hydraulic plants. It contains five 400-hp and three 300-hp Hazelton upright boilers, equipped with Murphy furnaces to comply with the smoke laws. Each boiler has its own chimney in order to secure adequate draft and economy of space. All exciter sets and condensing apparatus are steam-driven. There are three 1,000-kw Westinghouse-Parsons steam turbines direct-connected to alternators, five Brush arc machines for commercial lighting, one General Electric 500-kw, 500-volt, direct-current generator, one Westinghouse 500-kw rotary converter and a 475-kw synchronous motor used in times of good water supply to drive the Brush arcs and a 500-volt General Electric generator. These latter are driven by an 800-hp Corliss engine when the water supply is inadequate.

Coal is handled at Springfield by an electrically-operated locomotive crane with a grab bucket which takes the fuel from the railroad cars and delivers it to a motor-driven coal crusher, whence it passes to weighing apparatus, and then to shunts leading to a belt conveyor which finally deposits it in bins above the boilers. Gravity feed to the furnaces follows. The ashes will be handled by a belt conveyor as soon as it is feasible. All the power plants are equipped with hand-operated cranes to facilitate inspection and repairs, removals or additions of machinery. George Creek coal is burned, costing about $4.75 per ton. Daily records are kept of the coal consumption per kw-hour, which averages about three pounds. The boilers are banked or allowed to become cold according to water conditions. On the average three boilers are ready for emergency service.

The total number of kw-hours generated by the plants of the company during the year ending June 30, 1905, was 11,331,299. Of this output, the water power plants supplied 63 per cent and the steam plant at Springfield the balance. The cost of manufacture has been reduced by the removal of belted units at Indian Orchard and Springfield, by the installation of a modern coal-handling system at the latter point in place of the laborious hand methods previously employed, and by the installation of steam turbines, which improve the load factor by their well-known operating economy at fractional outputs. The wiring at Indian Orchard has been thoroughly modernized and all the plants put in the basis of concrete construction.

The operating economy of the power plants is kept track of by regular wattmeter readings, records of coal consumption, labor cost, water meters and recording gauges at the hydraulic stations. The power house force is organized on the basis of first-class wages and eight-hour shifts.

Incandescent lighting is carried out on single-phase circuits of 1,200 and 2,400 volts, and street lighting by 5-amp., direct-current Brush arcs. Power is supplied in quantity where desired by a two-phase, 5,000-volt circuit, the high potential being carried as far as the consumer's premises. There is also a 500-volt, direct-current power circuit available. On June 30, 1904, about 25 miles of underground conduit were in service, and this is being increased at the rate of about five miles per year. Circuits are tested for grounds or excessive losses at least once a week. To improve the economy of distribution, small house-to-house transformers are very largely being superseded by large transformers with grouped residential and commercial loads. These large transformers are frequently placed in manholes, with three-wire secondary leads feeding the street on each side. The cost of maintaining distributing lines has been considerably reduced by the installation of the underground system and also by replacing air-cooled or "dry" transformers by the oil-cooled type. Special care is also taken to keep the pole lines in first-class condition. The telephone is used throughout all the system, private wires being run at the company's expense to the homes of all responsible employes. The policy of the company in regard to connecting up loads located outside the main distributing system varies according to the investment in new equipment required, but in general it may be said that no new business is refused, however far it may be from the center of distribution. If the territory is undeveloped, the customer may be asked to bear a share in the extra investment required to meet his conditions, but the arrangements in such cases admit of no specific classification. The terms of each contract naturally depend upon the problem in hand, but as the territory develops and becomes profitable, the conditions usually are found to grow more favorable to the original customer, leading to the possible refunding of his pro rata share in the primary extension.



THE

WATER PROBLEM

IS SATISFACTORILY SOLVED

PURE WATER

MAY BE SECURED

IF YOU USE AN

ELECTRIC FILTER

We have a filter on exhibition at our office which will produce from one to 30 gallons of pure water per hour, according to the demand.

INEXPENSIVE and RELIABLE

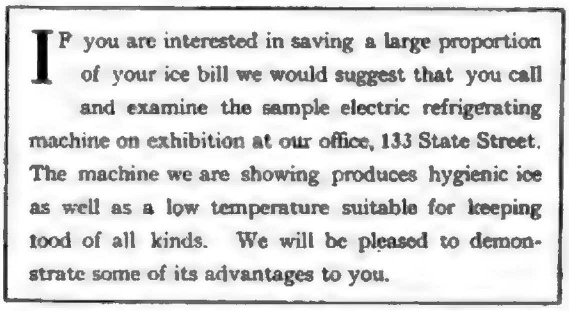
We will be pleased to demonstrate the merits of this filter to those interested.

UNITED ELECTRIC LIGHT CO.

133 STATE STREET

Fig. 2.—Example of Advertisement.

Portable watt-hour meters are used in making service tests of consumers' meters. Card index records of meters, pole locations, underground services and customers are constantly maintained in the office, and drawings and data are filed alphabetically in a special safe. The addressograph and the adding machine are also in the office.



If you are interested in saving a large proportion of your ice bill we would suggest that you call and examine the sample electric refrigerating machine on exhibition at our office, 133 State Street. The machine we are showing produces hygienic ice as well as a low temperature suitable for keeping food of all kinds. We will be pleased to demonstrate some of its advantages to you.

Fig. 3.—Example of Advertisement.

The United Electric Light Company advertises extensively in the local newspaper, changing the text of its "write-ups" from time to time as circumstances dictate. Special efforts are made to point out in terse, pithy language the broad economy, cleanliness and convenience of electricity in all its applications. The practice of variety in the advertisements is fostered by the almost numberless applications of electricity which the central station supplies. Two examples of advertisements are shown in Figs. 2 and 3.

Circular letters are sent to customers as occasion warrants, and neat circulars bearing upon the all-around usefulness of electricity are constantly kept before the public eye in the company's offices, on tables, beside the cashier's window, etc. Customers are also solicited by two men who devote practically all their time to getting new business. An excellent exhibit of electrical appliances is maintained by the company at its general offices. These are located on the ground floor at 133 State Street, and the front of the premises is bounded by two large windows filled with electric heating or other equipment of interest to the general public. Inside are set up ready for operation at will electric radiators, flatirons, stoves, coffee pots, a cigar lighter, small motors and an electric filter. Besides the latter are shown two bottles of Ludlow water before and after treatment, and a report by an expert chemist of Springfield showing that in a certain case the sample of water before filtration contained from 4,000 to 11,000 bacteria, and after filtration from 16 to 140 bacteria only, a reduction of from 97 to 99.8 per cent. A refrigerating machine driven by a ½-hp, 110-volt, three-phase induction motor is also shown, and the walls are hung with a number of excellent photographs of the company's power plant exteriors and interiors. The stock room is located on this floor and is brilliantly lighted by Nernst lamps. "Meridian" lamps are also used in the office. On one of the walls is a panelboard upon which are mounted lamps varying from 2 cp to 50 cp in size, wired up for service. Adjoining each lamp is a statement of the cost per hour at the regular rates, as follows:

Cost per Hour at Regular Rates.

1/10c.	2/10c.	39/100c.	45/100c.	51/100c.	9/10c.	1 3/10c.	1 8/10c.	3 1/10c.
2 cp.	4 cp.	6 cp.	8 cp.	10 cp.	16 cp.	25 cp.	32 cp.	50 cp.

The rates of the United Electric Light Company for incandescent service are special for very large customers, but in general they are based upon the "Wright Demand" system. Twice the maximum demand reading is charged at 18 cents per kw-hour and the excess at 8 cents. A sample bill is reproduced herewith (Fig. 1). The rates for motor current vary from $50 minimum yearly charge for 1-hp motor to $600 minimum for the 25-hp and 30-hp sizes; the charge per kw-hour varies from 5 cents in 2-hp to 5-hp motors to 3¼ cents in 25 or 30-hp motors. Electric sign current costs from 6 to 8 cents per kw-hour, on a separate meter, and current for electric heating costs from 3 to 5 cents per kw-hour on a separate meter. No discounts are used.

Gas competition is met by furnishing a better illumination at fair rates. The gas arc has been vanquished in many cases by the use of the Nernst lamp, or by clusters of "Meridian" lamps with pagoda shades. Free incandescent renewals are made by the company, and in new installations the company provides meters and lamps without charge. Customers buy their own motors. Over 500 alternating arc lamps of the enclosed type are in commercial service. No apparatus is rented to customers and the company's inspectors are all uniformed. The window lighting business has become very highly developed in Springfield and electric signs are largely used.

Single-Phase Equipment for the St. Clair Tunnel.

Last week we made note of the fact that St. Clair Tunnel Company had adopted single-phase locomotives for the operation of trains through the Sarnia tunnel, and mentioned a few of the general features of the installation. We are now able to give a more detailed account of the locomotives and the power equipment. There will be six locomotives, each of which will be mounted on three pairs of driving wheels which will sustain the entire weight distributed by equalizer bars similar to those used in steam locomotive practice, will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse friction draft gear, MCB automatic couplings, air sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel mounted on a framework of iron which supports both walls and roof.

The principal dimensions will be approximately as follows: Length over end sills, 27 ft. 9 in.; rigid wheel base, 12 ft. 0 in.; width over all, 9 ft. 6 in.; height from top of rail to top of cab, 12 ft. 6 in.; diameter of driving wheels, 62 in.

The operating apparatus will be arranged along the sides of the cab, leaving a free passageway 3.5 ft. wide the entire length. The cab will be lighted and heated by electricity.

Westinghouse combination automatic and straight air and American driver brakes will be used. The air supply will be provided by a two-cylinder motor-driven air compressor. A motor will be geared to each axle, giving each unith an aggregate rated capacity of 750 hp. The motors are of the Westinghouse single-phase, series-wound, compensating type. Each motor will weigh complete approximately 14,500 pounds, the armature weighing approximately 5,600 pounds.

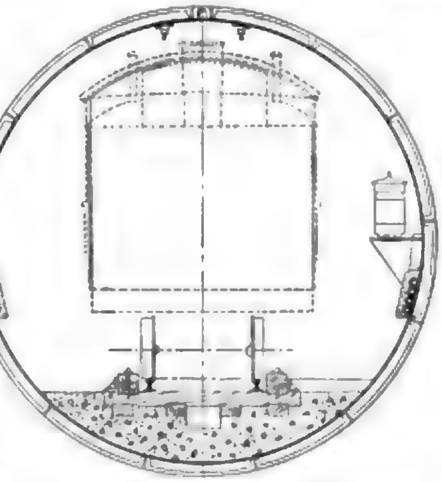


FIG. 1.—CROSS-SECTIONAL VIEW OF TUNNEL.

The motor frame consists of a steel cylinder cast in one piece and enclosed at the end by brackets of the same material, which carry the bearings and oil reservoirs. The suspension noses and safety lugs form a part of the main casting. Seats for the axle bearings are cast solid with the frame. Bearings are of phosphor-bronze lined with babbitt, and each is divided into two parts. They are of exceptionally large dimensions, and are arranged for oil waste lubrication. The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom and

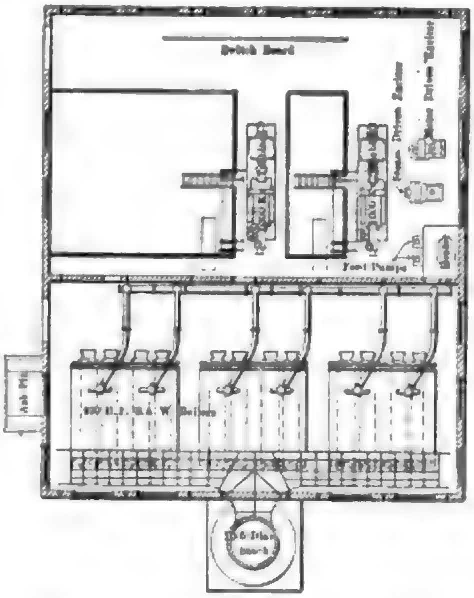


FIG. 2.—GENERAL PLAN OF POWER HOUSE.

passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps which are split at an angle of 35 deg. with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame which extend over the axle rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders.

Within the cylinder of the motor frame there is built up a core of soft-steel punchings, forming a complete laminated field core. The punchings are dovetailed into the frame and clamped between end rings of cast steel. The field coils are wound with copper strap insulated between turns and around the coils by mica, and are finished by taping and dipping, and are impregnated in the best grade of varnishes, providing a sealed coil which can withstand the most severe internal heat, and is practically indestructible under the usual conditions of heavy railway service.

In addition to the main coils the field core carries a neutralizing winding which consists of copper bars placed in slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding which is connected in series with the main field winding and with the armature circuit. The magnetizing effect of this auxiliary winding is directly opposite to and neutralizes that of the armature winding, thus eliminating the effect of armature reaction and improving the commutation and the power factor. The main coils can be easily removed without disturbing the auxiliary winding.

The armature cores are formed of slotted soft steel punchings built up upon a spider and keyed in place. The spider is forced upon the shaft with heavy pressure and secured by a steel key. Coils of copper strap are embedded in the slots and joined to form a closed multi-circuit winding which is cross-connected, like the multi-circuit winding of a direct-current generator. The basis of the insulation is mica. A preventive resistance is connected between the commutator and each main coil, introducing a preventive action which is effective only when the coil is passing under the brush.

During operation a forced circulation of air supplied by motor-driven blowers enters at the rear, distributes itself thoroughly throughout the motor and escapes through the perforated cover over the commutator. This system of forced ventilation of both motors and auxiliary apparatus secures a maximum output from a given weight of material, and a high ratio of continuous output to the one-hour motor rating common in railway practice. It also provides effective ventilation while the locomotive is not in operation as the blower may be driven while the locomotive is standing at the station or at the end of the line. Motors ventilated in this manner are enclosed and are thereby protected from internal damage by dirt and water and from mechanical injury.

Each motor is wound for 240 volts and 25 cycles per second and has a nominal rating of 250 hp on the basis of usual electric railway practice.

The essential elements of the control equipment include the collecting devices, the auto-transformers, the unit switches, the preventive coils, the reverser and master controllers. A multi-unit system of control is provided with pneumatically-operated switches, and circuit-breakers, and a low-voltage control circuit. Any unit may be controlled from either end, and two or more units may be coupled together and operated from a single cab and by a single crew. A control circuit is carried from one unit to the next by means of connecting sockets and jumpers in the usual manner.

Speed control of the driving motors is secured by variation of the voltage at the motors obtained by means of taps taken from the winding of the auto-transformer which receives current from the trolley at 3,000 volts and reduces it to 240 volts or lower, according to the tap employed. These taps are connected to unit switches from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field coils of each motor.

The unit switches are in effect pneumatically-operated circuit breakers of great power and reliability. The mechanism is such that a rolling and sliding contact is obtained when the switch closes and opens. The arc is broken at the taps, leaving the contact surfaces smooth and unscarred. Each unit has a magnetic blow-out coil with laminated core. The switch cylinders are controlled by magnetically-operated valves, current for which is obtained from a 50-volt tap from the auto-transformer. The sequence of operation is governed by the master controller in conjunction with a system of interlocks which prevents short-circuit of the steps between taps from the auto-transformer or improper operation of the controlling mechanism. At any running point four controlling switches are closed. Through the preventive coils approximately the same amount of current is drawn from each of these switches and the leads to which they are connected. To change to a higher voltage on the motors, the master controller is moved to the next notch, opening the last switch of the group that is closed and closing the switch next higher, with the result that the motor voltage is shifted up one step. By this arrangement the voltage at the motor will be completely under control of the locomotive driver and may be varied up and down at will without interrupting more than one-quarter of the load current. Small switches in the circuits to the magnets of the reversing switches will enable any motor or combination of motors to be cut out without disturbing the others.

Every one of the 17 controlling connections provides an efficient

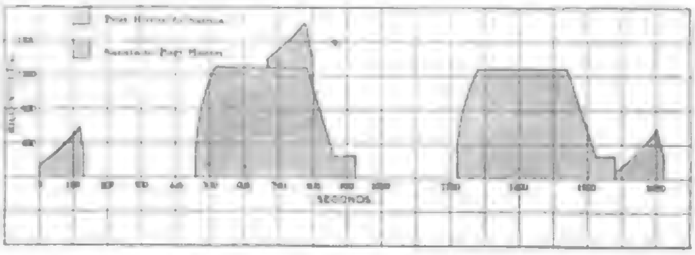
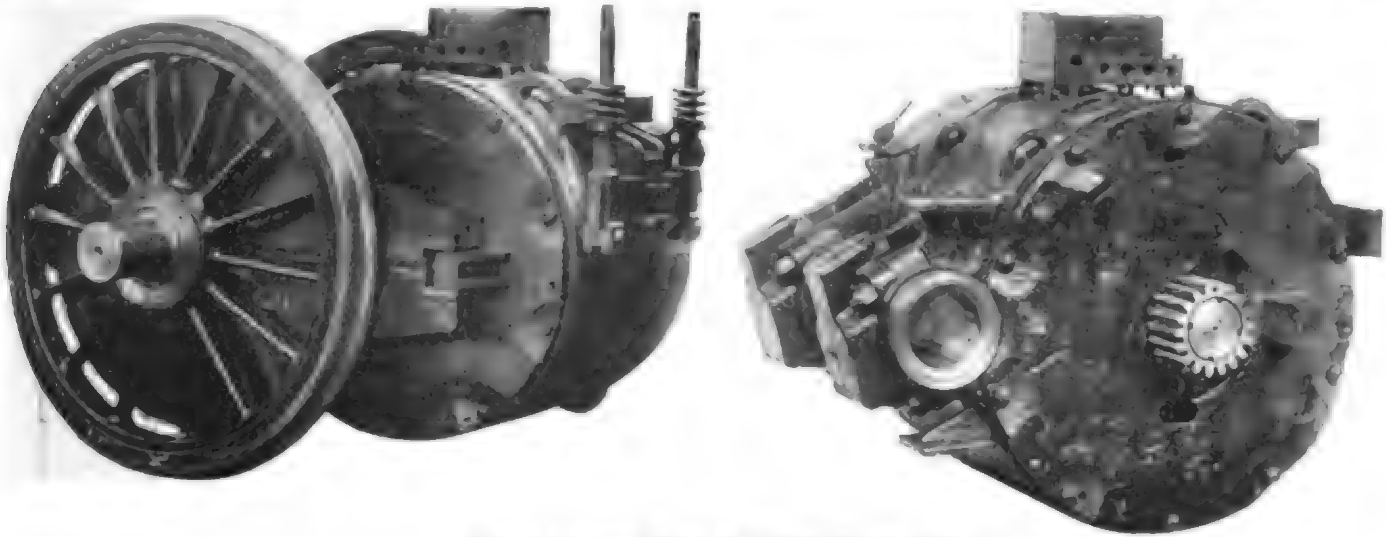


FIG. 5.—CURVE SHOWING POWER REQUIRED TO DRAW 1000-TON TRAINS THROUGH TUNNEL.



FIGS. 3 AND 4.—VIEWS OF SINGLE-PHASE MOTOR.

running point. This number is ample to prevent any slipping of the driving wheels due to increase of current from one notch to another. Whether empty or heavily loaded, operated in single or multiple units, torque and draw-bar pull may be gradually applied and the locomotive started without jar.

Each locomotive unit will be equipped with a pneumatically-operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The proportions of the pantagraph will be such that, when extended, it will make contact with the trolley wire 22 ft. above the rail, and, when closed down, the contact shoe will not extend more than 18 in. above the roof of the locomotive. The pantagraph will have a broad base and will be constructed of light and stiff material. A No. 4-0 grooved overhead trolley wire will be suspended from a single ⅝-in., high-strength, double galvanized, steel strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

For the operation of the electric locomotives a complete power plant will be installed by the St. Clair Tunnel Company, including two 1,250-kw, 3,300 volts, three-phase, 25-cycle, 1,500 r.p.m., rotating-field, Westinghouse steam turbine units with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply power to light the buildings, yards and tunnel, to operate motor-driven centrifugal and triplex pumps which drain the tunnel and approaches and operate the sewage system, to run motors in the roundhouses and for other purposes.

The pump motors will be of the three-phase induction type, wound for 440 volts. In each of the roundhouses, one at Port Huron and one at Sarnia, there will be installed a 30-ton, three-phase motor to be operated directly at the transmission e.m.f. of 3,300 volts. There will be two 40-kw, 125-volt, direct-current exciter generators, one of which will be driven by a steam turbine, the other being direct connected to a 3,300-volt, threee-phase induction motor. The switchboard will provide for one single-phase railway feeder, four three-phase pumping feeders, and four three-phase lighting feeders. A Tirrell regulator used in connection with the exciters will serve for maintaining the voltage at the proper value.

The new equipment will handle that portion of the Grand Trunk Railway system which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair River. The tunnel proper is 6,032 ft. long, and the line to be electrically operated measures 19,348 ft. from terminal to terminal.

A pair of the new units will be capable of hauling a thousand-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heavier trains can be divided or sent through together with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in 15 minutes, under the following conditions:

It will be coupled to the train on a level track at a point 1,200 ft. from the summit and must accelerate it up to a speed of 12 miles per hour in two minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent to the level track in the tunnel at a speed not exceeding 25 miles per hour, continue on the practically level stretch under the river, and then draw the train up a 2 per cent grade at the rate of 10 miles per hour to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 miles per hour is reached. Each unit must be capable of exerting a tractive effort of 25,000 pounds for a period of 5 minutes, in addition to the force required to accelerate the train at the starting point and to run with it into the terminal yard, from which point it must immediately run back to a position 1,200 ft. from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must, therefore, make a run of the character described every 30 minutes.

It is expected that the electric equipment will greatly relieve the present traffic congestion, which is due in a large measure to the necessity of dividing trains at the terminal points, and will greatly simplify the operation of the road.

The work of installation will be conducted under the supervision of Mr. Bion J. Arnold, of Chicago, consulting engineer for the tunnel company, by whom the plans and specifications were prepared.

New Telephone Patents.

SYSTEM OF TELEPHONY.

A system of telephony has been patented by Mr. A. G. Davis, of Schenectady, N. Y., in which the telephone current or wave is related to the resonance of the transmitting circuit. With such a system we must, of course, have a primary source of alternating current which produces a current of frequency and wave form such that it is inaudible in the receiving mechanism. If a line be charged with such a current and then by the proper design of the telephone instruments with regard to capacity and inductance, a combination circuit may be formed which will resonate perfectly, or in as near perfect resonance as desired with the impressed alternating current. Mr. Davis advocates a circuit slightly out of tune, where a slight effect upon the constants of the circuit varies the current rapidly. For a transmitter for varying the constants he suggested the familiar condenser transmitter and also a transmitter similar to the magneto transmitter except that it is not polarized. One will affect the capacity, the other the inductance. Mr. Davis conceives a relation between his transmitter and resultant current such that the instantaneous current values will approach proportionality with the instantaneous positions of the diaphragm with reference to its normal position.

A multiplex system is also suggested by varying the frequency of the impressed alternating currents and providing several simultaneous sources of supply.

COMBINED TELEPHONE AND TELEGRAPH SYSTEM.

A combined telephone and telegraph system has been brought out by I. Kitsee, of Philadelphia, for use along railways. Normally the telephone and telegraph are both connected to the line. The former is of no effect on the latter because of condensers included in its circuit. Similarly, the telegraph is of no effect upon the telephone because, first, of its inductance and second because the batteries of all stations are similarly poled and substantially equal. In order to telegraph the sending station must reverse its battery. This is the key to the invention.

PARTY-LINE SYSTEM.

R. H. Polk has invented a party-line ringing device which consists of special switchboard circuits adapted by the use of two jacks for each two-party line to ring each station the same as for direct use. The bells of the stations, one off each side of the line, are grounded through condensers. If we ring on one jack we ring one side of the line. If we ring on the other jack, a reversing relay reverses the line automatically.

LETTERS TO THE EDITORS.

Switch Mechanism.

To the Editors of Electrical World:

Sirs:—Your editorial of December 23, 1905, on "Converter Sub-Stations" makes some pointed remarks about the present craze in the design of switchboards in which everything possible is made automatic. The tendency to revert to simpler apparatus is apparent, but the cost of some of the switchboards and switch control mechanisms in some modern stations is appalling and amounts, in a great many cases, to absolute waste. As I have said before the International Electrical Congress, it is better to burn up occasionally an inexpensive switch than to burn up all your money in the beginning by expensive switches and mechanisms.

The switchboard should be so simple in design and operation that a glance at its face, the machines and lines will indicate the use of every piece of apparatus on it. I have been criticised by some engineers for the "extreme" to which I have gone to eliminate all possible automatic apparatus, but a record of the operation of our stations sustains my course. We have very little automatic apparatus, yet most of our trouble has been with this class of apparatus. The hand-operated or "brain-operated" apparatus has practically a clean record.

I would also plead with the manufacturers to make switches of two classes, one class being operated electrically or by oil or air under pressure, and the other arranged for the simplest mechanical operation. Many stations do not need, and some cannot afford, the more expensive apparatus, which is generally good to show—if the cost is not mentioned. Every switch manufactured ten years ago is probably obsolete to-day, which should be remembered when laying out new work. As an example, during the last two years it became necessary to replace every high voltage switch on the system of the California Gas & Electric Corporation. To have installed the apparatus offered by manufacturers would have cost about $200,000. Hand-operated switches of our own make were installed instead at less than one-fifth the cost, and these have stood every test that has been put on them. Where possible, all switches are operated by a simple lever, and we have found that a man on one end of a lever is the surest way of producing a desired result on the other end.

SAN FRANCISCO, CAL. F. G. BAUM.

Topical Classification for Electrical Engineering References.

To the Editors of ELECTRICAL WORLD:

SIRS:—I have noted with interest the recent article by Mr. George Parsons on "A Topical Classification for Electrical Engineering References," pages 910-912, of Vol. XLVI of your journal.

I thoroughly approve of his statements concerning a topical classification with energy as the fundamental basis of the arrangement; the possibilities for expansion, and the writing and classification of notes on cards. Mr. Parsons' illustration with respect to the Cooper Hewitt mercury vapor lamp to show the advantage of the topical over the alphabetical classification is apt. I may be permitted further to remind you that the topical classification is independent of language and can be employed for international service where no alphabetical classification could serve. The classification of articles on "nitrogen" with its German and French equivalents, "Stickstoff" and "azote," will illustrate what I mean.

I desire, however, to call Mr. Parsons' attention to the fact that the International Institute of Bibliography of Brussels has published in French a very considerable development of Melvil Dewey's last classification, which is at least worthy of mention.

Mr. Parsons could have distinguished more thoroughly between the *manufacture* and *use* of electrical machinery, although the basis of the classification is "energy." The electrochemical engineer manufacturing accumulators will not be satisfied with the complete separation of this subject from "primary cells"; "accumulators" and "primary cells" should have a general head in common. Many patents, for instance, are taken out on jars, grids, insulators, etc., covering their use in both primary and secondary cells. If no general head is provided such references must be duplicated.

It would further seem Mr. Parsons' intention to place notes on fuses, circuit-breakers, etc., in at least three places. This would again not satisfy the manufacturer of these articles, unless it is intended to group duplications of such reference under the sub-heads, "Interior wiring."

The subdivision "Chemistry and direct products," if signifying electrochemistry, it would be impossible to develop and retain consistently under electrical engineering. If the classification is to follow Dewey—and uniformity cannot be over-emphasized—this subject belongs properly to "chemical technology" and to "metallurgy."

I would further recommend the use of symbols—and decimal symbols, as suggested by Dewey, have been found the simplest—for the subjects; especially if the notes are numerous and are to be frequently worked with, and if time is a factor.

These decimal symbols also tend to equalize chapters of like importance and will remove such distortion as is to be noted in Mr. Parsons' classification where "electrolytic rectifiers" (a second-place sub-head under "transformation," appears to be of as much importance as the second-place sub-head under "utilization," "electric railways."

CONCILIUM BIBLIOGRAPHICUM, ZURICH. A. L. VOGE.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Motor.—AMMON.—In a report of the Olympia electric exhibition in London, a 10-hp Goldschmidt motor, built by Crompton & Co. for 750 r.p.m., with four subdivided slip rings, is described. The rotor has a three-phase star winding. On each of the slip rings a number of insulated rods is placed corresponding to the number of poles. These insulated rods are all connected with the neutral point of the rotor winding. The arrangement is shown in Fig. 1 and the action is as follows: If a brush is in such a position that it connects the slip ring with one of the insulated rods, one of the rotor phases is short-circuited and gives a repulsion torque. The corresponding position of the brushes on the different slip rings yields a continuous torque. The brushes on the slip rings are connected with a starting resistance which is gradually short-circuited. The motor then continues to run as an induction motor. The motor control is accomplished by a small displacement of the brush yoke and for this purpose the latter is connected mechanically with the regulator. The motor gives a starting torque equal to 1.75 times the full-load torque while consuming 1.5 times the current. The controller which is used with this motor for elevators is provided with a brake-cylinder to prevent too rapid switching-in, while on the other hand an immediate switching-off is accomplished by springs.—*Elek. Zeit.*, December 28.

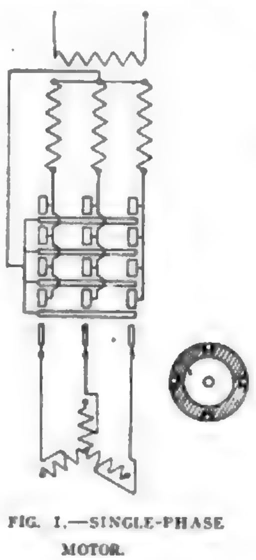


FIG. 1.—SINGLE-PHASE MOTOR.

Compensated Single-Phase Motor.—LEHMANN.—In studying the compensation of single-phase motors the author has been led to a class of compensated motors, the feature of which is that the compensation of the phase difference is obtained without auxiliary brushes so that the number of necessary brushes becomes equal to the number of poles. The author proposes to discuss in his article the theory of these motors and to compare the theoretical conclusions with the results obtained in practice. The arrangement discussed by him is shown in Fig. 2. It shows an ordinary repulsion motor with a commutator and short-circuited brushes, the line between the brushes being displaced against the direction of the primary field. The stator may have an ordinary continuous winding, supplied with current at two points, *a b*, but being also connected at two other points, *c d*, with n adjustable reactance, *L*. The author shows that by properly adjusting the value of *L* and the angle between the lines, *c d*, and the direction of the primary field, it is possible to obtain perfect compensation of the phase difference at different loads. At the same time it is possible to adjust the torque by this method. Further, if the magnetic reluctance is the same in all directions, a perfect revolving field is obtained at synchronism and consequently the voltage between the segments of the commutator disappears at this speed. In the present installment the author gives the mathematical theory.—*L'Eclairage Elec.*, December 23.

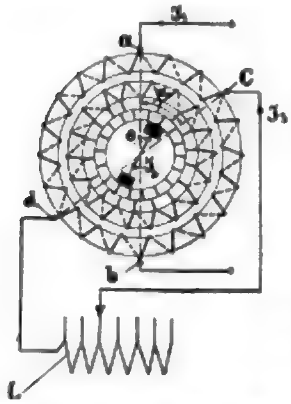


FIG. 2.—COMPENSATED MOTOR.

Commutation Poles.—Arnold.—A note supplementary to his recent theoretical article on commutation of direct-current machines and interpole construction. He gives a numerical example from practice. In this case the reactance e.m.f. calculated according to Hobart is 0.92 volt and calculated according to Mueller is 0.75 volt; since a reactance e.m.f. below 2 volts is considered the criterion for good commutation it would follow that the machine should behave well as to commutation As a matter of fact, however, it tends to spark. This shows that the reactance voltage alone does not determine the liability to spark.—*Zeit. f. Elek.* (Vienna), December 24.

Liege Exposition.—Reyval.—An illustrated description of a gas-driven generating set exhibited at Liege. The 250-hp gas-engine is exhibited by the Deutz Company, the generator by the Garbe-Lahmeyer Co. The speed is 160 revolutions and the 143-kw generator gives 1,240 amperes at 115 volts. Details of dimensions are given.—*L'Eclairage Elec.*, December 23.

Lights and Lighting.

Conductivity of the Vapor from the Mercury Arc.—Child.—An abstract of a paper presented before the Am. Phys. Soc. on an investigation of the space in the neighborhood of a mercury arc. The vapor coming from a mercury arc is highly conducting. A luminous space gradually spreads out from the arc, and the front of this region has the greatest conductivity and the greatest luminosity. This conductivity is not due directly to ions coming from the arc, nor to rays sent out by it. It is not due to any leakage over the surface of the glass. It is probably not due to the high temperature of the gas. A probable explanation is suggested by Prof. Ernest Merritt, that is, that when the ions first recombine, they are in a condition of unstable equilibrium, much like the atoms of radio-active matter and that many of these combinations break up again into positive and negative ions. There is an e.m.f. between electrodes inserted in different parts of the tube, which is possibly due to the more rapid diffusion of the negative ions.—*Phys. Rev.*, December.

Power.

Power in Cement Plant.—An illustrated article on the electric power plant of the Lakefield Portland Cement Co. Electric power is transmitted from two hydraulic stations. There are connected to the various machinery throughout the works four 100-hp, five 50-hp and one 15-hp and two 10-hp induction motors.—*Canadian Elec. News*, December.

Electricity in Mines.—Guarini.—An illustrated description of some electrical installations in European mines, describing different kinds of apparatus for chain and locomotive haulage, hoisting and ventilating.—*Mines and Minerals*, January.

Electric Winding.—Creplet.—A paper presented before the Liege Congress on the electric driving of winding drums for pit-mouth haulage, with special reference to the practice at a French mine.—Lond. *Elec. Rev.*, December 15.

Fan Blowers.—Snow.—An illustrated article of a general nature on the condition of fan-blower design.—*Cassier's Mag.*, January.

Electric Capstans.—Davy and Raudot.—An article on electric capstans, which are divided into three classes: First, those with direct-connected motors, second with spur gearing, and third with worm gearing. The authors are in general favor of the second class. Some results with an electric capstan of a French make are given.—*L'Industrie Elec.*, December 25.

Lathes.—Perkins.—A fully illustrated article on large electrically-driven lathes.—*Iron Age*, January 4.

Efficiency of Steam Turbines.—Marguerre and Anders.—Two communications in which the authors continue their controversy on the method of determining the efficiency of steam turbines. *Elek. Zeit.*, December 28.

Boiler Water.—Snow.—An illustrated paper on water softening for boiler use.—*Jour. Western Soc. Engs.*, December.

Cost of Power.—Griffin.—An article giving formulas and a diagram for calculating the cost of generating electric power for varying cost of coal and for varying average output of the machines expressed as fraction of their rated capacity.—*St. R'y Jour.*, December 30.

Traction.

Hanger Bolts.—Tweedy.—An article on preventing the failure of insulated hanger bolts on electric tramways. The failure is due to the deposition of conducting and foreign matter and to the formation of oxides, and these again are caused by moisture which is thrown into the hanger as the trolley wheel passes under it. The author, therefore, interposes a shield between the trolley wheels and the bolt. He does this by stamping out an annular disc from hard or flexible fibre, rubber, dermatine, or even a metal sheet, which is threaded over the end of the hanger bolt, and retained in position by clamping it between the top of the lug of the car and the underside of the hanger bolt. Some results are given from actual practice.—Lond. *Elec. Rev.*, December 29.

Electric Automobiles.—Joel.—The author criticises the article of Rae, published in Elec. World and Eng. October 21, 1905 In calculating the power required to start and run a truck of 9 tons, Rae assumes a draw-bar pull of 30 lbs. per ton, and he calculates that two electric motors giving together 4.8 hp would be sufficient to run this truck. The writer claims that this is far too low and that the "whole article, with calculations, curves and results, is unfortunately based upon these false premises and is therefore erroneous."—Lond. *Elec. Rev.*, December 29.

Improvements in Trucks.—Cook.—An abstract of a paper read before the (Brit.) Tramways and Light Railways Association. The author discusses various improvements in the construction of trucks. The author considers the radial truck as one of the most important improvements, since it combines the best qualities of the single-truck car and the double-truck car.—Lond. *Elec.*, December 22.

Installations, Systems and Appliances.

Supervision of Electric Installations; Accident Statistics.—Passavant.—A paper read before the Berlin Elec. Soc. Prussia, intends to introduce supervision of all electrical installations by the government. The author as a representative of the electrical industry is strongly opposed to this. Five years ago the act of regulations and rules for electric installations, prepared and adopted by the German Assoc. of Elec. Engs., was not strictly followed by all firms, and the association could not enforce the rules. At that time some of the electrical engineers being annoyed by the opposition called for supervision by the government. This is now considered to have been a great mistake, and it is thought that such supervision when becoming a law will hurt the developments of electrical industries in Germany. There is thought to be no justification for official supervision

Accidents in Mines.

Year.	Total number of fatal accidents.	Due to electricity. Fatal.	Due to electricity. Not fatal.	Due to explosions. Fatal.	Due to breaking in of tunnels, etc. Fatal.
1899	859	4	1	26	394
1900	848	2	5	20	403
1901	956	2	6	59	431
1902	818	4	5	10	391

of electrical plants. In 1904 there were in Germany between 200,000 and 250,000 accidents, of which 1,000 were fatal, but among these 1,000 there were only 16 electrical accidents and half of them occurred in high-tension installations and were due to great carelessness. The preceding statistics on fatal accidents in mines are given for four years.

There were one hundred times as many fatal accidents due to the breaking-in of tunnels, etc., as to electricity. During the first 11 months of 1905 there were 7 fatal accidents in Germany due to escaping gas, and 48 accidents due to gas explosions, but nobody has yet thought of supervision of every gas installation by the government. The claim that there are dangers of fire from electricity is thought to be very much exaggerated. From the statistics of a large German fire insurance company it appears that during the seven years from 1894 to 1900 there were 42,369 fires, of which only 169, that is, about 0.4 per cent, were due to electricity. It is significant that the number of electric fires in the four years from 1901 to 1904 has remained almost the same, although the number of electric installations has very much increased. The author concludes that this shows that the rules and regulations of the association are now finding general recognition in practice, although they are not enforced by the government, and that general government control would be a nuisance. He agrees that special buildings, such as theatres, store-houses, etc., should be subjected to government control, but on account of their special character and not on account of the electricity used in them.—*Elek. Zeit.*, December 28.

Berlin Electricity Works.—A statistical article on the development of the Berlin Electricity Works. Fig. 3 shows the development from 1894 to 1905. All the figures represent kw-hours consumed. The drawn-out curve gives the consumption of electric energy for motors (37,219 kw-hours in 1904-5); the light dotted line the consumption for traction purposes (47,288 kw-hours in 1904-5); the highest curve gives the total consumption. On June 30, 1905, 12,549 electric motors with an aggregate capacity of 39,921 hp were connected to the mains. They were used for the following purposes: Ventilators, 1,868 motors (601 hp); presses, 1,730 (5,005 hp); metal-worker shops, 1,775 (7,551 hp); elevators, 1,698 (9,704 hp); wood-worker shops, 1,241 (4751 hp); butchers, 678 (3,394 hp); grinding and polishing machines, 376 (1,390 hp); paper cutters, 369 (1,149 hp); pumps, 252 (906 hp); sewing machines, 229 (201 hp); cloth cutters, 194 (140 hp); laundries, 230 (672 hp); spooling machines, 96 (274 hp); leather-worker shops, 111 (417 hp); electroplating shops, 75 (239 hp); for driving dynamos, 76 (809 hp); for grinding and roasting coffee, 78 (153 hp); for cleaning hats, 27 (74 hp); for miscellaneous purposes, 1,446 (3,491 hp). For the year 1904-5 there was an increase of 1,937 electric motors having a total capacity of 6,132 hp. At the end of June, 1905, the total length of the cable network of the Berlin Electricity Works was 3,736 kilometers.—*Zeit. f. Elek.* (Vienna), December 24.

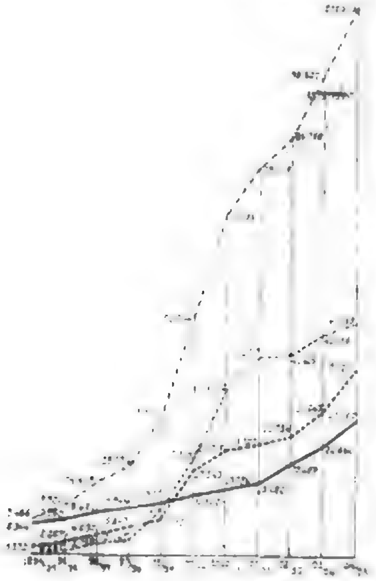


FIG. 3.—CHART SHOWING ELECTRICAL DEVELOPMENT.

Power in Tall Office Buildings.—Benjamin.—An article giving the results of some tests of the power plants of three tall office buildings in Cleveland, A and B being 14-story high buildings, relatively narrow and deep, while C is only 10 stories in height, but covers a large area. A and B employ hydraulic elevators while in C electricity is used both for lighting and for elevator service. The cost of boiler hp per day was 17.8 cents in A, 14.5 cents in B, and 18.5 cents in C. These figures do not include rent, interest, or depreciation. The high cost of power compared with that in a power plant is due to the boilers being run so much below their capacity. The total cost of power per square foot of space per year works out as 16.3 cents in A, 10.6 cents in B, and 6.26 cents in C. These figures seem very low, compared with figures of Wilson from tests of New York sky-scrapers, who found the corresponding cost for buildings of 15 and 18 and 16 stories as 35 cents, 15 cents and 14 cents, respectively. "The extremely low cost shown by building C would seem to indicate better economy in power for a moderately high building covering a large area than for the tower-type of building. The use of electric elevators in place of hydraulic elevators points to a saving in power. The cost of electric power in this building was about 2 cents per kilowatt-hour."—*Cassier's Mag.*, January.

Lead Poisoning Due to the Electrolysis of a Water Pipe.—Latham.—An abstract of a paper read before the Brit. Asso. of Water Works Engs. The author refers to a case of lead poisoning which was clearly traced to the electrolytic effect of a leakage current on a water pipe. The paper emphasizes the importance of earthing in an effective manner, at the generating station, the negative pole of an uninsulated return system of private house wiring. If this precaution is taken and the installation is otherwise carried out in a satisfactory manner, there is no likelihood of any electrolysis occurring.—Lond. *Elec.*, December 22.—In the same issue a letter by Nalder records a case in which an electric lighting company's own cable was damaged by electrolysis. This matter is commented on editorially.—Lond. *Elec.*, December 22.

Surging in High-Tension Lines.—David.—An account of oscillographic researches made by the Central Electrical Laboratory of Paris on the high-tension circuit of the Mediterranean Coast Power Co. Instantaneous values of e.m.f. and current were obtained by means of a Blondel-Charpentier oscillograph. Various oscillographs are reproduced.—*Elec. Rev.*, January 6.

Electricity on Board Ship.—Kergarouet.—A continuation of his article on applications of electricity on war ships. The author considers the adoption of a voltage of 120 as an important progress. He deals with the methods of wiring and distribution.—*L'Eclairage Elec.*, December 16.

Chicago Station.—A fully illustrated description of the Fisk Street Station of the Commonwealth Electric Co., of Chicago. It is equipped entirely with steam turbines, and the most modern apparatus, and will have a capacity of 156,000 kw.—*Western Elec.*, January 6.

Electrophysics and Magnetism.

Very Thin Films.—Koenigsberger and Mueller.—A description of a method by which the authors are able to observe optically an oxide film on a metal of molecular thickness. One conclusion drawn is that the passivity of iron cannot be due to an oxide film.—*Phys. Zeit.*, December 1.

Measuring the Speed of Roentgen Rays.—Marx.—The principle of his method is the same as mentioned recently in the Digest. The author has now modified the method so as to be applicable for demonstration purposes in the lecture room.—*Phys. Zeit.*, December 1.

Electronic Theory.—Bucherer.—A note in which the author expresses doubts as to the validity of Lorentz's hypothesis of deformed electrons and offers, himself, a modified hypothesis of an incompressible deformed electron which is believed to avoid some difficulties.—*Phys. Zeit.*, December 1.

Discharges Through Gases.—Wilhelmy.—An historical summary of researches on the discharge of electricity in gases, up to the foundation of the electronic theory.—*Dissertation of Catholic Univ. of America*, Washington, 1905.

Electrochemistry and Batteries.

Storage Batteries.—Parr.—A paper read before the Leeds Section of the (Brit.) Inst. of Elec. Engs., on storage batteries, their deterioration and the cost. The author discusses the usual impurities in sulphuric acid and water. Pure distilled water should always be used since its cost is trifling in comparison with the cost of a new battery which the use of impure water might entail. The practice which some central station engineers adopt of using the condensed steam from the boilers is dangerous, because boiler water, in addition to its natural impurities, often contains some special alkaline softening fluid. Another equally dangerous custom with some engineers is to add from 1 oz. to 2 oz. of ammonium sulphate, sodium sulphate or sodium carbonate per gallon of the electrolyte, with the object of improving the condition of the cells. This practice, while giving a rich color to the plates, in time acts detrimentally on them, diminishing both the capacity and the efficiency. Accepting the limitations put by battery makers on the amount of impurities allowable, it would seem that the electrolyte should be free from arsenic, nitrogen compounds, sulphuretted hydrogen, sulphurous acid, and organic matter, and that it should contain only mere traces of hydrochloric acid and iron. The author is making a long series of tests on the effect of different impurities in the electrolyte on the behavior of the battery. In the results so far obtained sulphurous acid appeared to have a deteriorating effect, although the tests are not yet closed. Some results are given of tests of a lead battery with different rates of charge and discharge. One of the diagrams given by the author shows clearly that the higher the discharge rate, the shorter is the time required for recharging and the smaller the output. Fig. 4 shows the results of tests made to determine the effect of different rates of charge upon the discharge capacity at a certain constant rate. The curves show that within the current limits taken the rate of charge has but little or no effect on the output of the cell at the particular rate of discharge. —Lond. *Elec.*, December 29.

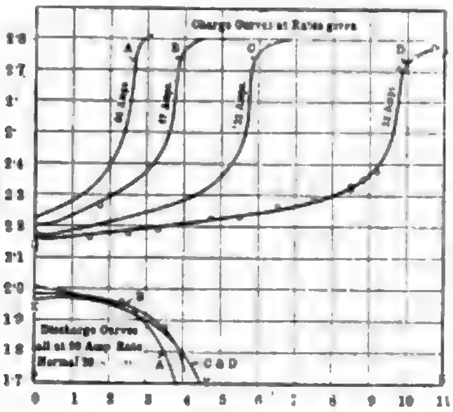


FIG. 4.—STORAGE BATTERY CURVES.

Injurious Effect of Acid Pickles on Steel.—Burgess. A phenomenon attendant upon the pickling of iron and steel articles by the use of acid solutions is the influence which such treatment exerts upon the physical properties of the metal. The injurious effect is often shown by the ruin of steel springs and other tempered articles which accidentally or by design have been subjected to the action of acid solutions. The author has studied the cause of this phenomenon and shows that the brittleness or "rotting" of iron and steel is due to the penetration into its pores of hydrogen rather than of acid, so that any method which would prevent the liberation of hydrogen would do away with the usually consequent brittleness. If nitric acid of such strength that no hydrogen is evolved be used, a bent steel wire may be completely dissolved without breaking, while when other acids are employed the wire snaps in two before corrosion has proceeded to any appreciable degree. If sodium nitrate be added to a sulphuric acid solution the liberation of hydrogen can be prevented and it may thus serve a most useful purpose. To avoid all necessity of pickling tempered steel springs, preparatory to plating, it may be possible that the tempering could be done in such a way as to prevent the formation of the oxide scale. With the idea of bringing about such a result an experiment was undertaken by covering the melted lead tempering bath with a layer of borax. Upon immersing a steel spring into the lead, through the layer of borax, the oxide was dissolved, and after subsequent immersion in oil and water a bright surface ready for electroplating was obtained. In some such way the disadvantages attendant upon the usual pickling process might be avoided. The harmful effect which hydrogen exerts is an additional argument for the substitution of the sand blast for the ordinary pickling method, but its universal adoption can hardly be looked for on account of the greater expense that would be entailed, especially in the handling of small work.—*Electrochem. and Met. Ind.*, January.

Ozone.—Steens.—A communication on the Marmier-Abraham system of producing ozone from air by electric discharges, and the sterilization of water by ozone.—*Eng'ing Record*, January 6.

Electrometallurgy of Zinc.—Peters.—A concise summary of developments and proposals made during the last years on the use of electrolytic or electric furnace processes in the electrometallurgy of zinc.—*Glueckauf*, December 2, 9, 16.

Units, Measurements and Instruments.

Losses in Induction Motors.—Bache-Wig and Bragstad.—To separate the losses in three-phase induction motors the following method may be used. The induction motor to be tested is driven by a direct-current shunt motor with which it is either connected directly or by a belt. The watt consumption of the auxiliary motor is first determined while driving the non-excited induction motor with open rotor; this is done at different speeds above and below synchronism. By these measurements the power consumed by the auxiliary motor + the power consumed by the belt + the friction of the induction motor are measured. In the case of direct connection of the two motors there is no consumption of watts by the belt. Secondly, at several speeds above and below synchronism measurements are made of the power consumption of the auxiliary motor when driving the induction motor with open secondary, but with excited primary. At the same time the watt consumption of the primary is measured at these speeds. The curves obtained in these measurements show a characteristic discontinuity at synchronism as well as in the watt curves of the auxiliary motor as in those of the stator. This discontinuity is due to the hysteresis torque. The watt consumption of the auxiliary motor is the sum of the loss of the auxiliary motor and of the belt; further of the friction and of the additional losses of the non-synchronous motor; and finally, of an amount of power corresponding to the hysteresis torque of the rotor of the induction motor. This last amount of power is negative below synchronism and is positive above synchronism. The difference in the measurement of watts of the auxiliary motor in the second and in the first tests therefore give below synchronism the additional losses minus rotor hysteresis and above synchronism the additional losses plus rotor hysteresis. The additional losses are therefore equal to the average of the two differences above and below synchronism. If the power consumed by the auxiliary motor is plotted as a function of the speed, first with the induction motor without current ("curve 1") and secondly with excited primary, but opens secondary of the induction motor ("curve 2"), then the sudden rise of the curve 2 at synchronism represents twice the rotor hysteresis, while the average height of the curve 2 above curve 1 represents the additional losses. The power supplied to the primary by the three-phase currents gives the iron losses. In order to determine the friction of the induction motor, its no-load losses are measured by running it unloaded with closed secondary and disconnected auxiliary motor. The power consumption thus determined less the iron losses and additional losses determined before gives the friction. Several numerical results of actual tests are given.—*Zeit. f. Elek.* (Vienna), December 3.

Electrolytic Meters.—Holden.—An illustrated paper read before the Birmingham section of the (Brit.) Inst. Elec. Engs. The author describes two new electrolytic meters. In the first one, the whole current passes through the meter, and the meter is essentially a simple gas voltameter, the weight of liquid which is decomposed being the indication of the ampere-hours. The second meter is a shunted one and employs so-called hydrogen electrodes, which have so far been used only in scientific research. A hydrogen electrode is a platinized platinum electrode saturated with hydrogen. Any hydrogen being evolved on it as cathode is absorbed by the platinum black. On the other hand, if such an electrode is used as anode and dips only partly into the solution while the remainder is in an atmosphere of hydrogen, then no oxygen is set free at this electrode, but hydrogen passes from the electrode into the electrolyte, forming water. A combination of two such electrodes as anode and cathode, therefore, shows no polarization so that when by a shunt arrangement only a part of the total current passes through such a combination, the current passing through the cell is always exactly proportional to the difference of potential at the terminal electrodes.—Lond. *Elec.*, December 22.

Meters.—Gerhardi.—A continuation of his long illustrated serial on electricity meters. In the present installment the author describes and gives diagrams of the connections of three-wire circuit meters and polyphase meters.—Lond. *Elec.*, December 22.

Vacuum Pump.—Fischer.—An illustrated description of a new rotary oil pump of the Siemens-Schuckert Co., by which it is possible to produce conveniently an extremely high vacuum —*Phys. Zeit.*, December 1, and *Dingler's Polyt. Jour.*, December 2

Selenium.—Wulf and Lucas.—An account of measurements made with selenium cells during the total eclipse of the sun August 30, 1905. The selenium cell may be used for two purposes, first for determining the change of light and second for determining the time moment of the beginning and the end of the total eclipse.—*Phys. Zeit.*, December 1.

Standards of Resistance.—Girouse.—An account of a verification of the standards of the legal ohm. The results obtained in 1905 agree very well with those of 1885.—*L'Eclairage Elec.*, December 23.

Electric Thermostat.—Chandler.—An illustrated description of a small electric thermostat in which mercury expands and closes the circuit at a predetermined temperature.—*Scien. Am. Supplement*, January 6.

Telegraphy, Telephony and Signals.

Telegraphy.—Maver.—Some notes on telegraphy in Asia. The yearly receipts of the Persian telegraph system are about $7,500, and the expenses of operation and maintenance about equal the income. In Japan there are in operation about 850 telegraph circuits, of which 90 are worked duplex and 10 are worked quadruplex, the remainder being worked on the ordinary simplex Morse sounder system. The simplex circuits are operated on the "open-circuit" plan, and, as a rule, current is supplied by Daniell cells, which, however, are being supplanted now by storage batteries in the larger cities. Japan has now about 20,000 miles of land telegraph lines and about 85,000 miles of wire. The total number of paid telegrams transmitted over these lines annually is about 17,000,000. Messages are transmitted in Japanese letters and in Roman letters.—*Cassier's Mag.*, January.

Influence of Earth in Wireless Telegraphy.—Sachs.—An account of experiments in which the transmitter and receiver were electromagnetically coupled. The author endeavored to examine the influence of the earth on the propagation of waves. His main conclusions are as follows: The earth's surface is for waves of 31 metres, a strong absorbing and weak reflecting medium. The connection to earth of sender or receiver is greatly prejudicial to transmission; insulating it is decidedly favorable. It is desirable to install the apparatus as high above the earth as possible. The integral effect at the receiver varies inversely with the square of the distance of transmission.—From *Ann. der Phys.*, abstracted in Lond. *Elec.*, December 29.

Telephone Tariffs.—The conclusion of a systematic summary and analysis of telephone tariffs in different countries.—*Jour. Telegraphique*, December 25.

Plant of the Trumbull Electric Manufacturing Company.

The Trumbull Electric Manufacturing Company, of Plainville, Conn., has recently completed a modern three-story and basement brick building for the accommodation of its rapidly growing factory equipment. The modest beginning of the company was made in a small one-story wooden structure where rosettes were manufactured. When a little later the company started the manufacture of switches, an engine room was added to the original structure, and then another story, until in 1903 the business assumed such proportions as to necessitate the addition of a two-story and basement ell-shaped extension, the company then undertaking the manufacture of switchboards.

At present the original room in which the company started is used as a storeroom for copper used in switchboard work, and the floor above is used to store finished stock. A large assortment of slate for switchboard use is stored in the basement of the ell-shaped extension, on the first floor of which are machines for cutting and trimming steel parts for cabinet boxes, grinding and buffing machines, and machines for drilling bolt and screw holes in slate. Here is also mounted and assembled all the heavier switchboard work. The upper story is occupied by the cabinet department, where wooden trims for cabinet and switch boxes are made.

SWITCH ASSEMBLY DEPARTMENT.

The new building is of slow-burning mill construction and is connected with the old building by a covered arcade. The basement is utilized as a receiving room for slate for switch bases, and slate drilling machines are located in one corner of the room. On the floor immediately above is the buffing room, air for which is supplied by two centrifugal blowers in the basement, and standard and special machines for the economical production of the metal parts used in the various devices. Abundant natural light is afforded by day, and at night incandescent lamps spaced every 8 ft. give ample illumination. The dipping and electroplating department is also located on this floor.

A one-story ell houses the power equipment, consisting of a small Atlas engine receiving steam from two horizontal tubular boilers and belted to a main shaft connected to auxiliary and counter shafting from which the various machines are driven. A Crocker-Wheeler generator belt-driven from the engine fly-wheel through a jack shaft also forms part of the power equipment. The energy from this generator is used to drive a motor which furnishes power to the machines in the switchboard department and also to furnish light. Current for this purpose may also be obtained from New Britain in case of mishap to the generator.

The various processes of assembling are carried out on the second floor, where the lacquering department and a department for the assembly of panel boards are also located. The general offices and drafting room occupy the third floor. An enameling room is located in a separate building. Here the slate is scoured and prepared for whatever finish is desired, after which it passes to steam-heated ovens in the assembly room.

The company is now manufacturing switchboards of any capacity. In addition there is turned out a very complete line of iron service boxes, special cabinet switches and standard switches from 15 amperes to 2,000 amperes capacity in all styles; porcelain base switches and battery switches, fuse blocks, fuse holders, pendant push-button switches, flush receptacles, fused and fuseless rosettes, plug cut-outs, enclosed fuse cut-outs, combination switches, panel cut-outs and panel boards. The officers of the company are F. T. Wheeler, president; J. H. Trumbull, treasurer, and Mr. Henry Trumbull, secretary. A New York office is established at 136 Liberty Street, in charge of T. D. Watson, where a complete stock is carried for immediate distribution.

Some Exhibits at the New York Automobile Shows.

While the magnificent automobile shows held at Madison Square Garden and at the new Sixty-ninth Regiment Armory from January 13 to 20, inclusive, were monopolized almost entirely by gasoline automobiles and their accessories, there were many interesting exhibits of minor electrical devices, and complete lines of electric automobiles. Considering that there were nearly 500 exhibitors on the official lists, it is evident that only a cursory examination could be made of the whole. Some concerns had exhibits at both shows, while others concentrated their energies in one display.

American Electric Novelty & Manufacturing Company, New York City, exhibited its "Ever-ready" automatic starter dry batteries, "bulldog" battery connector, portable electric lights, ammeter and gasoline tank filler. The exhibit was in charge of Messrs. E. J. Alvin, O. J. Bryan, G. W. Edge, F. A. Boss, S. S. Shepard, L. Keller, J. F. Eline and C. K. Crossman.

Atwater Kent Manufacturing Company, Philadelphia, Pa., displayed its line of voltmeters, volt-ammeters, timers for one, two, three and four cylinders, switch with and without plug attachment, spark generator and mechanical device using one non-vibrating coil. Messrs. Kent, Raymond, Dunning, Jacobs and Little were present.

Connecticut Telephone & Electric Company, Meriden, Conn., showed the "Connecticut" pocket meters, spark coils, switches and coil-current indicators. Among the representatives of the company present were E. C. Wilcox, E. D. Bright, B. L. Lawton, R. C. Rogers and E. V. Wilcox.

Cooper Hewitt Electric Company, New York, was represented by A. F. Hubbard, N. C. Hubbard, J. O'Shea and W. D. Evans. Mercury vapor converters, mercury vapor lamps and a large charging panel for attaching ten 14-cell batteries at once formed part of the exhibit.

Hess-Bright Manufacturing Company, Philadelphia, Pa., had Hess-Bright and D. W. F. ball bearings displayed throughout the Garden and Armory as well as auto parts mounted on its ball bearings, including shafts, transmissions, change gears, wheels, magnetos, etc. H. Hess, F. E. Bright, R. D. MacDonald, C. L. McCalla, A. Hegardt, A. Nairn and N. Hahn were in attendance.

Edison Storage Battery Company, Glen Ridge, N. J., attracted many visitors to its exhibit in the Armory. A tray of each type of cells manufactured by the company was on exhibition as well as historical cells showing the development of the Edison battery. One cell of the new improved Edison battery was also shown. W. G. Bee, E. J. Ross, Jr., and F. H. Sadler looked after the interests of the company.

Eastern Carbon Works, Jersey City, N. J., exhibited a complete line of its Eastern and Atlantic dry batteries, together with battery connectors and flash lights. E. J. Wilson, G. W. Mills and O. L. Turgeon were in attendance.

William Cramp & Sons' Ship & Engine Building Company, Philadelphia, Pa., showed samples of Parsons' manganese bronze castings, white brass castings, manganese bronze and white brass ingots, manganese bronze rods and rolled sheets. The company has space in both shows and was represented by Richard Thompson and Courtland D. Cramp.

National Battery Company, Buffalo, N. Y., showed a sparking battery and a set of twenty-four cells of 9-CB battery for electric runabouts. Battery accessories, sample demonstrating panel and photographs of installations completed the exhibit. J. R. H. Richmond, R. Kimberly, P. V. Hoyt and J. DeMallie represented the company.

National Carbon Company, Cleveland, Ohio, exhibited the Columbia dry cells, signal dry batteries, reserve dry batteries, multiple batteries, auto-cell batteries and spark coils. N. C. Cotabish, M. H. Moffett, A. E. Carrier, A. C. Henry, F. C. Park and J. C. Irvine took care of all visitors.

Rushmore Dynamo Works, Plainfield, N. J., exhibited a number of navy standard lens mirror searchlights, acetylene lens mirror searchlights and generators for automobiles, launches, power boats, etc.

Semi-Dry Battery Company, Newark, N. J., showed the Dunn semi-dry cell and batteries.

Standard Roller Bearing Company, Philadelphia, Pa.—Grant roller bearings, Standard roller bearings, ball-end thrusts, roller-end thrusts, bevel-gear automobile axles, chain-drive axles, ball and roller bearing hubs, together with a complete line of steel, brass and bronze balls, cups and cones and special ball bearings were exhibited by this company at the Armory, and at the Garden. Those in attendance included S. S. Eveland, R. H. Grant, F. Beemer, L. J. Hoover, T. J. Heller and F. M. Germane.

The Westinghouse Companies' exhibit in the Armory was in charge of E. H. Heinrichs. The following apparatus was on exhibition: Westinghouse-Schmid touring car, which has a capacity of 24 horse-power, Cooper Hewitt electric converter and mercury vapor lamps, Westinghouse D-1 air compressor for use in connection with a Morgan & Wright tire to demonstrate the utility of the compressor for filling tires with compressed air and a Westinghouse storage battery receptacle. The touring car is built in France by the Societe Anonyme Westinghouse, Havre.

C. F. Splitdorf, New York City, had on exhibition some of the "hot-stuff" Splitdorf coils used successfully for gasoline engine ignition purposes. The exhibit though small attracted much attention, the coil being shown in operation.

Morgan & Wright, Chicago, exhibited a line of their automobile tires as well as the M. & W. tape, the adhesive and good insulating qualities of which are well known to the trade. A large representation of the company was present, including C. J. Butler, A. I. Philip, C. S. Shugard, T. R. Burton, W. C. Marion, Jr., A. Measure, R. G. Kennedy, J. C. Weston, J. J. Alexander, E. F. Jackson, E. M. Greene, G. M. Seewald, C. Measure, I. J. Cooper and G. A. Burnham.

Warner Instrument Company, Beloit, Wis., exhibited their auto-meter which shows how fast a car is traveling. The instrument is built like a chronometer. Magnetic force is used as the motive power and this acts directly on the indicating dial, which is mounted on a pivot, the ends of which ride in sapphire bearings. The revolving magnet tends to draw the dial in the direction of its revolution, this tendency being opposed by a hair spring. The greater the rapidity of the magnet's revolutions, the greater the displacement of the dial, so that even reading over the scale results. The action of the magnet on the dial being direct, there is nothing intervening to cause a variation in the reading.

Vehicle Equipment Company, Long Island City, New York, occupies spaces in the exhibition hall and basement of Madison

Square Garden. The exhibit was comprehensive, including electric vehicles of all sorts, broughams, landaulettes, victorias, station wagons, coaches, ambulances, express wagons, delivery wagons, baggage vans, brewers' trucks, dumping trucks, etc. The company builds over one hundred standard designs of commercial vehicles and in capacities varying from one to six tons. The two large exhibits naturally required a large force of attendants, among whom were R. McA. Lloyd, H. H. Havemeyer, R. W. McGinnis, P. C. Chrysler, H. D. Lloyd, H. Havemeyer, W. L. Brown, R. H. Doughty, A. Bourquardez, C. G. Rainer, C. B. Jaeger, J. R. Kinsey, T. E. Martin, A. F. Madden, A. J. Doty, E. E. Everett and F. F. Phillips. What little argument was needed to convince one of the superiority of electrically-propelled vehicles for any use whatever was easily supplied by this efficient corps.

THE BAKER MOTOR VEHICLE COMPANY, of Cleveland, Ohio, had its exhibition on the Twenty-fifth Street side of the Sixty-ninth Regiment Armory. This was the only electric vehicle company exhibiting on the main floor of the Armory show. The line of vehicles built by this company comprises imperials, stanhopes, surreys, station wagons and broughams. The exhibit was in charge of C. B. Rice, the New York representative of the company, who had a corps of assistants.

Centrifugal Boiler-Tube Cleaner.

The illustrations herewith represent a new type of cleaning head called a "three-arm rocker-arm head." It has cone cutters attached to the forward end of steel arms and star cutters at the rear end. These arms are attached to a spider and work on a pivot, so that they are self-adjusting at both ends, and can work in and out, according to the condition of the scale in the tubes that are being cleaned. Centrifugal action keeps the cutter against the scale with sufficient force to remove it without doing the least injury to the tubes.

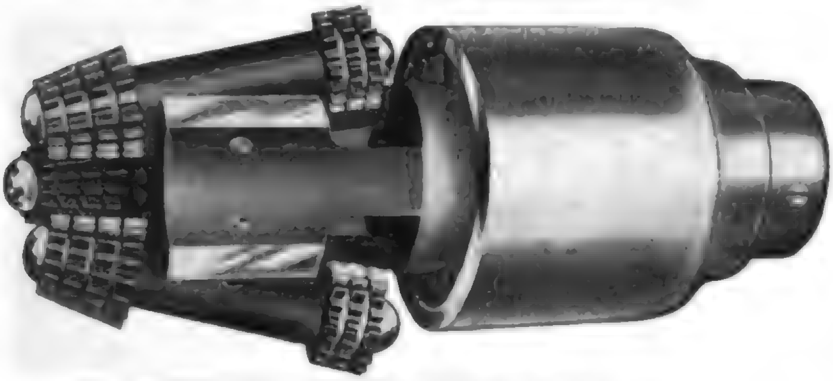


FIG. 1.—TURBINE CLEANER WITH ROCKER ARM HEAD.

The cleaning head is driven by a miniature hydraulic turbine, the particular type of turbine represented in Fig. 1, being extra heavy and strong, and therefore, suitable for very severe conditions. It is furnished with either ball or thrust bearings. The manufacturers state that tests have shown that a machine equipped with ball bearings will run with much less friction than when supplied with any other type of bearing.

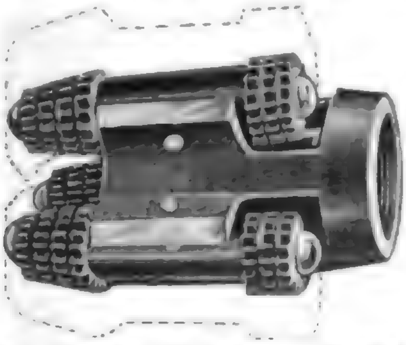


FIG. 2.—THREE-ARM ROCKER-ARM HEAD.

This boiler-tube cleaner is made by the Lagonda Manufacturing Company, Springfield, Ohio.

New Construction in Fibre Pulleys.

The Xylotite Product Company of Cincinnati, O., has placed upon the market two new designs of Xylotite pulleys which are illustrated herewith. Fig. 1 shows an entirely new construction in fibre pulleys. The iron web is cast solid with the hub and the fibre rim is then glued and dowelled to the edge of the iron web, which makes a strong, light pulley, very neat in appearance, and which the manufacturers report as giving satisfaction to the customers. This form of construction is used for pulleys from 8 to 30 ins. in diameter where the face does not exceed 8 ins. Fig. 2 shows a style of pulley used by a number of manufacturers of small motors. It is the regular Xylotite pulley with a light iron flange at one end.

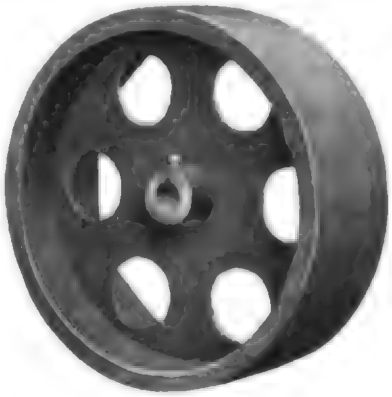


FIG. 1.—FIBRE PULLEY.

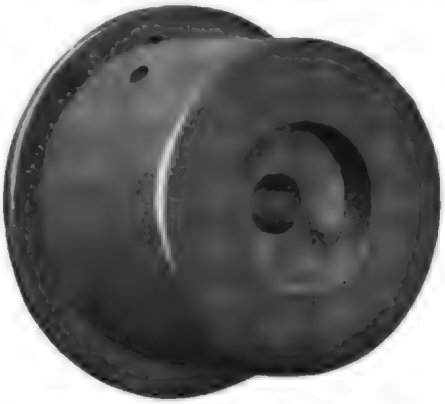
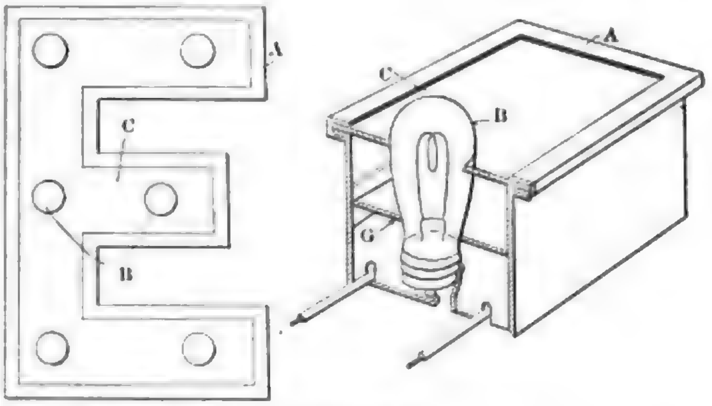


FIG. 2.—FIBRE PULLEY.

Combination Electric Sign.

The illustration herewith shows the main features of an electric sign combining the bulb and transparency types. In the illustration *A* is a metal box and *C* is a translucent plate or fabric; *B* indicates the ends of the electric lamps; and *G* is a white reflecting surface. The body of the letter is made of



COMBINATION SIGN.

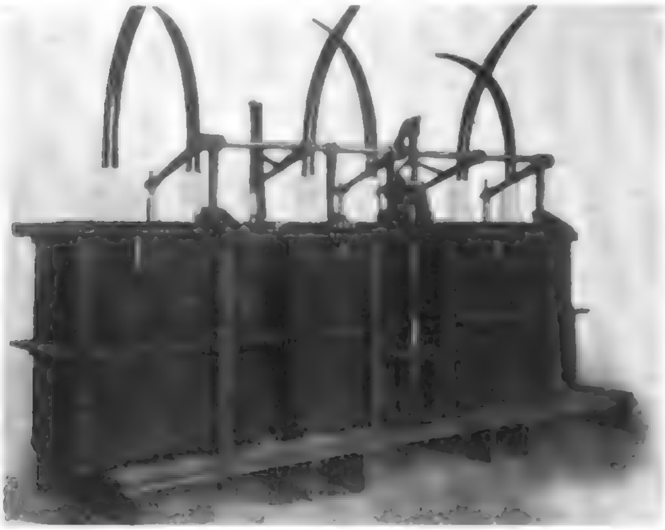
metal. The electric bulbs project slightly through the translucent face, the lower half of the bulb serving to light up this face. This effect is assisted by the partition plate at G, which, together with the sides of the interior, is painted white.

This electric sign is being placed on the market by the Day-and-Night Sign Company, 82 Beaver Street, New York.

Electrically-Operated Oil Circuit-Breaker.

The breaker shown in the illustration herewith was designed by the Westinghouse Electric & Manufacturing Company primarily for the Ontario Power Company's work. It is intended to handle power up to 45,000 kilowatts per three-phase circuit, and will open a circuit under any conditions of overload or short circuit which may occur with a power house capable of delivering 150,000 kilowatts. The insulation to ground and between terminals is designed to withstand a break-down test of 150,000 volts, and the insulation between poles is twice that amount, since the poles are electrically separate.

The three poles of the switch are closed together by means of a toggle joint operated by a single direct-pull solenoid. The switch is held in a closed position by the toggle being carried just beyond the center and is tripped out by the tripping coil armature striking this toggle and knocking it backward, allowing the switch to open by gravity. Each pole of the switch gives a double break, the length of each break being approximately 17 in. The closing magnets require approximately 5,000 watts direct current, while the tripping magnets require about 300 watts.



ELECTRICALLY-OPERATED OIL CIRCUIT-BREAKER.

The oil tanks, of which there are three, are made of boiler iron lined with an insulating material with barriers interposed between the stationary contacts. The contact parts have renewable arcing tips and contacts; The leads with their insulation and the upper porcelain insulators may be readily removed from the switch, giving access to the contact parts for inspection and repairs. The top covers of the tanks are made of treated soapstone slabs, part of which are also removable. Each tank is provided with an oil drain opening in the bottom and an overflow just above the normal oil level. Each tank has an oil level gauge and requires approximately 160 gallons of oil, weighing approximately 4,000 pounds. The total weight of each three-pole switch complete, the tanks being filled with oil, is approximately 15,000 lb.

A two-pole double-throw indicating switch is provided upon each three-pole oil switch for use in connection with the controlling and indicating devices. The circuit-breaker is not automatic in itself—an overload relay operated from series transformers being necessary.

Hawaiian Electric Pumping Installation.

On page 444 of the issue of *Electrical World and Engineer* for September 9, 1905, there was given a description of the electric pumping plant which the Makee Sugar Company was installing at Keila, on the island of Kanai, Hawaiian Territory. Since the publication of that description, several changes have been made in the plans of the company, and an account of the work is given below. It was the original intention to use at the pumping station a synchronous motor, which would require a 50-hp motor for starting, as well as an exciter, controllers and apparatus for throwing the starting motor in or out; but it was found that the system could be simplified by the use of an induction motor. The operation of the plant remains otherwise practically the same, and of course the induction motor requires neither a starting motor nor exciter but merely controlling apparatus. The efficiency of the whole plant will be the same with an induction motor as with a synchronous motor, while in simplicity of construction, reliability of operation, small amount of attention required and also in the matter of first cost the induction motor has the advantage.

The pumping plant will be located five miles from the power station. The driving induction motor will be a Bullock machine rated at 225 hp, and will be connected through a rope transmission to a duplex, double-acting Riedler pump, having a capacity against 250 ft. head ranging from 1,750 to 2,800 gal. per minute, according to the speed at which the pump is driven. The speed of the pump, operated at its full capacity, will be 116 r.p.m. It is to be extra heavy and furnished with Allis-Chalmers latest improved mechanically-operated pump valves. The variation in the speed of the pump will be obtained by varying both the voltage and the frequency of the current supplied to the induction motor.

The power station will contain a 300-kw, three-phase Bullock alternator, which when driven at the normal speed of 450 r.p.m. will deliver 60-cycle current. The primary driver will consist of a specially designed Pelton impulse water wheel, operating under a fall of 400 ft. of water conveyed in penstock pipes from a mountain stream and delivering its power continuously to the generator, direct connected, at six different speeds, which are secured by the use of six different sets of buckets arranged on wheels of varying diameters. The generator will have its exciter direct connected to it, and the exciter has been so designed that it can deliver the full voltage and current required for excitation even at the minimum speed. By means of an automatic regulator, the exciter voltage will be maintained constant at all speeds of rotation, and it will, therefore, be unnecessary to change the adjustment of the generator rheostat when the speed of rotation is changed. In addition to the automatic regulator, a hand-operated field regulator will be installed for use in an emergency. As both the frequency and the voltage change in the same ratio, the induction motor will at all times be operating with constant magnetic flux.

This method of varying the capacity of the pumping equipment has been adopted by Mr. Z. S. Spaulding, president of the Makee Sugar Company, as conforming closely to the requirements of variations in the available power at the different seasons On account of the limited amount of power, it is desirable to utilize, as far as practicable, the maximum water supply at all times The head being constant, the velocity of the water at the delivery nozzle is constant, and the power varies directly with the power supply. By changing the dimensions of the wheel carrying the buckets, the rotative speed of the generator is changed, while the speed of the water remains constant at all times, and the maximum efficiency is obtained from the water wheels.

It may be of interest in this connection to mention that the Hawaiian Islands lead the world in high pumping irrigation. We are informed that the Allis-Chalmers Company, which furnished the above described electrical and pumping machinery, has supplied 32 different irrigation pumping machinery equipments to Hawaiian companies. These equipments vary in capacity from 2,000,000 to 12,800,000 gallons per 24 hours, and operate under heads varying from 35 to 775 ft

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Activity continues in manufacturing lines, particularly iron and steel, machinery and kindred industries, and as regards prices in finished products there is an advancing tendency. The continuance of mild weather favors outdoor activity, which is reflected to a large extent in the sustained demand for building materials. Railway lines are doing a large business, and the shortage of cars is not so acute. Fair to good collections are reported and money is easier, with a good demand. In jobbing and wholesale lines the feature is the call for prompt shipment of spring goods. There is a strong undertone in the iron and steel market. The Steel Corporation will make extensive additions to its plants, particularly in the Pittsburg and Youngstown districts. Contracts for structural shapes are of moderate proportions, but some heavy business is pending. During 1905 the United States Steel Corporation produced 10,175,000 tons of pig iron and 11,995,000 tons of ingots. This surpasses the output of 1902 when the total was 7,975,500 tons and 9,745,000 tons, respectively. The machine tool and machinery trades report a good outlook, the largest demand coming from the railroads. The market for refined copper was more irregular for future delivery. Claims are still made for further advances, but certain interests state that the best prices have been reached. Lake and electrolytic is quoted at 18⅞, and casting stock 18⅝. Cotton is stronger in tone and the cotton goods market is somewhat stiffer. The business failures for the week ending January 11, as reported by *Bradstreet's*, aggregated 286, against 220 the week previous and 295 during the corresponding week last year.

ROSSITER, MACGOVERN & COMPANY EXTEND THEIR SCOPE.—The firm of Rossiter, MacGovern & Company has been organized and will extend its activities to the field of engineering and contraction, making a specialty of steam and electric railway and power plant work. The capital of the company has been doubled, being largely supplied by the new president of the company, Mr. J. C. Brackenridge, formerly chief engineer and manager of the Brooklyn Rapid Transit Company, and lately Commissioner of Public Works of Brooklyn. Mr. Frank MacGovern will continue as vice-president and general manager. Mr. Clinton L. Rossiter, who retires as president, will remain a member of the executive committee. Rossiter, MacGovern & Company have enjoyed a most prosperous career since they commenced business, about fourteen years ago, for the purpose of purchasing and selling electrical and steam apparatus. The business increased so rapidly that it became necessary to incorporate the firm seven years ago. During recent years the amount of the company's sales of electrical apparatus has been exceeded by that of few if any of the electrical manufacturing companies in the country outside of the very largest. As an adjunct to its business, the company established sometime ago a repair shop in Jersey City and offices in St. Louis and Boston. The plans of the company to engage as engineers and contractors will not interfere with its present well established business of the purchase and sale of electrical and steam apparatus of all kinds. In fact, the company proposes to erect another large repair shop in the neighborhood of New York, on the water front, to replace the present shop in Jersey City, but the location of this shop has not yet been decided upon. The board of directors includes J. C. Brackenridge, Frank MacGovern, Clinton L. Rossiter, D. H. Valentine (director of B. R. T.), and Edward Rossiter (treasurer N. Y. C. & H. R. R. R.).

NORTHERN CALIFORNIA POWER.—A vast project to take up the water of Feather River in northern California, and carry it through tunnels and aqueducts for the development of 400,000 horse-power or enough to supply all the towns of the Sacramento Valley, Oakland, Alameda, and Berkeley with electrical power, is the purpose of a $50,000,000 corporation, organized by I. Brown Wilson & Co., of New York and San Francisco. The corporation is backed by F. H. Ray, Edwin Hawley, and A. C Bedford, all prominent in the financial world of New York city, and the project is but the nucleus of a vast plan of similar projects which will extend through Oregon and Washington, and for which $100,000,000 is to be set aside. From the head of the Sacramento Valley, power will be transmitted through the valley and to San Francisco by means of two-pole lines, 175 miles in length.

SHAWINIGAN POWER.—United States Consul Worman, of Three Rivers, reports that the North Shore Power Company has been absorbed by the Shawinigan Water & Power Company, an electrical enterprise largely capitalized by Americans and Belgians. The Shawinigan Falls, where this company has its works, rank next to the falls of Niagara in importance as a Canadian water power. Not a tenth of its capacity is at present utilized. The absorption of the North Shore Company by the Shawinigan Falls Company means the reorganization of that company's affairs and the broadening of its enterprises. Besides the railway now building to connect Shawinigan Falls and Grand Mere with Three Rivers, there will now be started a system of trolleys for the district.

THE CHICAGO PNEUMATIC TOOL COMPANY states that on account of the compressor business being offered exceeding its manufacturing capacity (amounting to only 400 compressors during the year 1905) that arrangements are now under way for increasing the capacity of its compressor works at Franklin, Pa., so as to give it an annual output of between 650 and 700 compressors. The machines of its manufacture are gradually taking the lead, thus necessitating increased facilities for taking care of the business offered. A large volume of business was lost to the company during 1905 on account of inability to make deliveries.

CONSOLIDATION IN BALTIMORE.—It is rumored that the proposed change in control of the United Railways & Electrical Company, of Baltimore, will be followed by the consolidation of the United Railways Company, the Consolidated Gas, Electric Light & Power Company and the Baltimore Electric Light & Power Company under the charter of the Maryland Securities Company, organized in 1902, which has remained dormant since then. The United Railways & Electric Company now controls all the street car lines in Baltimore and the neighboring county.

BISHOP GUTTA-PERCHA COMPANY.—At a meeting of the stockholders of the Bishop Gutta-Percha Co., held at the office of the company, 420 East 25th Street on January 10, the following persons were elected directors: Messrs. Henry A. Reed, Wm. Boardman Reed, Henry D. Reed, Louis F. Reed, Ellen I. Anderson. Mr. Henry A. Reed was elected president and treasurer, and Mr. Wm. Boardman Reed vice-president. Mr. Louis F. Reed was appointed secretary and Mr. Henry D. Reed, superintendent. The usual semi-annual dividend of 5 per cent was declared.

SIGNALS ON NEW YORK CENTRAL.—The New York Central Railroad Company has, according to advices from Rochester, awarded to the General Railway Signal Company of that city a contract for interlocking and block signals amounting to $2,000,000. This will tax the capacity of the Rochester plants for eighteen months. The equipment is intended for the zone of electric motive power extending about twenty-five miles from the Grand Central Station. The system of signals is the most comprehensive ever devised by any railroad.

NEW RUBBER CONCERN.—At Trenton, N. J., on January 6th, the Continental Rubber Company of America, was incorporated with an authorized capital of $30,000,000. The company is to produce rubber and manufacture rubber materials. The incorporators are Henry A. Bingham, Thomas W. B. Middleton and Cornelius A. Cole, all of Jersey City. It is understood that this company has very heavy financial backing, and will develop new rubber sources.

INDUSTRIAL BUILDINGS.—Mr. J. G. Rossman, in the Atlanta (Ga.) *News*, has been advocating industrial buildings for Southern cities, equipped with power. He says: "I have arrived at my conclusion from a long experience in dealing hand-to-hand with the class of small manufacturers who would welcome such buildings and includes my observations in Seattle, St. Louis, Boston, Baltimore, etc. I find that the demand is urgent in all sections of the country. In my work in the South recently in developing water power enterprises and electric power companies I have been especially impressed by the crying demand for this work in the larger cities."

THE GREEN FUEL ECONOMIZER COMPANY, of Matteawan, N. Y., some time ago began the manufacture of fans, blowers and exhausters upon a large scale. Recent sales are listed below. Two 310-in. induced draft fans to the American District Steam Heating Company, of Minneapolis, Minn.; a 280-in. heating and ventilating fan and heater for Kimberly & Clark, Kimberly, Wis.; two ventilating fans for Public School No. 85, New York City; two ventilating fans for the Farr Alpaca Company, Holyoke, Mass.; a forced draft fan for the Buckeye Engine Company, Providence, R. I.; an induced draft fan and engine for George E. Kunhardt, Lawrence, Mass.; a forced draft fan and engine for the Standard Silk Company, Phillipsburg, N. J.; a heating and ventilating fan for Public School No. 71, Queens, New York; a forced draft fan for Hind & Harrison, Clarks Mills, N. Y.; heater coils for the Gilbert Paper Company, Menasha, Wis.; heater coils for Shea, Smith & Co., Chicago, Ill.; a planing mill exhauster for the Whiton Machinery Company, Whitonville, Mass.; a volume blower for the Chandler Planer Company, Fitchburg, Mass.; two induced draft fans to the Delamar Copper Company, Chrome, N. J.; heater coils for the Saginaw Valley Traction Company, Saginaw, Mich.; an economizer, induced draft fan and engine to the Massachusetts Chemical Company, Walpole, Mass.; two sets of heater coils and ventilating fans for the Atlas Wire Company, South Bartonville, Ill.; an induced draft fan and engine for the Trojan Laundry Company, Troy, N. Y.

POWER IN VANCOUVER.—An important order recently secured by the Canadian Westinghouse Company was obtained from the Vancouver Power Company, of Vancouver, B. C. This order included a 1,500-hp, 2,200-volt, revolving-field, engine-type generator, which will be direct-connected to a Pelton water wheel. This is a duplicate of the generators now in operation in the power plant of this company and will operate in multiple therewith. The order includes switchboards and air-blast transformers of 550 kw capacity. There is also included in the order a 1,000-kw, 60-cycle rotary converter to operate at 550 volts. This converter will furnish power for railway work.

ROBINS CONVEYORS.—The Robins Conveying Belt Company has recently opened an office at 749 Railway Exchange Building, Chicago, Ill. Mr. C. Kemble Baldwin, the chief engineer of the company, is in charge of this office and is prepared to handle all inquiries from parties in the Middle West. The Robins Company has entered an order for a 30-in. conveyor for a gold dredge in the Oroville District, Cal. Among other orders on hand is one for a 24-in. and an 18-in. conveyor from the Pratt & Whitney Company, of Hartford, Conn., and one for a mast and gaff rig from the Pawtucket Gas Light Company, of Pawtucket, R. I.

LIGHTING WELLAND CANAL.—A conspicuous departure in the lighting of canals is that of the Welland Canal near St. Catherine, Ont. Over 600 alternating-current series arc lamps have been provided by the Canadian Westinghouse Company and these have been in operation for the past few months and have given splendid service. This installation as a whole redounds great credit to the Ontario government, as well as to the consulting engineer, Mr. R. J. Parker, under whose direction the complete plant was installed.

DEMAND FOR STORAGE BATTERIES.—It is stated that the business of the Electric Storage Battery Company, continues on the same large scale as last year. The Louisville & Nashville Railroad recently placed a large order and a large business has also developed with the steel mills, the company having secured large contracts from the Carnegie Steel mill in Youngstown, O., and the Illinois Steel Co. at Chicago.

THE GOLDEN KEY MINING COMPANY, Hillside, Ariz., is installing a power plant to operate its mining machinery. Contract has been closed for two of the well-known "Hornsby-Akroyd" oil engines of 16 hp each, built by the De la Vergne Machine Company, of New York.

LARGE COPPER ORDER.—It is stated that for its electrical work the New York Central Railroad system has closed contracts for 2,000,000 lb. of copper wire at 21c. per lb. When the plans were drawn up calling for the use of this wire, the market was between 15 and 16c.

CATALOGUES WANTED.—The Adirondack Hardware Co., G. L. Starks, manager, at Saranac Lake, N. Y., has opened an electrical department, which would like to receive catalogues, circulars, quotations, etc., and other data from manufacturers of electrical supplies and apparatus.

Financial Intelligence.

THE WEEK IN WALL STREET.—Easier money and favorable reports about railway and industrial properties gave rise to decided activity on the stock market, with resultant further advances in stock values. There was a wide expansion of speculation. The principal features were the large advances in iron stocks as well as in minor industrials and railroad specialties, and United States Steel shares showed further activity with higher quotations than they have reached since the present bull market began. Electric and traction securities were weak and somewhat neglected and prices tended downward. Allis-Chalmers common lost ¼ point net, closing at 23¼, but preferred made a net gain of ¾ point and closed at 63¾. General Electric closed at 179, a decline of ½ point, and Westinghouse common and preferred at 174⅛ and 188, respectively, these quotations representing fractional gains. Brooklyn Rapid Transit closed at 91½, a net decline of 2½ points, and Metropolitan Street Railway at 125⅝, which is a gain of 1⅜ points. Western Union's last quotation was 93¼ and American Telephone & Telegraph closed at 136½, a net loss of 1¼. American Locomotive closed at 76⅜ for common and 119⅝ for preferred, the former being a decline of 1⅜ points and the latter a gain of 2⅛. Interborough Rapid Transit made a net gain of 1 point on the curb market, closing at 233. Mackay Companies is quoted at 58¾. The curb market was quiet early in the week, but developed considerable activity toward the end. Movements in the copper group were irregular and it is stated that insiders would rather sell than buy. Following are the closing quotations of January 16:

NEW YORK

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
Allis-Chalmers Co.	23	23¼	General Electric	179½	178
Allis-Chalmers Co. pfd.	63	63¾	Hudson River Tel.	..	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	232¾	233¾
American Locomotive	78	76⅜	Mackay Cos.	58⅞	60
American Locomotive pfd.	117	119	Mackay Cos. pfd.	73	74
American Tel. & Cable	90	91	Marconi Tel.	...	..
American Tel. & Tel.	136	138	Metropolitan St. Ry.	124¼	126⅝
Brooklyn Rapid Transit	93⅝	90⅝	N. Y. & N. J. Tel.	..	..
Electric Boat	28	28	Western Union Tel.	93¼	93¾
Electric Boat pfd.	66	65	Westinghouse com.	172	170
Electric Vehicle	16	15	Westinghouse pfd.	..	.
Electric Vehicle pfd.	21	21			

BOSTON

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
American Tel. & Tel.	136¾	136⅛	Mass. Elec. Ry. pfd.	63¾	60
Cumberland Telephone	...	117	Mexican Telephone	..	..
Edison Elec. Illum.	...	250	New England Telephone	134⅝	137¾
General Electric	..	..	Western Tel. & Tel.	13	15
Mass. Elec. Ry.	18¼	18¾	Western Tel. & Tel. pfd.	84	..

PHILADELPHIA

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
American Railways	52	52	Phila. Electric	7⅝	8⅛
Elec. Co. of America	12	12	Phila. Rapid Trans.	32	33⅝
Elec. Storage Battery	82	83	Phila. Traction	..	..
Elec. Storage Battery pfd.	..	...			

CHICAGO

	Jan. 9	Jan. 16		Jan. 9	Jan. 16
Chicago City Ry.	198	197	National Carbon	79	80¼
Chicago Edison	...	...	National Carbon pfd.	115	117
Chicago Subway	...	...	Union Traction	...	..
Chicago Tel. Co.	...	..	Union Traction pfd.	...	..
Metropolitan Elev. com.	27	26			

MINNEAPOLIS GENERAL ELECTRIC.—Note was made in these pages recently of the personal changes in the management of the Minneapolis General Electric Co. The directors of the company have declared an initial dividend of $2 per share on the common stock, in addition to the usual 3 per cent semi-annual dividend on the preferred stock. The company is under the management of Stone & Webster, who by careful and aggressive direction have taken advantage of the growth of the city of Minneapolis and developed the business of the company so that it shows earnings for the 12 months ending November 30, 1905, of $724,000 gross and $352,000 net. During this time the company has added largely to its power facilities and distributing system. Over $500,000 has been expended out of the earnings in these improvements and the balance of the money needed has been raised by the issue of additional preferred stock from time to time, and by the sale of escrow bonds.

MONEY FOR SUBWAYS around New York City is likely to be required in large blocks in the near future. The total cost of the proposed three new subway systems—the 7th and 8th Avenue line, the Lexington Avenue line, and the Third Avenue line—is estimated at approximately $100,000,000. This total covers only that part of these lines on Manhattan Island. The extensions in the Bronx will cost about $15,000,000, construction being not so expensive. The existing subway cost originally $35,000,000, but the additions of tracks and changes in plans caused an additional expense of nearly $15,000,000 making the entire cost nearly $50,000,000.

SAN FRANCISCO CONSOLIDATION.—The merger deal has been closed, which accomplishes the absorption of the San Francisco Gas & Electric Company by the California Gas & Electric Corporation, together with financial interests represented by N. W. Halsey & Co., New York bankers. On January 2 the purchasers paid the Union Trust Company, of San Francisco, as trustee for the San Francisco Gas & Electric stockholders, $3,151,000 cash. There was also turned over under the terms of the sale $9,000,000 of preferred stock and $9,250,000 in the new 5 per cent 30-year gold bonds of the Pacific Gas & Electric Company, which has been incorporated by the purchasers as a holding company. N. W. Halsey & Co. receive some of this company's stock for having advanced the $3,651,000, which includes the $500,000 forfeit money deposited with the Union Trust Company when the option was taken on the properties purchased. San Francisco Gas & Electric stockholders get $90 a share, $25 in cash and $65 in the new bonds. The Union Trust Company, as trustee for the stockholders, is to have two directors in the new company, the California Gas & Electric Corporation, and also in the San Francisco Gas & Electric Company. The San Francisco Gas & Electric Company has elected a board of directors. John A. Britton, who is also the president of the Pacific Gas & Electric Company, was elected president and F. G. Drum, vice-president. Charles L. Barrett, secretary and treasurer under the old ownership, were re-elected by the new management. This company will retain its individuality as the local system in San Francisco. The Pacific Gas & Electric Company is now one of the largest and most important public utility corporations in the world. It will operate in 18 counties, serving a territory 250 miles long by 125 miles wide and controlling vast water powers and the longest electric transmission line in existence. Plans are in preparation for enlargements and improvements in the gas and electric plants in San Francisco and through the State. The completion of the French Creek power plant, of the Valley Counties system, on which work has been suspended for more than a year, will be rushed this season.

DIVIDENDS.—The International Steam Pump Company has declared a regular dividend for the quarter of 1½ per cent on the preferred stock, payable February 1. The Milwaukee Electric Railway & Light Company's directors have declared the regular quarterly dividend of 1½ per cent, payable January 31. The Edison Company, of Boston, has declared a regular quarterly dividend of 2½ per cent, payable February 1. Directors of the Chicago Edison Co. have declared the regular 2 per cent quarterly dividend, payable February 1. The Electric Co. of America has declared the regular semi-annual dividend of 35c. per share, a rate of 7 per cent per annum, payable January 31. The National Steel & Wire Co. of New Haven has declared the regular quarterly dividend of 1¾ per cent on the preferred stock. The Grand Rapids Railway Co.'s directors have declared the regular quarterly dividend of 1¼ per cent on its preferred stock, payable February 1. Minneapolis General Electric Co. has declared a dividend of 2 per cent on the common stock, in addition to the 3 per cent semi-annual on the preferred. The Jacksonville Electric Company has declared a semi-annual dividend of $3 per share on the preferred stock and $3 per share on the common stock, payable February 1. The Westfield Power Company has declared a semi-annual dividend of 2½ per cent. The directors of the Electric Bond & Share Company has declared the regular preferred quarterly dividend for the three months ended December 15, 1905, and an additional 1¼ per cent dividend for the period from December 15, 1905, to February 1, 1906, payable February 1. Directors of the American Light & Traction have declared the regular quarterly dividend of 1½ per cent on preferred stock and 1 per cent on the common, payable February 1. The American Graphophone Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable February 15. The Central District Printing & Telegraph Company has declared a dividend of 2 per cent, payable January 31. Directors of the Butte Electric & Power Company have declared the regular quarterly dividend of $1.25 on the preferred stock, payable February 1.

LONG ISLAND HOLDING COMPANY.—The Long Island Consolidated Electrical Companies, the entire capital stock of which is owned by the Long Island Railroad, has been organized as a holding company for the purpose of taking over the control by the latter company, as well as such other electric railways as may be purchased or constructed as feeders to the lines of the Long Island Company in the near future. An authorized issue of 4½ per cent 40-year collateral trust mortgage gold bonds, not to exceed in the aggregate the amount of $10,000,000, is designed to cover the cost of acquired and constructed subsidiary electric roads, and to provide for the future development and extension of these and similar properties. The following electric railways are to be turned over to the Long Island Consolidated Electrical Companies: Huntington Railroad Company, Ocean Electric Railway Company, the Northport Traction Company, the Nassau County Railway Company, the Glen Cove Railroad Company, and the Jamaica & South Shore Railroad Company. The Long Island Company also owns one-half of the capital stock and bonds of the New York & Long Island Traction Company, and will acquire one-half of the capital stock and bonds of the Long Island Electric Railway Company, at a total cost of $1,360,507. These securities are also to be turned over to the Long Island Consolidated Electrical Companies.

THE UNION ELECTRIC LIGHT AND POWER COMPANY, of St. Louis, one of the local public service corporations owned by the North American Company, has issued $4,000,000 in new securities through an underwriting syndicate. The new security is a collateral trust note, drawing 5 per cent interest, and running for three years. It is secured by $4,000,000 of the capital stock of the Union Company deposited with the Mississippi Valley Trust Company, as trustee. The notes have a form of guarantee by the North American Company in which the parent corporation pledges itself to buy the stock in at par on the expiration of the notes. The notes are being sold principally in New York. The collateral for the notes increases the stock of the Union Company to $8,000,000, out of an authorized capital stock of $10,000,000. The company has a bonded indebtedness of $25,000,000. The money from the sale of the notes was put into new improvements in the power plants. Most of it was used in completing the new Ashby Street power house.

OKLAHOMA LIGHTING BONDS.—Proctor & Borden, Equitable Building, New York City, are offering $100,000 of Oklahoma Gas & Electric Company, Oklahoma City, first mortgage 5 per cent gold bonds, subject to call at 105 and interest. They are part of a total authorized issue limited to $300,000, reduced by action of the sinking fund to $290,000, and secured by first mortgage on the property of the company, and followed by an authorized issue of $1,000,000 general mortgage 5s, of which $514,000 are now outstanding. Sufficient of the general mortgage bonds are reserved to retire the first mortgage bonds at maturity. Of the general mortgage bonds, $225,000 are owned by the Electrical Securities Corporation, a subsidiary corporation of the General Electric Company, and deposited as part security for the collateral trust bonds, the property on which the first mortgage bonds are secured, representing a cash investment of over $600,000. The net earnings for the calendar year ending December 31, 1905, are equal to over six times the annual interest on the first mortgage bonds.

KEYSTONE TELEPHONE.—The Keystone Telephone Co.'s report submitted to stockholders at the annual meeting showed the following for the fiscal year ended December 31, 1905: Gross earnings, increase, $64,795, and net earnings, increase, $18,588. There was expended in extension of the plant in 1905 a total of $630,370. The total credit to profit and loss December 31, 1905, is $292,578. There are over 19,000 telephones in use in and around Philadelphia, and it is expected to add 6,000 in 1906. Two hundred and seventy miles of conduits are owned. The year ended December 31 shows as follows:

	1905.	1904.	1903.
Gross	$719,745	$654,950	$468,860
Expenses	444,041	397,834	235,100
Net	$275,704	$257,116	$233,760

PHILADELPHIA COMPETITION.—As to new lighting competition in Philadelphia, the member of a prominent Philadelphia brokerage house says: "The now assured competition for the Philadelphia Electric Co. is indicative of the calling of another assessment of $2.50 per share, and I believe the recent selling of the stock and the subsequent low price has been by inside people who do not care to pay another assessment. I am told that there is an order in the market to dispose of 35,000 shares of this stock for an influential financial interest in the company and that a portion of this order has already been executed."

BLOOMINGTON, ILL., PROPERTIES.—Hodenpyl, Walbridge & Co. have sold the Bloomington and Normal Street Railway, Heating and Lighting system of Bloomington, Ill., to the McKinley syndicate for $1,000,000. The syndicate is building and operating interurban lines throughout Illinois. It already owns the Consumers' Heat and Light system and the interurban franchises in Bloomington.

General News.

PRAIRIE GROVE, ARK. The electric light plant was suspended January 1, after being in operation only about three months. The reason assigned is lack of patronage.

LOS ANGELES, CAL.—The People's Gas Company, of Monrovia, has been purchased by the Edison Electric Company for $30,000.

SAN BERNARDINO, CAL.—The Hill Street power plant of the San Bernardino Electric Company has been destroyed by fire. The loss is estimated at $65,000.

LOS ANGELES, CAL.—The Pacific Light & Power Company and the Edison Electric Company have announced lower flat rates. Meter rates are reduced from 15 cents to 11 cents per kw-hour.

NAPA, CAL.—The trustees of St. Helena have granted a franchise to I. N. Enright and Raymond Benjamin for an electric light and power line system. Bids for the franchise will be opened in February.

LOS ANGELES, CAL.—Messrs. Phillips and Torrance, directors of the Home Telephone Company, of this city, have acquired a 50-year franchise from Oakland for the Home Telephone Company, of Alameda County, paying therefor $32,500.

BAKERSFIELD, CAL.—A number of canal and irrigation companies have commenced an action in the Superior Court to restrain the Edison Electric Company, the California Power Company, and other allied interests from obstructing the water of Kern River by a dam in the stream.

SISKIYOU, CAL.—The Siskiyou Electric Power Company is connecting up the Fall Creek and Shasta River plants in order to supply the increased demand for power. The survey just completed over the 1,500 acres recently purchased by the company gives a 160-foot fall in 6,600 feet and the water supply is sufficient to develop approximately 100,000 horse-power. The company has refused the city of Ashland an extension of the fifteen days' option at $65,000 for the purchase of the local plant.

SAN FRANCISCO, CAL.—At the annual meeting of the stockholders of the Golden State Power Company the following-named officers were elected for the ensuing year: A. S. Macdonald, president; Joseph D. Redding, vice-president, and Rothwell Hyde, secretary. The company owns all the original water rights on the North Fork of the Feather River, extending from Big Bend, Butte County, to Big Meadows, Plumas County. The company is said to be planning a development of 200,000 horse-power,

WINDSOR LOCKS, CONN.—Electric lighting for the Burnap Opera House has been furnished by the dynamo recently installed by G. W. Gates to light his store.

WATERBURY, CONN.—Instead of an electric lighting plant as suggested in the Mayor's message, the Waterbury *Republican* proposes that the city government should establish a public heating plant.

SOUTHPORT, CONN.—There is growing favor in the project to utilize Mill River to furnish motive power for an electric light plant for lighting the town and business places under municipal ownership.

NEW MILFORD, CONN.—The New Milford Electric Light Company is the defendant in a suit brought by the town of New Milford for damages alleged to have been made to the highway on the west bank of the river by the construction of a new dam by the lighting company. The sum mentioned in the suit is $10,000. The new dam was completed about a year ago, and replaced an old wooden structure.

WINDSOR LOCKS, CONN.—The local electric lighting station met with a serious mishap last week by the independent starting up of the water wheel when nobody was at the station. This did considerable damage before it was discovered. The damage to engine and other machinery and the fire loss will require about $3,000 to replace. The company supplies lights for streets and domestic service for Windsor, and the villages of Warehouse Point and Broad Brook across the river.

DENVER, COL.—The plant of the Lacombe Electric Company was partly destroyed by fire Jan. 8. This plant supplies the street lighting of Denver and some incandescent lighting, especially in the residence districts. It is expected that street lighting service can soon be resumed, although the incandescent lighting apparatus was disabled. The Denver Gas & Electric Company helped make up for lack of light on the downtown streets by keeping its flat rate sign and window display lighting on all night instead of turning it off at midnight as usual.

KOKOMO, IND.—J. W. De Haven writes that a stock company is being organized to construct a dam in Wild Cat Creek for light and power purposes.

WASHINGTON, IND.—The Bell Telephone Company is starting the building of a line from Vincennes, Ind., to Olney, Ill., and thence to Effingham and Mattoon, Ill.

CAMBRIDGE CITY, IND.—James A. and Charles A. Boyd, owners of the Independent Telephone Exchange of this city, have purchased the Hagerstown independent telephone plant. The system comprises nearly 2,000 instruments.

SOUTH BEND, IND.—President Thorwood of the South Bend Telephone Company announces that his company is to be merged into a corporation backed by New York and St. Louis capital, which will control most of the telephone systems in northern Indiana and Ohio.

TERRE HAUTE, IND.—The Citizens' Telephone Company, of Terre Haute, has purchased a site for its new exchange at a cost of $4,500. Plans have been prepared for the erection of a three-story fireproof brick building. An elaborate switchboard will soon be installed. It is estimated that the expense of erecting and fitting the building will amount to $100,000.

FORT WAYNE, IND.—At a recent meeting of the stockholders of the Home Telephone & Telegraph Company of Ft. Wayne, it was decided to complete the purchase of the National Telephone Company, with its long-distance telephone lines in Ohio, Indiana and Michigan, and its local exchanges in Sturgis, Kendallville, Auburn and New Haven within the next sixty days.

PITTSBURG, KAN.—The Labette County Telephone Company, the Parsons Telephone Company and the Pittsburg Telephone Company, all of this State, have been merged into one system with properties aggregating over $200,000 in value. The new company will be known as the Citizens' Home Telephone Company and will probably have its headquarters in Pittsburg. George Spangler, of Chetopa, has been elected secretary. Improvements will be made and new lines built.

JASPER, KY.—Both the electric lighting and the water plants of Jasper have been purchased by the town authorities. The capacity of the lighting plant has been increased by 3,000 lights.

NEW ORLEANS, LA.—At a recent meeting of the City Council was introduced an ordinance granting to A. Von Hoffman and his associates the right to establish and maintain a telephone system in the city for a term of fifty years.

TURNER, ME.—E. L. Staples has purchased a 250-light dynamo and has installed it in his place of business, preparatory to furnishing the illumination for the stores and residences of the village.

PORTLAND, ME.—At the annual meeting of the Consolidated Electric Light Company of Maine the following officers were elected: President, Leander W. Fobes; vice-president, Charles W. T. Goding; general manager and treasurer, George E. Raymond. George E. Raymond was elected secretary of the corporation.

PORTLAND, ME.—The Maine & New Brunswick Electrical Power Company is making a large hydro-electric development at the Aroostook Falls, in the British Colony, chiefly for utilization in Maine, under surveys of Mr. B. D. Whitney, of Gardiner, Me. The consolidated company has charters from both sides of the frontier. The plant near Fort Fairfield is to develop about 2,700 hp for delivery at distant points, such as Houlton, 52 miles southward, and Van Buren, 48 miles to the north. A sale of current is estimated at $32,000 per year, with operating expenses of $7,000 and $5,000 interest on bonds. The plant will cost about $91,000, not inclusive of transmission line. The plant is to be in operation this year.

HOLBROOK, MASS.—The committee appointed to ascertain the number of lights needed and how much the cost would be to install the proposed electric light system has looked over the ground with Mr. Bailey, of the Randolph Electric Light Company, and will be ready to make its report at an early date.

SPRINGFIELD, MASS.—The United Electric Light Company plans to furnish increased power to the Boston & Albany Railroad and the United Drop Forging Company's plant for lighting and operating purposes as soon as the new Boston & Albany Railroad bridge over the Connecticut River is completed, so that larger wires can be connected up.

WEST SPRINGFIELD, MASS.—Frank L. Worthy plans to furnish electric power to operate the mills of the Warren Thread Works in Westfield from a motor in his power plant on the bank of the Westfield River at Mittineague, provided franchises permitting the erection of poles and wires are granted him by the selectmen of this town and Westfield.

MUSKEGON, MICH.—As already noted, the American Light & Traction Company has by purchase added to its list of properties the Lacomb Electric Company of Denver, Col., and the Muskegon Traction & Lighting Company, of Muskegon, Mich. The property is the more extensive and valuable of the two purchases. It consists of gas and electric plants, and a street railway system 15 miles in length. The company was incorporated and began business in 1901, as a consolidation of the Muskegon Street Railway Company, the Muskegon Gas Light Company and the Muskegon Electric Light Company. It is the terminal for the Grand Rapids third-rail system. Its net gain above expenses and fixed charges for the year ending Feb. 23, 1905, was $25,650.

GRAND RAPIDS, MICH.—The long-standing dispute over the Thornapple Electric Company's franchise has been amicably settled. M. B. Wheeler has filed his acceptance of the amended franchise.

MONROE, MICH.—The municipal lighting plant, which the voters have refused to improve or dispose of, has been shut down for lack of sufficient appropriation. It is said that the Board of Works cannot secure any more coal, as the city owes $700 for what has been used. A meeting has been called for the purpose of discussing the situation.

PORT HURON, MICH. The Port Huron Light & Power Company announces a reduction in the rate for commercial lighting. Last spring the company made a cut in its rates for residence lighting, amounting to 20 per cent. On January 1 a differential rate was made to apply to all lighting service except resident lighting. The new rate will be 15 c. per kw-hour for the first 30 hours and 5 c. per kw-hour for all power used in excess of that amount. The present rate is 15 c. straight.

PETOSKEY, MICH.—Judge Fred W. Mayne, of Charlevoix, proposes in behalf of a syndicate to furnish electric power to Petoskey at the rate of 4 c. per kw-hour for lighting and 2½ c. for commercial purposes, the distribution to be in the hands of the city. He also proposes to buy the Petoskey lighting plant if it should be offered for sale. The power is to be generated at a dam on the Pigeon River in Cheboygan County. Though the rate is said to be lower than that at which Petoskey can produce the power, the scheme will probably be opposed by those who believe in municipal ownership.

MARSHALL, MO.—A mass meeting was held at Marshall, January 11, in the interest of the Central Electric Railway from Miami to Sedalia by way of Marshall. The company expects to complete the road within one year.

NORMAL, MO.—The Kinloch Telephone Company is completely rebuilding its system at Normal. It has leased the second story of the First National Bank building into which it will move its exchange, which will be materially enlarged. A new switchboard with a capacity of 700 telephones has been ordered and is expected to be installed in the new exchange early this month. The board will be of the central energy type.

KIRKWOOD, MO.—The citizens are discussing a proposition to sell their lighting plant to the General Service & Development Company, said to be owned by the North American Company, and they will have an opportunity of voting on the question at a special election to be held about February 15. Two ordinances have already been drawn up and are in the hands of the City Attorney. It is understood that the contracts have been agreed upon and signed, subject to the approval of the voters. The General Service & Development Company made an offer some time ago to assume the $17,000 now outstanding on the municipal plant, which was built five years ago at a cost of $30,000, besides paying in cash the sum of $8,000. It is said that the company offered to furnish the town with its lights at $14.50 per lamp, or a total of about $3,500.

WOODBURY, N. J.—The City Council has appointed a committee to go to Trenton to urge on the Legislature the enactment of law permitting cities of the third class to erect and maintain gas and electric light plants.

TRENTON, N. J.—The Trenton, Lakewood & Atlantic Railroad Company will issue $2,500,000 bonds. While the company is chartered to build a road between Trenton and the seashore, it is said that some of this money may be used for construction work in Monmouth County.

ORANGE, N. J.—Mayor Isaac Shoenthal in his annual message recommends the early consideration of the subject of a municipal electric light plant, the city to either construct its own plant or co-operate with other cities in the establishment of a joint municipal lighting plant.

BROOKLYN, N. Y.—The consent of the new State Gas and Electric Commission to an increase of $3,200,000 in the capital stock of the Kings County Electric Light & Power Company of Brooklyn was filed in the office of the County Clerk of Kings County yesterday. With the consent is filed the petition of the company asking for permission to increase the amount of the capital stock from $5,000,000 to $10,000,000.

NEWARK, N. J.—A bill will, it is thought, be introduced in the next legislature for the installation of an experimental lighting plant by the city. The bill, as drawn by City Counsel Joseph Coult, provides that any city having an available site or sufficient power to operate it, may construct a plant for experimental or permanent lighting purposes. The bill gives such cities the authority to issue bonds to cover the cost of such a plant.

NEW LEXINGTON, OHIO.—T. J. Smith and J. B. Rhodes have been granted a telephone franchise and will incorporate at once as the Citizens' Telephone Company.

CANAL FULTON, OHIO.—An ordinance has been passed granting permission to the Massillon Light, Heat & Power Company, of Massillon, Ohio, to establish a system for furnishing electric light, heat and power in this village.

HURON, OHIO.—A sentiment seems to be growing here in favor of disposing of the town's electric lighting plant. It is claimed that the lighting plant has been a constant burden on the resources of the town and that it should be disposed of.

NEW CARLISLE, OHIO.—The proceedings brought in probate court several months ago by the Springfield & New Carlisle Telephone Company to compel the village council to give that company a franchise has been dismissed. The franchise has been granted by the new council.

COLUMBUS, OHIO.—Direct long-distance connection between independent lines of Ohio and West Virginia will be secured through an arrangement recently perfected by M. B. Overly, of the United States Long Distance Company, and the West Virginia Telephone Company. The line is already completed from Columbus to Athens and work upon its extension to Parkersburg, W. Va., will be immediately commenced.

COLUMBUS, OHIO.—The new toll board of the Columbus Citizens' Telephone Company was recently completed. It is said to be the largest switchboard for long-distance business installed in any independent plant in the country. It will have 32 operators' positions, and will start in with 60 long-distance lines, 22 Franklin County exchange connections and 60 rural and suburban connections. The company is also installing automatic telephones at the rate of 15 per day.

INDIANA, PA.—The Indiana Telephone Company suffered the loss of nearly 200 instruments by a recent fire.

DUSHORE, PA.—A committee is reported to have been appointed to look into the matter of securing a lighting system for Dushore.

PHILADELPHIA, PA.—An organized effort is to be made to have the next Pennsylvania Legislature pass a bill to give the electric railway companies the right to carry freight.

YORK, PA.—The stockholders of the Merchants Electric Light, Heat & Power Company elected these officers for the ensuing year: president, Charles H. Bear; vice-president, George C. Campbell; treasurer, Harry Wasbers; secretary, Thomas B. Loucks; directors, Albert Falk, Arthur M. Burger and W. L. Bear.

ALLEGHENY, PA.—The public works committee has ordered printed for the council an ordinance to permit Henry Phipps to lay water and steam pipes and electric wires under Rebecca Street in the First Ward. It is said Mr. Phipps' intention is to erect an electric power and heat plant, so as to furnish light and heat for his tenants in the community.

ABERDEEN, S. D.—The Grant County Telephone Company states that during the past year it has expended in improvements over $20,000 and has constructed 400 miles of line.

BONHAM, TEX.—J. W. Russell and associates, who recently obtained control of the street railway system at Bonham, are preparing to make important improvements and extensions.

HOUSTON, TEX.—The Houston Lighting & Power Company has been reorganized and its capital stock increased from $750,000 to $1,000,000. A. H. Ford, of New York, is one of the incorporators.

HOUSTON, TEX.—The original plan of building the Houston-Galveston Interurban Railway direct to Virginia Point, across the bay from Galveston, has been changed and the road will run from Houston to La Porte via Gonda. The survey for the new route is now being made.

WAXAHATCHIE, TEX.—Mercer Carter and associates, of Dallas, who are promoting the building of an interurban electric railway between Dallas and Waxahatchie, are making good progress in the preliminary work. It is said that the construction of the line is assured and that the work will be started at an early date.

PROVO, UTAH.—Amendments to the articles of incorporation of the Utah County Light & Power Company have been filed with the County Clerk. The capital stock is changed from $50,000 to $200,000, and the life of the corporation is increased from 50 to 100 years. The annual election of officers will hereafter take place on the fourth Monday in January, instead of the second Monday.

HARRISONBURG, VA.—The Blue Ridge Light & Power Company has purchased from the Virginia Power Corporation what is known as the Nicholas water power on North River, west of Port Republic.

SEATTLE, WASH.—An ordinance applying for a franchise to operate street railway lines on Fifteenth Avenue north has been introduced in the Council by the Seattle Electric Company.

TACOMA, WASH.—Frank L. Davis, City Clerk, writes that all bids opened on December 27 for furnishing electric current for a period of 5 or 10 years have been rejected. There is some talk of the city constructing a power plant of its own. William Welsh, Commissioner of Public Works, and Mr. Davis, estimate that a system sufficient to supply the city with water and generate 6,000 horse-power can be installed at a cost not to exceed $300,000.

LOOMIS, WASH.—The water wheel for the Palmer Mountain Tunnel & Power Company's electric power plant is being put in. The company will sell the electric light in the town of Loomis on the following monthly scale: 1 16-candle-power, $1.15; 2 16-candle-power, $1.75; 3 16-candle-power, $2.25; 4 16-candle-power, $2.75; 5 16-candle-power, $3.50. Each additional light 50 cents. 1 8-candle-power, $1.00; 2 8-candle-power, $1.00; 3 8-candle-power, $1.15. Each additional light 25 cents. 1 32-candle-power, $2.00; 2 32-candle-power, $3.50; 3 32-candle-power, $4.50. Each additional light, $1.00. 1 arc light, $6.00; 2 arc lights, $10.00; 3 arc lights, $13.00.

FOND DU LAC, WIS.—The Eastern Wisconsin Railway & Light Company announces a new schedule which took effect January 1, making the base rate 12 c. per kw-hour with discounts ranging from 10 and 10 on bills of $1.25 to $0 to 30 and 10 on bills of $36 to $60.

BELOIT, WIS.—A purchase and consolidation of the electric light, gas and water companies in Beloit is being considered by A. W. Rich and T. S. Briggs, of Cincinnati, and J. J. Davis, of Anderson, Ind. Several conferences have been held and the deal is in a fair way to become consummated.

ST. CATHARINES, ONT.—H. H. Collier, solicitor for the Buffalo, Niagara & Toronto Railway, says that building operations will commence early in the spring. The line will be run from Niagara-on-the-Lake to Buffalo, through St. Davids and Bridgebury, with a branch to St. Catharines and Welland.

MANILA, P. I.—The installation of a modern telephone plant is being rushed to completion by the Philippine Telephone & Telegraph Company, Manila. A modern switchboard will be shipped from San Francisco soon, together with a force of electricians to install it. An extensive underground conduit system is half finished and the balance of the work is being rushed to completion, including a modern central office building. The Philippine Telephone & Telegraph Company was organized in San Francisco during the past year, and owns a 50-year concession granted by the Philippine Commission, after which arrangements were made to purchase the property of the Manila Telephone Company, the original system installed by the Spaniards twenty years ago. As soon as the telephone plant is completed in the city of Manila an extensive system of long-distance lines will be extended into the provinces. The company is composed of some of San Francisco's most prominent business men.

Construction News.

SELMA, ALA.—The City Council is considering the purchase of the plants of the Selma Lighting Company and the Selma Water Company.

HARTFORD, ALA.—It is proposed to soon install at the municipal electric light plant an air compressor for a deep well. J. W. Merchnon is superintendent of the plant.

POCAHONTAS, ARK. The Pocahontas Ice & Power Company will construct an electric light plant and a 10-ton ice plant. The equipment will consist of two 25-hp boilers and one 75-kw single-phase alternator. The company has a capital stock of $25,000. Ruebel & Wells, Chemical Building, St. Louis, are engineers in charge of the construction.

SAN FRANCISCO, CAL.—Thomas Barbour, of the Risdon Iron Works, of this city, is reported to have matured his plans for the erection of a large water-power plant in Butte County, on the Feather River, two miles above Oroville. Above the dam four large barriers will be built in order that the force of the current will have been spent on these before it strikes the dam proper. From the dam the water will be carried in a concrete canal to the turbines. A conservative estimate places the amount of water in the river here at the lowest season at 50,000 inches, while others estimate as high as 100,000 inches. At the first figures, with a fall of 50 feet, the plant should be capable of 12,500 horse-power. Mr. Barbour does not intend to generate power for transmission to distant Oroville plants, but to offer it to manufacturing enterprises.

LOS ANGELES, CAL.—Two companies have been organized here having for their purpose the construction and maintenance of long-distance telephone lines over what is popularly known as the "Puget Sound Country." The Northwestern Long Distance Telephone Company has incorporated with a capital stock of $1,500,000, of which amount $200,000 has been subscribed. With the cities of Portland, Seattle and Tacoma as centers, it is proposed to connect all of the prominent cities of the Northwest, even crossing the international boundary into Vancouver, B. C. The length of mileage at present contemplated is 2,000 miles. To do the work, the Puget Sound Telephone Construction Company has been incorporated with a capital of $200,000, of which amount $20,000 has been subscribed. The directors in both corporations are: C. H. Randall, G. K. Barrere and H. E. Rice, all of Los Angeles.

KREMMLING, COL.—The East Argentine Company is about to erect an electric power plant here at an estimated cost of $400,000.

GREEN MOUNTAIN FALLS, COL.—There is said to be a good opening here for the establishment of a large power plant. For information address F. A. Hunt, Postmaster.

DENVER, COL.—An electric railway is projected between Denver and Leadville, a distance by the route proposed of 115 miles. Lines will radiate from Leadville to various mines, and to the Horseshoe District and Twin Lakes. The road will be equipped with the single-phase system.

CANAAN, CONN.—William Canfield is said to be interested in the establishment of two power plants in this town. One of these will be a private plant, located on Mr. Canfield's premises and will furnish light for the Canfield Building

GROTON, CONN. There is no barrier in the way of the erection of the new power house and all the dock accommodation sought by the borough. As regards the foundation work for the power house and boiler house, Contractor Marcus Trail, of Poquonoc, has started the excavating work.

NEW BRITAIN, CONN.—The Connecticut Railway & Lighting Company has discontinued its power plant on Chestnut Street, and all its power for lighting and traction purposes for this district is now obtained from the sub-station at Black Rock in the western outskirts of the town. Electricity is transmitted to the sub-station from the plant of the New Milford Power Company on the Housatonic River in Litchfield County. The distance is about forty miles.

HARTFORD, CONN. Soon everything will be in readiness for the Hartford Electric Light Company to supply 10,000-volt current to the Consolidated Railway Company. A line of poles has been put in position up the river bank in East Hartford from the temporary bridge to the railroad causeway. More real estate has been acquired by the Consolidated system for the carrying out of their purpose to have a quick service between Hartford and Rockville.

HARTFORD, CONN.—It is reported that a number of park promoters are negotiating with the Consolidated Railway Company relative to the installation of a modern amusement resort, to be called "The White City," in the famous Charter Oak Grounds in Hartford. It is proposed to locate the White City between the half-mile track and the entrance to the park. It is likely that the installation of this park will require quite a good deal of new track work on the part of the railway company, but up to the present time nothing definite has been determined.

WATKINSVILLE, GA. E. B. Thompson and associates contemplate the erection of an electric light plant.

ROCKMART, GA. The election for bonds for an electric lighting system resulted in favor of the issue.

BUENA VISTA, GA. The citizens voted in the affirmative for a bond issue to provide for the construction of an electric light plant. T. B. Rainey is city clerk

BRUNSWICK, GA.—The Southern Electric, Gas & Water Company, which has the franchise for the building of an electric railway in Brunswick, announces that work on the new road will begin immediately and that cars will be in operation by June 15.

MACON, GA.—The directors of the Macon Electric Railway & Light Company have confirmed contracts for about $85,000 worth of improvements to the local system. New machinery will be installed and the capacity of the plant tripled.

HILLSBORO, ILL.—The Macoupin County Telephone Company is planning to spend $25,000 in improvements and extensions during the coming year.

CHICAGO, ILL. A meeting of the directors of the Metropolitan West Side Elevated Railroad Company will be held in a few days, when plans for extensive and much-needed improvements will be taken up. The plans now under contemplation by the company include a new power house to cost $500,000.

BELLEVILLE, ILL. The Belleville Retail Merchants' Association is arranging for the organization of a company among its membership for the construction of an electric light and gas plant. The plan for the erection of a plant on the part of the association was brought about by the excessive rates of the Belleville Gas & Electric Company, which had promised a reduction of its rates with the first of the present year, but refused to make any concession. A. E. Krebs is interested in the new project.

CHICAGO, ILL.—In the report recently presented to the City Council by City Electrician Carroll and City Engineer Ericson, emphasis was laid upon the statement that the most desirable uses for municipal purposes of the power now being developed at Lockport by the sanitary district would be for the operation of municipal street railways, which can use all the power that the sanitary district can furnish for twenty-four hours each day. The city's streets and municipal building can be lighted provided a disposition can be made of the power during hours when lighting is not required, which may be done if the city is given the right to dispose of power for commercial purposes during the day. Sewerage pumping stations, bridges and other minor utilities may be equipped for electrical operation, but would not to any appreciable extent serve to utilize during the daytime the released power used for electric lighting during the night. It is not considered economical or practicable to change the present water works plants to electric operation. The experts figure the drainage canal will have part of its plant developed by January 1, 1907, and will desire at that time to know what part of the power the city will take. The sanitary trustees because of the lack of knowledge regarding the cost of their plant have been unable to say how much this power will be sold for. The experts desire that it shall be given to the city at actual cost, which will probably be lower than electrical power produced by steam-driven plants. Until the Calumet channel is opened the sanitary district will be able only to produce 15,000 horse-power, but later 21,000 or 22,000 horse power. The city now has 6,700 arc street lights which will require about 7,000 horse power. This power the drainage district will deliver at 48th Street and the canal. To light the entire city requires 22,000 additional lights. For a municipal street car system it was figured that 95,000 horse-power would be necessary and in that case the city would use much more than can be produced by the sanitary district.

RICHMOND, IND.—The business of the municipal power plant has so increased within the past year as to make necessary the building of an addition and the installation of new machinery sufficient to double the present capacity of the plant

TERRE HAUTE, IND.—The West Terre Haute Electric Light Company, a recent organization, proposes to erect and operate an electric light and power plant in West Terre Haute. In addition to lighting the city, the company will furnish power for coal-mine tipples and for other industries.

JEFFERSONVILLE, IND. The Louisville & Southern Indiana Traction Company has purchased a site in this city upon which it proposes to build and operate a large power plant. The officials of the company state that it is the aim to furnish power and light for the numerous traction lines which it is believed will soon be running out of Jeffersonville in various directions. Work is to be started on the new plant within a short time.

NEWTON, IA.—The officials of the Newton & Northwestern Railway Company, which operates a steam line from Newton northwest to Rockwell City, have completed plans for an extension to Fort Dodge, which will be equipped for electric interurban service for passengers. The plant includes the purchase of the property of the Fort Dodge Heat, Light & Power Company, which is now operating the lighting and heating plants in that city, and also the street railway system.

SALISAW, I. T.—It is proposed to install a municipal electric light plant here.

GARDEN CITY, KAN.—A new 200-drop switchboard will be installed by the local telephone exchange in a short time. Various other improvements are contemplated by the management.

PARSONS, KAN.—R. C. Rawlings, of Chanute, is asking for a franchise for an electric railway in this city. The company he represents has secured a franchise from the Chanute Council.

AUGUSTA, KY.—An electric light plant will be erected here. For particulars address J. P. Reese, clerk of committee.

LOUISVILLE, KY.—The Cumberland Telephone & Telegraph Company, with headquarters at Nashville, Tenn., will build two lines between this city and New Orleans at an estimated cost of $450,000.

DAWSON SPRINGS, KY.—Reports state that the New Century Hotel Company will enlarge its electric light plant in order to furnish the town with light. Both arc and incandescent lamps will be supplied.

OWINGSVILLE, KY.—A. W. Morrison, of Montreal, Can., E. B. Carr, of Philadelphia, and William A. Young, of Morehead, have been granted franchises to build an electric railway 23 miles in length through this county.

NEW PROVIDENCE, KY.—The Clarksville Electric Light Company has received the contract for wiring the buildings of the Odd Fellows' Home, at New Providence, Ky., which is to be equipped with a complete system of electric lights.

LOUISVILLE, KY.—Ebenezer Howes, of Utica, is said to be interested in an attempt to organize a company to build an electric railway from Utica, Ind., to the line of the Louisville & Southern Indiana Traction Company, connecting Jeffersonville and Jasper. The proposed line will be eight miles in length.

LOUISVILLE, KY.—Improvements and extensions involving the expenditure of not less than $750,000, and possibly $1,000,000, are to be made by the Louisville Railway Company this year. The plans as outlined in a general way comprehend the addition of a storage battery to the power equipment, the installation of two turbines, the extension of the Eighteenth Street line four miles beyond its present terminus, the probable extensions of all the interurban lines of the company and the building of ten miles of new lines in the city.

ALGIERS, LA.—The Algiers Railway & Lighting Company has let to the New Orleans Engineering Company, of New Orleans, La., the contract for building a line from Gretna to Algiers, a distance of four miles. Leigh Carroll is president of the railway company.

WATERVILLE, ME.—John A. Jones, of Lewiston, has commenced surveying here for an electric railway to be constructed in the spring between Waterville and Shawmut.

NEW PORTLAND, ME.—Reynolds Bros., of Winslow, Me., have bought two of the mills at the North and it is expected that the water power will be fully developed in the spring.

EASTPORT, ME.—About $2,000 worth of new machinery and supplies has been recently received at the plant of the Eastport Lighting Company in this city for the improvement of its system.

ELLSWORTH, ME.—Title to the lower dam on Union River has passed from the Ellsworth owners to the Bar Harbor & Union River Power Company, W. H. Burten, of Boston, president of the company, having exercised the option held on the property, and paid over $12,000.

PORTLAND, ME.—The annual meeting of the Consolidated Electric Light Company of Maine has been held and the following officers were elected: President, Leander W. Fobes; vice president, Charles W. T. Goding; General manager and treasurer, George E. Raymond.

WATERVILLE, ME.—The Messalonskee Electric Company expects within a short time now to occupy its new place in the Moor Block. The rooms are being rapidly fitted up and when completed will make good offices. The third floor will probably be used as a work shop, and have equipment for this part of the work.

DEXTER, ME. At the meeting of the Dexter Board of Trade the principal matter which came before the members was the report of the municipal lighting committee which for the past few weeks has been pursuing an investigation with the idea of finding out if possible if this town could be lighted with power furnished from the plant of the Sebasticook Light & Power Company at Pittsfield. According to the report of the committee consisting of Edwin Bunker, W. L. Foy and F. J. Gerry, the project was not only possible but feasible in every respect. It was learned from Charles E. Vickery of the Sebasticook Light & Power Company that the company can furnish, if needed, 300 horse-power at $25 per horse-power.

BALTIMORE, MD.—The United Railways & Electric Company is building four and a half miles of double-track extension from Sparrows Point to North Point. David E. Evans, of Baltimore, has the contract for three and a half miles and the Maryland Steel Company will build the other mile.

FREDERICK, MD.—Announcement was made January 12 to the effect that the syndicate now in control of the Frederick & Middletown Electric Railroad Company is getting ready to receive bids for the construction of an electric railway from Baltimore to Hagerstown. Both the Catoctin and South Mountains will be tunneled and this work will cost approximately $1,000,000. The building of the entire road, it is estimated, will cost $6,000,000 to $8,000,000. A large power house will be erected on the Monocacy River, and it is understood that the contract for this work will be the first to be given out.

SPRINGFIELD, MASS.—The new woodworking concern of Johnson & Hibbard will be supplied with a 20-horse-power electric motor.

WESTBORO, MASS.—A petition has been received from the South Middlesex, Hopkinton & Westboro street railway, asking for the right to carry freight in the town of Westboro.

CHESTER, MASS.—Plans are being discussed for the construction of a telephone line between Chester and Blandford. A committee has been appointed to take up the preliminaries. A. L. Lewis is chairman of the committee.

BOSTON, MASS.—The Boston & Northern and Old Colony Street Railway companies have each petitioned the Railroad Commissioners for authority to issue $200,000 bonds for the purpose of making additions and improvements.

FITCHBURG, MASS.—The laying of the conduits for the electric light wires is all completed so far as the streets are concerned and the conduit layers are working in the Nashua River, at the company's plant, where already half the river has been tunneled.

WESTFIELD, MASS.—The annual meeting of the Westfield Power Company has been held and the following officers were elected: President, M. B. Whitney; treasurer, J. B. Campbell; directors, M. B. Whitney, C. J. Little, S. B. Campbell, George Dunbar, Thomas Little, George H. Loomis, L. P. Lane; superintendent, George C. Dunbar.

GREENFIELD, MASS.—The Board of Trade directors have taken up the matter of having the streets lighted during the dark mornings of the middle of the winter from about five o'clock until daylight. A committee was appointed to present the matter to the Greenfield Electric Light & Power Company, and that company is now considering the terms for such additional lighting.

HANCOCK, MICH.—It is stated that the Michigan State Telephone Company has made an appropriation of $7,000, to be expended in improving the Iron Mountain system.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Water Power Electric Company has taken out a permit for the erection of a 1½-story brick sub-station for power purposes. The cost is estimated at $6,000.

SHELBY, MICH.—The Pere Marquette Light & Power Company will soon petition the Council for a franchise to sell electric power for lighting and other purposes. The company controls the lighting system at Pentwater and has arked the Hart Council for a franchise and contract for that village. The company is capitalized at $150,000 and owns 600 acres of land and the Pentwater lighting system. If there is not a sufficient demand for the use of the present output of 1,100 horse-power, another company will be organized to operate an electric railway between Hart and Pentwater.

PIPESTONE, MINN.—The Council is considering the establishment of a municipal lighting system here.

DULUTH, MINN.—Work will be begun soon on the construction of an electric railway from Biwabik to Hibbing, the funds having been secured by arrangement for the sale of bonds. The company, known as the Missabe Range Traction Company, has been granted a franchise for right of way. Forty miles of road will be constructed at an estimated cost of from $700,000 to $800,000. Under the terms of the franchise the road must be completed within three years.

NEW ALBANY, MISS.—The city has voted in favor of the proposed issuance of $9,000 bonds for improving the electric light plant and water works. J. O. F. Wilcox, Jackson, Miss., is the engineer in charge.

CORINTH, MISS.—The city has granted a franchise to W. J. Lamb, Simon Rubel, M. T. Bynum, Abe Rubel and C. Lennon to build and operate an electric railway in Corinth; also to operate an electric light and power plant. The same parties have also applied for charters from Mississippi and Tennessee to build electric railways to the Tennessee River.

OMAHA, NEB.—The Omaha & Council Bluffs Street Railway Company has been granted the right to cross certain roads in Sarpy County by the Commissioners of that county. This is for the new line to Bellevue, for which the company has its own right of way.

GORHAM, N. H.—The Berlin Electric Light Company is setting its poles through Gorham. The poles are in line with the poles of the Cascade Electric Light and Power Company.

NEW YORK, N. Y.—The recent increase in the capital stock of the American Light & Traction Company was made for the purpose of enabling the company to take over the properties of the Lacomb Electric Company, Denver, Colo., and the Muskegon Traction & Lighting Company, of Muskegon, Mich. The latter property is the more extensive and valuable of the two purchases, consisting of gas and electric plants and 15 miles of street railway.

WENTWORTH, N. C.—James V. Price and Samuel Ellington will construct a telephone line from Wentworth to Madison.

WINSTON-SALEM, N. C.—The Frits Manufacturing & Power Company has secured a permit for the building of a street car line here.

GREENSBORO, N. C.—The North State Telephone Company, of High Point, N. C., has secured a franchise to construct and operate a long-distance telephone system.

WEST ASHEVILLE, N. C.—There is a movement on foot here for the establishment of an electric lighting plant and the promoters are meeting with considerable encouragement.

SPENCER, N. C.—The Spencer Mountain Mills Company has had its charter amended so that it secures the right to develop water powers and operate electric lines. Its capital has been increased to $105,000.

CLEVELAND, OHIO.—The Cleveland, Ravenna & Alliance Traction Company has completed all surveys. J. W. Holcomb and C. R. Morley, of Cleveland, are back of the enterprise.

GEORGETOWN, OHIO.—An election will be held January 29 for the purpose of voting on a proposed issue of $15,000 bonds for establishing an electric lighting system in the town.

DELPHOS, OHIO.—George F. Wilson and others of this place are promoting an electric railway to extend from St. Marys to Defiance through Delphos, Spencerville and Cloverdale.

ZANESVILLE, OHIO.—The citizens of nearby towns are endeavoring to induce the new owners of the Zanesville Railway & Light Company to build a line to Duncan Falls and McConnelsville.

NEWARK, OHIO.—The Newark Independent Telephone Company is perfecting plans for the extension of its lines and making other improvements in order to provide for the demands of its rapidly increasing business.

EAST LIVERPOOL, OHIO.—The East Liverpool Traction & Light Company, which recently consolidated several traction lines and lighting plants in this vicinity, has negotiated for the issue of $3,000,000 bonds, of which $600,000 will be reserved for future additions and improvements. The company has elected officers as follows: Van Horn Ely, president; C. A. Smith, vice-president; Edward McDonald, secretary-treasurer.

PORTLAND, ORE.—The Mount Hood Electric Company, which is establishing a large power plant at the junction of the Sandy and Bull Run rivers, expects to reach Portland within six months with its wires. Only a portion of the power will be developed at first, but the plants will have an ultimate aggregate capacity of 80,000 hp. Actual construction on the plant on the Sandy will start in the spring as soon as the weather will permit.

SPRINGFIELD, OHIO.—The Springfield, Charleston, Washington C. H. & Chillicothe Traction Company has been sold at receiver's sale to George W. Baker, of Beaver, and Theodore Troupe, of Springfield, representing a Cleveland syndicate composed of W. H. Craft, E. B. Thomas and E. W. Christy. The company will be reorganized and an $800,000 bond issue floated with which it is the intention to extend the line to Washington C. H. and eventually to Chillicothe.

CHAMBERSBURG, PA.—The Borough Council has passed an ordinance granting permission to the Cumberland Valley Railroad Company to erect a power house on Kennedy Street. The probable cost of the plant is estimated at $100,000.

ALLENTOWN, PA.—Application has been made by the Schuylkill Valley Traction Company to lay tracks in West King and Berks Streets, Pottstown, in order to extend its lines from Pottstown to Birdsboro. At the latter place the road will connect with the company's tracks running to Reading. The building of the link will make a complete electric railway between the latter place and Philadelphia.

PITTSBURG, PA.—Street railway charters have been granted for the construction of electric lines from Monongahela River towns to Wellsburg, on the Ohio River. The charters are for the Coal Center Electric Company, West Middletown Electric Railway Company, Washington & Brownsville Street Railway, and the Independence Street Railway Company. The nominal capital of each company is $12,000. D. B. Neagley, Charles H. Robensteen and William T. Pierce, of Pittsburg; W. H. Armstrong and H. M. McClure, of Washington, Pa., are the incorporators.

YORK, PA.—In the region of McCall's Ferry, where the work preliminary to that of constructing an immense power plant and dam by the McCall's Ferry Water & Power Company is in progress, flowing ice in the river recently interfered with the engineers and workmen in crossing and recrossing the stream. To overcome the delays an engineering trick was resorted to and the broad river was practically bridged within a space of 24 hours. A 1-inch cable was taken from the company's equipment for the building of the dam and was uncoiled. The cable was dragged across the river and made fast to a large tree on either side of the river. It was then stretched by the united efforts of 200 men at either end and 50 horses. A basket was then rigged to the cable with a roller attachment for its operation. In this basket car swinging high above the surface of the river the engineers and workmen make their transits across the stream.

EDGEFIELD, S. C.—The city is considering the installation of water works and an electric light plant. J. C. Sheppard is chairman of the committee.

ANDERSON, S. C.—Practically all of the new issue of stock of the Anderson Traction Company, amounting to $220,000, has been subscribed and the 10-mile line to Belton will in all probability be built.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company is now preparing for the extension of the Broadway Line to Fountain City.

MEMPHIS, TENN.—The Memphis Street Railway Company is contemplating numerous improvements in its system, including the building of new lines and the extension of its present ones. For this purpose it has recently increased its capital stock from $500,000 to $5,000,000.

MUSSEL SHOALS, TENN.—It is expected that a bill will be introduced in Congress granting a large Philadelphia electric company a franchise to develop the power of the Mussel Shoals on the Tennessee River. The engineers of the company have reported that there is enough power at the Shoals to supply a large number of cities within a considerable distance of the power plant.

LUFKIN, TEX.—McCarthy, Starnes & Company, of Lufkin, will install an electric light and power plant in that place.

BEAUMONT, TEX.—Emmett Landry is promoting the organization of a new electric light and power plant for Beaumont.

DALLAS, TEX.—It is announced that everything is in readiness for the early construction of the interurban electric railway between Dallas and Mesquite. A. C. Nafus, of Mesquite, is interested in the project.

EL PASO, TEX.—Plans for the extension of the electric railway system of the El Paso Electric Railway Company from El Paso to East El Paso are said to have been approved by Stone & Webster, of Boston, the owners of the property.

HOUSTON, TEX.—The Houston Lighting & Power Company, which has been reorganized with a capital stock of $1,000,000, has obtained its charter from the secretary of state. The incorporators of the company are A. H. Ford, of New York; Henry P. Dart, Sr., Henry P. Dart, Jr., E. A. Neugass, Isidore Newman and sons, all of New Orleans; Norman Alexander, of New York, and J. W. Terry, of Galveston. W. H. Chapman remains with the new company as general manager. Additions and improvements will be made.

IRON GATE, VA.—An electric lighting system will probably be established here. Address the Mayor for further information.

BLUEFIELD, W. VA.—William E. Fowler, of Graham, has applied for a charter to erect an electric light plant here. There will be water works and an ice plant run in connection with the lighting plant.

VIENNA, VA.—Reports state that the Washington, Arlington & Falls Church Railway Company is considering the erection of an electric power plant at Vienna. F. B. Hubbell is vice-president and general manager, 3528 M Street, Washington, D. C.

SHENANDOAH, VA.—The Town Council has awarded a contract to George C. Morgan, of Chicago, for the installation of water works and an electric lighting system. The power will be obtained from the Shenandoah River, near the town. The cost of the enterprise is estimated at $25,000.

LURAY, VA.—The Shenandoah River Power & Light Company proposes to develop the water power of the Shenandoah River two miles from Luray and transmit electric power to the town for lighting and other purposes. A dam is being constructed across the river and from 600 to 1,200 horse-power will be developed.

KENOSHA, WIS.—The Kenosha Electric Railway Company has sent a petition to the City Council asking that the company be granted a franchise to make extensions to its lines in the city.

MILWAUKEE, WIS.—Franchises for two electric railways have been asked of the Common Council, one by the Milwaukee Northern Railroad Company to enter the city from the North, and the other by the Chicago & Milwaukee Electric Railway Company, coming from the south. The Milwaukee-Northern Company proposes to make its line a part of an interurban system which eventually will run from Fond du Lac to Sheboygan, thence down the shore to Kenosha, where it will connect with the line to Chicago. Franchises are also being asked of the Councils of Port Washington, Sheboygan, Fond du Lac and Cedarburg.

CULIACAN, MEX.—The Compania Minera de Penuco will install an electric light and power plant in the Concordia district, State of Sinaloa.

SAN CRISTOBAL, MEX.—A company of local capitalists has been organized in San Cristobal for the purpose of installing an electric light and power plant. The same company will build an electric street railway system in the town.

DURANGO, MEX.—James H. Lesdon, an electrical engineer, has been investigating the situation here on behalf of an American syndicate, said to be of Boston, with the view of installing a new electric light and power plant for the city of Durango. The same parties contemplate constructing an electric street railway system in Durango.

OWEN SOUND, ONT.—The promoters of the Huron & Ontario Electric Railway Company state that the construction of the road will be begun in the spring. The company's offices are in Toronto.

ST. CATHARINES, ONT.—Arrangements are now being concluded for the construction and erection of two poles of reinforced concrete, 150 feet in height, to carry transmission wires over the old Welland Canal for the Lincoln Electric Light & Power Company. There are nearly 100 of these concrete poles erected along the Welland Canal electrical transmission line.

COMITAN, MEX.—An electric light and power plant is to be installed in Comitan by a company of local capitalists.

MAZATLAN, MEX.—The installation of an hydro-electric plant at the falls of the Piaxtle River in the State of Sinaloa is to be made by the Compania Minera Guadalupe de los Reyes, which owns several mines in the Cosala district. The plant will have a capacity of 5,000 horse-power and will cost about $800,000. The plans for the plant were prepared by Robert McF. Doble, of San Francisco.

SAHUARIPA, MEX.—Miguel A. Lopez, an attorney of the City of Mexico, has obtained a concession from the federal government on behalf of a syndicate of capitalists for the erection of a large electric power plant on the Yaui River, near Sahuaripa. The free importation of the material and machinery necessary for the construction of the plant is granted. It is stated that the proposed plant is to provide power for mines and industries of the Sahuaripa district.

PARRAL, MEX.—The concession which L. Iwansky, of Parral, and associates obtained from the federal government of Mexico several months ago for the installation of a large electric power plant in the Parral district, has been taken over by a syndicate of Pittsburg, Pa., men and a company is now being organized. This project was referred to in ELECTRICAL WORLD AND ENGINEER Dec. 9, 1905. In addition to providing power for the Parral district the company has planned to build transmission lines to the Inde, Santa Barbara and Guanacevi mining districts.

New Incorporations.

LOS ANGELES, CAL.—The Mutual Electric Company has recently been incorporated. Its directors are F. J. Steele, J. O. Horton, J. E. Moore, J. T. Boyd and A. W. Billington, all of this city.

DALZELL, ILL.—S. H. Brakel has been granted a franchise to construct and operate a telephone system in Dalzell.

CHILLICOTHE, ILL.—The Chillicothe Water, Light & Power Company has taken out incorporation papers. The incorporators are W. H. Foster, Frank H. Earl and Charles H. Kingsbury. The capital is $75,000.

HOOPESTON, ILL.—The Hoopeston Gas & Electric Company has filed articles of incorporation, with a capital named at $200,000. The incorporators are Frederick A. Platt, William L. Jenks and H. L. Handley.

TERRE HAUTE, IND.—The Indiana Rapid Transit Company has filed articles of incorporation to build a traction line from Terre Haute to South Bend. P. M. Dunn and A. M. Weeden are among the incorporators.

ELKHART, IND.—The Elkhart Independent Telephone Company has been incorporated with a capital stock of $1,250 to install and operate a telephone system. G. G. Taylor, A. W. James, J. C. Taylor are the incorporators.

ELIZABETHTOWN, ILL.—The Hardin County Telephone Company, of this place, has filed articles of incorporation, with a capital stock of $6,000. Among the incorporators are T. D. White and Daniel W. Whitenberg.

ROSEBORO, N. C.—The Roseboro-Fayetteville Telephone Company has been granted a charter. The company proposes to construct a line from Roseboro to Fayetteville and branches for a number of farmers and others in that section

CARTHAGE, N. C.—The Carthage Telegraph Company has filed its charter and will construct and operate a telegraph line between Cameron, Hallison and Carthage. W. C. Petty, J. C. Petty and W. C. Petty, Jr., are the promoters of the project.

UNADILLA, NEB.—Articles of incorporation of the Unadilla Telephone Company have been filed with the County Clerk. The company will build an exchange of fifty telephones, which will connect with the farms in that neighborhood, the central office being in this city.

LAKE BENTON, MINN.—The Lincoln County Telephone Company has been incorporated with a $50,000 capital.

HURDLE MILLS, N. C.—The North Carolina Telephone Company has been chartered, with a capital of $100,000. The incorporators are J. S. Schley and others.

KALAMAZOO, MICH.—The Kalamazoo & Eastern Railway Company has been incorporated under the laws of Michigan for the purpose of building an electric railway from Kalamazoo to Paw Paw and Marceline. The capital stock of the company is $250,000, and F. F. Bennett, of this city, is one of the principal incorporators.

DAVENPORT, OKLA.—C. R., W. R. and C. A. Ridley have filed articles of incorporation for the Ridley Telephone Company, having a capital stock of $5,000.

HENNESSEY, OKLA.—The Electric Light & Power Company has been incorporated, with a capital of $15,000, by C. C. Smith, Fred Ehler and others.

DUNKIRK, OHIO.—The Manufacturers' Light & Power Company has been recently incorporated by A. O. Fisher, R. R. Ramsey and others. The company is capitalized at $50,000.

SAXONBURG, PA.—The Saxonburg Heat & Light Company, with a capital of $5000, has been incorporated by John B. Patterson, of Freeport; W. H. Knock, of this city, and others.

WILKESBARRE, PA.—The Hazleton, Weatherly & Mauch Chunk Electric Railway has been incorporated, with a capital of $200,000, for the purpose of reviving the project to build an electric railway between Hazleton and Mauch Chunk. Frank Larned is president of the company, and other Wilkesbarre capitalists interested in the undertaking are J. K. Weitzenkorn, Christian Walter and A. H. Bloom.

SIOUX FALLS, S. D.—A company has been organized and incorporated by Sioux Falls business men, under the name of the Sioux Falls Interurban Electric Railroad Company. Among those behind the project are Dr. R. F. Brown, Michael Gerin and J. A. Gross. Dr. Brown is president of the company and George A. Pettigrew secretary.

NASHVILLE, TENN.—The Farmers' & Merchants' Telephone Company, of Frederick County, Va., has been incorporated by J. H. Funkhouser, P. H. Funkhouser and J. S. Haldeman.

CESTOS, TEX.—Articles of incorporation have been filed by E. C. Hoyt, J. W. Kerns and H. A. Seaton, composing the Independent Telephone Company, of this city. The company, having a capital of $25,000, will establish a telephone system here.

KNOXVILLE, TENN.—The Knoxville & Maryville Electric Railway Company has been incorporated by W. S. Nash, Robert Vestar, Joseph P. Gant, W. T. Parham, J. C. Sterchi, J. Burger and Haywood Garrick. The company is capitalized at $100,000,

BRENHAM, TEX.—The Brenham & Washington Telephone Company has been chartered here for the purpose of constructing a telephone line from Brenham to Washington. John M. Mathis, E. P. Curry and D. C. Giddings are the incorporators.

INWOOD, W. VA.—The Inwood Rural Telephone Company has been organized to construct a telephone system.

SHAMROCK, TEX.—J. E. Walker, Barnett Blossom and Rea Blossom have incorporated the Walker Telephone Company, having a capital of $10,000.

BLACKSVILLE, W. VA.—The Greene County Telephone Company has been incorporated to construct and operate telephone lines in Marion and Monongalia counties. The company is capitalized at $100,000 and is composed of Edward McSweeney, Thomas B. Lee, Edward Barrett and Edward T. Galway.

OSCEOLA, WIS.—The Osceola Farmers' Mutual Telephone Company has been organized. The capital stock is $25,000. John Getchel and S. A. Francis are among the directors.

LOYAL, WIS.—The York Center Telephone Company has filed articles of incorporation with a capital of $10,000. Among the incorporators are W. J. Rush and C. H. Brown.

New Industrial Companies.

THE J. W. SMITH ELECTRIC COMPANY, of Norfolk, Va., has filed articles of incorporation with a capital stock of $10,000. The company will engage in a general electrical construction business.

THE MENOMINEE ELECTRICAL MANUFACTURING COMPANY, of Menominee, Mich., is preparing plans for the erection of a new plant to be constructed of brick and stone. The new building will be 62 ft. by 335 ft.

THE GEORGIA MANUFACTURING & PUBLIC WORKS COMPANY has been organized at Marietta, Ga., to take charge of the Marietta Electric Company and other utilities. The new concern has a capital of $600,000.

THE W. J. BARR ELECTRIC COMPANY, Cleveland, Ohio, has filed articles of incorporation, with a capital stock of $200,000. W. J. Barr, J. W. Burrell, C. M. Little, D. P. Foster and William E. Patterson are the incorporators.

THE ELECTRIC CABLE COMPANY, Bridgeport, Conn., has filed its articles of incorporation with the Town Clerk, stating its capital stock to be $5,000. The new company will conduct a general electrical business. Edwin W. Moore is one of the incorporators.

THE NEW YORK-NEW ORLEANS ELECTRIC COMPANY, New Orleans, La., has been chartered with a capital of $1,000,000 to engage in a general electrical business. The officers are Maurice J. Hart, president; Hewes T. Gurley, vice-president, and Robert O. Randle, secretary and treasurer.

THE BROWN-SPEAR-SLOANE COMPANY, San Francisco, Cal., has been incorporated with a capital stock of $65,000, by F. L. Brown, L. E. Spear, C. F. Sloane, H. F. Wilson and Victor Enginger. The company succeeds to the business of the Charles F. Sloane Company and will handle a good line of electrical supplies.

THE AMERICAN AUTOMATIC TELEPHONE COMPANY, of Rochester, N. Y., has been incorporated for the purpose of manufacturing electrical and mechanical apparatus. The company has a capital of $1,500,000, and was incorporated by Joseph E. Webster, J. William Lattig, John Raines, Alvaro L. Thompson, Henry H. Stebbins, Jr., and George R. Raines.

Legal.

ECKERT BUSTS.—A verdict for $4,000 was awarded last week to Grant Wright, as assignee to Frederick E. Triebel, the sculptor, by a jury in Part I. of the Supreme Court, Brooklyn, N. Y., against Clendenin Eckert, president of the International Bank Note Company. The money was asked for the execution of two bronze busts of Gen. Thomas T. Eckert, father of the defendant, and formerly president of the Western Union Telegraph Company. It was urged by Mr. Eckert that a bust of his father was made by the sculptor for $600, and that he afterward made the two busts as a speculation. He denied having ordered them. Mr. Triebel testified that he had made the first bust for $600 on the promise of the defendant to get orders for him. Eckert failed to do so, he said, and Triebel demanded the full price for the busts. Several experts were called to testify to the value of the busts, among them Sculptor Niehaus and Wilson McDonald. The busts were exhibited in the court room.

A FRANCHISE ATTACKED.—Attorney General Mayer of New York State announced last week that he had received a petition from Abraham Sartorius, a citizen of New York City, to begin an action on behalf of the State to annul the corporate rights and franchises of the New York Electric Lines Company and for an annulment of its charter to do a general telephone business in this city. Mr. Sartorius gives three reasons for his petition. One is that the New York Electric Lines Company has suspended its ordinary and lawful business for more than one year; the second that the company has forfeited its privileges and franchises by a failure to exercise its powers; the third that the company did not begin the transaction of its business within two years of the date of incorporation. The franchise granted to the New York Electric Lines Company recently passed into the control of the Great Eastern Telephone Company, which has announced that it intends to use it to begin a general "independent" telephone business in this city.

Obituary.

MR. GEORGE H. THAYER, for thirty years superintendent of the Chicago and Northwestern Railway division of the Western Union Telegraph Company, died a few days ago at his residence in Norwood Park. Mr. Thayer was born at Weathersfield, Vt., on Jan. 8, 1843. He was connected with the Western Union Company forty-five years.

MR. C. H. HINES.—We report with deep regret the sudden death from fever at Puebla, Mexico, of Mr. C. H. Hines, who was on his way to New York suffering from the effects of tropical malaria and had stopped en route to consult a doctor. A biographical sketch was given in our issue of October 14. He was born in Buffalo, N. Y., March 6, 1865. While following the medical course in the New York Medical College, he became interested in electricity and in 1884 he entered as a student the works of the Daft Electric Company at Greenville, N. J., where, under the personal supervision of Mr. Leo Daft, he assisted in the first commercial railway work in this country, and in equipping the cars Volta, Ampere and Ben Franklin, the latter being used in the Daft pioneer experiments on the New York elevated. From 1886 to 1891 he was in the employ of Mr. Augustus Noll and the Edison Electric Illuminating Company of New York. In 1891 he went to Salvador, Central America, where he designed and erected steam and hydraulic alternating-current plants in two cities, these being among the first electric plants installed in those countries. In 1893 he installed the city plant at Tampico, Mexico, and also in the same year that at Newton, N. J. In 1896 he became superintendent of construction for the Andrews-Ryan Company of Boston, and installed two central exchanges, at Hampton, Va., and Haverhill, Mass. In 1898 and 1899 Mr. Hines was engaged in cable work at Santiago and Manila, and in 1901, while a constructing engineer for the General Electric Company in the foreign department, erected large plants at Charleston, S. C., and Banes, Cuba. In August, 1901, he was appointed superintendent of the electrical department of the Lorain Steel Company, remaining with that company until February, 1893, when he was appointed electrical engineer of the Canadian Pacific Railroad. While occupying this latter position he designed large plants at Montreal and Fort Williams, aggregating 10,000 horse-power, and had charge of the electrical work of 8,000 miles of railroad and two steamship lines. This position he resigned to accept employment by the Erie Railroad Company as consulting engineer and to prepare a report on equipping the Erie shops electrically. Upon the expiration of this duty Mr. Hines went to the United States of Colombia, where he reconstructed the Medelin electrical generating plant. While there he became interested in gold mining and upon his return to this country was sent back as superintendent of two large gold mining properties. Mr. Hines was an inventor in several departments of electrical engineering and has been granted patents among others on a brush holder, magazine arc lamp, reduction furnace, controller, brake, system of car ventilation and method of winding coils. He contributed a number of articles to the technical press, dealing principally with electric power distribution in shops. He was a member of the American Institute of Electrical Engineers and other societies. He leaves a widow and family. Unfortunately, Mr. Hines had no life insurance, and his illness had exhausted his savings so that the widow is left entirely destitute. Under these circumstances his friends may be glad to learn the address of Mrs. Josephine Hines, viz 179 Decatur Street, Brooklyn, N. Y., where she will be during the month.

Educational.

LECTURES AT STEVENS.—On Jan. 8 two special lectures were given to the senior class of the Stevens Institute of Technology, Hoboken, N. J. The subject of the first was "Patent Law," delivered by Mr. Wm. R. Baird. This is the first of three lectures to be given on this subject. It was full of information and will be of use to students of an inventive turn. The other lecture was given by Mr. J. W. Lieb, Jr., associate general manager of the New York Edison Company. The subject was "Generation and Distribution of Electricity in New York City." His "bird's eye view" of the conditions of electric lighting in New York City was very comprehensive, and the address was of great value to those who heard it.

LIBRARY OF TECHNOLOGY.—The International Text-Book Company, Scranton, Pa., has issued a 40-page descriptive catalogue dealing with its "Library of Technology," which has been prepared by the Faculty of the International Correspondence Schools, in conjunction with many of the best-known engineers of America. The books treat of all classes of engineering. The volumes on elementary electricity and magnetism, dynamo design, alternating currents and electric transmission, electric lighting, electric power stations and electric railways are exceedingly practical treatises on these subjects. It is stated that the material in each book has been gone over carefully by some practicing engineer familiar with the particular subject, so that possible inaccuracies and misstatements have been eliminated.

WORCESTER POLYTECHNIC INSTITUTE.—The Worcester Polytechnic Institute has just published its thirty-sixth annual catalogue, the information contained giving evidence of gratifying progress along the lines of technical education. In glancing over the list of alumni, one is particularly impressed by the very large proportion of the total number of graduates who are at present engaged in work for which they were fitted by their Institute courses. By far the greater number of these men are engaged either in actual engineering or very closely allied work. The catalogue shows a total registration of 388 against 324 last year and 272 two years ago. A corresponding increase is noted in the number of candidates for the advanced degrees of Master of Science and Doctor of Science and the professional degrees of Mechanical, Civil, Electrical and Chemical Engineer. The addition of courses in electrical engineering having to do especially with electric railway and power plant engineering is also noted, these courses being under the direction of Professor A. S. Richey, the only addition to the faculty, whose title is Assistant Professor of Electric Railway Engineering.

Personal.

ROSSITER, MACGOVERN & CO., of New York, have announced their entrance into the engineering and contracting field as engineers and contractors for all classes of work, with steam and electric railways and electric power plants as specialties. Mr. J. C. Brackenridge, president of the company, is well known in the traction field through his connection with the Brooklyn Rapid Transit Company, first as chief engineer and later as general manager. His association with the Brooklyn Rapid Transit Company extended over a period of ten years, during which all of the more recent power stations of the company were built, the greater part of the elevated railway system electrified and the operation of the cars extended over the present Brooklyn Bridge, all of which was accomplished under his immediate supervision. Mr. Brackenridge resigned from the Brooklyn Rapid Transit Company two years ago to accept the position of Commissioner of Public Works, of Brooklyn, which office he occupied until the first of the current year. Mr. Frank MacGovern, under whose direction the present success of the company has been attained, will continue as vice-president and general manager and Mr. James R. Floyd, Jr., as treasurer. Mr. Clinton L. Rossiter, who was formerly president, has resigned from that office but remains a member of the executive committee and is still actively connected with the company.

MR. J. C. BRACKENRIDGE.

MR. FRANK MACGOVERN.

DR. H. B. ROCKWELL has resigned as general superintendent of the Mobile Light & Railroad Company, of Mobile, Ala.

PROF. F. B. CROCKER, of Columbia University, has made a trip to Cuba this winter for recreation, and has just returned from Havana.

MR. F. D. WHARTON, lately with the Wilkesbarre, Pa., Gas & Electric Company, has been appointed as superintendent of the Dauphin County, Pa., Gas Company.

MR. A. M. MATTICE has resigned from the Allis-Chalmers Co. and is removing from Milwaukee to New York, where he will take up important engineering work.

MR. JOHN MESSLER, who was formerly with the Quincy, Ill., Gas, Electric & Heating Company, has joined the firm of Miller & Butler, electrical engineers and supply dealers, in that city.

MR. F. SARGENT, the consulting electrical and mechanical engineer of Chicago, sailed last week for England, accompanied by his wife. He will spend some little time on the other side.

MR. ALLEN RIPLEY FOOTE, for lack of support, has been compelled to suspend the issuance of his week paper, "Public Policy," which aimed to establish better relations between corporations, the public and labor.

MR. J. J. GORMAN has resigned as an officer of the Manhattan Electrical Supply Company, New York. We are informed that he still retains his interests in the company, but will no longer be actively engaged in conducting the business.

MR. EDWARD TAYLOR, formerly engineer of tests of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., has become sales agent for the H. W. Johns-Manville Company, of New York, for Milwaukee and the surrounding territory.

MR. WILLIAM S. EARLE, for the past four years connected with the office of the City Engineer, of Worcester, Mass., has resigned to accept a position under Mr. Frederick A. Huntress, general manager of the Rio Janeiro Street Railway & Power Company.

MR. C. E MITCHELL, who has held the position of assistant to the president of the Western Electric Co., Chicago, for sometime past, is resigning to accept the position of assistant to Mr. Oakley Thorne, president of the Trust Company of America, New York.

MR. WALTER C. KERR, the well-known president of Westinghouse, Church, Kerr & Co., is the subject of an illustrated biographical sketch in the *Sibley Journal of Engineering* for December, just issued. Mr. Kerr is one of the trustees of Cornell University, from which he graduated in the class of 1879, becoming instructor and assistant professor.

MR. HERBERT E. RYDER, for the past 16 years connected with the Marlboro, Mass., Electric Company, has been promoted from chief electrician to superintendent. He began as a lamp trimmer and has worked his way up steadily through all the grades. He is popular with the public. The service of the company will now be put on a 24-hour basis.

MR. H. E. GAWTRY, for so many years president of the Consolidated Gas Company, of New York City, which operates also the electric lighting systems, has gone to Southern France and Egypt in search of health this winter. It will be remembered that he resigned the presidency some months ago, but assumed the chairmanship of the executive committee.

MR. JOHN A. BRITTON, who has been the active manager of the California Gas & Electric Corporation, with the title of vice-president and general manager, was elected to the presidency of the San Francisco Gas & Electric Company upon the recent reorganization of that corporation. Mr. Britton is also to become president of the Pacific Gas & Electric Company.

MR. H. H. SUPLEE.—In the current January-March *Forum*, Mr. Henry Harrison Suplee's record of "Applied Science" gives numerous specific examples tending to show that a characteristic feature of modern engineering is the extent to which material means are modified to suit the desired ends instead of the reverse procedure, which used to be the case.

MR. HARRY M. BEARDSLEY, secretary and treasurer of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., has been appointed receiver of the Elmira & Seneca Lake Railroad Company in place of D. A. Hegarty, of New York City. The line will be operated by the Elmira Traction Company, and Mr. Beardsley, who has had a large share in the negotiations which have been on for sometime, is well qualified by virtue of his intimate acquaintance with the affairs of the line to administer the receivership.

MR. IRVING MOULTROUP, of the Boston Edison Company, representing the steam turbine committee of the National Electric Light Association, has sailed to Europe to investigate turbines. It is the intention of the committee this year to report on the progress of the steam turbine here and abroad, also to include in its work an investigation of gas turbines.

MR. HENRY T. SCOTT.—It is announced from San Francisco that Mr. Henry T. Scott has been elected president of the Pacific States' Telephone & Telegraph Company at a salary of $25,000 a year. Since the death of John I. Sabin there has been no president of the corporation. Mr. Scott was formerly president of the Union Iron Works, which built the famous battleship "Oregon."

MR. BENSON BIDWELL, whose name became well known in the early trolley days, has been advertising in the St. Louis papers the chances of an everlasting fortune in his "cold motor" and his "water electric generator." The stock is offered at a generous reduction, and the returns are to be illimitable. The devices are not explained, but are set forth on a background of non-luminous rhetoric.

MR. A. P. SEYMOUR.—We learn that owing to ill health, Mr. A. P. Seymour, vice-president and treasurer of Pass & Seymour, Inc., Solvay, N. Y., has retired from business and will hereafter make his home in Southern California. Mr. Seymour's stock has been acquired by the interests that have been identified with the company since its inception 15 years ago. The company has indeed done splendid work in raising the standard of porcelain insulation for electricity and the departure of Mr. Seymour from the field of active work will be deeply regretted by many old friends.

Mr. P. N. NUNN, so well known in connection with power transmission enterprises in the west and more lately in connection with work at Niagara, has just issued a handsome pamphlet entitled "Tne Development of the Ontario Power Company." It is large octavo, well illustrated and gives an excellent description of the engineering features of the plant, as well as of the reasons for adopting certain types of apparatus. Mr. Nann, who is deserving of great credit for his share in this undertaking, is careful to name several of the engineers associated with him, viz., Messrs. O. B. Suhr, V. G. Converse, C. H. Mitchell, J. H. Bailey and J. R. Harsch.

MR JOHN LORENZ, who has for the past three years been the general manager of the combined railway, light and gas properties of the Jackson Electric Railway, Light & Power Company at Jackson, Miss., is retiring from the management of the said property to become president of the Jackson, Clinton & Western Traction Company which company proposes to build an interurban line from Jackson, Miss., to Clinton, Miss., a distance of 10 miles. The line is to be built on private right of way, and will carry express and baggage. Mr. Lorenz has had the active control and management of this class of properties for 16 years and has proven himself a very competent manager and organizer.

MR. B. E. SUNNY, manager of the Chicago district for the General Electric Company, has been taking a prominent part in practical philanthropic movements for several years past and was honored last week by appointment to a place on the board of trustees of the State Hospital for the Insane at Kankakee, Ill. This is the beginning of a movement by Governor Dineen of Illinois to place the management of Illinois state institutions on a non-partisan basis and appoint men of business standing and qualifications to these places. Mr. Sunny's appointment is therefore gratifying both to his immediate friends and to the advocates of good government the state over.

MR. JOHN LUNDIE, the well known and highly respected electrical engineer, has been made the subject of attack by Secretary of War Taft, because of statements made on the Panama Canal by Mr. P. Bigelow in *The Independent*. The drift of the attack on Mr. Lundie's reputation may be inferred from the following passage: "Just as Mr. Wallace left the Isthmus he appointed this same Mr. John Lundie as consulting engineer, at a salary of $500 per month, to make a report of oils and fuels on the Isthmus, subject to the approval of the chairman of the Commission. Mr. Wallace's action was disapproved by Mr. Shonts, and Mr. Lundie was not appointed. The writer's willingness to draw his facts from such a fountain of manifest malice, injured vanity, and disappointed ambition, completely refutes his good faith in asserting his wish to find and state the truth."

HON. C. D. WRIGHT.—Hon Carroll D. Wright, former head of the Department of Labor, has been decorated with the Order of SS. Maurizio e Lazzaro, conferred upon him by the King of Italy in recognition of his work as a political economist. The presentation was made by Count Aldrovandi, the Italian Vice Consul. The order of S. Maurizio is among the oldest orders of chivalry in Europe. It was founded in 1434 by Amedeus VIII, restored in 1532 by Emanuel Filibert, and afterward consolidated with the Order of S. Lazzaro, which is so ancient there is no record of its foundation. The decoration carries with it the right to wear the uniform of the order. Under the Court regulation, the Chevaliers of the order are classified with the Chevaliers of any other order as to their precedence at Court functions. The decoration itself is a large Maltese cross in white enamel and gold, with a wreath of laurel in the centre.

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Trade Publications.

THE WORCESTER ELECTRIC MFG. CO. has sent out a very handsome calendar for 1906, and incidentally calls attention to its line of knife switches, switchboards and panel boards.

ALTERNATORS.—The Allis-Chalmers Company, Cincinnati, Ohio, has issued bulletin No. 1048, giving a well-prepared description of Bullock alternating-current generators of both the engine and fly-wheel types.

MOTOR DRIVE.—Circular No. 18 of the Electro-Dynamic Company, Bayonne, N. J., illustrates some interesting motor drives in which the "inter-pole" motor shows its advantageous variable-speed, non-sparking characteristics.

GLOBE VALVES.—A bulletin recently received from Jenkins Bros., 71 John St., New York, gives an illustrated description and an itemized price list of extra heavy brass and iron Globe valves for pressures in excess of 150 pounds per square inch

ENGINE-STOPS.—The Consolidated Engine-Stop Company, 100 Broadway, N. Y., has issued an attractive circular on the Monarch engine-stop and speed-limit system which serves to call attention to the fact that the Monarch system insures against death, accident, bursting fly-wheels, monetary losses, etc.

TELEPHONES.—The Kellogg Switchboard and Supply Company, Chicago, Ill., has issued a neat little calendar, in connection with which it calls attention to the fact that it manufactures telephones of every description for either magneto or common battery systems, a few of which are illustrated in the pamphlet containing the calendar.

ELECTRIC FLASHLIGHT NOVELTIES.—A well-illustrated, 48 page catalogue recently received from Stanley & Patterson, 40 Cortlandt St., New York, is devoted to "Matchless" electric flashlight novelties, including pocket lamps, electric candles, illuminated clock dials, gas lighters and surgeons' and photographers' electric lighting outfits.

FUSIBLE HANGER BOARDS.—Bulletin No. 28 of the H. T. Paiste Company, Philadelphia, Pa., deals with a new line of fusible hanger boards for multiple arc lamps, which comprise the necessary types for three distinct styles of wiring, namely, cleat, concealed and molding. Brief descriptions are also given of panelette and taplets and similar wiring specialties.

ELECTRIC HOISTING MACHINERY.—Bulletin No. 62, recently issued by the Crocker-Wheeler Company, Ampere, N. J., contains what can be characterized as a well-prepared and adequately illustrated article on electric hoisting machinery. The illustrations show the application of Crocker-Wheeler motors to all kinds of hoisting machines as built by several manufacturers.

LIGHTING SUPPLIES.- Supply catalogue No. 7,504, of the General Electric Company, Schenectady, N. Y., gives a price-list of parts of edgewise wound, parallel-rod, 220-volt direct-current enclosed arc lamps, forms 5 and 1, without cut-out or cut-out resistance Flyer No. 2,169 of the same company deals with double push-button flush pocket switches, while flyer No. 2,170 treats of "Competition" knife switches.

INSULATED WIRES.—The Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., has issued a booklet devoted to "Paranite" and "Peerless" rubber-covered wires and cables. The booklet contains a photographic reproduction of the National Electrical Code and numerous tables of weights and measurements and useful information regarding metals, wiring tables, etc.

TELEPHONE EXCHANGES.—Bulletin No. 14 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is a handsome loose-leaf catalogue dealing with private branch telephone exchanges. The bulletin is of practical value to the experienced telephone man, containing information concerning every detail which enters into the construction of these exchanges. The bulletin contains 42 pages and is illustrated throughout.

INDUCTION MOTORS.—Circular No. 200 of the Commercial Electric Company, Indianapolis, Ind., gives a brief description of a line of motors which this company is now placing on the market. It is stated that advantage has been taken of the experience of the various European manufacturers by retaining the services of the eminent engineer, Mr. H. M. Hobart, of London, who has for years been engaged in designing corresponding machines for various continental factories.

SPRINGS—The Wallace Barnes Co., Bristol, Conn., manufacturer of small springs of every description, in an artistically-designed and executed pamphlet shews illustrations of a great variety of springs manufactured by this concern. The cuts, which are displayed in an artistic manner in the margins of the pages, present views of springs of many forms, including the extension and compression varieties, motor springs, automobile-engine springs, etc. The company also makes a wide variety of hardened and tempered washers.

A BRITISH CALENDAR.—The business enterprise of our English cousins in the field of advertising is indicated by the New Year's tokens which have recently found their way to this side of the Atlantic. Prominent among these is the elaborate blotting pad of the Electrical Power Storage Company, Ltd., 4 Great Winchester St., London, E. C., which holds a desk blotter flanked by a most useful scribbling diary containing space for every day in the year, interleaved throughout with blotting paper, and surmounted by 12 strips containing the days of each month in bold type, fastened at the ends by brass clamps, and easily detachable.

THE CLEVELAND RUBBER WORKS, of the Mechanical Rubber Co., at Cleveland, O., issues a very neat folder showing the seven sizes of its soft rubber rings for protecting the bases of sign and display lamps exposed to the weather. Every incandescent electric sign and display lamp thus exposed to the weather should be protected at the base in this manner. When lamps are so equipped, there is not much likelihood of short circuits, which means less possibility of fires and longer life for the lamps. The expense of using the rings amounts to practically nothing, when the service rendered is considered. There are seven sizes of "Cleveland" rings being made for the purpose, which permits of their use on every style of lamp.

FANS, BLOWERS AND EXHAUSTERS for heating and ventilating, mechanical draft and other purposes are described in a booklet issued by the Green Fuel Economizer Co., of Matteawan, N. Y. This company has for many years installed fans and exhausters for mechanical draft in connection with the Green fuel economizer and has long been aware that important improvements could be introduced in air moving apparatus. The Green Fuel Economizer Company does not contract for the engineering of plants, nor for the installation of heating and ventilating plants in competition with the heating and ventilating contractors. It has recently added large shops to its plant at Matteawan to handle this branch of the business.

RAIL BONDS.—The John A. Roebling's Sons Company, Trenton, N. J., has issued a neat catalogue dealing with soldered rail bonds. The bond of this type is made of a flat strip of copper wound to the required dimensions and shaped in a press. The strip is tinned to prevent corrosion, and the method of manufacture produces a one-piece bond of great flexibility. The solder pocket is a distinct feature of the Roebling bond. A socket is formed on the face of the bond, about one sixty fourth inch deep and somewhat smaller than the part of the bond in contact with the rail. The solder is run into the pocket by heating the bond to the proper temperature, and it consequently "sweats" to the surface.

QUEEN & CO., 1010 Chestnut Street, Philadelphia, have issued a new catalogue 1105, describing their electrical testing instruments and other scientific apparatus. The line is most complete and the Queen shops and laboratories in Philadelphia have now been concentrated in one building to the immediate proximity of which they have recently moved their wholesale departments, so that they are better prepared than ever to handle orders with promptness and precision. Further information than the catalogue supplies, as to any of the instruments, will be furnished on request. The Queen Company are constantly designing and producing new apparatus, and invites correspondence as to any such appliances in the scientific instrument line.

THE WHEELS OF VICTORY. As specially commemorative of the victory which the Abner Doble Company, of San Francisco, won at the Louisiana Purchase Exposition, it is presenting to its friends an allegorical design in photogravure typifying "Victory." This is a photographic reproduction from a bronze by M. Debut, the original of which is in the private office of Mr. William A. Doble, president of the Abner Doble Company. The water wheel upon which "Victory" is riding is a photograph, reproduced to the correct scale, of the runner of the company's wheel exhibited at St. Louis. Appreciating the fact that the photogravure has some artistic merit and realizing that a few friends may desire to have it framed or suitably mounted, the company has refrained from placing printing of any description on the face of the card.

GENERAL CONTRACTING.—An illustrated bulletin recently received from Frank B. Gilbreth, 34 W. Twenty-sixth St., New York, gives an outline of the principles underlying the "cost-plus-a-fixed-sum" contract, and shows numerous views of contracts already completed. Seventeen illustrations are given of a complete manufacturing town recently built at Spragues Falls, Maine, for the St. Croix Paper Company. The contract included all work necessary to turn a dense forest into a manufacturing town, and to harness the falls to furnish power for lamps and motors for the factories and other buildings. The work included railways and macadamized streets, cottages, private residences, boarding houses, hotels, blocks of stores, machine shops, store houses, railway freight terminals, pulp and paper mills, 2,000-ft. concrete dam, steam, water and electric power plants, etc. The entire town was built in eight months.

REFRIGERATING MACHINERY.—An unusually attractive little mailing card combining the artistic and the practical has just been published by the De La Vergne Machine Company, of New York. The card contains a three page table of properties of saturated ammonia gas by Prof. De V. Wood, extended by G. Davidson.. The first page bears a half-tone cut of one of the company's standard horizontal refrigerating machines and a line cut of a series of bars the length of which represents the gross tonnage of refrigerating and ice-making machines of the 43 largest builders. The company does not indicate the names of the machines represented by the respective bars with the single exception of the De La Vergne. We understand the cards are for general distribution, so that any one interested in same can obtain a copy of these useful tables upon addressing the De La Vergne Machine Company, foot of East 138th Street, New York City.

News of the Trade

STORE AT LYNN, MASS.—Mr. George C. Smith has taken the Sheehan store, near the monument, and will now carry there a full line of electrical supplies.

M. B. FOSTER ELECTRIC COMPANY, New York City, has been awarded the contract for the outside lighting system at the Central Islip State Hospital, for which bids were opened November 1.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has secured the contract for 30,000 hp of hydraulic machinery to be placed in the first of the nine hydro-electric plants to be built on Catawba River, N. C., for the Southern Power Company.

WESTINGHOUSE IN OHIO.—The increasing business of the Westinghouse Electric & Mfg. Company in the territory covered by its Columbus, Ohio, office has necessitated its moving into larger quarters. After January 15 it will be located in Room 923 Columbus Savings and Trust Building.

THE WAGNER ELECTRIC COMPANY, St. Louis, Mo., at a recent meeting elected Thomas H. West, president of the St. Louis Union Trust Company, a director. He succeeds S. B. Pike, who has removed to Portland, Ore. The directors re-elected are: James Campbell, S. M. Dodd, J. C. Van Blarcom, James W. Bell, Albert Blair and W. A. Layman.

THE BRILLIANT ELECTRIC COMPANY, Cleveland, Ohio, has made arrangements with E. B. Latham Company to represent it exclusively on both types of "Brilliant" lamps in New York City and the vicinity. The sale of these lamps is increasing rapidly and the manufacturer is making arrangements for representative agencies in most of the large cities in this country.

THE NATIONAL ACME MANUFACTURING COMPANY, Cleveland, O., to serve its constantly increasing trade in the Middle and Northwestern States more satisfactorily, has decided to open a warehouse in Chicago at an early date, where a complete stock of set and cap screws and kindred goods will be carried. Exact location will be announced later.

WESTERN ELECTRIC COMPANY, of Chicago, is establishing a branch supply house in Indianapolis, Ind., having recently acquired ownership of the supply department of the Central Union Telephone Company. It has effected a lease of the large building on West Maryland Street, heretofore occupied by the Central Union Telephone Company, where it will carry an extensive stock of electrical supplies.

THE VIADUCT MANUFACTURING COMPANY is pushing its pocket telephone, patented Sept. 19, 1905, as a very convenient outfit for suburban railroads, firemen, line inspectors, and others. This company is also making a new fire alarm box, of recent invention, consisting of a combination watchman's and fire alarm outfit for street purposes or for large establishments. It continues to make district messenger call boxes, and its telephones are known favorably all over the country.

WICKES BROS.—In addition to the general machinery business, heretofore conducted by Wickes Bros., the electrical field will be more actively entered into. They offer for prompt delivery alternating and direct-current machinery of every description suitable for central station work for complete installations. In addition to the offices in New York City, this firm has offices in Boston, Philadelphia, Pittsburg, Chicago and Saginaw.

THE M. B. WHEELER ELECTRIC COMPANY, Grand Rapids, Mich., has secured the contract for the electrical equipment of the Michigan

Plaster Company's plant at Grandville. The installation consists of a 100-hp generator and six large motors, together with the necessary switchboard for controlling the circuits operated by these machines. The work will cost $3,000. The company has also secured the contract for installing an electric plant for the Hackley-Phelps-Bonnell Company, of Hackley, Wis. This will consist of a 15-kw generator, engine and switchboard, and the wiring for 200 incandescent lamps.

NEW YORK TELEPHONE COMPANY, 15 Dey Street, reports an enormous growth of business in 1905, with a net gain of 51,491 stations in the five boroughs, giving a grand total on January 1, 1906, of 242,155 stations in service or under contract. The prospective growth for this year is 75,000 stations, two-thirds of which will be in Manhattan. Last year saw an increase of 35,000 in Manhattan and the Bronx. The opening of the subway also had a marked effect on building operations in the northern part of Manhattan and in the Bronx, and accordingly a large number of apartment houses were planned for and built, most of which provided for a complete system of telephones operated through the popular private branch exchange system—each room being equipped with a telephone. More than 500 apartment houses now have private branch exchange systems providing for over 15,000 telephones. Every hotel in Manhattan of any prominence has a private branch exchange system with a telephone in each room and adequate booths in convenient places for the use of the telephone by the public. More than 160 hotels are thus equipped, containing over 22,000 telephones. During the year four new exchanges were added in Manhattan and a 15-story building represents the new requirements of the general staff at headquarters on Dey and Cortlandt Streets.

ELECTRIC ESCALATORS.—The result of the tabulation of a careful count made at Macy's department store in New York of the handling of customers by elevators and escalators during the recent holiday season adduces some interesting conclusions. During the month of December, up to and including December 24, the escalator at Macy's took on an average, more people away from the first floor than all of the elevators in the entire building and it has always carried many more passengers than the eight elevators which are in its close proximity. When it is considered that the elevators occupy, in the case of the Macy store, for example, 25 times the aisle space and many times the floor space and that the escalator is located in only one spot of the large area while the elevators are distributed on three sides of the store, the tremendous benefit of the escalator to business is obvious. A most noteworthy feature of the handling of the holiday crowd at the great new "Boston Store" in Chicago was the absence of congestion and confusion because the ascending and descending crowds were marshalled by the escalators and never allowed to come into conflict. The escalator is manufactured by the Otis Elevator Company.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., reports that it is turning out steam turbines as rapidly as its present shop facilities will permit, and the huge extensions to its already enormous plant at West Allis have been dictated largely by the necessity of providing more room for this branch of manufacture. Meanwhile orders for reciprocating engines have not ceased to pour in, and the capacity of the company's works is being taxed to the utmost to keep up with the demand for its standard Corliss types. Most of the sales at present, both of turbines and reciprocating engines, include orders for Allis-Chalmers "Bullock" generators to be direct connected to them. The electrical apparatus is now built at the company's works in Cincinnati, but when the new West Allis shops are finished complete power units of all kinds will be constructed there. An interesting equipment was recently shipped from the West Allis, Milwaukee, works of the company, as evidenced by a photograph which has just been received. On a string of flat cars there were loaded the bodies of two steam turbines, each of them occupying not more than one-half the floor space of its car, yet these machines represented in their combined capacity the delivery, under normal conditions, of nearly 5,000 horse-power.

NEW YORK CENTRAL, besides adopting electric locomotion, is modernizing in other respects. The creation of a general advertising department for all the New York Central Lines, and the placing in charge of that department the veteran railroad advertiser, George H. Daniels, who has been for nearly twenty years the General Passenger Agent of the New York Central Railroad, marks an era in the history of advertising in America. The New York Central Lines are the first great system to create an advertising department which covers all the railways in their system, and the far-reaching consequences of such a movement cannot be appreciated at first sight, but this action on the part of the management of these lines emphasizes the value of advertising generally, and forces the conclusion of a strong belief in the efficacy of railroad advertising in particular. Some idea of the importance of this new department can be had when it is understood that it will control the general advertising in America and in foreign countries of the New York Central, Boston and Albany, Lake Shore and Michigan Southern, Michigan Central, Cleveland, Cincinnati, Chicago and St. Louis, Rutland, and Lake Erie and Western railways and their leased lines, having their western terminals at Chicago, St. Louis and Cincinnati and their eastern terminals at New York, Boston and Montreal, and embracing more than twelve thousand miles of the best equipped railways in the world. In this connection it may be mentioned that a banquet to Mr. Daniels by a number of his friends, emphasizing this event, is to be given at the Waldorf-Astoria in February.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JAN. 9, 1906.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N.Y.]

809,300. SWITCH PLUG WITH ELECTRICAL FUSE; Alexander Hepke and Kurt Diener, Berlin, Germany. App. filed July 20, 1904. A plurality of fuses are rigidly fixed in the plug and electrically connected at one end with one contact. A movable member connects each of the other ends with the other contact, so that when one fuse blows, the circuit may be established through another fuse by turning a disk.

809,301. ELECTRIC MULTIPLE-FUSE PLUG; Alexander Hepke and Kurt Diener, Berlin, Germany. App. filed July 20, 104. The several fuses in the plug are arranged to be used one after the other. The formation of the contacts is controlled from the outside and the cutting in of a new fuse can only be effected when the plug is out of the circuit, the switching ring being then turned to engage the next fuse.

809,302. TRANSFORMER CUT OUT; John P. Heatherington, Logansport, Ind. App. filed Jan. 27, 1905. A system of transformer regulation where a plurality of transformers are employed for varying loads. A magnet-operated switch cuts in or out the various transformers, depending on the amount of the load.

809,305. ELECTRICAL PIANO PLAYER; Pannell B. Kehoe, Flemingsburg, Ky. App. filed Apr. 27, 1905. The piano keys are operated by magnets having sectional windings different numbers of which are energized for each note, depending on the strength required for the particular composition played.

809,309. ELECTROPLATING APPARATUS; Arthur W. L'Hommedieu, Chicago, Ill. App. filed April 22, 1905. Details of construction of a revolving barrel for plating small articles in quantity, with anodes near the surface of the barrel and resident cathodes near the axle. A perforated receptacle of non-conducting material prevents the articles to be plated from making contact with the anode.

809,311. FIREPROOF WIRE; Amanda M. Lougee, Boston, Mass. App. filed Nov. 5, 1903. An armor conduit containing a conductor covered with an insulating, fireproof, moisture-proof compound and capable of internal and external use in all positions heretofore requiring the usual lead or iron pipe in which the insulated wire is inserted.

809,312. PROCESS OF MAKING FIREPROOF CONDUCTORS; Amanda M. Lougee, Boston, Mass. App. filed May 23, 1904. The wire is first coated with an insulating compound and surrounded with a fireproof jacket about which is a plastic layer of fireproof and vulcanizable ingredients, in the outer surface of which is embedded a wire covering having a coating of special materials which form a part of the covering. A second or third covering of wire and coating are then applied and the whole vulcanized and rendered as nearly integral and homogeneous as possible.

809,313. PROTECTED CONDUCTOR; Amanda M. Lougee, Boston, Mass. App. filed May 23, 1904. The conductor is enveloped in a vulcanizable compound over which is tightly woven a wire jacket having a vulcanizable fireproofing and insulating compound incorporated with it and penerating the meshes. The whole is covered by a thick external coating of permanently flexible compound containing ingredients to render it moisture, electrolysis and fireproof, and vulcanized together as a one piece article.

809,394. ELECTRICALLY OPERATED PORTABLE DRILL; Adolph Pedersen, Cleveland, O.. App. filed Sept. 19, 1904. Details of the driving mechanism, employing a motor having its armature supported in ball bearings in alignment with the drill axis, and having a plurality of back gears to properly reduce the speed.

809,433. ROTARY ELECTRIC SWITCH; John Dugdill, Failsworth, Manchester, England. Mar. 15, 1905. Adapted to hanging incandescent lamps. The lamp cord depends from a spring drum and the switch blades are so related to said drum as to be closed when the cord is pulled down, and opened when it is released to be drawn upward.

809,460. MOTOR CONTROLLER; Adolph Pedersen, Cleveland, O. App. filed May 26, 1905. A cut-out magnet is applied to one of the pole pieces of the motor of an electric drill, and mounted in a special way on the flux, corresponding to abnormal current.

809,492. PROCESS OF ELECTROLYTIC PRODUCTION OF LUSTROUS METALLIC COATINGS UPON METALS; Alexander Classen, Aachen, Germany. App. filed Sept. 28, 1905. Lustrous metallic coating are produced directly by electrolysis, by adding one or more glucosides to an ordinary electroplating bath.

809,515. ELECTRICAL RAILWAY SIGNALING SYSTEM; Milton H. Loudon, Kansas City, Mo. App. filed June 29, 1905. The railroad is equipped with a special trolley in circuit with signal devices on all the trains. The section between trains forms one arm of a Wheatstone bridge, the varying resistance of which is effective to first display a lamp, and finally set the brakes within the locomotive cabs.

809,529. ELECTRIC LAUNDRY IRON; Earl H. Richardson, Ontario, Cal. App. filed Apr. 25, 1905. The laundry iron has a pair of cores therein each of which extend from the point to a rear end or corner. The cores are wound with resistance wires throughout their lengths, the purpose being to secure a uniform distribution of the heat.

809,595. BELL PUSH, PULL, ETC.; Lawrence S. Wilks, Whipps Cross, England. App. filed May 1, 1905. A push botton is made of glass and is located at the end of a projecting knob through which the light passes from the interior of the building and illuminates the push button so that its location may be readily discerned.

809,630. TROLLEY ATTACHMENT; Edward D Rockwell, Bristol, Conn. App. filed May 17, 1905. In order to avoid crippling a car by the breakage of its trolley wheel, the patentee aims to provide each car with a fork attachment which can be inserted into the place of the broken wheel and serve sufficiently well to carry the car to the repair barn.

809,643. MEANS FOR CONTROLLING MERCURY VAPOR ELECTRIC LAMPS; Percy H. Thomas, East Orange, N. J. App. filed Apr. 23, 1904. An electric lamp and an iron wire in a hydrogen atmosphere are included in series with the vapor lamp so as to give a high starting resistance, and a steadying resistance during the operation of the lamp.

809,647. ELECTRIC CELL; Kumajiro Tsukamoto, Tokyo, Japan. App. filed Jan. 14, 1904. A primary cell with a cylindrical zinc casing and a hollow carbon tube, covered with blotting paper and filled with a mixture of graphite, manganese dioxide, potassium chloride, potassium permanganate and ammonium chloride. The space between carbon tube and zinc casing is filled with a mixture of ammonium chloride, potassium chloride, gypsum, mercuric sulphate, and dextrine.

809,677. STARTING COMPENSATOR FOR ALTERNATING-CURRENT MOTORS; Edward F. Gehrkens, Schenectady, N. Y. App. filed June

24, 1904. A switch is provided for use in connection with an auto-transformer and circuit fuses, so that in starting the motor the auto-transformer will be in circuit and the fuses cut out, but in the running position the auto-transformer is cut out and the fuses are in circuit.

809,693. MECHANICAL MOVEMENT; Gray W. Johnston, New York, N. Y. App. filed March 27, 1905. The switch is adapted to close different circuits alternately upon the energization of a magnet, periodically energized from any suitable source. The switch is applicable, among other uses, to the operating of a track switch in which it is necessary to move the switch point alternately by successive currents from the same trolley circuit. Construction embodies a link depending from the solenoid core and working in a V-shaped cam groove upon the switch arm.

809,700. THERMOSTATIC SWITCH FOR INCANDESCENT ELECTRIC LAMPS; John V. Kimmey, Jr., New Haven, Conn. App. filed April 1, 1905. One side of the circuit is completed through a bowed plate of metal rigidly fixed at both ends and having wound around it material offering resistance to the passage of current. Electrical contact is made between the center of the bow and a pin connected in the lamp circuit. The expansion of the bowed plate, owing to the passage of current, breaks the contact, which is again made when the metal contracts, giving the light a twinkling effect.

809,706. ELECTRIC ALTERNATING-CURRENT MACHINE; Karl Arvid Lindstrom, Vesteras, Sweden. App. filed June 29, 1905. The windings are so placed mechanically on the armature that the harmonics generated in the sine wave of e.m.f. under one pole are displaced practically half a period in relation to the corresponding harmonics generated at the other pole, so that they neutralize each other.

809,707. PNEUMATIC TRAIN CONTROL SYSTEM; John B. Linn, Schenectady, N. Y. App. filed Oct. 16, 1902. A spring-pressed piston is moved varying distances within each car by the train pipe pressure which serves to successively uncover ports in the side walls which lead to the successive pneumatically operated contactors.

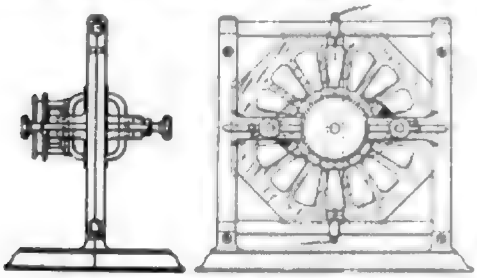
809,728. ELECTRICAL HEATING SYSTEM; Arthur D. Newton, Hartford, Conn. App. filed July 9, 1904. The heaters are included in a circuit which is automatically opened by a cut-out magnet in case an unusually heavy load is imposed upon the motors.

809,742. STORAGE-BATTERY PLATE; David P. Perry, Chicago, Ill. App. filed June 8, 1903. The grid consists of three flat superimposed lead plates, perforated and cut in a certain way so as to form pockets for the active material.

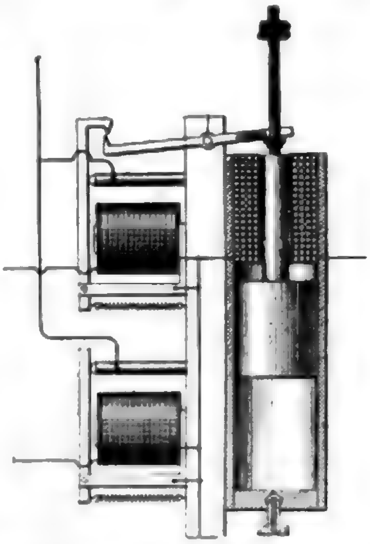
809,743. CROSS-ARM FOR CARRYING HIGH-TENSION WIRES; Evan E. P. Petery, Indianapolis, Ind. App. filed Aug. 19, 1904. The cross arm is of the usual shape, but made of glass and integral with the insulators so as to give greater insulation.

809,747. HANGER OR EAR FOR OVERHEAD ELECTRIC TROLLEY WIRES; Abraham Richardson and Thomas S. Jones, Blackpool, England. App. filed Feb. 6, 1905. The hanger has two halves which clamp the wire and are held together by an engaging ferrule or cup, depending from the guy-wire support.

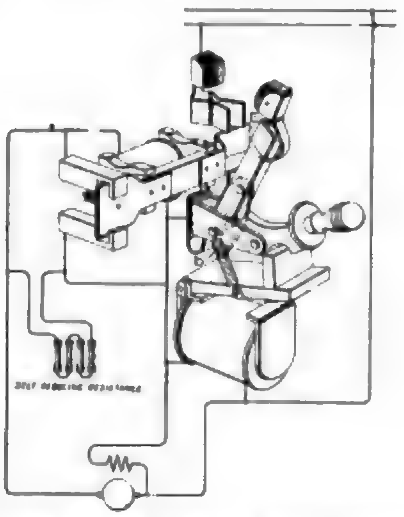
809,761. ELECTROSTATIC INFLUENCE MACHINE; Elihu Thomson, Swampscott, Mass. App. filed June 23, 1904. Mechanical features of construction of electrostatic machine having Wimshurst sectors. The two stationary plates are octagonal and are held by a two part enclosing frame secured together by screws.



809,761.—Electrostatic Influence Machine.



809,794.—Railroad system.



809,878.—Starting Device for Electric Motors.

809,762. TELAUTOGRAPHIC AND OTHER ELECTRIC CIRCUITS; George S. Tiffany, New York, N. Y. App. filed Apr. 22, 1901. A complete telautograph system in which alternating currents are used, but which are obtained from a direct-currrent source. The purpose is to secure reversals in the movement of the stylus by reversing currents, at the same time utilizing the ordinary current mains for obtaining the power.

809,770. ASYMMETRIC CELL; Max Büttner, Wilmersdorf-Berlin, Germany. App. filed Aug. 4, 1904. An aluminium electrode is used as electrolytic valve with an electrolyte, consisting of a solution of caustic ammonia and boric acid.

809,774. SYSTEM OF CONTROL; Frank E. Case, Schenectady, N. Y. App. filed June 12, 1905. A feature of a special pneumatic train control system by which a circuit breaker in the motor circuit is opened upon the exhaustion of the pneumatic system when the motor circuit remains energized, but not when the motor circuit is de-energized. The idea is to have the circuit breaker tripped in case of overload, but not with the usual movements of the controller arm. Special features for utilising the motors as a magnetic brake are also provided.

809,773. EMERGENCY OPERATING MEANS FOR REVERSING SWITCHES; Frank E. Case, Schenectady, N. Y. App. filed Aug. 23, 1904. Each car has mechanical connections from both platforms to a single switch beneath the car and in the motor circuit by which the motors are arranged in closed circuits including the series fields in a direction to build up the same and generate current. The purpose is to obtain a magnetic brake in case the power fails and the usual air brakes do not operate.

809,782. COMBINED CIGAR CUTTER AND LIGHTER; William H. Crawford, Cliftonforge, Va. App. filed May 11, 1905. The cutter has connections with an arm by which the arm is moved whenever a cigar is inserted into the cutter. The arm carries the usual wick and electric igniter so that a flame is automatically provided whenever the end of the cigar is cut off.

809,787. ALTERNATING-CURRENT MOTOR; Max Deri, Vienna, Austria-Hungary. App. filed May 2, 1904. The motor operates as a single-phase induction motor, but starts from rest as a series motor. The rotor winding is short circuited at a number of points indivisible by the number of poles of the motor, so that it acts as a short-circuited secondary when full speed is reached.

809,793. ELECTROSTATIC VOLTMETER; James Ferguson, Glasgow, Scotland. App. filed Mar. 29, 1904. A form of quadrant electrometer of portable form. The interior of the case has an insulating coating which in turn has a conducting coating within it. The usual fixed cells of the electrometer are connected to this conducting coating.

809,794. RAILROAD SYSTEM; Hannibal C. Ford, Jamaica, N. Y. App. filed Sept. 12, 1905. A train control system in which a train is automatically stopped in case an engineer passes a caution signal above a certain speed.

809,798. MEANS FOR CONTROLLING OVERHEAD ELECTRIC CARRIERS; Henry M. Harding, New York, N. Y. App. filed Apr. 21, 1902. The main portions of the telpher line are constantly charged to the full working potential, but at the stations the telpher system has a low potential so that the cars automatically stop thereat when they are loaded by reason of insufficient power to operate the motors. When the cars are empty, however, the power is sufficient to operate the motors to propel the cars onward. The station parts of the line may be charged to the full potential when desired to move a loaded car thereat, or for any other purpose.

809,825. ELECTRIC METER; William J. Lloyd, Pittsfield, Mass. App. filed May 10, 1904. An induction watt-hour meter of substantially the ordinary form having a rotary disc, a current coil and potential coils which act thereon at the usual 90° phase separation. Auxiliary current coils are, however, provided for minutely adjusting the phase relation. The damping magnet is specially arranged so that its flux threads the disc twice.

809,835. ALTERNATING-CURRENT MACHINERY; Addams S. McAllister, New York, N. Y. App. filed March 2, 1905. A non-inductive resistance is placed in shunt to the field coils of a single-phase commutator motor for the purpose of causing the field magnetism to lag behind the armature current so that the electromotive force counter generated at the armature will likewise lag behind the armature current. Under the speed conditions, the armature current tends to lead the circuit e.m.f. and thus improves the power factor.

809,837. FUSE-PLUG; Henry T. Paiste, Philadelphia, Pa. App. filed Nov. 23, 1904. In permanent electrical connection with the terminals of the plug are spring clips designed for holding the ordinary cartridge fuse.

809,842. APPARATUS FOR THE PRODUCTION OF CALCIUM CARBIDE; Edgar F. Price, George E. Cox and James G. Marshall, Niagara Falls, N. Y. App. filed Oct. 19, 1904. For electrodes in calcium carbide furnaces graphite rods are used of reduced cross-section and length, to offset the greater cost of the graphite. The rods are mechanically strengthened and protected from oxidation by a re-inforcing body of cement. The electrode-holders and sockets are water-cooled.

809,864. INSULATED RECEPTACLE FOR PANEL AND SWITCHBOARDS; William C. Tregoning, Plainville, Conn. App. filed Feb. 18, 1905. The arrangement of the several parts of the receptacle is such that it may be assembled piece by piece upon the front face of the switchboard, and after the metallic parts forming the contacts are in place the insulating casing may be put in place and securely locked.

809,873. PANEL CUT-OUT AND RECEPTACLE; Frank T. Wheeler, Plainville, Conn. App. filed Feb. 18, 1905. The contact members are connected with the circuit terminals and removably secured to the base. An insulating sleeve surrounds the threaded sleeve contact, and the former may be readily replaced without disturbing the metallic parts of the receptacle.

809,878. STARTING DEVICE FOR ELECTRIC MOTORS; Howard B. Wilson, Schenectady, N. Y. App. filed Mar. 10, 1904. Magnetite tubes are included in series with the motor circuit so as to provide a starting resistance which diminishes as the magnetite becomes heated. When the potential drop across the magnetite has fallen to a certain amount it is automatically cut out by a magnetic device so as not to absorb power from the circuit.

809,904. EMERGENCY ELECTRIC-LIGHTING ARRANGEMENT FOR THEATRES AND SIMILAR BUILDINGS; Fritz Brand, Berlin, Germany. App. filed March 21, 1905. Lamp groups on the different floors and galleries are fed from batteries in the cellar through leads vertically arranged, each circuit being independent of the other. Each battery is situated as nearly as possible directly underneath the lamp groups supplied by it and is protected by the cellar walls and by fire-proof covers.

809,908. SYSTEM OF CONTROL; Frank E. Case, Schenectady, N. Y. App. filed Oct. 1, 1904. A complete pneumatic multiple train-control system having two train pipes. Controllers upon each car are similar in appearance to the ordinary engineer's valve.

809,917. ELECTRIC HEATER FOR OIL WELLS AND METHOD OF MAKING SAME; Benjamin F. Gardner, Chicago, Ill. App. filed Apr. 5, 1904. A cylindrical iron frame has a rubber composition coating, including asbestos, in which the heating coil is embedded.

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ELECTRIFYING ELECTRICITY.

It might seem to most people that there was nothing particular to complain about in the rate and rapidity of electrical development during the past 50 years, which have seen the various applications in the electrical field in America attain a total investment and capitalization of over $5,000,000,000, a yearly electrical expenditure of the American people of $1,000,000,000, and an annual production of over $200,000,000 of electrical apparatus. For a good many of us, however, such advance is slow, such figures are small, such development is tame. It is certainly true that some branches of electrical industry have not been made the most of by those engaged in them, and in a general way it is also true that the public could use electricity a great deal more than it now does. A plan is afoot for the co-operative stimulation of electrical development, and Mr. J. Robert Crouse, Jr., has been its special advocate for some time past, as already noted in these pages. His idea is that a small percentage tax on present production put into advertising and "publicity" would bring notable returns to the whole art and industry. Elsewhere in this issue appears an argument from Mr. Crouse on this subject, to which careful attention should be given by every one whose self interest should induce him to join in such a campaign.

THE NORTHWESTERN ELECTRICAL CONVENTION.

The convention last week of the Northwestern Electrical Association in Chicago was a distinct advance over its predecessors of recent years. The great success scored by the Chicago meeting was largely due to retiring President Williams and to the co-operation which he received from a live executive committee. These gentlemen some time ago energetically took up the matter of the preparation of a programme, laying down the policy that it should include only topics of live interest to operating central station men, and that papers should be printed long enough in advance to insure adequate discussion. The immediate result was a most gratifying revival of interest in the association, good attendance at the sessions and excellent discussions. There is now every promise of a bright future if the energetic and up-to-date policy of the outgoing management is continued; and the adoption of a plan whereby the board of directors shall include three past-presidents is a guarantee of continuity of policy. A few years ago economy of production and distribution were the principal topics discussed at Northwestern conventions, but the recent awakening of interest in the more purely business side of the central station was strongly reflected in the papers presented at the Chicago meeting and in their discussion. Of all the subjects taken up at the convention, those pertaining to the organization of the business-getting departments of a central station excited by far the most interest, though matters relating to the engineering side were by no means ignored.

Elsewhere we print abstracts, together with the following discussions, of all the papers presented at the meeting except two which are reserved for our issue of next week. These latter are the paper by Mr. George Williams on "Organization and Development of a New Business Department," which led to the most important discussion of the meeting; and the paper by Mr. W. D. Burford on "Underground Construction," which was also discussed at some length. Mr. Kimball, in his paper, spoke very encouragingly of the future of the Middle West as a manufacturing center and of the probable ensuing growth of demand for central station power for small and large factories in that territory. The situation which he presented, and which applies to the entire country, so far as relates to extension of electric power, should inspire central station companies to prepare for growth of power load by placing their generating stations on a good basis with respect to economy of generation and the study and adoption of systems of rates which will invite this class of business to central stations instead of being diverted through the installation of isolated steam plants. While this in some sections is, of course, largely a matter of the future, yet on the course of central station companies during the next five years will depend the business of many following years.

Perhaps the most interesting point brought out in the discussion on meters was the experience showing that complaints of customers as to inaccuracy of meters may be largely obviated by teaching them to read their own meters and how to make rough tests as to their accuracy. As a rule, if a customer is interested enough to make complaint as to the accuracy of his meter, he will be sufficiently interested to listen to explanations offered, and if at all reasonable will be inclined to follow advice provided that it is offered in terms that he can understand and in a spirit to which he cannot take exception. The idea of educating the customer in meter reading and testing is not at all new, literature with this end in view having been published by manufacturing companies and supplied to central stations; and where advantage has not been derived from this plan, it has not been as much the fault of the customer as of the central station through neglect, either to adopt it or to carry it out properly. Judging from the discussion, the more recent types of meters do not require to be inspected as frequently as the older types. As meter inspection tests form quite an item of expense—though within bounds one well justified—it is gratifying to know that with modern meters this can safely be reduced. Another paper of value from the data it gives is that by Mr. Gonzenbach on combining lighting and railway plants. While there is no doubt that a plant for operating both railway and lighting circuits can be designed to secure a high combined economy, in consolidating existing railway and lighting plants frequently the economy anticipated has not been realized; and this would have probably been indicated by the careful preliminary study which should always be made of all the conditions, local and engineering, affecting final economy.

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CENTRAL STATION POWER BUSINESS IN SMALL TOWNS.

There is probably no respect in which central station companies operating under the same conditions differ more widely than in the amount of power business they are carrying. For example, in one rural village in Illinois with a population less than 3,000, the maximum power load reaches 65 kw. While no figures are obtainable as to the average load in this village, it is safe to say that it is higher than in an adjoining city of 14,000 inhabitants where the average load is only about 15 kw. There are neighboring towns where there is almost nothing in the way of small manufacturing and where all the power used in the town is in a few very large factories which have generating plants of their own, as large, or larger than that of the central station company. These are exceptional conditions, however. The rural village of 3,000 inhabitants and the city of 14,000 referred to were neither of them remarkable either for the presence or the absence of the usual amount of power business. In fact, in the rural village all the available power load had not been secured. The large town was one having plenty of small industries which were power consumers. The facts of the case seem to be that the management of the combined electric lighting and gas company in the large town had considered the electrical end of the business simply as a necessary evil, and had made no attempt to cultivate the power load. This is apt to be the weakest point of consolidated electric light and gas companies, although there are notable exceptions.

The development of the power business is not by any means a question of very low rates or competition. Of course, low rates help develop a business and are necessary to secure the large power users, but they are not the only key to success along this line by any means. How inefficient low rates are in building up a power business unless they are used in conjunction with other means of pushing the business, was forcibly brought to attention recently in a visit to a city where conditions were no better than in the larger of the two towns before referred to, as far as the amount of power business was concerned. Power was being sold at a regular rate of 5c. per kw-hour. There had been two companies in the town to compete for business, yet the power load was merely nominal, in fact, hardly enough to pay for keeping the station in operation during the day. This may interest those who think a low price alone is the only thing necessary to get business. In all probability more business could have been secured in the town at 8c. or 10c. per kw-hour, provided the management had gone after the power business in the right way.

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METHOD OF MEASURING INDUCTANCE.

There are numerous methods now known and available for the measurement of the inductance of a coil or a conductor. These are capable of being classified in various ways. One method of classification is with reference to the source of measuring current. Thus there are methods which involve the use of a voltaic battery and commutator, others which involve low-frequency alternators, and yet others which involve high-frequency alternators, or oscillating condenser charges. The high-frequency methods are generally preferred for measuring very small inductances, such as the inductance of a copper rod a few feet long. On the other hand, the battery and low-frequency methods are generally applied to the measurement of larger inductances. As mentioned in the Digest this week, Messrs. E. and W. H. Wilson have recently described in the London *Electrician* a method of measuring self-inductance, using low-frequency, alternating currents. The method is interesting, because it seems to be applicable to the measurement of very small inductances; i. e., inductances of the order of a metre, in absolute value. It employs a quadrant electrometer and an air-cored series transformer.

Results are reported on the inductances of wattmeter and ammeter shunts of strip metal. An alternating current of sufficient strength to produce a potential difference of one volt in the shunt is employed. This potential difference is led to the quadrants of the electrometer, while the secondary winding of the series transformer produces an e.m.f. of about 500 volts, connected between the electrometer needle and the case of the instrument. The voltage between the quadrants would thus be exactly in phase with the current, if the shunt under test were devoid of inductance. The secondary voltage in the transformer would also be exactly in quadrature with the current, ignoring the secondary open-circuit impedance. Consequently, the alternating voltage of the needle being in quadrature with that between quadrants, there would be no resultant deflection of the needle. But the effect of inductance in the tested shunt will be to bring the voltage across the tested shunt behind the phase of the current and thus out of quadrature with the voltage of the needle. The magnitude of the resulting deflection of the needle, therefore, permits the inductance to be evaluated. The method is evidently very simple and convenient of application. When applied, however, to measuring very small inductances, it would seem that care would be necessary to eliminate disturbances, not only of adjustment in the electrometer, but also in the capacity and inductance of the secondary circuit of the transformer. In other words, when the method is applied to its limits, it needs to be demonstrated that the voltage of the needle is strictly in quadrature with the current, in spite of small capacity in the secondary circuit, and also that the alternating current is for all practical purposes devoid of disturbing harmonics.

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POWER SCHEMES FOR THE RAND.

To judge from the projects now under way there is little danger that the great mines of the Transvaal are long to be without an adequate supply of power, whatever may be done as regards the Chinese labor question. Not only is the Victoria Falls proposition being pushed to the front, but the rival power project outlined last year by Mr. Robert Hammond is rapidly being exploited. The two projects are of a character that raises some extremely interesting practical questions. On the one hand we have a transmission of about 700 miles through the wilds of Africa from the tremendous Falls of the Zambesi, and on the other a short transmission from cheap though rather poor coal in the neighborhood of the Rand. There is a fine appeal to the imagination in the former that counts for something even in these days of sordid money grubbing. To take out of the heart of the African continent power from the mightiest cataract on the eastern hemisphere, and to transmit it more than twice as far as human enterprise has ever dared before, to the richest mines that ever tempted avarice, is a fact the thought of which quickens and tingles a little even the most stagnant blood. But capital is timid when working at its own risk, and the palmy days of African company promotion have passed. Mr. Hammond's rival plan is no more sensational than making a railway cut or building a breakwater. It is a cold-headed grasping of local conditions and utilizing their resources with calculating deliberation. Here are seams of coal, poor to be sure, as steam coal goes, but easily mined; not far away is the Vaal River with plenty of water for condensation; and there, fifty or sixty miles away, is the auriferous Rand.

There is nothing very risky about such a proposition if the market can be secured on contracts stable enough to justify the outlay. The cost of delivering power at the bus-bars can be calculated from known data with a very good degree of precision. The transmission of the energy involves neither a desperate struggle with nature nor any uncertainty as to the ultimate results. The voltage necessary is within the range of common experience, and neither methods nor apparatus need be in any sense experimental. It is, in short, a proposition frankly commercial such as a score of engineers would take up and put through without raising an eyebrow. Its value as a paying enterprise depends merely on what can be done with the market. There is very little reason to doubt that Mr. Hammond's estimate of 1.4 cent per kw-hour as a practicable selling price for energy delivered can be realized, and we fancy that if he could guarantee a good load at that figure for a reasonable term of years he could find plenty of American capital. But how about Victoria Falls? Mr. Esson has recently stated that the estimated cost of a single circuit for bringing 20,000 kw to the Rand is about $5,000,000—in other words $250 per kw as capital charge for the transmission line alone. If that figure is correct it implies at any reasonable figure for interest, care and maintenance, an annual charge per unit which would come very near to paying the whole expense of generating and transmitting from the steam power proposed. There seems to be considerable difference of opinion as to the cost of developing hydraulic power at Victoria Falls, but it certainly is not an amount at all negligibly small, and when added at any plausible figure to the costs of generation and transmission, it leaves a precious small margin upon which to compete with power locally generated and distributed. The crux of the whole matter seems to be in keeping down that tremendous investment and expense for the transmission.

In a previous state of existence of the Victoria Falls project, much was made of the value of copper as an investment. That it is likely to depreciate greatly from its normal price in years past seems improbable, and yet copper strung up in the wilds of South Africa cannot be regarded as a quick asset. To make the proposition attractive from a financial standpoint we should wish to see the cost of the transmission very greatly reduced below the figure mentioned. To this end the energy of the engineers must be bent. The problem of dealing successfully with voltages now considered transcendental must be solved, as it very likely will be. More than this, the cost of the conductor itself must be reduced. If the present high price of copper should be anywhere nearly maintained, which seems improbable, there may be a dull time in power transmission. Perhaps the best outlook is toward the more extensive use of aluminum. To-day being manufactured by special processes at only a few points, it can be held in price just below the cost of the equivalent copper conductor, but this condition of affairs cannot be a permanent one, unless all signs fail. With aluminum wire at twenty cents a pound or thereabouts, a price at which it can be sold at a profit one of these days, if not just now, the economies of line construction will wear a very different aspect. As things look an increasing production and use of aluminum is the most cheerful fact that the engineer has to contemplate. Not only copper but most of the other metals used in the arts have of late risen seriously in price, and unless aluminum comes to the rescue the outlook in many directions is rather bad. But this aside, the success of the Victoria Falls project or of any other of like kind, turns entirely upon the line costs, which are mainly controlled by the practicable voltage. As we have previously suggested, the best thing for those interested is to get down to business at once and carry out a series of experiments at high voltage upon a scale that will render them valuable as precedents as well as tests. Hydraulic power is often very cheap merely because it is unutilizable by reason of its isolation. To render it valuable, high voltage is the thing that really counts, and by which most future enterprises must stand or fall.

Discussion on Railway Sub-Stations at Chicago.

A meeting of the Chicago branch of the American Institute of Electrical Engineers was held the evening of January 16, to discuss the papers on sub-stations recently presented before the A. I. E. E. in New York. In the absence of Mr. K. B. Miller, chairman of the Chicago branch, the meeting was presided over by Mr. L. E. Ferguson, vice-president of the Chicago Edison Company.

Prof. P. B. Woodward gave brief outlines of the papers by Messrs. Ashe and Ricker, abstracts of which were printed in these columns in the issue of December 23, 1905.

Mr. George A. Damon, being called upon to lead the discussion, spoke especially of the comparative infrequency with which it is possible to apply Kelvin's law in designing sub-stations and deciding upon their locations in actual engineering practice.

Mr. P. Junkersfeld said it was generally the practice in large systems to start rotary converters from the direct-current side, while in small sub-stations starting from the alternating-current side was more common. The units selected should be as large as can be economically operated. Real estate and buildings formed a very important percentage of the total sub-station investment in large cities. In order to avoid the losses due to possible abandonment of rotary converter sub-stations because of changes in the art, it is becoming customary to design these buildings so that they would be useful for other commercial purposes in the localities in which they are situated should they ever be abandoned as sub-stations.

Mr. J. M. S. Waring, referring to the failure of storage batteries to respond quickly enough in the case of short circuits to prevent rotary converters from flashing over, called attention to the fact that nearly all batteries operating on railway loads in the United States are used in connection with boosters which, of course, influenced the quickness of their action.

Mr. Ernest Lunn, taking up the point of the quickness of battery response to overloads and short-circuits thought that the resistance drop in the plates was a more important factor than the slowness of the chemical action of the battery. Low resistance in the plates and terminal lugs would help the battery materially in responding quickly.

Mr. Bion J. Arnold stated that at one time he had thought that the storage battery possessed advantages in the way of improving the load factor of the engines and thus of improving the fuel economy. He remarked that he is now not so sure that the battery actually improves the fuel economy, but it undoubtedly gives greater reliability of service. A common argument against batteries is that they cost as much as engines and generators for carrying the same amount of load. Nevertheless, he thought batteries more economical for carrying short peak loads of from one to two hours' duration than the equivalent capacity of engines and boilers would be.

Mr. Winslow thought that there should be used at least one of the three following protective devices; namely, overload relays on the alternating-current side of the converters, reverse current relays on the alternating-current side of the converters, reverse current relays on the direct-current side and speed limiting devices. He spoke of some overload time limit relays operating in from three to six seconds with 100 per cent overload.

Mr. W. G. Carlton said that there was great difficulty in securing relays which could be adjusted so that there would be any appreciable difference in the time taken to operate on short-circuits. Considerable investigation and testing had failed to discover any time-limit devices which could be placed on feeders at sub-stations and at power stations with the assurance that they could be set so that there would be sufficient difference in the time of operation on short-circuits, to cause the circuit breakers at the sub-station to open before those at the power station.

Mr. Edward Schildhauer thought it to be desirable to cut out a line instantly in the case of short-circuit. Relays set for operation in six seconds at 100 per cent overload should operate instantly on short circuits.

Mr. Junkersfeld called attention to the fact that of all the protective devices enumerated, the one limiting the speed of rotary converters was the only one installed primarily to protect apparatus. The other devices were for the protection of the service from interruption by preventing the spread of disturbances. After all, protection of the apparatus was not a very serious question in practice, as was shown by the fact that on a large system having from 55 to 60 switchboards operators and aggregating about 70,000 kilowatts in machinery capacity, only three cases of damage to rotary converters had occurred in five years of operation. It was protection of service rather than protection of apparatus than was to be sought for.

Co-operative Stimulation of Electrical Development.

From time to time during the past nine months we have taken occasion to call attention to the plan outlined by Mr. J. Robert Crouse, Jr., for the co-operative development of electrical production and consumption, the idea having been first formally presented by him at the Denver electric light convention last June. We are now in receipt from Mr. Crouse of an important contribution on the subject, given in extenso below, to which we would direct attention. As one identified for many years with the incandescent lamp industry, the carbon business, and the manufacture of electrical glassware, Mr. Crouse has had unusual opportunities to become informed as to the general situation, and the opportunities of development by means of systematic, united effort. The communication follows:

A few introductory remarks with your indulgence, possibly at the expense of platitude, as to the basis and theory of this proposed co-operation. Association and co-operation are increasingly the watchwords of modern commercialism. "Competition is the life of trade" crystallizes the sentiment of a period in business development which is merging into a new régime, characterized by the sentiment "Co-operation is the life of trade."

Not co-operation of manufacturers or others to set prices or conditions of sale to the buyer, but broad-gauged co-operation among all the different interests through associations, societies or otherwise, working for general progress and improvement on the basis of the square deal. Through such co-operation furthermore developing the strength to attain an approximation to it.

The governors of the Western States believed the American people should see the wonders of the West before spending their money to visit Europe. They met and devised co-operative plans for bringing this about. This was modern co-operation.

The governors of thirteen Southern States appreciated that the South needed more people to develop her great natural resources. They recently met and made plans for co-operating in the expenditure of both time and money to accomplish this result. This was modern co-operation.

These two instances might be otherwise characterized as associated or co-operative self-interest. While experience amply proves that self-interest is the great "prime mover" in the affairs of men, the more widely it can be made co-operative or associated (necessitating the recognition of the rights of others) the more nearly it exercises its most proper and efficient function in the line of progress. May it not be well to consider whether there does not exist likewise in this great electrical field a common ground on the basis of which co-operation of this kind, in some degree at least, may be broadly undertaken to the advantage of all?

At first blush it may seem that our interests are too diversified and conflicting as manufacturers, publishers, jobbers, dealers, contractors, societies, associations, salesmen, central station, etc., but when we have reviewed all the interests, conflicting or harmonious, the fact remains that they form a continuous chain (kinks and all) from the manufacturer to the consumer.

This great body of 86,000,000 consumers, spending $12,000,000,000 annually, or putting it into the bank for future expenditure, controls the exchequer from which we are all, directly or indirectly, endeavoring to secure an honest livelihood in turn for the making, selling, installing or distributing of electrical apparatus, supplies and current. If this be true, it suggests that there does exist a community of interest among us all for the promotion of the increased use of electrical appliances and devices by the public for light, heat and power, as against all competitive means and methods for the same purposes. Any increased success in accomplishing this through co-operation obviously predicates greater demand for "Everything Electrical," from the coal pile to the final appliances through which the public is electrically served.

The question then is, can any scheme of practical co-operation be devised which will bring about the result desired by all, and will such results probably be large enough to justify the expenditure of both time and money in their accomplishment? This is a subject which has interested the incandescent lamp manufacturers for a year past.

We believe such co-operation is not only possible, but profitably so. As "faith without works" is profitless, these manufacturers have backed their faith with an appropriation of $10,000, to which has been added another $10,000 from other sources, for the initiation of the plans.

It has been determined to undertake practical work along co-operative lines through the medium of the Co-operative Electrical Development Association. While this Association will look to the manufacturers generally for the revenue with which to prosecute the plans, equal importance is attached to securing the moral co-operation of all other electrical interests, societies and associations.

It would at this time be premature to go into the detailed plans of the new Association, until its activities had both aroused and justified sufficient interest in them. It may be said, however, by way of passing, that they have been fully and freely laid before many men in the various electrical interests, whose counsel and criticism has been sought and secured. Whatever degree of merit they may now possess is attributable to their hearty co-operation and encouragement. As initial progress in this work has been possible along these lines in the past, so, for the future, it points for continued and permanent success to systematic cultivation of the same sources of strength.

Your attention is respectfully called to certain campaigns of commercial business-getting literature which either are, or are about to be, issued to all the central lighting stations of the country, in direct line with the purpose of the new Association, through the medium of co-operating advertising agencies. The objects of the new Association are one in common with the electrical technical press along all lines looking to increased commercial activity, directly or indirectly, in the sale of current, and it will both seek their co-operation, and endeavor in turn to co-operate with them, along any practicable lines.

Finally, coincident with the recent and prospective great advances made by the mechanical and electrical engineers in increasing the efficiency of prime movers, the means of transmission, and the final appliances through which the public is served, this new Association stands for a vigorous attempt to match, and, if possible, to exceed, these accomplishments in the commercial field, through a general appeal to the selling ingenuity of the fraternity for effort along co-operative lines. To you, if sufficiently interested in the detailed plans of the new Association, as they have thus far been developed, the writer would be pleased upon rquest to submit the preliminary prospectus for criticism and comment.

Fighting Fraud Against Corporations.

The annual meeting of the Alliance Against Accident Frauds was held at the Hotel Astor, New York City, on January 17. Between forty and fifty traction companies were represented. These officers were elected: Russell A. Sears, of the Boston Elevated Electric Railroad, president; James R. Pratt, of the United Electric Railways Company, of Baltimore, vice-president; Chauncey S. Miller, of the Casualty Company of America, secretary and treasurer. Copies of barratry bills from different States were discussed and a sub-committee was appointed to draft a bill to check the operations of "shyster" lawyers, unprincipled physicians, paid witnesses and "ambulance chasers."

It is expected, judging by the attendance of representatives from Canada and the receipt of proxies from Great Britain, that the Alliance will become an international association. The Alliance has ample funds to defend its members from fraud. It is estimated that $450,000 is collected in this country each year by means of fraudulent and exaggerated claims.

Lightning Protection Upon Electric Railways.

An interesting recommendation in regard to lightning protection upon electric railways was made by Mr. H. W. Young, of the Westinghouse Company, at the December meeting of the New England Street Railway Club. Mr. Young pointed out the fact that many inherent failures heretofore erroneously ascribed to defective apparatus for lightning protection have now been eliminated, and urged the importance of co-operation on the part of operating companies with a view toward getting a better idea of the quantitative side of lightning disturbances. In order to secure as conclusive evidence as possible as to the operation of lightning arresters under actual service conditions, investigations are recommended with special test papers which can be placed in the discharge gaps of the arresters and so arranged that no discharge can pass the gaps without passing through the record paper.

Mr. Young recommended that every electric road should place the problem of lightning protection in the hands of a special man, equal in training to the average technical graduate or first year student with one of the large electric companies. It would be the sole duty of this man to map out the system, locate arresters, see that they were properly maintained and well grounded, use tell-tale boxes with paper records of their operation, and report regularly to the manager after each storm as to the damage done to apparatus, approximate loss of revenue, remedies applied, etc. He contended that the cost of doing this would be a small matter in view of the resulting benefits to the system. While this recommendation is perhaps somewhat radical—for it is difficult to believe that on any except the larger systems there would be work enough of this character to keep one man busy all the time—there is no doubt that more systematic efforts are necessary on the part of operating companies. There would seem to be no special difficulty in assigning the work outlined to the electrical staff of a company, holding some one operating engineer or assistant responsible for the condition of the lightning protection apparatus. Such an employe would in effect be superintendent of lightning protection, and his duties might well be undertaken by many other electric companies than those devoted purely to electric railway service.

Competition Between American and German Electric Manufactures in the World's Markets.

Some interesting statistical notes on competition between German and American electrical manufactures are given by Dr. Glier in the *Elektrotechnische Zeitschrift* of January 4. The writer states that in both the United States and Germany the electrical industries have grown to such dimensions that the output is larger than the home consumption. Both countries are, therefore, forced to export part of their production. While the yearly value of the export of electrical machines, appliances, etc., from Germany was in the average $11,000,000 during the last three years, the export from the United States in 1905 amounted to $12,000,000.

Which countries represent the battlefields of the rival manufacturers? Formerly it was Europe, and especially Great Britain, to which both countries chiefly exported. Thus, the export from Germany to Great Britain in 1902 represented 30 per cent of the total export; in 1903 it was 27 per cent and in 1904 it was 20 per cent. The export from the United States to Great Britain in 1901 and in 1902 was not less than 48 per cent of the total export, 39 per cent in 1903, 23 per cent in 1904, and 15 per cent in 1905. On the average during the years 1901 to 1903 the yearly export from Germany to Great Britain represented $1,306,500, and from the United States to Great Britain $2,530,000—that is twice as much as Germany. In recent years however, the export from both countries to Great Britain has considerably diminished.

In Belgium, Russia, Italy, Spain, Netherlands, Sweden, Norway, Austria-Hungary and Switzerland, the German exporter does not appear to suffer from strong competition of the American exporter. The four chief European countries to which Germany exports are Great Britain, Russia, Belgium and Italy.

In countries outside of Europe, the American exporter appears to be ahead of the German exporter in almost every case. In Canada, Mexico and Japan the American exporter reigns supreme. These three countries bought from the United States in 1898 electric machinery at a value of $4,000,000 (20 per cent of the total), in 1904 $2,776,000 (49 per cent), and in 1905 $4,028,000 (53 per cent). The consumption of electrical machinery in these three countries is increasing, but this increase is completely covered by export from the United States. The exports from Germany to these three countries in 1904 amounted to $178,000.

With respect to South American countries, the export from Germany has increased to Argentine and Brazil; it amounted to $219,000 to Argentine, $52,000 to Brazil and $70,000 to Chili in 1904. The total exports to Argentine, Chili, Uruguay, Brazil and Peru were:

	1903	1904	1905
From Germany	$283,000	$360,000	$——
From United States	413,000	278,000	568,000

The exports from Germany to British Australia were $53,000 in 1903, $44,000 in 1904, while the United States exports in 1904 were $314,000 and in 1905 $662,000. In British East Indies the United States are also much better represented than Germany.

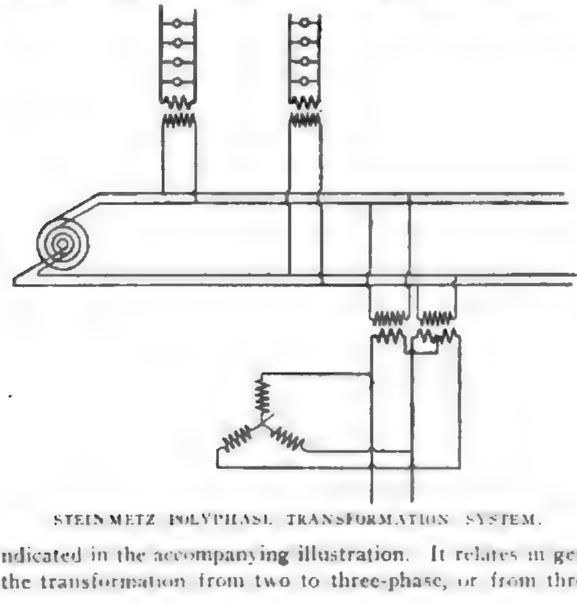
Strong rivalry still exists in British South Africa, with the Americans ahead. The exports from Germany were $75,000 in 1902 and $65,000 in 1903. The exports from the United States were $69,000 in 1902, $122,000 in 1903, $101,000 in 1904, and $114,000 in 1905.

Electric appliances are exported from the United States chiefly to Europe and especially to England; but Canada, Mexico and Japan are also good customers.

The only article of the electrical industries which is exported from Germany to the United States to any considerable extent is arc lamp carbons, the average amount for the years 1890 to 1894 being yearly $16,000, for the years 1895 to 1899, $70,000 and for the years 1900 to 1904 $44,000.

Polyphase Transformation.

A patent granted January 16 to Dr. C. P. Steinmetz on a system of electrical distribution is of particular interest at the present time, not so much on account of the technical information which it affords, but owing to the early date at which the application was filed and the broadness of some of the claims. The invention is indicated in the accompanying illustration. It relates in general to the transformation from two to three-phase, or from three to two-phase, as the case may be. The method employed seems to differ inappreciably from the one in common use at the present time.



STEINMETZ POLYPHASE TRANSFORMATION SYSTEM.

The patent, the application for which was filed on April 13, 1894, contains 28 claims, three of which read as follows: "(14.) The combination of a plurality of transformer windings and a connection between the end or approximately the end of one winding and approximately the middle point of another of said windings; (15) The method of electric distribution herein set forth, which consists in generating three-phase currents, transmitting the same to a desired point or points, converting such currents into quarter-phase currents and utilizing such last-named currents for operating translating devices. (24) The method which consists in producing two-phase alternating currents transforming the same into three-phase, alternating currents, transmitting the energy in the form of three-phase, alternating currents and utilizing the energy thus transmitted."

It may be of interest in this connection to mention that the notable paper by Mr. C. F. Scott on "Polyphase Transmission," which first described the Scott system of transforming from three to two phases, was read before the National Electric Light Convention at Washington on March 1, 1894. It is noteworthy also that on August 24, 1893, in discussing a paper by Prof. F. B. Crocker before the International Electrical Congress, at Chicago, Dr. Steinmetz stated that any system of polyphase currents can be transformed into any other system of polyphase currents by using only two stationary transformers.

The Municipal Plant of Cumberland, Md.

A month or two ago considerable publicity was given in the newspapers to a dispatch from Cumberland, Md., stating that the cost of the municipal arc lighting plant there was only $34.06 per light per year, everything included. We have obtained a copy of the report upon which this claim is based, but do not find anything in the figures to support it. As we are at a distance from the place, we have asked a central station manager in Maryland to discuss and analyze the report, which he does in the subjoined communication:

The plant in question is working under very favorable conditions, but notwithstanding that, I can show a cost of nearly $60 per lamp. The plant was placed in a small building next to the water works, and by adding a few dollars to the water employees, and hiring an electrician and trimmer they were ready for business as far as salaries were concerned. Taking their figures, which are absolutely approximated, except salaries, we have $7,879.01 for salaries and labor, fuel and supplies, $2,280 6 per cent depreciation, interest on bonds $800, making a total of $10,959.01. Deducting $2,000, value of supplies on hand, the total cost was $8,959.01, or $34.06 per lamp for 263 lamps. But the plant has cost the city $40,000, and the machinery is of the antiquated design, with four of the five arc machines belted to one 18x24 engine, which is overloaded. There is no reserve, which means that it will not be long before the demand is greater than the capacity of the plant, while breakdowns must be provided for.

In my figures 10 per cent depreciation will be charged, although I think under the conditions 15 per cent is nearer the truth, but I want to be as conservative as possible.

Cost of plant, $40,000.		
Salaries and labor	$3,333.58	
Fuel	2,280.00	
Supplies	8,536 53	
		$7,807.01
Depreciation, 10 per cent on $40,000		4,000.00
Interest on bonds and appropriation 6 per cent., $40,000		2,400.00
Additional fuel		366.40
Labor not considered		300.00
Oil, waste and packing		250.00
Lamp renewals		600.00
Repairs, engine and boilers		250.00
		$16,063.41
Deduct actual value supplies on hand		495.50
Total maintenance		$15,564.91

This amount divided by 263 lamps gives $59.10 per lamp per year.

In order to show the unwisdom of the city of Cumberland in going into the electric lighting business, when a company already formed and doing business stood ready to furnish lights as cheap as and in the long run cheaper than the city, even under favorable conditions; and also, because the information may be useful to other municipalities, that may have this subject under consideration—I take the liberty of submitting a history of the Edison and the municipal plants.

The Edison company began operation in 1884, and from the beginning lighted the streets and alleys, and all public buildings with incandescent lights. The original charge for street lighting, all night, and every night in the year was $10.80 for 10-cp lamps, and $12.00 for 13-cp lamps. Later all lights were changed to 16-cp lamps at $12 per year. About 1891 the Council asked for a few arc lights, and the company installed a Westinghouse 2,000-cp, 10-amp. arc system with the understanding that after arc lights were once available, the city would gradually replace the incandescent lights with arcs.

When the company first started the arc system, there were about five or six arc lamps on the circuit, and after about two years the number had grown to about a dozen. At this point it dropped the price from $100 to $91 per year per lamp. The city added a few lights each year, and at the end of 13 years the company were furnishing the city only 27 lights, and so scattered, that it required nearly 30 miles of wire to reach the lights. At this time the street lighting consisted of about 400 incandescent and 27 arc lamps, at a yearly cost of less than $7,500 per annum.

It is true the streets at that time were not as brilliantly lighted as at present, except where the arc lights were placed, but the 400 incandescent lamps covered all alleys, dark spots and holes in the city, impossible to reach with arc lights alone. Do not infer that I consider incandescent street lighting superior to arc street lighting. I bring this part of the history up merely to show that while the streets to-day are more brilliantly lighted under the present system, yet there are many dark alleys and holes to-day, that were formerly lighted with a 16-cp lamp, while it is costing the city 100 per cent more than when they were buying the service. If the city had accepted the price of $60 per year for arc lights, which was made to the committee appointed by the council to build the addition to the water works for the electric light plant, the city would be as well off financially, and considerably better off as far as distribution is concerned, and at a considerable less cost per year.

In the first place 175 arc lights properly placed would be sufficient, and at a cost of $60 per year would amount to $10,500, and 100 incandescent lights at $12 per year would make 275 lights at a cost of $11,700 per annum. Many of the city arc lights are erected at places where a 16-cp lamp would be satisfactory, and many dark holes, such as under shade trees, etc., that have no lights could be lighted to the satisfaction of the people, at a cost of $12 per year, so, 175 arc and 100 incandescent lights properly placed would give a better distribution than the present system, with a saving to the taxpayers of $4,000 per annum, and relief from the present antiquated plant. The problem is whether to add to the present junk pile, or throw it out, and spend $50,000 for a plant that will be adequate to supply the demands.

In 1897 a number of citizens thought the street lighting was costing too much and agitated for a municipal plant. As usual the cry struck a popular chord, as a cost of $35 per light was promised, and the plant was to cost only $20,000. The question was put to a vote of the people and was carried by a large majority. Accordingly, plans were drawn and bids asked for, but later were withdrawn, as no bids came within the amount of bond issue of $20,000.

The next move on the part of the citizens was to cheapen the plans so as to come under the $20,000 appropriation. In the meantime the company offered to furnish arc lights at $60, and tried to show the committee that $20,000 would not build the proper plant, and in fact the manager is on record as saying that if the city was bound to build the plant, they had better spend $40,000 and build a plant that would not have to be thrown out in a year or two. A construction company undertook to build the plant on the new plans, and after placing all the poles so that all the trees in the city came in contact with the wires, and placing 50 per cent of the poles 2 ft. in the ground instead of 6 ft., it broke up before the plant was completed.

The plant was finally placed in operation in September, 1898, and from the very first night was overloaded. They ran along for several years adding lights, until the engine was unable to pull the load, and it was necessary to do something. Advice was asked and I made a suggestion, and a rough idea of what was best to be done under the circumstances, and also advised them to secure the services of an efficient electrical engineer—which they did. The engineer, a capable man, looked the plant over thoroughly, and later submitted a report advising just about what I had suggested, viz., throwing out the original plant, and placing proper and up-to-date machinery, capable of not only caring for the present, but for the future, as well as making provision for the lighting of the city buildings.

Electrical Engineers of the Times.—XLVI.

MR. CHARLES R. UNDERHILL.

Charles Reginald Underhill was born in Chappaqua, N. Y., November 2, 1874. He attended the public schools until 1891, when he entered the employ of the Western Electric Company, New York, in the inspection department. This position gave him an excellent opportunity for the study of telegraphy and telephony, and while gaining a practical knowledge of applied electricity he also acquired a technical education by diligent evening study, and by correspondence instruction, which secured his promotion to the charge of the electrical testing and inspection in this department. During this employment Mr. Underhill designed a number of electrical testing devices, which greatly increased the efficiency of the department.

MR. CHARLES R. UNDERHILL.

In 1900 Mr. Underhill accepted the position of chief electrical engineer of the Varley Duplex Magnet Company, and in 1901 went to Providence, R. I., the manufacturing department of this company being at the American Electrical Works. Realizing the lack of published data regarding electromagnets and solenoids to perform a given duty, Mr. Underhill devoted several years to the careful study of this branch of design, and in 1904 read a paper on the subject before the Northwestern Electrical Association. In the same year he published a book entitled "The Electromagnet," and a number of articles on electromagnets and solenoids for the technical press.

In the fall of 1904 Mr. Underhill engaged in consulting electrical engineering in New York. He is the inventor of an instrument for printing in English characters, Morse messages, from a regular Morse wire, which system, while not yet in commercial use, has attracted much favorable attention. Mr. Underhill is a member of the American Institute of Electrical Engineers.

CURRENT NEWS AND NOTES.

COLUMBIA UNIVERSITY.—The 1906 catalogue of Columbia University shows the total number of officers of administration and instruction to be 573, and the total number of resident students 4,755, as against 4,833 last year. These figures do not include the extension students, of whom there are nearly one thousand.

AWAITING ELECTRICITY.—In his first annual report to the New York Legislature, N. V. V Franchot, State Superintendent of Public Works, points out that the number of boats navigating the State canals has fallen from several thousand to not more than 600. The superintendent recommends the abandonment of certain parts of unused canals, which would curtail the annual expenditures. The canal system is dying for want of electrification

RECEPTION TO PROF. W. OSTWALD.—Previous to his departure for Europe, after a season of lectures at Harvard and Columbia, and elsewhere, Prof. Wilhelm Ostwald has consented to meet the members of the New York Section of the American Electrochemical Society and their guests on the evening of February 2 at the Chemists' Club, 108 West 55th Street. A number of prominent scientific men will make short addresses and a souvenir will be presented as a tribute of affection from his former students, as a recognition by his admirers of his services to electrochemistry. Members of the affiliated scientific societies of the city are especially invited to be present.

CHIP OF THE OLD BLOCK.—A telegram from Pittsburg of January 21 remarks: "George Westinghouse, Jr., only son of the inventor and manufacturer, is working in the Westinghouse electric plant at East Pittsburg as an apprentice. He was graduated from Yale last year, and after a few months' rest entered the shop on January 1 to learn the business. He receives precisely the same treatment as the other employes, carries his dinner in a tin pail, and rides from Solitude, the Westinghouse mansion, to the works in a street car. Young Westinghouse will take a complete course in electricity, going through all departments of the plant."

700-*FOOT TOWER.*—Announcement has been made by the Friede Globe Tower Company of its definite plans for a 700-ft steel tower at Coney Island. The proposed tower will be 300 ft. in diameter and contain a pedestal roof garden, to be placed 150 ft. above the ground, including a restaurant, theatre and roller skating rink; an aerial hippodrome, 250 ft. above the ground; a moving café and dance hall, 300 ft. up; a palm garden at 400 ft., an observatory platform at 500, and still higher a branch of the Weather Bureau, including the largest revolving searchlight in the world. It is estimated that more than 7,000 tons of steel will be used in the structure, which is to be fire-proof, and the cost of which is placed at $973,500.

IN A LIBRARY.—An interesting illustration of the way in which electricity is superseding gas and oil for high-class illumination is found in the library of the Hotel Touraine, Boston. The library is well known to hotel patrons as one of the cosiest corners in the Hub, and its well-stocked bookshelves, easy chairs and open fire-place are deservedly popular with the guests of the house. The table lighting is accomplished by handsome lamps with standards and shades bearing a close resemblance to the familiar oil banquet lamps of earlier days; but in place of ill-smelling and leaky oil or of stifling gas burners the lamps are all equipped with incandescent electrics. The clean, cool and even illumination which results is a part of the atmosphere of this attractive room, and the use of electricity is a by no means negligible factor in the preservation of its handsome furnishings.

THE FRITZ GOLD MEDAL.—The John Fritz gold medal, founded on the occasion of the eightieth birthday of the veteran steel engineer and manufacturer in 1902, by the four national engineering societies, has just been awarded to Mr. George Westinghouse by the board of trustees. The medal is by the deed of foundation to be "awarded for notable scientific or industrial achievement" and the "specific achievement" which will be named on the certificate is the Westinghouse air brake. The first recipient of the Fritz medal was Lord Kelvin; Mr. Westinghouse is the first American. The medal represents in reality the initial results of united effort and co-operation among the national engineering societies. The next result has been the gift of Mr. Andrew Carnegie for the United Engineering Building, of over $1,000,000, the societies furnishing the land. Of the $200,000 required by the American Institute of Electrical Engineers, that society has already pledges for over $100,000.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—Mr. W. C. L. Eglin, secretary of the association, announces that the twenty-ninth convention of the National Electric Light Association will be held at Atlantic City, on the New Jersey seashore, on June 5, 6, 7 and 8, 1906. Owing to the many additions to the membership of the association now being made, as well as other evidences of increased interest in the association work, it is confidently believed that all previous records of attendance will be broken. It is the intention to provide a suitable hall for such exhibits as may be made by the manufacturers and supply dealers who are members of the association. Atlantic City at that season of the year is most attractive, being all furbished up for the summer business, which begins with a rush one or two weeks later. It is understood that no particular hotel will be made headquarters, and that the sessions will be held on the pier. Due announcements will be made. Mr. G. F. Porter will, as usual, be the efficient master of transportation.

NOVEL LABOR AGREEMENT.—President W. C. Gotschall, of the New York & Portchester Railroad is anxious to avoid any conflict with the labor unions and wants to make everything sure, pending the final action which it is hoped the Board of Estimate will be able to take on January 26, as to the awarding of the franchise. To prevent strikes during the construction of the New York & Portchester Railroad, the road's management and a committee of the Central Federated Union are negotiating for an agreement for three years on the same basis as the agreement between the Rapid Transit Commissioner of the Central Federated Union and the Rapid Transit Contractors' Association. The latter agreement covered all the work in the building of the subway until it was completed. The agreement between the central body and the contractors for the construction of the subway was drawn up after a general strike had taken place some time after the work started, and enabled the contractors to complete it much sooner than they would otherwise have done.

CURING SEASICKNESS.—A curious chair invented by Dr. C. Brendal, of Tchupeakowka, Russia, has recently been under test on the Hamburg-American liner *Patricia*, plying to New York, and on the English Channel steamer *Peregrine*. It is described in the *Scientific American*. The invention consists essentially in making the movements of the ship when pitching, rolling, heaving, and setting less felt by the passengers, by providing special chairs, couches, or a whole platform forming part of the deck, and giving to these, either by machinery or by hand, short up and down movements. Consequently, as the long movements of the vessel are thus changed into a great number of short motions, which are constantly interrupted by brief movements in an opposite direction, the causes producing seasickness are counteracted. The device, which is illustrated, consists of a chair with the seat movably arranged with respect to the legs, arms and back. The short up and down movements are given by a small electric motor located between the legs of the chair, and connected by means of a belt with an eccentric actuating the seat. The speed and intensity of the movements can be regulated between considerable limits by means of suitable devices incorporated in the mechanism. A number of passengers, who have tried the device, declare that while they were in the chair, they felt no symptoms of illness, but when no longer using it, the seasickness in some cases at once returned, although not in others.

ST. LOUIS STREET RAILWAYS carried 170,000,000 passengers in 1905, a figure that was only exceeded by 30,000,000 in the phenomenal year of 1904, when the Louisiana Purchase Exposition was held there.

NIAGARA WATER.—At Washington on January 19 Representative Burton, of Ohio, introduced a joint resolution asking for an early report regarding the use of the water flowing over Niagara Falls. The report is requested from the United States members of the International Waterway Commission.

ELECTRIC AUTOMOBILES.—In connection with the two great automobile shows, the New York Edison Company did an effective bit of advertising by directing attention to the facilities furnished by such a central station supply as its own. Nearly all the uptown stables and garages have Edison charging service, and the company itself has no fewer than 50 electric automobiles in use, including runabouts, delivery wagons and trucks.

PORTO RICO BY WIRELESS.—Gov. Winthrop, of Porto Rico, American West Indies, has acknowledged the receipt of the first paid wireless message between New York City and Porto Rico. It was sent on January 6 and received the same night, although owing to an absence of inland facilities it was not delivered at the Executive House until next morning. The message was sent through the Manhattan Beach station of the Atlantic De Forest Wireless Company as a test.

OLIVER UP AGAIN.—In the New York Legislature at Albany, N. Y., on January 19, the distinguished statesman and patriot, Assemblyman Oliver (Dem.), New York, introduced a series of bills, two of which provide for municipal ownership in cities of the first class. He declared that he had introduced these bills when he was in the Assembly in 1898. One provides for city ownership of lighting facilities, the other for that of street railroads, surface, elevated and underground.

CHICAGO MUNICIPALISM.—At Chicago, on January 18, the City Council, in special session, did all it could to advance the municipal ownership plans and passed the rest on to the people. The franchise extension ordinances were laid away to rest, with no chance of an awakening, at least until after the April election. As the traction situation stands now, the voters of Chicago will have to decide irrevocably next April whether or not they want to borrow $75,000,000 and go into the street railway business or leave it to private enterprise, under proper control and regulation.

ENDOWMENT FOR SCIENCE.—By the terms of the will of W. C. Putnam, the Davenport (Iowa) Academy of Sciences becomes prospectively one of the most richly endowed institutions of its kind in this country. Mr. Putnam left an estate of $700,000 with provisions for limited incomes to relatives, the remainder of the revenues to be paid to the academy and the entire estate to go to that institution at the death of the surviving brothers and sisters. His art collection and library, each the most valuable private collection in the State, are left to the academy, with provision for a fire-proof building in which they are to be installed. Mr. Putnam had been a leading financier and business man of Davenport for years.

NOVEL CONCILIATION.—The announcement is made that the presidents of the Chambers of Commerce of Troy and Albany have been elected members of the boards of directors of the United Traction Company of Albany. They were, so to speak, made ex-officio members of the board, it being arranged that their successors in the presidencies of the Chambers should succeed them in the board of the United Traction Company. The Delaware & Hudson Company recently purchased absolute control of the United Traction Company of Albany, partly, it was understood, for the purpose of forestalling keener competition between the railroad and the suburban electric lines of the United Traction Company. To maintain harmonious relations with the public, the railroad company has included these two representatives of the business interests of Troy and Albany who may be expected to present the public's side of all questions which may come before the board of the United Traction Company. It will be interesting to see how this plan works out in practice.

ELECTRIC FREIGHT HAULAGE.—The Massachusetts Electric Company is preparing to enter the freight and express business and has secured the consent of various cities and towns between Fall River and Boston and many on the North Shore. It has now taken the matter before the railroad commissioners for their approval. On the South Shore, Brockton alone will give the Old Colony Street Railway Company a large express business in the shipment of leather from Boston and Fall River to the Brockton factories and the reshipment of shoes to both cities. On the North Shore the Boston & Northern Company can effect a large saving in the transportation of its coal from tidewater to its power houses instead of paying heavy freight rates to the Boston & Maine Railroad. There are also prospects of a large and remunerative business awaiting the inauguration of a general freight and express service on the North Shore.

WIRELESS STATION AT SEAGATE.—The Marconi Wireless Telegraph Company has announced the opening of a new station as a part of the gatehouse at Seagate, the summer resort at the northern end of Coney Island. Outside it is a mast 150 ft. high, from which the wires are strung, and which lead into the operating room. The station is connected with all points in the United States by telegraph lines, and the Marconi apparatus is of the latest pattern, and provided with a new attachment to prevent interference by any other wireless system. The station has an effective forwarding range of 200 miles. Its receiving apparatus is capable of handling messages from any distance. The new station forms the final link in the chain of stations whereby all the big Atlantic liners are in communication with shore uninterruptedly for between 60 and 70 hours from their New York docks. Incoming vessels first get into touch with Cape Race, Newfoundland, when 1,500 miles away from Sandy Hook. Before they lose touch with Cape Race they have picked up Sable Island, off the Nova Scotia coast; before dropping Sable Island they have opened communication with Siasconsett, and then they are successively in communication with Sagaponack, Babylon and Seagate. Outgoing steamers reverse this process.

FIVE-CENT TELEPHONES.—Not later than July 1 this year the New York Telephone Company will put in effect a five-cent pay station rate in Manhattan and Brooklyn as against the present pay station rate of 10 cents. The five-cent rate will become operative in both boroughs at the same time, and the only reservation that will be made will be at hotels, where the hotel management itself holds to the present ten-cent rates for service from rooms and apartments. Addressing some 400 local representatives of the Bell system in the New York territory, assembled at dinner last week, Mr. U. N. Bethell, general manager, said: "The great element that has rendered the reduction of rates possible has been the condensation of the New York business by the increased number of exchanges or central offices and the consequent decrease in the distance of the subscriber from his central office. This has tended to reduce the cost of maintenance and has increased the efficiency of the service. Now, regarding opposition companies, I do not want to blind my eyes to the fact that the Bell companies have opposition in many places, but I do not believe the day ever will come when the public will, for any length of time, tolerate the existence of two telephone companies in the field because of the annoyance, and the expense of double service. The only advantage to the public from an independent company is that the independent company makes the older company more regardful of the rights of the public and of the duty the company owes to the public. Since I have been connected with the New York company it has continued to do business just as though it had a competitor on the same block and doing business on equal terms."

FOR A CANADIAN ROAD.—It is stated from Toronto, Canada, that the Temiscaming Railway Commission have recommended the advisability of electrifying the Temiscaming & Northern Railway, which is owned by the government, for the entire distance so far constructed, about 151 miles. It is proposed to obtain the power from the water falls along the line of the road.

MICA IN PERU.—It is stated that several veins of mica have been discovered at Quilca, a small port on the coast of Peru, situated but a few miles from Mollendo, and that a syndicate headed by the firm of Carlos Aramayo has been formed to exploit the discovery. It is thought that the Peruvian mica will bring a high price, as it is almost as transparent as glass and in large sheets.

ELECTRICITY IN SPAIN.—U. S. Commercial Agent Milton M. Price, of Jerez de la Frontera, reports the building of an electric railroad in that section of Spain. He says that there are no railroads being constructed in Andalusia. Some years ago a route was surveyed and estimates made from Jerez to Algeciras to save 100 miles of travel by the present railroad, and another was projected to two cities 40 or 50 miles from here, but no construction company has yet been formed. They are now building an electric tramway from Cadiz to San Fernando, a distance of 10 miles, and it is proposed to run the track around the city of Cadiz. Other Spanish enterprises of a similar character have been noted in these pages recently.

INVESTIGATING UTILITIES.—Marwick, Mitchell & Co., chartered accountants, have been appointed accountants to the committee of the National Civic Federation, which is to make an exhaustive examination in the principal cities of this country and of Europe, in order to determine whether it is profitable for municipalities to own their own public utilities. The investigation will include an examination of the accounts of the principal gas, electric light, water and street railway plants, whether privately owned or at present owned by the municipalities in which they are situated. It is expected that the work will start without delay. The cost of the work is being defrayed by general subscription.

PROTECTION AGAINST GRAFT.—At Albany, N. Y., on January 17 Senator Marks' Anti-Grafting bill was reported by the Senate Committee on Codes. The bill provides that every corporation such as gas, railroad, light, power, telephone, public service, transportation and financial companies must within ninety days after the adjournment of the Legislature file with the Secretary of State a sworn and detailed statement of all expenses incurred or paid in connection with the employment of attorneys, counsel or legislative expenses for promoting or opposing legislation. Senator Marks believes this publicity will prevent lobbying and grafting. The word "grafting" has been stricken out of the measure.

BROOKLYN MUNICIPAL TROLLEYS.—Borough President Bird S. Coler, of Brooklyn, proposed that the city shall make an actual beginning in the matter of municipal ownership of street surface railroads. Mr. Coler plans that the city shall lay and own tracks in Livingston Street, Brooklyn, when that thoroughfare is widened, and lease them for short terms to the local railroad companies. Livingston Street is to be widened to relieve the congestion of travel in Fulton Street. Already the Brooklyn Rapid Transit Company has applied for the privilege of laying and using tracks on the widened street. Mr. Coler asserts that Livingston Street is the "only remaining key to the city railroad situation in Brooklyn." In a letter which he sent to Engineer Nichols, of the Franchise Bureau, he disapproved of the Rapid Transit Company's application and urged that the city construct the road, leasing it for periods of one or two years to any company desiring it.

THE VICTORIA FALLS PROJECT.—In a letter to the London *Times*, Mr. W. B. Esson after discussing some of the controverted points relating to the project for transmitting power 700 miles to the Rand from the Victoria Falls of the Zambesi, concludes that from all of the data so far at hand, there is no reason for believing that the proposal to utilize the falls on an 80,000-hp scale is economically sound, and that its realization would be commercially successful. He estimates at $5,000,000, the cost of a line to transmit 20,000 hp, and at $20,000,000 the line for transmitting 80,000 hp, including provision for spare conductors. The annual cost of the latter would, at 10 per cent, be $2,000,000, while the coal and water bills of a steam station of the same capacity would be $2,217,500.

BURROWING IN BROOKLYN BOROUGH.—Deputy Commissioner of Water Supply Cozier, of Brooklyn, is perfecting a scheme by which the city will be able to give important information to corporations and contractors regarding sub-surface construction in that borough. The plan has been drawn up by Electrical Engineer H. S. Wynkoop. The deputy commissioner says: "Mr. Wynkoop's plan contemplates an expenditure of $150,000 to secure a revenue of $50,000 per annum. It gives information quickly and reliably; it does away with guesswork and enables the municipal engineers to draw their specifications so closely that contractors may submit the lowest bids possible for the actual work to be done; it conserves what little space remains beneath our roadways; it insures the greatest dispatch in opening and closing the streets. Municipal engineers, contractors and corporation officials are united in their advocacy of the proposed plan."

REDUCTION OF PRICE.—With regard to the effect of the reduction in the price of current to 10 cents the kilowatt-hour, a question raised in the *New York Times*, Mr. Arthur Williams, general inspector for the New York Edison Company, produced data gathered by his clerks. Comparisons were made in batches of fifty patrons in different localities. The chief object was to see whether these patrons were adding to their consumption of current. Fifty customers in the East Sixties showed a reduction in the bills amounting to 25 per cent. In another section an increased consumption of 12 per cent was shown, with a decrease in the bills of 19 per cent. Fifty west side houses showed an increased consumption of 11 per cent, and a decrease of 22 per cent in the bills. Another batch of fifty patrons showed that there was less than 1 per cent increase in the use of electricity, and that the decrease in the money paid the company was fully 33 per cent. The New York Edison Company is making good this situation by a vigorous and strenuous campaign for new business, and its reports show a banner month of new contracts in December.

EFFECTIVE JOURNALISM.—Last November we called attention to the spirited manner in which Mr. J. C. Donnell, of the Maryville (Mo.) Electric Light & Power Company, had fought the battle for his company against outside promoters by means of a daily paper of his own publication called the *Gas News*. A recent note from Mr. Donnell says: "In order to round out the work and eliminate completely any further efforts of the kind on the part of the city council and their official organ, I found it necessary to issue a sequel to the *Gas News* and named it *The Searchlight*. One issue of that completely closed up the official organ. Not a word has appeared in that paper since against the light company, and now after waiting thirty days to hear from them I now take pleasure in mailing you a copy of the *Searchlight*, which will, I presume, be the last issue. I might say that we hold the city contract, draw our pay promptly the first of every month and are not afraid of any gas proposition on earth. I might add that the editor of the 'official organ' called at my office after the issue and ordered his private residence wired and equipped for electric lights; also his printing establishment. I find him a very profitable customer." Mr. Donnell is to be heartily congratulated upon the outcome of his plucky and ingenious fight.

The Hydro-Electric Plant of the City of Sofia, Bulgaria.

By FRANZ KOESTER.

FOR supplying electricity for light and power in the city of Sofia, Bulgaria, the water of the river Isker is utilized. The present hydraulic installation is for 2,000 hp, but by tapping the river at a higher point, and installing another conduit, 3,000 horsepower becomes easily available. At the lowest stage of the river it would be possible to store at the upper dam 15,000 cubic meters (5,300,000 cu. ft.) of water. The average discharge of the river is 5 to 6 cubic meters (176 to 222 cu. ft.) per second. The dam is of solid masonry, and is provided with two waste gates, as shown in Fig. 1. A few yards above the waste gates in bulkhead are the two head gates for the supply tunnel, which is 1,100 meters (3,600 ft.) long, 2.50m. deep (8.2 ft.) and 2m. (6.56 ft.) wide.

About 25m. (82 ft.) from the head-gates, there is an overflow in the tunnel, a rack for catching foreign matter, and a discharge gate for emptying the tunnel. The tunnel has an arched roof with straight sides and bottom, being cut to a grade of 2/10 per cent. At the end of the tunnel is a building large enough to accommodate the present penstock and the additional penstock which would be required for the second installation. This water-house contains a waste weir, an inlet gate to the penstock and a fine rack. The penstock is built especially strong for high pressure and is of riveted steel plates, 5 to 8 mm. (.197 to .305 in.) thick. Of course, the 5 mm. plates are used on the upper end of the penstock where the pressure is least. It is built in sections 6m. (19.6 ft.) long, and 1.4m. (4.6 ft.) diameter. Before the penstock enters the power house it is supplied with a butterfly gate, and enters a manifold, from which branch pipes lead to the turbines.

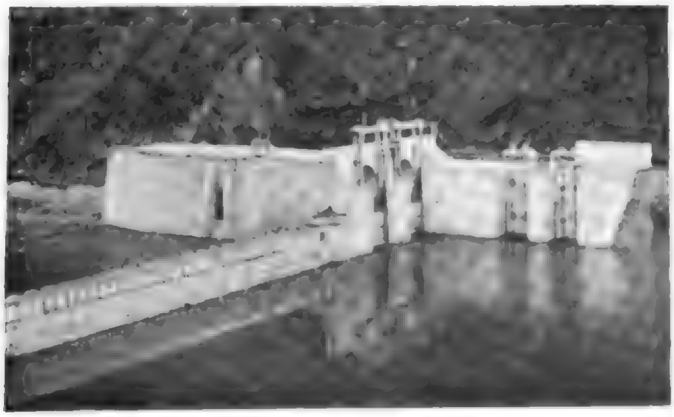


FIG. 1.—DAM AND BULKHEAD.

The power house is located 22 km. (13.7 miles) from Sofia. It is built of birch, and is 12.5x30m. (41x98.4 ft.) and designed to accommodate six hydro-electric units, four of which are now installed. At the side of the power house is a switch-room 4.8x9.9 m. (15.7x32.4 ft.). Near the power plant is a two-story building, the first floor of which is used as a repair shop, and the upper story as the dwelling of the superintendent.

The turbines, shown in Fig. 3, are designed for a working head of 52 to 55m. (170.5 to 180.4 ft.) to use 960 to 910 litres (249 to 236 gallons) of water per second, and at a speed of 400 r.p.m. to develop 500 horsepower, at an efficiency of 75 per cent. They are of the horizontal radial outside discharge type, and are placed on a floor above the basement containing the penstock manifold. The water is conducted up through the main floor and enters the side of the turbine. Draft tubes which conduct the discharge to the tailwater below are well submerged.

This type of turbine, made by Piccard & Pictet, of Geneva, has the advantage of giving uniform power under varying heads of water supply. A cylinder gate between the stationary part and the runner, which controls the speed of the turbine, is water-balanced, so that it operates easily and noiselessly. This may be controlled by hand or by a motor, which in turn is controlled by a centrifugal governor.

Each turbine is provided with a fly-wheel, and is direct-connected to the generator by means of a flexible insulating coupling. The generators, which are of the Oerlikon type, have an output of 425 kw at 400 r.p.m., 53 cycles, 8,000 volts. Each rests on 44 porcelain insulators. The revolving part carries 16 laminated pole pieces. The field coils are made up of 110 turns of 7 mm. copper wire. The stationary armature has 48 open slots, in which are the armature coils, each of 65 turns of 3.4 mm. copper wire, placed in seamless mica tubes. The generator is well ventilated by openings in the frame. As the stationary armature is all cast in one piece, the bed plate is so constructed that the armature may be moved to one side for access to the revolving part. The main shaft bearings are cast on the bed plate. Each generator is provided with its own exciter of 90 kw, 50 volts, mounted on the overhanging main shaft.

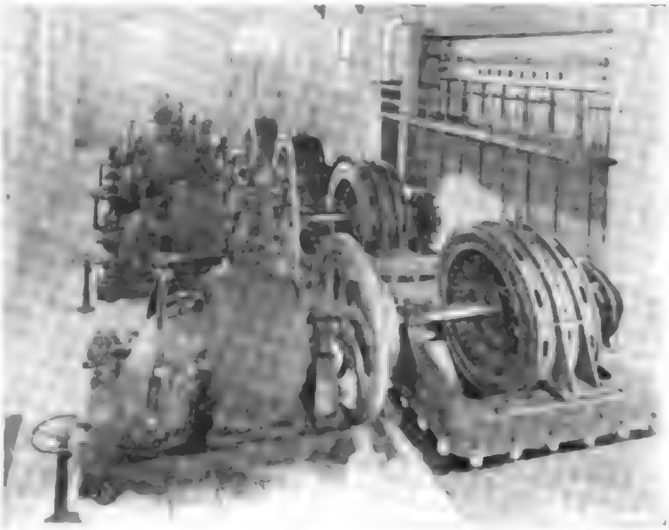


FIG. 2.—VIEW OF INTERIOR OF SOFIA POWER HOUSE.

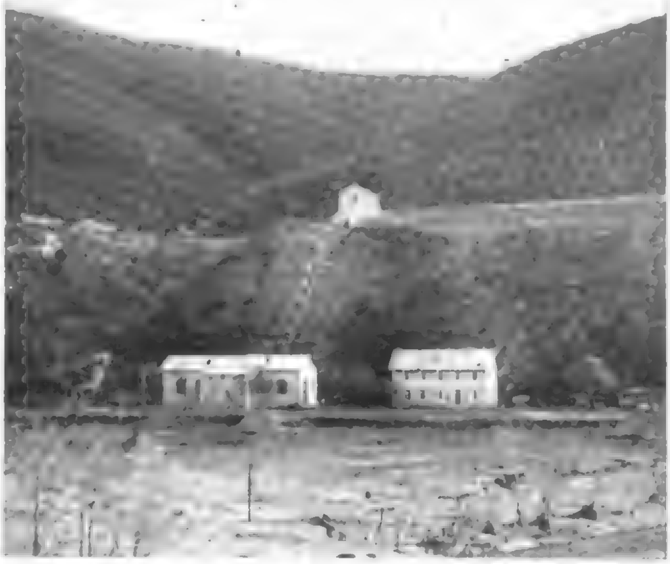


FIG. 3.—POWER HOUSE, PENSTOCK AND SUPERINTENDENT'S HOUSE.

Aluminum bars mounted on porcelain insulators conduct the current from the generators under the floor through accessible tunnels to the switchboard. The switchboard consists of an iron frame, having a gallery placed about 7 ft. above the floor, for giving access to the front of the marble slabs which are carried on the upper part of the frame. On the gallery are mounted levers for the switches of the high-tension circuits, both from the generators and for the main line wiring, and also stands with hand-wheels for the rheostats. Above each stand are the necessary switchboard instruments, mounted on the marble slabs. One panel on each side of the switchboard is reserved for the further enlargement of the plant. At the extreme left are the instruments controlling the main line wires, while on the extreme right are the necessary instruments for connecting the generators in parallel, with accompanying phase lamps and voltmeter switches.

The generators work on a ring bus-bar system, Fig. 4, having switches so placed that the cutting out of any generator will not disturb the operation of the others. The entire system is provided with horn lightning arresters.

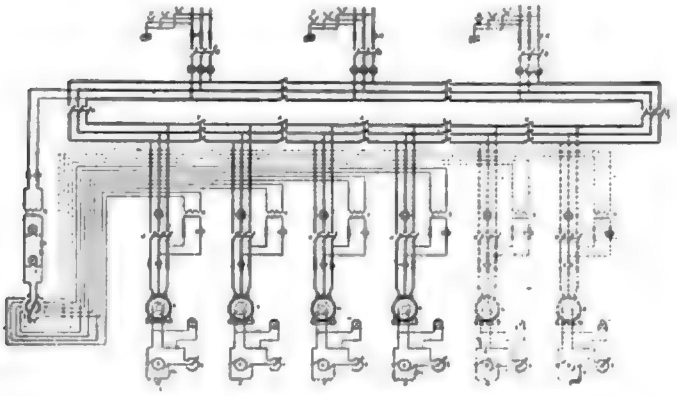


FIG. 4.—BUS-BAR SYSTEM, SOFIA POWER PLANT.

Both power and lighting circuits consist of 8-mm. wires run on double petticoat porcelain insulators on wooden poles. The whole length of the circuit is 16.2 k m. (10 miles). Around the outskirts of the city is placed a system of transformers with a total capacity of 400 kw for reducing the e.m.f. from 7,200 volts to 156 volts for lighting. The secondary circuits in the city are run underground and are fed from 5 transformer stations of 260 kw capacity, which are supplied with current at 3,400 volts from a main transformer station in the outskirts, where the tension is reduced from 7,200 volts.

The contract for power house, transformer station and the entire electrical equipment was given to the Oerlikon Maschinenfabrik, Switzerland, which built and installed the generators and other electric work, and sublet the masonry and the turbines.

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Nitrogen from the Atmosphere.

At the inauguration of the new chemical institute of the Technische Hochschule in Berlin, Prof. O. R. Witt gave some interesting information regarding recent developments in connection with the production of nitrogen from the air by electrical means. According to the *Elektrotechnischer Anzeiger*, the professor said that the greatest progress had been made in Norway, where Prof. Birkeland, assisted by Herr S. Eyde, had developed a commercial method of producing nitrogen, using an arc elongated by a magnetic field and an e.m.f. of 5,000 volts. Experiments were first started with a 20-hp plant in 1903. After experimenting with plants of small size the inventors built the first factory at Notodden in May, 1905. The equipment consists of three furnaces, each consuming 700 hp, and all three combined deal with 75,000 litres (2,650 cu. ft.) of air per minute. Before entering the furnace, the air is mixed with nitric oxide which gives it an intense brown color. After passing through the furnaces the gases are led to stone towers (having a capacity of 8,800 gallons each) where nitric acid is formed. Copper tubes are used as electrodes, being cooled by a water circulation. It is stated that plants of less than 5,000 hp are not commercial; in fact, it would seem that installations of less than 20,000 hp are also doubtful in this respect, even if the power be very cheap.

The Electrical Distribution System of the Public Service Corporation of New Jersey.—III.

(*Concluded.*)

By G. U. G. Holman.

CENTRAL JERSEY.

THE important plant in Central Jersey of the Public Service Corporation is at Metuchen, supplying sub-stations in Rahway, Carteret, Perth Amboy, New Brunswick, Bound Brook and Plainfield. Each of these sub-stations replaced generating plants which in general consisted of countershafting and old type generators with slow speed simple engines, or small units driven from simple high-speed non-condensing engines. The locations of all these plants made it necessary to cart all the coal used at a cost of from 28 to 40 cents per ton, and every one except Bound Brook was obliged to buy water for the boilers.

The Metuchen station consists of two 1,000 kw Curtis-General Electric turbo-generators, 13,200-volt, three-phase, 60-cycle; two S. K. C. 500-kw, 6,600-volt, three-phase, 60-cycle generators, direct connected each to a Pennsylvania cross-compound condensing Corliss engine; three Stanley 50-kw, 6,600-2,300 volts, three two-phase, 60-cycle, oil-cooled transformers; two three-phase, 500-kw, 60-cycle transformers for stepping-up the Stanley generators to the bus-bar 13,200 voltage, and one 300-kw, three-phase, 60-cycle rotary, transforming to 600 volts direct current. There are two 600, one 700, and two 800-hp Climax boilers at 150 lb. pressure.

The transmission pressure from this station is 13,200 volts, local service being carried by 2,300 volts from step-down transformers. The line is most substantial throughout this district, Hemingray insulators being used. The feeders vary in length from 4½ to 9½ miles, and are given two transpositions at one-third and two-thirds the distance covered by each particular feeder. All the feeders are overhead, except those in New Brunswick, which are carried on the stone work of a bridge over the Raritan River at this point, then through a three-conductor steel-armored submarine okonite cable under the Delaware and Raritan Canal which parallels the Raritan River. On the New Brunswick side of the canal the line feeds underground through okonite single-conductor lead-covered cable, each drawn in a separate conduit to the sub-station about 550 ft. distant. The whole underground and under-water system is provided with oil switches and in duplicate, thus making it possible to carry the whole load on either set entirely independent of the other in case of accident.

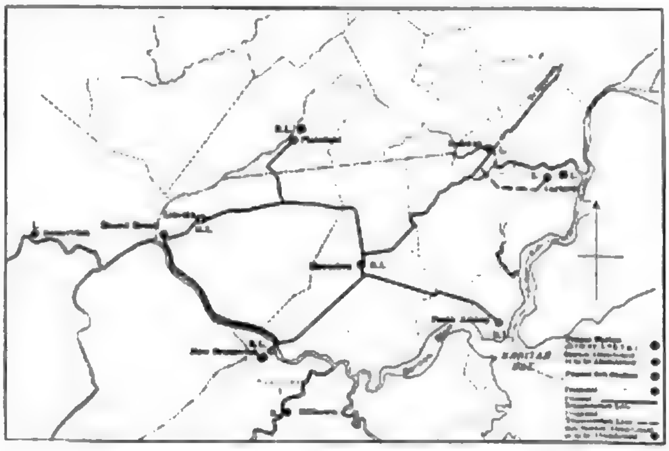


FIG. 1.—MAP OF CENTRAL JERSEY SYSTEM.

The Carteret station, superseded by the sub-station of the same name, was a non-condensing plant. It did not produce its own steam, but purchased it from a neighboring manufacturer. It consisted of two General Electric generators, of 37½ and 19 amperes respectively, of a voltage of 2,300. The larger generator was direct connected to an Ames Iron Works engine. The smaller generator was belted to the same engine.

The Carteret sub-station is to be fitted up with step-down transformers 13,200 to 2,300 volts, and supplied from the Metuchen station.

The Rahway sub-station contains four Stanley transformers for light and power, 6,000-2,300 volts, three to two-phase, 60-cycle of 50 kw each; and one Westinghouse 200-kw, two-phase, 60-cycle rotary, producing 550 volts direct current for railway service.

The Perth Amboy sub-station contains two General Electric 300-kw three-phase, 60-cycle rotaries, giving 600 volts direct current for railway supply; six Stanley 6,000-2,300-volt, three to two-phase, 60-cycle transformers of 50 kw each for incandescent lighting service; and three General Electric 31-kw Tub transformers for arc light service, 6,200 volts, three to two-phase, 60-cycle. The three to two-phase connection is used to obtain a balance of the transmission independent of the number of transformers employed.

The New Brunswick sub-station contains one 200-kw Westinghouse rotary for light and power, 2,500-volt, two-phase, 60-cycle; two 30-kw and two 50-kw Stanley transformers 6,000-2,300 volts, three to two-phase, 60-cycle; and three General Electric 30-kw., three to two-phase, 60-cycle Tub transformers used for street arc lighting.

The Lincoln sub-station now supplying Bound Brook and vicinity is to be disbanded and moved to Bound Brook. It now contains one Westinghouse 200-kw and one General Electric 200-kw rotary, each of 60-cycle, three-phase, of 550 and 600 volts respectively, supplying railway lines. There are also two Stanley 50-kw, 6,000-2,300-volt, three to two-phase, 60-cycle transformers for supplying light and power; and three 10½-kw, 2,300-volt General Electric static transformers, single-phase, 60-cycle, for supplying incandescent street lighting.

The Plainfield generating station is to be abandoned and used as a sub-station, additional transformers and rotaries replacing existing steam-driven units. These latter now are two 350-kw Westinghouse 1,150-volt, two-phase, 60-cycle generators, each direct connected to a vertical cross-compound Ball & Wood condensing engine; one 120-kw Westinghouse 1,150-volt, two-phase, 60-cycle generator belted to a Westinghouse compound condensing engine; and one 225-kw Westinghouse 550-volt direct-current railway generator direct connected to a Westinghouse compound condensing engine. The present transforming apparatus which is to be added to, consist of two 200-kw General Electric rotaries, three-phase, 60-cycle, for supplying 600-volt direct current for railway use; and two 100-kw General Electric rotaries 6,600-1,150-volt, three to two-phase, 60-cycle for supplying lighting circuits. The boiler equipment to be discarded is of two 300 and two 200-hp Stirling, and two 250-hp Cahall boilers, at 150 lb. pressure.

The Somerville station, about to be abandoned and its circuits taken over upon the new Bound Brook sub-station, consists of two General Electric 90-kw, 1,150-volt, three-phase, 60-cycle belted generators run by a 150-hp Ball & Wood cross-compound non-condensing engine.

The plant at Milltown is entirely a direct-current railway station and is to be retained as an independent station to supply railway feeders. It comprises two Westinghouse 225-kw, 550-volt generators, each belted to an horizontal cross-compound Cooper & Company condensing engine; a 500-kw, 550-volt Westinghouse generator direct connected to a vertical cross-compound Ball & Wood condensing engine; a Bullock 100-kw series booster of 250 volts, direct-connected to an horizontal Ball & Wood simple condensing engine; one Westinghouse 300-kw, 360-volt, 25-cycle generator direct connected to a vertical cross-compound Brown-Corliss condensing engine; and two 50-kw motor-generator sets, one of 550 and the other of 250 volts, used as a booster and getting its energy from the 360-volt, 25-cycle generator. The boiler equipment is six horizontal return tubular 125-hp boilers, at 125 lb. pressure, four made by Currier & Sons, and two by McCabe.

Thus the Central Jersey system, at the moment consisting of five central plants and three sub-stations, will shortly be supplied from two plants and seven sub-stations, and the light and railway plant—Metuchen—will be connected with the plants of the Northern New Jersey system by means of the tie feeders from the sub-station at Rahway to be run to Elizabeth, the latter already being connected with Newark.

In suburban communities with many shade trees and scattered residences as are found throughout the territory supplied by the Public Service Corporation the subject of street lighting and the kind of light to adopt has been and is a problem. The incandescent light is most desired by municipal officials as giving the best distribution of light for the money and surburban places have not the money at their disposal like the cities.

The systems of incandescent street lighting used are various at the present time. There is the shunt-box system using a multiple lamp with the shunt in parallel; the series system using series lamps with film cut-out in the base of the lamp; the series system using a multiple lamp, with lamp as shunt and film cut-out in the fixture; the series system, using a multiple lamp with film cut-out in the socket.

The Junction sub-station, fed from Marion, is a new one, having one 1,000-kw, General Electric, 13,200-volt, 25-cycle rotary, producing 550-volt direct current for railway service.

The Bayonne sub-station contains one 1,000-kw and one 500-kw, General Electric, 13,200-volt, 25-cycle rotary, giving 500 volts direct current, feeding railway lines. There are also four 150-kw, General Electric static transformers, 13,200, three-phase to 2,300-volt, two-phase, for lighting.

SOUTH JERSEY SYSTEM.

The present South Jersey system of the Public Service Corporation consists of the lighting stations at Trenton, at Bristol and at Mount Holly, together with the light and railway plant at Camden and the sub-stations supplied by the Camden plant at Moorestown, Merchantville, Haddonfield, Gloucester and Woodbury. The Gloucester sub-station is only now replacing the old plant at that point.

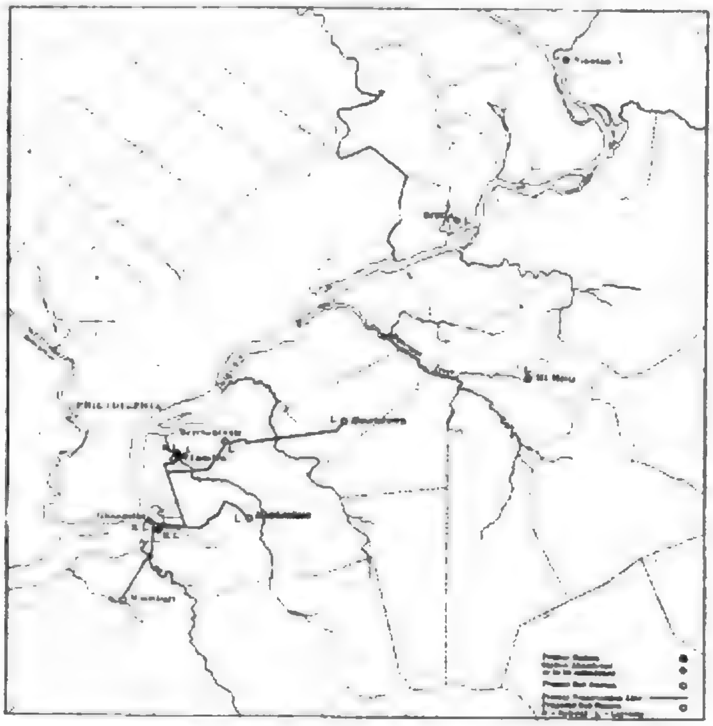


FIG. 2.—MAP OF SOUTH JERSEY SYSTEM.

The plant at Trenton contains three Stanley 500-kw, 2,500-volt, two-phase, 60-cycle generators, each direct-connected to a cross-compound Pennsylvania Iron Works condensing engine of 800 hp; two Northern Engineering 194-kw, 264-volt, direct-current generators, used for power service, each coupled to a synchronous two-phase, 2,400-volt motor, and one Brush arc of 14.8 kw and one General Electric arc machine of 39.6 kw, both belted to a 200-hp, cross-compound, non-condensing Ball & Wood horizontal engine. There is one General Electric, 260-volt, 100-kw, direct-current generator as a spare unit, belted to the Ball & Wood engine. There are four Babcock & Wilcox boilers of 300 hp each, at 125 lb pressure, and a Berry fire-tube, 300-hp boiler, also at 125 lb pressure.

The Bristol plant contains two 60-kw, General Electric; three Westinghouse of 45 kw, 35 kw and 25 kw, respectively, all five 125-cycle, 1,100-volt generators, belted to jack shaft driven by one Westinghouse compound, 100-hp, and two standard Westinghouse engines of 80 and 45 hp. All the engines are non-condensing. The boilers are one Warden return-tubular, 100-hp; one 150-hp Charles Ervien, and one 80-hp Hoff & Fontain.

The Mount Holly station is a 110-volt Edison plant of four 25-kw and two 12½-kw Edison bipolar machines, belted to two high-speed Armington & Sims engines of 80 and 25 hp and an Ames high-speed, 80-hp engine. All are non-condensing. There are two horizontal tubular Centerville boilers of 100 hp each, at 125 and 90 lb., respectively.

At Camden there is a railway plant and a lighting plant, now consolidated into one. The railway end is provided with one General Electric, 200-kw and one Westinghouse, 225-kw, 550-volt, direct-current generator, each belted to one of two vertical cross-compound condensing Ball engines; two Westinghouse, 800-kw, 550-volt generators, each direct-connected to a Pennsylvania Iron Works horizontal cross-compound condensing engine, and one General Electric, 600-amp., 100-volt booster, driven by a direct-current, 500-volt motor on same shaft.

The light and power end contains two 1,000-kw Parsons horizontal steam turbo-generators, 11,000-volt, 60-cycle, three-phase, supplying the sub-stations at Gloucester, Woodbury, Moorestown, Haddonfield and Merchantville. The station also consists of transformers to supply 2,200 volts alternating current for lighting in Camden, and for alternating-current arc lighting. The boilers are six Babcock & Wilcox, of 250 hp each, at 200 lb., for supplying the new turbines; and four 150-hp horizontal Coatesville boilers, at 120 lb., and six vertical fire-tube Berry 300-hp boilers, at 120 lb. pressure. The units just replaced are five 72-kw, Thomson-Houston arc machines; one Westinghouse, 100-kw and one Thomson-Houston, 62-kw, 550-volt, direct-current generators, used for power, and 1,240 kw in ten General Electric, Thomson-Houston and Stanley 1,100-volt, 125-cycle generators. The displaced engines consist of one Cooper 1,000 hp, one single-cylinder, vertical, Corliss, 700-hp; three Westinghouse, compound, 250-hp; two single-cylinder, Buckeye engines of 150 and 250 hp, and one tandem compound, 400-hp, Harrisburg engine. All the engines were belted. The discarded boilers are two 500 and two 200-hp, double-deck, horizontal Coatesville boilers, at 115 lb., and three vertical, fire-tube, Berry boilers of 330 hp each.

The Gloucester plant supplying the railway consists of three Westinghouse, 225-kw, 550-volt generators, each belted to a 250-hp Westinghouse compound engine. Arc lights are run by five Wood arc machines of 25 kw each, belted to a line shaft which is driven by a 200-hp Wetherill Corliss engine.

The sub-station section of the Gloucester plant consists of a 40-kw Pittsburg, 11,000 to 2,200-volt transformer, distributing incandescent lighting.

The Woodbury sub-station has a 40-kw Pittsburg transformer, 10,000 to 2,000 volts for incandescent lighting only.

The Moorestown sub-station contains one Stanley 60-kw, 11,000 to 2,200-volt transformer for incandescent lighting. There are also two constant-current, General Electric regulating coils of 10½ kw each, 60 cycles and 5.5 amp., for series incandescent street lighting.

Haddonfield has two 100-kw General Electric, 11,000 to 2,200-volt transformers. There are also two General Electric constant-current coils of 10½ kw each and 5½ amp. and two constant-current transformers of 60 kw each and 5½ amp., used for series incandescent street lights; also one constant-current General Electric transformer, 7½ amp., for series arc lighting.

The Merchantville sub-station contains a General Electric, 60-kw transformer, 11,000 to 2,200-volt; a constant-current reactive coil, 60-cycle, 10½ kw and 5.5 amp., for series incandescent street lighting; and one 4.4-kw, General Electric compensator, also series incandescent street lights.

In Camden there are two storage batteries on the railway circuits, a 300-amp. battery on Delaware Avenue and a 100-amp. battery at Westmount. Attached to the railway line at Moorestown is a 200-amp. battery.

Some of the plants now under the charge of the engineers of the Public Service Corporation have been in their care for so little time that changes to produce greater economy and more concentration of central power stations have not yet been perfected. There is room for great improvement along these lines to which the engineers are fully alive, so that in a comparatively short time one may expect to see the simplicity of perfection where now the complexity of the present situation is exposed to view.

This account would not be complete without mentioning the fact that the Corporation has its own central telephone exchange with private wires to all its offices, stations and sub-stations, insuring perfect service for intercommunication on company business. The uniform courtesy extended to the writer by the officials and employes of the Public Service Corporation whom he met in his search for information is appreciated and herewith acknowledged.

Burglar Insurance in Dubuque.

L. D. Mathes, general manager of the Union Electric Company, of Dubuque, Iowa, followed up an epidemic of burglary in that city with a circular worded:

"BURGLAR INSURANCE—WE SELL IT."

"Not in the form of a written policy, but something more effective and more dreaded by the Knight of the Dark Lantern. The all-day and all-night service of

"THE MATCHLESS LIGHT."

Then follows a quotation from the article in the November *Ladies' Home Journal*, in which an ex-burglar says: "Other things being equal, a burglar will always pass a house lighted by electricity for one lighted by gas. The reason for this is that houses lighted by electricity are now wired in such a manner that the turn of a switch or the pressure of a button on one floor will illuminate another floor. Then, electrically-lighted houses are much more likely to be equipped with modern burglar alarms. Houses so wired are practically traps for the burglar. He may be working on the ground floor, for example, when some member of the household in a chamber above is aroused and fancies that he hears some one moving about below. At once the man of the house reaches for the electric switch and turns on the light for the lower floor, so that the burglar finds himself in a blaze of light, while the man of the house, a gun in his hand, is screened by the darkness. This puts the householder in a position to shoot without being shot at."

The circular then continues: "The above is of immediate local interest due to the following related occurrence: 'Two K's of the D. L., gentlemanly or otherwise, recently conducted an inventory of the possessions of one of our prominent citizens, appropriating such of the family plate as appealed to their artistic temperament. The spirit of annexation being not entirely satisfied, the nocturnal visitors proceeded to invade the establishment of a second well-known family. The head of the house from a second-story bed chamber was alarmed, reached for the electric button—a twist of the wrist—a flood of light and a hasty get-away, minus booty.'

"This protection is offered to every householder—is also suggested to merchants for the illumination of the subterranean passages in the rear of their stores (more generally known as alleys), and their valuable stocks. The automatic time switch will cut the lights in and out at any predetermined hour. Details and estimates upon application."

Mr. Mathes reports that he has had several inquiries as a result of this circular and has wired the rear of three stores for 16-cp lamps on goose-neck fixtures.

In another circular this company has recently sent out, the announcement is made that arrangements have been completed whereby the Union Electric Company will obtain each month and mail to those interested a limited number of copies of the *Electric City*, published by the Chicago Edison Company as a substitute for *Illustrated Electricity*, the publication of which has been suspended.

Convention of the Northwestern Electrical Association at Chicago.

THE fourteenth annual convention of the Northwestern Electrical Association was held January 17 and 18 in Chicago, instead of at Milwaukee, in order to take advantage of the opportunity to visit the Chicago Electrical Show, now in progress. The sessions were held in the Great Northern Hotel.

President C. H. Williams, of La Crosse, Wis., called the convention to order at 10 o'clock a.m., and after some routine business delivered the presidential address. He called attention to the practice begun this year of having the papers printed in advance for distribution among members that they might have an opportunity for preparation of discussion. It had been the effort of those preparing this programme to restrict it to subjects which were alive and which would assist in bettering the financial results of central station properties. During the last year or two, much effort had been exerted by plants all over the country to develop sales departments. He hesitated to touch upon this subject for fear of getting entangled in the far-reaching subject of rates; but the subject is one of such vital importance that the time is well spent where the facts are gone after and displayed. Results show that education of the people is possible in every community, not only in business places to the use of window display and decoration, but on the streets to the use of electric signs and outlines, and in the homes to raising the standard of illumination. Many managers fail to set a proper pace by neglecting to make their business places and homes a living example of the many unfamiliar uses to which electric service is particularly adapted. How many are there who have an investment of $150 per consumer, including plant and distributing system, who would consider it almost suicidal to spend one dollar per capita in an endeavor to increase the sales per consumer 25 per cent? And again, how many are there who have given the subject a proper and fair trial and found the results unsatisfactory? A large part of the troubles causing interruptions to the service are traceable to defective interior wiring. It might be of direct interest to members to consider the advantages and disadvantages of having municipal authorities take upon themselves the inspection of and responsibility for this work.

At the close of this address the secretary, Thomas R. Mercein, who is also general manager of the Electrical Show, announced that the following day, January 18, had been set aside as Northwestern Electrical Association day, and arrangements made to receive the association as a body.

On Thursday the following officers for the ensuing year were elected: President, Mr. H. Almert, Chicago; first vice-president, Mr. E. B. Kirk, Oshkosh, Wis.; second vice-president, Mr. Frank Baker, Evanston, Ill.; secretary and treasurer, Mr. B. C. Adams, Madison, Wis. Directors—Messrs. Irving P. Lord, Waupaca, Wis.; C. H. Williams, La Crosse, Wis.; Roger N. Kimball, Kenosha, Wis.

The nominating committee expressed the high appreciation of the association for the retiring secretary and treasurer, Mr. Thomas R. Mercein, who had served so faithfully and well for the past eleven years, and suggested that some token be purchased and presented to Mr. Mercein as an appreciation of his efforts in behalf of this association. The board of directors include two past-presidents of the association and one past vice-president, and the nominating committee recommended that in the future the board of directors be made up of the three junior past-presidents of the association. Mr. E. B. Kirk, of the Winnebago Traction Company, represents the electric railway interest in the new list of officers.

In taking the chair President-elect Almert, in a few remarks commended warmly the good work of President Williams the past year. He said the association had gone into a little rut in the past years, and all realized it was necessary to get out of it. The earnest efforts put forth by the president during the past year would be an example to guide future efforts.

Mr. Allen, of Beloit, moved an earnest vote of thanks from the association to the retiring President Williams, which motion was enthusiastically carried.

Mr. Harold Almert, the new president of the Northwestern Electric Association, is manager of several electric light and power companies controlled by a syndicate of Chicago bankers. For three years past he has been manager of the Cicero Light, Heat & Power Company, of Oak Park, Ill., and he is now manager of the Constantine Hydraulic Company, of Constantine, Mich., and of the Three Rivers Light & Power Company, of Constantine and Three Rivers, Mich. He is a Chicagoan by birth and twenty-nine years of age. His education was obtained in high school and manual training school, and as he puts it, "in the school of experience." He took a course in the Chicago School of Applied Electricity, and later acted as instructor of this school for one year. For four years he was in the engineering department of the Chicago Telephone Company, and for four years also was superintendent of water and light for the Lincoln Park Commissioners in Chicago, having in charge the lighting and water supply of the North Side parks and boulevards. For a time he was a sales engineer in the Chicago office of the Buckeye & Jandus Electric Companies. During the time he was filling these various positions he was also fitting himself for his later work by taking a course in the Chicago Law School, of which he is a graduate, and in the International Accountants' Society, of Detroit. His election to the presidency of the Northwestern Electrical Association comes as the logical conclusion to the active part he has taken in its affairs for several years past. During the past year he has been a vice-president in that association. Mr. Almert has the combination of engineering ability and the faculty to get acquainted with and secure the confidence of men, which goes to make the greatest success in the work he has chosen.

PRESIDENT HAROLD ALMERT.

The papers presented which developed the greatest interest were several on central station business-getting methods, which led to much discussion on that subject. Abstracts of these papers and the discussion will be printed next week together with an abstract of a paper and its discussion on "Modern Underground Construction," by Mr. W. D. Burford.

The first paper presented was that of Mr. Geo. H. Barrett, of La Crosse, Wis., on meters, which in the absence of the author was read by Mr. Irving P. Lord:

THE PROPER HANDLING OF CONSUMERS' METERS.

The author recommended that upon meters being received from the factory, a record be made in a book kept for the purpose, of the manufacturer's and the purchasing company's number, and that then the meters be taken to the testing room and subjected to a reasonably careful test. The label of the back of the meter "this meter has been carefully tested on various loads and found to be correct," does not always mean just what it says. Instances had come under the author's observation where the various connections in the meter were not all properly made, others where essential parts were entirely missing and still others where the meter was so far out of the proper adjustment as to preclude utterly the possibility of a careful test having been made in the factory. These conditions do not exist to any great extent, although they occur altogether too frequently. He therefore urged that each company make its own test of a meter before placing it in service.

The man installing the meter should have an intimate knowledge of the delicacy of the instrument. A hammer should never be used in fastening a meter to its support; proper tools and screws should always be at hand for fastening in place with the least possible jar. As to the location of the meter, central-station managers have not given this subject the attention it deserves. Time is lost by meter readers and testers hunting step ladders and carrying them up and down several flights of narrow stairs. No meter should be installed until the wireman completes his work. When placing a two-wire meter on a system having a grounded neutral, great care should be exercised to see that the outside wire is connected to the fields of the meter, for if the neutral in the building becomes grounded, the registration will be low. A new meter should ordinarily give satisfactory results in service for a period of six months, when it should be inspected and cleaned and so far as possible brought to its original condition.

When a customer makes a complaint on the amount of his bill, he should be listened to attentively and unless some reasonable explanation can be given to him by the office man, such for example, as his bill covering a period of five or six weeks instead of the usual month, the complaint should be turned over to the meter department for adjustment. The man to adjust complaints of this kind must be tactful and polite under all circumstances and be able to convince the customer that he understands his business, if the customer is open to conviction. The subject should be discussed with the customer openly and frankly. The previous test of his meter, when and where it was made and the result, should be explained and invitation given to assist in a test. He should be interested in the operation of his meter, but in explanations technical terms and phrases should be avoided as far as possible. Take the cover off the meter and by turning on one, two or any number of lamps and counting the number of revolutions made by the disk in 60 seconds, one can readily tell whether the meter is very far out of the way or not. Having ascertained this, ask the customer to turn on any number of lamps he chooses and tell him from the speed at which the meter is running? the number of lamps turned on. Repeat the test with more or less lamps burning and tell him how many he turned on or off as the case may be. He will immediately take interest in the test and set about trying to catch you in error. Should it be found that the meter is to some extent fast, make a more careful test using an indicating wattmeter or any of the various methods used by the craft.

While the customer is interested, instruct him how to make a rough lamp test of his meter, urging him to do so frequently and to read his meter at least once a week. Show him that it is to his interest to become as familiar as possible with his meter. In a little while he will become convinced that the meter can be relied on, and a good friend of the company will have been made out of what might have become a chronic kicker. The effect of educating complaining customers in this way is not only to get the good-will of that customer, but he will relate his experience to other customers and prevent the spread of complaints on meters.

As to the number of meters taken care of per meter man, one cannot average more than eight or ten meters a day if indeed he can do that much, if he cleans them and gives them any kind of a thorough test at all. With two thousand meters it would therefore require about eight months' time to cover the entire system if a man gives this, his whole time, every day with no other duties to perform. However, in the majority of cases it is not necessary to do more than clean up and adjust for light load. A meter on full or medium load is usually not far from correct. It is nearly always the light load accuracy that gives a manager cause for worry, as the revenue lost from this source alone must be considerable. Cleaning and testing on light load with the aid of an ammeter in the circuit where the load is lighting exclusively should be sufficient and should not occupy to exceed from 20 to 30 minutes. If in addition the meter must be disconnected from the circuit and a careful test made on all loads, the time consumed in the operation will probably be double that which it was in the other case. A system of inspection of meter readings should be made by the manager or in the case of the larger plants, by the head of the meter department. For example, a jewel may become cracked or chipped, which would cause a meter to run slow. This will not be detected by an ordinary bill clerk and meter readings will become less and less until they stop entirely. In too many cases it is not until then that the attention of the meter department is called to the matter. By having someone with a knowledge of meters and their weaknesses scrutinize the bills, this would be avoided. The author called attention to the chances for error by confusion of meter constants. For example, a meter having a constant of two might get into the record book as having a constant of one-half and this error carried along for months or even years. This is another argument in favor of having the man in charge of the meter department inspect the readings each month. There is also opportunity for confusion due to the fact that some meters read in watt-hours and others in kilowatt-hours. Danger of confusion where both classes of dials are used can be avoided by omitting the reading of the first dial altogether, so that all results will be put down in kilowatt-hours.

In the discussion of this paper, Mr. W. H. Winter, of Darlington, Wis., recited the recent experience of his company which installed a water power plant in 1896, and took customers on a flat-rate basis, which plan worked very well until the load passed the limit of the water power, and the coal bills begun to eat up dividends. He then described troubles of the company in introducing meters in place of flat rates.

Mr. B. C. Adams, of Madison, thought Mr. Barrett's paper referred more specifically to direct-current meters than to others. A direct-current meter should be tested most often, but the frequency of tests depends largely on the location of the meter and the importance of the service that it handles. He had direct-current meters around the city that did not need to be tested more than once a year, but they should be tested that often. Alternating-current meters did not need to be tested oftener than once a year and should usually run much longer than that. They had meters on their lines at Madison that had tested out just as accurately when they came into the shop after three years as when they were first put on a line. He criticized Mr. Barrett's suggestion of testing meters in place for customers, and thought that meters should be taken into the shop and tested there, inviting the customer to watch the test and bring somebody with him who knew the meter business and who was not connected with the company furnishing the power. A customer can usually be satisfied by such a test.

As to whether on a three-wire meter a 110-volt pressure coil or a 220-volt coil should be used, the General Electric Company uses the former and the Westinghouse Company the latter. He had experienced no trouble with the 110-volt pressure coil, but has had lightning affect the 220-volt coil meter and short-circuit the line. Unless the man that is looking for the trouble knows where these 220-volt meters are, he has difficulty in locating a trouble.

Mr. Kimball, of Kenosha, said his company had saved much time in meter reading by having meters located in the cellar alongside the gas meter so that a man in reading electric meters does not have to go through the houses to closets or attics. In regard to having people read their meters, the Milwaukee Gas Light Company got out a blank for gas users which his company at Kenosha had made use of and distributed to all its customers, especially those whose bills had increased. He found that in every case where customers read their meters every day and kept track of their consumption on these blanks, the difficulty was obviated. Mr. Adams also registered a protest against the difference in dials referred to in the paper. He thought all stations should insist on having kilowatt-hour dials on the meters.

Mr. J. H. Harding, of Laport, Ind., said that on meters reading in watt-hours they had removed the first hand, making all meters read in kilowatt-hours, thereby overcoming the chance for error between the watt-hour and kilowatt-hour dials. He thought that the most important point brought out by the paper was the feature of educating customers to read their own meters and figuring their own bills. They will not kick when they become acquainted with the working of their meters and they grow to have confidence in them. He had very little complaint from customers on meter reading.

Mr. Winter said that it was much easier for customers to read and test their own meters where there was a watt-hour dial for the reason that they can turn on, say, four lights, and by reading the meter at the end of an hour know just what has been used, whereas with a kilowatt dial they have to put on three or four times that amount. In reading meters his company paid no attention to the watt-hour dial.

Mr. B. C. Dinius, of Zion City, called attention to an alleged slowness of commutator type meters operating on alternating-current when heating devices such as curling irons, flat irons, etc., are turned on. No one seemed able to explain this trouble.

At the Wednesday afternoon session the paper by Mr. W. D. Burford on "Modern Underground Construction" was presented, an abstract of which and of the discussion following its reading, will appear next week. This was followed by the paper of Mr. P. H. Korst, of Janesville, Wis., entitled

SUGGESTIONS FOR INCREASING THE POWER OUTPUT OF CENTRAL STATIONS.

Almost all places of 8,000 or more inhabitants now have a day power service and in many of the smaller towns it will soon be adopted. With the increasing use of heating devices and the numerous applications of electric power for residences, stores and shops, it will only be a matter of a few years before every central station will furnish a 24-hour service. A day power circuit is always a benefit and helps a city's growth by making it easy for small factories to start at a low first cost and small operating expense for power, which fact should be brought prominently before the people and newspapers so that they will be interested in pushing the development of the power business.

The usual practice in charging for power is to charge a minimum of $1 per month per horsepower or fraction thereof installed. Some obtain the maximum demand by an instrument such as the Wright demand meter and charge one rate for the first 30, 60 or 90 hours of use per month at the maximum demand, a low rate for all over that. The Doherty method is to make a fixed monthly charge for the readiness to serve, based on the fixed charges of the central station and the size of the customer's installation, and then charge for the power used by meter at a low rate per kw-hour. Others use a modified rate similar to the Doherty or Wright demand methods. Many use the older methods of a minimum rate for the installation with a base price per kw-hour and a sliding scale of discounts governed by the quantity used. There are still a few places that sell power at flat rates. All of these methods have their strong and weak points and none has become so thoroughly in use as to be recommended as the proper method.

Intermittent and small users of power such as residences, dentists, physicians, offices, etc., are usually connected to the lighting meter and pay lighting rates until their power demands warrant a separate meter. It is customary to offer special rate to such customers as use power 24 hours a day and also those whose business is such that it is possible to dipense with the use of power during the hours of peak lighting in winter. Sometimes water plants make special rates to customers which have steam plants and who use electric power only during such portions of the year that there is ample water power. This enables the central station to carry a smaller steam reserve for use during seasons of low water.

Good solicitors employing all or part of their time according to the field for canvassing, are invariably a good investment, and especially in starting new applications in power work, which can be used as an object lesson to other customers. About the first question asked a solicitor is what the power will cost, and often the question is based on an average use of power far above what the actual would probably be. Often it is necessary to install motors for desirable customers for a few months, on trial, to demonstrate the cost of operating. Good judgment and engineering skill should be used so that a good saving of power can be effected by eliminating the wastes due to shaft and other losses, and also obtain the greater convenience, larger and better output with the other numerous advantages of electric, and thereby making a satisfied customer.

It is good policy for the central station to sell and install motors at cost. This keeps the installation cost low and should insure a first class economical motor, put in so as to obtain the best results. Several manufacturers of motors issue books on the applications of motors to various kinds of work, the power needed to drive machines under different conditions and much other useful data to a solicitor. They will also be found ready to give any information in their power to aid in securing a power customer, and when several good jobs are in prospect, will often send a skilled salesman to help land the business.

Judicious advertising always pays. A live newspaper is always a good medium, but a story should be made concise and catchy. Do not try to tell too much at once, but leave something for to-morrow. Well selected cuts help very much to the attractiveness of an advertisement, and many manufacturers will be glad to loan suitable cuts illustrating their products. Circulars, sent to a well selected mailing list and carefully followed up by a solicitor, always bring good results. Many manufacturers gladly send descriptive pamphlets and flyers for distribution and these always bring in inquiries if properly sent out. Since central stations also sell advertising through illuminated signs, they should be liberal advertisers to be consistent and show faith in it.

Heretofore the use of electric power has been largely confined to the smaller factories and printing offices, but it is being rapidly extended to stores and residences. Automatic refrigerators are being successfully employed now in restaurants, meat markets, etc., but there is a large unexplored field for it in domestic use. There is no reason why electric plants cannot obtain as large returns from residences for electricity at power rates, for heating and power use, and battery charging for automobiles, as gas companies now get for fuel gas. Power, in addition to refrigerators, can be used to operate pumps, laundry machines, dish washers, ice cream freezers, ventilating fans, and it is a safe prediction that this will soon become one of the most profitable fields for the sale of current for these purposes and also help largely to solve the vexatious servant girl problem. Another advantage is that residence customers will employ considerable electricity during the day, on Sunday and holidays when the station load is usually low.

The use of small motor-driven air compressors should also be vigorously pushed among barbers and physicians for their special needs, among saloons for charging beer in place of carbonic acid gas, and for other purposes, such as house cleaning outfits, and drilling and chipping metal or marble.

Fans are successfully employed in winter to keep frost off the show windows, and to blow through steam or hot water radiators, thereby increasing their heating capacity, and also to place over hot air registers to start a circulation of hot air when the wind is in a direction that will not let them operate properly. In many cities the power circuits on the outskirts reach some farmers who can be induced to use power for pumping water, shredding corn, sawing wood, cutting feed, separating cream and other uses.

In the discussion of Mr. Korst's paper, Mr. Almert said it is generally recognized that the increase of the use of electric current and power for other purposes is merely a question of the education of the public, but before that is done, it is quite necessary to educate the central station man, who should learn before attempting to disseminate knowledge. Taking the country over, the average central station manager has a very limited knowledge of the various uses of electric power. The present tendency is to consolidate small properties, the effect of which is very good because it gives an opportunity to employ specialists in this class of work, and organize a contract department. The individual small station is generally much handicapped by the limitations of the managers themselves. Another thing handicapping the small stations is the use of obsolete high-frequency apparatus not suited for power. In a meeting of this kind there is usually much enthusiasm over opportunities of increasing business, but the resolutions made by managers at such times are too often like the average New Year's resolution. As Mr. Korst says, "Keep continuing at the work and finally you will get people to see things in your light."

Mr. Burch, of Madison, said, "we may think we know it all, but a stranger will come into any one of our towns and do more business than we who are located there all the time. The stranger takes nothing for granted, but tries to get customers that we would think it impossible to obtain."

In reply to a question as to whether he considered 125 cycles out of date, Mr. Almert said it was. The change to 60-cycle did not have to be made all at once. The high-frequency transformers will work on 60 cycles with lower capacity and lower efficiency. The machinery now being built in improved forms is all for the lower frequency. High-frequency transformers are usually dry air cooled, and the sooner one gets rid of those the better.

Mr. Kimball, of Kenosha, emphasized the importance of having customers when changing from large steam engines to electric power, to subdivide the source of power and put in several motors rather than one large motor. The tendency on the part of customers is to put in one large motor in order to save in first cost; but the large motor would be apt to be run under-loaded, and with an enormous starting current, making it bad for the central station regulation.

GOVERNMENT TESTS ON FUEL.

C. J. Davidson, of the Milwaukee Electric Railway & Light Company, presented a short paper giving an abstract of results obtained by the United States Geological Survey at the Louisiana Purchase Exposition at St. Louis in 1904, investigating American coals. Following are some of the conclusions of the tests:

(1) The tests in the steam boiler plants of 65 carload samples of coal from 17 states indicate the high steaming quality of American coals and that the quality of many of these coals may be improved by washing.

(2) Most of the American coals and lignites can be used as a source of power in a gas-producer plant.

(3) As indicated by comparative tests of 14 bituminous coals from nine states, the power efficiency of these coals when used in the gas-producer plant is two and one-half times greater than their efficiency when used in a steam boiler plant, or in other words, one ton of these coals used in the gas producer plant has developed on a commercial scale as much power as 2½ tons of the same coal when used in the ordinary steam boiler plant.

(4) Some of the lignites from undeveloped but extensive deposits in North Dakota and Texas when tested in the gas producer and gas engine, have shown unexpectedly high power producing qualities, such as promise large future development in those and other states.

(5) Some of the American coals and the slack produced in mining these coals can be briquetted on a commercial basis.

The author commenting on these says that all of his own investigations for several years have convinced him that while various fads may retard the evolution of the prime mover, that by the law of the "survival of the fittest" the internal combustion engine must supersede any possible type of steam motor.

Mr. J. C. McMynn said that he still adhered to the general statement made at the meeting of the Association in Milwaukee in 1894 to the effect that the cheaper the fuel, the cheaper the steam. The most important point in building a plant is to find the cheapest fuel that can be bought and build the furnace under the boiler to burn that particular coal. There has been a great advance in the last few years in Chicago in burning coal intelligently. There has also been a movement among certain coal men to sell their coal on the basis of the heat units in the coal, which is doing much to help the economical generation of steam.

Mr. Edward H. Taylor spoke of the difficulty of getting the same coal all the time for a steam plant. It is easy for a coal man to substitute one coal for another under an ordinary coal contract. The method his company had introduced was as follows:

After the coal is selected a chemical analysis is made of it, and a contract is drawn in which it is stated that the coal of the sample as delivered corresponds to certain chemical analysis, which is used for the purpose of identifying the coal in the future delivered on this contract. For instance, take a certain coal which costs \$2.30 a ton, and the test shows 13,000 B.t.u., moisture 10 per cent and ash 8 per cent. The contract is drawn on the basis of \$2.30 per ton, but if the coal varies in heat units the price is to vary accordingly. The following is the method of determining the B.t.u. Take the original B.t.u. of the coal, 13,000, and if the moisture is 10 per cent, deduct 1,300, which would leave 11,700, which would make the commercial B.t.u. of the coal as delivered. Now multiply that by 2,000 lbs. to the ton, which would give 23,400,000 B.t.u. per ton. As the price is \$2.30 divide the number of B.t.u. per ton by that to find the B.t.u. for a cent per pound. Add the cost of removing the ashes at 50 cents a ton, making the basis of the contract in this case about 100,000 B.t.u. for one cent. On a 5,000-ton contract an analysis of the coal is made once a week. The sample is taken by the regular method and analyzed and reported to the consumer, and the contractor. If the B.t.u. for one cent is lower than 100,000, the price drops accordingly, and the price always bears the same proportion to the original contract price. The city of Chicago has canceled all outstanding contracts and let them on this basis, to the amount of 200,000 tons.

Mr. W. B. Jackson, of Madison, thought everyone should appreciate the advantage of knowing what the coal is doing. Similar work to that being done in Chicago and Minneapolis is being done by most of the large companies in the East, although not in such a systematic manner.

Mr. Kimball thought that the common standard of quantity of coal used per kw-hour was not the proper basis for judging the qualities of the coal, nor was it fair to the coal man. He found the best basis to figure on was the amount of water which can be evaporated with a dollar's worth of coal.

Mr. Dinius said that in making coal tests he determined the cost of evaporating 1,000 cu. ft. of water, which was then reduced to pounds of water, the final result being the cost per 1,000 lb. of water evaporated. The test was easy to make at any time.

Mr. Kirk said that in the traction power house at Oshkosh he had put in some stokers and immediately on getting them in operation they evaporated about 25 per cent more water, but for some reason the water per kw-hour immediately increased about 15 per cent. He had not yet been able to test the steam for moisture. He did not know but the moisture might have been carried over, due to the intense heat from the stokers. Mr. Kimball thought this a question of boiler design and steam space. Mr. Kirk was evidently forcing his boilers harder with the new stokers than he had before.

THE ECONOMY OF COMBINED RAILWAY AND LIGHTING PLANTS.

Ernest Gonzenbach, of Sheboygan, Wis., took up Wednesday afternoon in a paper on the subject of the saving to be effected by combining railway and lighting service in one power plant as compared with operating separate plants. He said it was rather unfortunate that at the present time most of the combined railway and lighting plants which are in operation are the result of consolidations of two or more corporations which originally had independent existences. The natural result is a lack of uniformity in the producing plant which time and the natural wear and tear of apparatus alone can eliminate. In too many cases we see a power station equipped with separate generators and engines for lighting and railway loads although the two sides are generally combined in the boiler room. Such plants are not getting the benefits of the best economy possible by combining the service, although the arrangement may be unavoidable where business will not warrant putting in new uniform equipment. One of the little economies which has an important bearing in this case is the fact that in the railway plant the heaviest loads occur during the summer months, July and August, which are the months of least activity in the lighting department. The lighting force can give some help to the railway force during the busy summer season and receive help during the winter season of heavy lighting. The amount of idle investment in a railway power station is not as great as in the lighting plant, but nevertheless a considerable amount of equipment has to be held in reserve to take care of the excessive loads which occur on perhaps 15 Sundays and holidays during the warm months. He gave typical load curves taken from actual daily averages of a plant in a small city which approximate closely the usual conditions in any city between 30,000 and 50,000 population.

A summer load of the lighting system has its peak between 9 and 10 p. m. amounting to 625 kw. This curve gives a lighting load factor of 29 per cent. Another curve shows a lighting load for the same plant during a day in December. The peak comes between 5 and 6 p. m. and amounts to 1,140 kw. This curve has a load factor of 40 per cent. A railway load curve on a typical winter day has its peak at 5 p. m. which amounts to 500 kw. Its load factor is 44 per cent. The winter lighting and railway peaks where they overlap give a resulted peak of about 1,600 kw. Another curve represents a typical railway load on a summer holiday when the peak occurs at 2 p. m. amounting to 950 kw. Another at 5 p. m. of 740 kw and a third at 8 p. m. of 500 kw. A smaller peak occurs at midnight. These peaks are due to park travel. The load factor of the combined summer curves is 53 per cent, and of the combined winter curves only 28 per cent. The lighting load represented in the curves was with a connected load of about 40,000 16-cp lamps including a number of stationary motors and city street lighting. A calculation is given showing that the cost of separate lighting and power stations would be $337,500, while a combined plant would cost only $250,000. Besides this saving in first cost, the saving in cost of operation is very considerable. One chief engineer only instead of two is required. There are only half the shift engineers required which would be necessary under separate operation, and the same rule holds true down the line as far as the coal passers. It is safe to say that the cost of labor will be about 33 1/3 to 60 per cent less in a combined plant than it is under separate operation. In addition to the saving in labor the fuel economy is decidedly improved. In a lighting plant boilers and engine work under disadvantageous conditions, as a rule, during light loads. The engines may be only partly loaded, therefore not giving their maximum efficiency. The same holds true of boilers. In the combined plant above referred to it is possible to so operate that there will always be a full load on one or more of the units. This gives the maximum efficiency. Data taken from a plant of this kind now in operation show that the saving in labor and fuel economy amounts to about $6,000 per annum, over and above the operating cost of separate plants. Add to this the $8,750 saving in interest and depreciation and we get a total of nearly $15,000 per annum saving accomplished in a plant of the capacity and dimensions referred to.

There are to-day a number of well designed power stations which supply lighting and power from one class of generators, and there seems to be no reason why the type of units in the power station of this class may not be identical at least within the limits outlined above. The direct current for the railway operation may be supplied through either motor-generator sets or through one or more combination sets consisting of alternating and direct-current generators connected together, and connected with a clutch coupling to the engine. The latter is a much more economical plan, as during light loads the railway generators may be operated from the alternating-current machines working as synchronous motors, thus reducing the number of prime movers in operation and giving a very high demand factor.

The operation of direct-current railway units from synchronous motors taking their current from lighting generators is being accomplished to-day and will be still more in the future. A Tyrrill regulator on the lighting lines will counterbalance any tendency to fluctuation caused by the railway load. A comparatively small storage battery will accomplish wonders in the way of regulating the fluctuating demand on the railway generators, and will enable both classes of service to be furnished from one machine, besides reducing the amount of railway apparatus which must be held in reserve.

Mr. Korst described briefly a water power plant owned by his company at Janesville, which has both 550-volt and 250-volt generators which can be run in series for railway work or in parallel on the three-wire lighting and power system.

Mr. Jewett stated that at Marion, Ind., the electric light company is operating satisfactorily two 500-kw steam turbines, either or both of which are run in parallel with a 400-kw Stanley inductor alternator driven by a Russell engine, all being 60-cycle machines.

Mr. J. M. S. Waring cited an instance at Milwaukee where railway and lighting plants were operated together and a storage battery has been installed which can be connected either to the railway bus-bars or to the direct-current lighting bus-bars. In a test he had made on the Metropolitan Elevated Railway power station in Chicago, it was found that in January, 1905, when batteries were in service the output had increased 25 per cent for the 24 hours over January, 1904, when there were no batteries, while the boiler hours had decreased about 10 per cent.

Mr. R. N. Kimball, of Kenosha then presented a paper on

THE STATION LOAD FACTOR AS A FACTOR IN THE COST OF OPERATION OF CENTRAL STATIONS.

The load factor very largely affects the cost per unit of output in any power plant. Three definitions were given as follows: The true load factor is the ratio between the average load and the maximum. The station capacity factor is the ratio between the average load and the rated capacity of the station. The engine factor is the ratio between the average load and the normal rating of the engine in question. In the writer's experience, boiler economy, unless the boilers are overloaded over 50 per cent, is not affected by the boiler being run underloaded except when underloaded to a large extent, when their radiation losses, which amount to about 5 per cent of the total full-load losses, make them a factor to be considered. Such low load conditions seldom exist in practice, as there are generally enough boiler units so that boilers may be cut out when not needed. In the average small station of under 500 hp a minimum number of men is employed consisting of an engineer and a fireman on each shift. Under these conditions, the cost of labor is constant and the cost per unit varies with the output. The improvement of the load factor lies almost entirely in the new-business department, as the engineer is powerless to do anything but change the engines to suit the varying load conditions and keep the engine factor as high as he can with the equipment furnished. If the station operates for lighting only, great improvement can be made in the load curve by starting a power circuit. In this connection, it it is always advisable to put in small motors whenever possible rather than large ones, especially if they are starting and stopping frequently.

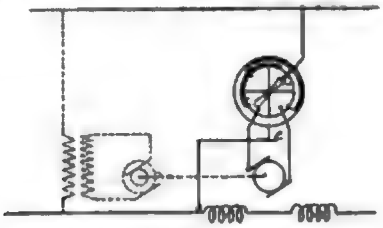
In Kenosha the load factor is lower during the winter than during the summer because they have considerable factory lighting during the months of November, December and January. The motor business and street lighting overlapping with the incandescent load makes a high peak and a low load factor. Curves were given for a cross compound Buckeye engine direct connected to a 220-kw alternator with the engine running condensing and non-condensing. Because they have a heating plant in Kenosha, they operate non-condensing during the winter and condensing during the summer. From the curves given, the author figured costs. The maximum range of the engine running condensing is much better than running non-condensing, so that the condensing engine is more economical with varying loads. Experience shows that better relative economy can be obtained by overloading engines than by underloading them, while the reverse is true of boilers up to the limits before mentioned. As an example of the application of a price sheet given it is assumed that the plant made in 24 hours 2,640 kw. The maximum load was 220 kw, the average load 110 kw; the load and engine factor 50 per cent. The cost of this power according to the writer's figures would be $42.24. If the same number of kw-hours was delivered at 100 per cent load factor, the cost would be $25.54, or at 75 per cent load factor, $30.62, or at 25 per cent load factor, $73.13. In Kenosha with the same equipment as last year the writer's company is selling approximately 100 per cent more energy, and the increase in income and profits well repaid the company for its study of load curves and load factors.

DISCUSSION ON STATION LOAD FACTORS.

In reply to an inquiry Mr. Kimball said that they started a motor circuit where there had been none before, and as the times had been good, the factories had been running overtime, and not having sufficient power, he had been supplying their long-hour business, which work gave a very good load. They formerly had a station with 140-cycle machinery and at first did not want to put in a new station until they knew they could get power load. They put out a solicitor but he did not sell any power. Then they put in the plant anyway with very satisfactory results.

Quadrant Electrometer as a Wattmeter.

In order to overcome the disadvantage incident to the use of a resistance placed in the "work-circuit" for the purpose of producing a potential difference to be applied to the quadrants of an electrometer when it is used as a wattmeter, Mr. Ernest Wilson, of London, England, according to a patent issued January 16, would obtain the potential for the quadrants from a secondary system affected by the flux produced by the work circuit. The inventor describes several methods for accomplishing this purpose, one of which is illustrated herewith. A small dynamo is driven at constant speed in a field produced by the current in the work-circuit, the armature of the machine furnishing to the quadrants through a commutator and brushes the necessary potential difference which is proportional to and in phase with the current in the work-circuit. The arrangement illustrated is applicable to the measurement of watts in direct-current as well as alternating-current systems.



QUADRANT ELECTROMETER AS A WATTMETER.

First Annual Convention of the Electrical Salesmen's Association.

The first regular meeting of the American Electrical Salesmen's Association was called for January 20, at the Grand Pacific Hotel, Chicago. This association was organized at Peoria, Ill., in October, 1905, and since that time about two hundred salesmen have affiliated.

The morning session was held behind closed doors. In the absence of Mayor Dunne at the afternoon session, City Prosecutor Taylor delivered an address of welcome. President Vincent Gray followed with a paper setting forth the purposes of the association. This paper was in substance that which appeared as a letter in the Electrical World and Engineer, December 23. The main purposes of the organizeation as outlined by President Gray, and as printed on the programmes of the meeting, were "fraternalism, uplifting of the standard of salesmanship, and the general advancement of the electrical interests."

At the conclusion of President Gray's address Mr. J. Robert Crouse, Jr., read a paper and addressed the convention urging the members to co-operate with the electric lamp manufacturers in their efforts to increase the demand for lamps, and in general to increase the demand for current supplied by central stations. He stated that the lamp manufacturers had raised $10,000 and that a similar amount had been secured from another source to be spent in increasing the demand for lamps. A 1 per cent increase in the number of lamps in service, he said, meant an increase in sales of 400,000 lamps per year. To operate the increased number of lamps 34,615 hp of machinery would necessarily be installed and this meant the sale at $125 per hp of $4,326,875 worth of wachinery.

Mr. Crouse related an incident illustrating how the salesman in his travels could encourage the use of electrical apparatus. While staying at a hotel in Pittsburg recently, he learned that a short time before an oil cigar lighter had exploded, and an employee of the hotel narrowly escaped injury. Mr. Crouse had the story of the accident written up and sent to the technical press. The papers in turn sent the story to the manufacturers of electric cigar lighters. In this manner a relatively small incident was employed to further the sale of electrical goods.

Following the address of Mr. Crouse, a paper entitled "Modern American Meter Practice," by Mr. R. C. Lamphier, superintendent of the Sangamo Electric Company was read. The paper described at some length all of the watt-hour meters that have been used in America to any extent.

It was deemed advisable by the committee on by-laws and was afterwards decided by the convention to drop the word "American" from the name of the association, making it the "Electrical Salesmen's Association. The convention also decided favorably on the suggestion of the committee that representatives of the electrical journals be eligible for membership. In regard to initiation fees and dues, it was decided to charge an initiation fee of $1 and annual dues of $2.

Another suggestion of the committee on by-laws that received the hearty support of the convention was a clause prohibiting the use of intoxicating drinks at any function of the association.

A committee consisting of Messrs. J. S. Corby, Francis Raymond, and J. A. Campbell was appointed to confer with Mr. Crouse in regard to devising methods of co-operation between the Association of Lamp Manufacturers and the salesmen, to promote the use of electric lights and other electrical apparatus,, supplied with current from central stations.

After much debate it was decided to hold the next meeting in Chicago, on the first Saturday following the first Monday of the Electrical Show.

The meeting closed with the election of officers. President Gray and Secretary George H. Erich retained their positions and C. R. Wood was elected vice-president for the ensuing year.

New Telephone Patents.

SEMI-AUTOMATIC EXCHANGE SYSTEM.

The semi-automatic telephone switchboard has been attracting considerable attention recently. For years engineers have been familiar with the advantages and disadvantages of the manual switchboard, as compared with the ideal automatic, and on the other hand we have had sufficiently good automatics to learn their primary weaknesses. Between these two extremes lies the hope of many, the semi-automatic, with the rather simple signalling of the automatic, and with manually-operated connecting cords. A patent has just been issued to A. T. M. Thomson, of London, for a rather simple and comprehensive system. The calling party sets dials upon his call-sending apparatus, incidentally winding up a spring for driving the contact wipers which effect the call, and in, and setting an indicator to show a legend "Exchange Called." At the same time a call lamp lights at the switchboard. The operator responds by plugging into the answering jack, extinguishing the lamp and tripping the sender so that the call set upon the calling sender will be transmitted to and registered upon a number receiving mechanism of the pair of cords being used. When the number appears, an operator inserts the calling plug corresponding, in the jack of the called subscriber. No time is lost in waiting for the call to be registered, as the answering cords are associated together upon one keyboard, and number-receiving devices and calling cords are upon another keyboard. Therefore one operator is concerned only in responding to lamps by plugging in, while the other operator merely responds to number signals. Both have the additional duty of clearing lines. The clearing-out signal appears first at the calling line, and upon disconnection of the cord from that line, a disconnect signal is given to the calling operator. Automatic ringing is employed, and the operators have no cause to talk to the subscribers. If a signal fails for any reason, the calling operator may attempt to get it by starting the subscriber's sender a second or third time for a repeat. Throughout the call the subscriber's indicator instructs him of the state of affairs, indicating "Call Received," "Busy," "Talk," etc.

EXCHANGE APPARATUS.

A combined drop and relay, the patent for which has been assigned to the American Electric Telephone Company, has been invented by A. Carless, of Chicago. The coil occupies the usual horizontal position, pole pieces being provided at the two ends which extend upwardly toward the horizontal armature. This armature carries a drop latch as a forward extension. Beneath the armature is a sensitive contact spring which gives way under the pressure, to close an auxiliary contact.

A new relay has been patented by C. L. Goodrum, of Rochester, N. Y., a side view of which is shown in Fig. 1. The design is almost self-evident. This relay is very simple and should be reliable. The coil is mounted by a bolt passing throughout the length of the core, the latter being tubular. The armature is prevented from lateral sliding by insulating pins which act as stops for the outside springs and which engage notches in the armature.

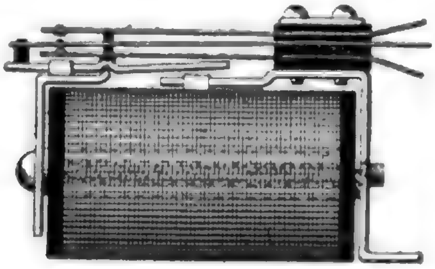


FIG. 1.—GOODRUM TELEPHONE RELAY.

TRANSMISSION CIRCUIT.

Fig. 2 shows a circuit arrangement for a telephone set which has been patented by H. A. Judge, of Washington. It will be seen that an extra coil is included in the circuit. This coil is of high inductance and as the current attempts to vary in it in response to the transmitter resistance variations the inductance of this coil produces various assisting and resisting "picks," which, it is claimed, improve the transmission and amplify the effects.

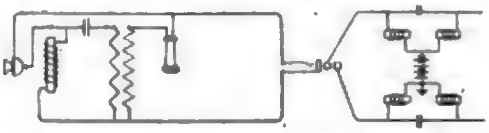


FIG. 2.—JUDGE TRANSMISSION CIRCUIT.

SUB-STATION DEVICES.

K. A. Poyas, of Los Angeles, has brought out a special receiver for the use of linemen of automatic systems. This is the ordinary receiver with two strap keys built into it responsive to exposed buttons. The strap of each key normally closes the talking circuit, but may be depressed on the anvil. This latter and each strap is provided with a flexible cord terminating in a spring clip. With such an apparatus, one can manipulate the switching devices of any line.

A rather novel magneto bell has been patented by E. R. Hollis, of Lamar, Colorado. The armature is suspended by flat flexible steel springs. These springs are secured to a yoke which is movable in a manner to vary the air-gap, and also in a manner to give a normal bias to the armature.

LETTER TO THE EDITORS.

Speed of Machine Telegraphy.

To the Editors of Electrical World:

SIRS:—I notice that in your issue of December 9, 1905, you quote from the *Journal Télégraphique* a tabular statement of "Speeds of various telegraph systems." So far as the figures regarding the Morse, Hughes and Baudot are concerned, they are not seriously wrong, as they are ordinary working speeds obtainable under practical condition; but there is nothing in the table to indicate that the figures quoted for several new telegraph systems are merely experimental and expositional, and not practical working averages. On the other hand, the figures given for the Murray automatic system are less than half of what it can achieve under similar favorable circumstances. The Murray system has reached a speed of 150 words a minute, and with particular difficulty a speed of 120 words (720 letters) per minute in each direction (duplex) can be attained; while a speed of 100 words (600 letters) per minute in each direction is obtainable with ease over long distances. This speed is in daily use with the Murray system between London and Edinburgh. Of course it is well known to telegraph engineers that maximum figures for telegraph systems, such as those published in the table referred to, are utterly misleading, and that speeds of more than 600 letters a minute in each direction simultaneously are of no practical value to telegraph administrations under present day conditions.

Some of your telegraphic readers may be interested to learn that the Murray automatic system is in regular daily work handling commercial messages between London and Edinburgh, and that the British Post Office is having a complete duplex installation of the system constructed for London-Dublin. The practical working trials of the apparatus in Germany are not yet concluded. Russia has ordered an equipment for two circuits, and the apparatus is shortly to be installed in Russia, probably between St. Petersburg, Moscow and Odessa. The Austrian telegraph administration has ordered a trial set to work between Vienna and Prague, and the Indian Government is having a complete duplex installation of the system constructed for Calcutta-Bombay, a distance of 1,230 miles.

LONDON, ENGLAND. DONALD MURRAY.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Brush Contact Resistance.—NANDI.—An account of experiments made in Glasgow University on the contact resistance of carbon brushes. With a current density of 20, 15, 10 and 5 amp. per sq. in. he found a brush resistance, per square inch of brush area, of 0.05, 0.125, 0.13 and 0.31 ohm, respectively. Arnold found the contact resistance of carbon brushes for current densities of 50 to 30 amp. per sq. in. and peripheral speeds from 1,200 to 2,400 ft. per minute to lie between 0.023-0.04 ohm per sq. in. of contact. Both these sets of experiments prove that with carbon brushes the contact resistance decreases rapidly with increasing current density. "Knapp says take an armature and put it into a lathe. On starting the latter and turning on even a moderate current the brushes will be seen sparking badly, although the same armature running in its own field and doing full work will run without sparking. From this he concludes that the presence of a field is necessary to prevent sparking. On this he bases his theory of commutation of current. From the results of the experiments related in this article it is clear that full-load current may be sent through an armature with carbon brushes, rotating away from its field, without causing destructive sparking. This points to the fact that 'contact resistance' and not 'the reversing magnetic field,' is mainly responsible for commutation of current, at least in machines with carbon brushes."—Lond. *Elec. Eng.*, January 5.

Wave Shapes in Three-Phase Transformers.—CLINKER.—The author formerly investigated by means of the oscillograph the effect of a star connection in excluding triple harmonics from the magnetizing currents of transformers. In the case of delta connection, triple harmonics circulate within the closed delta and may be regarded as induced currents set up by a slight triple-frequency flux in the cores. The author has now investigated the effect on the triple-frequency component, due to a gradual change in three steps from delta to star connection. Diagrams are given showing the increase of the magnitude of the triple component.—Lond. *Elec.*, January 5.

Three-Phase Transformers and Wave Shapes.—Field and Dykes.—Three communications illustrated by diagrams giving supplementary notes to the recent article of Clinker.—Lond. *Elec.*, December 8 and 15; January 5.

Permutators.—Menges.—A communication referring to an old German patent of his of 1882 which is interesting in connection with the construction of the modern "permutator," which was recently described in Electrical World and Engineer.—Lond. *Elec.*, December 29.

Lights and Lighting.

Electric Arc.—Stark, Retschinski and Schaposchnikoff.—An account of an experimental investigation, some results of which are as follows: The voltage drop in the column of the arc is greater in an atmosphere of hydrogen than in one of carbonic acid. With copper electrodes the difference is greater than with carbon electrodes. This phenomenon is due to the cooling effect of the electrodes and of the arc. There is a very great difference between the cathode drop and the anode drop in the mercury arc, which indicates a great difference between the speed and the mass of the positive and negative ions inside of the arc. The cathode drop in the mercury arc with the cathode of mercury is independent of the current. The anode drop depends upon various factors and increases somewhat with the current. The results obtained by the authors are in agreement with the conclusions of the ionic theory of the arc.—*L'Eclairage Elec.*, December 31 and January 6.

Power.

Chicago.—A report to the Mayor and Council of Chicago on the most advantageous municipal uses of power from the hydraulic development of the Chicago Drainage Canal for which construction work is now in progress. The report is signed by the city electrician, the city engineer and the commissioner of public works and states that the most desirable use of the power would be for the operation of municipal street railways, which can consume all the power that the sanitary district can furnish for 24 hours each day. Second, power could be used for the lighting of the city streets and the municipal buildings, provided disposition can be made of the power during such hours when lighting is not required. Sewage-pumping stations, bridges and other minor utilities may be equipped for electrical operation, but would not to any appreciable extent serve to utilize during the day time the released power used for electric lighting during the night. It is not economical or practicable to change the present water works plants to electrical operation. New proposed plants may be electrically operated, and careful consideration should be given to this matter before new designs are decided upon.—*Western Elec.*, January 13.

Electric Equipment of Factory.—A fully illustrated article on the electric equipment of the works of J. Hopkinson & Company at Huddersfield, making a specialty of steam fittings. There are a 275-kw and a 150-kw direct-current dynamos, delivering current at 220 volts. The group-system of driving has been adopted in the iron and brass departments where each line of shafting is operated by a slow-speed motor through a chain drive. The motors are both the shunt and compound-wound types, and include six of 20-hp, one of 12-hp, 10 of 10-hp, and one of 5-hp.—Lond. *Elec. Rev.*, January 5.

Artificial Furnace Gas.—Richards.—In a continuation of his serial on metallurgical calculations the author deals with Mond gas and water gas, numerical examples being given.—*Electrochem. and Met. Ind.*, January.

Gas Engine.—A description with detailed drawings of the Oechelhauser gas engine, using producer or blast furnace gas. Lond. *Eng'ing*, January 5.

Gas Power.—Hooghwinkel.—An abstract of a paper on the generation of electric power from the waste gases of blast furnaces and from coke-oven gases. The latter method is considered to be very promising.—Lond. *Elec. Rev.*, January 5.

Traction.

Electrification of French Railway Lines.—An illustrated article on recent developments on the Paris-Orleans suburban line which first adopted electric traction for the tunnel road between the old terminal at the Quai d'Austerlitz to the new one at the Quai d'Orsay. Recently the same company has doubled its lines from Paris to Bretigny, a distance of 20 miles, but electric traction has been for the present limited to the Paris-Juvisy section. The third rail is used with a voltage of 600, three-phase current being transmitted at 5,500 volts and converted into direct current in three sub-stations. Since the trains take a current amounting to as much as 1,500 or 2,000 amp. for starting, the third rail has been given a high conductivity. It consists of a mild-steel flanged rail, weighing 100 lb. per yard, along which are placed, for the greater part of the distance, two lengths of mild-steel rails, fitted fish plates and forming counter rails; the latter weigh 50 lb. per yard. The three rails are bolted together every three metres. They are in 22-metre (72-ft.) lengths, and are electrically bonded at each joint by four flexible copper bonds, 220 square millimetres (0.34 square inch) in section, two being for the third rail and one for each counter rail. In order to increase the conductivity of the return circuit the track rails of the neighboring main lines for steam traction are electrically bonded as well as the tracks for electric traction; junction boxes are mounted along the track in the usual way. The company now owns eleven electric locomotives and five motor cars, the construction of which is illustrated. The electric locomotives are fitted with four 270-hp motors, each driving an axle by gearing, and capable of giving a speed of 43.5 miles an hour to a 200-ton train. Series-parallel control of the motors has been adopted. The motor cars are equipped with four 125-hp motors, one being mounted on each axle, the multiple system of control being used.—Lond. *Eng'ing*, January 5.

Brake.—An illustrated description of an electric railway brake with hydraulic release made by the Allgem. Elek. Ges. Fig. 1 shows the brake electromagnet in section and indicates the connections generally. When the handle of the small brake controller is moved to the "on" position, current is enabled to flow through the main coil, 1, and the plunger, 2, and the rod, 3, move to the left against the action of a helical spring, thus causing the brakes to be applied. As soon as the desired braking effect has been attained, the large valve, 6, is caused to be closed by sending a current of short duration through the solenoid, 5, the current through the main coil, 1, being interrupted at the same time. The plunger piston, 2, cannot return because the liquid, which was previously drawn into the cylinder past the valve, 6, is now entirely enclosed. Hence the brakes remain "on" without loss of energy for any length of time. If it is desired to release the brake by degrees, current impulses are sent through the coil, 7. This causes the small valve, 8, to lift momentarily, and a small quantity of liquid is able to flow from the brake cylinder back into the tank. The brakes are thus released quite gently. In order to release the brakes rapidly, a current of longer duration is sent through coil 7, and the large valve, 6, opens and lets the liquid escape quickly. The brake, it is stated, weighs only 260 lb. and the small controller has a weight of some 30 lb.—Lond. *Elec.*, December 29.

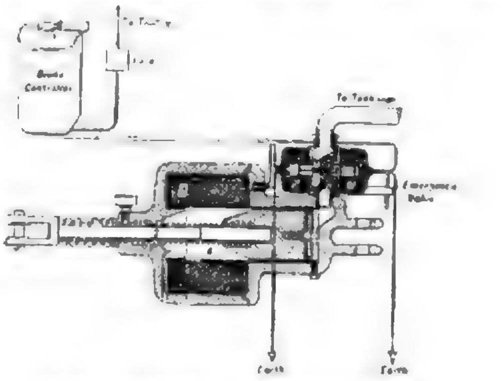


FIG. 1.—ELECTRIC RAILWAY BRAKE.

Electric Traction in England and United States.—A long editorial on a report of Fell, the chief officer of the London County Council Tramways, who recently paid a visit to America. He calls attention to the development of interurban lines in the United States while in England they are as yet few in number and not particularly prosperous. The reasons are restrictive legislation and the protection of vested interests. "The standard of track and paving maintenance in America is very poor. 'Disgraceful' is Mr. Fell's word for some of the cities, and he adds, 'it would not be tolerated here.' This strikes another note of difference. In America the street railway is indispensable, the good paving of a street a quite secondary matter. Here [in England], even in the best managed towns there is a large public which considers the tramway a nuisance." The operating expenses in London per car-mile compare pretty well with those in New York. The earnings per route-mile of electric lines in London amounted last year to $100,390, while in New York the figure was $87,140. The Boston subway and the traffic organization in connection therewith come in for considerable commendation. "The American may learn from us in the collection of fares. Nothing strikes an Englishman as more curious than the 'fare indicator' in a New York car. No tickets are issued, the conductor works the indicator for every fare he collects (that is, he should), and is responsible for so many 5 cents as the fingers point to. Naturally he cannot be sure of getting every fare on a crowded car, much less can the company be sure of getting every fare he takes."—Lond. *Elec.*, December 22.

Single-Phase Locomotive.—Some notes on the tests made by the Swedish railway authorities with single-phase traction on the Tomteboda-Värtan line. Of the experimental track only 3¾ miles are ready at present, but about as much more are under construction and later on more additions will be made. The trolley wire is a round 0.325-in. hard-drawn copper wire, and is suspended at a height over the rails of 15 to 18 ft. Since one object of the experiments is to determine the most suitable method of wire suspension, many different kinds of suspension have been used on different parts of the track. In all cases the insulation is double, there being one insulator between the pole and the span and cross-bar and one insulator for the message wire. The return current passes through the rails, but these are not provided with rail bonds, except on a small part of the line. This arrangement is made in order to test whether at the high voltage used (up to 20,000) rail-bonds will prove necessary or not. A telephone line runs along the line on the trolley poles. Some experiments regarding influence of the railway current have shown that the static influence is considerable, the voltage of the telephone line to ground amounting to about 4,000 volts in some cases. In order to correct this, two discharging coils were connected between the two telephone wires and ground. These removed the static charge, but the telephones are provided with high-tension insulation. A description is given of the locomotive of the Siemens-Schuckert Company which was noticed recently in the Digest.—Lond. *Elec.*, January 5.

Temperature Rise in Switches.—SCHOEPF.—In connection with a paper on automatic train control, the author communicated some tests on temperature rise in pneumatically-operated electric switches. He also emphasized the flexibility of this system and the power which can be concentrated in a small space, in the turret controller where the switches are operated from a pneumatic cylinder, connected thereto by means of a lever, as well as in the rectangular controller where the switches are connected directly on to an extension of the piston rod. In either of these controllers the switch closes with a quick and steady motion, the contact pieces first closing at or near the top, and as the piston rod moves forward the contacts roll and slide one on the other, finally resting at the heel and under the full pressure of the air against the piston. This motion between the switches has the effect of keeping the contact pieces perfectly clean, with the result that the carrying capacity of the switch is always a maximum. The temperature tests shown in the curves of Fig. 2 were obtained upon a switch having contacts 1 in. in width and with various pressures on the contact. The piston was 2.75 in. in diameter, and the several pressures on the contact were obtained by varying the pressure per square inch of the compressed air admitted to the cylinder.—Lond. *Elec.*, December 15.

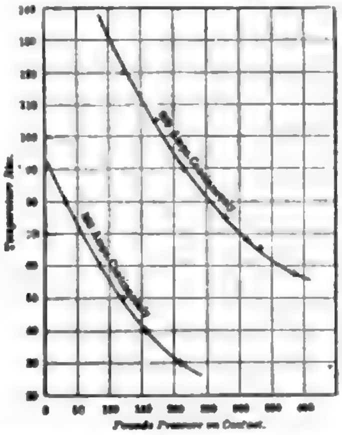


FIG. 2.—CURVES OF TEMPERATURE RISE.

Point Controller.—An illustrated description of the Tierney-Malone point controller for tramways. The point-moving mechanism consists solely of two solenoids and the frame carrying the push-bars. Either solenoid is energized, according to the direction in which the driver has to take the car. The solenoids derive their energy from the trolley wire through permanent cables, which are laid in one of the usual ways from the points to the nearest pole, and thence are carried up the pole to a pair of contacts which are attached to, but insulated from, the trolley wire at a convenient distance, say 40 to 50 ft. from the points. Every trolley head is provided with supplementary contacts which are insulated from the head and from each other. From them run insulated wires to a switch on each platform. The contacts on the trolley are placed so that they can clear frogs, switches and crossings.—Lond. *Elec. Rev.*, January 5.

Train Weight and Acceleration Units.—MAILLOUX.—A further communication explaining his preference for the 2,000-lb. American ton. As acceleration unit he uses, with the present American units, the mile-per-hour-per-second and with the metric system the kilometer-per-hour-per-second.—Lond. *Elec.*, December 22.

Installations, Systems and Appliances.

Aluminum Fuses.—SCHWARTZ AND JAMES. An article giving some notes on aluminum fuses. Aluminum, zinc and cadmium are highly electropositive to copper and brass, and in the presence of moisture this contact difference of potential is likely to give rise to corrosion of the contacts with consequent increase of contact resistance and impairment of the fuse. For damp situations, these metals are, therefore, not suitable for fuses, but a good plan to overcome this difficulty would be to coat the contact clips of the fuse blocks with tin.—Lond. *Elec. Rev.*, January 5.

Lead Poisoning by Electrolysis.—An editorial under the title "A New Calumny," referring to the case, recently mentioned in the Digest, of alleged lead poisoning due to electrolysis of a water pipe by an electric stray current. It is claimed that no proof whatever has been given for that statement. The service pipe affected ran out to a dead-end and could by no possibility whatever form part of a return circuit for stray currents. The whole of the corrosion took place on the inside of the pipe.—Lond. *Elec. Rev.*, January 5.

Electrochemistry and Batteries.

Electrolytic Copper.—ADDICKS.—A paper giving a concise review of the electrolytic copper refining process. In American refineries high-grade anodes are universally used, containing from 98 to 99.5 per cent of copper. The cathode copper is exceedingly pure, usually running about 99.93 per cent copper, with hydrogen as the chief impurity. Objectionable cathode impurities are of two classes—those which decrease the electrical conductivity and those which make the metal brittle. Arsenic and antimony represent the first class; tellurium and lead the second. Good cathode copper should show but a few thousandths of a per cent of arsenic and antimony. The various items making up the tank resistance are analyzed.—*Electrochem. and Met. Ind.*, January.

Edison Accumulator.—A note discussing the probable formula of the active nickel material in the Edison accumulator. It seems now to be established that the nickel electrodes of alkali accumulators contain only hydrated Ni_2O_3, and not any peroxide NiO_2, for whose existence there is no proof at all.—Lond. *Eng'ing*, January 5.

Lead Accumulator.—PETERS.—An account of results of some tests of the Climax accumulator. Its special feature is the positive pole electrode which is characterized by segments pressed out of a cast lead plate by means of a kind of knife by a special machine.—*Centralbl. f. Accum.*, January 1.

Storage Batteries.—BROEKMAN.—A paper read before the Dublin section of the (Brit.) Inst. Elec. Engs. discussing various points of the construction of storage batteries and their use in central stations. He highly recommends the introduction of board diaphragm separators acting as a complete screen between plates of opposite polarity. Some remarks are made on the use of end-cells, boosters, etc.—Lond. *Elec.*, December 29.

Units, Measurements and Instruments.

Measuring Self-Induction.—E. AND W. H. WILSON.—An illustrated description of a method for the measurement of self-induction. The arrangement is shown in Fig. 3. *R* is the resistance whose self-induction is to be found, shown as a straight shunt. *Q* is a quadrant electrometer, whose quadrants are connected to the terminals, *A* and *B*, of the resistance, *R*, and whose "case" is connected to a point, *O*, midway between *A* and *B* when the best accuracy is desired, but which can be connected to either *A* or *B* with accurate results when the potential difference between *A* and *B* is small compared with that between the "needle" and "case" of the electrometer, *Q*. *T* is an air-transformer whose primary coil can consist of a single turn of stout wire when large currents have to be dealt with. (In the experiments of the authors six turns were employed for large currents and 246 turns for small currents. The secondary of this transformer consisted of 40,000 turns of copper wire, having 5,000 ohms resistance, and was the secondary of an induction coil.) One end of the secondary circuit is connected to the "case" of the electrometer and the other to the "needle." *M* is a multi-cellular voltmeter connected between the "needle" and "case" of the electrometer. *V* is a hot-wire meter which can be used to measure the current in the circuit when the resistance, *R*, is a suitable shunt; but, if more convenient, an ampere-meter can be placed in the circuit. It is necessary that the electrometer should obey Maxwell's law under the conditions of the test. Adopting Maxwell's symbols, *C* is the P.D. between the "needle" and "case." *A-B* is the potential difference between the quadrants. *C* is supplied by the secondary circuit of the air transformer, and is in quadrature with the current in its primary circuit. If *x* be the current in the circuit, then the potential difference, *Rx*, will produce no movement of the "needle" if the electrometer is a true wattmeter, since it is in quadrature with *C*. If *L* be the coefficient of self-induction of the resistance, *R*, and *f* the frequency, then for a simple harmonic current $2\pi fLxC$ will be measurable on the instrument if it has sufficient sensibility, and is equal to θK where θ is the deflection and *K* a constant. The constant, *K*, is found by impressing known voltages between the needle and the case and between the quadrants, and noting the deflection θ', in which case *K* will be equal to the product of the voltages divided by θ'. If alternating voltages are employed, the power factor as between them must be unity, or direct voltages can be used with convenience. In order to find *L* it is necessary to determine the frequency, *f*, the amperes, *x*, and the volts, *C*. Virtual values can be used. Results of some tests of this method are given.—Lond. *Elec.*, January 5.

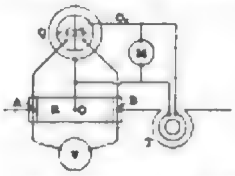


FIG. 3.—MEASURING SELF-INDUCTION.

Magnetic Testing of Cast Iron by the Permeability Bridge.—CAMPBELL.—An account of an investigation undertaken to determine a suitable method for testing bars of widely-different magnetic properties by means of the Ewing permeability bridge. This instrument is primarily intended for the comparison of bars of nearly the same quality, errors being introduced if the sample to be tested has a very different permeability from the standard. In order to get over this difficulty, which is encountered particularly in the case of cast iron (the curve for which differs in form very considerably from that of the usual soft-iron standard), the author utilized a number of different standard bars of various degrees of magnetic quality, and compared each successively with the cast-iron bar, using the bridge only to determine the points where the permeabilities were equal in each case; that is to say, where the *B/H* curves of the sample and standard in question crossed. This was done by keeping the number of turns on both branches equal and varying the current till a balance was obtained, thus eliminating entirely the error due to inequality in the magnetizing forces. In order to carry out effectively this method of crossing points, a large number of standards were required, and this magnetic quality had to be progressively graduated. In order to fill in the gaps which would exist with the use of ordinary materials, the author used, in some cases, tubes of the same external diameter and measured their apparent permeability. The curves for the series of standards were obtained by the usual double bar and yoke method, and in some cases corroborated by ballistic tests of rings. The method has been used with great success over a long series of tests, carried out at the British National Physical Laboratory.—Lond. *Elec.*, December 22.

Bureau of Standards—Reichsanstalt, Etc.—A note giving the following data on the amounts granted by Germany, Prussia, France, the United States and England to their national institutions for physical and engineering testing and research.

Country. Name.	Cost— Bldg.	Eqpmt.	Annual grant.	Receipts for work, annual.	No. of tests.	Staff.
Germany, Reichsanstalt		$1,000,000	$80,000	$10,080	$18,951	80
Aichungs-Kommission		240,000	42,500	...	...	..
Prussia, Versuchsanstalt		687,500	75,000	45,000	5,000	140
France, Laboratoire d'Essias	135,000	100,000	27,500	...	...	12
U. S. A., Bureau of Standards	350,000	225,000	95,000	570	1,666	58
England, National Phys. Lab.	95,000	...	27,500	29,715	28,183	50

In Germany and Prussia the State takes the fees; the above Reichsanstalt fees are for the year 1900. The receipts of the Bureau of Standards given above are for the first year. The receipts and the number of tests of the British National Physical Laboratory include the Observatory Department. The building cost of the British National Physical Laboratory given above is in addition to buildings standing on the side; a further grant of $25,000 has been received for this year, and a memorial has been extended to the Chancellor of the Exchequer on behalf of the Laboratory regarding the subject of an additional State grant to the institution; it is signed by 150 members of Parliament.—Lond. *Elec.*, December 22.

Osmium Lamp for Photometric Comparisons.—REVESSI.—An account of experiments made to determine the value of the osmium lamp as a secondary standard. The author tested two lamps of 37 volts and 25 cp which were connected for 70 days in a circuit in series with a low resistance. Every day the lamps were connected to a storage battery and photometric tests were made. It was found that with constant current the cp first increases and reaches 103 per cent of the original value after 200 or 250 hours; it then slowly decreases, and after 800 hours is 97.6 per cent and after 1,680 hours 96.0 per cent of the original value. At constant voltage the cp increases during 200 hours to 106.7 per cent and then decreases until it is 98.2 per cent after 800 hours and 93.2 per cent after 1,680 hours. These results show that it is preferable to use constant current. The variation in this case during 900 hours is 0.7 per cent, and is smaller than with any other secondary standard lamp. The resistance of the osmium filament reaches a minimum after 500 hours. The moment of maximum cp at constant voltage is therefore not identical with the moment of minimum resistance. It is probable that in the filament first a charge occurs in the metal itself and after that a decrease of the cross-section.—*Zeit. f. Beleucht.*, December 30.

Standard Cells.—HULETT.—An abstract of an Am. Phys. Soc. paper on electrolytic mercurous sulphate as depolarizer for standard cells. Such cells have now been under observation for about two years, and it appears that the cadmium cells have been exceptionally constant, as variations of single cells are not over two parts in 100,000. The Clark cells are not so constant since they show variations of about 5 parts in 100,000, disregarding the temperature variations due to the generation of gas at the zinc amalgam. A serious difficulty with Clark cells has been their great tendency to crack at the zinc side; but this may be avoided by allowing the platinum wire to extend well into the leg of the cell and cover it except at its point with a thin sheet of glass. The ratio of the voltage of the Clark cell at 15° C. to the cadmium cell at 20° is 1.4067; the ratio for the two cells at 18° is 1.4033, at 21.1° 1.3997 and at 25° 1.3349.—*Phys. Rev.*, January.

Transmitting the Readings of Thermometers to a Distance.—MARTINY.—An article illustrated by diagrams and giving a summary of the principal systems which have been developed for this purpose.—*Elek. Anz.*, January 4.

Testing Motors.—CARTER.—A description in detail of the arrangements for the commercial testing of small motors up to 15 hp.—Lond *Elec.*, December 29.

Telegraphy, Telephony and Signals.

Tuned Wireless Telegraphy.—SLABY.—The concluding paper of his long serial on the tuning of wireless telegraph transmitters. Coupled systems have always two waves, one being the first harmonic of the other. Indirect excitation should be applied if in tuning, the higher harmonic is to be used; direct excitation is preferable with the use of the fundamental wave. To obtain the best action at a distance, the mutual common self-induction of the oscillating circuits must have a certain, although small, value. The whole transmitting system is to be considered as one unit like an electric generator. The law which is valid for all electric generators with constant e.m.f. that the useful outside work is a maximum if it equals the internal loss in the generator (efficiency equal 50 per cent) holds good for the transmitting system in wireless telegraphy, as has been proven by the experiments of the author.—*Elek. Zeit.*, December 21.

Wireless Telegraphy.—ERSKINE-MURRAY.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. The author gives a summary of recent developments in wireless telegraphy and describes various systems. To explain the propagation of electric waves round the curve of the earth's surface, he assumes that the spreading of the waves into space is prevented by a highly conducting layer high in the atmosphere so that the waves travel round the earth much as if between two parallel conducting planes. The correctness of this hypothesis is questioned in an editorial note.—Lond. *Elec.*, December 15.—The author replies to the criticisms in a letter of Lond. *Elec.*, December 20.

Syntonic Wireless Telegraphy.—HEDDINGER.—An article illustrated by diagrams discussing the limitating factors of syntonic wireless telegraphy.—Lond. *Elec.*, December 22 and January 5.

Miscellaneous.

Expiring British Patents.—A table giving a list of the more interesting British patents which will expire during 1906. Among them are patents, covering Hutin and LeBlanc's amortisseur; Lundell's spherical continuous-current motor; Lundell's method of speed control of an electric motor by providing two armatures and two field windings; the use of non-arcing metals in lightning arresters by the Westinghouse Company; Mathiesen's arc lamp regulating mechanism; Felton and Guilleaume's type of paper-insulated telephone cables, and interlocking armoring; Willson's electric smelting of refractory ores; DeLaval's flexible shaft for turbine wheels; Schmidt's superheater; Diesel's internal combustion engine known by his name; the Oechelhaeuser two-stroke gas engine; and Parsons' method of governing steam turbines by admitting steam in puffs, the duration of which is regulated by the governor.—Lond. *Elec.*, January 5.

Zeit. f. Elek.—The name of the *Zeitschrift für Elektrotechnik* (Vienna) has been changed into *Elektrotechnik und Maschinenbau.* The scope of the paper has been enlarged so as to include subjects of mechanical engineering. The journal continues to be the organ of the Vienna Electrical Society and of the Austrian Association of Central Stations. The abbreviation of the name to be used in the Digest in future will be *Elek. u. Masch.*

Mineral and Metal Production in 1905.—The annual statistical tables on mineral and metal production in the United States in 1905. The total on-metallic production had a value of $777,849,418, against $642,912,777 in 1904; the total metallic production was $706,765,872 in 1905 against $491,888,362 in 1904. The largest advances of metals are in iron from 16,276,641 long tons ($225,268,711) in 1904 to 23,010,625 long tons ($382,666,694) in 1905, and in copper from 817,715,005 lb. ($106,320,950) in 1904 to 925,267,840 lb. ($145,257,798) in 1905.—*Eng'ing and Mining Jour.*, January 6.

Adjusting the Direction of a Searchlight on Board Ship.—DUBOIS.—A detailed illustrated description of a method of adjusting the direction of a search light from a distance by electrical means.—*L'Industrie Elec.*, November 10.

Electric Chime.—HOPKINS.—An illustrated description of its construction.—*Scientific Am. Supplement*, January 6.

BOOK REVIEWS.

DYNAMO DESIGN. Its Theory and Practice. By A. Press. New York: McGraw Publishing Company. 102 pages, 28 illus. Price, $2.00.

This small volume is a very interesting and suggestive contribution to the theory of design of direct-current machines. It would seem as though little could be added to the large number of books extant on this subject, but the work of Mr. Press is original in many respects and full of such suggestions as will put thoughtful designers to thinking, even though these suggestions may not always be right or be backed by proper experimental evidence. The book is divided into seventeen chapters, treating of the armature diameter and length, ratio of pole enclosure to pole pitch, the armature iron and copper losses, the working densities in the iron and copper, the slot shape, design of the commutator, and the determination of the sparking and heating constants. In reading through the various chapters we cannot but admire the many pretty and original ideas which the author develops more or less fully, but we also are filled with regret that so many premises are accepted without carefully investigating their foundations, thus introducing a somewhat uncritical attitude where the greatest care should have been exercised in testing the assumptions upon which the calculations are based. While brevity is generally an advantage, too much brevity is decidedly objectionable in chapters of such intrinsic complexity as those on commutation and sparking, and such conditions as the brushes covering more than one bar; and the mutual induction of the coils, under commutation, upon each other, should have been investigated and commented on. The theory of commutation is the author's specialty and it would have been easy for him to present the subject in such a manner as to make it not only attractive, but also comprehensible and useful to the designing engineers. Diagrammatic representations of some of the differential equations used would also greatly enhance the value of Mr. Press's theory.

To illustrate our point of view in criticising some of the author's methods, let us turn to Chapter XI on "Armature Self-Induction," which commences as follows:

"In determining the armature self-induction the following formula can be employed:

$$\left.\begin{array}{r}\text{Self-induction per ampere turn per}\\ \text{cm. length of imbedded conductor}\end{array}\right\} = \frac{.38\ (p+6)}{\sqrt{q}}$$

in an authoritative manner as though there could be no doubt about its truth, whereas it is altogether erroneous and without any experimental foundation. If the author's great talent for theorizing had been chastened and tempered by the fire of solid experience he would have used more discernment than is shown in some of his assumptions. While these crudities disagreeably jar upon the experienced designer studying the book, there are so many good features which compensate for this defect that we feel safe in saying that the reader of the little treatise will receive suggestions which will prevent any feeling of disappointment produced by a certain easy-going spirit of taking things for granted which should be proved by facts and experiment. The book is one in which all intelligent and thoughtful designers of direct-current machinery will be interested and from the study of which they will receive useful suggestions.

ELEKTRISCHE KRAFTUBERTRAGUNG. By Wilhelm Philippi. Leipzig: S. Hirzel. 386 pages, 4 plates and 32 ills.; paper. Price, 18 marks.

This substantial volume is addressed by an engineer to engineers. It treats of the practical achievements of electric power transmission and distribution in Germany both by direct and alternating currents. Formulæ are given for many of the important data occurring in such installations. Applications are described, and abundantly illustrated, to hoisting, elevators, cranes, tool and machine driving, boring, ventilating, and work in factories and farms. The book is excellently adapted to the needs of students who have become acquainted with the nature and action of dynamo machinery and who seek to become acquainted with its practical applications. The book will also be a useful reference for engineers on the subject of practical utilization of power transmission over short distances.

INSTRUMENTE ZUR MESSUNG DER TEMPERATURE FUR TECHNISCHE ZWECKE. By Otto Bechstein. Hannover: Gebrüde Jänecke. 64 pages, 61 ills. Price, 1 mark.

This pamphlet is very clearly and interestingly written from the engineering standpoint. The theory of operation of the apparatus is not deeply entered into. An illustrated description is merely given of the various types of thermometers and pyrometers in industrial use. These are in brief, gas thermometers, liquid thermometers, maximum-and-minimum thermometers, recording thermometers, pyrometers, calorimeters, optical pyrometers, thermo-electric pyrometers and electric-resistance thermometers.

A final section deals with the manipulation of thermometers in general and the relative advantages of different types.

The engineer will find the pamphlet of interest and value.

BOOKS RECEIVED.

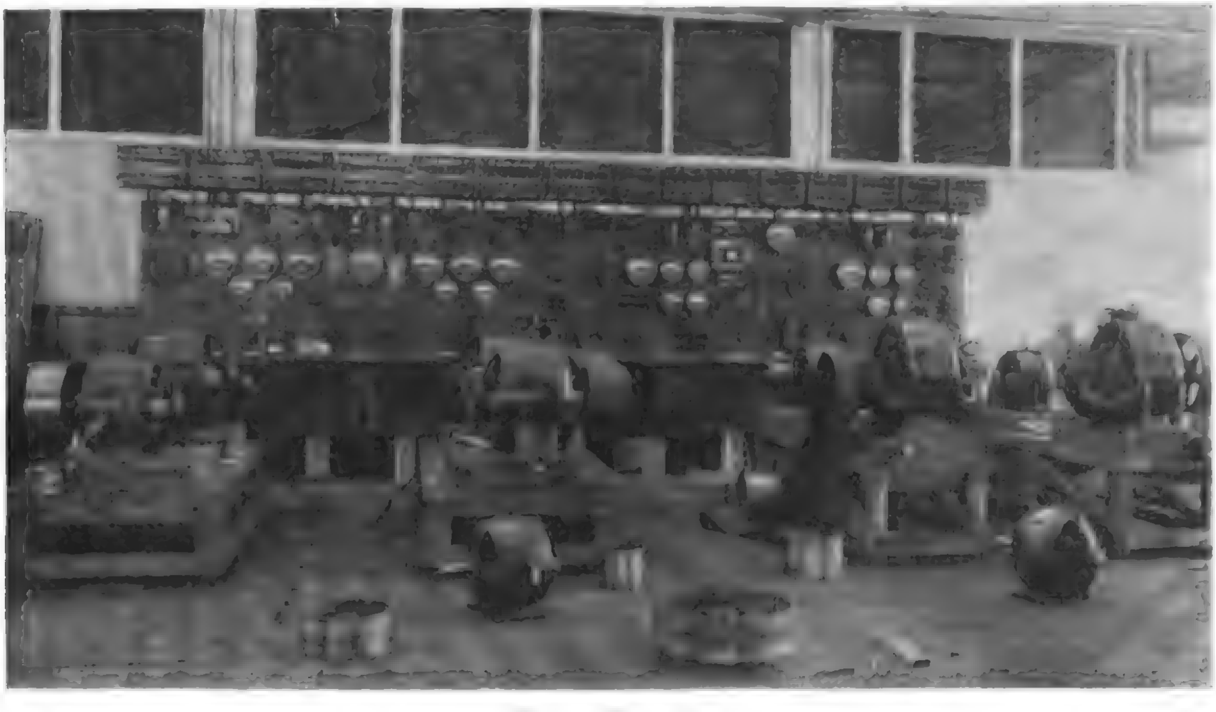
THE STEAM ENGINE AND OTHER STEAM MOTORS. Vol. 1: The Thermodynamics and the Mechanics of the Engine. By Robert C. H. Heck. New York: D. Van Nostrand Company. 391 pages, 190 illustrations. Price, $3.50.

ELEMENTE DER VEKTOR-ANALYSIS. Second Edition. By A. H. Bucherer. Leipzig: B. G. Teubner. 103 pages, illustrated. Price, 2.40 marks.

DIE ELEKTRISCHEN BOGENLAMPEN. By J. Zeidler. Braunschweig: Friedrich Vieweg und Sohn. 140 pages, 130 illustrations. Price, 5.50 marks.

Testing Equipment of the Electro-Dynamic Company.

Before making factory tests on commercial machines the usual procedure is to fasten the machine to the floor and belt it to another machine which it is to drive or be driven by, according to whether the tested machine is a motor or generator. The time spent in thus adjusting the machine and the belt is oftentimes almost as great as that required for the actual test, factory test runs as a rule being quite short. The special testing equipment installed by the Electro-Dynamic Company at its factory in Bayonne, N. J., is unique in that the time required to adjust the machine is reduced to a minimum, and the test board connections made extremely simple.



TESTING EQUIPMENT.

The machines built by the company are the now well-known "Inter-pole" variable-speed motors, the speed variation being obtained entirely by a variable resistance inserted in the main field circuit, which is shunt-wound, the small inter-poles, which counteract field distortion, being series wound. As shown in the illustration herewith, four testing units are provided, each comprising a table and a switchboard fitted with all necessary instruments and accessories. This equipment is capable of taking care of seven sizes, the smallest being rated at 1 hp at a four-to-one speed variation and at about 2½ hp at constant speed; and the largest rated at 15 hp at a four-to-one speed variation and at 40 hp when running at constant speed. Generators are provided with the same frame sizes as motors. Although the company builds generators and motors for 500 volts, the majority of the machines are wound for operation on 110 or 220-volt circuits, and current at these potentials is supplied to the board.

Each of the tables is 7 ft. long, the two on the right being 30 in. wide and about 21 in. high, while the two on the left, intended for machine sizes four to seven inclusive, are about a foot wider and three inches lower. The dimensions of the tables were chosen with a view to having the machines overhang only a trifle if at all, the height being such that any adjustment such as setting the brushes, taking speed measurements, applying terminals, etc., can be easily made. The tests usually consist of heat runs and efficiency tests at minimum speed, and with variable-speed motors a short, full-load test at maximum speed for the purpose of determining the resistance needed in the controller for speed regulation and also to observe conditions of sparking.

The company finding the greatest demand for its motor rated at 5 hp on a four-to-one speed variation for machine tool operation, all four tables are capable of testing this size of machine. The table framework is made of three-by-four timber well braced and covered with 3-in. planking, the bolts used in the construction having their heads countersunk. A casting is fitted at each end of the table to receive a bed movable along the length of the table, the distance apart of the beds beng regulated by screws. Each bed is provided with 16 drilled and tapped holes, each set of four holes being spaced to receive the holding-down bolts of one of the standard size frames. The arrangement is such that the central planes of the standard pulleys of all sizes coincide, so that when two machines of the proper size are placed on the table and the belt arranged, the latter will run steadily.

Each switchboard section to accompany a table is provided with a motor and a generator panel since nearly all the tests involve the use of a motor and generator. A 110-220-volt, three-wire circuit supplies the board, and whenever current at a higher potential is required, this is supplied by a motor-generator set. Above the top of the board may be seen fifteen load rheostats. These have terminal posts on the board as shown, by means of which they may be connected in series, multiple or series-multiple, according to the voltage and current of the generator. The motor panels are provided with field rheostats of high resistance and others of large current-carrying capacity. An ammeter, switch and fuse are provided in the field circuit, and a controller with reversing switch, fuses and two ammeters in series are provided in the armature circuit. One ammeter has a scale reading up to 15 amp. and is used for measuring the load current of small motors and also the current taken by a motor running free; beyond its range it may be made inactive by means of a shunting switch. The second ammeter, which is always in circuit, has a range large enough to measure the current on any motor operating from the board.

The field circuit arrangement of the generator panels is almost the same as that of the motor panels with the exception of the rheostats, which are not so varied and which do not possess so great a resistance. Included in the armature circuit is an ammeter, circuit-breaker, fuses, a set of cast-iron grid rheostats for loading the generator and a double-throw switch for leading the generator load to the rheostats or back on the power line. The voltmeter on each pair of boards is provided with leads extending to the table so that voltage readings, etc., may be taken from any part of the table. A shelf is arranged along the face of the switchboard for note books, pads, additional instruments, etc. By means of the overhead crane with which the shop is equipped, a machine may be picked up in any part of the shop and deposited on the table where the test is to be made, after which the same means is used to convey it to the shipping department. Although in operation only a little over a year the company is now building machines with 397 ratings, about 15 sizes of frames being used.

Curtis Steam Turbines in Mining Work.

The economy of the steam turbine at all loads renders it particularly adaptable for mining power purposes in conjunction with electricity as the intermediary, and now that transportation by electric mining locomotives and mine lighting by electricity have become so well established the steam turbo-generator is the logical source of the necessary power.

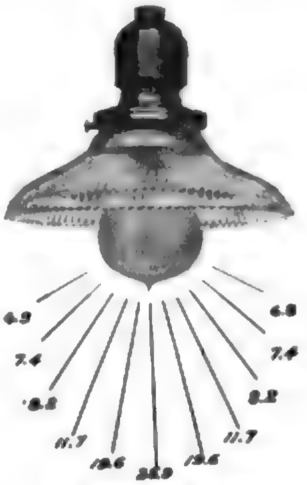
The Curtis steam turbo-generator, built by the General Electric Company, of Schenectady, N. Y., has met with much success in this class of work. Seven 500-kw, 2,300-volt, 60-cycle alternating-current generators driven by Curtis turbines have been purchased by the Delaware, Lackawanna & Western Railroad Company for operating mining locomotives and hoists in the coal mines at Scranton, Pa. Three of these machines were put in commercial service in November, 1903, and such has been their success that another has since been installed and an order has been placed for three additional machines which are now being installed at Nanticoke, Pa. Other Curtis turbines in process of construction for coal mining work are a 500-kw machine at Iron Mountain, N. Y., for the Delaware & Hudson Railroad Company; one 1,500-kw and one 75-kw machine for the Cowanshaunock Coal & Coke Company, at Echo, Pa., and two of 75 kw for the North Jellico Coal Company, Louisville, Ky.

One of the most recent adaptations of the turbine in this work is at Flat River, Mo. The Federal Lead Company will install three 500-kw, four-stage, 480-volt Curtis steam turbo-generators, which will operate at 60 cycles, three-phase, for lighting and power work in the company's mines. A duplicate exciter system will be furnished, consisting of a 25-kw turbo-generator set. In addition to the above, the General Electric Company will also furnish a complete switchboard equipment for a three-phase power feeder system, and for four single-phase lighting circuits.

In foreign countries the Consolidated Gold Fields Company, of South Africa, has one 1,000-kw and three 500-kw Curtis steam turbines in successful operation. In the same country also the Witwaters Rand Deep Mining Company operates a 500-kw turbine, using the power so generated in gold mining. In Japan a 1,000-kw machine is being installed in the Miike Coal Mine.

Prismatic Reflectors for Incandescent Lamps.

In connection with the interest which has been aroused in the application of effective lighting combinations consisting of scientific prismatic reflectors and high-efficiency lamps, it may be well to call attention to some very useful shades which have recently been developed for use with small units. These reflectors are made in six styles, of which three are used for distributing the light, and three for concentrating the light. Each of these reflectors is made to fit a standard 2.25-in. holder, and, as the illustration will show, is very graceful in design. They are

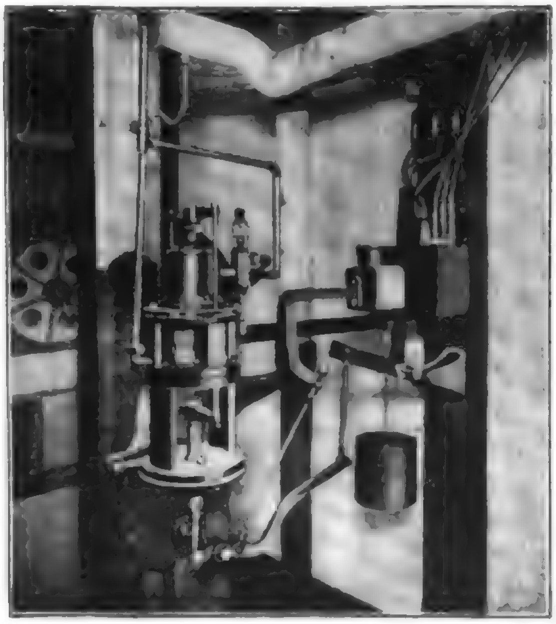


PRISMATIC REFLECTOR.

just being placed on the market by the Holophane Glass Company, 227 Fulton Street, New York.

Intermittently-Operated Elevator Pump Induction Motor.

It has been customary when installing induction motors for operating pumps supplying hydraulic elevators to run the motor continuously and provide an automatic by-pass around the pump so that the discharge of the pump will return to the suction whenever water is not needed to maintain pressure in the tank. In the Tudor apartment building in Chicago, which has a motor operated off the two-phase circuit of the Commonwealth Electric Company, a 15-hp induction motor was installed belted to an 8 by 10-in. triplex pump. This motor which was installed by the Adkins, Young & Allen Co., of Chicago, is provided with means for automatically starting and stopping the motor according to the pressure of air above the water in the compression tank supplying the elevators. The arrangement for starting and stopping is very simple and is illustrated in the accompanying engraving, for which we are indebted to the *Electric City*, published by the Chicago Edison Company. The motor is controlled by a General Electric oil switch. The oil switch is operated by the mechanism of a regular Mason belt shifter, the belt shifter being operated hydraulically by the tank pressure. This shifter is such as is used for shifting belts on elevator pumps driven from line shafting. The belt shifter operates between the pressure of 35 and 80 pounds per square inch, throwing the switch on at the former pressure and off at the latter pressure.



PUMP INDUCTION MOTOR.

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Electrical Features of a Textile Mill.

There is now under construction at South Lawrence, Mass., the largest and most finely equipped factory in the world for the manufacture of worsted yarn. This mill, that of the Wood Worsted Company, will embody many novel features and conveniences for the comfort of 5,000 employes. It will have a total floor space of 1,300,000 sq. ft. distributed in three buildings. Of these the main structure will be 1,437 ft. long, 123 ft. wide and six stories in height. Apart from this will be the power house, boiler house and office. This latter is so arranged that, in event of future extensions, it will form a portion of another mill, which is planned to be a duplicate of the one now in process of construction.

In the electrical equipment of this mill there are several engineering features and details in the general plan of operation, which invite special attention. The main building will be heated and ventilated by the blower system and the further comfort of the operators is assured by the proposed installation of escalators which are of such a capacity that they will carry the 4,000 employes in this structure from basement to the top in five minutes. The boiler house for supplying steam to the plant will eventually contain forty horizontal return tubular boilers, 78 in. in diameter and 20 ft. long. Mechanical draft with duplex fans and economizers will provide for the most economical fuel consumption.

In the power house are to be located two main generating units. These consist of a double non-condensing engine rated at 1,800 hp, running at 133 r.p.m., direct-connected to a 1,500-kw General Electric generator, and a second unit, comprising a compound condensing engine with two vertical and two horizontal cylinders of 5,000 hp capacity, running at 120 r.p.m., direct-connected to a 4,000-kw General Electric generator. The exhaust steam from the non-condensing engine will be used for heating, wool washing, dyeing and finishing, and the condensed steam from the compound engine will also be used in these operations. In addition to the main generating units, there will be a 100-kw, 240-r.p.m. generator for light loads and emergency work. Excitation current for the generating units will be furnished by a 65-kw, 125-volt, motor-driven generator, with a small direct-connected steam unit of like capacity acting as a reserve.

These main generating units, above mentioned, will supply current at 40 cycles and 600 volts to a most complete and modern switchboard, from which distributions will be made to the various buildings. The switchboard will consist of 33 panels, with lighting and power feeder circuits grouped on opposite ends of the board. These circuits are planned so that different parts of the mill can be operated individually.

About 5,000 hp of induction motors will be employed for this group driving of machinery. The motors are of the latest General Electric type wound for 550 volts and range in size from 8 to 175 hp. All motors are planned for ceiling suspension. With each motor of 125 hp or above a non-automatic switch will be installed, as each of these motors is on a separate feeder circuit protected at the main switchboard by an automatic switch. The smaller motors are safeguarded by automatic oil switches installed on a trunk line.

The general lighting will be done by direct-current arc lamps, the steps in current transformation from alternating to direct being taken by constant-current transformers and mercury arc rectifiers. This system possesses marked advantages as to first cost and economy of operation, over the ordinary methods of transformation. In this case constant current from the main generating units is obtained by four 50-light General Electric, constant-current transformers. The constant alternating current so obtained is rectified by means of General Electric mercury arc rectifiers and operates 200 direct-current arc lamps. Aside from the arc lighting, six 25-kw and two 10-kw General Electric transformers will furnish current for the incandescent lamp illuminations.

Throughout this mill the engineering features have been carefully studied to incorporate the latest devices and best methods possible in the production of its output. The wide experience of the president of the Wood Worsted Company, Mr. Wm. M. Wood, and its treasurer, Mr. B. F. Smith, Jr. (associated with the American Woolen Company), as well as the engineering ability of its designers, mostly men associated with that company, are reflected in the model construction and carefully selected equipment. The building plans were drawn by Dean & Main.

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25,000-Ohm Resistance Coil.

The accompanying cut shows a resistance unit manufactured by the Ward-Leonard Electric Company, Bronxville, New York, which is of especial interest in that an extremely high resistance with a large ampere capacity is obtained in a unit whose over-all

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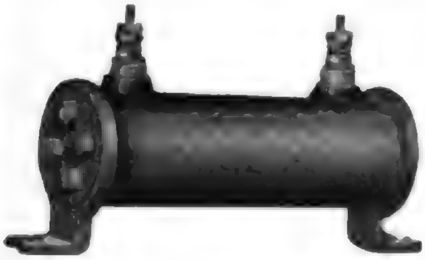
dimensions are very small. The resistance of the unit is 25,000 ohms, with a capacity of 80 watts continuous service and with a capacity for great overloads for short periods of time. This unit is 6 in. long by 2¾ in. in diameter. The unit consists of three Ward Leonard enameled resistance units enclosed in a casting, the space between the enameled tubes being filled in with sand. The sand fills the entire space and holds the tubes so that they are not subjected to any mechanical strain. The sand has a very high specific capacity for absorbing heat energy, which permits the enameled units to be greatly overloaded for short periods of time. Each enameled unit has a resistance of 8,300 ohms (approximate), is 4 in. long and 7/16 in. in diameter. The resistance wire has a temperature coefficient not greater than that of German silver. The unit is entirely enclosed, rust-proof and does not present a fire hazard. The Ward Leonard Electric Company claims that this is the smallest unit in the world for this high resistance.



25,000-OHM RESISTANCE UNIT.

A Simple Composing Machine for Advertising Matter.

The typesetting and composing machine shown in the accompanying illustrations aims to cover a field which no machine has heretofore invaded; that is, the composition of advertising matter which is ordinarily of so irregular a character that it cannot be set on the composing machines now in use. Advertisements usually require several changes of fonts in order to give due emphasis to certain parts and make them stand out prominently. For this reason an advertising composing machine should be provided with a multiple font magazine so arranged that any font can be brought into action without a moment's delay. Furthermore, the matter must be set in individual type instead of line slugs, because, owing to its diversified character it is more liable to contain errors than is straight matter, and errors cannot be easily corrected when the lines are cast in solid slugs.

These requirements are met in the new composing machine, which carries a four-font magazine, comprising a total of 400 matrices. A keyboard of a hundred keys controls the matrices and any of the fonts may be brought into operative position by shifting a lever. Individual character type is cast, the casting taking place immediately after the key is touched and without waiting for an entire line or column to be set. In this machine no spaces are cast until all the characters of a line are cast, but the words are assembled separately in chambers of an auxiliary magazine, and then the spaces are cast and moved successively into the galley with the words. The necessary thickness of the spaces is determined by a simple counting device on the machine.

By adopting this method of justification the mechanism is reduced to the extreme of simplicity. The machine which is here shown contains but 200 pieces, as against 1,800 in one of the prominent composing machines now in use. This great simplification of parts is due entirely to the new system of justification. Another feature which has done much to simplify the machine is the free use of electricity to control the various actions. In this way all the usual keyboard complications are entirely avoided.

The matrix magazine is very unique. It consists of several bars rectangular in section and bearing the matrices in single rows on their several faces. The purpose of having several bars is to provide for the difference in body thickness required by various characters. The same characters are duplicated on each of the four faces of the bar, but in different fonts, so that when it is desired to change from one to another of these fonts the bar is turned until the required face is brought to the operative position. The entire magazine of matrix bars turns simultaneously and the operations can proceed with the new font until another change is desired, which may be similarly effected. The entire magazine can be removed and replaced with a new one in half a minute, and if the new matrices call for a type body of different thickness the entire operation, including change of the mold, can be done in a minute and a half.

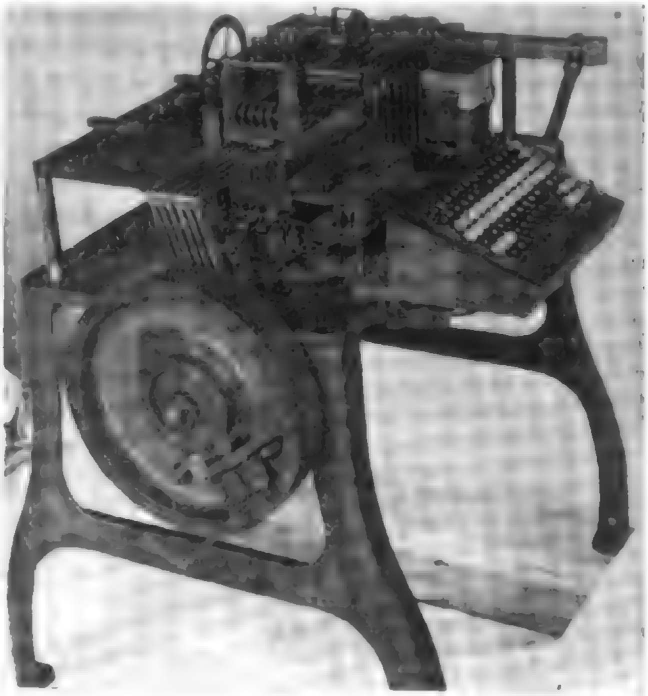


FIG. 1.—MAGNETICALLY-OPERATED COMPOSING MACHINE.

The operation of the machine may be understood by referring to the drawings. Whenever a key, *a*, is touched, it completes the circuits of three electromagnets, *B*, *C* and *D*, as shown in the diagram, Fig. 2. There are six magnets, *B*, one for each matrix bar, and a hundred magnets, *C*, one for each matrix. When a magnet, *B*, is operated it withdraws a dent, *b*, from the slide bar, *E*, permitting the latter to move forward under tension of a spring acting on a lever, *e*. The slide bar carries the matrix bar over the mold. The magnet, *C*, operates to stop the matrix bar when the proper matrix reaches the mold, and this it does by raising a pin, *c*, in the path of a heel formed on the slide bar. The whole operation of casting the type and returning the matrix to its initial position is controlled magnetically, as is also the casting of the spaces.

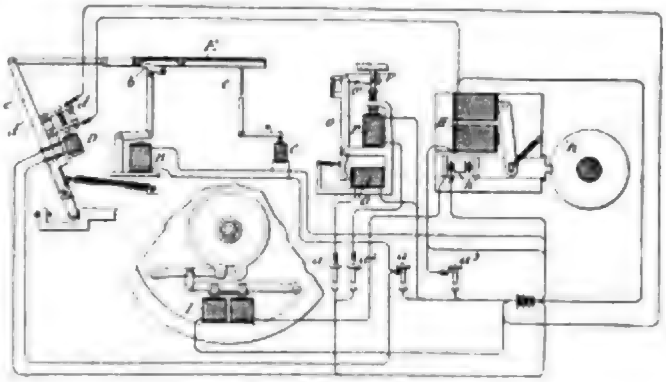


FIG. 2.—DIAGRAM OF CIRCUITS.

The action of the machine is exceedingly rapid, even more so than was at first anticipated. As originally designed the circuit of the magnetic clutch, *I*, was closed immediately on touching a key of the keyboard, but the cam shaft responded so quickly that a matrix bar was often clamped to the mold before the desired matrix was reached. This necessitated the use of the ingenious circuit closer, *D*, which would operate only when the proper matrix arrived at its destination.

A patent on this simple type composing machine has recently been granted to Messrs. John R. and Gustave A. Pearson, of Brooklyn, New York.

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The Chicago Electrical Show.

The past two weeks have been busy ones in electrical matters in Chicago. The Electrical Trades Exposition held at the Coliseum January 15 to 27 served as a drawing card for meetings and conventions of electrical men from all over the middle west. These conventions are reported elsewhere. The Electrical Show itself has proved to be a great success in attendance and in the support given by manufacturers. The floor of the Coliseum was fully occupied. The evening attendance was all and sometimes more than could comfortably be accommodated.

The management of the Electrical Trades Exposition Company, of Chicago, which carried out the undertaking certainly deserves great credit for its marked success in a time when electrical exhibits are being so frequently asked of manufacturers and in a city which has its full share of attractions in the way of shows of various kinds. The officers are Samuel Insull, president; Charles E. Gregory, first vice-president; E. B. Overshiner, second vice-president; John Jay Abbott, treasurer; Stewart Spalding, secretary, and Thomas R. Mercein, general manager.

The active management was mainly taken by Mr. Mercein and by Mr. Homer E. Niesz, of the Chicago Edison Company, who was a director in the exposition, and had charge of publicity matters. The show has been successful beyond any of the hopes of exhibitors or promoters. Exhibitors who went in expecting benefit only in the way of general publicity without direct returns have found the direct returns excellent.

The General Electric Company made an exhibit the most prominent and best crowd-drawing feature of which was a display of new cooking and heating appliances. These were shown in operation by demonstrators who were constantly in attendance. Besides the G. E. flat-iron and coffee percolator there were many other recently developed cooking and heating devices, including broilers, toasters, waffle irons, glue pots, luminous radiators, cigar lighters and heating pads. There was also exhibited a small geared motor for operating a breast drill and similar, somewhat larger, motors for operating sewing machines and other household machinery. Among the heavier apparatus exhibited was a motor generator set for automobile charging from alternating-current circuits, a hoist and a mercury vapor rectifier. The booth was surrounded with rows of "G. E. M." high-efficiency incandescent lighting units with prismatic glass reflectors. The recent lamps of this type do not have the frosting carried as far up on the lamp bulb as the first ones because of the reduction of light due to frosting. In another part of the building, was a 25-kw horizontal shaft, direct-current Curtis turbo-generator running 3,600 r.p.m. such as is used for exciter units and train lighting. There are some 21 of these in service on Pennsylvania limited trains, 5 on the Burlington Denver trains, and on other roads.

The Chicago Edison Company and its allied companies, the Commonwealth Electric Company and the North Shore Electric Company, occupied the best and most prominent space in the center of the Coliseum. These companies fitted up a kitchen where all kinds of cooking was done electrically. Joining the kitchen was a dining room, showing how artistically an electrically-lighted dining room can be arranged. Over the dining room table was a large art glass shade hanging by four bronze chains from the ceiling. The art glass shade had a brown glass septum for diffusing and softening the light from the incandescent lamps contained in the shade. Around the canopy of this fixture was a cluster of round frosted lamps. The whole effect was very pleasing. Adjoining the dining room was a space occupied by an electrically driven refrigerating machine from the Brunswick Refrigerating Company, of New Brunswick, N. J. In another part of the booth was a large Miehle printing press operated with electric motor and some smaller motor applications. A handsome special edition of the *Electric City*, published by these companies was issued for the Electrical Show, and a daily edition of this publication was also printed during the show on the motor-driven printing press in the booth.

The Chicago Pneumatic Tool Company exhibited its line of electric breast drills which have been placed on the market to do the work heretofore performed only by pneumatics. As electric current for operating is much more generally obtainable than compressed air, it goes without saying that there is an immense field for these drills in the marketing of which the Chicago Pneumatic Tool Company will have the hearty co-operation of central station companies wishing to extend the market for power. This exhibit also included samples of the "little giant storage battery."

The Federal Electric Company, of Chicago, was well represented by signs in its own exhibit space and by numerous other electric signs over the Chicago Edison Company's exhibits and many others.

The Haller Machine Company had a very large attractive sign operated by a flasher at the booth of the American Electric Supply Company and a very large exhibit of different styles of electric signs in that booth in addition.

The Phoenix Glass Company had a small but handsome display of some of the latest designs of electric shades for use with incandescent lights and arc-light inner globes.

The Coburn Flexible Conduit Company, and the National Metal Molding Company, of which I. A. Bennet is the western manager, exhibited a small house or booth of Economy iron conduit and "Fexduct" flexible conduit.

The University of Wisconsin engineering department made an exhibit, the most interesting features of which were an electric furnace of the type used in the notable investigations carried on with electric furnace work at that university by Prof. Burgess and others, and samples of products obtained from the electric furnace. Some interesting photographs were also shown of buildings and work rooms at the university.

Armour Institute of Technology made an exhibit consisting largely of testing apparatus. One part of the exhibit was devoted especially to its work in telephony under Prof. Kelsey.

C. H Thorardson, designer and builder of special experimental and high potential apparatus, gave frequent exhibitions of high-potential discharges from a transformer which he used in similar demonstrations at the Louisiana Purchase Exposition in St. Louis. It is hardly necessary to say that these high potential discharges raised more commotion and attracted more attention when in operation than anything else on the floor of the Coliseum. Mr. Thorardson also showed a very neat and substantial set of appliances for demonstrating the fundamental principles of electricity and magnetism which he makes for schools and colleges.

The Electric Appliance Company exhibited Packard lamps, Sangamo wattmeters and various other goods which it handles.

The Sangamo Meter Company made a very fine exhibit of its new non-infringing wattmeter for alternating or direct-current circuits. This wattmeter is the one described in the ELECTRICAL WORLD recently.

The H. A. Petersen Manufacturing Company constructed its booth of "Harvey-duct," the iron pipe conduit which it manufactures at its new factory at Harvey, Ill., along with marine-duct and interior-duct.

The Overbaugh & Ayers Manufacturing Company had an extensive exhibit of the "Oamco" universal swing brackets and portables. This company makes a specialty of adjustable brackets, very useful for shop, drafting room and office lighting.

The Sarco Company had as the most novel feature of its exhibit a couple of flame arc lamps of German manufacture, using impregnated carbons with a wire core. The light given is golden yellow. These lamps burn two in series on 115 volts and were said to consume four amperes. They operate on direct or alternating-circuits. These lamps are of the type in which the carbons both point downward at an angle, the arc being at the lower tips. The life of the carbons is stated to be about 14 hours, consumption being about one inch per hour.

The Wagner Electric Manufacturing Company, of St. Louis, exhibited both its regular constant speed, self-starting, single-phase induction motor and its hoist motor which starts with characteristics similar to a series motor.

The B. F. Sturtevant Company exhibited a direct connected marine engine and generator, and some electrically-driven fan blowers.

The Simplex Electric Heating Company had one of the largest and best visited exhibits. It was devoted entirely to electric heating appliances, of which it makes such a large variety. It included all sizes of irons from the smallest to the largest in commercial use, chafing dishes, in at least six different designs, curling irons, heaters, heating pads, nursery milk warmers, water cups for boiling water, soldering irons, glue pots, hair dryers, ovens, griddles and electric ranges. An electric kitchen was kept in operation.

The Peru Electric Manufacturing Company exhibited its porcelain specialties for electric purposes, of which it makes an immense variety.

The Lang Electric Company showed samples of its switchboard work.

The General Storage Battery Company had a large exhibit showing its "Bijur" batteries for all purposes from spark coil operation to central station and isolated plant work.

Dossert & Company exhibited their famous appliances for terminals and splices in electrical work.

The H. B. Camp Company had a booth devoted to Camp tile duct.

The Automatic Electric Company exhibited its automatic telephones and a small automatic exchange.

The American Circular Loom, of which Thomas G. Grier is the western representative, made an exhibit at the Grier Company's booth. Mr. Grier also showed other specialties for which he is agent.

The American Steel and Wire Company exhibited its steel and iron wire products, and a variety of bonds and rail bonding tools.

The Guarantee Electric Company had in process of reconstruction an armature showing the repair methods used by this company.

The Stanley-G. I. Electrical Manufacturing Company had its exhibit moving promptly at 8.30 on the opening night. It had a prominent place well occupied by both stationary and moving machinery. A Challenge Gordon press was belted to a new type direct-current printing press motor in operation. An automatic motor-driven stereopticon threw on a small screen pictures of the factories and apparatus, interspersed with works of art. Polyphase and single-phase induction motors were shown, the latter of the resistance and reactance type. The arc apparatus was especially complete, including regulators, an arc panel switchboard and a test rack on which were placed the latest types of lamps, including the L4 midget lamp and the K31, which has the carbon holder mounted on a crosshead and is wound with indestructible magnets of enameled wire. A table contained samples of the Wright "maximum demand" meter, hot-wire ammeters and voltmeters and watch case instruments, besides many others. A new slide oil switch was shown and fittings for interior work.

Crane Company.—The exhibit of Crane Company afforded engineers and others interested in power plant equipment an opportunity of seeing the latest design and improvements in valves and steam specialties. Two of the valves shown were equipped with electrical devices by means of which the operation may be controlled from any desired point. One of these valves was an 8-in. high-pressure motor-driven "Ferrosteel" gate valve. In this arrangement a motor is attached directly to the valve in such a way that by the operation of the motor the valve may be opened or closed as desiired. When the switch, located at any distance from the valve, is thrown to open or close the valve, the motor continues in operation until the valve has been tightly seated or opened full. At the completion of this movement the motor automatically stops. The other one of the electrically-operated valves was a 24-in. hydraulically-operated gate valve provided with an electrical device by means of which the admission of water into the operating cylinder is controlled. Both of these valves were connected up so that their practical operation could be seen. Among the other valves and steam specialties exhibited was an 8-in. triple-duty, high-pressure globe valve, an 8-in. automatic stop and check valve, a 30-in. low-pressure gate valve, an 8-in. high-pressure separator, a 24-in. vacuum oil separator, an 8-in. high-pressure vertical separator, a Cranetilt return and a Cranetilt non-return steam trap.

The Western Electric Company exhibited a marine set consisting of a 50-kw generator direct-connected to a vertical engine. The set was designed especially for steamship lighting, but is well adapted to any restricted floor space. The exhibit included a number of power motors of various sizes and motors for crane and hoisting service, of the box type, built very compact and designed to stand heavy service. Sewing machine motors of a new type built for alternating-current and for direct-current work were shown operating machines. The speed regulating gear of these motors is so constructed that the speed may be varied through a very wide range by simply pressing down the tread of the machine. When pressure is removed from the tread, the motor is cut out of circuit. The whole exhibit was flooded with light from a string of 25 series alternating standard street arc lamps. These lamps were connected to a series regulator. In the background of the exhibit were three large paintings showing the New York, the Chicago and the Hawthorne factories of the company.

The Monarch Electric & Wire Company had space near the fountain in the center of the building. Samples of weatherproof wire manufactured by the company were shown in sizes varying from No. 20 wire to 500,000 circular mil cable. Galvanized strand wire of several sizes was also exhibited.

The Manhattan Electrical Supply Company exhibited a full line of telephones and parts used in the construction of telephones. In addition to these electric bells of various sizes were shown. Telegraph instruments of various kinds were placed in a showcase near the aisle.

The Edwards Electric Headlight Company had several of its headlights in operation. The lights are adapted for use in locomotives, wrecking cars, steam shovels and interurban cars. The turbine and dynamo operating them are built on the same base as the headlight.

The American Electric Sign Company had on exhibition a number of signs of its manufacture.

The Acorn Shade & Reflector Company, of Chicago, had a very attractive exhibit of stand and ceiling lamps fitted with arc glass shades.

H. T. Paiste had space in the southern portion of the building where were exhibited Fielding receptacles, fuseless rosettes and other specialties for window lighting.

The Central Electric Company had at one corner of its booth a pillar consisting of reels of "Okonite" wire. Attached to this was a "biscuit" consisting of a half sphe[illegible] diameter of crude rubber used in insulatio[illegible] [illegible] telephone rather interesting feature of the exhibit was a piece of submarine cable which had been caught in the screw of a tugboat and twisted out of shape. This cable illustrated the amount of torsion the cable may be submitted to without destroying the insulation. In addition to these features the exhibit included a full line of D. & W. new code fuses and all styles of fuse boxes. In one corner of the booth was a case containing every type of lamp manufactured by the Columbia Incandescent Lamp Company.

The American DeForest Wireless Telegraph Company had an exhibit and a receiving station at the Coliseum which received its full share of popular attention.

The Chicago Lamp & Reflector Company made a display of its shades and reflectors for electric purposes.

The Electric Storage Battery Company, of Philadelphia, had a very attractive exhibit, showing the various types of storage batteries, both the "Chloride Accumulator" and the "Exide Accumulator" being exhibited. The largest cell exhibited, a type R-71 element in a type R-83 lead-lined tank, is a duplicate of one of the 2,544 cells now being installed by the New York Central

& Hudson River R. R., on the lines between New York and Poughkeepsie. Each cell has a capacity to discharge 4,200 amperes for a period of one hour. Other cells shown were a G-9 in lead-lined tank, an F-11 in glass tank, and E-11 in glass jar. A switchboard panel, of blue Vermont marble, had mounted upon it the standard instruments used in the operation of an electric railway line battery. Railroad car-lighting cells of several types were shown. The Illinois Central R. R. is equipping its system with "Chloride" and "Exide" batteries, for block signal service, and samples of these were exhibited. The "Exide" vehicle and sparking batteries occupied a prominent place. The exhibit was in charge of the company's Chicago office staff, consisting of Messrs. G. H. Atkin, J. M. S. Waring, J. A. White, Irving Seaman, and H. B. Marshall.

The McFell Electric Company had installed as a feature of its exhibit an open circuit fire alarm system having a constant test on the line. But two wires are used for wiring the system, and any number of boxes may be placed on these circuits. The number of the box pulled is registered at the central station.

The Fort Wayne Electric Works had a prominent space and large exhibit near the center of the building. Arc lamps were hung from side posts, and a corner post was utilized to display electric fans of the company's manufacture. A feature was made of the Fort Wayne prepayment induction watt-hour meters. These, as well as multiphase meters and other types of Fort Wayne meters, were mounted on the rear wall. Some were connected up and in operation, the covers being removed to show the parts. Show cases near the aisles contained all the parts necessary in the construction of meters. In addition to machinery manufactured by the company there was also shown in the booth the Shelton electric vibrator.

The Dayton Electrical Manufacturing Company, the Bishop Gutta Percha Company, the American Electric Heater Company, the Electric Gas Lighting Company and the Schwarze Electric Company were represented by D. G. Welling, who has recently opened up a Chicago office for these companies. The displays were made in the booth of the McFell Electric Company.

Sam J. Gorman & Company exhibited a full line of vibrating apparatus. A vibrating bed attracted much attention. The patient lies on water cushions, some of which are heated by electricity. An electric motor beneath the bed gives the vibratory movement.

Charles E. Gregory, president of the Guarantee Electric Company, had on exhibition the first dynamo installed in Chicago. This was a bi-polar machine brought to Chicago and exhibited in the *Inter-Ocean* office in September, 1875. Some of the lamps used with the machine were suspended nearby. These consisted of large globes filled with nitrogen and hermetically sealed. The carbon pencils fed upwards automatically. The lamps took 30 amperes at 10 volts, and had a life of about 700 hours.

The Bryan-Marsh Company exhibited all styles and sizes of incandescent lamps of its manufacture. These varied in size from a small "peewee" lamp to some of 150 cp. The company was represented by F. B. Nicholl, city salesman for Chicago, and [illegible]ughton, general manager of the company.

The Nungesser Electric Battery Company showed in pyramidal form several sizes of its 1900 type dry battery. Other styles of dry batteries manufactured by the company were also shown.

The National Carbon Company exhibited on a structure of carbon in the center of the booth a Columbia dry battery of 1,000 amperes capacity. Other makes of dry cells in which carbons are used of the National manufacture were also shown. The central structure supporting the batteries was surrounded by various carbon products, while parts of telephones, carbon brushes and electric light carbons completed the display.

The McRoy Clay Works exhibited single duct conduit and other styles in nests of two, four and six ducts. Attractive photographs, showing installations of conduits in various cities, were also shown.

The Miller Anchor Company exhibited anchors of various sizes and styles.

Felix Hamberger exhibited several Siemens flame arc lamps. The peculiar colors of the rays given off by these lamps attracted much attention.

The Safety-Armorite Conduit Company adopted a unique method of showing the smooth interior of its conduits. Various sizes of "loricated" and "galviduct" conduit were mounted on a frame, a small incandescent lamp being placed in that end of the conduit farthest from the aisle. The smooth interior could be readily observed. The exhibit was in charge of A. H. Friend.

The M. Krantz Manufacturing Company displayed panel boards, and other electrical apparatus. Photographs of large buildings in which the company's products have been installed were hung on the walls of the booth.

The Metropolitan Electrical Supply Company had on exhibition a new flasher recently gotten out by the Phelps Company. This is the "skedoodle J," and is operated by a thermostat. It will handle current up to 25 amperes. This flasher was shown in operation connected in the circuit of lamps of a sign above the booth. Other features of the exhibit were Barriett motors, "hylo" lamps and Dixon graphite brushes.

W. H. Schott, central station and heating engineer, showed a vacuum heating system. Steam was obtained from boilers in the basement of the building at about 100 pounds pressure. This was reduced to 6 pounds on lines corresponding to street mains. Radiators connected to the piping system were subjected to vacuums of 20 in., 19 in., and 0 in. The vacuums were maintained by thermostatic check air valves. Pressure gauges were placed in the pipe lines at various points to show the differences in pressure.

The Niagara Tachometer and Instrument Company exhibited several styles of tachometers in a very interesting manner. The instruments were all mounted on a stand and were belted to an electric motor below. These tachometers depend upon centrifugal force alone for their action, no springs or parts which may need occasional adjustment being employed.

The Electro-Dynamic Company had an exhibit that attracted considerable attention. An "interpolar" motor was belted to a duplicate, the latter being driven as a dynamo. A large station ammeter showed the load on the motor, and a voltmeter calibrated for speed indicated the revolutions per minute. The speed of the motor was varied through a range of 400 per cent. It was reversed at full speed and at 100 per cent overload, as indicated by the ammeter, without sparking at the brushes. Another feature of the exhibit was a Moloney transformer connected with instruments in the circuit for making efficiency tests. The exhibit was in charge of the Chicago manager, F. L. Merrill, and F. G. Bell, engineer for the company. Francis Raymond represented the Moloney Electric Company.

The Universal Electric Storage Battery had on exhibition a cell of 800 ampere-hours capacity that had been in service on the Chicago & Alton Railroad for the past eight months. There were no evidences of deterioration about the plates. Other styles of batteries shown included those for electric vehicles and for train lighting equipments. On a large board were shown parts of the battery in various stages of manufacture.

The American Conduit Company, in addition to different sizes and lengths of bituminized fibre conduit, exhibited a "line entrance" for carrying high tension wires into power houses and buildings. This "line entrance" is made of bituminized fibre conduit. Sections of fibre conduit laid in cement were also shown.

In the booth of the Benjamin Electric Mfg. Company were hung several types of its new "arc-burst" clusters. These attracted much attention on account of their neat appearance. The company also exhibited a new style of lamp guard which does not require the lamp to be removed when the guard is placed in position; and in addition wireless clusters both of the multiple and series type were shown in different stages of construction.

Porter & Berg had as one of the features of their exhibit a 75,000-volt insulator of the type used by the Edison Electric Company of Los Angeles, Cal. Other insulators that have been installed on lines of 60,000, 66,000 and 45,000 volts were also shown. A feature of the exhibit were the Imperial arc headlights for street railway service. In addition the exhibit included Kalamazoo trolley wheels of various sizes and styles, samples of Spear carbon brushes, Wilson trolley catchers and retrievers and International fare registers. At the entrance of the booth was an Empire safety tread. This tread, which consists of carborondum embedded in a steel plate, has been used extensively on steps to elevated railway structures. The Central Electric Manufacturing Company exhibited a full line of Blackhawk dry batteries.

The India Rubber & Gutta Percha Insulating Company was installed in a neat booth where it exhibited cross-sections of lead-covered and other cables, as well as reels of insulated wire of various sizes.

University of Illinois.—In this exhibit the most interesting piece of apparatus shown was an oscillograph for recording the wave form of alternating currents. The walls of the booth were well covered by numerous views of the university buildings and laboratories. Among the photographs was that of the electric test car recently obtained for making street railway tests of various kinds.

The Vesta Accumulator Company exhibited an electric horn which has just been put on the market. It is for use on automobiles or street cars and is put in operation by pressing a button. It is operated by a Vesta ignition battery, a full line of which was shown.

The Lincoln Electric Company showed two of its variable-speed motors. The variations of speed in these motors are obtained by throwing the armature lengthwise of the shaft into a weaker field.

The Chicago Battery Company exhibited "Duro" searchlights of varying sizes. These are made from 8 to 50 cp and are for use especially on yachts. Portable Duro storage batteries varying in capacity from 25 to 250 amp. were also exhibited.

The American Electric Fuse Company was represented by P. G. Jones and G. W. Rodormer. The Allen-Bradley crane controller was a feature of the exhibit.

Purdue University exhibited a number of current measuring devices and other apparatus, all made by students. One of the most interesting features of the exhibit was an autographic recording apparatus for use in testing electric railway cars. The apparatus was used on the tests of the Electric Railway Test Commission. There was also exhibited lecture apparatus for demonstrating the properties of alternating-current circuits, for measuring the fall of magnetic potential, and for measuring core losses. Some charts showing the remarkable growth of the institution in the last few years and the number of graduates compared with other technical schools were of interest.

The Crocker-Wheeler exhibit was installed on one of the main aisles. The largest piece of apparatus exhibited was a 75-kw, three-phase belt-driven alternator. In addition to this the exhibit included a 12-kw belted exciter generator, a 5-hp, 560 to 1,600-r.p.m. variable-speed motor and a standard 5-hp, 30-volt, slow-speed machine. On the walls of the booth were hung photographs of special machinery manufactured by the company. These photographs included those of the 4,000-kw water wheel driven units to be installed for service on the Chicago Drainage Canal. The exhibit was arranged by Julian Roe, Western manager of the company, and was very neat in appearance.

The J. L. Schureman Co. exhibited a very complete line of elevator controllers, prominent among which was one of the four full magnet type which the company is supplying to the Mabbs Elevator Co. for installation in the Board of Trade Building in Chicago. The elevators to be controlled by these will travel at a speed of 600 ft. per minute. The exhibit included new gauge type of pressure regulators for pump and air compressor service, together with various sizes of automatic starters. The magnet switches designed by the company for the control at a distance of circuits of any capacity will in a great many instances eliminate the necessity of running heavy mains to the point of operation. The switches are equipped with carbon breaks and blow-out magnets.

The Allis-Chalmers Company, of Milwaukee, had a 25-hp, direct-current Bullock type N motor belted to a 60-kw Bullock alternator and this in turn generated alternating current for a line of Bullock induction motors ranging in capacity from 2 hp to 30 hp. Engineers visiting the exhibit were attracted at once by the ring from a 1,500-kw steam turbine placed on a table in one corner of the booth. There was also shown a section of blading from one of the 5,500-kw turbines now being built at the West Allis shops of the Allis-Chalmers Company. A large assortment of small motor and generator parts, including punchings and insulated coils, were also displayed, and these attracted a large number of people who were not particularly interested in the larger types of electrical apparatus. In two show cases were arranged the electrical and power bulletins of Allis-Chalmers Company, all of them being printed on India tint paper, and embellished in the handsome style now distinctive of that company's publications. The booth was lighted by a red, white and blue electric sign, from which hung clusters of incandescent lamps. A desk, settee and chairs in mission style with posts, railings and floor covering to match, together with Oriental rugs, completed the furnishing of the booth.

Westinghouse Exhibit.—The exhibit of the Westinghouse Companies occupied spaces 3 and 4 of Section D, and in it were displayed some of the products of the Westinghouse Electric & Manufacturing Company, the Nernst Lamp Company and the Cooper Hewitt Electric Company. The Westinghouse Electric & Manufacturing Company had on exhibition its graphic recording voltmeter, as well as a full and complete line of Westinghouse current-measuring portable and precision instruments. The recording voltmeter exhibited conveyed a good idea of the line of switchboard instruments being manufactured by the Westinghouse Company for making continuous records. The record is made by means of a fountain pen, moving in a horizontal line across the paper. The line of watt-hour meters comprised type B single-phase, type C polyphase and prepayment single-phase, alternating-current meters, and also a direct-current meter. In circuit-breakers were shown its type F oil, its type F carbon-break and its railway type circuit-breaker. Its exhibit of transformers comprised a 5-kw, "O.D.", a 7½-kw, single-phase, type "C," and also a 5-kw, three-phase type "C" transformer. Alongside of the 5-kw, "O.D." transformer were shown the coils for both low and high-tension, and also two low-tension coils assembled together, but sawed apart in the center to show quality and method of insulation. An appliance on exhibition which was of general interest to the public and of particular interest to central station operators, was a Westinghouse 5-kw pipe-thawing transformer. The company had a number of its smaller sizes of motors, including direct-current, type R motors of ½ hp, ¾ hp and 1 hp, a type "S" direct-current motor of 4 hp and a "C.C.L." induction motor of 5 hp capacity. In close proximity to the motors was shown a Westinghouse oil-immersed auto-starter. A line of Westinghouse fan motors for the season of 1906, for use on both alternating and direct current were displayed, and a complete line of Westinghouse arc lamps for both currents were in operation. Mounted on large display boards was a complete line of overhead railway line material for both direct-current and single-phase, alternating-curren catenary line construction. The exhibit was lighted on one side by Cooper Hewitt mercury vapor lamps and on the other by Nernst lamps. The electric sign overhanging the exhibit was illuminated by Sawyer-Man incandescent sign lamps. The Nernst lamps shown were the two-glower, four-glower and six-glower sizes.

Frank B. Cook's exhibit included a complete line of telephone protective apparatus, from switchboard protectors to pole cable terminals. One large main distributing frame had mounted on it the five different types of protective apparatus that Mr. Cook has made, the earliest type being the No. 4 with tubular coil and the latest being the No. 8 self-soldering protector. Pole cable terminals of all sorts and descriptions were also shown. Mr. Cook also showed a decided novelty in the way of a land anchor which bores its own way into any depth of earth desired, by simply turning it to the right, and a single turn to the left throws out two blades into the earth, obtaining a hold on practically 18 in. of undisturbed earth by the use of an anchor with a 6-in. blade. Cook's self-welding wire joints for connecting copper wires attracted a great deal of attention. The Cook joint is a decided departure. The joint is so made that the mere act of twisting draws the sleeve into the recess between the wires, stretching it absolutely tight around both wires, and making a perfect self weld. In addition to these novelties Mr. Cook showed his well-known line of junction boxes, guy clamps, test connectors, subscribers' station protectors, fuse strips, U-bolt clips,

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Complaints are still made by the retail trade of the effect of the mild weather on business. Collections and some re-order business from wholesalers is likewise affected, but on the other hand outdoor industry continues with unabated activity, particularly building operations. Spring trade prospects continue as favorable as heretofore. All reports indicate an earlier than usual opening of wholesale operations in dry goods, shoes and kindred lines. Most staple products are notably strong for a mid-winter season, especially cotton. Finished materials in iron and steel are in active request, and the mills are running to full capacity with sufficient orders booked to insure a full six months' work and in some lines nearly the entire year Structural plants have taken on considerable new work and the warm weather has greatly stimulated demand for finished products. Copper has weakened on consumers' efforts to resell overpurchases of spot metal. The closing quotations were 18¼c. for Lake and electrolytic and 18c. for casting stock. It is stated that the visible supply of electrolytic copper is the smallest for years, and that all that is likely to come from the refining works for months ahead is contracted for at prices well toward 19c. The exports of copper in the form of wire bars, ingots, plates and cakes, so far this month, aggregate 9,650 tons. The business failures for the week ending January 18, according to *Bradstreet's*, aggregated 279 against 286 the week previous, and 304 the corresponding week last year.

WESTINGHOUSE-PARSONS TURBINES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has received during the past two months many orders for Westinghouse-Parsons steam turbines. The largest orders were received from the Transit Development Co., Brooklyn, N. Y., for a 7,500-kw turbine; Edison Electric Co., Los Angeles, Cal., for a 7,500-kw turbine; the Laclede Power Co., St. Louis, Mo., for two 2,000-kw turbines; the Chautauqua Traction Co., Jamestown, N. Y., for a 1,500-kw turbine; the Mt. Whitney Power Co., Visalia, Cal., for a 1,000-kw turbine; the North Shore Electric Railway, San Francisco, Cal., for a 1,000-kw turbine, and the Winston-Salem Power Co., Winston-Salem, N. C., for a 750-kw turbine. Other orders are from the Beacon Mfg. Co., New Bedford, Mass; Water, Light & Gas Co., Hutchinson, Kan.; Pressed Steel Car Co., Pittsburg, Pa., and the Solvay Process Co., Syracuse, N. Y., for 500-kw turbines, and from the Baltimore & Ohio Railroad Co., Baltimore, Md., and E. R Ladew, Glen Cove, L. I., for 300-kw turbines The turbine to be installed by the Transit Development Co. will be of the multiple expansion parallel-flow type, direct connected to an alternating-current generator running at 750 r.p.m., and will operate with dry saturated steam at 175 pounds boiler pressure and 28-in. vacuum. The generator will be of the rotating field enclosed type, and will deliver three-phase current at 6,600 or 11,000 volts. The Los Angeles Edison Co.'s turbine unit will be of the same general type. It will operate at 750 r.p.m., with dry saturated steam at 160 pounds steam pressure and 27½-in. vacuum, and will deliver three-phase current at 16,500 volts. The turbines for the Laclede Power Co. will operate at 1,200 r.p.m., with dry saturated steam at 165 pounds boiler pressure and 28-in vacuum, and will deliver three-phase current at 2,300 volts.

AUTOMATIC TELEPHONES.—The Automatic Electric Company, of Chicago, reports a most prosperous year's business during 1905, with every prospect of a large increase during 1906. It is interesting to note that this company during the past year has installed 20 new public exchanges, representing a total of 23,418 subscribers' lines, one of which, at Columbus, Ohio, serves 8,000 lines In addition to these public exchanges, the company has installed 10 private exchanges, serving a total of 413 stations. It is stated that the greatest growth in automatic telephony during the coming year will probably be on the Pacific Coast, franchises having been granted to independent companies in several cities, in which the automatic system is specified. It is claimed that at least a million dollars worth of business is in sight in this territory alone. Among the developments of the Automatic Electric Company during the past year are those of the party-line system and a new trunk selector switch. This switch is exceedingly compact, and it will admit of the installation of a multiple-unit system, consisting of scattered branch exchanges of one hundred lines each which can be put in the corner of a building, in the manhole of a conduit under the street, or in any convenient place, leaving the main exchange in the central part of the town for trunking purposes, thus doing away with a large percentage of the outside lines, and making a proportionate saving in outside construction and maintenance cost.

WESTINGHOUSE STEAM ENGINES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has recently sold 6,130 horse-power of its various types of steam engines, the largest order being from the Illinois Steel Co., Chicago, Ill., for one 38 and 76x54 vertical cross compound Corliss engine of 3,000-hp capacity. Of the other types of engines manufactured by this company were sold 1,720 hp of Standard, 1,150 hp of compound, and 200 hp of Junior. These orders were received from the International Steam Pump Co.; Colorado Fuel & Iron Co.; St. Louis & San Francisco Railway Co.; Sonneborn Realty Co.; Pullman Car Works; American Pipe Mfg. Co; Parks Gold Mine; Burgess Electric Co.; Wm. E. Peck & Co.; Chicago, Milwaukee & St. Paul Ry., and Hotel Walton, Philadelphia, Pa.

HOWARD E. CROOK & CO.—The Howard E. Crook & Co., of 320 West Mulberry Street, Baltimore, Md., have moved into larger quarters at the above address. They are now doing considerable work in both steam and electrical construction. The most prominent work which they now have under way is the Jacob Tome Institute, Port Deposit, Md.; Springfield State Hospital, at Springfield, Md.; New Maryland Institute Building, New Eastern High School Building, and the Washington Apartment House at Baltimore, Md. They have recently completed the construction work at the new electric power plant and sub-station of the Maryland Telephone Company in Baltimore. They are now in the market for considerable material for the above work.

CURTIS TURBINE SALES.—The Delaware, Lackawanna & Western Railroad Company has purchased seven 500-kw Curtis steam turbines from the General Electric Company for mining work at Scranton and Nanticoke, Pa. Other Curtis turbines in process of construction for coal mining work are a 500-kw machine at Iron Mountain, N. Y., for the Delaware & Hudson Railroad Company; one 1,500 and one 75-kw turbine for the Cowanshannock Coal & Coke Company, at Echo, Pa., and two 75-kw turbo-generators for the North Jellico Coal Company, of Louisville, Ky.

ROBINS BELT ORDERS.—The Robins Conveying Belt Company has recently secured an order from the Solvay Process Company, Syracuse, N. Y., for 16-in. and 24-in. belt conveyors. These conveyors are intended for use in one of the stone-crushing plants of its purchasers. Among other orders the Robins Conveying Belt Company now has on hand is one from the Highland Coal Company, of Somerville, Mass., for a bucket elevator, and one from the Western Engineering & Construction Company, of San Francisco, for a 30-in. conveyor for handling gold tailings.

OFFICE BUILDING EQUIPMENT.—The dynamos for "The Nicholas," a new 16-story office building now being erected in Toledo, Ohio, will be furnished by the F. Bissell Co., of that city. They will be one 160-kw, one 50-kw, and one 100-kw Northern generators, engine type. The F. Bissell Co. is district manager for the Northern Electric Manufacturing Company, of Madison, Wis., and handles a large trade in Ohio, Indiana and Michigan, which includes switchboards and other specialties of its own manufacture.

NEW STORAGE BATTERY FACTORY.—We are informed that on account of the great increase in the demand for its Bijur "high-duty" elements, the General Storage Battery Company has decided to enlarge its factory at Boonton, N. J., by erecting buildings furnishing an additional 48,000 sq. ft. of floor space, and to install hydraulic and steam or gas generating machinery, aggregating over 1,000 horse-power.

NEW WIRE PLANT.—At Worcester, Mass., the American Steel & Wire Company will add to its Worcester plant a building to cost $300,000. The addition is to be the electric cable works at the south mill.

CHICAGO TELEPHONE REPORT.—The annual report of the Chicago Telephone Company for the year ended December 31, 1905, shows as follows:

	1905.	1904.	1903.	1902.
Gross	$7,131,342	$6,373,116	$5,334,590	$4,570,806
Expenses	5,504,531	4,809,500	4,113,246	3,368,335
Net	$1,626,811	$1,563,616	$1,421,344	$1,202,471
Dividends	1,400,000	1,400,000	1,274,835	1,075,193
Surplus	$226,811	$163,616	$146,509	$127,278

The following interesting statistics are given in the Chicago Telephone Company's annual report:

	1905.	1904.	1903.	1896.
No. exchanges	156	111	114	31
Toll stations	57	80	81	68
No. exch. telephones	143,223	117,893	101,187	15,384
Underg'nd cond. miles	335	254	235	54
Underg'nd direct miles	1,755	1,468	1,372	185
Miles wire undergr'nd	187,231	161,202	149,234	20,548
Miles wire on poles	52,213	45,189	41,484	12,713
Total miles of wire	291,155	253,088	231,198	40,450

At the close of 1905, 143,223 subscribers' stations were in service, 25,330 more than at the end of 1904. Seven thousand six hundred and eighty-six stations of this increase are found in the suburban and rural districts in which the company operates in Illinois and Indiana. Telephones are installed in seldom less than 80 per cent and in many districts over 90 per cent of the farmhouses. To produce the net growth in 1905, 63,096 "In," or installation, orders and 37,766 "Out," or discontinuance, orders have been treated by the company in the departments. This treatment of 100,862 telephone stations resulting in a net increase of only 25,330 represents a feature of the telephone business which must be carefully reckoned with as telephones increase in the residences and places of business of the small users, many of whom are tenants. Eighty-four thousand two hundred and fifteen of the telephones now installed are for receiving service upon a message (or measured) rate basis. It would appear that the company's 58,000 pay stations are not particularly profitable.

CHESAPEAKE & POTOMAC TELEPHONE COMPANY.—The report of U. N. Bethell, president of the Chesapeake & Potomac Telephone Company, which has been forwarded to Congress, shows that the receipts of the company for the year 1905 were: Telephone earnings, $786,816.49; real estate earnings, $48,433.25; a total of $835,249.74. The expenditures were: General administration expenses and taxes, $101,336.11; traffic expense, $195,536.78; maintenance, $256,866.06; rentals and sundries, $41,458.88; real estate expenses, $57,832.97; interest charges, $103,245.12; a total of $756,295.92. The net earnings from all sources were $78,953.82, which less depreciation of $46,292.50, leaves a revenue balance for the year of $32,661.32. The receipts and expenditures on account of capital in the District of Columbia for the calendar year 1905 were: Receipts account of capital; proceeds of company's notes, $238,726.45; expenditures account of capital: For construction of underground conduits and cables, $120,087.26; for construction of poles, aerial wires and fixtures, $31,539.95; for central office equipment, $87,099.24; total capital expenditures, $238,726.45. Cost of work, not including real estate in the District of Columbia, December 31, 1905, $2,678,472.06.

CANADIAN GENERAL ELECTRIC.—Advices from Toronto say: "A few weeks ago the stock of the Montreal Power Company was listed in London and a considerable amount of British capital was attracted thereby. The Canadian General Electric Company has now followed the same line of action and has determined to go to England in the future for the enlistment of new capital. Large contracts have been offered this company, running into many millions, but so congested is the Canadian money market that the company has been unable to secure on anything like favorable terms the working capital necessary to enlarge its plants to Peterboro and Toronto in a way that would enable it to handle the new business offered. The company has been constantly expanding since it was taken over from American capitalists, in 1897, and now has a paid-up capital of $4,700,000. The present deal involves the sale of 11,000 shares of unissued stock at $120 and the entire block has been sold and the proceeds, $1,320,000, placed to the credit of the company. Under the arrangement the stock is to be listed in the London market and none of it will come on the Canadian market for a long term of years."

HOUSTON LIGHT & POWER.—Perry, Coffin & Burr and N. W. Harris & Co. are offering $300,000 of the first mortgage 5 per cent gold bonds of the Houston, Tex., Lighting & Power Company. These bonds are secured by a first mortgage on the company's entire property and franchises; the value of the physical property is largely in excess of the bonded debt; the company does the entire public and commercial electric lighting business in Houston, the largest city in the state, with a population of more than 65,000; the company's franchises are favorable and unlimited in time, and the net earnings are over four times the annual bond interest. Mr. A. H. Ford, the president, states that the property of the company is modern and in excellent condition. The power station is a brick and steel structure, with a generating capacity of 3,300 kw, including a 1,500-kw generator and turbine engine, recently installed. The physical property is, in point of value, largely in excess of the bonded debt (secured by closed mortgage). The company's capital stock is $500,000 preferred and $500,000 common. The surplus earnings in 1905 were $120,488.

ELECTRIC LINES COMPANY.—The New York Electric Lines Company, whose charter Attorney-General Mayer refused to annul, has elected officers and directors. The company controls a conduit franchise and through it the Great Eastern Company seeks to enter the telephone field in New York City. The following directors have been elected: George R. Bidwell, William Graves, Richard M. Montgomery, Wayne W. Wilson, Edward M. Millard, Herman G. Loew, Percival E. Jones, D. A. Reynolds and George Riley. The board elected William Graves president, Herman G. Loew vice-president, Wayne W. Wilson secretary, D. A. Reynolds treasurer and George R. Bidwell manager. The Coast Line Telephone Company of New Jersey, which is an ally of the Great Eastern Company, has filed an application for a franchise in Newark. The new company has 22,000 contracts where, it is alleged, the old Bell Company has only 19,000 telephones in the same territory.

DIVIDENDS.—The directors of the Western Telephone & Telegraph Company have declared the regular semi-annual dividend of 2½ per cent on preferred stock, payable February 1. The directors of the Cambridge Electric Light Company have declared a regular quarterly dividend of 2½ per cent, payable February 1. The Ohio Traction Company's directors have declared the regular quarterly dividend of 1¼ per cent, payable February 1. The directors of the Consolidated Car Heating Company, of Albany, have declared the usual semi-annual dividend of 1½ per cent. The United Traction Company's (Albany-Troy) directors have declared the usual quarterly dividend of 1¼ per cent. A regular dividend of 1¾ per cent has been declared on National Carbon preferred, payable February 26.

ELECTRIC BOND & SHARE.—The General Electric Company has sold to a syndicate headed by Lohrke, Rosen & Co. all its interest in the preferred stock of the Electric Bond & Share Company. The General Electric retains ownership of the common stock of the Bond & Share Company and President C. A. Coffin will continue to act as a director of the Bond & Share Company. This company was organized last year with a paid-up capital of $4,000,000 for the purpose of aiding in the financing of electrical enterprises such as electric railways and lighting and power transmission plants.

PHILADELPHIA BELL TELEPHONE.—The statement of Bell Telephone of Philadelphia for the year ended December 31, 1905 (December estimated) compares as follows:

	1905.	1904.		Changes.
Gross	$4,400,000	$3,756,060	Inc.	$643,940
Expenses	3,325,000	2,810,803	Inc.	314,197
Net	$1,275,000	$945,257	Inc.	$329,743
Dividends	899,068	836,010	Inc.	63,058
Surplus	$375,932	$109,247	Inc.	$266,685

CINCINNATI GAS & ELECTRIC.—The Cincinnati Gas & Electric Company has decided to increase its capital stock from $5,000,000 to $36,000,000. The increase is made in connection with the company's preparations to enter the natural gas field as indicated by the new franchise recently granted by the city council.

SOUTHERN NEW ENGLAND TELEPHONE.—The annual meeting of the Southern New England Telephone Company will be held January 30, at New Haven, Conn., where the stockholders will vote on the proposal to increase the capital stock of the company from 50,000 shares to 60,000 shares.

CHICAGO, ILL.—Northwestern Elevated extensions to Ravenswood and East Evanston are expected to make large earnings from the start. It is understood that for this purpose $1,000,000 treasury bonds available will be issued.

APPARATUS WANTED.—The town of Lexington, N. C., expects to furnish patrons with a day service, and is in the market for a 100-kw, 250-volt direct-current generating set, direct connected.

OREGON POWER DEVELOPMENT.—The Mount Hood Electric Company, organized to develop power from the waters of Big Sandy and Zig Zag glaciers, near the summit of Mount Hood, is inviting bids on machinery for a plant to generate 30,000 hp. The company has acquired several miles of riparian rights on the Sandy River, and surveys have been made for three plants, using the water of the stream three times on its descent of the mountain. The corporation is financed by a bond issue of $1,000,000 to the Bank of America, a San Francisco institution, and this sum is to be expended in construction of plant No. 2. The aggregate head secured at the three plants is 850 ft., divided as follows: 300 ft. at plant No. 1, 320 ft. at plant No. 2, 230 ft. at plant No. 3. The glaciers, at an elevation of 9,000 feet, furnish most of the water from July 15 to October 15, when Oregon rains begin. The incorporators are G. W. Waterbury, C. W. Miller and Edwin D. Whitney, and the company has organized with a directory of prominent business and professional men of Portland.

THE ELECTRIC CABLE COMPANY, of Bridgeport, Conn., which was recently organized with a capital stock of $500,000, has acquired a tract of land from vice-president George C. Edwards near the factory of the Bridgeport Chain Company and will utilize it as the site for a large plant. The plot has frontage of 265 feet on the tracks of the New York, New Haven & Hartford Railroad and of 250 feet on Central Avenue. The contract has been awarded for the erection of the first story of the plant which is to be constructed. The building will be a one-story brick structure with basement, and the dimensions will be 150 by 250 feet. The contract calls for the completion of the factory within ninety days. A minimum force of 100 workmen will be employed at the outset when manufacturing operations begin. The Electric Cable Company has absorbed the Wire Magnet Company of New York. It will manufacture wire cables, insulated wire, motors, armatures and all kinds of electrical machinery.

BOSTON ELEVATED CONTRACTS.—The Boston Elevated Company will increase its rolling stock and motor cars to the extent of 45 elevated and 37 surface cars. The elevated cars cost close to $10,000 each, making the total expense of the 45 cars $450,000. The surface cars are slightly less expensive, costing about $7,000 each, so the new surface equipment will involve an expenditure of about $260,000, making the entire cost of new rolling stock about $700,000. The new elevated cars will follow very closely the present cars, being made more nearly non-combustible. The Elevated Company for a number of years adhered closely to the 25-ft. car. The present policy is to increase the size of the car both in seating capacity and motive power. The General Electric Company and the Westinghouse Company are both bidding for the electrical equipment.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph's instrument statement for December and twelve months compares as follows:

December—	1905.	1904.	1903.	1902.
Gross output	163,828	122,285	88,947	84,095
Returned	57,381	49,898	39,678	33,121
December net output	106,447	72,387	49,269	50,974
Twelve months' gross output	1,841,628	1,216,576	1,109,888	1,078,517
Returned	623,934	515,529	480,691	453,803
Twelve months' net output	1,217,694	701,047	629,197	624,714
Total outstanding	5,698,258	4,480,564	3,779,517	3,150,320

This means a total of 2,849,129 stations if all are in use, at the present time.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., recently received an extraordinary order for meters. The order comes from the Commonwealth Company, of Chicago, and calls for 4,396 watt-hour-meters of the high-torque type. This is the largest single order the factory has received in years. A few weeks ago an order for 1,000 meters was received. The company is also installing an electric plant for the Superior Construction Company, at L'Anse, Mich., and a carload of machinery was shipped to that point recently. Among other recent orders was one for a carload of machinery shipped to the Pratt Ice Manufacturing Company, Pratt, Kan., in which was included a 1,400-light generator.

HEATING AND VENTILATING.—Among recent orders for heating and ventilating apparatus, the Sprague Electric Company has furnished complete equipments for the new U. S. Custom House, Senator Clark's residence and the Redman Bank Building, all in New York City, and for the town hall in Meriden, Conn. The Sprague Company has long made a specialty of electric equipments for operating heating and ventilating apparatus.

PLANT FOR STEEL MILL.—Milliken Brothers, 11 Broadway, New York, have placed orders for their new open-hearth steel plant and rolling mill on Staten Island, for the electric generators with the Westinghouse Electric & Manufacturing Company, and for the engines to operate the electric power plant to the C. & G. Cooper Company, Mount Vernon, Ohio.

CALIFORNIA ELECTRIC ROAD.—The Northern Electric Company, which proposes to build a standard gauge railroad from Chico to Oroville, Cal., with extensions to other towns, has doubled its capital to $6,000,000 and authorized $6,000,000 bonds for construction.

THE ELECTRIC CHAIN COMPANY of Attleboro, Mass., and B. L. Colvin & Company, of Providence, R. I., have consolidated, and announcement is made that the business of the latter concern will be moved from Providence to Attleboro.

CATALOGUES WANTED.—Mr. Robert Anderson, 175 Sparks Street, Ottawa, Ontario, Canada, is desirous of procuring catalogues from manufacturers of dynamos, motors and electrical supplies.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was considerable activity and a bullish feeling in stock speculation, due to easier money conditions and sanguine views as to the effects of existing favorable business conditions. Iron and steel shares were very strong. In the railroad list attention was divided between the high-priced standard stocks and the specialties, and among the industrials there was a tendency to take hold of stocks which have not received any great share of favor in the recent past. In the traction list Brooklyn Rapid Transit developed strength and showed manipulative support, while the Metropolitan group was inclined to slump on the introduction of a bill at Albany, apparently having for its purpose the prevention of the merger between the Metropolitan and the Interborough interests. The sales of Brooklyn Rapid Transit ran up to 204,500 at prices ranging between 90 and 92¾, the closing quotation being 91⅛, which is a net decline of ⅛ point. Metropolitan Street Railway closed at 125, thereby losing ⅝ point net, while Interborough Rapid Transit made a gain of 2½ points (on the curb market), the closing quotation being 235½. There was comparatively little business done in the electric shares, Allis-Chalmers common closing at 23⅛ and preferred at 63⅜, these quotations representing a net gain of ⅛ in the first case and a net loss of ⅜ in the second. General Electric lost one point on the week's business, closing at 178, and Westinghouse 1⅛ point, the last quotation being 173. The closing price for American Locomotive common was 76¾ and for preferred 119¼, these figures representing a net advance of ⅛ and a net decline of ⅜, respectively. Western Union closed at 93½ and American Telephone & Telegraph at 143, the latter being a net advance of 6½ points. The curb market participated in the enthusiasm of the Stock Exchange during the week and several stocks became active with some substantial advance, Mackay Companies' shares being among them. Trading in contracts of the new Metropolitan Traction Company suddenly ceased, following the proposition to change the character of the terms which are to be offered to shareholders of the subsidiary companies. Following are the closing quotations of January 23:

NEW YORK

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
Allis-Chalmers Co.	23⅛	23⅛	General Electric	178	178
Allis-Chalmers Co. pfd.	63⅜	65¾	Hudson River Tel.	...	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	233⅛	234
American Locomotive	76⅝	76¾	Mackay Cos.	60	62⅝
American Locomotive pfd.	119	118	Mackay Cos. pfd.	74	75
American Tel. & Cable	91	90	Marconi Tel.	...	..
American Tel. & Tel.	138	140	Metropolitan St. Ry.	125⅝	124¼
Brooklyn Rapid Transit	90⅝	91⅛	N. Y. & N. J. Tel.	...	..
Electric Boat	28	26	Western Union Tel.	93¾	93½
Electric Boat pfd.	65	60	Westinghouse com.	170	171
Electric Vehicle	15	15	Westinghouse pfd.	...	..
Electric Vehicle pfd.	23	21			

BOSTON

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
American Tel. & Tel	138⅛	141	Mass. Elec. Ry. pfd.	60	60⅛
Cumberland Telephone	117	117¼	Mexican Telephone	..	3⅜
Edison Elec. Illum.	250	...	New England Telephone	137⅝	139
General Electric	...	..	Western Tel. & Tel.	15	15
Mass. Elec. Ry.	18⅛	18⅜	Western Tel. & Tel. pfd.	..	86

PHILADELPHIA

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
American Railways	52	53⅛	Phila. Electric	8⅛	9
Elec. Co. of America	12	12	Phila. Rapid Trans.	32⅜	32⅝
Elec. Storage Battery	83	86	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
Chicago City Ry.	197	...	National Carbon	80¾	.
Chicago Edison	...	...	National Carbon pfd.	117	..
Chicago Subway	...	61⅜	Union Traction	...	.
Chicago Tel. Co.	...	...	Union Traction pfd.	...	..
Metropolitan Elev. com.	28	..			

General News.

SAN FRANCISCO, CAL.—A movement is on foot among the merchants about Union Square to erect fancy poles along the edge of the park so as to add to the beauty of the locality. Each pole is to carry eight 32-cp electric lamps inclosed in large white glass globes. The poles will be of ornamental iron and cost $100 each. The expense of putting in the ornamental fixtures is to be paid for by the property owners, but the tenants are expected to pay the operating expenses.

SAN FRANCISCO, CAL.—An interesting point in connection with the recent purchase by the California Gas & Electric Corporation, of this city, of a 9,700-hp single horizontal, spiral case, reaction hydraulic turbine, is contained in the fact that this turbine will operate under a head of 550 feet at a speed of 400 r.p.m., which is the highest head under which a turbine of this type has ever been installed. This turbine and accessories will be furnished by the Allis-Chalmers Company, of Milwaukee, and is destined for installation at Chico, Cal., where the Corporation controls the water rights.

SANTA CRUZ, CAL.—John Martin and Eugene de Sabla have purchased from Fred W. Swanton and his associates the Co-operative Electric Light Company, of this city. It is understood that Martin and de Sabla take all of the stock of the company for $100,000. This company furnishes electric light to the main part of Santa Cruz. This is the second lighting company in the city which Messrs. Martin and de Sabla have purchased within the last few weeks, the first one being the Santa Cruz Electric Light & Power Company for which they are said to have paid $110,000. That company furnishes power for the Santa Cruz electric roads, as well as electric lights. It is also reported that the gentlemen are seeking to purchase the Big Creek Power Company, which has a hydro-electric power plant in the Santa Cruz Mountains. This company furnishes lighting for Watsonville and other surrounding towns, also power for several electric roads. By these deals, Messrs. Martin and de Sabla will have almost entire control of electric lighting and power interests in Santa Cruz County, as they already have throughout central California and in the Bay counties. .

GOLDFIELD, COL.—The Pueblo & Suburban Traction & Lighting Company, of Pueblo, is reported to have secured the contract for lighting the city for five years at $12 per month per arc lamp.

PLAINVILLE, CONN.—At the recent special town meeting, the selectmen were authorized to spend not more than $1,500 for street lighting. This is an increase of $400 over the last appropriation.

NEW HAVEN, CONN.—The contract for the construction of the electric railway between Seymour and Naugatuck has been let by the Connecticut Railway & Lighting Company to D. W. Blakeslees' Sons, of New Haven.

YALESVILLE, CONN.—A petition has been prepared and presented to the selectmen of Wallingford requesting that a special meeting of the citizens be called to consider the organization of a district scheme for lighting the streets of Yalesville.

DARIEN, CONN.—At a meeting held recently to consider the question of establishing a street lighting system, the impression seemed to prevail that application should be made to the Legislature for authority to bond the town for the purpose.

ROCKVILLE, CONN.—The Hockanum Company, manufacturers of worsted and woollen goods, will hereafter be operated by electric power. Each floor will be equipped with an independent motor. The concern is now installing two new Bigelow boilers. An electric lighting plant has just been established.

NEW BRITAIN, CONN.—The Connecticut Railway & Lighting Company has discontinued its power plant on Chestnut Street, this city, and all of its power for lighting and traction purposes for this district is now obtained from the sub-station at Black Rock in the western outskirts of the town. Electricity is transmitted to the sub-station from the New Milford Power Company's plant on the Housatonic River in Litchfield County, a distance of about 40 miles. The Chestnut Street plant will not be dismantled for the present, but will be retained for emergency purposes. Three sub-stations, located at Black Rock, Cheshire and Waterbury, are now supplying various districts of the Railway & Lighting Company's system with power generated at Bulls Bridge on the Housatonic. The company has a 30-year contract with the New Milford Power Company.

CHICAGO, ILL.—The Chicago & Southern Traction Company is seeking to increase its capital stock from $100,000 to $2,000,000.

CHICAGO, ILL.—The directors of the Metropolitan Elevated Railroad have appointed a committee to take up the question of providing additional power.

HEYWORTH, ILL.—Two telephone exchanges and a number of business houses were destroyed by fire here recently. The total loss is estimated at $50,000.

PLAINFIELD, IND.—A new telephone service between Plainfield, Clayton and Brownsburg is being established by the Central Union Telephone Company, and exchanges are being installed at all three places, at a cost of about $20,000.

LAWRENCEBURG, IND.—A company of local capitalists, headed by W. H. O'Brien, is seeking a franchise to operate a combined electric light and power plant and water works system. It is believed that the petition will be granted.

HARTFORD CITY, IND.—The Central Union Telephone Company's exchange has been combined with that of the United Telephone Company, and hereafter the business of both companies will be transacted from the one office in the building of the latter company.

EVANSVILLE, IND.—The revised proposition of the Cumberland Telephone Company in the form of a new franchise has been received and filed. An abstract of the important features of the franchise follows: "The rights and privileges herein granted to the said Cumberland Telephone and Telegraph Company shall be for a period of forty-five years; twenty-three free telephones for the use of the city; the city is allowed the exclusive use of two feet of one arm on each pole for its fire alarm telegraph wires. The company agrees to make connections with all farmers' lines in Vanderburg County, and free connection to the patrons of the Evansville exchange with such farmers' lines.

MUSCATINE, IA.—Reports state that the electric light and gas plants, together with the street car system, all of which belonged to local parties, have been sold to a syndicate represented by J. H. Brown and George Mayer, of Chicago. The consideration is said to have been $750,000.

TOPEKA, KAN.—The Topeka Edison Company, at its annual meeting, elected the following directors: B. E. Sunny, L. E. Myers, E. W. W. Wilson, George H. Taylor, George B. Caldwell, E. A. Potter, Jr., M. A. Low, J. E. Hurley and W. A. L. Thompson. The gross earnings of the company for 1905 were reported to be $173,527 and operating expenses of $94,978, leaving net earnings of $78,540.

NEW PROVIDENCE, KY.—C. W. Kelly, of Jeffersonville, Ind., has petitioned the Town Board for an electric light, heating and power franchise.

ACKLEY, LA.—The city has voted to accept the gift of John Rath, whereby it comes into possession of a municipal electric light plant valued at $10,000. A competent superintendent will be placed in charge of the plant.

SOUTH ACTON, MASS.—A plan is being formulated to have this village lighted with electricity.

WESTBORO, MASS.—The Selectmen are said to be considering the construction of an electric light plant.

HAVERHILL, MASS.—Inspector of Wires Corson advocates strongly the putting underground of all electric wires as soon as it can be accomplished. In the meantime he would recommend a more thorough inspection of the present overhead systems.

SPRINGFIELD, MASS.—If the Heath Telephone Company secures the franchise in Whately, for which application has been made, it will make connections at the county line with the Citizens' Independent Company, but it is not proposed to consolidate with that company.

CHICOPEE, MASS.—Many of the aldermen are not anxious to serve on the committee to investigate the electric lighting plant conditions. The Mayor in his inaugural address declared the electric lighting plant to be in fine condition, but later had the order introduced looking toward an investigation.

DUXBURY, MASS.—The town will soon have its streets lighted by electricity for the first time. A company of local capitalists has been formed and a franchise to erect poles and string wires will be asked for immediately. A power plant will eventually be erected, but it is stated that until next summer current will be taken from Plymouth. It is proposed to extend the system to the summer colonies at Brant Rock and Green Harbor, and it is not improbable that a section in Marshfield will be furnished with light.

FALL RIVER, MASS.—Chapter 34 of the revised laws under authority of which attempt is being made to secure municipal ownership of gas and electric lighting, provides that any proposition of this character must receive a two-thirds vote of the members of the city government for two consecutive municipal years, after which the decision must be ratified by a majority of the voters at the annual or a special city election. If Alderman Manley's order gets by the government this year it will be necessary for favorable action on the part of the government of 1907 before the proposition reaches the people.

BAY CITY, MICH.—The Pere Marquette Railroad Company is preparing to light its premises by electricity. Dynamos and boilers will be installed in the new warehouse now being constructed.

LUDINGTON, MICH.—The Stearns Lighting & Power Company announces that during the year 1905 it added 150 customers. In view of the gas competition it offers two months lighting free to all parties wiring up between now and March 1.

GRAND RAPIDS, MICH.—It is rumored that plans are on foot for the consolidation of the Edison Company and the Grand Rapids-Muskegon Electric Water Power Company, the concern which is building a $300,000 dam on the Muskegon River. Should this deal go through it will eliminate all competion and the Edison Company will retain its supremacy in this city.

GRAND RAPIDS, MICH.—In a report made by General Manager Samuel A. Freshney, of the municipal lighting plant, covering the last four months of 1905, it was stated that for that period the total number of lamps in circuit was 727 as against 701 during the same period of the previous year. It also showed the cost of operation to have been reduced from $9,088.73 to $8,500.01.

MINNEAPOLIS, MINN.—City Engineer Andrew Rinker has submitted a report to the Water Works Committee which does not favor utilizing the water power controlled by the city for the operation of an electric light plant for the courthouse and city hall. He figures that it will cost more to convert the two lower pumping stations into power plants and operate them than it does to run the present electric plant in the courthouse, and that it would cost $18,250 a year to maintain the plant after it was installed. The present system costs $15,405 a year, a difference of $2,845. Mr. Rinker said it might be possible to utilize the water power in operating about 300 arc lamps for street lighting purposes, but he would not recommend the plan, saying if the city was going into the lighting business there should be one large central plant of sufficient capacity to light the entire city. An effort will be made to dispose of the city's water power rights or at least make some arrangement whereby the city will be relieved of the payment of $4,000 annually for power that is not used.

ST. LOUIS, MO.—The Edison Illuminating Company held its regular stockholders' meeting January 18 and re-elected the following-named directors: Henry C. Scott, S. W. Fordyce, W. S. Scott, Horace W. Beck and E. V. Matlock.

CLINTON, MO.—The Council has voted to put the question of municipal ownership of the light and water systems before the people. A special election will be held February 16. The people will be asked to vote bonds to the amount of $30,000 for the light and $70,000 for the water plant.

PASSAIC, N. J.—Mayor Greenlie has signed the contract giving the Public Service Corporation the lighting of the city for five years, with 2,000 cp street arc lamps at the cost of $85 and the commercial light at 12 cents per kw-hour on a sliding scale to 10 cents for the last year of the contract. This ends what was one of the longest and bitterest lighting fights in the State. A year ago the Public Service offered to supply the city with lights for $77.90 per annum, and commercial light for 12 cents, but the Weehawken Company war was on at the time, and the feeling was so bitter against the Public Service that the offer was not accepted.

ROME, N. Y.—The Thousand Island Electric Light & Power Company has filed its annual report, showing the capital stock to be $25,000, all paid up, liabilities not exceeding $10,000, and assets of at least $20,000, all of which constitutes a very good showing for the company.

OWEGO, N. Y.—The Owego Light & Power Company has elected officers as follows: William S. Truman, president; Hon. W. G. Phelps, vice-president; George F. Andrews, secretary and treasurer; Horace Yothers, superintendent.

NIAGARA FALLS, N. Y.—A meeting of the stockholders of the Niagara, Lockport & Ontario Power Company has been called to be held at Lockport on January 30. Action will be taken on a proposition to alter the certificate of incorporation of the company so as to extend its business and to include purposes, power and provisions, in addition to those now held.

HAMLIN, N. Y.—At the annual meeting of the stockholders of the Hamlin Telephone Company the following officers were elected for the ensuing year: President, D. R. Singleton; vice-president, John Martin; secretary, Isaac Palmer; treasurer, Charles Baase. It was unanimously voted to continue construction work until the system extends to all parts of both towns. A large switchboard will be installed to accommodate the increasing number of subscribers, and copper wires will be run on its trunk lines from Brockport to Troutburg, Morton, East Hamlin and Sunnyside Beach, with a central office at Hamlin and another at Brockport.

GRAND FORKS, N. D.—C. P. Trepanier has made arrangements with H. Fant, manager of the local exchange, to connect with the Tri-State Telephone Company, which will build a line from Ardoch to Thief River Falls along the Soo. The company expects to build a line the full length of the Soo extension as far as Kenmare. The Northwestern Company has taken its long-distance connection out of the Thief River Falls exchange, and will ask for a franchise for a new system at that place.

ELYRIA, OHIO.—The Elyria Southern Telephone & Toll Company has increased its capital stock from $40,000 to $75,000.

LORAIN, OHIO.—The Lake Shore Electric Railway, which controls and operates the Lorain Street Railway, is making important improvements to the line between Lorain and Elyria. Portions of the line are to be double tracked, ten new cars installed and the city service much improved. The old direct-current generating machinery has been shut down and the line will be operated from rotaries installed in the old power station.

CINCINNATI, OHIO.—Keen competition for a telephone franchise in Cincinnati is promised. The Interstate Telephone Company, operating in Kentucky, has applied to the Council for a franchise, and Attorney Powel Crosley, for the Cincinnati Telephone Company, asked for a postponement of action on other franchises for a week or ten days until his company could prepare its application. Application has also been made by the Queen City Home Telephone Company.

COLUMBUS, OHIO.—According to Superintendent Willcox's report during the year 1905 the city was lighted by an average of 1,500 street lamps at an alleged average cost of $49 per lamp, while under contract the cost was $71.50. The total cost for operating the plant during the year was $74,400. It was estimated at first that $65,000 would be needed and an appropriation was made covering that amount. The allowance for depreciation does not appear.

TOLEDO, OHIO.—The Toledo Railways & Light Company at its regular annual meeting re-elected the present officers and directors with the exception that Charles W. Wason, of Cleveland, and W. L. McKenna, of New York, were elected directors in place of Messrs. Barton Smith and H. S. Holt. Contracts have recently been closed for two 1,000-kw Curtis turbines to be connected to alternating-current generators, two 1,000-kw rotary converters, one 1,000-kw motor-generator set, and four 700-hp boilers. A large extension to the storage battery station will be installed.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company will supply arc lamps to the city at $69.72 per lamp during 1906, which is a reduction of nearly four dollars from the old rate. The reduction is doubtless due to the fact that the city has acquired a plant of its own with the annexation of South Brooklyn, and it was suggested that the entire city might be lighted from that plant if the lighting company did not make a better rate. The reduction means a saving to the city of about $5,000, which will be used to purchase additional electric light equipment. The acquisition of the South Brooklyn lighting plant is regarded as an opening wedge toward municipal ownership in Cleveland. Upon the urgent representations of Mr. Springhorn, Director of Public Service, the committees put into the budget an appropriation of $56,000 for the plant. Of this $40,000 is for new buildings and machinery, $10,000 to carry wires and poles across the bridge so as to light the southwestern part of the city, and $6,000 for the cost of operating.

WILKESBARRE, PA.—The mayor has recommended in his annual message the construction of a municipal lighting plant.

PLYMOUTH, PA.—The new electric light plant of the Wyoming Gas & Electric Company has been successfully put in operation. The plant is one of the largest and best equipped in this part of the State and the company, which has heretofore been hampered for lack of power, will now be able to meet all demands with an improved quality of service.

SUNBURY, PA.—The Middle Creek Electric Light Company, composed of Northumberland and Snyder County capitalists, has purchased the Edison light plant in the town of Northumberland. This is said to be the first commercial light plant in America, having been installed by Edison himself, who until quite recently held a block of the company's stock.

PHILADELPHIA, PA.—The Bell Telephone Company has opened a new exchange at Fourth and Manning Streets, which will be called "Lombard." This was made necessary by the increased demands in the Market central office. All subscribers south of Walnut Street and east of Sixth Street will be transferred to the new exchange. The new central is a four-story building of granite and brick. The interior is finished in selected white quartered oak and the equipment comprises the latest developments in telephone apparatus. A feature of the place will be a school for operators.

PHILADELPHIA, PA.—The Philadelphia Electric Company has taken title to the plant of the Southern Electric Light & Power Company at 20th and Chestnut Streets. The plant, which is the largest in the city, consists of four power houses, an office building and repair shops, and is valued at $450,000. Officials of the Philadelphia Electric Company have declined to make any statement concerning the transfer, but it is understood that the real estate covering the fourteen plants scattered throughout the city, which have retained their corporate existence, although controlled by the one company, will now be conveyed to the parent company.

YORKVILLE, S. C.—The Catawba Power Company is now furnishing power for the operation of the Tavora Mills, of this place.

GAINESVILLE, TEX.—At the annual meeting of the Gainesville Merchants' Electric Light Company, the following officers were elected: E. J. O'Bierne, president; Charles A. Zilker, vice-president; W. H. O'Bierne, secretary and general manager; W. L. Grennhill, treasurer.

BELLINGHAM, WASH.—The Columbia Improvement Company has let a contract to the Platt Iron Works Company, of Dayton, Ohio, for furnishing the 3,300-hp turbine which will be installed at the Nooksack Falls power plant. The cost will approximate $12,000.

RAMPART, WASH.—The construction party of men in the Signal Corps have completed a new telegraph line along the Highland of the Yukon, between Rampart and Fort Gibbon. This permits the abandonment of the section between Baker and Gibbon, which was exceedingly difficult to maintain in summer, owing to the extensive swamps of the lower Tanana.

SEATTLE, WASH.—According to local press reports, the city lighting plant is proving a costly luxury. The total revenue from sale of current during the month of December, 1905, is said to have been less than $1,000. More than three-quarters of a million dollars have been spent in the construction of the plant, toward which the people voted in 1902 for a bond issue of $590,000. It is probable that another issue of bonds will be asked for, as at least $300,000 will be needed for the construction of new lines if the city is to compete on even terms with the established electric light and gas companies.

DEPERE, WIS.—The Green Bay Gas & Electric Light Company, of Green Bay, has petitioned for a franchise to operate in Depere.

NELSON, B. C.—According to figures given out by the city officials, the first year of municipal control of the street railways in this city has resulted in a loss of $5,663.70. The city took over the railway at the beginning of 1905 on a lease of three years. The cost of running the system proved to be $9,000, while the receipts were less than $6,000. The cost of power alone was $2,400. Some time during the current year the city hopes to be in position to supply power from the municipal electric light plant at a nominal cost.

WINNIPEG, MAN.—During 1906 the Bell Telephone Company will make special efforts to give Manitoba and other western farmers the benefits of telephone connection. The company will either build the line and give service on a yearly rental basis, the same as in Winnipeg or on other local exchanges, in which case the farmer has free service to and from the local exchange, or it will connect its local and long-distance lines with systems built by the farmers themselves, and will, in this case, give expert and financial assistance to farmers who prefer to supply their own service. The Bell Company now has eighty-five exchanges and toll offices in Manitoba, and thirty additional are now under course of construction. Other extensive additions and extensions will also be made this year. It is expected that during 1906 thousands of farmers will be added to the local exchanges throughout the province.

MEXICO CITY, MEX.—The corner stone of the central exchange building of the New Telephone Company has just been laid with appropriate ceremonies. It is hoped to have the exchange open for business in about three months. More than half of the entire underground system is now laid, most of this being in the central portion of the city, and the company is now pushing work on the outlying sections.

BERLIN, ONT.—The question of provincial operation of the telephone system is being agitated here. A petition has been prepared and forwarded to the Legislature, urging the Government to take into immediate consideration the matter of establishing such a service.

OTTAWA, ONT.—With the failure of the Fox River as a source of water power, the Ottawa Hydraulic Company found itself without natural resources. For some time negotiations have been on foot whereby the Northern Illinois Light & Power Company, controlling the electric lighting and street railway utilities, has obtained from the Canal Commissioners a lease of the water coming down the canal and into the "side-cut." As the Hydraulic Company's rights rested solely on such water as came through the Fox River feeder, which is now extinct as a water course, there was nothing left for the latter company except to make such terms with the electric company as it could.

Construction News.

WATKINS, ARK.—A 20-year franchise for an electric light plant has been granted to B. F. Hill. The plant will be located at the roller mill in the eastern part of town.

FORT SMITH, ARK.—The City Council has granted to the Interurban Traction Company an extension of one year in which to begin work, making the third extension since the company was incorporated two years ago. E. B. Miller, of the Commercial Club, is said to have interested Memphis capital in the enterprise. The work is to be commenced within twelve months, and three miles are to be completed eight months thereafter.

ROGERS, ARK.—The Rogers Electric Light, Heat & Power Company, installed here last spring, has been consolidated with the Rogers Motor Co., and reincorporated as the Rogers Light & Motor Co. The new company will double its capacity by installing a new 200-hp boiler and a 150-kw dynamo. By April it is hoped to have in successful operation a good day load. Mr. J. L. Dunn has been retained as general manager by the new company.

LOS ANGELES, CAL.—The Los Angeles & Rodondo Railway Company is preparing to install a new power plant.

SAN DIEGO, CAL.—The San Diego Electric Street Railway system is to increase the capacity of its plant.

PASADENA, CAL.—The Pacific Electric Railway Company is planning improvements and extensions here that will necessitate building more than a dozen miles of trackage in the near future.

CHICO, CAL.—Bids in writing will be received by the Board of Supervisors of Butte County, at Oroville, February 10, for the purchase of an electric light franchise, as applied for by J. A. Foster.

REDDING, CAL.—The actual work of surveying for the electric road between Red Bluff and this city will be commenced very shortly. The temporary headquarters of the surveying crew will be at Red Bluff and the work will be rushed along as rapidly as possible.

VALLEJO, CAL.—Col. J. W. Hartzel, of this city, announces that the new San Francisco, Vallejo & Vaca Valley Electric Railroad & Steamship Company has been financed with the aid of English capital and that the road, which will approximate 100 miles in length, will be built during this year.

STOCKTON, CAL.—The directors of the Central California Traction Company have authorized a bond issue of $1,500,000, to build and operate the new Stockton Electric Railroad system and the interurban lines projected. Eight and half miles of track have been laid in Stockton by the company this winter, and franchises call for extensions to Lodi and Woodbridge in the northern part of the county.

SAN DIEGO, CAL.—It is understood that plans are well under way for the establishment of an electric lighting plant at La Jolla for the purpose of supplying light and power to that town and Pacific Beach. The new company is said to be composed of Los Angeles capitalists. Part of the machinery has been ordered, it is said, and the company claims that it will be able to furnish electric lights within ninety days after the franchise applied for has been granted.

HAYWARD, CAL.—As a result of the many complaints made by citizens of this town regarding the poor quality of electric lighting which has been furnished by the Suburban Electric Company, there is a probability that the company will in the near future furnish its own power. Heretofore the Suburban Electric Company has been getting its electric power from the Standard Electric Company. Reports state that the Suburban Company will erect a plant on the bay shore.

REDDING, CAL.—The Shasta County Board of Trade has been notified of the intention of the Boston syndicate, promoted to Alonzo Cloaver, to construct an electric railroad from Redding to Weaverville, and thence to the Pacific Coast. Two surveys have already been made. The work is to commence as soon as the road of the same company now being built out of Union, Ore., is well under way. Trinity and Shasta counties will give moral and financial support to the new road here, which will be extended to other towns along Bayou Teche.

LOS ANGELES, CAL.—Representative Smith has introduced a bill in Congress granting the Edison Electric Company of Wyoming, with headquarters in this city, the right to occupy and use lands for construction and operation of power plants in San Bernardino, Sierra and San Gabriel forest reservations and to divert the water of Mill Creek, Santa Ana River, Lytle Creek and Kern River. Permits to this effect have heretofore been granted by the Agricultural and Interior Departments. The bill is designed to afford electric power for lighting and traction purposes in a number of cities in Southern California.

FT. MORGAN, COL.—The citizens have decided to construct a municipal electric light plant.

NORWALK, CONN.—The town of Norwalk has installed the necessary equipment for the electrical operation of the Washington Street drawbridge over the Norwalk River, at South Norwalk.

BRIDGEPORT, CONN.—The Connecticut Railway & Lighting Company has decided to double track its recently completed Cheshire trolley line, running from New Haven north toward Hartford. The company has also promised to open a service between Meriden and Waterbury via Cheshire, in the near future.

NEW LONDON, CONN.—The Board of Water Commissioners of the Borough of Groton has practically decided to whom the contract for furnishing the remaining equipment of the new power house will be awarded. The contract for furnishing the generators and other electrical equipment has been awarded to the Crocker-Wheeler Company. The contract calls for delivery in ten weeks and the price to be paid is $6,200. In addition to supplying a 160-kw generator the contract includes motors, switchboard and all the inside wiring of the power house. The plant will probably be ready for operation by May 1. The machinery will be ready inside of ten weeks and the structure will be far enough along in that time so that the machinery can be installed without delay.

DOVER, DEL.—The Diamond State Telephone Company has decided to extend its lines from Kenton to Down's Chapel and thence to Hartley. Also from Felton to Viola and Greenwood.

WILMINGTON, DEL.—It is reported that estimates are now being prepared for the proposed plant of the Wilmington Heat, Light & Power Company. The cost of construction is estimated at $500,000.

WILMINGTON, DEL.—Charles C. Kurtz, president of the new Wilmington Heat, Light & Power Company, confirms the reported purchase of the Braywine storehouse of the Jessup & Moore Paper Company. The company will at once secure plans for the construction of a modern power house and the entire plant will cost, it is said, about $500,000.

DOVER, DEL.—The Diamond State Telephone Company will establish an exchange at Harrington, the centre of the great Delaware small fruit belt. General Manager Baker has approved the plans for the extension of a trunk line from Viola southward probably to Shelbyville, passing through Felton, Farmington, Greenwood and Bridgeville. Harrington will be the central point for this service.

WEST PALM BEACH, FLA.—Dr. J. E. Liddy and associates have applied for a 20-year franchise to establish and operate a telephone system to cost not less than $5,000.

ROCKMART, GA.—The citizens have voted to issue bonds for an electric light plant.

ELBERTON, GA.—It is proposed to install at the electric light plant a 125-hp engine and a 75-kw, 133-cycle, two-phase alternator.

CANTON, GA.—W. A. Carlisle, of Gainesville, Ga., is engineer for the proposed light and power plant, to be constructed on Etowah River.

COCHRAN, GA.—Bids will be received by W. B. Denham, City Clerk, until February 6, for water tower, fire pump, boiler, generator and engine, for the water and lighting plant.

CARLTON, GA.—L. F. Edwards, of Athens, is reported to be preparing to develop Watson's Shoals on Broad River, and will transmit the current to Carlton, and erect a cotton factory; probable cost of work proposed $100,000.

SAVANNAH, GA.—The Savannah Light Company, at its recent meeting, decided to build a new conduit from the power house to connect with the underground system at Witaker Street and York Lane, a distance of two miles. The cost of the work is estimated at $16,000.

WALLACE, IDA.—The Mullan Electric Light & Power Company is reported to have petitioned the City Council for a franchise.

BOISE, IDAHO.—The Independent Long Distance Telephone Company contemplates making improvements which will involve an expenditure of from $60,000 to $80,000 upon its plant in Boise. The new exchange and office building, now well under way, will cost upwards of $15,000, and will be a model structure for the purpose for which it is intended. The new switchboard will cost over $20,000 and equipped for a four-party selective ringing system. It is to have a capacity of 6,000 lines. A new switchboard and other facilities for rural lines will also be installed.

WAUKEGAN, ILL.—The North Shore Electric Company is planning to construct a power plant on the lake front at Waukegan, to cost about $50,000.

JACKSONVILLE, ILL.—It is said that $18,000 has been appropriated for the construction of a municipal electric light plant. Edward Brown is the engineer.

AURORA, ILL.—Plans are on foot to connect the large Catholic cemeteries with the railroad at Bellewood. The cost of the proposed extension is about $100,000. The Aurora-Chicago Railway Company is behind the project.

AURORA, ILL.—Plans and estimates are being prepared for the construction of a municipal electric light plant, to cost about $10,000. C. C. Hinckley is city electrician.

CHICAGO, ILL. The Chicago Telephone Company has plans for a new 16-story building for exchange and office purposes. The company shows gross income, $7,131,342; expenses, $5,504,531; net, $1,626,811; surplus, $226,811.

GALESBURG, ILL.—The Central Railway Company, of Peoria, is said to have transferred 90 per cent of its stock to the McKinley Syndicate. The new company will shortly commence the construction of a new 15,000-hp electric plant in Peoria.

MONON, IND.—The Town Board is reported to have granted to A. A. Wallace a 25-year franchise for an electric light plant.

FT. WAYNE, IND.—The Kerr-Murray Manufacturing Company, Ft. Wayne, is making arrangements to erect a new electric power plant.

NORTH VERNON, IND.—The North Vernon Independent Telephone Company has asked the City Council for a modification of its franchise so as to permit it to increase the present telephone rates of $1 and $2, for residences and business houses respectively. The company has decided to expend $17,000 in adding to its equipment during the coming year.

MILL CREEK, I. T.—The City Council has granted the Mill Creek Electric Light & Power Company a franchise to establish a lighting system.

MARSHALLTOWN, IA.—The Peterson Light, Heat & Power Company may erect a municipal heating plant here.

OSKALOOSA, IA.—The Oskaloosa Light & Fuel Company has been purchased by the Heald-Stevens Company, of Grand Rapids, Mich.

AFTON, IA.—It is reported that bids will be received until Feb. 12 by the Lighting Committee, of which E. A. Lee is chairman, for an electric light plant.

DES MOINES, IA.—At the annual meeting of the Western Electric Telephone Company, the expenditure of some $200,000 in improvements during the coming year was authorized.

DES MOINES, IA.—The Mutual Telephone Company, of Des Moines, during the coming year, contemplates expending about $30,000 in stringing and laying cables. During the past two years the company has spent over $500,000 in improvements. The expenditures for 1905 were given out as $375,000.

BURTON, KAN.—The matter of an electric light plant is being agitated in this town and a local company will probably be organized.

SCRANTON, KAN.—A meeting has just been held here with reference to securing an electric light system for the town, and definite steps to that end will be taken soon.

COFFEYVILLE, KAN.—The Kansas & Southern Electric Railroad is said to be planning to build to Coffeyville. L. F. Mitchell and Paul Fuzz, of St. Louis, are backing the project.

PITTSBURG, KAN.—The Home Light, Heat & Power Company has awarded to W. T. Osborn & Company, electrical engineers, of Kansas City, Mo., the contract for its electric light plant.

MIDWAY, KY.—B. S. Kincart, of Campbellsville, has petitioned for a franchise for an electric light plant.

HOPKINSVILLE, KY.—The Clarksville Electric Light & Railway Company has placed an order with Eastern firms for machinery for its power plant valued at between $30,000 and $60,000 for March delivery.

LOUISVILLE, KY.—Lawrence Jones, Peter Lee Atherton and others have petitioned the Council for a franchise to construct a electric light plant in that section of the city bounded by the river, Broadway, Brook and 6th Streets.

PRINCETON, KY.—An ordinance will be presented at the next Council meeting, authorizing the sale of a franchise to the highest bidder for an electric street car system, and a power, heat and lighting plant. Eastern capitalists are interested.

NEW IBERIA, LA.—A 25-year franchise has been granted to A. F. Augur to operate an electric street railway system in New Iberia. The work is to be begun within five months. It is expected that the line will be expended to other towns along Bayou Teche.

LAFAYETTE, LA.—It is proposed to soon install at the municipal electric light plant a series alternating-current arc system of about 75 lights and to use alternating current on the suburban districts; also a 150-hp boiler and about two miles of incandescent lines. Charles J. Maller is superintendent.

ELLSWORTH, ME.—The Bar Harbor & Union River Power Company is reported to have purchased the lower dam on Union River, and it is stated that permanent work will commence in a short time.

BANGOR, ME.—President John R. Graham, of the Bangor Railway & Electric Company, announced that a new dam will be built at the Veazie Power Station of the company the coming season, across the Penobscot River. The dam will be of concrete and an important addition to the water power development of the river. The company will expend $150,000 in improvements this season.

DEXTER, ME.—The committee on investigating the electric light situation does not report a great deal of headway. It is now pretty well understood that there is a stumbling block in the way of getting power from the plant of the Sebasticook Power Company at Pittsfield. In the meantime the plans for the new power house which N. Curtis Fletcher, of Boston, is to build are being inspected by local contractors and bids upon the construction of the house have been received.

BALTIMORE, MD.—The Waverly barn of the United Railways & Electric Company was destroyed by fire recently, resulting in the damage and loss of a number of cars. The car barns will not be rebuilt on the old site, it being the intention of the officials of the company to dispose of the property and erect new barns farther north.

DUDLEY, MASS.—Local people are agitating all-night electric light service, and if interest enough is aroused an appropriation will be called for at the annual town meeting.

PITTSFIELD, MASS.—The City Council has adopted an order authorizing the mayor to petition the Legislature for permission to remove overhead wires within half a mile of North and South Streets.

WEST MEDWAY, MASS.—The selectmen have given their final hearing on the petition of the Edison Illuminating Company for location of poles, etc. The number of lights in town has been limited to 200.

WESTBORO, MASS.—The Selectmen have called a special town meeting, to be held at the town hall Wednesday evening, January 24, when the town will be asked to consider the establishment of a municipal lighting plant.

LYNN, MASS.—Plans are under way for the construction of a railway from the line of the Rutland Road to the marble quarries in Danby, recently purchased by the Vermont Marble Company. The company will erect a power station on Mount Tabor to generate power to operate the machinery in the quarries.

NORTH ADAMS, MASS.—A bill has been presented in the House, accompanied by a petition signed by Frank S. Richardson, vice-president and treasurer of the North Adams Gas Light Company, to authorize the company to furnish electricity for light, heat and power in the towns of Munroe, Savoy and Florida.

BOSTON, MASS.—The gas commission has given a hearing on the petition of the Hyde Park Electric Light Company for authority to increase the capital stock $62,500, making the total capital $350,000. E. W. Burdett appeared for the company and explained that the proceeds for the new stock were to be used in construction, additions and in paying the floating indebtedness. Frank B. Rich, chairman of the Board of Selectmen, was present and intimated that he would oppose the petition.

BROCKTON, MASS.—Repairs to the electric lighting plant of the City Hall that are estimated will cost $1,000 will have to be made this year. The committee on City Hall held a meeting last evening. Chief Engineer Al. Leonard came before the committee and urged the necessity of making these repairs this year if the efficiency of the plant is to be maintained. He has recommended these changes for several years without result. The committee was informed that affairs are in a rather serious condition as a result of the neglect of other city governments to make proper repairs and that the engines are in such condition to-day that general repairs must be made on these and on the dynamos.

LAPEER, MICH.—W. E. Brown and Joseph H. Crawford, of Flint, have petitioned for a franchise to furnish light and heat.

LANSING, MICH.—The Piatt Heat & Power Company has secured practically all of the right of way for the Grand Ledge electric railway and announces that the road will be built during the year.

MARION, MICH.—An electric light franchise has been granted to E. S. George, of this place, the franchise stipulating that the plant shall be in operation by July 4. The plant will be run by water power.

GRAND RAPIDS, MICH.—The Grand Rapids & Battle Creek Inland Lakes Traction Company reports that it has the right of way for its proposed line practically all secured, and that the road is reasonably certain to be built during the coming season.

PONTIAC, MICH.—The Clinton River Power Company has been reorganized and development work will be pushed as rapidly as possible. H. von Schon, of Detroit, is consulting engineer for the new company.

MANISTEE, MICH.—Bascom Parker, of Niles, is said to have purchased the gas and electric light plants here and will probably make improvements.

BANCROFT, MICH.—Lloyd Stoddard, representing a Saginaw concern, has asked for an electric lighting franchise at Bancroft, and for a contract to light the village. He offers to light the village until midnight each night for $50 per lamp per year, and furnish incandescent lighting at 12 cents per kw-hour. His company proposes to utilize the power of the Shiwassee River and light Morrice and Perry as well as Bancroft.

FARMINGTON, MINN.—Charles Heckel, of Prescott, Wis., has petitioned for a franchise for an electric light plant here.

REDLAKE FALLS, MINN.—E. L. Healy, of Redlake Falls, is reported interested in the construction of an electric light plant.

WATERVILLE, MINN.—C. H. Birch, George J. Dressel and others are interested in the formation of a company with a capital of $8,000 to construct an electric light plant.

CANNON FALLS, MINN.—The water power plant on Cannon River, plans for which have been pending for some time, will be constructed this year. Power will be transmitted to Northfield and Cannon Falls and possibly to Red Wing. H. von Schon, of Detroit, Mich., is chief and consulting engineer.

BOULDER, MONT.—Edward Kennedy, of Basin, Mont., is interested in the construction of an electric light plant at Boulder.

GREAT FALLS, MONT.—The Rocky Mountain Bell Telephone Company will make improvements in its system here and will install a new switchboard.

BUTTE, MONT.—W. H. Reber has made application for a 40-year electric light franchise for the operation of a lighting system here.

MILAN, MO.—The Milan Telephone Company has been sold to the Bell Telephone Company in consideration of $10,000.

ST. JOSEPH, MO.—The proposition to build a trolley line from Trenton to Chillicothe has been revived and it now looks as if the road would be built. Chicago and New York capital has been interested to the amount of $600,000.

ST. LOUIS, MO.—Eugene C. Slevin, Edward V. P. Schneiderhahn and C. A. Cunningham have applied for a franchise to construct and operate an electric railway from St. Louis to Ferguson and Florissant. The new road will shorten the route from Florissant to St. Louis by about five miles. The promoters agree to begin work within six months from date of acceptance and to have the road completed within two years.

VANDALIA, MO.—The City Council has granted the Vandalia Electric Light Company a 20-year franchise. The rates for lights are practically the same as heretofore, but the provision is made that the lights must be up to the standard all the time or consumers need not pay the rates. The city will pay 75 cents for 16-cp lights and $1.35 for 32-cp lights. Mr. Beshears, who owns the plant, states that he expects to organize a stock company and will equip the plant for both night and day service and furnish power for manufacturing purposes.

PIERCE, NEB.—The Pierce Electric Company is considering the installation of a storage battery. M. J. Henzler is manager of the company.

GRAND ISLAND, NEB.—The City Clerk writes that an election will be held on March 6 to vote on an issue of $35,000 bonds for a municipal electric light plant.

WARREN, N. H.—The Baker's River Telephone Company at its annual meeting voted to increase its capital stock to $3,500 and to begin construction as soon as the ground opens in the spring.

ORANGE, N. J.—Press reports state that bids will be received by the Committee on Street Lights until February 5 for lighting the city for three and five-year terms from December 1 next.

NEWARK, N. J.—Application has been made to the Board of Works by the Coast Line Telephone Company for a franchise empowering the concern to construct a new telephone system in this city. The company asks the right to construct conduits through every important thoroughfare in Newark.

TRENTON, N. J.—At the special meeting of the Board of Freeholders, January 17, a franchise was asked by the Trenton, Ewing & Hamilton Traction Company to lay tracks on several county roads in order to extend the Trenton street railway lines in the direction of Trenton Junction, Hamilton Square and within half a mile of Allentown. The matter was placed in the hands of the Road Committee and will be considered at the February meeting.

MACEDON, N. Y.—It is probable that an election will soon be held to vote on issuing bonds for an electric light plant.

LAKE PLACID, N. Y.—Application has been made to the County Commissioners by the town for permission to build and operate a municipal lighting plant.

BROADALBIN, N. Y.—The State Gas Commission has granted the application of the Broadalbin Electric Light & Power Company to do business and issue $40,000 bonds and $7,500 of stock.

LOCKPORT, N. Y.—The Lockport Gas & Electric Light Company has decided to improve the local street lighting system. Enclosed arc lamps will be installed. O. M. Diall is superintendent of the plant.

SYRACUSE, N. Y.—The Niagara, Lockport & Ontario Power Company is making preparations for the erection of another double line of steel towers paralleling the one which is partially completed between this city and Lockport.

NEW YORK, N. Y.—Cary T. Hutchinson, Chairman of the Commission on Lighting, has recommended to the Board of Estimate that $100,000 be appropriated to carry on the work of subways for electric and other wires in the various boroughs of the city.

SENECA FALLS, N. Y.—The Interurban Gas Company, which supplies gas to Geneva, Seneca Falls and Auburn, is reported to have purchased the plant of the Seneca Edison Company. It is said to be the purpose of the Interurban Company to construct an electric light plant at Geneva, to supply Geneva, Waterloo and Seneca Falls with electricity.

BLACK RIVER, N. Y.—A new hydro-electric plant is to be installed at this place. Mr. J. B. Taylor, the owner of the Watertown Gas Company, is backing the project. There is available about 4,000 hp at low water. The current will be transmitted to Watertown, 7 miles distant, and utilized for a new lighting system and other purposes. The development on the Black River will utilize the entire flow at 20-foot head. Mr. C. C. Burns, of Watertown, is the hydraulic engineer, and Mr. Bert H. Shepard, of Black River, is consulting and electrical engineer.

ROCHESTER, N. Y.—The proposition has been made to the city by local engineers that in its two great trunk sewers Rochester possesses a water power sufficient to develop 500 hp daily at a minimum estimate. These two sewers empty into the river gorge fully 200 feet above the level of the river, and the sewage proper is so diluted by the flow of water and the long course over which it runs that the power-producing properties of the water are little, if any, reduced by its presence. A meeting is to be held to discuss the project and the advisability of installing the necessary plant.

CARRINGTON, N. D.—The citizens have voted to issue $10,000 water and light bonds.

WILLISTON, N. D.—A bond issue of $12,000 is to be voted upon here shortly, for establishing an electric light plant and water-works system.

FOSTORIA, OHIO.—The Toledo, Fostoria & Findlay Railway is planning to make a further extension into Toledo. F. W. Adams is securing the right of way.

STEUBENVILLE, OHIO.—The Steubenville & Pleasant Heights Traction Company has applied for a franchise to enable it to build an extension to La Belle View.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Traction Company is preparing to double track a considerable portion of its city system here and make other improvements.

LODI, OHIO.—Col. C. V. Hard, of Wooster, and W. H. Abbott, of Cleveland, were in Lodi recently looking after matters in connection with the Cleveland, Ashland & Mansfield Railway.

CLEVELAND, OHIO.—T. F. Hynes, of Cleveland, is promoting the Sandy Valley Traction Company, which proposes to build a line from Alliance to Canal Dover, touching Oneida, Waynesburg and several other towns.

EAST LIVERPOOL, OHIO.—Arrangements are being made to install a new switchboard in the Bell telephone office soon. This is the third switchboard to be installed and will accommodate from 100 to 150 more subscribers.

CINCINNATI, OHIO.—The Cincinnati, Milford & Loveland Traction Company, which recently extended its line to Blanchester, is now planning a further extension to Wilmington, with Columbus as the ultimate objective point.

SHELBY, OHIO.—J. W. Williams, H. W. Hildebrand, I. E. Will and others, of Shelby, are applying for a franchise for entrance for an electric railway into town. They propose to build from Shelby to Plymouth, a distance of eight miles.

CLEVELAND, OHIO.—The Lake Shore Electric Railway Company has closed a contract for a 2,000-kw Westinghouse-Parsons turbine for its Beach Park power station. About 3,000 hp of boilers and stokers will be contracted for immediately.

CHILLICOTHE, OHIO.—It is announced that G. A. Vaughters has obtained a controlling interest in the Chillicothe Electric Railway, Light & Power Company and will manage the property in the future. Considerable new equipment will be purchased.

LIMA, OHIO.—Bids will be received by the Board of Public Service until February 24 for the installation of a power plant to drive two 18-inch centrifugal pumps and deliver 500,000 gal. from each against a main head of 17 feet and a maximum of 25 feet friction included. For further information address the city engineer.

COLUMBUS, OHIO.—In a recent communication to the Council, George S. Marshall, city solicitor, expressed the belief that commercial lighting by the city is the only solution of the electric light question in Columbus, and asked the Council to petition the Legislature to grant to cities that power. The city now has a splendid municipal plant, with its pole line complete all over the city, and it would be comparatively inexpensive to increase the capacity of the plant to furnish all the people desiring it with electric light and power.

BAKER CITY, ORE.—A representative of the Pacific States Telephone & Telegraph Company has been looking over the ground here with a view to establishing an exchange.

GRANT'S PASS, ORE.—The Condor Water & Power Company has purchased the plant of the Grant's Pass Water, Light & Power Company and will make improvements to same.

COTTAGE GROVE, ORE.—A company has been organized for the purpose of constructing a telephone line to Bohemia. A capital of $1,500 has been subscribed up to the present time. Another meeting will be held February 5 for a further discussion of plans.

GRANITE, ORE.—Anthony Maher, of Sumpter, Ore., and W. E. Hurd, are promoting a project for the building of an electric railway from Sumpter to Granite and on to the Greenhorns, the Red Boy and Alamo, the main object being to furnish transportation to the smelter at Sumpter or to outside points.

PORTLAND, ORE.—The syndicate which has been formed by Moffat & White to build and operate an electric railroad between Portland and Salem, Ore., has been closed. This new road will be about fifty miles long and the construction work which has already commenced has progressed as far as Chenawa. The road will be laid with 70-lb. steel rails, and the construction throughout will be of the most substantial character. The work is in charge entirely of Barstow & Chambers, engineers of New York and Portland, of which Mr. W. S. Barstow, president of the New York Electrical Society, is at the head.

PORTLAND, ORE.—Two new companies have applied for franchises to operate in the city—the Cascade Power Company and the Banfield-Veysey Fuel Company. The Cascade Company proposes to establish a plant for lighting and power purposes which would cost about $500,000, and said that $250,000 additional would be expended by the company in construction work. M. C. Banfield, of the Banfield-Veysey Fuel Company, states that his company intends to put in a steam-heating and cold storage plant and would also furnish electric light and power. The proposed plant will cost approximately $750,000, the money to be furnished by local capital. It is desired to install the plant this coming summer if the franchise is granted in time.

WARREN, PA.—The Corry & Columbus Street Railway Company is preparing to begin the construction of its proposed line between Corry and Columbus in the spring. C. P. North, of Warren, is president of the company.

ALLENTOWN, PA.—Plans are under way for the construction of a new trolley line to connect Bethlehem, Catasauqua, Alliance and Nazareth with Allentown. The proposed line will be under the control of the East Pennsylvania Traction Company.

PITTSBURG, PA.—The Corporation Committee of the Council on January 19 recommended the passage of the ordinance granting the Southside Electric Manufacturing Company permission to extend its lines and conduits to all parts of the Southside.

OIL CITY, PA.—Bids will be received until February 20 by the Commissioners of Water and Lighting (A. M. Breckenridge, clerk) for lighting the streets, city buildings and hose houses with electricity for periods of 5 and 10 years, commencing July 1, 1906. .

CARLISLE, PA.—The Cumberland Valley Railway Company has decided to operate the Waynesboro Branch and the South Pennsylvania road by electricity. An electric power plant will be erected in Chambersburg which will cost, together with the most modern equipment, $135,000.

ANDERSON, S. C.—The Savannah River Power Company has been organized to develop Gregg and Cherokee Shoals on Savannah River. Partial development will be made at first at a cost of about $300,000. J. E. Sirrine, of Greenville, is the engineer.

PIERRE, S. D.—The Sioux Falls Interurban Electric Railway Company announces that it will build a line in the spring in a southwestern direction to Parker.

KNOXVILLE, TENN.—The Knoxville & Maryville Railroad has asked for a franchise over certain streets of this city.

DAYTON, TENN.—The Rhea County Electric Light Company, of which W. J. Holman is superintendent, contemplates replacing its engine and generator with machines of larger size.

NASHVILLE, TENN.—It is stated that the Nashville Home Telephone Company will begin the installation of a telephone system in Nashville during the present year. The company expects to have 6,000 telephones installed within two years.

DALLAS, TEX.—Announcement is made that the Dallas Consolidated Electric Street Railway Company will spend more than $200,000 in improvements. Of this sum $80,000 is to be used for the increase and improvement of the rolling stock, while the remainder, $120,000, will be expended in trackage and general improvements.

BEAUMONT, TEX.—Extensive improvements are to be made in the light plant of this city. The company has awarded contracts for new and improved machinery in the power house and light plant sufficient to provide for increased capacity to supply 6,000 additional lights, while the present light service will be incidentally bettered and improved. The improvements will cost over $50,000.

GAINESVILLE, TEX.—The annual meeting of the Gainesville Electric Railway & Light Company has just been held and the following named officers elected: Edward J. O'Bierne, of Atlanta, Ga., president; Chas. A. Ziker, of San Antonio, Tex., vice-president; W. H. O'Bierne, of Gainesville, secretary and manager; W. L. Greenhill, of Gainesville, treasurer. The company desires to put the plant in better condition and expects to take up the railway project in due season.

MOAB, UTAH.—Charles A. Robertson is reported to be preparing to establish an electric light and power plant at this place.

NORTHFIELD, VT.—The village trustees are preparing a report as to the cost of building and equipping a new electric light plant and will call a special meeting soon.

COLONIAL BEACH, VA.—The Town Council has granted Capt. E. S. Randall a franchise for lighting the town by electricity and for the establishment of a telephone service. The electric light plant now used to light the hotel at the Beach will be enlarged.

OLYMPIA, WASH.—John L. Murray is reported to have petitioned the Council for a franchise for an electric light system.

KENNEWICK, WASH.—G. E. Wood, of Genesee, Idaho, has secured a franchise and will establish water works and an electric light plant here.

TEKOA, WASH.—F. J. and J. W. Mahoney have petitioned the City Council for a franchise to install and operate an electric light, heat and power plant.

CENTRALIA, WASH.—The Centralia-Chehalis Electric Railway franchise has passed the Council. It provides for a railway to be built between the two cities.

DAVENPORT, WASH.—The Spokane & Big Bend Electric Railway has asked for a franchise through Lincoln County and the matter will be taken up by the County Commissioners on February 23. Davenport has also been asked for a 10-year franchise through its streets.

BELLINGHAM, WASH.—The County Commissioners are reported to have granted to the Whatcom County Railway & Light Company, of which Francis E. Frothingham, of Bellingham, is manager, a franchise to construct lines and conduits over the road connecting this city with the Nooksack Falls power plant, for the transmission of electric power to Bellingham.

OLYMPIA, WASH.—John L. Murray has asked for a franchise for a steam heat and electric light plant. It is proposed to erect a large plant on the water front in the mill district at the head of the bay, which will furnish steam for heating purposes to buildings in the business section and electric current for power and lighting purposes in perhaps a more extended territory. One of the interesting features of the plan is to utilize waste material from several of the big mills on the water front for fuel. The cost of the plant is estimated at $50,000.

VANCOUVER, WASH.—Manager J. R. Harvey, of the Vancouver Electric Light & Power Company, has announced that the entire stock of the corporation has passed into the hands of H. W. Goode, of Portland. While the price paid has not been made public, it is understood that the amount received was $200,000. It is said that the purchase was made by Mr. Goode on behalf of himself and Eastern capitalists desirous of entering the lighting field of the Northwest. Mr. Harvey states that improvements totaling $50,000 are planned for this year.

BELOIT, WIS.—W. H. Wheeler is interested in the organization of a company to build a street railway in Beloit.

SHEBOYGAN, WIS.—It is stated that the Citizens' Telephone Company will expend $30,000 in installing automatic telephones.

OCONTO, WIS.—Bids will be received at the office of the city clerk until February 6 for furnishing the city for a period of three years 50, more or less, arc lamps of 2,000 cp each, to be operated all night on a moonlight schedule. Joseph Pocquette, Chairman Electric Light Commission.

OLDS, CAN.—The town is trying to secure an electric lighting plant. Address the mayor.

CALGARY, CAN.—The City Council is considering plans for an electric lighting plant, to cost $20,000.

PRINCETON, CAN.—F. E. Voight has decided to erect an electric lighting plant on the Similkameen River.

CHILLIWAC, B. C., CAN.—A. M. L. Hawkes, of this town, has been engaged to design the new plant for the Chilliwac Light & Power Company.

PRINCE ALBERT, CAN.—Willie Chipman, C. E., Toronto, Ont., is preparing plans to develop the water power 12 miles north of here to supply the town with light and power. Addres Mayor Cowan.

CALGARY, CAN.—The Canadian Pacific Railroad Company will develop the water power at Kananaskis Falls and transmit it to this city, a distance of 63 miles, for light, heat and power purposes. Address Supt. Dennis, Calgary.

WINNIPEG, MAN.—Bids will be received by Alderman J. C. Gibson, chairman of the Fire, Water and Light Committee, until February 12 for 100 to 200 series alternating-current arc lamps, 100 to 200 cut-outs, two or four constant-current transformers, and two 500-hp electric generators.

WINNIPEG, MAN.—The Winnipeg, Selkirk & Lake Winnipeg Electric Railway has broken the negotiations for the sale of its property to the Winnipeg Street Railway Company and applied to the Winnipeg City Council for permission to lay rails on the city streets and bring its lines into the heart of the city.

ST. JOHN, N. B.—The Council has adopted a resolution authorizing the Safety Board to employ an electrical engineer to estimate the cost, etc., of establishing an electric light plant.

ST. JOHN, N. B.—At a meeting of the town authorities recently, the provincial engineer reported in favor of the plans as submitted by the Grand Falls Water Power Company for the development of water power at Grand Falls.

BOBCAYGEON, ONT.—Charles E. Stewart, village clerk, writes that the proposed municipal electric light and power plant will cost from $10,000 to $15,000. Bids will be called for in a few months.

WOODSTOCK, ONT.—Bids will be received until January [illegible] by John Morrison, City Clerk, for $50,000 bonds, the proceeds of which will be expended in improving the water works and electric light system.

GUELPH, ONT.—The directors of the Guelph Street Railway are considering the extension of their road to Puslinch Lake and Hespeler, a distance of about nine miles. The extension will probably cost $150,000.

PICTON, ONT.—R. A. Norman, city clerk, reports that bonds to the amount of $[illegible] will be sold, to be used to install a new electric street lighting plant and to improve and extend the present commercial and residential system which is owned by the city.

New Incorporations.

SACRAMENTO, CAL.—Articles of incorporation of the Sacramento & Lake Tahoe Railway Company have been filed with the County Clerk. The purpose of the company is to construct and operate a railway from Sacramento to Auburn, a distance of 40 miles. The capital stock of the company is $7,500,000.

LOS ANGELES, CAL.—The Mt. Wilson Railway Company, of Pasadena, has been incorporated with a capital stock of $500,000. The directors are William R. Staats, James H. Holmes and W. S. Wright. This company will assume the obligations of the Pasadena & Mt. Wilson Toll Road Company.

JOILET, ILL.—Articles of incorporation of the Joliet & Southern Traction Company have been filed. The capital stock is $10,000 and the incorporators are H. A. Fisher, E. F. Fisher and others.

INDIANAPOLIS, IND.—Capitalists of this city and Chicago, who plan to build an electric railway between this city and Louisville, have incorporated the Indianapolis & Louisville Traction Company, capitalized at $3,000,000. The incorporators are John E. Greeley, Robert Candee and B. F. Rice.

CRAWFORDSVILLE, IND.—The Crawfordsville & Northwestern Traction Company has filed articles of incorporation with the Secretary of State. The capital stock of the company is $100,000. The proposed line is to start at Crawfordsville and pass through Wesley, Waynestown, New Richmond, Wingate, Attica, Hillsboro, Melott, Aylesworth, Stone Bluff, Newton, Williamsport, Kramer, Carbondale, Judyville and Pener. Spencer J. Hunt, A. L. Mason and J. F. McFarland are the incorporators.

NEW ORLEANS, LA.—The Algiers Railway & Lighting Company, with a capital of $360,000, has been incorporated and will absorb the Algiers Water Works & Electric Company, of Algiers, La.

BEATRICE, NEB.—The New Home Telephone Company, with a capital of $20,000, has been incorporated by F. H. Woods, of Lincoln, and others.

OREGON CITY, ORE.—Articles of incorporation have been filed by the Oregon City & Farmers' Independent Telephone Company, with a capital of $5,000.

PORTLAND, ORE.—The Oregon Independent Telephone Association has been organized in Portland, with a charter membership comprising a large number of the independent companies of the State. The officers are F. H. Stowe, president; S. G. Hughes, vice-president; P. L. Brown, secretary and treasurer.

LEBANON, PA.—The Myerstown and South Lebanon electric companies have filed articles of incorporation, the capital stock of each company being $5,000. The directors of both concerns are Dr. Walter Rigg, Milton Miller and Harry H. Reigel.

HARRISBURG, PA.—Charters were issued at the State Department last week to six Western Pennsylvania electric railway companies, all having the same incorporators: Shenango-Midland Street Railway Company, 7 miles of road in the vicinity of Sharon, $42,000; Northern Middlesex Street Railway Company, to build 4 miles in the vicinity of Wheatland, $24,000; Shenango Northern Street Railway Company, to build 4 miles of line in the vicinity of Sharon and Hickory township, Mercer county, capital $24,000; Central New Castle Street Railway Company, to build one mile of line in New Castle, capital $6,000; Shenango Southern Street Railway Company, to build 3 miles of line in the vicinity of Wheatland, capital $18,000. The incorporators are: Edward Ripley, C. G. Glatson, W. H. Waugh, J. D. White and E. A. Henry.

ETTRICK, WIS.—The Ettrick Telephone Company has been incorporated by K. A. Knutson, and others, with a capital stock of $8,000.

HALE, WIS.—Pleasant Valley Telephone Company has been incorporated, with a capital stock of $4,000, by Leo L. Swain and five others.

New Industrial Companies.

THE NATIONAL ENGINEERING COMPANY, successor to McGrew & Bruning, consulting and construction engineers, has been incorporated at Columbus, Ohio.

THE ENGINEERING, LIGHT & ILLUMINATION COMPANY, of New York City, having a capital stock of $20,000, has been incorporated. The directors are A. A. Ernst, Edgar Beekman and C. C. Beekman.

THE RUSSELL ELECTRIC COMPANY, of Danbury, Conn., has been formed; capital stock, $25,000; incorporators, William Edwin Russell, and William Earl Russell, of Danbury, and Charles B. Russell, of Worcester, Mass.

GAIL-WEBB MANUFACTURING COMPANY, Buffalo, N. Y., has filed articles of incorporation in which the directors are named as follows: H. M. Gail, H. M. Smith and O. M. Gail. The company is capitalized at $25,000 and will manufacture telephone apparatus.

THE ELECTRIC MACHINE MANUFACTURING COMPANY, New York City, has been incorporated. The company is capitalized at $25,000, and the following gentlemen are named as directors: F. G. Hall, Jr., of Brooklyn; W. P. Passenger, of New York, and Thomas Aldcorn, Union Hill, N. J.

VICTOR ELECTRIC MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated, with the following directors: I. B. d'Homergue, L. P. Baldwin, Harry Hertzberg, William P. Snyder and Harry F. Ashbury. The company has a capital stock of $100,000, and will manufacture electric meters, etc.

THE HARTFORD LIGHT & EQUIPMENT COMPANY, of Hartford, Conn., has filed a certificate of incorporation. It has a capital stock of $75,000, and it proposes to lease and rent prismatic hoods for intensifying and diffusing electric light. The company has elected these officers: President, James H. Bolton, of Hartford; vice-president, Henry Schoenfield, of Congers, N. Y., and secretary and treasurer, William S. Davis, of Hartford.

Legal.

CHICAGO TRACTION LITIGATION.—At Chicago on January 17, suits were filed by the city in the Circuit Court against the Union Traction Company for $1,500,000 and the Chicago City Railway Company for $500,000 for violations of the good service ordinances. The suits were filed by Julius G. Grossberg, traction ordinance counsel for the city, and were intended to forestall any possible injunctional proceedings which the companies might bring against the city.

ROOF TELEPHONE WIRES.—The Appellate Division of the New York Supreme Court has affirmed a judgment of the lower court in the case of Ratje Bunke against the New York Telephone Company. The plaintiff sued to recover $200 for the use of the roof of his house at 327 Pleasant Avenue for telephone wires. Justice Laughlin writes the opinion of the Appellate Division. He says: "The defendant has no right to invade private premises and attach its wires to roofs or chimneys without a license from the owner, and it has no right to maintain them after a change in ownership without further license. It is difficult for a plaintiff in such a case to prove the damages which he is entitled to recover. In the case at the bar we are of the opinion that he has proved his case by the best evidence obtainable."

BARRING UNION MEN.—The Appellate Division of the New York Court has handed down an opinion in the case of Harry Marcus, who was charged with and convicted of coercing one Hyman Sheinbaum to enter into a written agreement with the H. Marcus Shirt Company not to become a member of any labor organization as a condition of obtaining employment with that concern. The Appellate Division reverses the judgment of conviction and orders the discharge of the defendant. Justice Laughlin writes the opinion, in which Presiding Justice O'Brien and Justices Patterson and Ingraham concur, Justice McLaughlin concurring in the result. The court holds that Section 171A of the Penal Code, which forbids the making of contracts of the kind described, is unconstitutional. Justice Laughlin says: "It has always been supposed, and the decisions so holding are numerous, that an employer, so long as the contract does not affect the public health, morals or welfare, is at liberty to employ or discharge whomsoever he pleases, and to refuse to employ any person without becoming answerable therefor except for a breach of contract for an unjustifiable discharge of an employe. The contracts at which the provision of the Penal Code in question is aimed, it is true, do discriminate against labor unions; but that is in the lawful exercise of the employer's right to employ whomsoever he pleases, and it is not competent for the Legislature to make it a crime for him to decide the question upon what considerations of race, or of religion, or of affiliations of the individual with civic organizations unless, of course, he makes a contract contrary to public policy and affecting the State itself, or, for instance, imposing as a condition that the employe shall not join the National Guard, the maintenance of which is essential to the peace and safety of the property of the State."

CONSTRUCTION OF POWER PLANTS.—The Appellate Division of the New York Supreme Court has reversed a judgment recovered by the National Contracting Company against the Hudson River Water Power Company for more than $500,000. The action involved altogether claims aggregating more than $1,000,000, including the counter-claim of the Hudson River Water Power Company against the National Contracting Company. The contracting company was constructing in 1900 a huge masonry dam across the Hudson at Spier Falls for the power company, under a contract which permitted the owner to change the plan, dimensions and material with the approval of William Barclay Parsons. It was believed it might become necessary to substitute a core wall with earth re-enforcements for solid masonry and the Hudson River Water Power Company gave notice to the contracting company that such a change might be required, but requested the contracting company to proceed with the work until the time came when the necessity for such a change could be determined. As the work proceeded the contracting company treated this notice as a breach of contract and sued for $500,000. The case was heard before Henry W. Bookstaver, as referee, whose report favored the plaintiffs. The appellate division, in an opinion delivered by Justice Ingraham, holds that there was no breach of contract and that the contract permitted changes in material of construction. He also holds that the decision upon the demurrer is a conclusive adjudication against the plaintiff's alleged cause of action, and that no breach of the contract on the part of the defendant existed which justified the plaintiff's refusal to perform or entitled the plaintiff to any recovery. The provisions of this contract did not justify the position taken by the plaintiff. The contract, under the provisions above referred to and others, contemplates a change in both the plans and methods of doing the work described. It was recognized that work of this magnitude could not be settled in all its details in advance of the conditions that were found to exist, and thus the necessity for the change of plans was recognized and provided for.

Personal.

MR. E. A. TURPIN, chief clerk to General Manager A. L. Drum, of the Chicago & Milwaukee Electric Railroad, has been appointed purchasing agent of the company.

MR. FRED'K R. SLATER, electrical engineer, announces that he has opened an office at 100 Broadway, New York City, for the practice of his profession.

MR. WELLS M. IRWIN has been elected president of the Board of Directors of the Keokuk & Hamilton Water Power Company, to succeed his late brother, the Hon. John N. Irwin.

PROF. ELIHU THOMSON gave a lecture last week before the Worcester, Mass., Board of Trade, on the power possibilities of the future. There was a large and enthusiastic audience.

MR. J. E. HODGSON, formerly of Philadelphia, has been given entire charge of the electrical department of the Fulton County Gas & Electric Company, of Gloversville, N. Y., which operates three or four of the companies in that vicinity.

MR. H. S. DURANT announces that he has recently taken a partnership interest in the firm of Geo. W. Conover & Co., of Chicago, purchasing and forwarding agents for independent telephone companies. Mr. Durant has been identified with the Automatic Electric Company's sales department for the past three years.

MR. FRANK CAUM, who in June of last year succeeded Mr. Norman McD. Crawford as general manager of the Hartford lines of the Consolidated Railway Company, operating the electric railway properties owned by the New York, New Haven & Hartford Railroad Company, has resigned to become the general manager of the Scranton (Pa.) Street Railway Company.

MR. E. G. WINSTON has accepted a position as engineer with the O. C. Irwin & Co., Crawfordsville, Ind., and will have charge of the design and manufacture of its entire product. Mr. Winston has had a number of years' experience with the leading electric companies and is well qualified for his new duties. The company manufactures alternating-curent generators and transformers.

MR. CUTHBERT SCHAEFER, who was for ten years in the contracting business in New Orleans, and who for the past two years has been connected with the B. F. Sturtevant Company, of Boston, in its Chicago office, enters the employ of Evans, Almirall & Co. in their Chicago office as assistant western manager. Mr. Schaefer is a graduate of Cornell University in the class of 1904.

MR. T. L. JOHNSON.—Mayor Tom L. Johnson, of Cleveland, says he has no intention of becoming a new Yerkes in Philadelphia. He is to talk over the Philadelphia street railway situation with the Philadelphia trades league committee and give them the benefit of his experience as a successful promoter and manager of street railways.

MR. HENRY T. SCOTT has been elected to succeed the late John I. Sabin as president of the Pacific States Telephone & Telegraph Company, with headquarters in San Francisco. At the conclusion of the directors' meeting, Frederick P. Fish, president of the American Telephone and Telegraph Company, entertained the directors and President Scott at a luncheon given at the St. Francis, in San Francisco.

MR. PUTNAM A. BATES will lecture before the Electrical Engineering Society of Columbia University, New York City, on February 7, at 8 p. m., on "Isolated Plant Engineering." The lecture will be given in room 301, Engineering Building. An invitation to attend is extended to those interested. Mr. Bates has lately given considerable attention to this class of work, and is the consulting engineer for the new Engineers' Club building on Bryant Park.

MR. RUSH B. HOLBROOK, formerly chief engineer of the Cedar Rapids and Marion City Railway Company and later chief engineer of the American Cereal Company, has recently taken up his residence in Chicago, where he will engage in business for himself as industrial engineer, taking up especially boiler room economies, smoke abatement and coal performances. Mr Holbrook's long experience with steam plants of all kinds and sizes fits him unusually well for this work.

MR. C. T. MORDOCK, of Terre Haute, Ind., has been appointed by President Blood to report to the twenty-ninth convention of the National Electric Light Association, to be held in June next, on "Methods of Theft of Current." Past President Ernest H. Davis will make a new compilaton of the laws of the different states governing theft of current, bringing same to date. This is one of the most important subjects with which central stations have to deal, and the report will be very valuable.

MR. J. R. DAVIS, late technical manager of the Midland Electric Company of New York, and Mr. A. J. Alexander's partner will very shortly visit the United States, with a view to purchase suitable machinery for elevators to be constructed at 38 grain receiving stations in the southern Argentine along the Great Southern Railway of the Province of Buenos Ayres. Mr. Alexander expects part of the elevator scheme will be completed for the wheat season of 1906-07 and the remainder in the following year The capital will probably be subscribed for in England.

MR. BENJAMIN KAUFFMAN, who has for the past year been assistant western manager for Evans, Almirall & Co., in their Chicago office, will become on Feb. 1 western manager for that company. Mr Kauffman is well known in the heating business, having been for some years connected with the Paul System Company, and afterwards with Thomas & Smith, of Chicago, and the Western Kieley Steam Specialty Company. Mr. Kauffman has been assistant manager for Evans, Almirall & Co. for the past year. He is a graduate of Washington University of St. Louis, Mo.

MR. H. E. ANDREWS takes the controller this week for the New York Central trolley system, as already announced. Mr. W. K. Vanderbilt, Jr., who has been in charge of the recently acquired electric traction properties of the New York Central Railroad, will sail for Europe this week for a long vacation. Mr. Horace E. Andrews, formerly president of the Cleveland Electric Railway, has been put in charge of all the Central's traction properties, with headquarters at the Grand Central Station. He is president of the Mohawk Valley Company, which is the holding company for the Central's traction lines.

MR. JOSEPH P. DEVINE, Buffalo, N. Y., the well-known manufacturer of vacuum drying and impregnating apparatus under the Passburg patents, announces that this business will be carried on in the future by the J. P. Devine Company, in which the Emil Passburg Company, of Germany, is interested. In fact the new company is really the American branch of the parent company. Mr. W. Strohn, who has been closely identified with the Passburg Company for 20 years, comes to this country as vice-president of the J. P. Devine Company, and the latter will have the benefit of his vast experience in manufacturing and installing this kind of apparatus. Mr. Devine is president of the new company, and the offices remain in the Mooney-Brisbane Building.

MR. T. A. EDISON made one of his rare visits to New York last week, one of the attractions being the automobile shows, where he spent several hours. He also gave a sitting to the sculptor, Mr. James Earle Fraser, for the Edison medal of the American Institute of Electrical Engineers—the work on which is now nearly finished. Mr. Edison is deeply interested in the United Engineering Building, and made a visit to the site in order to see how that great enterprise is advancing. He was very much pleased to find steel and stone several stories up in the air. Mr. Edison is a contributor of $5,000 to the Institute Land and Building Fund, which is being raised to pay for the Institute's portion of the land on which the $1,000,000 building given by Mr. Carnegie is being erected.

MR. K. L. MARTIN.—Mr. Kingsley L. Martin, who has been assistant engineer in charge of the Williamsburg Bridge, has been made engineer in charge of both bridges. Archibald McLean, at present assistant engineer in charge of the Brooklyn Bridge, is placed under the direction of Mr. Martin. Olaf M. Kelly has been designated as assistant engineer in charge of the Williamsburg Bridge, and also acts under the direction of Mr. Martin. Mr. Martin, who thus receives complete charge of both bridges, is a son of C. C. Martin, who used to be Chief Engineer and Superintendent of the Brooklyn Bridge. He is 37 years old, and has been connected with the city bridges since 1892, during which time he has had a great deal to do with the electrical questions and problems arising in connection with the bridges.

DR. ROBERT ABBE, a well-known physician of New York City, reporting his experiments with radium, states that it is an effective cure for gout, but does not touch deep-seated growths like cancer. "My idea is that growths or sores of the skin are evidences of balking nature. That is to say, a part of the skin gets tired and refuses to work. It is a good deal like a recreant citizen, who refuses to obey the laws. He's tired of them. Sometimes by giving these persons a little moral support we can cure them. And so it seems to me it is in these physical ailments of the skin. Radium in a great measure seems to supply the deficiency. It gives a tonic to the tired spots. It pleases me to think that along these lines we may perhaps discover a cure for cancer. The germ of the disease has not been found—not even though 10,000 eyes are daily glued to miscroscopes to find it. It may be that cancer means merely nature balking, tired out in various spots of the body."

MR. FRANK N. JEWETT will on February 1 become district representative, with offices in the Marquette Building, Chicago, for the Wagner Electric Manufacturing Company, of St. Louis. Mr. Geo. C. Foster, who has formerly represented the company in Chicago, together with the Allis-Chalmers Company's interests, will hereafter devote all his time to the Allis-Chalmers Company. Mr. Jewett graduated from Cornell in 1893, and after leaving the University was for three years connected with the sales department of the Payne Engine Company, of Elmira, New York. For the past ten years Mr. Jewett has been connected with Evans, Almirall & Co., of New York City, engineers and contractors for their system of heating, which has been largely used for central station heating systems. For six years Mr. Jewett has been western manager and engineer in charge of that company's Chicago offices in the Monadnock Building. Mr. Jewett is also interested in central station properties, being vice-president of the Albert Lea (Minn.) Light & Power Company.

TELEPHONE PERSONNEL.—At a dinner of the New York Telephone Company last week, Mr. U. N Bethell announced that on March 1, after a continuous service of thirteen years as general manager of the company, he will retire from his office as general manager of the company and assume the duties of First Vice-President and also as President of the New York and New Jersey Telephone Company and several other companies, all operating in the territory between the St. Lawrence and the Potomac. Among other changes announced by Mr. Bethell, introduced for the purpose of the improvement of the service and creating harmony between the operating companies of New York and vicinity.

was that there will be one operating department for the New York and the New York and New Jersey Companies. J. C. Reilly, present manager of the New York and New Jersey Company, will be promoted to Vice-President of that company; J. J. Carty, chief engineer of the New York Company, will become chief engineer of both companies. Supt. H. F. Thurber, of the New York Company, will become the general manager of both companies. Theodore Spencer will become Vice-President of the Bell Company of Philadelphia, F. H. Bethell will become Vice-President of the Chesapeake and Potomac, H. F. Stevens will become Vice-President of the Central New York, and H. E. Hawley will become Vice-President of the Hudson River Company.

Trade Publications.

STEAM ENGINES AND BOILERS.—The Trump Manufacturing Company, Springfield, Ohio, has issued an illustrated catalogue dealing with self-contained side-crank steam engines, and steel boilers of the upright and horizontal stationary and semi-portable types.

STAMP MILLS FOR MINES.—Bulletin No. 1408 of the Allis-Chalmers Company, Milwaukee, Wis., gives a complete description of the Tremain steam stamp mill which has been designed to meet the demands for a simple mill for use on mining properties in the first stages of development.

VARIABLE SPEED.—Booklet 39, issued by the Northern Electrical Manufacturing Company, Madison, Wis., shows some motor drives embodying the well-known Northern variable speed motors which respond to the motor controller with a minimum effort of the machine hand, and secure promptly the graduation of motor speed suited to the work or to the man's own degree of dexterity.

ELECTRIC MINING MACHINERY.—The Jeffrey Manufacturing Company, Columbus, Ohio, has distributed among its friends copies of a well-designed calendar for the present year. Views are given of an electrically driven chain coal cutter and an electric mine locomotive with a string of mine cars just leaving the pit mouth. Surrounding these views are inscribed the words "The Jeffrey cuts the World's coal, and the Jeffrey locomotives haul it."

BOILER-TUBE CLEANERS.—The Lagonda Manufacturing Company, Springfield, Ohio, has just issued a handsomely illustrated catalogue of 36 pages which discusses tube cutters, damper regulators, reseating machines, as well as boiler-tube cleaners. The cleaners are of both the turbine-driven and manually-operated types. These are sold, rented or used by the company in cleaning boilers by contract, just as the customer may prefer.

CORLISS ENGINES.—Bulletin No. 1501 of the Allis-Chalmers Company, Milwaukee, Wis., gives a complete description of Reliance Corliss engines of the belted type, which have been designed to meet the demand for more concentrated power, as the available space has yearly become more expensive. The new design embodies somewhat higher rotative and piston speeds than in the other types, and has, therefore, made necessary a thorough reconsideration of the details entering into the engine as a whole. Each part of the engine is well illustrated in the bulletin.

VARNISHED CAMBRIC CABLES.—The General Electric Company has issued publication No. 1,050, dealing with varnished cambric cables. The construction of the cables is as follows: Specially prepared cotton fabric is coated on both sides with multiple films of insulating varnish. The coated cloth is cut into strips and applied to the copper core with films of special non-drying viscous and adhesive compound between the copper and the taping to prevent any possible action of varnished films on the copper. The result is a flexible and homogeneous insulating wall of great dielectric strength. This insulation, unlike paper, does not absorb moisture and can be used for interior wiring without lead. It is, therefore, unnecessary to seal the ends. It is stated that leaded varnished cambric cable installed in 1898 on 11,000-volt circuits in connection with overhead transmission lines, exposed to lightning discharge, is still in use without failure or deterioration.

DIRECT-CURRENT MOTORS.—The Sprague Electric Company, 527 West 34th Street, New York, has issued bulletin No. 224, dealing with type D direct-current motors of the shunt, series and compound-wound types, designed for 115, 230 and 500-volt circuits. The motor frame consists of a cylindrical magnet yoke, to the inner side of which are bolted the poles each of which supports a field coil. The poles are built of laminated steel punchings, with projecting pole horns for spreading the magnetic flux, and for retaining the field coils. Each pole being bolted to the inner surface of the yoke, a pole with its field coil can easily be removed without disturbing the yoke or the armature. As showing the care taken in insulating the machine, it is worthy of note that the completed armatures are dipped, while hot, in an insulating and moisture-proof compound and then thoroughly baked, which treatment renders the winding impervious to moisture and so cements it in place that destruction of the insulation by vibration is practically impossible.

STATIONARY TRANSFORMERS.—The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has placed upon the market a line of core-type transformers as an addition to its familiar lines of shell-type transformers. The high and low-tension coils are wound separately, allowing inspection of all finished parts before assembling. The low-tension winding is composed of one coil per leg, each coil having two sections. These sections are connected so that the inner section of one leg is in series with the outer section of the other leg. This arrangement insures an equal loading of each primary coil irrespective of the loading of the secondary. A balanced voltage is thus maintained on the two sides of a three-wire distributing system. The high-tension winding is divided into two coils per leg to reduce the voltage. Among the advantages of the core-type construction are noted the elimination of sharp bends, which are harmful to insulating material, the circular coils being effectively and economically insulated. These transformers are described at great length in bulletin No. 1126, which has just been issued.

IN A SOUVENIR PROGRAMME.—In the "souvenir" programme, issued for the opening week of the new Majestic Theatre in Chicago, appears the following item: "The electric light and power equipment in the Majestic Theatre Building is one of the best and most modern private plants of its kind in the city. It was built and installed by the Allis-Chalmers Company, of Milwaukee, and consists of three generating units composed of Reynolds-Corliss engines, of the Reliance type, direct connected to Bullock direct-current generators. Two of the engines are 20 in. x 36 in., producing 300 hp each; the third is 16 in. x 30 in. and of 150 hp. The two larger engines are each connected to a Bullock direct-current generator of 200-kw capacity, while the smaller is coupled with a 100-kw generator of the same make. There are two compensating sets, each consisting of a Bullock 45-kw generator and a 15-kw machine. This plant produces a 220-volt power current and a 110-volt lighting current, distributed by the three-wire system through a seven-panel switchboard. The power is used for running the elevators, scene-shifting machinery, compressed air plant, ventilating plant, etc., and furnishes the lighting current for all the building and the theatre illumination."

News of the Trade.

THE MACALLEN COMPANY, of 338 Congress Street, Boston, manufacturer of line material, has changed its name from W. T. C. Macallen Company to that given above.

THE STANLEY-G. I. ELECTRIC MFG. CO. has established an office at No. 505 Postal Telegraph Building, Kansas City, Mo., for the purpose of more conveniently and more quickly taking care of its many customers in the State of Kansas.

THE BANNER ELECTRIC COMPANY, of Youngstown, Ohio, has recently moved into its new building, where it has every facility for handling its growing business. The company's new home is a three-story brick structure and contains 32,000 square feet of floor space. The capacity of the new plant is said to be 5,000 lamps a day.

THE W. & S. MFG. CO. is the name of the new company that succeeds to the business of Wilson & Smith, 9 Hunt St., Worcester, Mass. This company has for a great many years been engaged in metal punching and die making and similar work. A special product of the old firm has been armature discs. The new company continues the business of the old without any essential change.

CATALOGUES WANTED.—The Black & Phipps Electrical Company, contractor and specialist, of Brantford, Ont., Canada, has entered the electrical fixture and supply business and has opened show rooms and office at 215 Market Street, that city. It would like to receive catalogues and price lists of general electrical supplies from the manufacturers, with price lists, and other information.

THE ALLIS-CHALMERS COMPANY reports the receipt of several contracts for turbine generating units of 500-kw capacity, among them one from the city of Jacksonville, Fla., which is installing new equipment consisting of two steam turbines coupled to 500-kw three-phase, 60-cycle, 2,300-volt generators. These units will be the first steam turbines of Allis-Chalmers manufacture to be installed in the South.

ELECTRIC MFG. & EQUIPMENT COMPANY. The name of the Wotton Electric & Manufacturing Company, of Atlanta, Ga., has been changed to Electric Manufacturing & Equipment Company, and the capital stock has been increased from $65,000 to $167,000 paid up. Mr. F. M. Laxton, the general manager, informs us that they are adding new buildings, new automatic machinery and thorough equipment in every respect, and have gone extensively into the manufacture of Wotton telephones, switchboards, and loud-ringing extension gongs. The growth of their switchboard business is due to the introduction of a new interchangeable type, available for both magneto and common battery service.

COAL & IRON BANK.—The Coal & Iron National Bank, Liberty & West Streets, New York City, is reaching a large and growing clientele in the electrical and mechanical field at the centre of which it does business, while in the railroad field it has many affiliations. Mr. E. E. Loomis, vice-president of the D., L. & W. R. R., has become a member of the board of directors and through this latest accession to the board it will now be associated with the following railroads: the B. & O.; C. R. R. of N. J.; Lehigh Valley; Reading; D., L. & W. This is in addition to a diversity of commercial and banking interests, representing an aggregation which can hardly be equaled by the board of directors of any other kindred institution. The Bank is therefore in a position to offer to houses in the electrical world the facilities of an institution which is safe, sound and conservative.

Weekly Record of Electrical Patents.

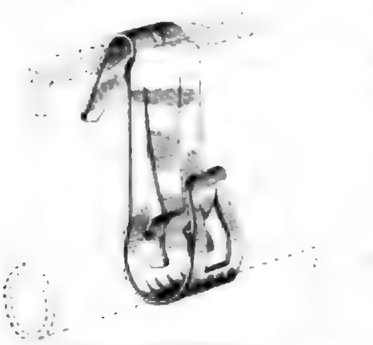
UNITED STATES PATENTS ISSUED JAN. 16, 1906.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St.]

809,929. INTERCOMMUNICATION TELEPHONE SYSTEM; Richard M. Beard, New York, N. Y. App. filed November 4, 1902. A secret service or party telephone line without central with independent wires for connecting the apparatus of any one station with any of the others, and with two groups of local circuits and apparatus.

809,939. APPARATUS FOR RECOVERING PRECIOUS METALS; Edward J. Garvin, Portland, Oregon. App. filed June 16, 1905. Details of construction of a tank for recovering the precious metals in an ore partly by solution and electrolytic deposition and partly by amalgamation.

809,966. STOPPING AND STARTING DEVICE FOR MOTOR DRIVEN APPARATUS; Walter B. Manny, New York, N. Y. App. filed Aug. 1, 1905. A switch for use with motor operated machine such as adding machines, having a spring pressed button in the operator's chair leg so that when the operator leaves the machine, the switch will automatically open and stop the motor.


810,004.—Cable Hanger.

809,996. SYSTEM OF ELECTRICAL DISTRIBUTION; Charles P. Steinmetz, Schenectady, N. Y. App. filed April 13, 1894. Relates to the transformation of two-phase to three phase currents or from three-phase to two-phase currents by means of two transformers connected in the familiar T method.

809,978. ELECTRIC SAFETY FUSE; Elmer L. Ogle, Peru, Indiana. App. filed May 25, 1904. An auxiliary fuse is connected in parallel with the main fuse and exposed on the outside of the fuse shell. A chemically impregnated paper covers the auxiliary fuse and is in turn covered by a transparent fire-resisting material such as mica. The blowing of the fuse discolors the paper and the mica covering prevents danger from external combustion.

809,984. ELECTRIC SAFETY-FUSE; Charles W. Rhoades, Peru, Indiana. App. filed May 25, 1904. A hinged spring indicator attached to the outer covering of an enclosed fuse and held under tension against it by a thread or wire passing around the fuse, immediately flies to an angular position when the thread is released owing to melting of the fuse.

809,993. CABLE HANGER; Frederick W. Sorg, Englewood, N. J. App. filed Dec. 16, 1903. A sheet metal strap is perforated with a pair of key slots in which a rivet pin may be engaged to hold the strap in clasped relation about the messenger wire and cable. The edges of the key slot are afterward folded in for the purpose of holding the rivet pin more securely.

809,995. ELECTRIC METER; William Stanley, Great Barrington, Mass. App. filed Mar. 7, 1905. The meter has current coils and a needle arranged to oscillate in the field thereof, the rate of oscillation being proportional to the current. The oscillations of the needle are converted into rotary movement so as to register upon the dials. An auxiliary coil is provided to give periodic impulses to the needle compensating for air resistance and friction.

809,999. RAILWAY SIGNALING; Samuel D. Strohm, Philadelphia, Pa. App. filed Aug. 20, 1801. The locomotive is fitted with depending contact brushes which move into different lateral relations under different circumstances. Different contact shoes along the track complete circuits with said brushes in their different positions. The mechanism is arranged to automatically set the danger signals, and to apply the air brakes of a following train in case it passes a danger signal.

810,004. CABLE HANGER; Frank C. Tabler, St. Louis, Mo. App. filed Feb. 6, 1905. A sheet metal hook having a pair of inwardly directed tongues which spring into engagement with the cable when it is placed in the saddle, and prevent its removal.

810,027. ELECTRIC SIGNAL; Charles C. Blake, Brookline, Mass. App. filed Aug. 19, 1905. Relates to a method of setting any desired signal along the road from the train despatcher's office by having pendulums of different vibrating periods at the several stations, and having a series of different pendulums at the despatcher's office which respectively synchronize with the different local pendulums. Impulse currents are transmitted whereby any desired local pendulum may be vibrated and the corresponding signal exhibited.

810,069. OVERHEAD TROLLEY HARP AND SHOE FOR ELECTRIC RAILWAYS; John Miller, Jr., Amesbury, Mass. App. filed Mar. 17, 1905. The patentee uses a pivoted sliding shoe instead of a wheel. The shoe is made in two halves with anti-friction rollers at each end of the groove, and a number of graphite pockets for the purpose of lubrication.

810,150. WIRELESS TRANSMITTING AND RECEIVING MECHANISM FOR ELECTRIC WAVES; Christian Hulsmeyer, Dusseldorf, Germany. App. filed Mar. 14, 1904. Relates to a system of operating any desired distance mechanism, such as fog whistles, gates, signals, etc., by predetermined permutations of wireless impulses. All the receiving devices have clock operated discs with specially notched peripheries, and it is necessary that the impulses should be received co-incidentally with the movement of the notches in order to operate any particular selected device.

810,144. PROCESS OF TREATING HIDES; Frank B. Hinkson, Newcastle, Pa. App. filed Dec. 27, 1904. The hides are so suspended in the electrolytic tank that each hide is disposed between one pair of electrodes; the current passes transversely through each hide and its direction is reversed at regular intervals.

810,179. APPARATUS FOR MEASURING WATTS IN ELECTRICAL CIRCUITS; Ernest Wilson, London, England. App. filed Dec. 17, 1904. The wattmeter is a quadrant electrometer, the difference of potential applied to the quadrants being obtained from the armature of a dynamo driven at constant speed in a field produced by the current in the work circuit.

810,235. ELECTRICAL MEASURING INSTRUMENT; Thomas W. Varley, New York, N. Y. App. filed Feb. 6, 1905. Instead of having the current coils of the dynamometer themselves create the magnetic field, the patentee makes use of a permanent magnetic field, the direction of which is distorted by the current coils. The potential coils move with the rotable armature or element as usual.

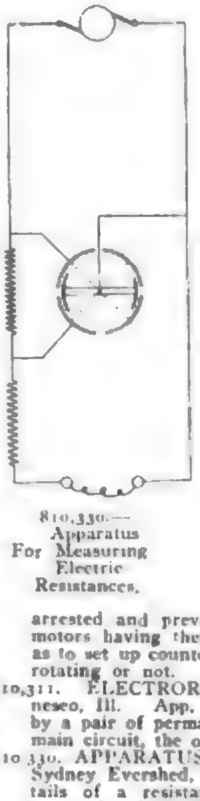
810,240. ELECTRIC MOTOR CONTROLLER REGULATOR; Paul A. Weyland, Maywood, Ill. App. filed June 14, 1905. An attachment for ordinary car controllers, having a plate movable with the controller arm upon which is a freely pivoted lever. The lever cooperates with stationary cam grooves and ratchet teeth in such a way that the controller arm must be moved step by step to its "on" position, but can be swung without resistance to its "off" position from any notch.

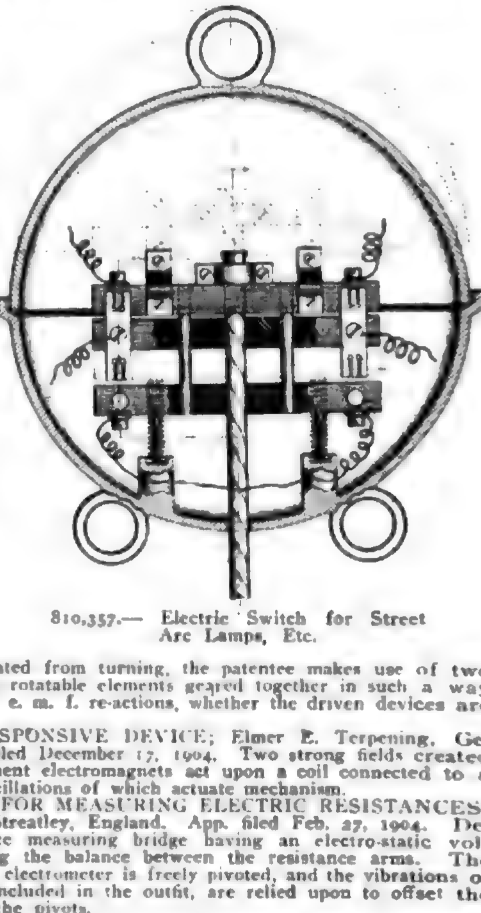
810,244. ELECTRIC POCKET BRACKET;; George C. Wright, Cleveland, O. App. filed Mar. 30, 1904. A bracket arranged to swivel on a vertical axis. A pair of concentric rings are engaged by spring-pressed contact studs to make the circuit for any angular relation.

810,262. RAILWAY TRAFFIC CONTROLLING APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Mar. 2, 1904. Relates to details of a block-signal system in which the semaphores are operated by the expansion of liquid carbonic acid. The main feature relates to the provision of a supplemental reservoir near the signal into which the gas expands before passing into the motor piston. The purpose is to avoid the stoppage of the motor valves by the solidification of part of the carbonic acid, which would take place if its expansion were allowed to take place in such valves..

810,263. PROCESS OF UTILIZING LIQUIFIED GAS FOR RAILWAY TRAFFIC CONTROLLING APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Dec. 12, 1904. Covers the process or method of the apparatus set forth in the preceding patent.

810,269. METHOD OF OPERATING ELECTRIC MOTORS; Arthur C. Eastwood, Cleveland, O. App. filed July 24, 1903.. In order to prevent over-loading a motor, no matter if its armature is entirely arrested and prevented from turning, the patentee makes use of two motors having their rotatable elements geared together in such a way as to set up counter e. m. f. re-actions, whether the driven devices are rotating or not.


810,330.—Apparatus For Measuring Electric Resistances.


810,357.— Electric Switch for Street Arc Lamps, Etc.

810,311. ELECTRORESPONSIVE DEVICE; Elmer E. Terpening, Geneseo, Ill. App. filed December 17, 1904. Two strong fields created by a pair of permanent electromagnets act upon a coil connected to a main circuit, the oscillations of which actuate mechanism.

810,330. APPARATUS FOR MEASURING ELECTRIC RESISTANCES; Sydney Evershed, Streatley, England. App. filed Feb. 27, 1904. Details of a resistance measuring bridge having an electro-static volt meter for indicating the balance between the resistance arms. The movable part of the electrometer is freely pivoted, and the vibrations of the hand dynamo, included in the outfit, are relied upon to offset the frictional drag of the pivots.

810,357. ELECTRIC SWITCH FOR STREET ARC LAMPS, ETC.; Peter H. F. Spies, New York, N. Y. App. filed Feb. 10, 1905. Relates to street lamps of the kind which can be raised and lowered by a cord. A pair of switch elements are separated by the movement of the lamp when it is lowered. At the same time the two halves of the box which normally encloses the switch elements, separate so as to expose them for inspection or repairs.

810,335. TELEPHONE PARTY-LINE SYSTEM; Frank B. Hall and Arthur F. Poole, Wheeling, W. Va. App. filed Sept. 23, 1901. Each station is connected with a continuous line on one side and with a normally broken line on the other side. The stations are normally connected to ground, and automatic switch apparatus at each station when actuated by current sent over the broken line opens the ground circuit and connects the broken-circuit sections to form a continuous line to the station desired.

810,345. TELEPHONE PARTY-LINE SYSTEM; Arthur F. Poole and Frank B. Hall, Wheeling, W. Va. App. filed Oct. 13, 1902. The apparatus at the substations is successively operated individually, electromagnetic apparatus controlled from the central building up a non-conductive circuit to any desired circuit.

810,346. PARTY-LINE SIGNALING SYSTEM; Arthur F. Poole and Frank B. Hall, Wheeling, W. Va. App. filed Oct. 13, 1902. See 810,335 and 810,345.

810,367. LAMP JACK FOR TELEPHONE SWITCHBOARDS; Sidney A. Beylad, Elyria, Ohio. App. filed Nov. 25, 1904. A metal tube to enclose the lamp, with one side extended and carrying contact springs.

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Changes of advertising copy should reach this office one week in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

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NEW YORK, SATURDAY, FEBRUARY 3, 1906.

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INTERNATIONAL CONFERENCE ON ELECTRICAL UNITS.

Although no details have yet been published concerning the conference at Berlin last October between the representatives of different governments on the subject of electrical units, yet we understand that an informal conference was held and that conclusions were reached. This conference, it will be remembered, was called in view of the resolution of the Chamber of Delegates, at the St. Louis International Electrical Congress, to the effect that the difference between the legalized electrical units in different countries were such as to warrant the appointment of an international commission on the subject. We believe that the conference decided in favor of selecting the international ohm in mercury, and the international ampere, determined by the silver coulombmeter as the fundamental primary concrete standard electric units. Also that the Weston cadmium cell containing solid hydrate of cadmium sulphate should be the standard cell, whose e.m.f. should consequently be determined by reference to the primary standard ohm and ampere. Also that an official conference should be called within a year to bring the legalized electric units in accord among the various governments represented.

It was hoped in this country that the two primary fundamental concrete standard units would be the volt and the ohm, because the electrolytically determined ampere involves a process and does not admit of continuous existence or substantial embodiment. However, that is really a matter for physicists to decide upon. The secondary standards of our national laboratories will no doubt consist of alloy-wire ohms, cadmium cells, and electrodynamometer ammeter balances. Our tertiary standards in enginering laboratories will be cadmium or Clark cells and alloy-wire resistance coils. If our standard cells are marked with the same voltage, at standard temperature, to one part in two thousand, and our coils with the same resistance to one part in five thousand, no matter to what national laboratory they are sent for calibration, we believe that the most exacting requirements of the electrical engineer will be fully met for the present.

THE SELF-EXCITING ALTERNATOR.

In a paper presented at the meeting of the American Institute of Electrical Engineers, Mr. E. F. Alexanderson described a form of self-exciting alternator which possesses some interesting features. The machine has a rectifying commutator for supplying unidirectional current to a field winding which differs in no essential manner from that used with separately excited alternators. At the terminals of the field winding is impressed an electromotive force whose value and relative time-phase position varies with the load on the generator and with the power factor of the load current. On page 244 of this issue may be found a description of this machine showing the method by which the three-phase voltage impressed upon the rectifier is obtained by means of the combined actions of auxiliary windings on the stator and series transformers connected in the load circuits.

It is interesting to note that the method which must be employed in order to prevent sparking at the commutator serves simultaneously to cause the machine to deliver a constant e.m.f. at its terminals. That is to say, the magnetomotive force of the current in an armature at non-inductive load occupies such a mechanical position with reference to the field poles as to shift the resultant air-gap magnetism from the poles, as is well known. When the machine is loaded the shifting of the magnetism causes the voltage in the auxiliary winding to reach its minimum when the rectifier segments have a position with respect to the windings which is different from the position when the machine is without load. Thus, even though the value of the voltage impressed upon the field winding were changed properly with change in load, the machine would not operate properly at non-inductive load without the series transformer, on account of sparking at the brushes. It is evident that this disadvantage would not exist for loads having zero power factor, either lagging or leading, since in such a case the magnetomotive force of the armature current is exerted directly in line with the field poles, and the proper commutating points are not shifted. The method of using the series transformers, as adopted by Mr. Alexanderson, results in shifting the phase position of the voltage impressed upon the rectifying commutator by a number of electrical-time degrees corresponding approximately to the number of electrical-space degrees through which the armature current distorts the field magnetism. The best position of the brushes remains the same for all loads, while the e.m.f. introduced at the rectifier in order to shift the phase of the impressed voltage also acts to increase the field magnetism to a value to cause the generator to overcome the impedance drop in the armature.

The A. I. E. E. Standardization Rules.

The American Institute of Electrical Engineers appointed a committee in 1898 to take up the subject of standardization. The committee made its report in the following year, in the form of a fourteen-page printed pamphlet. The report dealt with the subjects of the classification, efficiency, temperature-elevation, insulation, regulation and rating of dynamo-electric machinery and apparatus. The bulk of the work lay in the definitions and classifications. The questions dealt with were, for example, what and where are the losses of power met with in a given type of dynamo machinery, and how should they be reckoned and computed? It is interesting to observe that no reference is made to a dimension, length, breadth, or size in the entire report, except in a table of sparking distances between needle-points. That is to say, the report excludes all consideration of details of manufacture, and deals only with broad classifications, definitions, or physical conditions. The temptation to a standardizing committee is naturally to work into details, and define the proper proportions of sizes and parts in machines or instruments. Although such dimensional standardization may have value at the date of its preparation, it is apt to hamper and restrict future production, since the forms and proportions of machinery and apparatus tend to change with the natural variations and development of the country, owing to political, economical and technological causes that lie beyond prediction.

The report of the standardization committee was successful from the date of its appearance. Although incomplete and imperfect in detail, it had a marked beneficial influence upon the electric industry. Engineers inserted its clauses in their specifications for machinery, and the manufacturers referred to it in their bids. The effect, in general, was to simplify and standardize machinery, to reduce the number of special orders, to reduce the delay in filling orders, and to reduce the cost of construction. A second edition of the report of the committee, revised and enlarged to twenty-six printed pages, appeared in 1902. The subjects covered in the second edition were the same as those in the first, with the addition of incandescent lamps or luminous sources. Again, there is to be noted a total absence of dimensions or sizes. This edition is in general use among engineers, buyers and manufacturers at the present time. The standardization committee is again engaged in revising and extending the rules to appear in a third edition of the report. The committee is made up of ten members of the Institute, three of whom represent the large manufacturing companies, three occupy university chairs of electrical engineering, one is a professor of electrophysics, one is a consulting engineer, one represents the central stations, and one represents the Bureau of Standards at Washington. It is expected that the new edition of the rules under preparation by the committee will not only revise the existing rules to the present date, but will also include a number of new subjects.

It will be remembered that the Chamber of Delegates of the International Electrical Congress of St. Louis in 1904 recommended that steps should be taken towards international standardization. It is earnestly to be desired that international standardization should be commenced. Of course the task is not easy. It is admittedly difficult to bring about agreement between all interests in electrical engineering—manufacturers, engineers, constructors, purchasers, operators, superintendents—in one country. It is, therefore, yet more difficult to bring about agreement upon the same questions in two or more countries; especially when it is remembered that the methods and customs differ markedly from one country to another, and that interchange of ideas is slow and difficult, when many miles separate different languages. In fact, it is almost hopeless to expect complete agreement between different countries on some of the matters that admit of standardization in each country taken separately. Nevertheless, it is sufficiently evident that there are certain fundamental considerations in connection with dynamo-electric machinery and apparatus which admit of universal standardization, and which when so standardized would doubtless meet with the approval of electrical engineers all over the world. These fundamental considerations may be defined as the essential mechanical or physical limitations of the apparatus, and which are not subject to variation in different countries or in the hands of different manufacturers. For example, the precise definition of the full-load efficiency of a dynamo ought to be the same, and ought to be determined in essentially the same way everywhere. Again, the full-load rating of a dynamo in kilowatts as determined by its temperature elevation, regulation, sparking and overload capacity should be the same everywhere and should be determined in substantially the same way. These propositions commend themselves, we think, to the intelligence of every electrical engineer, in any country. The opposite standpoint is, in fact, not only illogical but ridiculous. Who would recommend, for example, that the full-load rating and full-load efficiency of a dynamo should be variable quantities from country to country, or be functions of latitude and longitude, like the duration of twilight, the frequency of recurrence of the aurora borealis, or the dip of the magnetic needle? We understand that a movement is on foot to initiate international standardization of dynamo electric machinery. We earnestly hope that the movement will succeed, in the interests of engineering and of civilization. If the movement be confined at the outset to the elementary definitions, mechanical and physical, we believe that it can not fail. The only danger will be in attempting too much at first.

Competition in Central Station Work.

Whenever in business affairs one examines the adverse conditions that must be met one finds competition in the front rank. Not that competition is always a bad thing—on the contrary it is sometimes a very necessary stimulant; but in a business like that conducted by electric supply stations its effect in deflecting business cannot be neglected, and it is one of the factors which tend to cause the diminished rate of growth to which we have several times of late had occasion to refer. The sales of energy from a central station may be roughly divided into those for lighting and power, grouping under the latter head the miscellaneous uses which do not strictly belong to lighting. The principal profit of most stations is at present in the former branch of its business, and in this it has to face generally stubborn competition from other illuminants, especially from gas. In the early days of electric lighting, say twenty years ago, the electric lamp, whether arc or incandescent, was a novelty and sales were, as in the case of every striking and useful novelty, helped by this very fact. This feature of the early growth of the business has well-nigh disappeared, leaving a competition based in many cases principally upon price. Of course, in his public capacity the central station man pooh-poohs the competition of gas with the brilliant, convenient, hygienic, modern, and universally advantageous incandescent lamp, but in the privacy of his office his characterization of gas competition is not always suitable for publication.

Taking as the unit of comparison the ordinary so-called 16-cp incandescent lamp, originally thus standardized as the equivalent of the legal gas-light, it is easy to see the status of affairs. The ordinary cost to moderate consumers under central station schedules of such an incandescent, including renewals, is from 1 cent to ½ cent per lamp-hour. On dollar gas as a basis, an equal amount of light costs rather less than the lower figure named, without taking mantle burners into the reckoning at all. On the side of the incandescent lamp one has, of course, the familiar virtues of freedom from vitiation of the air, increased steadiness of the light, flexibility in disposition for best illuminating effects, and freedom from the chance of leaking gas. These are all valuable properties which have had a great effect in building up the business of electric lighting. As regards the modest consumer, however, the first advantage has upon the whole small weight. For with a number of burners small with relation to the space concerned, the practical vitiation of the air is not great enough to make a strong impression upon the average man. The steadiness of the light, too, while striking in comparison with a poorly adjusted gas burner, is not at all impressive in comparison with a good gas burner of the Argand variety. The chance of leaks is a more important matter. Gas companies of late are very keen in watching for this trouble and have reduced it to an inconsequential matter so far as the ordinary man is interested. The adaptability of the electric lamp to artistic effect, both in fixtures and in illumination, is one of its greatest competitive advantages, and should always be kept to the fore. But for a very large number of moderate consumers the competition reduces itself almost entirely to a matter of price, and at the present time the gas companies manage generally to retain a small but persistent margin to the good. In dwellings, for instance, the average gas bill is very much less than the average electric lighting bill would be.

When it comes to the next larger class of work the advantages of electric lighting count more heavily, and were it not for mantle burners would be very generally decisive. But while the incandescent lamp has remained at approximately the same efficiency for twenty years, the introduction of the mantle burner has increased the efficiency of gas lighting by some four or five hundred per cent. The lamp-hour from a modern mantle burner costs the consumer, including renewals, something less than 1/10 cent reduced to the same lamp unit as before. To offset this great difference we have a great advantage in the matter of color in behalf of the incandescent lamp and whatever gain may be made in a part of the field by the use of arcs. The common enclosed arc is somewhat but not greatly more efficient as an illuminant than the incandescent lamp, and whatever gain may be made in the matter of cost must depend mainly on a discount scale weighted to favor the arc. As a matter of fact, the mantle burner still retains some of its advantage of cheapness as an indoor illuminant despite the arc. It may be properly held that the discriminating shop keeper ought to prefer the arc or incandescent lamp at any price, that the public ought to be educated and so forth. The answer as practically delivered may be found in any of the less prominent streets of our larger cities. In spite of its bad color and its other disadvantages, the mantle burner has in virtue of its being by far the cheapest common illuminant, taken to itself the cheaper field in increasing measure. Of course, one may very well swell one's chest and proclaim that gas is all very well for the proletariat, but gentlemen should use the latest improvements. Nevertheless the less opulent portions of our cities are growing at a pace that leaves the "best residence districts" far behind, and when the votes are counted the disparity is even more conspicuous.

In the most important business and residence sections electric lighting has a well deserved prominence. It is unquestionably the best means for large illumination, in which quality counts for more than price. Even here, however, there is not freedom from competition, for while gas is at a disadvantage, the isolated electric plant is not to be left out of the reckoning. It is actually a far more serious competitor than is generally suspected, and while it can be discouraged in some instances, it certainly cannot be permanently put out of business save by making prices that most central stations rather hesitate to quote. The gas companies are, for the most part, out of the running at present. They have steadily pursued a policy of nearly flat rates which are low enough to foster the small consumer, although not much modified in favor of the large user. This condition is not likely to be permanent, for a tendency is already obvious toward more liberal discounts for large patrons of the gas plant. How far sheer price will come to count is hard to estimate. Probably much of the important work can never be touched by gas competition directly. Nevertheless, the gas engine running on 50 per cent gas in isolated plants is yet to be reckoned with. To sum up the situation, while the electric central station lighting business is still a great and growing one, it is at present between two fires. The gas companies have, in the past decade, entrenched themselves strongly behind the small and moderate consumer, by making a low base price for their product and by pushing with great vigor improved illuminants. They have as yet rather neglected the large consumer, in whose case electric lighting has an intrinsic advantage. Meanwhile electric lighting companies have made a high base price for their product and have rather discouraged the small user while gaining by liberal discount a great mass of large work upon which they rely for keeping up their business. Each appears to have tended too far in a particular direction. It behooves the central stations to keep up with every advance in practice that can lessen the price difference between electricity and gas, as well as to keep up their campaign of education as regards quality.

CENTRAL STATION BUSINESS-GETTING SYSTEMS.

By far the most interesting part of the proceedings of the recent convention at Chicago of the Northwestern Electrical Association was that dealing with central station business-getting methods, an abstract of which appears elsewhere in this issue. The subject is one which is daily attracting more attention among central station men, and there is now promise that before long the reproach that in business methods central stations are not up to date, and that they are far behind their gas competitors, will be removed. We believe, however, that a charge of unprogressiveness against central station men in general is by no means justified. From the technical standpoint our central station companies are, with very few exceptions, wide awake and frequently go beyond their resources in their eagerness to take advantage of new improvements in apparatus. The defect appears to be confined to business-getting methods, and as pointed out by one of the speakers, this is not so much due to lack of appreciation of the importance of this side of central station work as lack of systematic organization for carrying on such work properly. Now that interest is becoming thoroughly awakened, there is a danger that the matter of business-getting organization will be carried to an extreme, and smaller central stations led to adopt methods which require for their proper execution expert service not available on the staff of a small plant. Even in the case of large stations, a business-getting system too elaborate may break down from its own weight. There is particular danger in following proposed systems without due regard to the resources available, and in becoming a mere servant to card files. The card hobby, with its tendency toward emasculation of the personal element and its short-hand treatment of facts, is one to beware of. In brief, a central station should view the problem of business-getting organization as one to be evolved along common-sense lines in accordance not only with the resources, monetary and personal, that are available, but also with local conditions; and in laying out a record and "follow-up" card system, no records of data, however great their intrinsic importance, should be provided for unless they will be specifically utilized in the scheme to which the cards apply.

In the discussion at Chicago to which we refer above, Mr. Almert sketched in detail a business-getting organization which can be safely commended as a guide to central station men who are taking up the matter without previous experience. A few of the details might, however, be modified to suit the case of smaller stations, and to these we shall here refer. We believe it would be well to have a card file specifically for "follow-up" purposes, and a suggestion on this point is given on page 263. This file should include marker cards for interpolation in order to designate, by means of projecting numerals, the date when further attention is required by the card or cards next to a marker. The more important suggestion in mind is, however, with respect to the record of each "prospect." To have this record scattered and consist partly of mere card references, is far from satisfactory, and we doubt if such a system is used extensively in other lines of business in keeping track of prospective customers. When a visit is to be made to a "prospect," or a letter written, the history of the case from the beginning should be at hand in such form that it can be given concentrated attention, and the "file wrapper" system is vastly superior in this respect to the card index and abbreviated reference system.

As generally applied, the wrapper consists of a heavy manila paper (120 lb., 22 in. by 28 in. tag paper, for example) folded once and with the name of the prospective customer written on the upper left-hand folded edge. A sheet cut 9 in. by 12 in. makes, when folded, a convenient sized wrapper which will contain a half sheet of letter paper flat or a full sheet folded once. The wrappers, of course, are filed and handled in the same manner as cards. Information sheets as filed are pasted at the left-hand edge, so that when the wrapper is unfolded its contents can be turned over like the pages of a book. In the case of a present customer, the first enclosure would naturally be a sheet—preferably a printed form—containing the technical data of his installation. In all cases there should be a sheet giving the result of a careful canvass made to determine the requirements of a prospective customer or of extensions that can beneficially be made in the installation of a present customer. When a personal letter is written a carbon copy on thin paper is inserted, being trimmed if it thereby can be inserted unfolded in the wrapper. Since the "follow-up" card file will contain a record of form letters, these need only be inserted in the file wrapper should they have some definite connection with the history of the case.

With such a system it will be seen that prior to making a visit a solicitor may make himself absolutely thoroughly informed concerning the entire history of a "prospect," and the information will come under his eyes in a manner to make upon his mind a much stronger impression than would be conveyed if he had to seek through files and decipher cabalistic card notations. Perhaps even a greater advantage in many instances would be that in case of a change of solicitors a new man can in a few minutes take up the thread of any unfinished case. From the discussion in Chicago it appears probable that a practice will grow up whereby smaller central stations can secure at intervals for short periods the services of an expert solicitor. The "file wrapper" record would be ideal in such cases, not only for giving the station a permanent record of the work of transient solicitors, but also through the entire history right up to date, of prospects being thus at the disposal of an expert solicitor when one is engaged.

REDUCING THE NUMBER OF OVERHEAD LINES.

In the article elsewhere in this issue on the plant at Springfield, Ill., some useful pointers are given as to the way in which the central station company there has attempted to decrease the number of wires carried on overhead pole lines in the downtown district. The hints given are especially useful to companies operating in cities of such size that there is beginning to be talk of placing all wires underground in the business district. On account of their number, telephone wires are usually first to be placed underground. Electric light and power companies can put off the evil day for some time by observing simplicity and neatness in overhead work. In the case at Springfield most of the transformers and secondary mains are located in alleys.

For the sake of simplicity, two-wire secondary distribution instead of three-wire has been adopted. The heavy secondary mains which usually are the most conspicuous on a pole line are run along the rear walls of buildings so that the service conductors for each building can be connected to them without running wires across the alley. The arrangement does away with the most unsightly part of electric light and power distributing circuits, namely the customer's service wires radiating from various poles in the alley to the different customers. By using good, substantial bracket construction along the buildings for the secondary mains with strong head guys at each end, the advantages of the plan in such cases as outlined appear to outweigh far any possible disadvantages of having mains supported on the buildings.

Stations That Have "Never Paid."

It would be interesting to know how many of the small central station companies of the country that have never paid a dividend are similar to one which recently came to our notice. The plant, which was serving a population of about 4,500, was apparently in an unusually prosperous and well-managed condition and had been growing rapidly ever since starting. The manager remarked that the plant had "never paid," which seemed like a rather startling assertion and called for further inquiry. It then appeared that while the company was originally organized with a small capital, no money had been either taken out or put in by the investors since it started, and that the total amount now invested in the plant is about 2½ times that originally put in. In other words, the reason that the plant has not paid is that the dividends have all gone back into the property in the shape of enlargements and improvements, and the stockholders have now a plant worth very much more than when they started. There are plenty such properties throughout the country, both in central station and matufacturing business. It has been the history of central station business throughout the country that the growth has been beyond anything the original stockholders anticipated and it has been a question of buying from time to time new machinery and apparatus or go out of business. A little closer analysis of what constitutes maintenance and renewals and what enlargements and improvements would put investments in electric lighting companies in the smaller towns in a somewhat different light before the local stockholders. The condition described is entirely a healthy one, and it is to be wished that it existed in some of the cities where extremely opposite tactics have been pursued and where not only new construction but maintenance and renewals have been charged to capital account.

The Electric Flat-Iron.

The electric flat-iron seems certainly to have come to stay as a steady source of central station income. From all over the country come reports of remarkable success in the introduction of this most generally used of electric heating appliances. The results mentioned in articles elsewhere in this issue following the introduction of the flat-iron in Belvidere, Ill., and Dubuque, Iowa, while unusually good in that so many irons were placed at the start, can, we believe, be duplicated in many other places if only the matter is taken up in the right way. Beyond question the electric flat-iron is its own best salesman. The main point is to get it into the hands of users for trial and sending them out on 30 to 60 days trial appears to be the best way of accomplishing this. While the electric iron costs more to operate than the older and more familiar types, just as unquestionably no user of electric light who can possibly afford it will go back to gas or kerosene, so no one who has used the electric flat iron wants to go back to gas or coal heated irons. People are willing to pay a good price for the sake of convenience and cleanliness, and there is in the electric flat-iron also a considerable element of time saving compared with other irons. This has been demonstrated in factories where ironing is done by piece work and where the output with electric irons has materially increased. For the most rapid introduction of the flat-iron, spring and summer are, of course, the best times. The latter part of the summer there are a certain number of people who will put the matter off until spring. Now is the time to get ready for a spring flat-iron campaign.

Grounding of Secondary Circuits.

While it is to be regretted that the late revision of the National Electrical Code does not frankly make mandatory the grounding of secondary circuits, a step in advance is the permission given to inspectors to do so. Grounding furnishes the only feasible method of making inside wiring entirely safe and free from dangerous conditions due to crosses with high-tension lines either on outside lines or inside transformers. Usually such crosses occur inside a transformer as a result of lightning, and they frequently remain undiscovered until the presence of the defective transformer is made known by a severe shock or perhaps a fatal accident to some one handling the wires or sockets inside of a building on the secondary circuit. Probably the great majority of smaller central station companies of this country have as yet failed to take this precaution of the grounding of secondary circuits. Only recently a small company operating in a country village had to pay several thousand dollars damages on a fatality caused entirely by the failure to ground a secondary circuit. Leaving aside for a moment all considerations of humanity, a payment of several thousand dollars in damages makes a big hole in the net earnings of a small company, and yet a company is simply inviting this sort of thing as long as it neglects to take the precautions which insure absolutely against it.

The effective grounding of secondary circuits need not by any means be a tedious or expensive operation, as set forth in the specifications in the revised National Electrical Code, printed in our first issue of the year. The detail which interests the smaller companies most, however, is an inexpensive and effective method of grounding at the base of poles upon which transformers are located and near which no good water pipe ground is usually available. For such grounds the large, buried copper plate suggested by the National Code rules, although effective if properly buried, is rather costly and requires considerable labor in excavating a place for it. One large company, which has given the matter of grounding such transformers a great deal of thought, and which maintains a high standard of construction in all respects, has found that a piece of 1-in. galvanized iron pipe 10 ft. long, driven into the ground at the base of a pole, will afford fully as good a ground as a copper plate, and at less expense. Such a pipe can be driven into the ground by the line gang and the ground wire soldered to it in a very short time. The ground wire to be soldered into the pipe is coiled in a spiral which will fit into the top of the pipe and then sweated in with solder, an asbestos paper plug having been inserted just below the spiral, to hold the solder. Although it may be some time before the underwriters will actually insist upon the grounding of secondary circuits in all the smaller villages of the country, it is not to the interest of any central station company to wait until that time comes before so doing.

Important Understanding in Lamp Litigation.

Mr. A. W. W. Miller, president of the American Electric Company, of New Jersey, and of its associated Missouri American Electric Company, of St. Louis, has issued an important announcement to the electric lighting industry and the electrical trade as to recent results connected with the litigation of which note has been made in these pages. We quote as follows:

"An understanding having been arrived at between the General Electric Company, a corporation of New York, the Edison Electric Light Company, a corporation of New York, and the American Electric Company, a corporation of New Jersey, and the Missouri American Electric Company, a corporation of Missouri, relative to the patent litigation against the Missouri American Electric Company, such arrangement being satisfactory to all the parties in interest, we have pleasure in announcing to users of and dealers in the incandescent electric lamps made and sold by us; that:

"All such litigation between the parties has been terminated; and that the American Electric Company of New Jersey and the Missouri American Electric Company of St. Louis, Missouri, have the legal and undisputed right, to the use of all patents on which monopoly is claimed by the National Association of Licensed Manufacturers of incandescent lamps; consequently there can be no interference with dealers in or users of our lamps."

In regard to this Mr. Miller says: "The proposed settlement with the General Electric Company has been fully consummated by an interchange of patents by which the General Electric Company dismiss all suits against this company at their cost, and give us a free license for the use of all the patents by which the 'combination' is kept together without restriction or responsibility of any sort or kind to them in the use of same." At the same time, Mr. Miller remarks, this leaves them free from "entangling alliances," while ensuring independence and freedom from molestation.

Annual Meeting and Dinner of the Chicago Electrical Trades Association.

The Electrical Trades Association of Chicago held its annual meeting and dinner during the last week of the Chicago Electrical Show, January 24. The place selected was the second floor of the Coliseum Annex adjoining the show. The meeting combined a business session and dinner. The secretary's report showed the membership in the Chicago association to be 155 manufacturers and jobbers, and the total membership in the allied associations of Boston, New York, Philadelphia, San Francisco, Montreal and Chicago to be 355. One hundred and twenty-five manufacturers and jobbers were present at the dinner. These included not only local Chicago trade representatives but men from all over the western and southern states and visitors from the East. The association as is well known is one formed ten years ago to put the matter of credits in the electrical retail trade on a more satisfactory footing, and weed out "dead beats." A number of reports were given from various members bearing testimony to the benefit derived from membership in the association, both in collection of bad accounts and the avoidance of them. In the absence of the president, Mr. E. R. Gilmore, and vice-president, Mr. Seymour Cuthrie, the secretary, Mr. Frederick P. Vose, was made chairman of the business meeting. After the reports of several committees, the election of officers was held with the following result:

Mr. Frank Beardslee, of the Beardslee Chandelier Mfg. Company, president; Mr. Seymour Guthrie, Kellogg Switchboard & Supply Company, vice-president; members of the executive committee: Mr. Thomas I. Stacey, Electric Appliance Company; Mr. E. R. Gilmore, Western Electric Company, and Mr. S. E. Kennedy, Central Electric Company. Mr. James Wolff was reappointed member on the National Board.

After the business meeting which immediately followed the dinner, Mr. James Wolff, of the New York Insulated Wire Company, took charge as toastmaster, and the following responded to toasts: Mr. Charles W. Wilkins, Partrick, Carter & Wilkins, Philadelphia, the founder of the association, spoke most happily and gave expression to his well known conviction as to the efficacy and thorough practicability of the Electrical Trades Association co-operative plan of credit protection, which he regards as one of the most important features in the electrical industry to-day. The other gentlemen on the program were Mr. Frank M Pierce, Manhattan Electrical Supply Co.; Mr F B Uhrig, Western Electric Company, Kansas City; Mr. Conover, the John A. Roebling Sons Company; Mr. Charles E. Gregory, Guarantee Electric Company; Mr. W. E. Phelps, the Phelps Company; Mr. Henry L. Walker, Detroit; Mr. J. E. Erner, the Erner Electric Company, Cleveland; Mr. S. S. Kennedy, Central Electric Co.; Mr. Harry Parsons, Western Electric Company, Chicago; Mr. Thomas R. Mercein, Milwaukee; Mr. Sisson, of the D. & W. Fuse Company, Providence

A Proposed Institute Trip.

The following circular has been issued to the membership of the American Institute of Electrical Engineers by the secretary: "The Board of Directors has received from the Institution of Electrical Engineers of Great Britain a cordial invitation to the American Institute of Electrical Engineers to visit England during the latter part of June next. A similar invitation has been received from the Associazione Elettrotecnica Italiana, to visit Italy during the season of the Industrial Exhibition at Milan beginning May 1, 1906.

"These invitations are in acknowledgment of the courtesies extended to both organizations by the A. I. E. E. It will be remembered that large representative bodies from both these societies took part in the Circular tour, on the occasion of the International Electrical Congress at St. Louis, September, 1904, and participated in a joint meeting at St. Louis

"Both of the proposed tours will embrace visits to important electrical plants, educational centers, and scenic features of these countries. The Italian trip would necessarily either immediately precede or follow the visit to England, in all probability during the month of May. The time of year precludes the possibility of making special arrangements for transportation in advance, and it will probably be necessary to depend upon individual arrangements for the transatlantic trip. The cost of the trip should, therefore, be estimated by the individual in accordance with his preference as to steamship line, return trip, etc.

"The proposed tour, if organized, will not take the place of the regular annual convention, which will be held as already proposed in a city of the Central West, June 26-29.

"The Board of Directors desires to obtain at the earliest possible moment an expression of opinion as to your participation either in one or both of the proposed visits."

Members are asked to notify the secretary as to their intentions touching this courteous invitation from abroad. The annual meeting of the Institute will, it is rumored, be held in a Western city, probably Milwaukee or Detroit.

The Question of Municipal Lighting Ownership in Boston.

In response to the request of Mayor Fitzgerald for a statement as to the existing provisions of law applicable to the establishment of a municipal lighting plant by the city of Boston, Corporation Counsel Babson submitted to the Common Council at its last meeting a most important opinion, covering the obligations of the city in the matter as well. No action was taken on the municipal lighting order and the corporation counsel's opinion was printed as a public document. We give the opinion below:

I am requested by you to transmit to the Common Council a full statement of the existing provisions of law applicable to the establishment by the city of Boston of a municipal gas and electric lighting plant and the obligations of the city in that event to purchase the property of the existing gas and electric lighting companies in the city, together with a statement of what property and franchises, if any, must be included in such purchase, the amounts necessary to pay therefor, the method of determining such amounts, the means and methods of paying the same, including the issue of bonds and the extent and legality of such issue, and any further information which in my judgment may be of value to the Common Council in acting upon the proposition before it.

The provisions of law applicable to the matter are contained in Chapter 34 of the Revised Laws as amended by Chapter 410 of the Acts of 1905. This chapter is in substance an act prohibiting a city or town from establishing a gas or electric light plant unless it buys the plants already existing within its corporate limits at a price to be fixed by the courts if the companies offer to sell. Section 2 of the act provides that a city shall not acquire such a plant until it is authorized by a vote of two-thirds of each branch of its city council passed in each of two consecutive municipal years and thereafter ratified by a majority of the voters at an annual or special city election.

If the second vote required by Section 2 of Chapter 34 has once been passed and approved by the Mayor and has been ratified at a city election the city is definitely committed and cannot thereafter rescind its action, no matter how unwise or impracticable under existing laws and conditions the undertaking may thereafter be found to be.—Hudson Electric Light Company vs. Hudson, 163 Mass., 346.

The passage of the second vote and its ratification by the voters will, under the law as it now stands, compel the city to purchase at their fair value those portions of the plants of the Edison Electric Illuminating Company, the Boston Consolidated Gas Company, the Charlestown Gas & Electric Company, and the East Boston Gas Company, lying within the city limits, and to pay damages for the severance of those portions of the plants lying outside the city limits, without any right on the part of the city to own the outlying portions of the plants.

By Section 13 of Chapter 34, Revised Laws, a city is authorized to purchase such outlying plants, but by Section 16 the right of such city to buy outlying plants shall cease unless the City Council, within 60 days after the filing of the schedules required by Section 15, votes that such purchase shall include the outlying property. Schedules were filed by the several gas and electric companies in accordance with Section 15 on August 24, 1905, and, as the City Council failed to pass the vote required by Section 16 within 60 days thereafter, the city has lost the right to acquire anything but those portions of the gas and electric plants which are within the city limits.

Very substantial parts of the plants of the Edison Company, the Consolidated Gas Company and the Charlestown Gas Company lie outside the city limits. The values claimed by these companies for the outlying properties in the schedules filed by them are in the case of the Edison Company $1,792,000; Consolidated Gas Company $3,346,000; Charlestown Gas Company, $300,870; total, $5,438,870.

By reason of the failure to pass the vote mentioned in Section 16 the city might be compelled to pay substantially the value of the entire gas and electric lighting plants owned by these companies and the East Boston Gas Company, by way of damages, although it can acquire only that portion of the plants in the city of Boston.

The property of the Boston Consolidated Gas Company is located not only in Boston, but also in Brookline, Milton, Chelsea, Somerville, Cambridge, Newton, Watertown and Everett. These properties are all connected, and in the case of many of the large mains in Cambridge and Somerville and Everett, to disconnect them from the rest of the plant would not only destroy their value, but would damage the portion of the plant in the city of Boston by taking away connections which are essential to the operation of every part of the plant.

The price to be paid by the city for the property and plants of the companies is its fair market value for the purpose of its use. This has been interpreted by the courts to mean its value as a going plant. The amounts claimed by the several companies who have complied with the law are as follows:

Edison Electric Illuminating Company	$26,500,000
Bonds and notes of Edison Company to be assumed	1,325,000
Boston Consolidated Gas Company	26,902,700
Charlestown Gas & Electric Light Company	2,075,730
East Boston Gas Company	700,000
Total	$57,503,430

In addition to this sum, which the companies claim by their schedules to be the value of their plants within the city limits, there is their claim for damages to the outlying plants amounting to $5,438,870.

The Edison Electric Illuminating Company has stations outside of Boston located in the following cities and towns: Somerville, Woburn, Milton, Dedham, Natick, Framingham and Canton. It also has distributing apparatus with property in 12 other places. In all the company has property located in four cities and 22 towns.

It is impossible to estimate how much of the $62,000,000 claimed by these companies would be allowed by the courts. If, for the sake of argument, we say that the companies would recover $52,000,000 of the $62,000,000 claimed, then this peculiar condition would arise: The ratification of the second vote of the City Council by the voters at a city election is a purchase under the act. The provisions for the payment of the purchase money appear in Sections 7 and 8 of said Chapter 34, and bonds may be issued for that purpose outside the debt limit, provided the whole amount of bonds so issued shall not at par exceed 2½ per cent of the valuation of the city, according to the last preceding State valuation. The aggregate State valuation on the city of Boston on May 1, 1904—the last to which I have access—was $1,237,038,351. Two and one-half per cent of this is a little under $31,000,000. So that the total amount of bonds which the city can issue for the purpose of paying for the property of the four corporations mentioned and for damages to their out-of-town plants and for additions which would be necessary could not exceed $31,000,000.

If we adopt the supposition (of course, a mere guess) that the companies could recover only $50,000,000 of the $62,000,000 which they claim, then the peculiar condition would arise that the city had voted to expend $50,000,000 and could only raise $31,000,000 to pay for the purchase.

The Edison plant at South Boston is reported to have enormous generating capacity. It is said to have been laid out and constructed with the idea of generating enough kilowatts of electricity to supply lighting facilities not only for Boston, but for the metropolitan district and beyond. The Edison Company supplies electricity from this station to the consumers in the territory extending from Framingham to the end of South Boston point. If the city desired to purchase this plant it is to be regretted that it did not exercise its right to purchase the staions and conduits outside the city limits, as the South Boston plant is apparently more extensive than is needed to supply electricity for the city proper.

The same may be said in a less degree of some of the properties of the Consolidated Gas Company. The Brookline plant, for instance, is situated in both Brighton and Brookline. It furnishes both gas and electricity. Its pipes, mains and conduits extend through the whole of Brookline and large portions of the city of Boston. If we purchase only the part situated within the city limits, which is all we can do now, we divide the property in such a way as to materially injure both the part that we acquire and the part which is left to the company.

Under the provisions of Chapter 34 of the Revised Laws, Section 15, the Mayor, committees of the City Council and experts employed by the city to determine the value of the plants offered for sale were authorized to examine the property and report upon its value and the desirability of its purchase. As far as I am informed, nothing of the kind has been done by the Mayor, committees of the City Council or experts employed by the city. If the street or fire department were going to purchase a horse of the value of $200 the department, before purchasing, would have an expert examine as to the soundness of the horse and its market value. The city seems to be drifting toward the time of taking votes which will make a purchase of property (forming the most important financial proposition ever brought before an American city) without any attempt to ascertain the market value of the property which it proposes to purchase or its earning capacity.

Inquiry is made of me as to the amount which may be necessary to pay for these properties. Although quite familiar with the plants of the Boston Consolidated Gas Company, I have never examined the plant of the Edison Electric Illuminating Company or those of the Charlestown and East Boston Gas Companies, and, not being an expert, my opinion would be of little or no value. There are ways open to the City Council to get the opinions of experts on the subject under Section 15 of Chapter 34 of the Revised Laws.

Electrical Engineers of the Times.

MR. J. E. WOODWELL.

Julian E. Woodwell was born at Wells, Me., January 7, 1874, and is the oldest of five sons of the Rev. William H. Woodwell of the Congregational Church. He graduated from the high-school of Sandwich, Mass., in 1890, and later from the high-school of Newburyport of the same state. Entering the Massachusetts Institute of Technology, he was graduated from the Department of Mechanical Engineering in 1896, the youngest member of his class. He took courses of study outside the prescribed curriculum of the Mechanical Engineering Department, including theoretical electricity and other subjects in the electrical engineering course.

MR. J. E. WOODWELL.

Immediately upon graduation Mr. Woodwell's services were engaged as assistant to Prof. S. H. Woodbridge of the Massachusetts Institute of Technology in the preparation of plans under Government direction for the renovation of the method of ventilating and warming of the Senate Chamber and the Senate wing of the U. S. Capitol, and also in the drafting of plans for the heating and ventilation of the South Terminal Station, Boston, upon which works he was engaged for a year. In February, 1898, Mr. Woodwell began his Government service, naving passed with credit the civil service examination for the position of elctrical draughtsman, U. S. Treasury Department. In July of the following year he was appointed inspector of electric light plants in the same department, which position he still holds. This office exercises general electrical supervision over the operation of the electrical and mechanical equipment of about 360 Federal post-office, custom house and sub-treasury buildings under control of the Treasury Department. An officer of that department is authority for the statement that the economies brought about by the administration of this office have resulted in annual savings which have probably passed the $100,000 mark. Congress has on two occasions recognized the value of the office by increasing the salary of the position and by appointing an assistant inspector.

Among the more strictly professional work done by Mr. Woodwell in connection with his present service are included the installation of systems of electric wiring and fixtures in more than 75 buildings, and complete electric power plants in ten of the larger of these buildings. Fifteen buildings have been equipped with isolated electric generating plants operated under the technical supervision of Mr. Woodwell's office, which also attends to the purchase of engineering supplies for all the buildings named, and to the making of contracts for light, heat and power service with private companies.

Outside the regular duties of his office Mr. Woodwell has prepared plans for the central heating and lighting plant now in operation in the Patent Office, Old Post-Office and Pension Office group of buildings in the Interior Department. He has rendered assistance in the preparation of a recent report to Congress relative to the proposed central power, lighting and heating plant for the Executive Department Buildings, and is now in associate charge of designing plans for the electrical and power equipment of the new National Museum Building and for the Onondaga County Court House, Syracuse, N. Y.

Mr. Woodwell is a member of the American Society of Mechanical Engineers and of the Society of Arts, Boston.

CURRENT NEWS AND NOTES.

CIVIL SERVICE.—The New York State Civil Service Commission will hold examinations on February 17 for a number of positions, including that of assistant electrical engineer; and a telephone operator for the New York County offices at $720 a year. Application forms can be secured by addressing the Commission, offices at Albany, N. Y.

HYDROGRAPHIC SURVEY.—The distribution of river stations by the Government hydrographic investigation at the present time is as follows: Twenty in Maine, 12 in New Hampshire, two in Vermont, six in Massachusetts, one in Rhode Island and two in Connecticut. There are, moreover, some 15 important stations on rivers in New England, where observations and reports on water flow are prepared by private parties, many of whom are interested in plans for hydro-electric development.

SONS OF JOVE.—The "Sons of Jove" held their "Rejuvenation," in Chicago, on the evening of January 25, when a number of Chicago electrical men were initiated into the order. The members appeared in parade on the floor of the Coliseum about 9 p. m. clad in the bright red hood and gown of the order, led by a herald and by Jupiter in the person of Mr. Charles A. Newcomb, of Houston, Tex. Following the Jovian members were a string of blindfolded new members to be initiated tied to a long rope. The parade wound up at the annex where the initiation and banquet followed.

THE EDISON MEDAL.—The Edison Medal Committee of the American Institute of Electrical Engineers, Mr. John W. Howell, chairman, has just issued a circular to the educational institutions of the United States, calling their attention to the fact that funds are available for the award of the medal this year and pointing out the conditions under which students can enter in competition for it. This will be the first award of the medal, and it is hoped that there will be many contestants for the honor. It is suggested that institutions of learning not already on the competitive list should make application for the necessary data and forms.

BELL AND BRANTFORD.—The city of Brantford, Canada, has, it is said, determined to set a good example to those cities that wait to honor a distinguished son until he is dead. The town's recognition of Alexander Graham Bell's services to humanity in inventing the telephone will take the shape of a memorial to be erected some time this year. To arrange details a committee has been formed. It has been suggested that the old Bell property at Brantford should be bought and maintained as a park. Dr. Bell's father went from Edinburgh to Brantford in 1870 and some of the very earliest experiments of a telephonic nature by Bell are said to have been made from his father's house to that of the Rev. T. Henderson in June, 1875. The idea has been suggested that Dr. Bell might present the homestead to the city for park purposes, but of course this would not carry out the idea of the citizens in seeking to honor him.

A LEIBNITZ MEDAL.—The Emperor William of Germany celebrated his forty-seventh birthday on January 27. In honor of the birthday a Leibnitz Medal has been established to be awarded annually by the Academy of Science for notable scientific achievements.

CONTROL OF CITY SUBWAYS.—A meeting was held last week in New York City at the call of the transit committee of the New York Board of Trade and Transportation, when it was voted by the representatives of thirty-one organizations in attendance to present to the mayor, the rapid transit commission and the board of estimate and apportionment a memorial to the effect that it is essential that effective city control over lines of subway to be built in the future should be reserved. It was also voted to hold another meeting to take steps to secure a permanent organization, in which all of the boroughs of the city will be represented, to work for the obtaining of better transportation service throughout the city.

TITLES BY TELEPHONE.—In an article in the February *World's Work*, Mr. W. G. Fitzgerald says: "One of Herr von Bulow's principal achievements as State Secretary for Foreign Affairs was the conclusion of the affair with Spain regarding the groups of the Caroline, Pelew and Marianne Islands, which gave great satisfaction to the Emperor and resulted in the promotion of the Secretary to the rank of count. The promotion took place in a typically modern way. The news of the termination of the South Sea trouble was telephoned by the Secretary to a high officer of the imperial household at the palace in Potsdam, some sixteen miles away. Five minutes later, the telephone in von Bülow's study rang, and the same officer said, "I am ordered to inform Your Excellency that His Majesty confers upon you the title and dignity of a count of the German Empire!"

ELECTRIC LIGHT FRANCHISES IN NEW JERSEY.—A bill has been introduced in the New Jersey State Legislature requiring that all new franchises or expiring franchises of public utility corporations shall be put up for competition and awarded to the best advantage of the municipality concerned. A successful competitor must pay to the holder of an expiring franchise the appraised value of property. All franchises are to be limited to 25 years in cities of the first and second class, and 50 years in other parts of the state. Another act introduced provides for condemnation proceedings whereby municipalities may acquire existing electric lighting plants, and authorizes cities to issue bonds to build and operate new electric lighting plants. A resolution must be passed by a city governing body setting forth that it is its intention to erect an electric lighting plant; an electrical engineer shall then be employed to make plans and prepare estimates. The bill allows the sale of power to public and private concerns and to adjacent municipalities.

TRANSFORMATION FROM THREE-PHASE TO SINGLE-PHASE.—In a recent issue of The *Electric Journal*, Mr. C. F. Scott discusses the operation of a single-phase circuit from a three-phase generator, and shows that the phases of the polyphase generator must, in any event, be badly unbalanced. In a normally operating symmetrical three-phase system, the flow of energy is uniform. It is comparable mechanically to the continuous flow of energy through the instrumentality of a belt. The single-phase system, on the other hand, has as its characteristic an intermittent flow of energy. It is, therefore, impossible to convert from three-phase to single-phase and continue the normal operation in both systems unless there be some provision for storage of energy, such, for example, as a rotating armature, which may be driven by a three-phase current and deliver single-phase current. Such a means of storing energy is not found in ordinary transformers. "The foregoing consideration is a conclusive answer to the proposition that single-phase power can be taken by means of ordinary static transformers from a three-phase system without unbalance."

PRICE OF CURRENT.—In the New York Legislature, Senator Page has introduced a bill providing corporations furnishing or selling electricity in New York City shall not receive in excess of 10 cents per kilowatt hour, the act to take effect July 1, 1906. Senator Desher has introduced a bill to reduce the price of electric lighting in Brooklyn to public and private consumers to correspond with the prices charged on Manhattan Island.

MASSACHUSETTS TROLLEYS.—To the railroad commissioners of Massachusetts the street railways report an added mileage during 1905 of about twenty-five miles. With new second track and sidings added its total is some fifty miles. The increase in expenses was $280,000; earnings increased about $879,000; passengers carried 532,731,017, an increase of 12,374,000 over 1904. Eighty-five persons were killed in accidents, eighteen passengers, thirteen employees and fifty-four other persons.

TUNNEL ON THE PENNSYLVANIA.—The famous Horseshoe Curve on the Pennsylvania Railroad, which is one of the scenic features along that line, is, according to a Pittsburg dispatch, to give way to a more direct cut-off. The plans which will probably be adopted call for a tunnel 9 miles long under the Allegheny Mountains. The tunnel will provide for four tracks and it is said that electric power will be used in conducting traffic operations. The cost of the tunnel and making the connections with the main line is estimated at over $15,000,000.

WESTERN SOCIETY ELECTION.—The electrical section of the Western Society of Engineers, Chicago, held a meeting for the discussion of "Cars for City Street Railway Service," on January 26. Mr. M. B. Starring, general manager of the Chicago City Railway Company, was the principal speaker. Officers for the section for 1906 were elected as follows: Chairman, Mr. S. G. McMeen, consulting telephone engineer; vice-chairman, Mr. Peter Junkersfeld, of the Chicago Edison Company; member of executive committee, Mr. Otto E. Osthoff, of H. M. Byllesby & Co.

MUNICIPALISM IN BOSTON.—The directors of the Boston Merchants' Association, at a special meeting called to act upon the matter of municipal ownership of a lighting plant last week put themselves on record as opposed to the project. The secretary read the statement of Corporation Counsel Babson recently forwarded to Mayor Fitzgerald on the subject. It was shown that in the event of the plans being taken over by the city the total damages claimed would be practically $60,000,000, involving on the part of the city about $3,000,000 annually to meet new obligations and to make up its loss of revenue in taxes.

BIG GAS CONSUMPTION.—Mr. Walter R. Addicks, acting president of the New York Consolidated Gas Company, who was before the Gas Commission, gave figures to show what the consumption of gas sold by the company in 1910 would be. After making the calculations by many different methods be prophesied that the sales in that year would amount to some 15,250,000,000 cu. ft. On the average, every inhabitant of the Borough of Manhattan uses 6,274 cu. ft. of gas made by the Consolidated Gas Company. This figure is arrived at by dividing the total output for last year by the population of Manhattan as given in the census of 1905.

THE FIRST ELECTRIC MOTOR.—An item current in the New England papers and quoted below from the Boston *Transcript*, is as follows: "Although unknown as an inventor and almost blind and heavily weighted with his 86 years, Wareham F. Chase invented 50 years ago the first electric motor, the model of which is now in the Vermont State House. The model will run to-day when an electric current is applied, as it did half a century ago in his shop in Montpelier." Considering that Thomas Davenport, the Vermont blacksmith, built his famous motor in 1836-7, it will be seen that Mr. Chase, while a pioneer, was very far from "first." Indeed, Davenport's work dates back crudely to 1834.

MUNICIPAL LIGHT IN BOSTON.—At the meeting of the Boston Common Council last week, the proposed municipal gas and electric light order involving the purchase of plants now worth at least $10,000,000, went over, by a large vote, and on presentation of a strong report from the corporation counsel.

CABLE FOR ECUADOR.—U. S. Consul-Gen. Dietrich writes from Guayaquil that the Central and South American Telegraph Company has secured an improved contract with the government of Ecuador covering a submarine cable. The company agrees in return to complete within six months a telegraph or cable line between Guayaquil and the capital of Esmeraldas Province.

ELECTRIC FREIGHT IN THE SOUTH.—Several projects for electric freight roads are being pushed. J. M. Dewberry, of Birmingham, and associates have secured franchises in Gadsden, Tuscaloosa and Birmingham for an electric freight railway from Gadsden, through Birmingham, thence to Tuscaloosa and from there to Tidewater nearby on the Warrior River. The franchises having been secured, and something of a definite nature in the way of development is now expected.

BERLIN CITY OWNERSHIP.—A cable dispatch from Berlin of January 29 says: "At a conference of the Berlin municipal authorities to-day with the municipal officers of eight suburban towns it was resolved to take the initiatory steps to acquire the Berlin Street Railway Company, which has practically the monopoly of the street railroads of Berlin and its suburbs, and to operate roads upon the joint account of the nine municipalities. The company has a capital of $25,000,000."

RÖNTGEN-RAY WORK.—It is noted from Baltimore that during the ten years since the discovery of the X-ray important research has been made by the medical department of Johns Hopkins University through the use of the ray as a diagnostic agent; and the results of great benefits derived from the early diagnosis and study of aneurisms, or morbid dilation of the walls of arteries, through this agent, have just been compiled and described by Dr. F. Howard Baetjer, of the university. Dr. Osler has added his opinion that an X-ray examination of the chest should be made in all cases. With the ray an absolute diagnosis, both positive and negative, can be made. Thus in the Johns Hopkins University out of 104 cases reported by Dr. Baetjer during the past four years 5 per cent of the cases of aneurism were accidentally found by means of the ray, there being no physical signs.

CHICAGO SUBWAY TRACTION.—The Chicago Central Subrailroad Company will ask the City Council this week for a fifty-year franchise for a ten-mile subway system under Chicago's downtown streets, extending from the south branch of the river to Twenty-second Street. Marcus Pollasky, a promoter and former law partner of Major Edgar B. Tolman, has evolved this plan for solving Chicago's traction question. It will take $100,000,000 and a franchise to do it. The company was organized as far back as March 11, 1894, with a capital stock of $15,000,000. It has been preserved intact. Mr. William H. Llewellyn, of 171 Broadway, New York, is treasurer of the company. August Belmont and other traction financiers are said to be interested. The subway is planned to form a connecting link between the various elevated and surface railroads, the idea being to remove all tracks and elevated lines from the streets in the downtown district. The construction is to be under approval of the Commissioner of Public Works.

ELECTRIFYING CANADIAN PACIFIC.—A special dispatch from Toronto of January 27 says: "The substitution of electricity for steam as a motive power is under consideration by the Canadian Pacific Railway, and to that end officials of the road are in consultation with experts as to the advisability and probable cost of the change. If it is decided to take the plunge a test will be begun within the next six months, the Montreal-Quebec section being first equipped. Should the experiment be successful the whole line of railway will gradually be converted into an electric road. The preliminary tests, according to present intention, will be made with Shawinigan Falls power, Niagara Falls power being afterward drawn upon for operating the lines in Ontario. The desire of the Canadian Pacific Railway to abandon steam is apparently due to the prospect now being rapidly realized of the Ontario field being covered by a network of electric lines which threaten both the passenger and freight business of the steam roads."

PROTECTING NIAGARA.—Senator L'Hommedieu has introduced bills in the assembly at Albany to repeal the charters of four Niagara companies, and advises that measures be taken to prevent the ruin of Niagara Falls by Canada. A duty is suggested on all electric power generated in Canada and transmitted to this country. At Washington on January 24, a joint resolution intended to protect the waters of Niagara Falls, "to preserve their natural beauty," and to investigate the diversion of the waters of Niagara River above the falls and all the other causes operating to diminish the flow of water over the falls was introduced by Senator Platt. The resolution authorizes the President to appoint four commissioners to meet similar commissioners from Great Britain, to investigate and report on the matter and to employ the necessary surveyors and clerks. The sum of $20,000 is authorized for expenses of the commission. The resolution was referred to the Committee on Foreign Relations.

TROY MEASURE.—A special dispatch of January 22 to the Toledo *Blade* says: "A remarkable condition has been brought to light by the Board of Public Service at Troy. Investigation has discovered that some of Troy's merchants and best citizens are indebted to the city for electric light and water service, some bills dating back to May, 1903. The aggregate is $2,080.80. Both the electric light and water works systems are owned by the city. A new board took charge January 1 and at once started a new clerk at work examining the books. In the list of delinquent water renters is an attorney who owes $186, a member of a city board who owes $40, a county official who has stood off the city on a $4 bill for two years, and a physician whose water and light have been shut off because of an unpaid bill for $17. The lighting plant is in bad condition, and is declared not safe to run 24 hours. An emergency generator is being rented at $50 a month for which the rent has paid the original cost many times over."

BRIDGE MOVING PLATFORM.—A proposal to equip the Williamsburg Bridge with a moving platform railway was laid before Bridge Commissioner Stevenson this week by Max E. Schmidt, chief engineer and general manager of the Continuous Transit Securities Company. By the plan the moving platform railway, operated by electric motors, would not only cross the bridge, but the system would be extended to subways to reach from the Brooklyn Plaza to the Bushwick Avenue station of the Long Island Railroad, and, on the Manhattan side, across town to the Desbrosses Street Ferry. This would do away with the present bridge terminals. But for the fact that it would necessitate the closing of the Brooklyn Bridge, which cannot now be done, the proposal would have been made for that structure. It may be put forward when the Williamsburg and Manhattan Bridges are both in operation and one of the tunnel routes is completed. On the bridge proper the plan is to operate three distinct movable platforms. These will run constantly, and passengers can step aboard without inconvenience. The platforms will handle a crowd as fast as it collects, for each passenger is whisked away as soon as he steps on it. The platforms run side by side, the first at three miles an hour, the next at six, and the third at nine miles an hour. A passenger could step from the first to the second and then on to the third, and on the last there would be seats. The plans appear to have every element of feasibility and economy. The capacity of the bridge would be increased by 60,000 seated passengers per hour. If the company gets its platforms on the bridge it will then ask the Rapid Transit Commissioners for leave to extend its system. It is proposed, if the whole plan of thus connecting the borough goes through, to make traffic arrangements for one 5-cent fare with surface or subway lines in Manhattan and Brooklyn. The fare for carrying passengers across the bridge proper is to be fixed at two tickets for 5 cents, or 3 cents for a single fare.

Electric Power Plant of Vermont Marble Co.

By N. L. Rea.

THE new power plant of the Vermont Marble Company, at Proctor, Vt., presents a number of interesting features and many industries in the country could profit from the general scheme. The power house is situated on Otter Creek, at the foot of Sutherland Falls, within a few hundred feet of the main mill of the Marble Company. This building is of reinforced concrete and masonry construction, and is connected with the forebay by a steel penstock 8 ft. in diameter and 500 ft. long. At the present there are in operation three 1,200-hp vertical shaft turbines, designed by Mr. Wm. M. White, of the I. P. Morriss Co. There are also arrangements for installing a fourth unit when needed.

These wheels operate under a head of 120 ft. and at 514 r.p.m. They are located on a reinforced concrete arch directly over the tail race, and discharge through a vertical draft tube. The water inlet is at the side of the wheel casing. The moving parts are supported by a water thrust supplied from the wheel casing, supplemented for safety by an oil-thrust bearing, supplied by a small triplex pump, driven by a chain drive from the governor shaft. This shaft is connected by bevel gears to the wheel shaft.

The wheels are direct-connected to 750-kw, 430-volt, 60-cycle, revolving-field, three-phase generators. These generators will carry a continuous load of 1,000 kilovolt-amp. On top of each generator is mounted a 35-kw, 125-volt, compound-wound exciter. One exciter is able to supply the field current for four generators. The generators connect through triple-pole knife switches to a common bus without any protective device whatever.

All the bearings are lubricated by gravity from a large tank under the roof, the waste oil being filtered and returned by a small motor-driven centrifugal pump to the storage tank. In the station are three 500-kw, 430-11,000-volt, oil-filled, water-cooled transformers; two 25-kw, 480-230-volt lighting transformers; one 35-light arc regulator, and a 100-kw motor-generator set. This set consists of a 100-kw, 250-volt, direct-current generator, direct-connected to a 150-hp induction motor. The direct current is used for crane service and electric-driven channelers in the quarries.

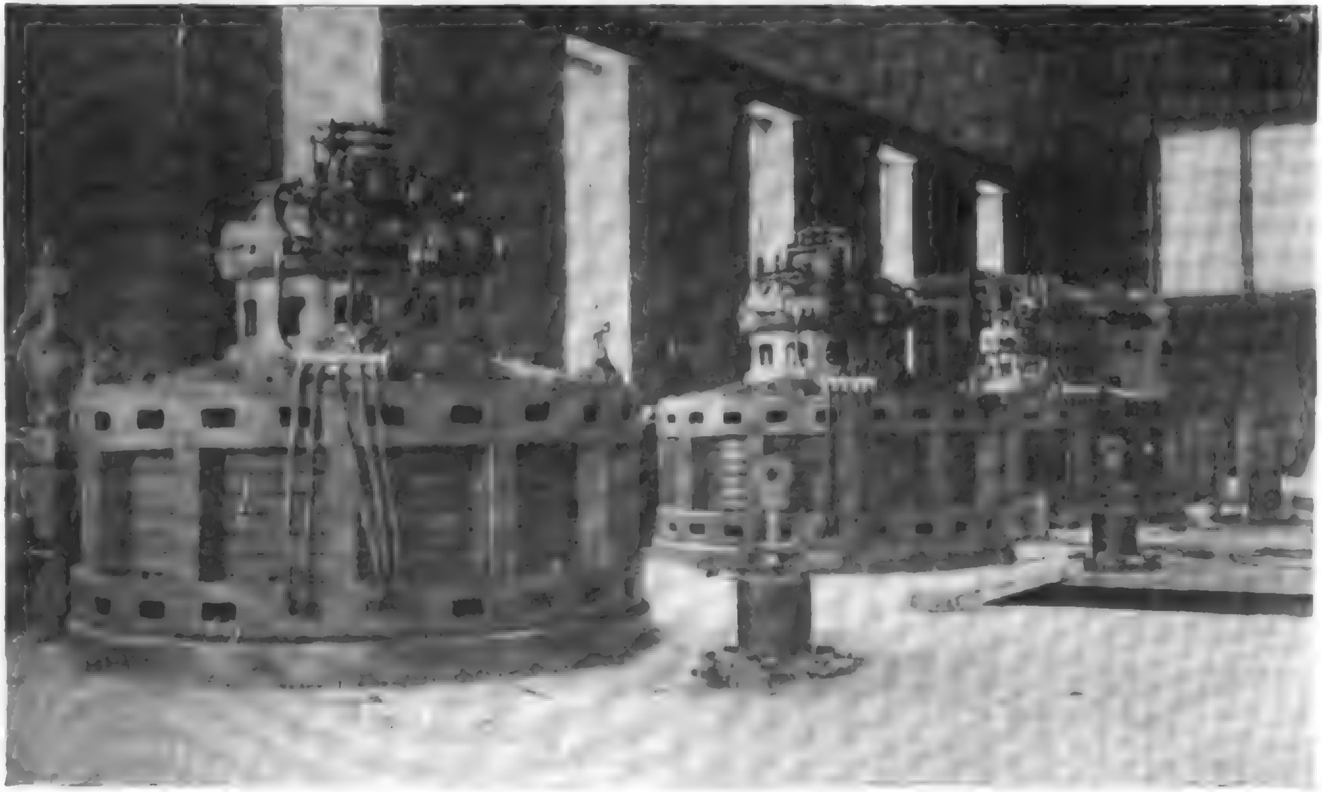

Fig. 1.—View of Interior of Power Plant of Vermont Marble Co.

The motor equipment in the Proctor mills consists of the following 440-volt induction motors: Three 250-hp, three 50-hp, three 30-hp and six 20-hp. The small motors, which are of the squirrel-cage type, are belted to line shafting, starting with compensators. From the shafting are driven rubbing beds, marble polishers, a machine and carpenter shop, grist mill, stone crusher, etc. The 250-hp motors are each placed in the center of a section of the line shaft in the main mill, and are used for driving marble saws. They are a combination of the internal and external starting resistance types, being provided with internal resistance operated by a lever on the motor frame, and also with collector rings on the shaft. Ordinarily the motor will be started with the external resistance by means of a controller, the internal resistance being used only in case of emergency.

FIG. 2.—VIEW OF EXTERIOR OF POWER HOUSE.

From the main station a 11,000-volt feeder runs to West Rutland, a distance of about five miles, with a short branch line to the Albertson mill and quarries.

At Albertson are located a 75-hp, 440-volt induction motor with its step-down transformers, and a 25-light arc regulator, for arc lamps in the underground quarries. In the West Rutland substation are two 50-light arc regulators, three 150-kw, 10,000-3,300-volt and three 10,000-460-volt oil-filled, water-cooled transformers, and one 250-kw motor-generator set. This set consists of a 250-kw, 250-volt, direct-current generator, driven by a 360-hp, 440-volt induction motor of the squirrel-cage type. The direct current is used for crane service and electric-driven channelers.

The motor equipment consists of one 75-hp, one 50-hp, one 15-hp and one 10-hp squirrel-cage type, 440-volt induction motors. In addition to the above there are three old revolving armature, 3,300-volt, synchronous motors, one 150-kw, one 100-kw and one 75-kw. These latter were driven formerly by a 500-kw, 3,320-volt revolving armature generator, direct-connected to a water wheel at Proctor.

All of the electrical apparatus was supplied by the General Electric Company.

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January Meeting of the American Institute of Electrical Engineers.

At the meeting of the American Institute of Electrical Engineers held in New York on January 26, 1906, there were presented two papers dealing with prime movers and alternators.

Mr. T. C. Martin, as chairman of the Institute Land & Building Fund Committee made a report up to date showing that toward the amount necessary from the Institute as its share of the cost of the land on which the United Engineering Building stands, viz., $200,000, the committee had pledges for a little over $100,000 already and had actually collected $55,000. Of the remaining $100,000 a large part would, he hoped, come from electrical corporations, but the rest of it must come from the membership. The general interest in the noble project, among the members, was shown by the fact that 620 subscriptions had already been secured, but so far only 200 of these had come from the New York district. The committee felt that the great enterprise was peculiarly one that should make the strongest appeal to the New York members, but at present only about 25 per cent of the local membership had contributed. The sum of $5 a year for 5 years would hardly strain any member, and the committee would be glad even to get $1 a year, where more could not be given. Over 500 members had given sums of $100 or less, and just over 300 of that number had given $25 each on the five-year basis. The speaker did not believe that a single man present would want to go into the new building without having done something, no matter how little, that would show his professional pride and interest in it. Such an opportunity could hardly come again in their lifetime, and should be seized. On request of Dr. Wheeler, the speaker stated that the General Electric Company had contributed and paid $25,000 toward the fund. In the seats of the hall were subscription blanks, which several members filled up before the meeting closed.

The papers were given the titles "Power Plant Economics" and "A Self-Exciting Alternator," the author of the former being Mr. H. G. Stott, and of the latter, Mr. E. F. Alexanderson.

POWER PLANT ECONOMICS.

The paper by Mr. H. G. Stott gave a complete analysis of the losses in a power plant from the coal to the bus-bars. The accompanying table shows the results obtained from such an analysis of the losses in a year's operation of what is probably one of the most efficient plants in existence to-day.

Each item given in this table was discussed in detail, and the author showed that the present type of power plant using reciprocating engines can be improved in efficiency as follows: Reduction in stack losses, 12 per cent; reduction in boiler radiation and leakage, 5 per cent; reduction in engine losses by the use of superheat, 6 per cent. Thus the net increase of thermal efficiency of the entire plant would be 4.14 per cent, increasing the total thermal efficiency from 10.3 per cent to 14.44 per cent.

The author presented curves to show that the best economy on dry saturated steam with steam turbines is practically equal to that of the reciprocating engine, and that 200° superheat reduces the steam consumption 13.5 per cent. The shape of the specific consumption curve, however, is much flatter than that of the reciprocating engine, so that the all-day efficiency of the turbo unit would be considerably better than that of the reciprocating engine, with the other great advantage of costing approximately 33 per cent less for the combined steam motor and electric generator. The expansion is relatively more nearly adiabatic in the low-pressure stage of the turbine than in the low-pressure cylinder of the engine, so that it has been proposed that the reciprocating engine should be run high-pressure where relatively it is more efficient than the steam turbine, utilizing the turbine for the low-pressure part of the cycle. In other words, use each where it is most efficient.

Analysis of the Average Losses in the Conversion of One Pound of Coal Into Electricity

	B.t.u.	%	B.t.u.	%
1. B.t.u. per pound of coal supplied	14,150	100.0		
2. Loss in ashes			340	2.4
3. Loss to stack			3,212	22.7
4. Loss in boiler radiation and leakage			1,131	8.0
5. Returned by feed water heater	441	3.1		
6. Returned by economizer	960	6.8		
7. Loss in pipe radiation			25	0.2
8. Delivered to circulator			223	1.6
9. Delivered to feed pump			201	1.4
10. Loss in leakage and high-pressure drips			152	1.1
11. Delivered to small auxiliaries			51	0.4
12. Heating			31	0.2
13. Loss in engine friction			111	0.8
14. Electrical losses			36	0.3
15. Engine radiation losses			28	0.2
16. Rejected to condenser			8,524	60.1
17. To house auxiliaries			29	0.2
	15,551	109.9	14,099	99.6
	14,099	99.6		
Delivered to bus-bar	1,452	10.3		

In discussing the gas engine, the author stated that the record of operation of several important installations of gas engines in power plants abroad and in this country seems to indicate that only one important objection can be raised to this prime mover, and that is that its range of economical load is practically limited to between 50 per cent load and full load. The author suggested that the combination of gas engines and steam turbines in a single plant offers possibilities of improved efficiency while at the same time removing the only valid objection to the gas engine. A steam turbine unit can easily be designed to take care of 100 per cent overload for a few seconds; and as the load fluctuations in any plant will probably not average more than 25 per cent with a maximum of 50 per cent for a few seconds, it would seem that if a plant were designed to operate normally with 50 per cent of its capacity in gas engines and 50 per cent in steam turbines, any fluctuations of load likely to arise in practice could be taken care of. By utilizing the waste heat in the gas engines for the purpose of assisting to make steam for the turbines, there can be saved approximately 37 per cent of the total heat lost in the gas engine. The author concludes that an internal-combustion engine plant in combination with a steam turbine plant offers the most attractive proposition for efficiency and reliability to-day, with the possibility of producing the kilowatt-hour for less than one half its present cost.

Mr. E. W. Rice, in opening the discussion, stated that the high efficiency attained in electrical machinery could, to a large extent, be attributed to the admirable testing instruments, the ammeter, the voltmeter and the wattmeters. If the steam engineer possessed the equivalent of these instruments, the efficiency of the steam engine plant doubtless would have been greatly increased. The paper of Mr. Stott is exceptionally valuable in that it presents a complete analysis of the various losses in the steam plant. The fact that no method is known at present of eliminating the enormous losses of some 60 per cent of heat units rejected to the condenser, emphasizes the importance of working with the highest possible vacuum. In a recent installation of turbo-generators in Philadelphia where the turbine is interposed between the exhaust of the reciprocating engine and the condenser, there has been added to the capacity of the plant some 1,800 kilowatts without any additional consumption of coal and without any appreciable addition to the labor. It is possible in such a plant with an increase of 50 per cent in the original investment, to increase the capacity by 66 per cent without appreciable increase in operating expenses. This method is a most excellent one for adding to the output of existing reciproacting engine stations, but in planning a new station it would seem that the added complexity would offset the advantages gained by such a combination. It is worthy of note that 53 per cent of the available energy in a certain quantity of steam lies in what is called the vacuum range.

Prof. Charles E. Lucke, of Columbia University, pointed out that the gas engine builders themselves were largely responsible for the lack of development of their own machinery. They claimed everything on earth for the gas engine, that it required only a child to run it, that it ran on so little coal that shortly it would be making coal, and people who bought these machines were inevitably disappointed. Strong points in favor of the gas producer plant resides in the fact that its efficiency is not nearly so sensitive to changes in load as is true with the boiler plant, and that the coal consumed by banked fires in the gas producer is very much smaller than for the same capacity of steam boilers. As to the reliability of properly designed gas engines, Prof. Lucke stated that he had observed in Germany numerous blast furnaces absolutely dependent on their air blast run exclusively by gas engines, in some cases without a single spare unit; thousands of dollars were tied up in the certainty of that blast, and all went right from year to year. As a gas engine is intended normally to operate at nearly its maximum load, it is said to have no overload capacity. This difficulty can be overcome readily, since it is possible to place in and out spare units on short notice, because there is no cylinder condensation to worry any one.

Mr. C. C. Chapelle remarked that the relative economies of the reciprocating-engine and steam-turbine plants as given by Mr. Stott were checked up within a fraction of a per cent by some results obtained under practically the same conditions of cost of fuel and labor in one of the large railway stations in the East.

Mr. W. L. R. Emmet outlined the operation of low-pressure turbines in series with reciprocating engines. The engines exhaust at some pressure from the atmosphere up. The steam passes from the engine into a turbine, which is a simple device without governor or any other auxiliaries which tend to complicate or make difficulties, and then passes into the condensers. The turbine performs exactly the functions of a vast third cylinder affording another expansion in the range which the reciprocating engine is incapable of filling. The turbine adds possibly 20 per cent to the output of the engine if the engine exhausts at the low pressure of 20-in. vacuum. It has no governor, and altogether is a very simple device, costing perhaps $35 or $40 per kilowatt, which is about one-fifth of what an equivalent capacity in engine equipment would cost. If cooling towers be installed in connection with any non-condensing plant the output can be practically doubled without the employment of any more men. This fact is very significant when one considers the number of non-condensing plants now in existence.

Mr. F. E. Junge, of New York, a member of the German Society of Engineers, of Berlin, discussed the influence of local conditions on power plant economics with special consideration of the mineral and metallic regions, basing his remarks on the conditions existing in Germany. He stated that if the surplus power that becomes available by the adoption of economical prime movers can be used in the works, where its value is equal to the corresponding reduction of the coal bill, or if it can be sold to advantage abroad, where its value varies with the local conditions, the gas engine will invariably be selected as the prime mover for central stations. In places where there is no market for the available surplus power, the steam turbine would always keep its field of usefulness.

A SELF-EXCITING GENERATOR.

The paper by Mr. E. F. Alexanderson described a recently developed type of self-exciting alternator which possesses a single field winding of the ordinary type carrying a direct current fed from a multi-segmental two-part rectifying commutator.

A general diagram of the alternator, which is a three-phase machine, is shown in Fig. 1. The exciting current is produced in an auxiliary three-phase winding placed in the same slots as the main armature winding. The terminals of this auxiliary winding are connected to three sets of brushes that bear on a rectifying commutator of special type. This commutator has one active segment per pole, covering practically two-thirds of the pole-pitch, the remaining one-third of the arc being insulated. Each alternate segment is connected to one terminal of the field winding, and the remaining segments to the other. By this arrangement the whole process of commutation is carried out in the stationary circuits before the current enters the field coils. The voltage generated in the auxiliary winding is sufficient to supply current for excitation at full inductive load; and the excitation is adjusted to the proper no-load value by a three-phase rheostat inserted at the neutral point of the auxiliary winding. Automatic compounding is accomplished by means of a series transformer connected to the rheostat; the transformer sends a current through the rheostat in a direction opposite to the field current, thereby eliminating the voltage drop in the rheostat. The elimination of the voltage drop in the rheostat changes over more or less of the field current from the rheostat to the series transformer. The secondary current of the series transformer is in phase with the line current, while the field current is practically in phase with the voltage. The amount of boosting in the field circuit will therefore depend not only upon the value of the secondary current, but also upon the power-factor of the load. A function of the rheostat which is just as important as the field control, is its influence on the commutation. As far as commutation is concerned, the full resistance of the rheostat may be considered as always being in circuit, although the larger part of the field current may flow through the series transformer.

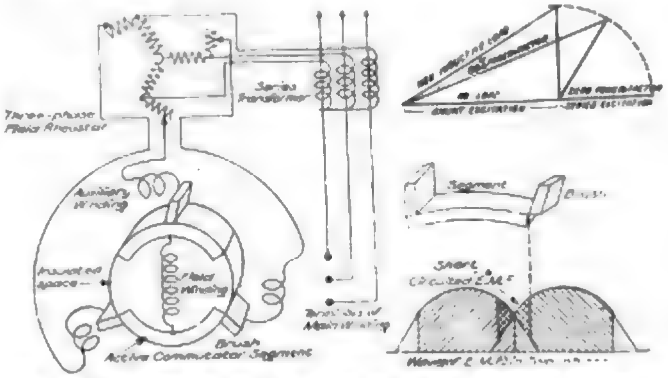

FIG. 1.—WINDING DIAGRAM, VECTOR DIAGRAM OF FIELD VOLTAGES AND DIAGRAM OF FIELD CURRENT.

The brushes are placed in such a position that the cross current due to two brushes being simultaneously on the same segment is half as large as the field current at the moment of rupture. In this way complete commutation takes place just before the brush leaves the segment, and consequently no sparking occurs.

The method used for compounding and compensating for armature reaction both for variation of the load and for changes in the power factor is extremely interesting. The phases of the auxiliary winding are connected in such a manner that the voltage induced in them lags by 90 electrical degrees behind the corresponding phases of the main winding. The secondary circuits of the series transformer are closed through the rheostat, and the current combines with the field current at right angles at non-inductive load, but is in phase with it at zero power-factor. At full inductive load of zero power-factor the field current in the rheostat is completely neutralized by the current of the series transformer. The effect of the series transformer on the exciting circuit is, therefore, equivalent to an additional electromotive force which can be combined with the electromotive force of the auxiliary winding at an angle dependent upon the power-factor, as shown in the vector diagram of Fig. 1. The resulting electromotive force available through this arrangement, for excitation, is such as to maintain a constant voltage at the machine terminal, neglecting the ohmic drop in the armature winding. The quantities noted above are slightly modified in practice to produce the exact degree of compounding or over-compounding desired.

In connection with this type of alternator, a most convenient method can be adopted for synchronizing. If one generator is to be started and synchronized with other self-exciting generators, it is only necessary to bring the machine up to approximate synchronous speed, and to close the main switch. The closing of the switch will cause a momentary rush of current, but the compounding of the other generators will prevent any material disturbance of the line voltage; and the machine, which has been started, will build up its field immediately. The rush of current which occurs when closing the main switch, if the generators are out of phase, is, however, not nearly so great with self-excited as with separately-excited alternators, because the self-excited machine has no definite polarity before synchronization, and the auxiliary winding tends at every moment to generate a polarity corresponding to the line voltage.

The discussion on Mr. Alexanderson's paper was opened by Prof. A. E. Kennelly, who commented on the apparent simplicity of the means which have been adopted not only for the excitation but for the compounding of the alternator described. It is considered more important to render alternators self-exciting than to compound them, because with these machines it is not the resistance drop but the impedance drop which must be overcome The various methods which have been used in the past for compounding alternators have reached only partial success, and have not been regarded as successful with high-voltage machines. The present method, however, seems to be applicable to machines of any voltage. It looks as though a station fitted with such apparatus as this might contain no machines other than the main turbo-generators, without exciters or synchronizers, the machines being thrown on and off at will.

Mr. C. F. Scott related some experience fifteen years ago with the self-exciting and self-compounding of an alternator, when the problem was found to be an extremely difficult one. One inherent disadvantage in self-exciting methods lies in the fact that variation in speed due to load on the generator are immediately transmitted to the exciter. There have been cases where the main generator was subject to such speed variations that when the exciter was driven by the same prime mover the service was very unsatisfactory, but when the alternator received its exciting current from a generator run at constant speed, the operation was satisfactory.

Mr. W. L. R. Emmet said that he had seen the new alternator working under very trying conditions, and that the performance of it is astonishingly good. A machine of this kind has accepted sudden inductive loads of more than its rated capacity without a sign of sparking at the commutator, and without an appreciable flicker in the lamps. The rapidity of its action is very remarkable. It can be compounded so as to take care of variations in speed as well as in load. Experience indicates that there is almost no limit to the size of machine to which this scheme can be applied.

Dr. A. S. McAllister remarked that the phase position of the voltage generated in the auxiliary winding depends upon the mechanical position of the winding on the core, and the phase position of the voltage in the series transformer depends upon the power-factor of the load. At non-inductive load these two voltages add at a certain angle, and at inductive loads they add at a different angle. Since a change in the angle of the resultant voltage is equivalent to a change in the position of the brushes, he asked if this change has any effect on the commutation when the load is varied from its full inductive to its full non-inductive value without moving the brushes

Mr. Alexanderson replied that the difficulty seems to be to make the machine commutate properly for no-load and non-inductive load, because the voltage impressed on the commutator is not of the same phase relation to the machine voltage at no-load and full load. The field is distorted by the armature reaction to approximately the same angle as the voltage impressed on the commutator is ahead of the voltage of the auxiliary winding. Therefore, the position of the brushes with no-load is nearly the best position on non-inductive load. At inductive load the voltage of the series transformer combines directly in phase with the voltage of the auxiliary winding, and at the same time the armature reaction combines directly with the field excitation, and there is no reason whatever for any displacement.

Some of the Obstacles in the Way of Electric Heating.

By C. D. Wood, Jr.

The attention of the public has lately been drawn to the progress in electric heating and cooking. This progress has been slow, but steady; however, if certain obstacles were removed from the way of the electric heating engineer, the progress would be still more rapid. In some cases electrical supply dealers are retailing six-pound electric irons in the neighborhood at $7, thereby extorting a profit of at least 100 per cent. This exorbitant price for electric irons is prohibiting the general sale of heating devices and in this way retarding the progress of electric heating in general.

Manufacturers of electric heating material have had a hard fight to obtain the proper heating units that would last. This has finally been accomplished, all things being equal, the progress from now on should be rapid.

Again, when a customer comes to the central station requesting the placing of an electric radiator in his house it is not the amount of current consumed that constitutes an objection, but when he finds that he must alter his wiring he gives up the project. If electrical contractors would take into consideration the practicability of installing electric heating and cooking devices, and for this reason increase the size of their wires, we are sure that the number of electric heaters would be very largely increased. Again, some central station companies have recommended electric radiators of one kilowatt capacity to heat a room that would require two kilowatts, and in so doing give the customer a chance to become thoroughly disgusted with the electric radiator, and eventually throwing it out of his premises.

Concerted action should be obtained between the manufacturers of heating devices, the central station and the contractors; such action would be of material benefit to all three parties.

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Electric Flat Irons and Soliciting at Dubuque Iowa.

Mr. L. D. Mathes, general manager of the Union Electric Company, of Dubuque, Iowa, says that his company now has approximately 165 electric flat irons in use by its customers. The plan of introducing these irons is to place them in the hands of the customer on 30 to 60 days trial. A large stock of irons is kept on hand and if the customer does not like the weight or size of the iron furnished at first, the company will change it until the customer is satisfied. At the end of 30 or 60 days, if the customer does not return the iron it is placed on the regular bill. Only one iron so sent out has been returned. This was in a case where a servant, who did all the ironing in the house, for some reason took a prejudice against it. Although it is difficult to arrive at the exact amount of income that these irons afford, it can be determined approximately from a customer's bills before and after the irons are in use.

It is estimated that each iron on the circuit is in use about 7½ hours per week, and if the irons are the average size taking 450 watts, this means a consumption per iron of about 15 kw-hours per month. The principal hotel in Dubuque is a good electric heating customer, its power consumption for electric heating being about 3,000 kw-hours per month. Here a large electrically heated slab has displaced a gas table for broiling meats, cooking griddle cakes, toasting, etc. This slab is divided into four squares, the heat being regulated on each square independently of the others, so they can be used for different purposes.

The system of charging in Dubuque is on a two-rate system. A maximum rate of 14 cents per kw-hour is charged until the customer has used the equivalent of 2 kw-hours per 16-cp lamp connected per month. For all over that amount the rate is 6 cents per kw-hour. Heating devices are not included in figuring a customer's connected load for the reason that these usually consist of flat irons which are not on during the peak load, and to figure these in on the connected load would make the rate too high for the operation of the heating appliances.

The Lighting of Dining and Bed Rooms.

By J. R. Cravath and V. R. Lansingh.

In a previous article* the authors called attention to the dissatisfaction that sometimes results from the use of electricity in residence lighting due to the fact that the lamps are not properly placed or equipped for the best results. The lighting of the most used room in the house (the living room) was then taken up at length. In the present article the lighting of two other important rooms in the residence is discussed: namely, dining and bed rooms. In studying this article, the reader can with profit refer to the articles by the authors on "Reflectors, Shades and Globes" in the Electrical World and Engineer of November 25, December 2, 9, 16 and 23, 1905.

LIGHTING OF DINING ROOMS.

A small dining room is probably the easiest room in the house to light. All that is necessary for ordinary purposes is to throw a strong light down on the table. The reflection from the white tablecloth to the walls assists greatly in the general lighting of the room. The main thing, however, is to have the table well lighted, and the balance of the room will usually take care of itself. The simplest and most economical arrangement possible for a small dining-room is a plain one-light pendant over the center of the table equipped with some type of reflector which will throw a large proportion of its light on the table while allowing some to escape through to light the walls and ceiling.

Fig. 1 shows such a simple arrangement for dining room lighting. The light is placed six feet above the floor, which is slightly lower than the ordinary height of chandelier. The dining room shown in Fig. 1 is about 15 ft. square, and for all ordinary occasions an 8-cp lamp in the prismatic glass reflector shown is sufficient. A lamp of larger candle power could, of course, be used on special occasions if the table were lengthened out. The particular prismatic reflector shown in Fig. 1 concentrates a little too much light on the center of the table at the expense of the edges. One giving a wider distribution of light would be desirable. This one light pendant idea can be elaborated into a very artistic fixture by substituting a chain for the rod and covering the reflector with silk or with a large art glass shade, as in Fig. 1A.

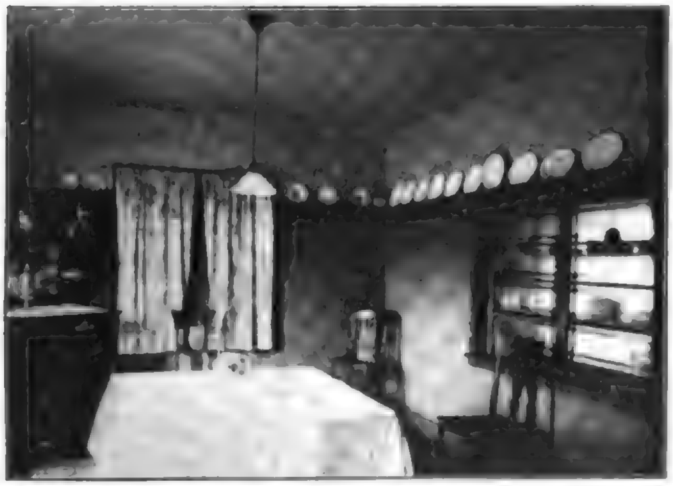
FIG. 1.—DINING-ROOM LIGHTING.

Fig. 2 shows how not to light a dining room with a one-light pendant. This pendant in Fig. 2 has the lamp placed at an angle of 45 degrees in a bell glass shade. The shade is not of the kind which greatly influences the distribution of light, and what influence it does have on the light is of no practical benefit because of the angle at which the lamp is mounted. With the arrangement shown in Fig. 2 a 16-cp lamp will not give as good results in any given room as an 8-cp with the pendant shown in Fig. 1.

Fig. 3 is another example of how not to light a dining room. It is a case of getting a large amount of light everywhere but on the table, where it is most needed. The lamps are placed at such an angle that the light of the bare filament strikes directly in the eyes of those seated at the ends of the table.

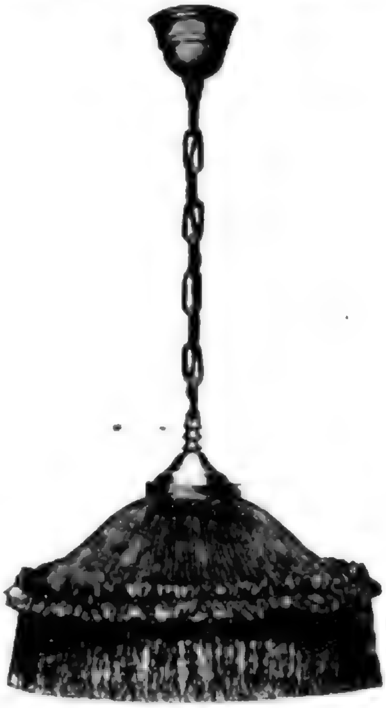
FIG. 1A.—ART GLASS SHADE.

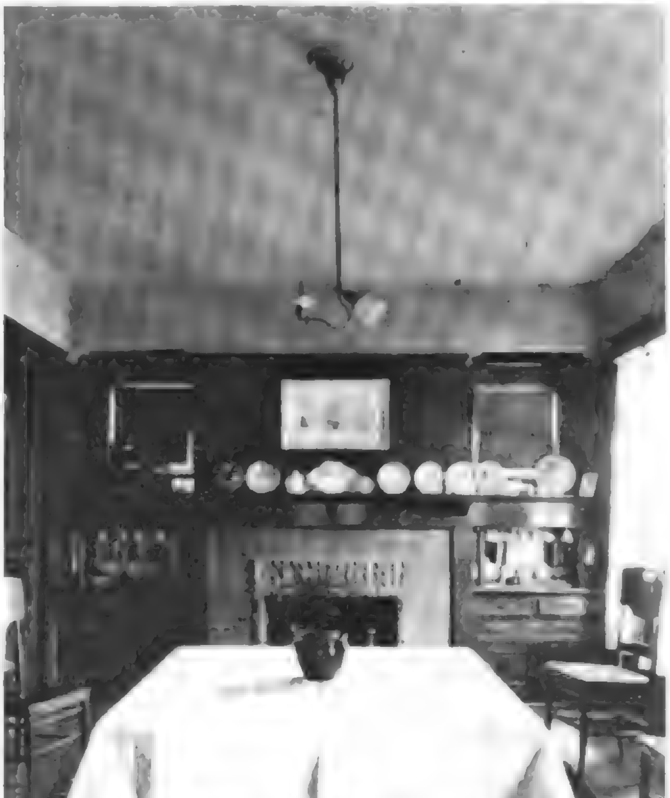
FIG. 2.—EXAMPLE OF POOR LIGHTING.

Fig. 4 shows an excellent way of lighting a dining room where something a little more elaborate than Fig. 1 is desired and where the room is too large to light well with a single pendant. In Fig. 4 the ordinary lighting of the dining room table is accomplished with the light within the opal dome reflector located in the ball of the chandelier. This opal dome gives an excellent distribution of light for this purpose and will throw light over a considerable angle so that a large table can be lighted. If additional light is wanted around the sides of the room on special occasions, the three lamps on the arm of the chandelier can be turned on. These are equipped with opal bell reflectors, which, when placed at this angle, throw considerable light to the high side walls, lighting up the plate racks and decorations of the room. Since the occupants of the dining room are usually seated around the table, frosted bulbs are not as necessary in these reflectors as they would be were the occupants of the room seated where the lights on the chandelier would come more nearly in the line of ordinary vision, but they are desirable nevertheless as they do away with glare and give a softer, better diffused light than the clear bulb lamps with but small loss by absorption.

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*Jan. 6, 1906, pages 29-33.

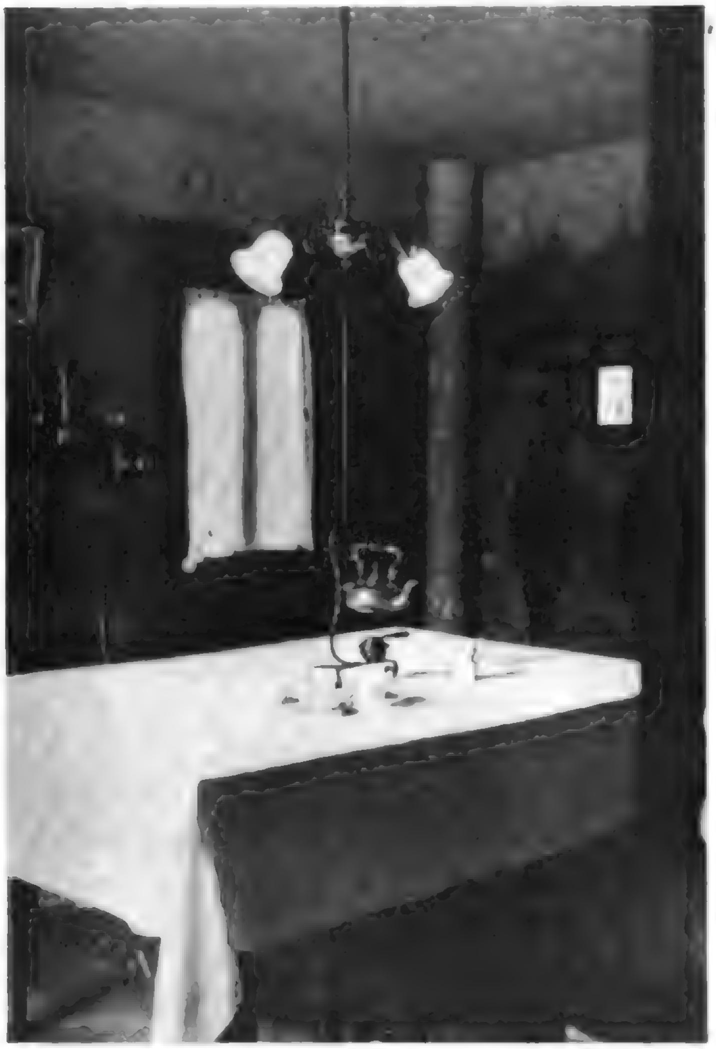

FIG. 3.—EXAMPLE OF POOR LIGHTING.

Fig. 5, which is a view of one of the private dining-rooms in Hotel Stratford, Chicago, is a good example of how not to light such a room. A cluster of nine lamps is placed near the ceiling without reflectors of any kind. The ceiling acts somewhat as a reflector, but a very inefficient one. It is safe to say that the table and the lower part of the room in general would be as well lighted with half the number of lamps were some simple and ornamental form of reflector used. With a chandelier placed as high as this, the high side walls, upon which there are elaborate decorations, would receive sufficient light were any translucent reflectors used, while the table and lower part of the room would receive very much more light and the artistic effect would be in no way interfered with. In this case frosted bulb lamps are not as necessary to pleasant illumination as where they are placed lower over a table.

The examples given of dining room lighting so far have all been of rooms with but one outlet, that being in the center over the table. Side wall brackets for general lighting are employed in some modern dining rooms with good artistic effect. The lights on such brackets since they are sure to be in the line of vision of some one sitting at the table must be well provided with diffusing globes to avoid discomfort of the persons facing them.

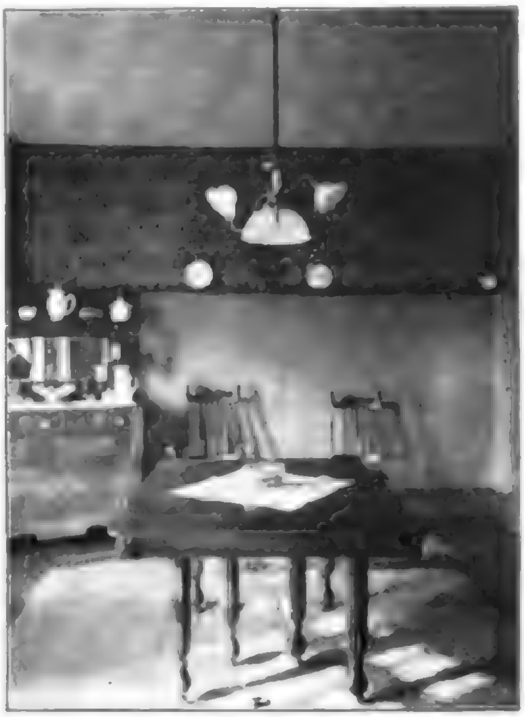

FIG. 4.—EXAMPLE OF GOOD LIGHTING.

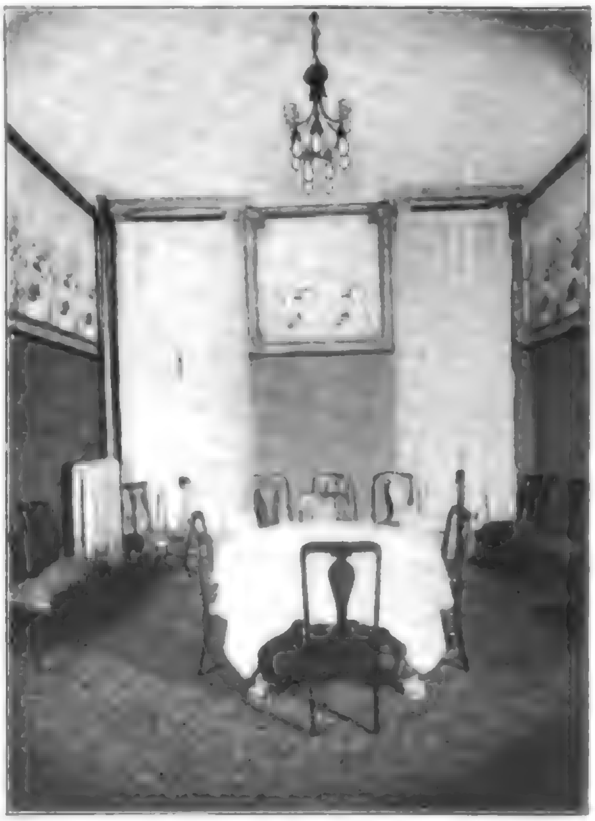

FIG. 5.—POOR LIGHTING OF HOTEL PRIVATE DINING-ROOM.

LIGHTING OF BEDROOMS.

The lighting of bedrooms, especially in the small residences where first cost must be kept low, is the most difficult problem to be met with in residence lighting. To light a bedroom properly, lights are needed at various times in a number of locations,

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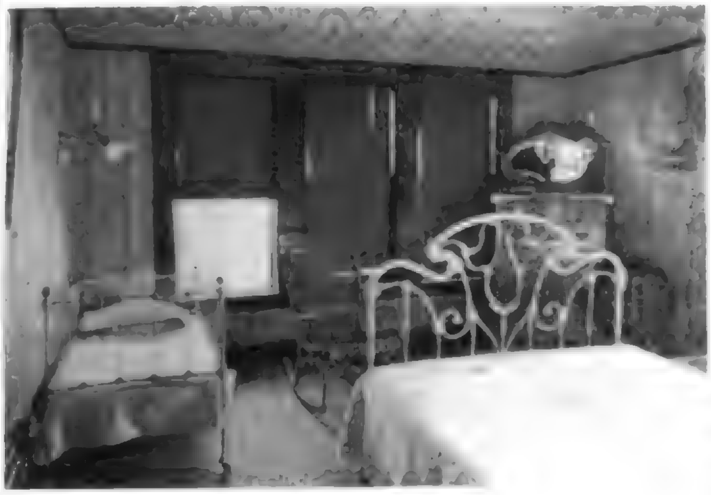


FIG. 6.—BRACKET LAMPS.

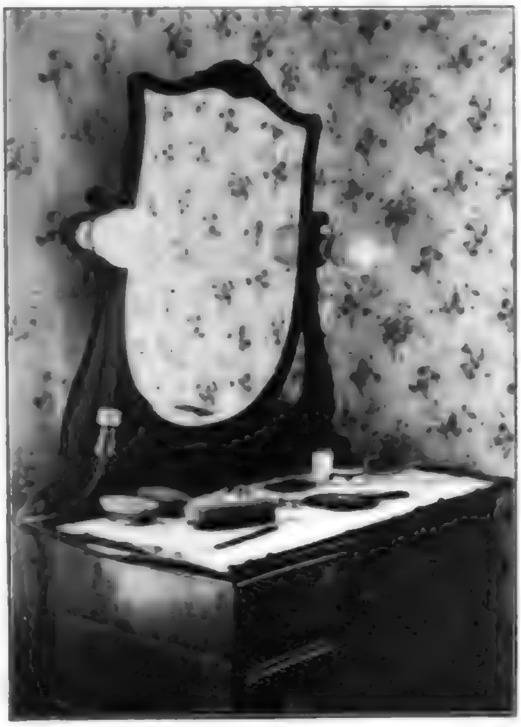


FIG. 7.—LAMPS ON DRESSER.

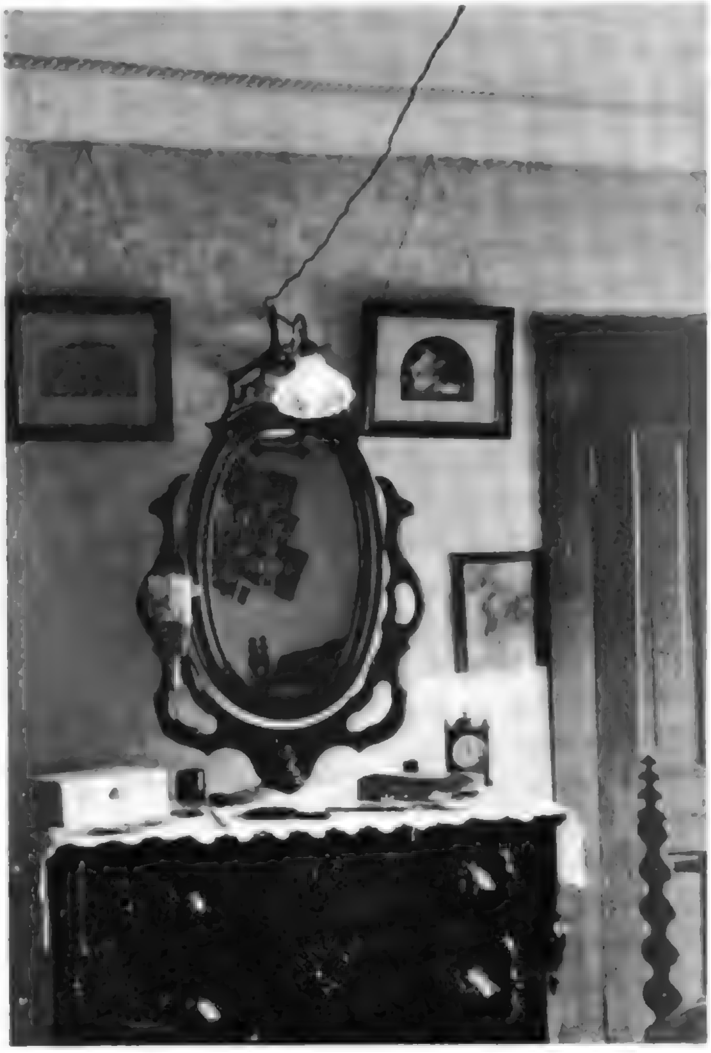


FIG. 8.—PORTABLE LAMP.

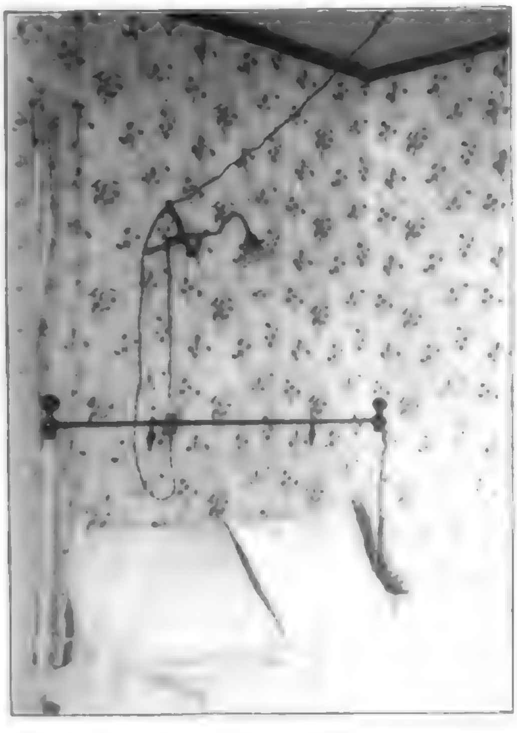


FIG. 9.—PORTABLE LAMP.

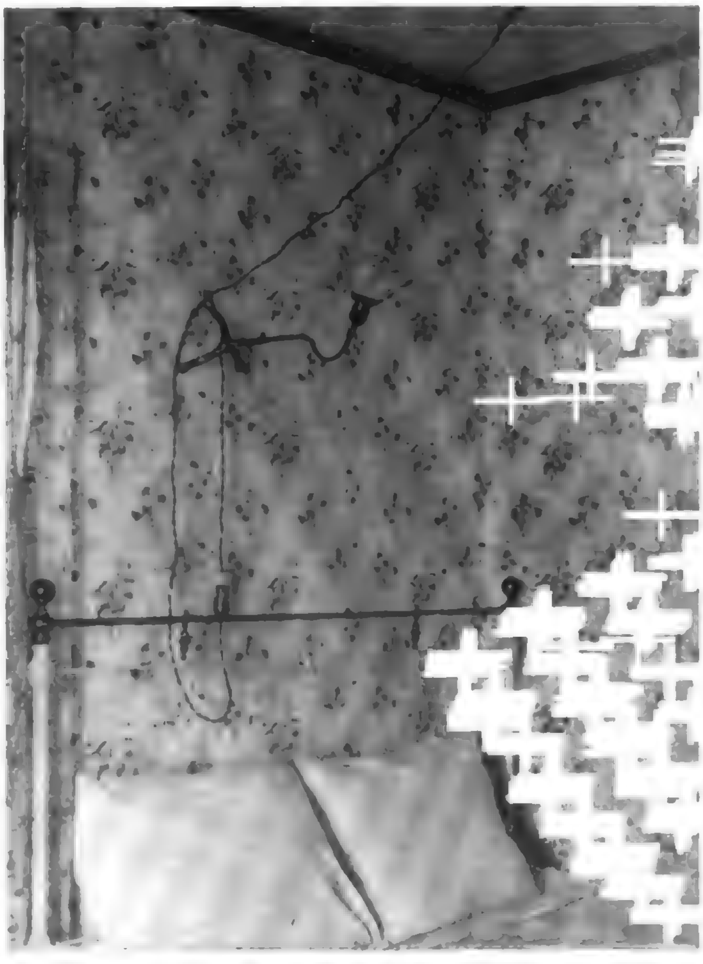


FIG. 10.—PORTABLE LAMP.

LIGHTING OF DINING-ROOMS AND BEDROOMS.

yet it is seldom that the owner is willing to pay for as many outlets as would be necessary to provide for all contingencies. Before considering specific cases, let us for a moment see just what lamps are needed in the ordinary bedroom. The first essential is usually for a lamp at the dresser so that a person standing in front of the dresser can have the use of the mirror without annoying shadows. To light a dresser mirror perfectly three lamps are necessary although they are seldom provided. One of these three lamps should be directly above the mirror, and the other two should be located on each side about 4½ to 5 ft. above the floor.

For the side brackets on each side of a dresser, upright lamps are generally preferable for the reason that if pendants are used, considerable light is thrown down on the floor, where it is practicaly of no value, little of it being reflected. If uprights are used, the light thrown upward strikes the ceiling and walls, adding to the cheerfulness and general illumination of the entire room.

The side lamps are needed to light the sides of the face of a person standing in front of the dresser and should be low enough so that there will be no shadow under the chin of a man shaving. These side lamps, if placed at this height, however, will not be high enough to light the top of a person's head so that there will be a shadow at that point, which must be obliterated by a lamp placed above the mirror for use in hair dressing if the one who plans the illumination is not to incur the everlasting ill-will of the ladies of the house. There should manifestly be some general illumination in a perfectly lighted bedroom, for which purpose a chandelier or pendant or a lamp at the ceiling in the middle of the room can be provided. In addition to this, it is desirable to provide a bracket immediately over the head of the bed for reading purposes and where it will be within easy reach of a person desiring to turn on the light in the night before getting out of bed. Besides this, if the closet is large there should be a closet light, although this is hardly necessary in small closets. We thus have five or six outlets in a perfectly-lighted bedroom, which is more than in most of the other rooms in the house and would be considered out of the question by most owners of small residences. Some compromise must therefore be adopted in most cases which will cut down the number of outlets or make one or two outlets available for more purposes. The use of portable brackets as described later is one of these compromises which, although undesirable from the standpoint of appearance, is nevertheless too practical and useful to be left out of consideration, especially in the wiring of old houses where one outlet in the center of a bedroom must frequently suffice for all purposes.

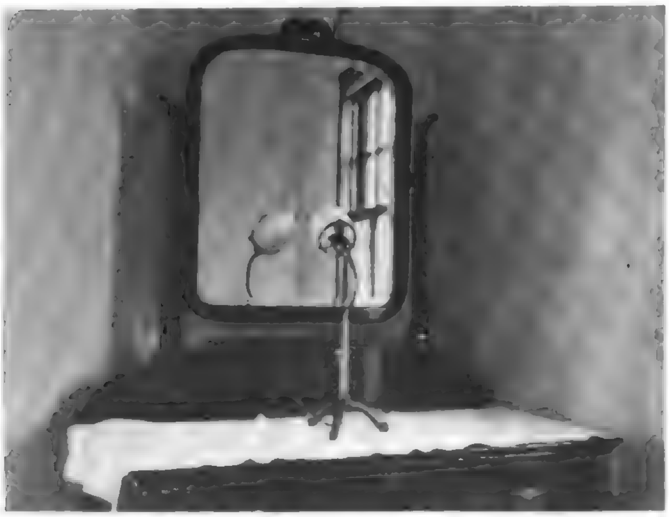


FIG. 11.—LAMP ARRANGED FOR SHAVING.

Another trouble usually met with in planning the lighting of a bedroom is the uncertainty as to the location of various pieces of furniture. It sometimes happens that there is only one good location for a dresser in a room, and in such a case, whoever plans the illumination can with safety and certainty place the dresser lamps with the knowledge that they will not be in the way of any future changes of furniture location the housewife may wish to make.

On the other hand it is sometimes difficult to locate brackets where they will not under some circumstances prove inconvenient and in the way of furniture. One way out of this difficulty is to provide one or more flush receptacles where lamps may possibly be needed. Portable brackets can then be hung up at any point and plugged into these wall receptacles, or a dresser equipped with side lamps mounted on the dresser, as shown later, can obtain current from these receptacles.

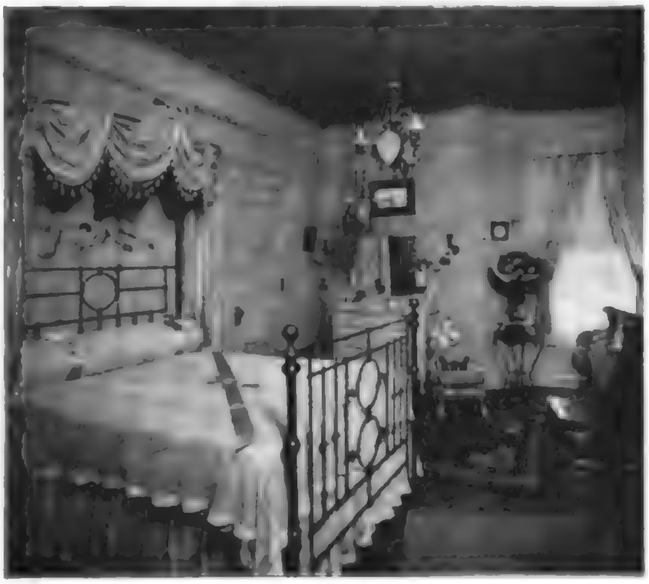


FIG. 12.—DRESSER LAMPS FOR BEDROOM.

Where the general lighting of a bedroom is to be provided for by a central fixture, the problem is not materially different from the general lighting of living rooms and parlors, and for suggestions on this point the reader is referred to the previous article devoted to that subject. The points that need special consideration in bedroom lighting here are, therefore, the lighting of dressers and the provision of bracket lamps over the beds or at other desired points.

Fig. 6 is a good example of the way bracket lamps are frequently placed in a small bedroom without any regard to the needs of the occupants and at places where they are most inconvenient. In this case the architect appears to have placed the outlets symmetrically with reference to the windows without considering anything else. It is impossible to make such lighting arrangements satisfactory in a bedroom. It would have been much better to have placed these two brackets on one side of the room at such a distance apart that a dresser could have been placed between them. The lamp should be frosted if used without a globe or else should be covered by an enclosing globe of frosted, sand-blasted or Holophane glass for diffusing the light.

Fig. 7 shows an arrangement of lamps mounted directly on a dresser. On a dresser especially designed with reference to having electric lamps mounted upon it, the arrangement might be made very artistic. On the dresser shown, there are two wall sockets mounted on each end of a piece of standard hardwood molding fastened against the back of the mirror. The unsightly ends of the molding are covered with round blocks of wood such as are used in mounting wall sockets, and the sockets are mounted on these blocks, the wood being finished to correspond with the dresser. The flexible cord and attachment plug which connect to the wires in the molding make it easy to connect up these dresser lamps to any socket outlet in the room. Such an outlet can either be located along the wall or at the middle of the room. In the latter case a long lamp cord is necessary. This arrangement has the advantage of always having the lamps on the dresser wherever it may be moved. The lamps as shown are excellent for shaving purposes, but must be supplemented by some higher lamp for hair dressing, as these lamps are too low to light the top of the head.

A diffusing and directing globe is placed on these side lamps for two reasons: In the first place, these lamps are so nearly in the ordinary line of vision that they would have a decided blinding effect if they were not provided with something to diffuse and reduce the intensity of the light. As far as diffusion is concerned, the same result could be secured to a less degree by the use of frosted bulb lamps or by sand-blasted, enclosing globes. The second reason for using these globes in this place was that, in addition to diffusing the light, they direct the rays. The type of globe used, as seen from the previous articles on reflectors, shades and globes, gives such a distribution of light that when placed as are these lamps on the side of the dresser mirror, much more light will be thrown on the face of a person standing in front of the mirror than with any of the other diffusing globes mentioned.

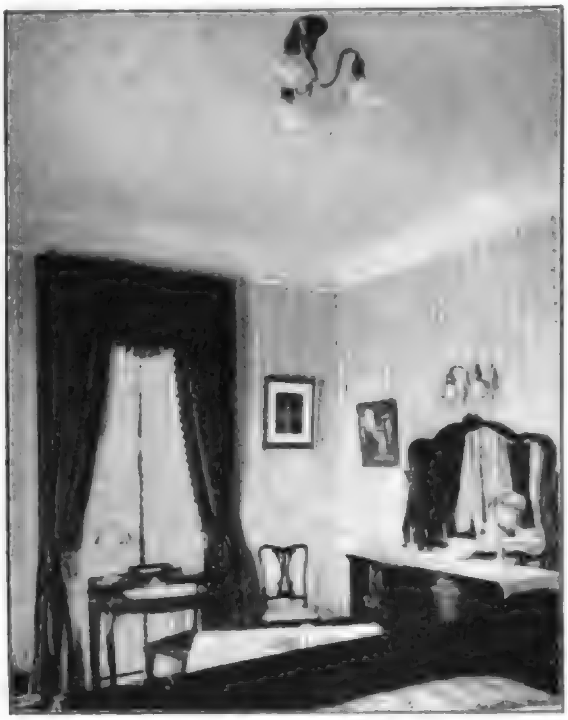


FIG. 13.—BEDROOM, HOTEL ASTOR, NEW YORK.

Another portable arrangement very useful in bedrooms where a number of outlets is wanted is shown in Figs. 8, 9 and 10. This is a portable wall bracket, which can be hung on a hook at any point desired and attached by means of a flexible cord and attachment plug to a socket anywhere in the room. In Fig. 8, this portable bracket is shown directly over the mirror of a dresser. It is equipped with a prismatic glass reflector, which throws a powerful light down on to the head of a person standing in front of the dresser, hence this arrangement is excellent for hair dressing, and in fact, almost all purposes for which a dresser light is needed except shaving. It can be made to serve the purpose of a shaving light on a dresser in a manner mentioned later.

Fig. 9 shows the use of the portable wall bracket as a reading light over the head of a bed. In this case the key socket at the attachment plug is within easy reach for turning on the light in the night. With the bracket in this position and a concentrating type of prismatic glass reflector, a 4-cp lamp is sufficient for reading purposes if the bracket is to be used for that purpose alone.

If the ceiling of the room is of light color, this bracket can be used to give a fairly good, evenly diffused light over the entire room by simply turning it up as shown in Fig. 10. By means of a thumb screw the arm of the bracket can be loosened and turned around at any angle. It can also be extended several inches to adapt it to different requirements. By turning the lamp towards the ceiling as in Fig. 10, the ceiling acts as a reflector to light the whole room by diffuse reflection and the light is soft and pleasing without being intense at any one point.

Fig. 11 shows how this bracket can be made to serve for shaving by setting it on the dresser in front of the mirror so as to throw the light into the mirror. The reflected light from the mirror falls on the face.

It is suggested that where the dresser lamps shown in Fig. 7, together with a portable fixture of this kind, are used in a bedroom for furnishing most of the light and the owner does not wish to pay for more than one outlet, a good arrangement is to place a 3 or 4-light wireless cluster at the ceiling in the center of a room. Attachment plugs for various portable devices can then be inserted in this wireless cluster or a lamp on the drop cord in the center of the room can be secured by attachment in a similar manner. Of course, these are in the nature of makeshifts, but, as said before, bedroom lighting, especially in houses already wired, is very much of a compromise between what is desirable and what is feasible.

For large bedrooms where expense does not prevent, the arrangement of dresser lamps shown in Fig. 12 is desirable. This dresser has a light at each side as well as one directly over the middle of the mirror. This is the ideal arrangement as far as the location of the fixtures is concerned, although there is some room for criticism as to the shades used on the brackets each side of the dresser. With brackets in such positions, where open shades of any kind are used, the lamps should have frosted bulbs or be enclosed in Holophane globes or sand-blasted to diffuse the light. If a Holophane globe or shade were used on the brackets shown in Fig. 12, that type should be selected which throws a maximum light in the desired direction—on the

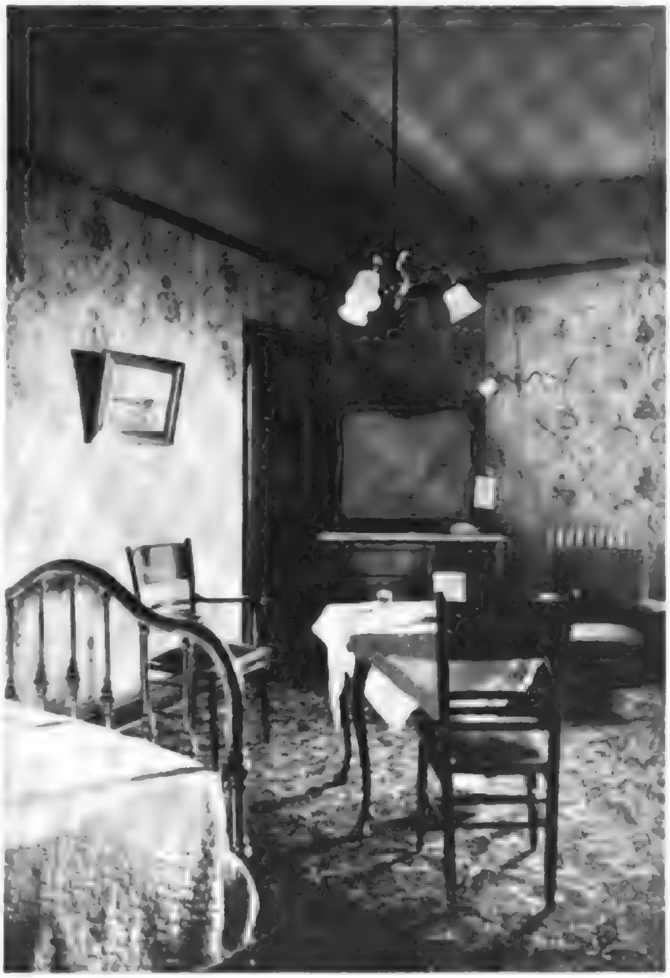


FIG. 14.—BEDROOM, CLAYPOOL HOTEL, INDIANAPOLIS.

face of the person using the dresser in this case. As regards the lamp on the pendant directly over the dresser, it would be well to put inside the ornamental globe some small reflector which would be concealed by the globe but which would assist greatly in throwing the light down on the head of the person using the dresser. As said before, this is a case where expense is of secondary importance, otherwise a different equipment both of the center chandelier and of the pendant over the dresser might be advisable. The ornamental opal globes on the center chandelier absorb a large amount of light and do not distribute it very well in downward directions where it is most needed. They diffuse the light well, however, and so are good from every standpoint except that of low cost of operation for a given amount of light.

A way in which the provision of three outlets for the lighting of the dresser mirrors can be obviated is by placing one bracket lamp directly over the mirror, as in Fig. 12, and if the room is to be used by gentlemen who wish to shave, providing a portable, electrically-lighted shaving mirror with frosted bulb lamps mounted on each side of it. Such mirrors can be purchased ready made in the open market or made to order to suit the purchaser. They are provided with attachment plug and cord for attachment to any socket and can be hung anywhere in a bedroom.

Where but a single bracket lamp is provided over the dresser mirror, it may be located too high to be reached with comfort. In fact, in a new house it should be located high to provide for the possibility of dressers with high mirrors being placed under it. For this reason a chain pull socket should be used on the bracket unless it is to be controlled by a wall switch.

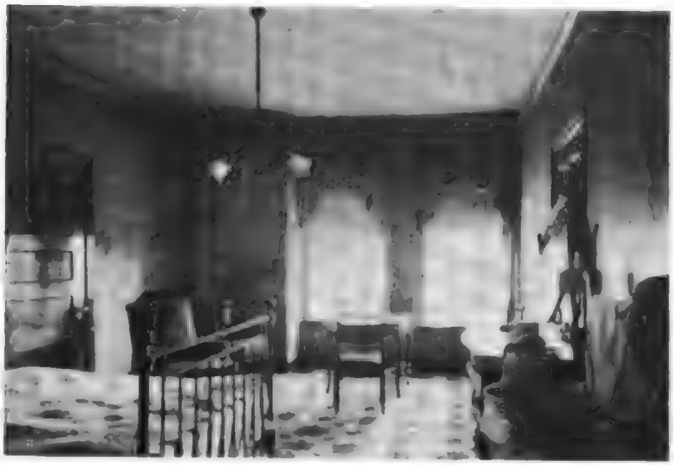


FIG. 15.—BEDROOM, BROWN PALACE HOTEL, DENVER.

Fig. 13 shows one of the bedrooms in Hotel Astor, New York. Here the dresser is lighted by two vertical 16-cp lamps placed on a bracket above the mirror. These lamps are equipped with Pagoda prismatic reflectors of a concentrating type and throw a very powerful light down on the person standing in front of the dresser and some light is reflected from the cloth on the dresser to the chin so that shaving is possible, though not altogether easy because of the shadow under the chin which is relatively much darker than the face. This scheme is hardly practicable where less than two 16-cp lamps are used, as that amount is needed to secure sufficient reflected light from the white cloth on the dresser to light under the chin. With lamps on each side of a mirror, lamps as low as 4-cp can be used with excellent results. In Fig. 13 the general lighting of the bedroom is beautifully accomplished by three 16-cp lamps at the ceiling, with Pagoda reflectors. These lamps have frosted bulbs and the room is well illuminated to its farthest corners so that reading can be done in any place in the room, although the light is much the strongest under the chandelier. The number and candlepower of lamps in this bedroom is larger than would usually be demanded in a private house, since in a hotel of this class, it is necessary to provide ample light to suit the most exacting rather than to attempt economy. The chandelier arrangement, shown in Fig. 13, for general lighting, would not be satisfactory without good reflectors on the lamps, and in fact, was not satisfactory before efficient reflectors were used for throwing the light down where it was needed.

Fig. 14 shows a peculiar lighting arrangement in one of the bedrooms at the Claypool Hotel, Indianapolis. The arrangement is remarkably unsatisfactory and inefficient. At the far end of the room is a two-light fixture suspended from a wall outlet. This in itself, is bad for mechanical reasons, and the fixture is of very little use where it is located, as it is almost over a radiator, so that it cannot be used to advantage either for the dresser or for reading. The two lamps used on this fixture might have been placed to much better advantage on each side of the space now occupied by the picture, in which case the dresser should occupy that location. The three-light chandelier in the middle of the room, in order to give the best general illumination in the room, should be higher and equipped with reflectors. The chandeliers in this room have roughed white shades, which are excellent for diffusing the light, but they do not cover the filaments and they let entirely too much light escape upwards. The room is not well lighted in all parts, even though the number of lamps is sufficient to more than accomplish this. It will be instructive to compare this room with that shown in Fig. 13, as the same amount of current is used in both cases and the room shown in Fig. 13 is much the better lighted.

Fig. 15 shows one of the bed rooms in the Brown Palace Hotel, Denver. Although it is not perhaps apparent from the photograph, the room is very long and narrow. The chandelier is equipped with corrugated, glass, bell shades, which act to some extent as prismatic reflectors, although very inefficient ones. The notable mistake made in this case is that the lamps are pointed cross ways of a long, narrow room, so that the maximum light is thrown on the side walls opposite the chandelier, leaving the ends of the room in comparative darkness. This is a common mistake, as there seems to be some kind of a tradition among architects and electric light wire men that a two-light chandelier should be pointed crosswise instead of lengthwise of a room or hall. If the lamps were bare and not equipped with reflectors, this would be the best arrangement, but when reflectors are used, lamps should be pointed lengthways of a room of hall. In this bedroom no provision is made for dresser lighting, so that the dresser must be moved into the middle of the room if the user thereof is not to stand in his own shadow.

The Springfield, Ill., Light, Heat and Power Co.'s Station and System.

THE Springfield Light, Heat & Power Company, of Springfield, Illinois, has recently built a new power station, for lighting, steam and hot water heating and railway purposes. This power station is notable on account of the size of the exhaust steam heating system supplied from it. In the majority of cities where exhaust steam or hot water heating is being done, the power stations are of much smaller capacity. The heating system of the company at Springfield, is one of the largest operated by any electric central station company in the country. About 200,000 sq. ft. of hot water radiators and 150,000 sq. ft. of steam radiators are connected to this station. On account of the exhaust steam heating load, the station is, of course, equipped with simple non-condensing engines.

The station is also interesting to electrical engineers because of the fact that during a part of the day, motor-generators supplying the alternating-current lighting and power system are operated off the railway bus-bars. This is done with a voltage regulation which is entirely satisfactory, as will be seen later. The station is located about five blocks from the center of the business district and is alongside a railroad. The coal is obtained from mines near the city. The coal now used is screenings which cost about 70 cents per ton.

Fig. 1 is a drawing showing a typical cross section through the power station giving the general arrangement of apparatus. The engine and boiler rooms are each 54 ft. wide and 150 ft. long. One of the notable things about the design is the large amount of room behind the boilers between the boilers and engine room walls. This space was allowed by the designers to provide for the exhaust steam and hot water heating apparatus, and this apparatus occupies a large portion of the space; although it is not shown in the cross sectional drawing, Fig. 1. Part of the basement under the boiler room is utilized for fuel economizers, which in this case are used to heat water for the heating system, as explained later.

A view of the engine room is shown in Fig. 2. This photograph was taken from the 20-ton traveling crane made by Pawling & Harnischfeger, of Milwaukee. The engine room necessarily contains several kinds of generating machinery, because of the various kinds of service given, some of which classes of service are relics of the old days.

Beginning with the light and power apparatus, there is one 800-kw, 2,300-volt, 60-cycle, three-phase generator direct-connected to a Fulton Corliss engine. There is also one 300-kw generator of the same voltage and frequency. There are two 100-kw, 250-volt, direct-current generators for power service direct-connected to Ideal engines.

In the railway department, there are two 550-volt direct-current generators, one of 800-kw driven by a Fulton Corliss engine, and one of 400-kw driven by a Bates Corliss engine.

There are several motor-generator sets. The largest of these is of 425 kw. On one end of its shaft is a 2,300-volt, three-phase, 60-cycle, alternating-current motor or generator, and on the other end a 550-volt, direct-current motor or generator. This set is used for either supplying the alternating-current power and light load from the railway bus-bars, or for supplying the railway load from the alternating-current bus-bars. Another motor-generator consists of an 100-hp, three-phase, induction motor, connected to a 75-kw, 250-volt, direct-current generator used for supplying the 250-volt power load. It is the usual practice at the present time to operate one of the large railway generators during the day to supply both the power and lighting load, the lighting load being carried by the large motor-generator.

The boiler-room contains 8 water tube boilers, six of which are Stirling of 414 hp, and two Babcock & Wilcox, each of 264 hp. All these boilers were built for 150 lbs. steam pressure. The stacks are of steel 60 ft. high above the grates and induced draught apparatus is used, for which purpose there are two 14 x 14-in. Buffalo Forge engines driving 18-ft. diam. x 5-ft. fans. The boilers are equipped with Green traveling link grates. Coal is shoveled from cars on the side track as indicated, just outside the boiler room in the space in front of the boilers and from there is shoveled into the hoppers of the mechanical stokers. Overhead storage bins are to be added later. Ash-conveying machinery was provided in the basement, but on account of troubles from breakages of the conveyors this conveying system is being abandoned in favor of dump cars which will be hoisted by an elevator of the hydraulic plunger type, located at one end of the boiler room.

Green fuel economizers with 11,500 sq. ft. of heating surface in three sections are located in the basement in a by-pass flue. These are used for heating water for the hot water heating system. A diagram of the piping connections is given later. There are six Yaryan-Stahl condensers each having 500 sq. ft. heating surface, for heating water from the exhaust steam. There are two Schott condensers each of 3,000 sq. ft. heating surface for the same purpose.

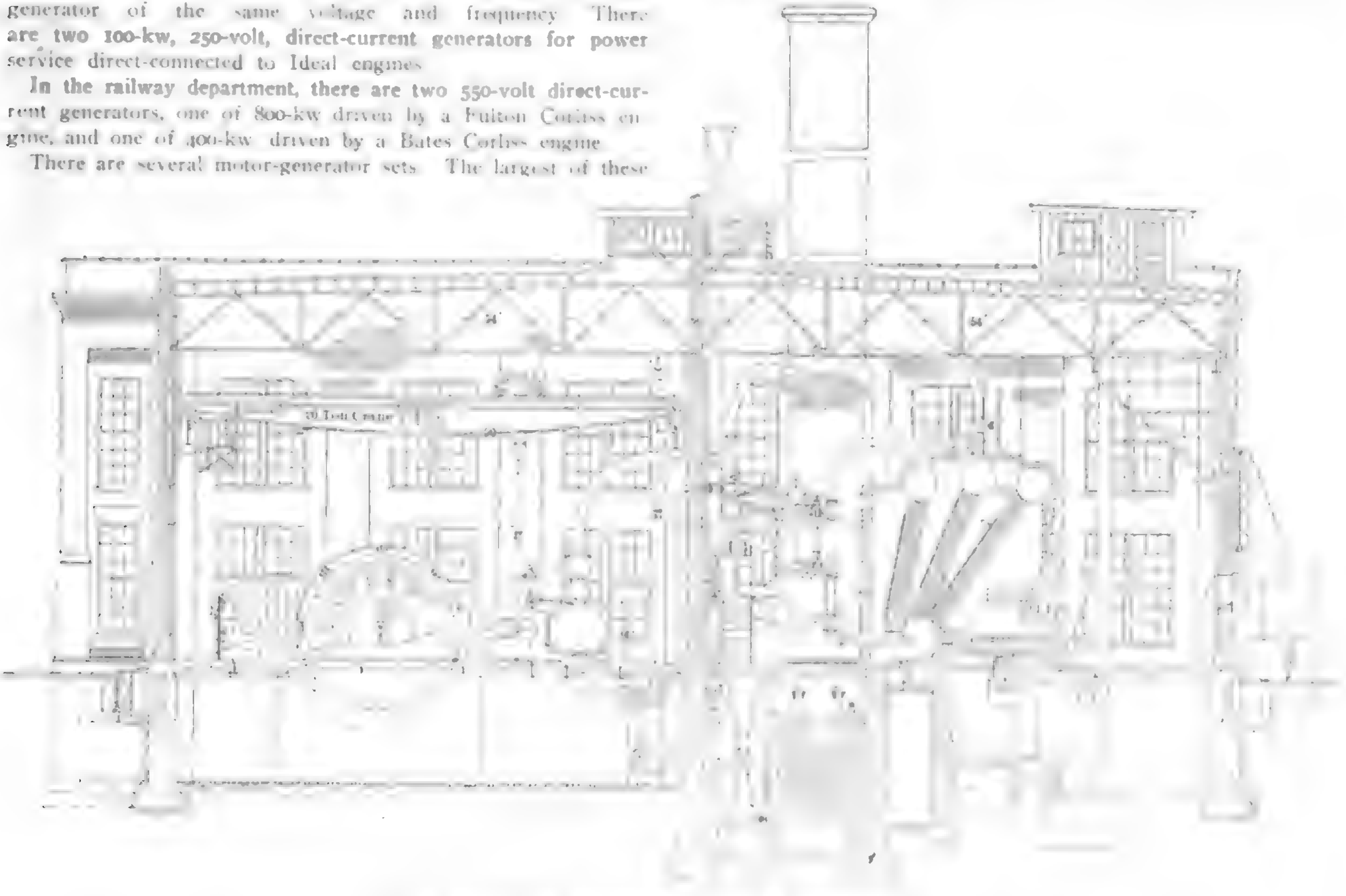


FIG. 1.—SECTION OF POWER STATION, SPRINGFIELD.

Three hot water circulating pumps for the hot water system have been installed, one of which is 15x16½x18 in., and the other two are 14x12x18 in. All are of the Laidlaw-Dunn-Gordon make.

For feed water pumping, one Worthington admiralty type pump 12x9¼x10 in. has been provided; two other pumps being available as feed pumps in case of emergency. Another feed pump is being purchased, however; the dimensions of which are 14x10x15 in., of Dean manufacture. Two horizontal 9x5¼x10 in. Worthington pumps are provided for feed water and other uses. Two open feed water heaters each of 1,000 hp are in use; one of Cookson and one of Cochrane make.

The station is piped for compressed air, which is used for cleaning armatures, and also supplying the automatic temperature regulators, which are used in all building where hot water service is supplied. A Westinghouse locomotive air pump maintains the air pressure. In the basement is a laundry for cleaning waste.

The station is kept very neat and clean; one thing which adds to the neatness of the concrete engine room floors being that a good floor paint for cement floors is used, which seems to act as a filler for the natural roughness of the cement, and prevents the oil from getting into the cement floors so that it cannot be removed. After the floor was so painted, it was very easy to keep it clean. The paint used is the Diamond brand floor paint furnished by the Billings, Chapin Company.

STATION PIPING FOR HEATING SYSTEM.

As said before, the apparatus for hot water and exhaust steam heating occupies considerable space in the power house, and is of much more importance than usual in a power house doing this kind of work. It will be noticed from the enumeration of the power house apparatus, that there are two sets of condensers for use in heating water for the heating system which are supplemented by a bank of fuel economizers for utilizing the heat in the fuel gases. Even these three means of heating are not sufficient in the coldest weather, and two of the boilers in the station have been fitted up so that they can be completely filled with water and used as hot water heaters. The present arrangement of piping for hot water heating in this station is of interest because it represents the result of the company's experiments and experience along this line.

Fig. 3 is a diagram showing the general scheme of the hot water circulating system inside the station. The return water as it enters from the street (Fig. 3), first goes through the circulating pumps from which a 12-in main takes it to a header to which are connected the six Stahl condensers in multiple. In multiple with these condensers there are also three fuel economizers. After leaving the economizers and first bank of condensers the water passes to the two 3,000-ft. Schott condensers. These latter condensers are also connected in multiple. After leaving the Schott condensers, all the water must pass through the water-tube boilers, which are connected in series, unless the by-pass on the boilers is open, in which case, of course, the boilers would be out of use. After leaving the boilers the water flows to the outgoing street main.

The important thing to notice in this piping arrangement, is that the boilers are connected in series with the rest of the heating apparatus. Attempts to operate the boilers in multiple with the other heating apparatus have not resulted satisfactorily.

So far only the connections of the hot water circulating system have been considered. The connections of the condensers to the exhaust steam main which runs the length of the engine room are very simple. These condensers are simply "dead-ended" onto the exhaust main. That is, one end is connected to the exhaust main and the other is closed. The condenser, therefore, takes exhaust steam as fast it can be condensed by water circulating in the condenser. Precautions are taken to let out whatever air that may accumulate in the condenser, just as in a one-pipe steam radiator. The exhaust steam main in the engine room basement is divided by valves into two parts.

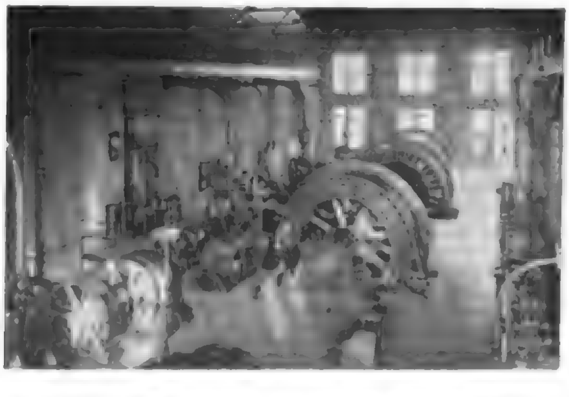


FIG. 2.—VIEW OF ENGINE ROOM.

STATION PERFORMANCE.

The station was designed with simple non-condensing Corliss engines, for the obvious reasons that the exhaust steam was needed for heating purposes. There is also a further reason that coal is so exceedingly cheap. The economical performance at this station as regards coal consumption is very interesting, because of the light it throws on the question which always comes up in station design where coal is very cheap, viz.: is the saving by compounding and condensing sufficient to pay interest and maintenance on the cost of the compounding and condensing? The coal consumption of this station, during those portions of the year when exhaust steam is not used for heating is about 10 lb. per kw-hour.

The maximum load on the station is now about 2,300 kw, of which 1,600 kw is in alternating-current output. Kilowatt-hour meter readings are taken daily. The average daily output for December was 19,153 kw-hours; the maximum being 24,207, and the minimum 14,414. The output in commercial light and power being for the month 385,338 kw-hour, while the railway output was 208,413 kw. This does not include some series arc lighting still done from another old station belonging to the company. The increase in light and power output over last year is approximately 20 per cent.

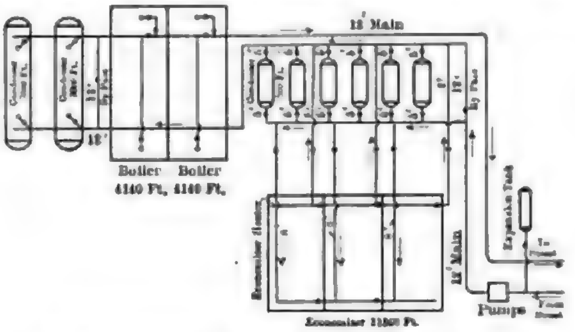


FIG. 3.—ARRANGEMENT OF HOT WATER CONNECTIONS.

Fig. 4 is a reproduction of the Bristol recording voltmeter chart, showing the voltage at the station alternating-current bus-bars for 24 hours November 19, 1905. As this was taken from the station bus-bars it includes compensation for the linedrop made at the station; the voltage being raised during the heavy load in the evening. A noticeable thing about this voltmeter chart is the regulation shown between the hours of 9 a. m. and 5 p. m., during which time the alternating-current load was supplied from the large motor-generator, the motor of which obtains direct-current from the railway bus-bars. As the railway generators are compounded to raise the bus-bar voltage, with increase of load, the railway bus-bar voltage is constantly changing, which of course, results in the changes of speed of the motor-generator. To maintain constant voltage on the generator of this motor-generator set under such conditions, a Tirrell voltage regulator is used. A few years ago, before voltage regulators were perfected a voltage chart showing such regulation under these conditions was unknown.

A remarkable record has been made by the commutator on the 400-kw railway generator in this plant. This generator, which was formerly in use in another station and frequently overloaded, has now been running about five years, and the commutator is apparently in as good condition as it was after the machine had been running a few days. No special care has been given to this commutator beyond an ordinary wiping off and a very small amount of lubrication. The brushes furnished with the generator are still in use on it.

DISTRIBUTION SYSTEM.

The company maintains three classes of circuits as follows: 2,300-volt, 60-cycle, three-phase, for power and single-phase for light; 550-volt direct-current for power supplied from the railway bus-bars; 250-volt direct-current for power.

The 550-volt motors on grounded circuit are used in places where the company could not supply them from other circuits at the time they were installed, and it was a case of the customer using a 500-volt grounded circuit motor or a gasoline engine, the insurance people seeming to prefer a well installed motor of this kind, to a gasoline engine.

The company has about 1,100-kw capacity in transformers in the down-town district, and 1,200 kw in outlying districts of which latter 250 kw is in the shape of transformers supplying power to small factories. The lighting distribution is all single-phase, three-phase being used for power.

UNOBTRUSIVE LINE WORK.

The line work in the down-town district, is notable on account of the care which has been used to make it as neat and unobtrusive as possible, and so keep down any objections to its appearance, which might result in a movement to have wires placed underground in the down-town district. For this reason secondary circuits in the down-town districts are two-wire instead of three-wire. The secondary mains are kept off of the poles as far as possible, and are run along the buildings on brackets with head guys to the building at each end. Customers' service taps can then be made directly to the main on the building, and the only secondary wiring which appears overhead in the alleys except on the building, is that run from the pole on which the transformer is located to the mains on either side of the alley. This plan not only does away with the heavy secondary mains on the poles, but with the numerous customers' service wires leading out from these mains, all of which lead to confusion of the overhead work.

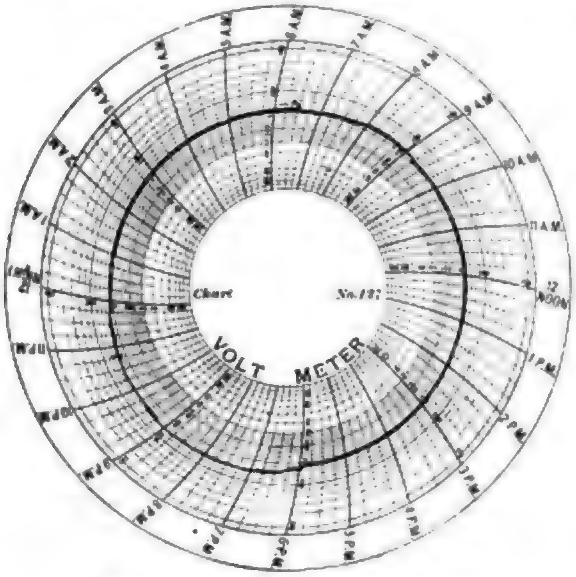


FIG. 4.—CHART OF VOLTAGE REGULATION.

In the residence district, three-wire secondary distribution is used, because of the distances to be covered are greater and the added complication of the third wire is not so important as down town.

The maximum size of transformer placed on a pole is 37.5 kw. Transformers as large as 50-kw are located in areaways. The secondary mains in each block are independent of those in other blocks, this being also a part of the general plan to keep down the amount of secondary wiring overhead. The primary circuits of transformers and branch primary circuits are provided with D. & W. enclosed fuses and cut-out boxes.

The hot water heating system is carried as far as one mile from the station. The exhaust steam heating, of course, does not cover so great a distance. The Powers automatic temperature regulators are used on all hot water services to prevent waste of heat. The company find it economical to do this rather than to depend on customers to shut off radiators when the room gets above a certain temperature; the customers' regular method is to open the windows wider.

CONNECTED LOAD.

The company has the equivalent of 40,000 16-cp incandescent lamps connected, to which should be added 1,000 alternating-current multiple arc-lamps, some of six and some of four amperes capacity, and 75 Nernst glowers. The Nernst lamps where installed have proved fairly satisfactory. The company find their cost of maintenance to be about the same as that of alternating-current arc-lamps. The company owns and maintains all lamps of whatever description and furnishes free renewals on incandescent lamps, including those of "Meridian" type.

The connected motor horsepower amounts to about 1,200. On account of the capacity of the new station and the economy with which power can be produced, as well as the importance of supplying the heating load with exhaust, rather than with live steam, the company has been actively engaged in following up the business of securing both large and small power users.

Springfield is a very good city in which to secure this class of business, and this load is growing rapidly. One of the most noticeable large power contracts secured recently, is that of supplying the Springfield Boiler & Manufacturing Company, with all the power for its new factory. This contract involves 300 hp in 440-volt, induction motors. Of course a low rate had to be made to secure a contract of this kind, as a factory of this size is strongly inclined to put in an isolated plant. This contract was made with a guaranteed minimum bill per horsepower connected and a very low rate for power consumed per kw-hour. The plant is located three-quarters of a mile from the power station, and is supplied over a separate line and metered at the power station.

RATES.

The rates are based on a maximum of 13 cents per kw-hour with 10 per cent discount for prompt payment. The minimum bill for each customer is $1, but beyond this no charge is made for the connected load that a customer may have. Long-hour consumers whose power consumption is as high as 350 kw-hours per month get a rate as low as 6 cents. The rates to ordinary long-hour power consumers get down as low as 4 cents per kw-hour, the discount being based on the amount of power consumed. By this arrangement elevator motors which take but a small amount of energy per month in proportion to their maximum demand bring a high rate, as it is considered they should.

Steam Department.—Direct radiation, 25c. per sq. ft. per annum; indirect radiation, 30c. per sq. ft. per annum; economizing coil, 15c. per sq. ft. per annum; meter rate, 50c. per thousand pounds water, with discounts for quantity.

Hot Water Department.—Per sq. ft. radiation, 15c. The payments are made in eight installments as follows: October 1, 5 per cent.; November 1, 10 per cent.; December 1, 15 per cent.; January 1, 20 per cent.; February 1, 20 per cent.; March 1, 15 per cent.; April 1, 10 per cent.; May 1, 5 per cent.

METER TESTING.

The practice of the company is to bring in residence customers' meters for test every six months, and commercial every four months. The company has connected about 2,800 meters and five men are employed on the work of installing, bringing in and testing meters. The meter-testing board is shown in Fig. 5. Both wattmeters and watt-hour meters are used in testing. An alternating-current induction meter is being tested on the left-hand panel. The meter under test is seen at the right bearing the number 2818. This meter happens to be of the Westinghouse type with glass case. In series with it is a Stanley watt-hour meter seen just at the left of the

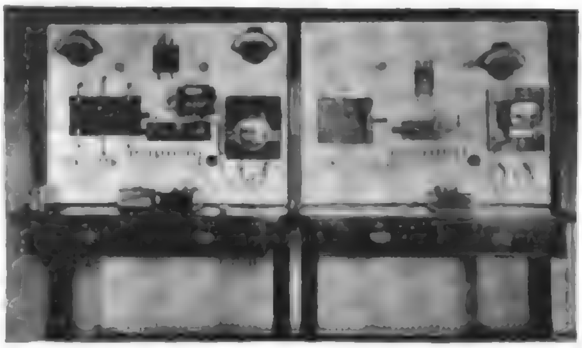


FIG. 5.—METER TESTING BOARD.

meter under test. On this Stanley watt-hour meter, one division of the first dial equals 3,000 watt-seconds, so that it gives fairly accurate readings on short runs. It is used for testing meters up to 15 amperes capacity. A Wiston indicating wattmeter is provided, which is seen on the table in front of the board. This indicating wattmeter is available for testing up to 25 amperes without a series transformer, and from 25 to 300 amperes with a series transformer. Back of the board is a choke coil for giving the meters an inductive load. Load is obtained by lamp banks behind the board, these lamp banks being controlled by the rows of single-pole switches seen on the front of the test panels. Meters to operate on inductive loads are tested with power factors as low as 75 per cent.

PROFITS OF THE HEATING BUSINESS.

In answer to the often asked question whether heating from a central station is more profitable than condensing the exhaust steam with the economy resulting from the use of condensers, General Manager Emil G. Schmidt thinks there is no question but that a compound condensing plant would save enough coal during a year as compared to a simple non-condensing plant to more than counterbalance any profits arising from the heating business. On an investment of about $200,000 in the hot water heating system, the company gets a gross revenue of only $30,000 per year out of which to pay interest, depreciation and operating expenses of this part of the business. This in itself can hardly be called an attractive investment. Nevertheless, there are some reasons of policy why it may be well for a central station to conduct a heating business because of the tendency it has to keep down the number of isolated plants in a town and to prevent competition in the lighting business from plants established primarily for heating.

The electric lighting, railway and gas business of Springfield is all controlled by a syndicate operating similar properties in other cities.

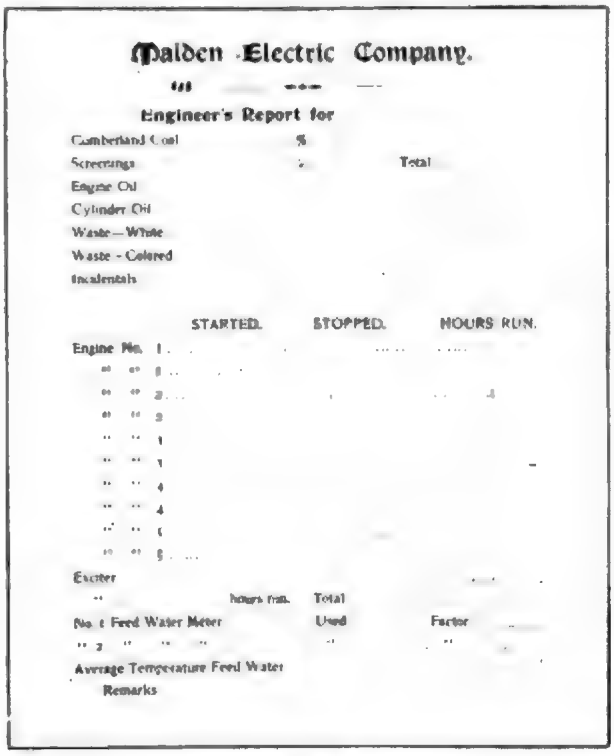
The officers of the Springfield Light, Heat & Power Company are H. D. Walbridge, president, New York; Emil G. Schmidt, general manager, Springfield; W. H. Brown, secretary, and H. T. Willett, auditor. The operation of the light, heat and power company is under the supervision of A. V. Schroeder, general superintendent, who has under him as department heads W. B. Reid, chief engineer; L. G. Eberly, chief electrician; R. L. Flannigan, superintendent of line construction; H. E. Powell, superintendent of heating, and A. D. Mackie, superintendent, new business department. The power station which has been described was built under the supervision of Mr. Schroeder, according to plans and specifications drawn up by Lichter and Jens, consulting engineers of St. Louis.

Central Station Economics in Massachusetts.

The Malden Electric Company was formed in 1885 and was an outgrowth of the Malden Electric Light Company, formed in 1880. It is under the same centralized management as the Haverhill Electric Company, Messrs. Tenney, Royce and Bradley, of 84 State Street, Boston, being the principal officials. The local manager is Mr. A. E. Bliss, with Mr. F. C. Sargent, chief electrician. The company is one of the most prominent organizations in Greater Boston and serves the four suburban residential cities of Malden, Melrose, Everett and Medford, covering 25 square miles of territory.

The power station is located in Centre Street Court, Malden, and is a remodeled plant built for efficient operation. The original station contained an antiquated outfit of belted units driven by non-condensing engines, poor coal-handling facilities and obsolete machinery in general. Production economy was out of the question in the modern sense. The new plant contains one 650-hp and three 400-hp Aultman & Taylor water-tube boilers, operating at 150 lb. steam pressure. The 650-hp boiler has 6,500 sq. ft. of heating surface and 105 ft. of grate surface. The 400-hp boilers each have 4,000 sq. ft. of heating and 78 sq. ft. of grate surface. The plant has a single brick chimney 153 ft. high with an inside diameter of 8 ft., and the furnaces are equipped with Sturtevant induced draft. There are three Rice & Sargent engines, two of which are direct-connected to a 750-kw alternator each, one to a 375-kw alternator, and a 400-hp Ames engine is direct-connected to a 250-kw alternator. All the generators are three-phase, 60-cycle machines, built for 2,300 volts. Two of the exciters are motor-driven, with one steam-driven exciter in addition. A Green fuel economizer is installed in the plant, and there is also a cooling tower system used at the peak of the load. Water is drawn from Spot Pond Brook for circulating purposes, and this takes care of about 100 hp of condensing apparatus. City water is used in the boilers. Coal is brought to the plant in wagons, dumped into a crusher driven by an induction motor and then carried to the bunkers by a mechanical conveyor system. The bunkers are located above the boilers, with automatic weighing apparatus and gravity feed. The storage capacity is 390 tons. A 16-ton crane traverses the engine room. The coal consumption of this modern station during the month of November, 1905, averaged 2.86 lb. per kw-hour.

At least twice each day circuits are tested for excessive losses or grounds. At times of light load the fires are banked in the furnaces not in active operation. One boiler is usually cold, for cleaning purposes. The economical operation of the plant is watched largely through the engineer's daily log and monthly report. The daily report blank is reproduced herewith. The power house force works on 10-hour shifts. Drawings and data are filed in fire-proof vaults at the main office.



Malden Electric Company.

Engineer's Report for

Cumberland Coal $

Screenings $ Total

Engine Oil

Cylinder Oil

Waste—White

Waste—Colored

Incidentals

	STARTED.	STOPPED.	HOURS RUN.
Engine No. 1			
" " 1			
" " 2			
" " 2			
" " 3			
" " 3			
" " 4			
" " 4			
" " 5			
" " 5			

Exciter

" hours run. Total

No. 1 Feed Water Meter Used Factor

" 2 " " " " "

Average Temperature Feed Water

Remarks

DAILY REPORT OR LOG.

The Malden Electric Company well illustrates the tendency of central station work to crystallize into a simple output of alternating current only. Not a direct-current motor or lamp is listed on the company's supply mains. The street lighting work is carried out by series arc and incandescent lamps; small single-phase motors are run off the incandescent lighting circuits; 6-amp., alternating-current, enclosed, multiple arc lamps are used in stores and factories; incandescent lighting is supplied at 2,200 volts primary with 110-104 volts secondary leads; and power on a large scale is supplied by 550-volt, 60-cycle, three-phase circuits stepped down from 2,200 volts primary. Large transformers have superseded small scattered units, the former being largely type H General Electric outfits. The company has a private branch telephone exchange at Malden, and all heads of departments are supplied with telephones at the company's expense. If a single new customer should desire power, say, 2,000 to 3,000 ft. from the company's mains, the customer would probably be charged half the total cost of line construction and be reimbursed when four customers are located on the new line. Portable watt-hour meters are used in making service tests.

The local newspapers in the company's territory are employed for regular advertisements, occasionally changed. Electric signs are used by the company at its agencies in the four cities served, and display boards of incandescent lamps are shown with the prices charged for each size. These run as follows for incandescent service:

COST PER LAMP-HOUR AT REGULAR RATES.

2 cp.	4 cp.	8 cp.	16 cp.	25 cp.	32 cp.	50 cp.
.18c	.3c.	.45c.	.75c	.9c.	1.5c.	1.8c.

At the main office in Malden an extensive display of heating and lighting equipment is made. Double show windows on the street level are utilized to advantage, and the display is changed or shifted about once every two weeks, on the average. During the Christmas season a large Christmas tree was displayed in one of the windows, illuminated in approved style by colored miniature lamps. A flashing sign is used in front of the office and the flasher, motor-driven, is mounted inside so that the public can study its operation in detail. In the office is also a marble switchboard which controls the office lighting. Upon this are mounted watt-hour meters in glass cases, which can be shown to the public and read or explained as occasion arises. Easy chairs, a neat table, settee and several popular magazines increase the attractiveness of the place and render any waiting which may be necessary in meeting appointments far from irksome.

An interesting method of advertising was practiced in 1904 by the company. Each month a 3-in. by 6-in. blotter with a small calendar upon the face was sent to customers and other interested parties. Besides the calendar, the blotter contained pithy comments suitable to the season in regard to the use of electricity. Thus, in January, heaters and sewing machine motors were discussed; in February, incandescent lamp renewals; in March, sewing machines for Easter dressmaking; in April, discounts; in May, June, July and August, electric fans; in September, sewing machine motors; in October and November, lamps, and in December, Christmas tree illumination.

Another effective piece of advertising was carried out by Mr. Ball, of the company, in connection with sewing machine motors. A sewing machine equipped with a 1/30-hp motor, was set up in the window and set in operation, sewing a piece of curtain cloth joined like an endless belt. A great deal of time and trouble was required to find the kind of cloth which would work thus automatically. Finally curtain cloth was found to be successful. The strip of cloth was then printed in large letters to tell the main facts of electric motor usefulness as regards sewing machines. These statements were fed forward one by one as the machine sewed, and they pointed out that a motor of this kind costs $15; that it saves time, trouble and fatigue, and can be operated at an expense of but one cent per hour. The electric signs at the company's agencies, where bills may be paid without taking the trouble to go to the main office, are set up in the form of an incandescent lamp, which can be seen from long distances up or down the street.

The work of soliciting new business in the case of the Malden Company has been carried out in a manner which suggests nothing short of the scientific foresight practiced by the Japanese in the recent war in the Far East. The entire territory has been canvassed with a thoroughness which leaves little or nothing to be desired in the way of information about prospective and actual customers. Two men devote practically all their time to the new business problem, and the data gathered in the campaign are filed on cards in a card index of great value. Each city is provided with a card different in color from the others, and for each building in the territory a card is filled out showing who the owner is, the occupant's name, the use of the building, a brief description of it, the number of rooms, occupant's business, the nearest main, transformer number, whether the building is wired for electricity, whether gas is used, power used, condition as to fixtures, contract data, and appointment and follow-up particulars. Upon the cards as a basis letters, appointments and personal canvassing proceed, and the work is considered complete only when the contract has been signed and the card transferred to another compartment in the index. The officials of the company thus have at their fingers' ends the details of their prospective and existing business.

The storage of lamps, transformers and meters, together with smaller supplies, is carried out in a building close by the power house. Every piece of apparatus is kept in a definite place, and labeled bins are provided for all sizes and voltages of incandescent lamps. On a second floor of this building is a well-lighted and convenient testing laboratory, equipped with a photometer room, high-potential testing set, precision wattmeter and other instruments for meter and lamp testing. Complete card index records are maintained covering all meters and transformers, with their history and tests; special tags are provided for new apparatus and the results of good organization are seen at every side. Monthly statements of transformers and meters are thus easily compiled. A convenient arrangement in the lamp testing room is the rotation of the lamp on the photometer stand by a small motor and the reversal of the rotation periodically.

The rates of the Malden Electric Company for power and lighting are set forth in detail in a small pamphlet distributed to the public freely at the offices, etc. All contracts bear a minimum monthly charge of $1 net. Deposits draw 6 per cent interest and all electricity is sold by meter rates. Incandescent rates for residence lighting are 15 cents per kw-hour from 0 to the first 33⅓ kw-hours burned in any month, and 14 cents for each additional kw-hour.[1] Ten per cent is saved from the gross amount if the bill is paid within 15 days of its date, e. g.:

ASSUME METER READINGS GIVE CONSUMPTION OF 50 KW-HOURS,
then 33⅓ kw-hour, at 15c.......................$5.00
16⅔ kw-hour, at 14c.......................2.33

Total net bill.......................$7.33
Gross price obtained by adding 10%.......................73

Total gross amount.......................$8.06

The commercial arc lamp rate varies from 7.5 cents to 3 cents per arc lamp-hour, as follows: The first 40 arc lamp-hours burned in any month by each arc lamp installed are sold at 7.5 cents up to 66⅔ arc lamp-hours—called the "primary arc lamp-hours." Above 66⅔ arc lamp-hours the balance of the 40 arc lamp-hours × the number of lamps in service is sold at 7 cents per arc lamp-hour—called "balance primary arc lamp-hours." "Secondary" arc lamp-hours are sold at 3 cents. Thus, assume 6 commercial arcs, each consuming 500 watts. The meter reading gives 300 lamp-hours, for instance. There are then 6 × 40 = 240 primary hours, of which 66⅔ cost 6.5 cents each and 173⅓ cost 7 cents each, leaving 300 — 240 = 60 lamp-hours at 3 cents each. When three or more lamps are used a 5 per cent discount is allowed; if four or five lamps, 10 per cent; if six or more lamps, 15 per cent. The minimum charge is $3 per month per lamp when one lamp only is installed, and $2 per month per lamp when two or more lamps are installed.

The commercial incandescent rates are determined on the basis of from ¾ to ½ cent per incandescent lamp-hour, of 50 watts, the primary and secondary hours being tabulated as follows:

PRIMARY INCANDESCENT LAMP-HOURS PER LAMP PER MONTH:

Jan., 50 hours.	April, 30 hours.	July, 10 hours.	Oct., 40 hours.
Feb., 40 hours.	May, 30 hours.	Aug., 20 hours.	Nov., 50 hours.
Mar., 30 hours.	June, 20 hours.	Sept., 30 hours.	Dec., 50 hours.

Secondary inc lamp-hours are the excess of the above schedule per lamp per month. The rates are as follows:

Primary incandescent lamp-hours (0 to 666), at.......... .75 cent
Primary incandescent lamp-hours (balance), at.......... .07 cent.
Secondary incandescent lamp-hours, at.......... .05 cent.

Assume an installation of twenty 16-cp lamps burning in December 2,000 lamp-hours. The primary incandescent lamp-hours are then 50 × 20 = 1,000. Of these 666 are billed at .75 cent, and 34 at .7 cent. The difference, 2,000 — 1,000 = 1,000, is billed at .5 cent. Ten per cent discount from the gross is allowed within 15 days.

"Meridian" lamps for stores are furnished free, and for houses, at cost. Renewals of "Meridian" and other incandescent lamps are free, except that high-efficiency incandescents are not renewed free for residences. The rates for motors vary from 4.5 cents to 1 cent per kw-hour, depending upon the amount of energy consumed, plus a readiness-to-serve charge of $1.50 per hp per month. Advice is freely given to customers by the company.

Wiring With Wooden Mouldings.

By Louis J. Auerbacher.

BEFORE taking up the present subject, the writer will return to the preceding article on "Exposed Wiring," printed in the first issue of last month, several points in which appear to require further explanation. In the paragraph in which fire and weather-proof wire are mentioned in connection with knob and tube residence construction, it should have been added that, though the rules specifically state that only rubber-covered wire shall be used for concealed work, nevertheless, some inspectors pass fire and weather-proof wire, and if permission has previously been given on the ground that such wire is preferable for reasons set forth. In describing the methods of passing wires through floors, as illustrated in Figs. 5 and 6, it was not intended to convey the idea that no additional protection is necessary when running from the floor up the wall, the object being only to describe the methods of passing through the floor. The wires should be boxed in or piped at least 6 ft. above the floor as explained in another paragraph of the article.

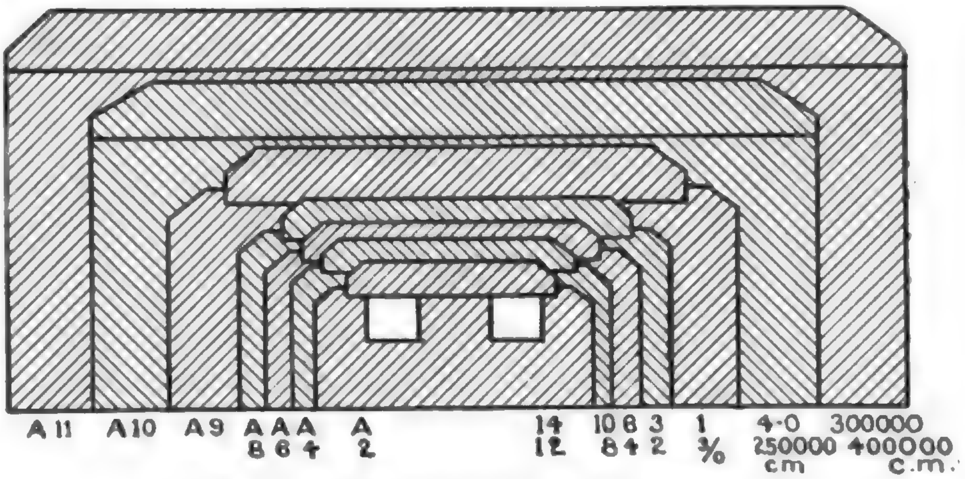


FIG. 1A.—EXACT SIZES STANDARD TWO-WIRE MOULDING.

Wooden moulding is extensively used by the electrical contractor in connection with commercial work in stores, offices and factories. By its use it is possible to make an installation of neat appearance, provided the moulding is run straight and is accurately mitered. Standard wooden mouldings are made in sizes shown in full size and cross-section in Figs. 1 and 1A, which also gives the size of wire each moulding will take. The moulding must have a suitable capping and must conform to the Underwriters' specifications as given in Rule No. 50 of the National Electric Code. Wooden moulding should never be used in damp places, or in buildings subject to fumes, such as stables, breweries, ice houses, etc.; nor should it be used on the inside of the outside walls of buildings, since these are subject to dampness. Wooden moulding should never be concealed and its use in air or elevator shafts is not permitted.

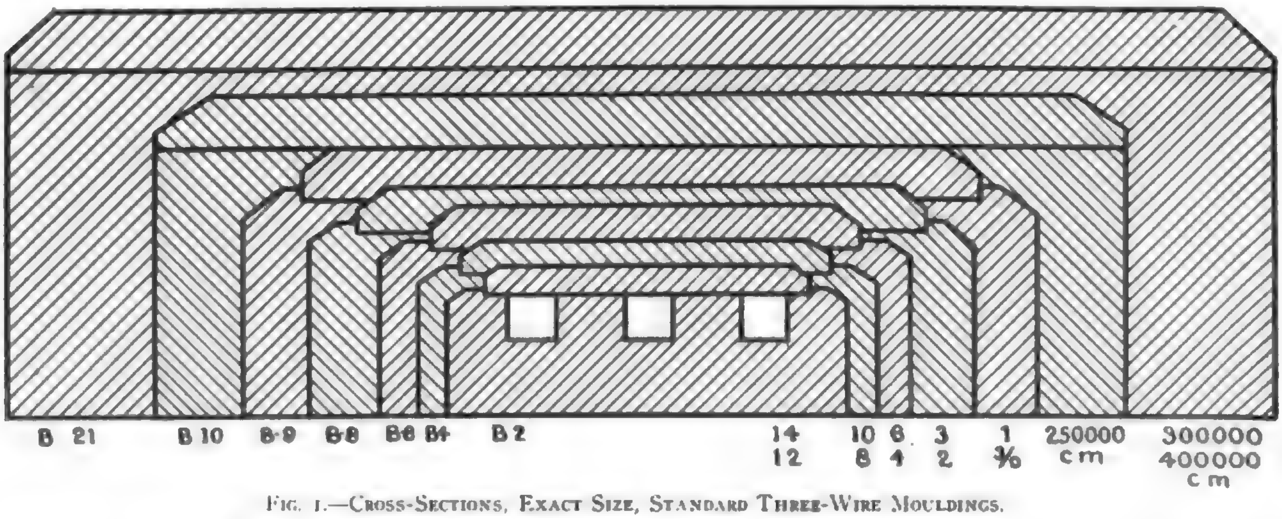


Fig. 1.—Cross-Sections, Exact Size, Standard Three-Wire Mouldings.

When buying wooden moulding the purchaser should be careful to get only good straight stock, free from knots or other imperfections. The cost of labor required to handle second-class material and "work it in" makes this practice poor economy. A good type of moulding is shown in Fig. 2. The grooves are circular and narrower at the opening than in the center. This form of groove holds the wire in place and enables the wireman to tack the capping without danger of the wire coming down. In the regular moulding, shown in Fig. 3, it is necessary to hold the wire in place with brads.

When laying out a moulding job, symmetrical designs should be followed so far as the distribution of the lighting permits. Where this is done the ceiling presents a neatly paneled appearance, as shown in Fig. 4. Moulding runs should always be finished off. That is, if an outlet is run near one end of a ceiling, "dead" moulding should be continued to the walls so as to give a finished appearance, as shown in Fig. 5.

There are many cases where special mouldings are necessary. This is especially true with private house work, where conditions are such that much fishing is impracticable and cutting is not permitted. The wood of such mouldings should match the wood in the room, and the backing should be made to conform with the Underwriters' specifications. The capping should match the trims or resemble picture mouldings. Various forms of special moulding are shown in Figs. 6, 7 and 8. In Fig. 9 is shown a scheme for wiring a room for picture lighting. The receptacles are stained to match the moulding, which should harmonize with the other woodwork. If neatly done the wiring is concealed so far as appearance goes, and this is the object sought. The feeds are fished, as shown in the illustration, there being very few rooms in which it is not possible to fish the circuit feed wires. A "concealed moulding" method of wiring bracket outlets is shown in Fig. 10. It is, of course, desirable to fish the run from the moulding to the bracket, as shown in the illustration; otherwise, the moulding must be run to the bracket from the main line of moulding around the room.

In combining concealed work with moulding, fibrous flexible tube, such as "Circular Loom" or "Flexduct," should be used. In such a combination no splice box is necessary and single-braided rubber wire may be used throughout.

In some cases wooden mouldings are permitted inside of outside brick walls which are exposed to the weather. In such cases a wooden backing one-half inch thick and painted with a moisture repellent, should be first installed and on this the moulding may be placed. Wooden moulding must never be installed in shafts of any kind; iron pipe or flexible steel are the only materials permitted.

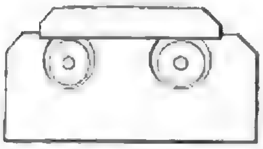


FIG. 2.

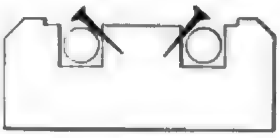


FIG. 3.

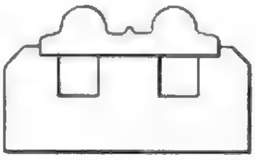


FIG. 6.

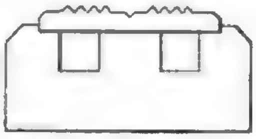


FIG. 7.

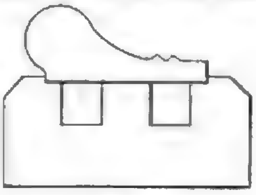


FIG. 8.

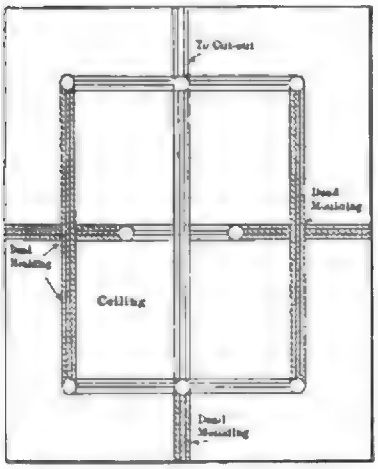


FIG. 4.

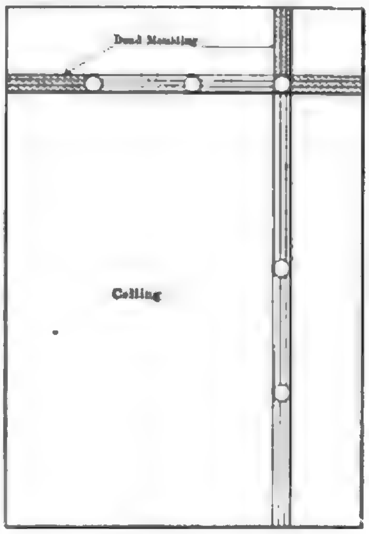


FIG. 5.

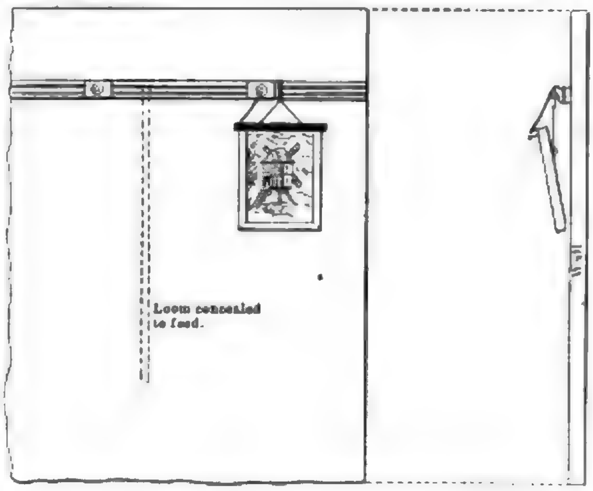


FIG. 9.

In laying out the feeders for a moulding job, it is often cheaper to use iron pipe in a shaft than to run mouldings through the floors of the building. The cost of baring floors and bushing them offsets the additional cost of the pipe, while the contractor is on the safe side and is in no danger of having an inspector compel him to take down the moulding and put up a backing for the reason that the "wall might get damp."

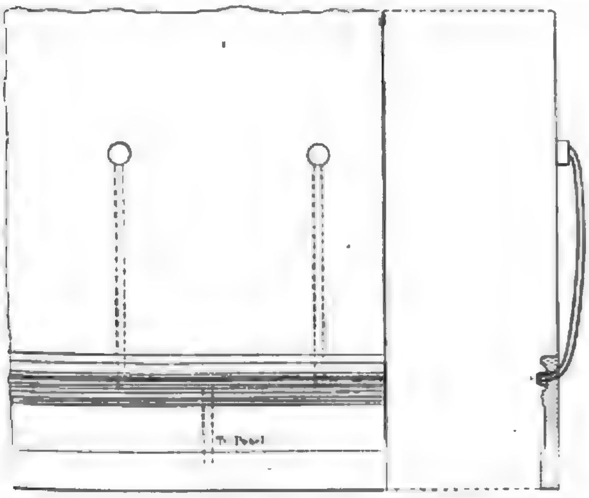


FIG. 10.

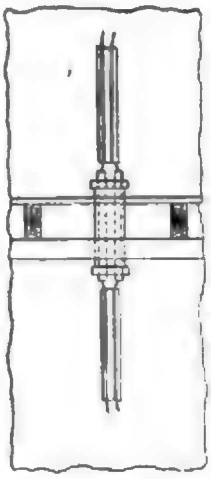


FIG. 12.

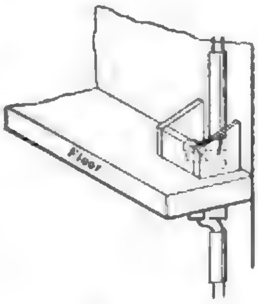


FIG. 13.

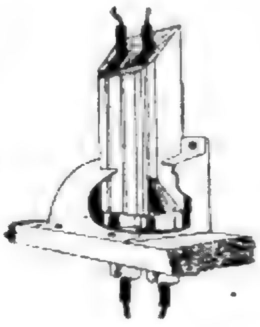


FIG. 13A.

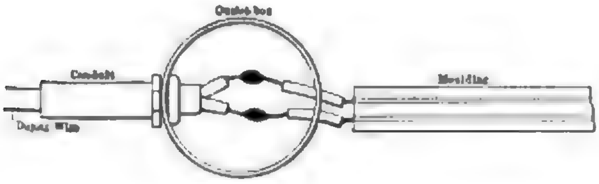


FIG. 11.

Moulding is often used in combination with conduit. When used in connection with solid pipe or flexible steel, an iron splice box is installed where the system of wiring changes. Fig. 11 shows a method of connecting a solid pipe circuit to a moulding circuit. The loom should run up to the moulding. The illustration shows uncovered wire with loom not drawn up tightly, so as to better distinguish the loom. A 4-in. outlet box with cover is used as a splice box, porcelain bushing or flexible tubes protecting the wires leading to the moulding and bushings, and lock nuts being provided on the pipe. When carrying wires from mouldings through floors, porcelain tubes or iron pipe only should be used.

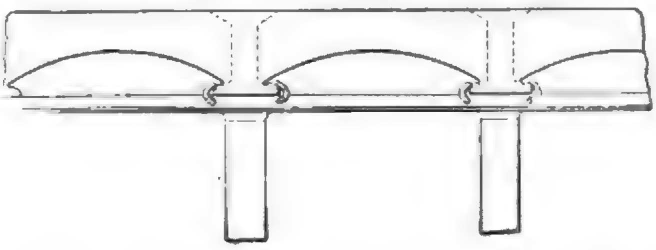


FIG. 14.

This requirement is made by Underwriters for the reason that water used in scrubbing floors will soak through fibrous tube and ground the circuits otherwise encased.

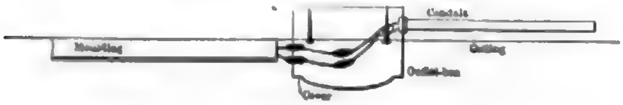


FIG. 15.

Figs. 12 and 13 show proper methods of carrying wires through floors. Where porcelain tubes are used a "kicking" block must be installed to protect the tubes from damage. The loom should be brought close to the moulding, leaving no wire exposed. Illustrations show exposed wire to show the loom better. Fig. 13A shows a device made for the purpose, which can be obtained at any supply house. When iron pipe is used for the purpose of carrying wires through the floors, as shown in Fig. 13, a flexible tube should first surround the wires. A separate pipe should not be used for each wire, since if the current is alternating, induction will result, and the Underwriters maintain that even though direct current may be used when the plant is first installed, alternating current may be substituted at a later period. When passing wires through walls or partitions, porcelain or fibrous tubes should be used.

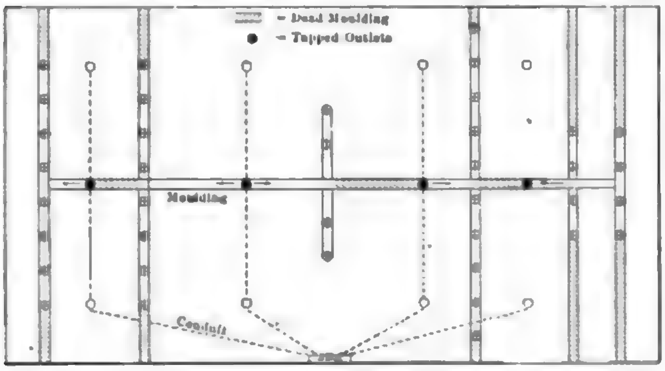


FIG. 16.

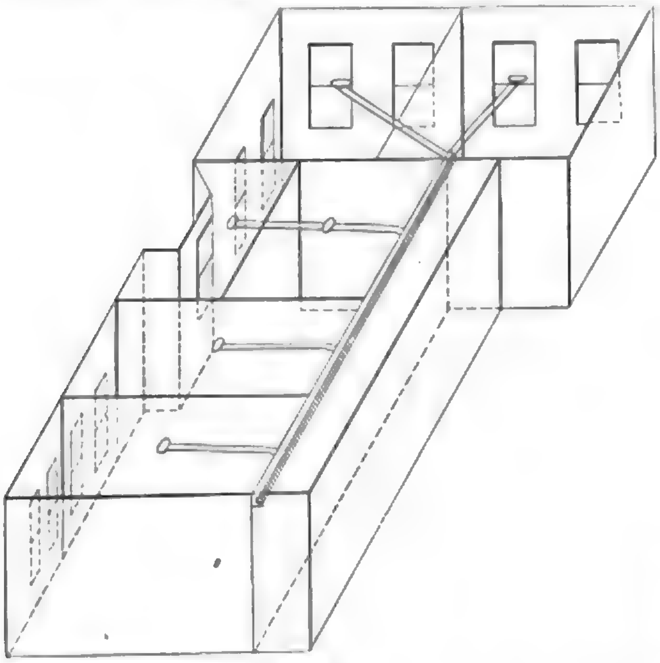


FIG. 16A.

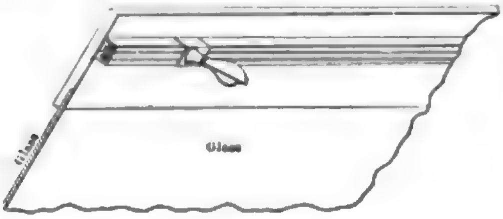


FIG. 17.

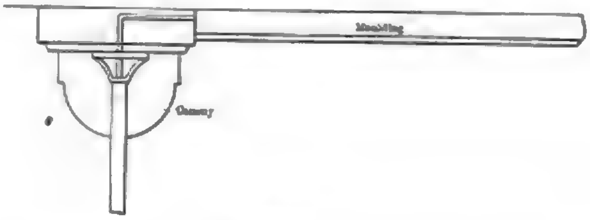


FIG. 18.

In estimating on moulding work, the nature of the surface to which the moulding is to be fastened determines the labor cost. When fastening moulding to lath and plaster, it is common practice to use long thin screws, and this is about 25 per cent more expensive than running moulding over wooden surfaces. Fireproof walls or ceilings, especially those with a wire backing for the plaster, give the most difficulty in fastening mouldings. In such cases it is necessary to drill holes which are then plugged with wood to which the moulding is screwed. The running of a hundred feet of moulding in this manner constitutes a good day's work for a journeyman and his helper.

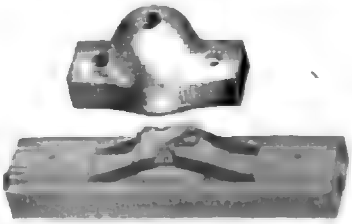


FIG. 19.

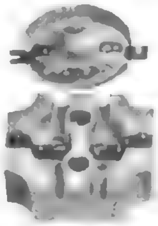


FIG. 21.

In running moulding on arched ceilings having exposed I-beams clamps are used to fasten the former to the latter, as shown in Fig. 14. In many of the modern fire-proof buildings wired with conduit, the tenants often require a number of drop lights. The circuit feeds are taken from the ceiling outlets and the wires are run in moulding. If the panel has no directory it will be necessary to make a diagram of the circuits and tap the outlets in such a manner that the 660-watt limit is not exceeded. When estimat-

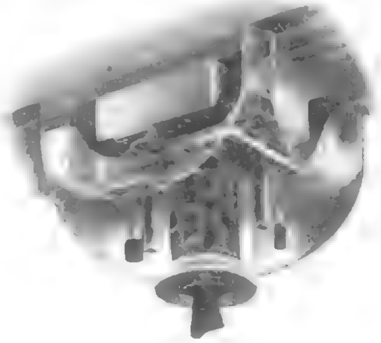


FIG. 20.

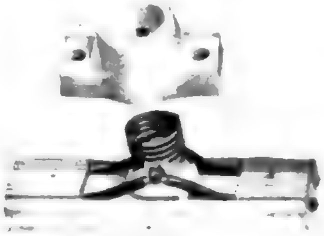


FIG. 22.

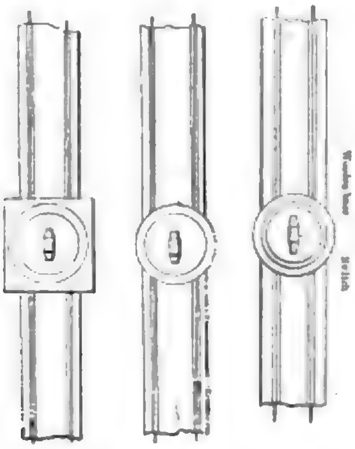
FIG. 23.

ing on such work the contractor should ascertain the capacity of the existing outlets, so that his estimate may be made to cover any additional circuit runs to the panel that may be required. When tapping the outlets for circuit feeds an iron outlet box with cover should be used. The wires in the unused outlets should be taped and caps or covers put over the boxes. Fig. 15 shows a method of tapping the outlet for moulding work, as described. Two long screws hold the one splice box up to the outlet box already installed. The loom should run close to the moulding so as to leave no wire exposed. Fig. 16 shows the wiring scheme of a fire-proof ceiling, in which the existing outlets have been tapped and wire run in the moulding as described. The "dead" portion of the moulding is indicated by the shaded parts.

Moulding wiring is frequently used in combination with flexible fibrous tubing, and for certain finished residence and apartment house work, makes a good, cheap combination. Moulding is used for the circuit feeds, the concealed runs to the outlets being made by wires tapped to the feeds and enclosed in fibrous tubing. As no splice boxes are required, this method is neat and cheap. Fig. 16A illustrates an apartment wired in this manner. If the ceilings are furred, an apartment of this kind should be wired in two days by a journeyman and helper, without breaking either walls or ceilings. The feeds are run up through the halls and cut-out box and meter loop should be provided for each apartment.

Keyless receptacles set on mouldings are used in wiring store windows, where the expense is to be a minimum. An aluminum reflector requiring no shade holder is used. Fig. 17 illustrates this combination. Moulding cut to length, with receptacles and wires all in place, may be made up at the shop and installed in the store window in a short time. The reflectors should not be spaced more than 12 in., and if dark goods are shown or if the window is deep or high, not more than 6 or 8 in. If the frame of the window is not wide enough to conceal properly the lights a curtain should be used; or better still, a dark strip about 8 in. wide may be painted on the window at the top. This strip may also be used as a transparent sign. This method of window lighting gives as good results as can be obtained by the use of mirror-trough reflectors and has the advantages of cheapness and quick installation. Mirror troughs must be made to fit the window, and if run on the sides a template of the miter at the angle must be sent to the manufacturer. All of this, of course, requires time and involves the risk of making mistakes in measurement and of breakage in transit.

Rubber-covered wire only should be used in moulding. Single-braided wire is used in this work. When changing from moulding to conduit, double-braided, rubber-covered wire must be spliced to the single-braided wire for pulling in the conduit. Where fixture outlets are installed, a circular fixture block 4 or 5 in. in diameter should be used. This not only gives a good support for the fixture, but also makes a neat backing for the fixture canopy. The wires are brought through the fixture block, as shown in Fig. 18; otherwise, it would be necessary to cut the canopy and thus disfigure it. Porcelain rosettes for use in connection with drop lights are shown in Figs. 19, 20 and 21. The rosette shown in Fig. 21 can be used either with or without fuses. Those shown in Figs. 20 and 21 are preferable for regular work, since they can be mounted directly on the moulding and at the same time are much neater in appearance. The receptacles shown in Figs. 22 and 23 are used for moulding work. The former is preferable, since it may be installed much more quickly. When installing the receptacle shown in Fig. 23, care must be taken that this is not placed in a position where it is liable to be injured; otherwise, it must be protected by a box.



FIGS. 24, 25 AND 26.

The snap switches used in moulding work should be mounted on a porcelain back, as shown in Fig. 24. By using such a back the wires are easily and neatly brought through the switch. Snap switches should not be installed as shown in Fig. 25, that is, directly on the moulding with no back; and if no porcelain backs are at hand the switch should be mounted on a round grooved block, as shown in Fig. 26.

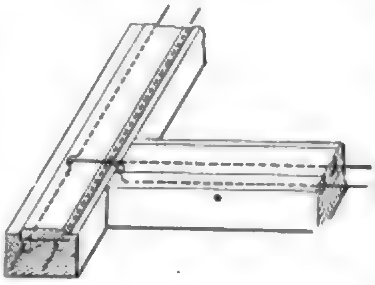


FIG. 27.

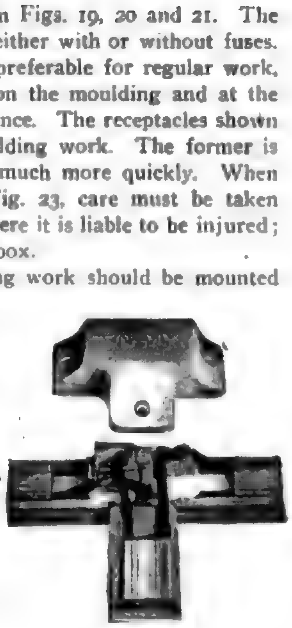


FIG. 28.

In branching off in moulding work, the tap is made as shown in Fig. 27. A good fitting for tapping circuits is furnished by the porcelain device shown in Fig. 28, by means of which time spent in splicing and soldering may be saved. It is almost needless to remark that if good work is to be done the workmen should be furnished with proper tools, including a good saw and miter box.

Repair Shop Notes.

By T. Barnard.

In order to make a success of testing electrical machinery to locate faults, certain special apparatus is very convenient. For the common class of work an auto-transformer is useful, and the details of construction for such an apparatus are given below, in connection with Fig. 1. No difficulty should be experienced in making this apparatus.

We first make our stampings, which may be cut in any tinsmith's shop. There are 300 pieces of armature iron No. 24, 3½ in. by 2 in., and 33 pieces, 7 in. by 2 in. The two legs of the transformer are assembled and pressed to 3-in. thickness in a vise. The best method is to begin to pack stampings together in twos. The second two is placed 2 in. along the first two, and this staggering is kept up until the three inches are made. Usually fifty of these punchings are required for one inch. They are then bound up with a piece of wire and are ready to place on the insulation. It will not be necessary to provide insulation between the stampings, since the apparatus will only be used intermittently. To insulate the core is bound up with about three layers of strip cotton and then varnished. A good quality of cardboard is next bound down with cotton and varnished. This will prevent injury to the wire when bending around corners in winding. The core is insulated to within 2 in. of each end, leaving 5 in. of winding space in the center. For 110 volts, 60 cycles, alternating, there are twenty sections in the winding, or ten on each leg. Each section of twelve turns is wound three wide and four deep. After being thus wound the two legs are placed together and their windings connected in series, care being exercised that no sections are connected in opposition. The small "keeper" stampings must then be put in position, and care must be taken that they are not driven into the windings.

After the transformer is thus assembled it should be connected to a controlling switch for the regulation of the testing e.m.f. It will be noticed that every button of the switch is a dead one, thus preventing a section from being short-circuited by the switch contact.

The first test to be noted is that of an armature, as in Fig. 2. The leads are contacted at the brush positions of the armature, diametrically opposite in the case of a bipolar, and 90° apart in the case of a four-pole machine, and so on. A telephone receiver is used, the sound therefrom indicating the condition of the coil insulation between the bars, the telephone contact being made between adjacent bars. The voltage should be adjusted so that a fairly loud hum will be heard in the telephone receiver. If the coil is short-circuited the hum will be reduced in loudness and sometimes not be audible. If there is an open circuit at the bars tested an excessively loud hum will be heard. A little practice will soon make one confident in carrying out these operations. A current indicator (marked *A* on Fig. 2) or a low-voltage glow lamp will show whether the armature is short-circuited between coils, the lamps brightening up at a short-circuit. In this case the voltage at the transformer should be about that of the lamp. By this method a fault may be usually located within one or two coils without breaking the connections of the armature. Sometimes a commutator fault consists merely in the presence of particles of metal between segments, and if the transformer is adjusted to five or ten volts, these may often be burnt out without doing any harm to the commutator, thus saving much time in locating and picking them out. In testing out the winding of an induction motor an exploring coil arrangement should be made to span the phases. When a current is sent through the different phase windings, a distinct hum should be heard at every pole. This method saves much trouble in testing out polyphase windings. I have used the tests above described and have found them quite satisfactory

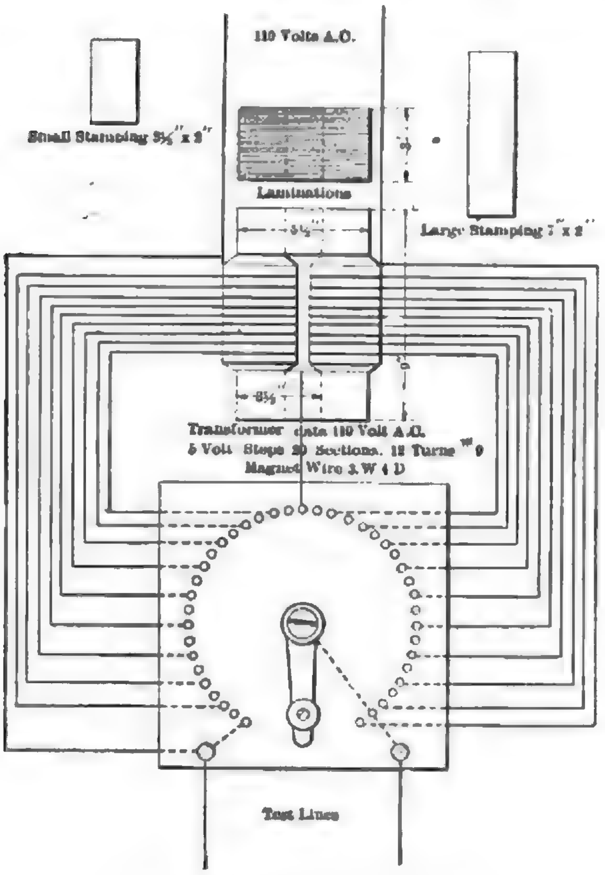


FIG. 1.—CONNECTIONS FOR TESTING

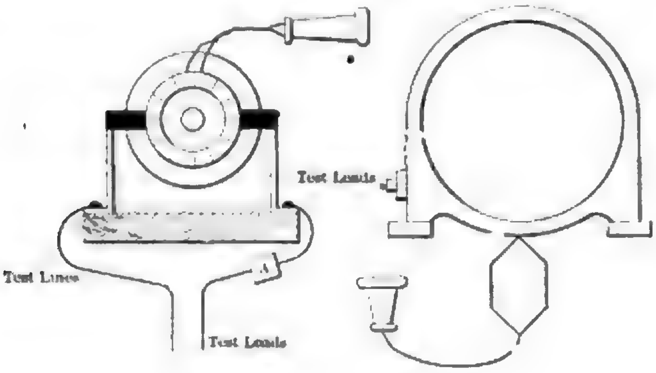


FIG. 2.—TESTING AN ARMATURE.

The Rome, N. Y., Gas, Electric Light and Power Company.

The Rome Gas, Electric Light & Power Company controls the entire gas, electric light and power business at Rome, N. Y., a city on the main line of the New York Central & Hudson River Railroad having about 20,000 inhabitants. The gas and electric light stations are located on the Erie Canal, and the local offices of the company are situated on North James Street. The company has a perpetual gas franchise, owns over fifteen miles of mains and has an annual gas output of over 32,000,000 cu ft. The net prices of gas for light and for fuel are $1.50 and $1.20 respectively. The equipment at the electric generating station consists of three 150-kw, three-phase, 2,200-volt, 60-cycle revolving-field alternators, one 50-kw, 500-volt, direct-current generator, one 75-hp, 220-volt, three-phase motor, Russell engines and Stirling water-tube boilers.

At present affairs at the station are in more or less of a transition state, it being the intention to shut down the station shortly and use energy from Trenton Falls. For this purpose three 500-kw, water-cooled, oil-insulated transformers are being installed to step down the 20,000-volt current to 2,000 volts for distribution over the company's lines. The transmission lines run from Trenton Falls by way of Utica. The poles, which are 71 ft. 6 in. long and stand 64 ft. above ground, are already erected, and in about another month the company expects to be able to shut down the generating equipment at Rome, and convert the station into a sub-station; the present equipment, however, will not be scrapped, but be held in reserve for emergency use

The distribution circuits are all overhead, and alternating-current is used almost exclusively, transformers on poles stepping down the voltage for commercial use where necessary. The company has a six-year contract to light the city on an all-night basis with 6.6-amp. enclosed arc lamps at 31 cents per lamp per night or $113.15 per lamp per year. The streets are heavily shaded by trees so that in most cases the lamps are suspended over the middle of the roadway. Commercial lighting is done by about 4,000 16-cp, alternating-current incandescent lamps.

For getting new business the company employs two solicitors, who devote their time mostly to increasing the power load. Advertisements are carried in the daily papers, pamphlets are occasionally distributed, and bill-board and pole advertising are resorted to. Pole advertising is devoted chiefly to increasing the sale of coke, which is a by-product of the gas works. Four incandescent lamps, two on each side of the pole, are so placed that persons walking up or down the street have their attention directed to a lighted sign on which is clearly printed in Gothic letters "Coke" or "Use Coke for Fuel." Every pole owned by the company and situated on the main thoroughfares is thus equipped. Little seems to be done to increase the sale of electric energy for domestic lighting. The office of the company is brilliantly lighted at night by numerous forms of Welsbach mantle lights situated along the walls and by Meridian electric lights which stud the ceiling. Gas arc lamps are used outside the building in front of each window and a large electric sign advertising coke is placed on a post at the curb. Gas fixtures, stoves and appliances are on display. The company finds a greater demand for gas for lighting and cooking purposes.

The company carries out inside construction and wiring, besides selling motors and appliances. Electricity is sold by meter, the rates to consumers using energy for lighting and power for motors of one horse-power and less ranging from 15 cents per kw-hour to 11 cents, depending on the quantity used. A discount of 10 per cent is allowed on all bills paid on or before the 10th of the month following that in which electric energy was consumed. The minimum charge for electric service per month is one dollar. Some direct-current at 500 volts is used for power. The service is maintained from 7 o'clock in the morning until 6 o'clock at night, Sundays and legal holidays excepted. The company is discouraging the use of direct-current for power purposes and will not accept any new business nor extend any service on this system. The rates vary from 5.96 cents per hp-hour to 2.38 cents and a discount of 5 per cent is allowed on all bills paid on or before the 10th of the month. A minimum charge of 20 cents per hp per month is made on all motors larger than one horse power for "readiness to serve" where the motor remains connected to the company's lines. Special inducements are now being made to consumers of alternating-current for power, and the alternating-current power load has trebled within the last six months. In fact the demand for 60-cycle alternating-current for power has far exceeded the supply, and the company is holding off prospective customers until the line from Trenton Falls is complete. The rates vary from $.0596 per hp-hour to $.0125, depending on the quantity consumed. Prompt payment is rewarded by a discount of 5 per cent, and a minimum charge of 20 cents per horse-power per month is made on all motors larger than one horse-power for "readiness to serve."

As is frequently the case where gas and electric plants are combined, it would appear that the interests of the electrical department suffer so far as relates to incandescent lighting, being considered merely as an auxiliary for arc lighting and power service.

The company is controlled by the United Gas & Electric Company, of Detroit, Mich. The president of the company is Mr. James T. Lynn, of Detroit, Mich; Mr. R. A. Field, of Rome, is superintendent; Mr. C. Chambers, chief engineer, and Mr. T. Lynch, chief electrician.

Advertising Follow-Up Methods for Central Stations.

By Frank B. Rae, Jr.

A follow-up system is built upon the same principle as a bulldog. It is founded on the never-let-go theory which presupposes the recipient of the follow-up matter to be a prospective customer who in time may be persuaded, argued, enticed, or hectored into buying. The system is designed to place selling arguments before the prospective buyer from twelve to fifty times a year. This cannot be done by a solicitor except at prohibitive expense. It can be accomplished successfully by following-up for from half a dollar to two dollars per prospect per year.

The follow-up advocate takes it as granted, before he puts his system into play, that each prospect is "alive," and that in order to bring him into line, it is necessary to:

(a) Supply complete information touching the product for sale, its uses, advantages and superiority.

(b) Appeal to the thriftiness and home pride.

(c) Overcome prejudices, just or unjust, which may exist against the advertiser.

(d) After the prospect is otherwise won, overcome the common failing of procrastination and close the sale.

He does this by a series of direct-by-mail advertisements which aim to touch successively each chord until the prospect surrenders. Theoretically, he perseveres till the prospect buys or dies.

Follow-up methods are as various as the men who design them, but it is safe to assert that, in the case of central stations, no such scheme will be successful which does not embrace the co-operation of well-drilled solicitors and friendly newspapers; or which is not well and carefully planned and systematized in advance of the first mailing. A disjointed succession of diversified mail-cards, folders and letters does not constitute a follow-up system. It cannot be counted upon to give consistent, dependable results. At best, it is but a hodgepodge, issued hurriedly and at random, or when other business is pressing, not issued at all.

As a preliminary to any aggressive follow-up campaign for business, the newspapers should be cultivated. They should be supplied with non-technical news items on electrical subjects of interest to their readers; with information on which to make announcements of improvements in the local plant, any reduction in rates, extension of lines, or other improvement and requested to add comment, pointing out that the company is voluntarily and aggressively bettering its service. This may look like a long order to some lighting companies, but it is worth all it costs, especially now, when the public is being lashed to a fury against utilities corporations, the "money power" and the "trusts." The purpose of favorable newspaper comment is to prepare the way for favorable or, at the worst, neutral reception of the follow-up matter; for without such neutral reception, your advertising will have the double duty of first overcoming whatever prejudice may exist against the company, and then persuading the public to get on circuit.

The actual follow-up matter should be planned, prepared and systematized with very strict regard to local conditions, the attitude of press and public, and the class or classes of people who are being solicited. It is in the planning and systematizing that such a campaign wins or loses—in the logical sequence of the advertising used; in the careful manner in which inquiries are to be acknowledged and followed, and in strict adherence to both the condition and the policy of the company. All the various mailing cards, letters and folders should be written and designed in advance. The system of handling inquiries, of checking and revising the mailing lists, of adapting the solicitors' labor and reports to the mutual benefit of both solicitors and the advertising—these are all vitally important points to be settled before a single piece of matter is issued. Having settled them the actual follow-up work resolves itself into the very simple proposition of seeing that the matter goes out promptly on the scheduled dates, that inquiries are carefully checked, followed and reported upon and that the enthusiasm of the soliciting force is kept at red heat.

When it is understood that the chief object of the follow-up is to pave the way, introduce and make definite appointments for the solicitors, the importance of having the latter always enthusiastic, always aggressive, will be appreciated. To be sure, the advertising will bring many voluntary contracts to the office, but the campaign should be educational rather than importunate; it should be tactfully insistent in presenting the advantages of central station service, rather than bluffly demanding business. The actual business-getting must, and always will, remain with the soliciting force. Advertising was never intended for, and never successful in, actually making sales except in the case of "mail-order" propositions.

The follow-up method, so far as the central station is concerned, is merely an advertising plan whereby you regularly, persistently and effectively keep the advantages of your service before every prospective customer within reach of your mains. That good follow-up is good and that poor follow-up is bad, has already been shown by the experience of several well-known lighting companies. That the method can be adopted with profitable results by the smaller plants has also been demonstrated. Invariably, when the scheme has failed to give the expected returns, the failure has been in the early planning. It may be made too elaborate, or too voluminous. It may contain too much bulldozing. It may be wasted upon ill-chosen lists. Most serious of all, it may be designed by an advertising man ignorant of the ethics of the lighting business, or by a lighting man lacking in advertising genius and experience.

Such faults should not be charged to the method, but to lack of skill in installing it. For in the last analysis, follow-up means simply organized advertising as opposed to a hit-or-miss lack of method in advertising, and as such is adaptable to any station where there are a hundred prospective customers.

Central Station Notes From Belvidere, Ill.

Probably the point of most general interest to other central station men in the recent work of the Belvidere, Ill., Gas & Electric Company is the remarkably successful and rapid introduction of electric flat irons in a town of 8,000 population. Last summer, Mr. C. L. Powell, general manager, sent out 50 General Electric flat irons to a list of customers selected at random. These flat irons were accompanied with a circular letter to the effect that the company felt that the electric flatiron was a device of such merit that it wished its customers to give it a trial and was sending one for trial. If for any reason the iron could not be used, the company would take back the iron, otherwise it would be put on the next month's bill. Out of this first 50, only four came back for various reasons. Soon after this set of irons was sent out, a lot of other customers came in, who felt rather slighted that they had been omitted in the first distribution and more irons had to be ordered immediately. The company now has about 75 electric flat irons on its line. The town has proved such a good place for electric heating that one of the electric meter manufacturing companies has arranged to have its own solicitor canvass the town with, of course, the co-operation of the central station company. A number of Simplex irons and other heating devices are in use.

Mr. Powell, manager of this plant, is also general manager of the Owatonna Gas, Electric & Heating Company of Owatonna, Minn. This company was sent 10 irons and they took so well that the local manager immediately sent back word to send 50 more.

These flat irons are, of course, placed on the regular residence lighting circuits and pay the regular rate. Besides flat irons there are about 25 curling iron heaters in use and several heating pads and coffee percolators. The company is now after a contract with a laundry. Under this contract, if it is secured, the laundry irons will be put upon a special meter.

The system of charging is similar to the two-rate scheme used in Cleveland, Ohio. The base rate is 20 cents per kw-hour, which is subject to a 25 per cent discount on the full rate portion of the bill, in consideration of prompt payment. For all power used in excess of 1,500 watt-hours per month per 16-cp lamp connected (about 30 lamp-hours), the rate is 7 cents per kw-hour. The power rate is 8 cents net for motors up to 25 kw-hours per horse-power connected, all over that being 4 cents per kw-hour.

In figuring the connected load in residences, only one-half of the actual connected load is taken. Heating and electric sign work is not figured on connected load.

The company does hot water heating under the Yaryan system, Mr. Powell, the manager, having formerly been connected with that concern. The hot water rate is 20 cents per square foot of radiation connected per season. A thermostat for automatic control is placed in each customer's service pipe.

The lighting and power is all done from two-phase, 2,300-volt generators. Although power for lamps and motors is supplied from the same bus-bars, separate feeders are used for the two purposes. The power house supplies also direct current to the local street railway and for a part of the interurban mileage between Belvidere and Rockford.

Business is increasing faster than it can be taken care of. The company does most of the new wiring and electrical construction work in the town, but would be glad to turn it over to a responsible contractor who would work a sufficient number of men to keep up with the demand.

Belvidere is not a remarkably good town for power, aside from the National Sewing Machine Company's large factory, and this has its own plant. The connected load in motors is 135 horsepower. There are about 1,100 eletric meters connected. The company is beginning to push electric signs and now has seven or eight. It does not furnish free renewals of incandescent lamps, but sells lamps to customers at 20 cents each. So far it has been able to keep cheap low-efficiency lamps off of the circuits by refusing to be responsible for inferior results as to lighting or dissatisfaction as to the size of customer's bills, if the customers insist on purchasing cheap lamps.

Advertisement Writing Contests.

One of the oldest and best advertising schemes on record is that of inaugurating prize advertisement writing contests. While hoary with age and threadbare from long usage, the idea persists, and with each repetition proves its value as a means of interesting a large number of people in the product advertised. Those who demand always the original, the extraordinary in advertising will not take kindly to a revival of the old advertisement contests for school children; yet in what way can we bring a knowledge of electricity as a home necessity closer to our public than by these means?

The whole aim and end of advertising is to spread the advantages of a product before the public, and we perform many strange feats to accomplish this end. The advertisement writing contest leads not only to the rapid circulation of the desired facts, but to a close and friendly study of the product by the public. And in limiting the contest to school children, we immediately interest every mother, father, uncle, aunt and all the tribe of elder brothers, sisters, cousins, friends and fiances. The resultant advertisements are pretty sure to be valueless, *per se*, but the names and addresses secured in this manner are of value if carefully followed up.

The following advertisement which appeared in the San Francisco Gas & Electric Company's bulletin, *Gas & Electricity*, shows how this progressive company adapted the scheme for its gas department. It can be used to promote interest in electric lighting with equal success:

ADVERTISING CONTEST

Last month was inaugurated an ad-writing contest, which is proving of great interest and value to school children. This was directed to school children who wrote the best advertisement for the gas range, the great labor-saver and economizer. We wish to include in this contest the best short articles from the users of gas ranges. If you have used a gas range, and find that it saves labor, dirt and expense; that it bakes and broils better; that your gas bills are $3 a month, whereas your coal bills were $5.00, write a concise, interesting article about it.

Ideas are worth money to us, and we offer grand prizes for the accepted article or ads. Many ads have been received, but as so many of our customers are in the country, the decision will be delayed until August 15th, when the contest will be decided by a committee of leading newspaper men. The first prize is a $20 gas range. The second prize is a $14 gas range. Address all communications, to etc."

A Clever Plan for Securing Good Advertising Copy.

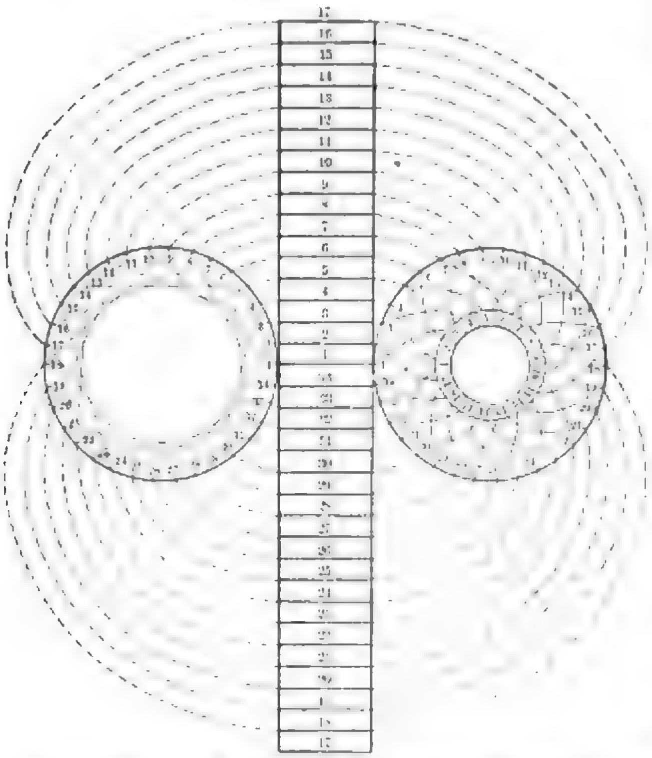
Every station manager who uses the newspapers, either from choice or policy, knows the annoyance, and even hardship, on having to prepare new and effective advertising copy each week. It is one of the most harassing of his manifold duties—which may account in some measure for the large number of mediocre electric light advertisements that appear in various parts of the country. The problem has been cleverly solved by Mr. J. E. Montague of the Niagara Falls Light & Power Co. The Niagara company employs three solicitors, and to these he delegates the task of writing, requiring each one to submit copy for the several weekly papers.

Naturally there is a considerable amount of rivalry, which results in the production of some very effective advertisements. The idea is one which may be adopted with good results by other managers. The solicitors being constantly "on the firing line," are particularly qualified to suggest the most salient and telling arguments in favor of the service. It only remains for the manager to coach them in a direct and forceful manner of expressing these arguments, to produce the very best class of electric light advertising.

LETTERS ON PRACTICAL SUBJECTS.

SIMPLE METHOD OF REPRESENTING ARMATURE WINDINGS.

I submit herewith a scheme of representing a simple loop winding on a four-pole machine, which is entirely new. It will be noticed that the diagram is very simple in idea, being merely the development of the armature as a cylinder with the slots numbered and having the commutator segments numbered also. The principal advantage of this method is that it is not necessary to draw the armature in any way out of proportion; but everything may be represented just as it is, and drawn to scale if necessary. By this means no false impressions are conveyed to the mind of a beginner, which I know from experience is often the case with other methods. It is evident from the diagram that any style of winding, however complicated or simple, may be shown by this method with equally good results. I have chosen the loop winding because it serves the purpose I have in mind just as well as a more complicated winding, and requires less time. It is very easy to trace the connections when the slots and segments are numbered as shown. In the case illustrated the armature has 34 slots; the commutator has 17 segments; the back pitch is 9, the front pitch 7 and the commutator pitch 1. The winding starts from commutator segment 1, passes to slot 31, then to slot 6 and back to commutator segment 2; it being a very easy matter to count the pitch in this diagram. Denoting the segments by *C* and the armature slots by *S*, the complete scheme is as follows:



SIMPLE METHOD OF REPRESENTING ARMATURE WINDINGS.

C	S	S	C	C	S	S	C
1	31	6	2	2	33	[illegible]	3
3	1	10	4	4	3	12	5
5	5	14	6	6	7	16	7
7	[illegible]	18	8	8	11	20	9
[illegible]	13	22	10	10	15	24	11
11	17	26	12	12	19	28	13
13	21	30	14	14	23	32	15
15	25	34	16	16	27	2	17
17	29	4	1	1	31	6	2

From this it is evident that the winding comes back to its original starting point, thus proving this scheme true. In summing up the advantages of this method over others, I should mention—1, its extreme simplicity; 2, its ability to be drawn accurately and to scale; 3, its ability to represent with exactness the position of commutator segments, armature slots and winding at the same time, and through these advantages, 4, the saving of time, space and worry. I believe that instructors of electricity will be glad to know of this method as well as others. One instructor in Baltimore to whom I have shown the scheme uses it with much greater success than with others.

Baltimore, Md. Edward K. Stembridge.

SINGLE-PHASE APPARATUS AND THE SMALL CENTRAL STATION PLANT.

Probably the majority of small central stations of this country operating in towns of 3,500 population or less are still using single-phase, 125-cycle apparatus for lighting. It goes without saying that the plants using this apparatus either have some direct-current apparatus for taking care of the power business or they have no power business at all save a few fan motors. Many of these stations are beginning to consider changes which will enable them to handle power business either by 500-volt, direct-current or from their alternating-current circuits. Many of them have been preparing for a change to 60-cycle generating machinery for some time, by putting in transformers suited to the lower frequency. The principal question that will have to be met when the change to the lower frequency for power purposes is made is whether to put in single-phase, two-phase or three-phase apparatus. The question has many sides to it and it is hoped that those who have given it thought will present their conclusions for the benefit of central station men. To invite discussion the following considerations are presented:

The simplicity of the single-phase apparatus is undoubtedly desirable, especially in small plants where there may be difficulty in balancing up a load between two or three circuits. It is undesirable to run two or three wires to every power customer; it is further undesirable to install two or three transformers for a power customer where one would do. As far as the question of distribution alone is considered, the single-phase system is far preferable. It therefore simmers down to a question of motors. Single-phase induction motors have been on the market for some time for constant-speed work which in performance are fully equal to two or three-phase induction motors, although not quite as simple as the two or three-phase motors and a little higher in first cost. On variable-speed motor work such as cranes and elevators both the single-phase and the polyphase systems have been at a disadvantage as compared with the direct-current type. Recent developments in the shape of elevator and crane motors having all the characteristics of series direct-current motors have given the single-phase system, if anything, a little advantage over the polyphase system, and in fact have placed it almost on a par with the 500-volt, direct-current system for scattered work in small towns. At the present time direct current has the advantage as to low cost of motors, two and three-phase induction motors coming second and single-phase motors coming last on this basis of comparison.

It is, therefore, up to the owner of the small alternating-current plant who is going into the power business to decide whether to adhere to the simple and flexible single-phase system with its high-priced motors manufactured by only two or three concerns, or to introduce the complications of the two or three-phase systems for the sake of cheaper motors, or as a third way out of the difficulty, put in a 500-volt, direct-current power service, apparatus for which can be obtained very cheaply in either the new or second-hand market. As far as simple distribution is concerned the 500-volt direct-current system in a small town offers probably fewer complications than the polyphase system. Its chief disadvantage is at the power station where two kinds of generating machinery must always be kept in operation. In a small plant this is an even greater disadvantage than in a large plant. With single-phase apparatus developing as rapidly as it is at the present time, the owner of a small central station about to put in a power service may well do some hard thinking before deciding to adopt some other system for his power service if he has a single-phase distribution already in operation.

Chicago, Ill. Chas. L. Jameson.

GROUND DETECTORS AND THEIR CONNECTIONS.

I note an error in the connections in the illustration (Fig. 1) of a ground detector printed in your December issue. The right-hand binding post of the Stanley ground detector should be connected to stationary vanes 1 and 4 as shown by Fig. 2 herewith, and the left-hand binding post of the instrument connected with vanes 2 and 3. Consider that at a given instant line *B* is positive and that this same line is grounded. With the connections as shown in Fig. 1, line *B* is positive, and the upper side of the condenser negative. By induction, plates 2 and 3, to which the right-hand binding post is connected, would be positive. Plates 2 and 3 and the top portion of the condenser form an insulated system. The positive charge on the lower portion of the condenser, which is directly connected to the line wire, attracts a negative charge on the top portion of the condenser. The top portion of the condenser is at one end of the system, and therefore a positive charge is set up at the distant end of the system on stationary plates 2 and 3. The author states that "if the ground is on line *B*, the pointer deflects to the right." Now, as line *B* is grounded, the movable vanes will have a plus charge, because they are connected directly to the ground. There will be repulsion between the movable vanes and vanes 2 and 3, as these latter are positively charged, and the movable vanes are also positively charged. Therefore the movable vanes will rotate in a clockwise direction and the pointer attached to the movable vanes will be moved to the left and not to the right. If the connections are changed so that the right-hand binding post of the instrument is connected to plates 1 and 4, and the left-hand binding post to plates 2 and 3, then plates 1 and 4 would be positive when the line *B* was grounded and a positive current was flowing in the line; the repulsion between plates 1 and 4 and the movable vanes would cause a counter-clockwise rotation of the movable vanes and the pointer would deflect to the right.

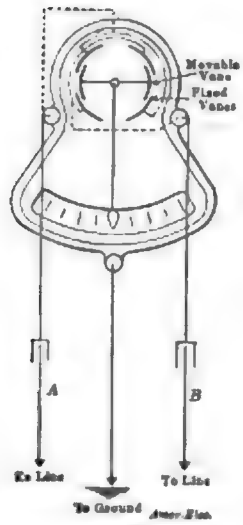


FIG. 1.

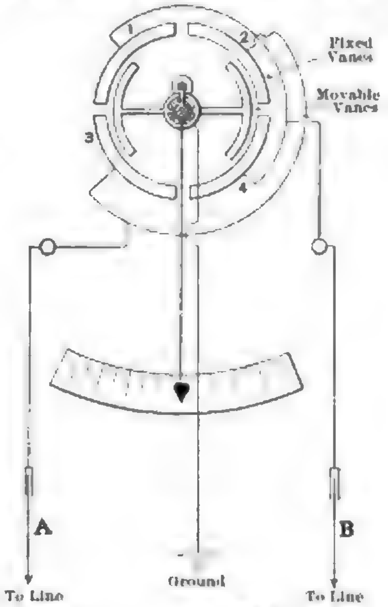


FIG. 2.

SCRANTON, PA. FRANCIS H. DOANE.

IMPROVED METHOD OF INSTALLING KNOB AND TUBE WIRING.

We note in connection with Mr. Auerbacher's article on "Exposed Circuit Wiring," published in the January 6 issue of the ELECTRICAL WORLD, that the holes in Fig. 1 are drilled at an angle by the ordinary brace and bit. We do considerable wiring work, and while we find the article pretty thorough, this method of boring holes is, in our humble judgment, quite antiquated. With the many patent boring machines now on the market, it is possible to bore holes straight and in line, thus not only saving much unnecessary pulling and straining of wires, but at the same time saving about 10 per cent in the amount of wire required. We are of the opinion that many electricians, especially in smaller towns, would be benefited by using these improved boring machines.

ORAN, MO. SCOTT COUNTY TELEPHONE COMPANY.

THE CARE OF COMMUTATORS.

It is well known that some commutators will run for years with almost no attention, while others need constant attention to keep them anywhere near good condition, and even with good attention they are not very satisfactory. The fact is that successful operation of a commutator is dependent on certain inherent qualities in the machine, rather than on the care which is bestowed after it is built and is in operation. There are cases in the writer's knowledge where railway generators subjected to heavy overloads at times have operated over periods of four or five years, without even having the commutators so much as sandpapered, and with less commutator care than any other machines operating an equal number of months. Upon inquiry as to the care given to the commutators it was learned that they had very little care; in fact, the least of any machines in the station. About all that was necessary was to keep the commutator clean and perhaps wiping with a very little of some kind of lubricant at intervals. The best way to stop sparking at the commutator is to have the proper design of machine in the first place; assuming of course that the machine is provided with good brushes and brush holders that will not chatter and that the brushes are placed at the neutral point. When these are provided, the performance of the commutator is largely dependent on the inherent qualities of the machine rather than upon the amount of care the commutator receives in service. It goes without saying also that once a commutator's surface is in bad condition, it will rapidly get worse, and here is where "A stitch in time saves nine."

CHICAGO, ILL. J. C. RANDALL.

INSTRUMENT FOR LOCATING SHORTS AND HEAVY LEAKS IN ELECTRIC CIRCUITS.

Fig. 1 herewith shows a simple home-made testing instrument for locating shorts and heavy leaks in electric circuits which will doubtless be of interest to your readers. I have used an instrument of this kind for many years with excellent results, and in fact any one with the slightest knowledge of electricity and engaged in trouble or repair work will find the instrument of great value. A wooden hoop 12 ins. in diameter is fitted with two ordinary binding posts as shown. Around the outside of the hoop is wound one pound of No. 25 single-cotton-covered copper wire as indicated by the arrows. After the coil is wound, it should be well shellacked and covered with tape in order to keep the wire in place on the hoop and also to protect it from mechanical injury. In connection with the hoop the operator should procure a head 'phone receiver, since this is more convenient than the ordinary watch-case receiver, and a small bee-hive buzzer. The receiver should be connected to the binding posts on the hoop, as shown in the sketch on the right, the cord being sufficiently long to enable the operator to manipulate the hoop conveniently.

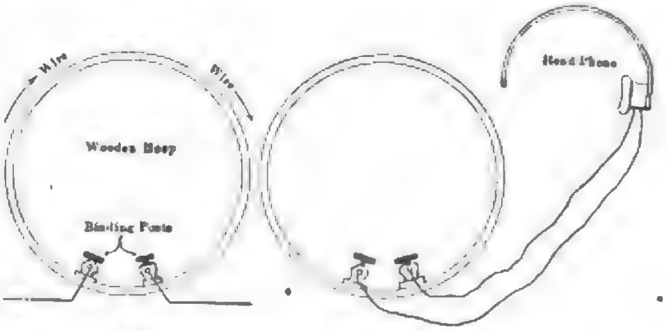


FIG. 1.—INSTRUMENT FOR LOCATING SHORT-CIRCUITS.

When testing for shorts or leaks on gas lighting or bell circuits, it is taken for granted that the operator will make sure that the batteries are in good working order. In testing for a grounded wire, a circuit is completed through a water or gas pipe, buzzer, battery and the defective circuit. The vibrations of the buzzer cause an interrupted current to flow over the line. By placing the receiver to the ear and holding the hoop where the buzzer is connected to the line the vibrations may be distinctly heard in the receiver. By following wherever the sound leads, the direction of the circuit is easily ascertained. Where the sound becomes weakest and almost indistinct is the location of the defect. This test may also be made on electric light circuits. In a store where there are many lights on a circuit, such troubles as punctured insulation, short-circuited sockets and switches, require some little time to locate ordinarily, especially if the switches are in gangs. By the use of this instrument the exact location of the defect is quickly ascertained. In decorative work where a number of streamers are run, each with a large number of lights, a defective lamp or socket causes a great amount of trouble, especially if the time is limited. With a coil of this kind, however, the fault is located in less time than it takes to tell. In making these tests, two dry batteries are placed in series with the buzzer on that line or an incandescent lamp in series will give the same results. At the place where the interruptions of the buzzer cease, the line is short-circuited.

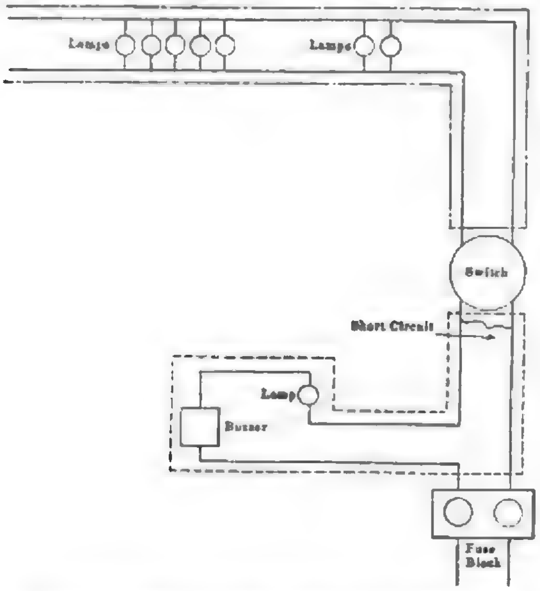


FIG. 2.—LOCATION OF SHORT-CIRCUIT BY INSTRUMENT.

This is illustrated diagrammatically in Figs. 2 and 3, which show a short-circuited switch and electric-light fixture respectively. In Fig. 2 the buzzer is in series with a lamp on the short-circuited line. The dotted lines indicate the travel of the sound; whereas the dash-and-dot lines show that part of the circuit which is silent. In Fig. 3 a battery is placed in series with the buzzer, the dotted lines showing the circuit in which the sound was heard and the dash-and-dot lines showing the circuit in which no sound was heard. The positions of the short are indicated in both instances. Where there are a number of shorts on the same line, the nearest short is indicated first. After removing this, if the buzzer still vibrates, the next short is located in like manner, and so on until the line is cleared. A coil of this kind may also be used to locate concealed pipe in buildings or pipe underground. The direction of the run is indicated as well as all branch lines. When used in such work about one-quarter pound more of wire should be added and five batteries should be used. Useless tearing up of floors and partitions and useless digging may thus be avoided in locating pipe runs.

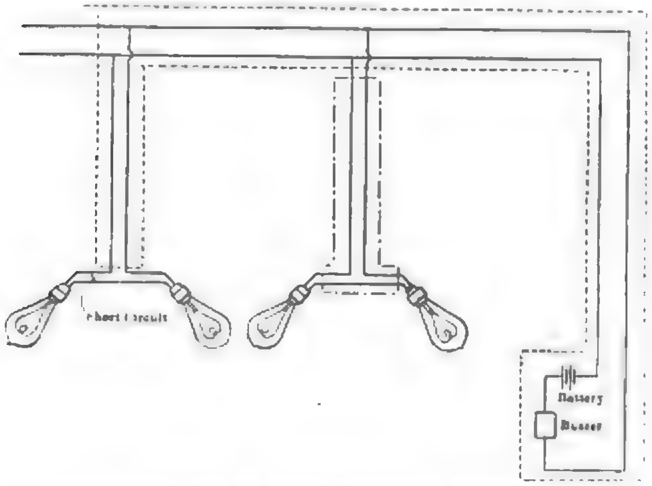


FIG. 3.—LOCATION OF SHORT-CIRCUIT BY INSTRUMENT.

WASHINGTON, D. C. C. W. PETRY.

I have read with no little interest W. Kavanagh's method of reversing the polarity of a generator as published in the first issue of the ELECTRICAL WORLD, and while the method given is ingenious, a less ostentatious method is available in which the reversal of polarity is accomplished by means of the series coils. The equalizer and circuit switches on the machine are all single pole and a switch with a discharge resistance is provided for the shunt-field circuit. Suppose one machine to be in service and the reversed machine to be disconnected from the bus bars; but running at full speed. The shunt-field switch of the reversed machine must be opened after which the equalizer switch of the reversed machine may be closed together with the main-circuit switch controlling the series coils. Current from the machine in service will then be shunted through the series coils of the reversed machine and this will usually be sufficient to reverse whatever residual magnetism remains in this latter machine. This fact will be indicated on the voltmeter, which will show a small voltage in the right direction. The shunt-field circuit may then be switched in and the machine should at once begin to build up. When the working voltage is reached the other main switch may be thrown in and the generator given its share of the load. If the amount of current shunted through the series coils of the defective machine is insufficient to reverse the residual magnetism, the series circuit of the machine in service may be opened and the whole current from the machine forced through the series coils of the reversed machine, and under working conditions this will not fail to cause this generator to build up properly. With the generators equipped as described the process of re-reversing the polarity of a generator and giving the machine its load requires no more time than that consumed in usually building up the machine and connecting it to the bus bars. Where the generator is not provided with a shunt-field switch and a discharge resistance, it is best to stop the machine and effect an opening in the shunt-field circuit by insulating the brush of the rheostat from the contact posts. Where the gen-

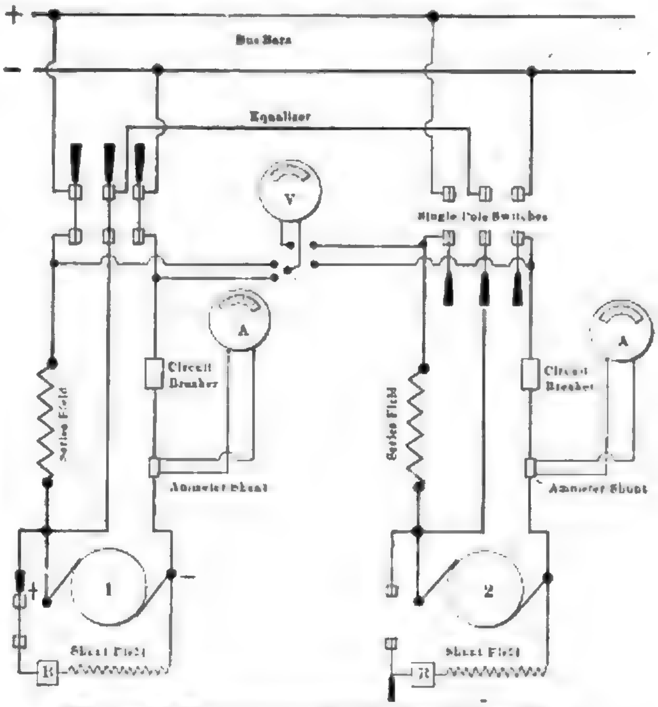


FIG. 1.—COMPOUND-WOUND GENERATORS IN PARALLEL.

erator is supplied with a three-pole switch, the lead containing the circuit breaker and ammeter may be temporarily disconnected by simply tripping the circuit breaker when throwing the series-field coils in parallel.

Brooklyn, N. Y. C. Thomas Jones.

A dynamo which has had its polarity reversed may be re-reversed much more simply and quickly than one would be led to suppose from Mr. Kavanagh's leter, published in the January 6 issue. Where there is but a single generator in a station the case is, of course, most troublesome, especially if the station is remote from all sources of current. In Mr. Kavanagh's case one machine was at rest and the other machine was running, the machine at rest having its polarity reversed. To re-reverse the polarity of this machine one of the armature terminals of the dead machine should be disconnected, and while the circuit through the machine's armature is thus opened, its circuit breaker and switches should be closed just as if it were going into service. Current from the bus bars will then excite the field in the right direction. Upon opening the switches and restoring the armature connection, the dynamo may be started up and put in circuit with its mate. Special care must be taken, however, to make sure that the armature circuit of the reversed machine is open before closing the circuit breaker and switches to magnetize it properly and that either the main switch or the circuit breaker is again opened before the armature terminal is restored to place. Failure to observe these precautions will result in a short circuit.

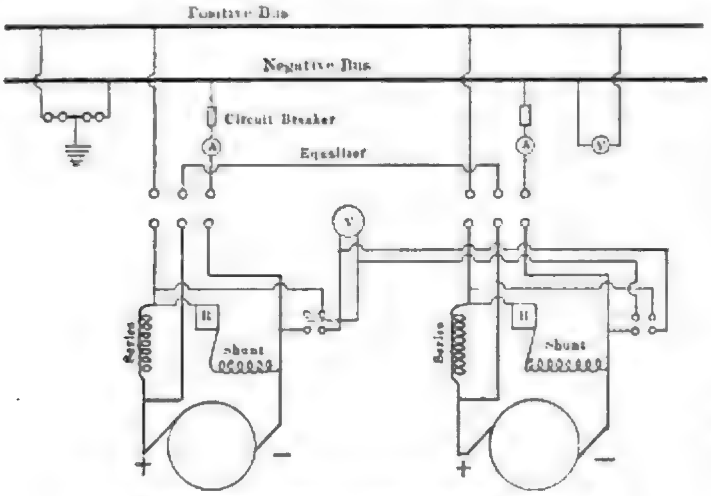


FIG. 2.—COMPOUND-WOUND GENERATORS IN PARALLEL.

New York City. J. Van Dyke.

A somewhat similar suggestion has been received from G. A. Iler, Thomas, W. Va.

MR. WHITE'S PROBLEMS IN LAMP AND INSTRUMENT WIRING.

I submit the accompanying diagram, Fig. 1, as a solution to Mr. White's problem in lamp wiring. Forty-eight lamps are connected on one side of the circuit and thirty-two on the other. One triple-pole double-throw switch suffices to solve the problem and by reference to the diagram it will be seen that it is impossible to throw 220-volt current either through the 110-volt lamps or back into the transformer. When the switch is thrown to the right the lamps are placed in multiple across the 110-volt mains. Throwing the switch to the left places the banks of lamps in series across the 220-volt mains. If it is desired to cut out either circuit at any time three-pole single-throw switches may be installed in each branch. Fig. 2 gives a solution to Mr. White's problem in instrument connections. The ammeter is connected to the hinges of a double-pole double-throw switch as indicated and single-pole single-throw switches are connected across the exciter-circuit leads. It is evident from the connections that the circuit may be kept closed while changing the ammeter from one circuit to the other. In operation the ammeter is first thrown on the exciter circuit and the single-pole switch across that circuit then opened. After the reading is taken the single-pole switch is closed and then the ammeter disconnected from that circuit. The same sequence of operation obtains on the other exciter circuit.

York, Pa. J. Henry Peck.

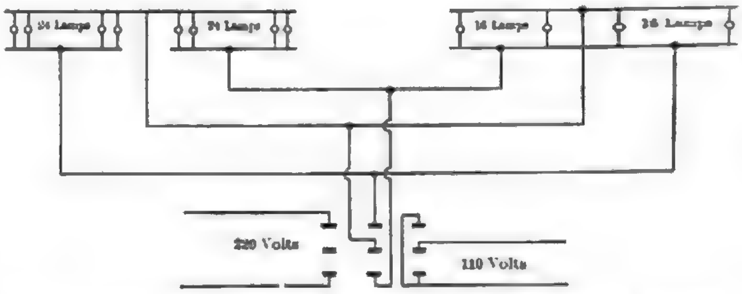


FIG. 1.—MR. PECK'S SOLUTION TO MR. WHITE'S PROBLEM IN LAMP CONNECTIONS.

These solutions coincide with those submitted by Mr. White. Similar solutions were received from J. Lindsay, New York; P. Mack, Omaha, Neb.; J. Redmond, Philadelphia, Pa.; H. Rush, Seattle, Wash.; Kenneth Spencer, Richmond, Va., and H. Silvester, Detroit, Mich.

The following solution (Fig. 3) is intended for Mr. White's exciter ammeter problem published in the January 6 issue. Two single-pole single-throw switches are connected across one lead from the exciter and the negative bus bar as shown, and a two-point switch or a single-pole double-throw switch is used to throw the ammeter in circuit with either exciter. To obtain a reading from the exciter circuit on the left, the two-point switch is thrown over to contact 2 and the single-pole switch on that side of the circuit opened. To obtain a reading from the circuit on the right, the single-pole switch in the circuit on the left is closed, the two-point switch is thrown over to contact 3 and the single-pole switch on the right is opened.

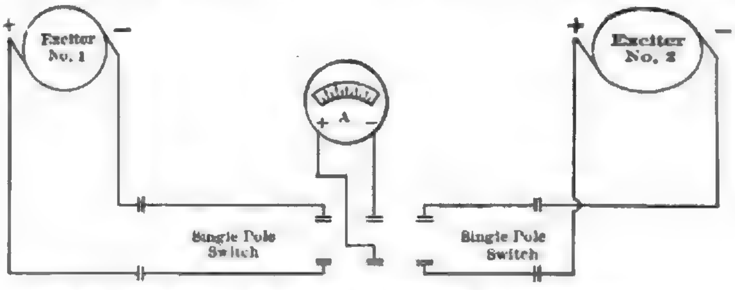


FIG. 2.—MR. PECK'S SOLUTION TO PROBLEM IN INSTRUMENT CONNECTION.

Victor, Col. D. C. McMeehan

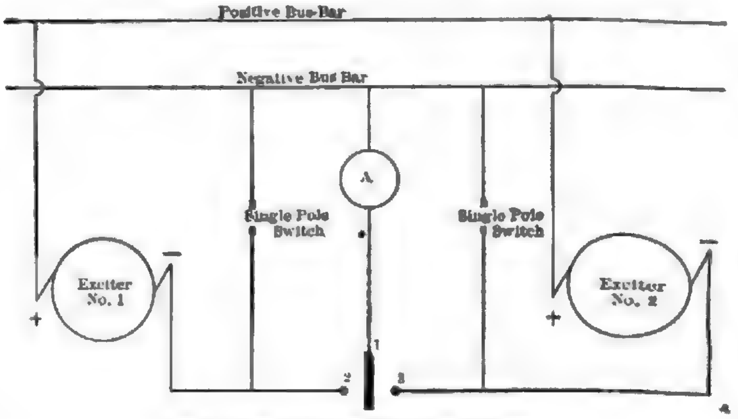


FIG. 3.—MR. M'MEEHAN'S SOLUTION.

I noticed Mr. White's problem in instrument connections in the January 6 issue, and having had the same problem to solve some time ago, the method used may be of interest. Fig. 4 shows a rather rough sketch of the apparatus made for the purpose. Two wedge-shaped pieces of well-seasoned wood boiled in paraffin are fitted with clips of spring brass, as shown. These clips are normally in contact with each other at their outer ends as indicated, and each clip is connected to one lead of the exciter circuit. Pivoted between the posts and free to swing, is a handle of wood treated with paraffin. One side is fitted with a piece of copper which wipes against a contact near the base, and the other side is fitted with a piece of copper its entire length, the pin on which the handle swings passes through the copper strip also, thereby making electrical connection with it. The ammeter is connected to these insulated strips. When a reading is desired, say of the exciter on the right, the handle is swung to that side; the spring brass clips are separated and the ammeter is placed in circuit. Current then flows from the exciter to the clip on the far side of the post, down the copper strip on that side of the handle to the pivot at the base, through the ammeter and back to the copper strip on the near side of the handle to the clip and out to the exciter circuit again. As soon as the handle is swung to the other side the brass clips snap together again so that the circuit is not broken. The sketch shows the apparatus bottom-side up, the handle being normally out of circuit, and occupying a mid position where it is retained by gravity. The apparatus works well for small exciter currents and was found very convenient for other purposes as well.

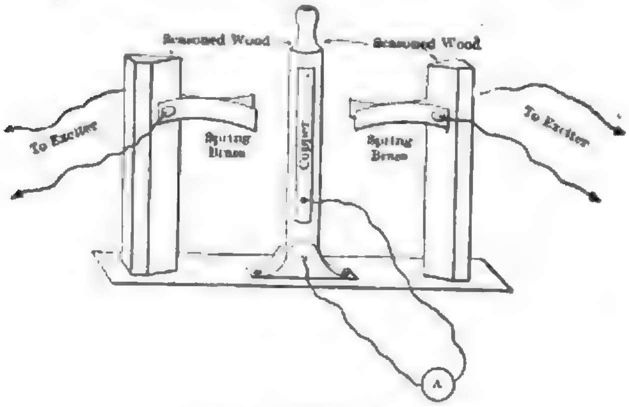


FIG. 4.—MR. ADDAMS' SOLUTION.

Newburgh, N. Y. M. S. Addams.

MR. BLACK'S PROBLEM IN MOTOR WIRING.

I submit the accompanying diagram as a solution of Mr. R. O. Black's problem in motor wiring, published in the January 6 issue of the Electrical World. Two series motors are connected to a line shaft and it is required to give the simplest arrangement of switches to obtain the following results: One motor only in circuit; two motors in series; two motors in parallel; two fields in parallel, armatures in series; two armatures in parallel, fields in series. In my solution I have endeavored to make the switchboard as nearly symmetrical as possible so as to avoid the confusion of having a large number of switches irregularly placed. Besides the double-pole single-throw switch which controls the current from the mains, five double-pole double-throw switches and two triple-pole single-pole switches are employed. By reference to the diagram it will be seen that switch No. 1 disconnects the whole system, including the controller, from the mains. When switches No. 1 and No. 2 are closed, the latter downward, either motor may be placed in circuit by simply closing its respective three-pole switch and closing switch No. 5 downward. By closing both three-pole switches with switch No. 5 still closed downward, both machines will be thrown in parallel. The motors may be placed in series by leaving switches No. 3 and No. 4 closed and throwing switch No. 5 upward. When it is desired to place both fields in parallel and the armatures in series, switches No. 3 and No. 4 are opened, switch No. 2 closed upward and switches No. 6 and No. 7 are closed downward. To place the two armatures in parallel and the fields in series, switch No. 2 is still closed upward, and switches No. 6 and No. 7 are also closed upward. By tracing the connections it will be seen that the current always enters the armatures and fields in the same direction, so that there is no danger of reversal on changing connections. It will also be evident that when switch No. 2 is closed upward, switches No. 6 and No. 7 are the working switches and switches No. 3 and No. 4 must be kept open. Likewise when switch No. 2 is closed downward switches No. 3, No. 4 and No. 5 are the working switches, and switches No. 6 and No. 7 must be kept open. The direction in which switch No. 2 is closed always indicates whether the top or bottom switches are to be used. It will also be evident that switches No. 6 and No. 7 are always closed in the same direction; either both up or both down. The scheme is not fool-proof because a short circuit would occur if either switch No. 3 or No. 4 were closed while switches No. 6 and No. 7 were working and vice versa. As a precaution, therefore, the controller should be provided with an automatic circuit-breaker or overload release.

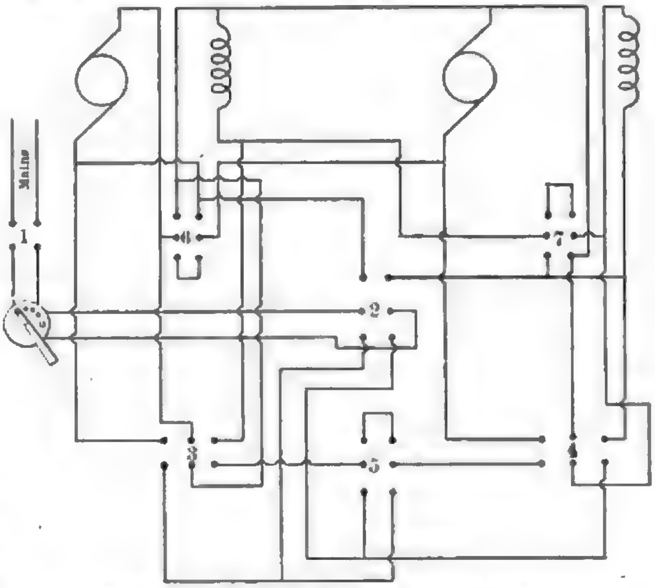


FIG. 1.—MR. EVANS' SOLUTION TO MR. BLACK'S PROBLEM.

Eaton, Ind. Chester A. Evans.

I beg to suggest the following solution of Mr. R. A. Black's series motor wiring problem in the Electrical World of January 6. A special knife-switch arrangement is used, built up from standard parts and consisting of four hinge posts with blades and four other posts. In the accompanying illustration the hinges are at points 1, 3, 6 and 8. To obtain the desired results the following connections must be made by the knife blades: Motor A alone, 1-2, 7-8; motor B alone, 3-4, 5-6; motors in series, 2-3, 6-7; motors in parallel, 1-2, 3-4, 5-6, 7-8; armatures in parallel, fields in series, 1-2, 3-4, 6-7; armatures in series, fields in parallel, 2-3, 5-6, 7-8. Care must be taken in choosing the knife switch that the handle clears the posts in the switch positions 1-2, 2-3, 6-7 and 7-8.

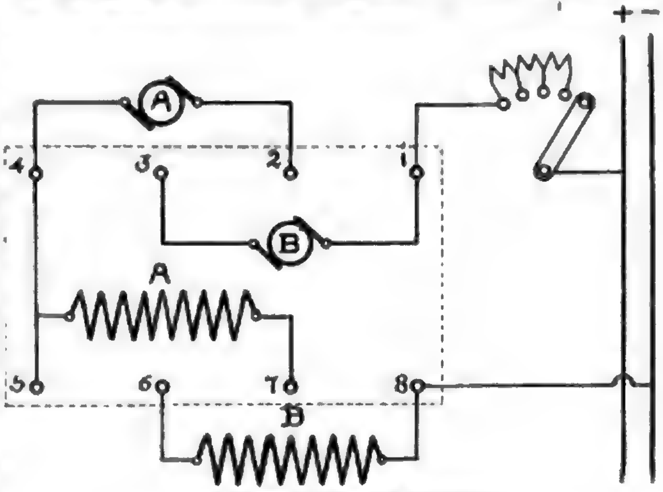


FIG. 2.—MR. MEURER'S SOLUTION.

Yonkers, N. Y. Fred Meurer.

IMPROVEMENTS IN APPLIANCES AND APPARATUS.

Alternating-Current Motor Reverser.—A simple non-sparking, quick-acting means of reversing alternating-current motors instantly was recently patented by E. H. Porter and B. Currier. It is well known that any alternating-current motor can be reversed in rotation by reversing the relative direction of the current in any one of its independent energizing circuits. In the circuit to be reversed two alternating e.m.f.s, or currents of opposing phase relation in series whose algebraic sum is zero, are supplied. By weakening either of the e.m.f's, or short-circuiting it entirely, the other e.m.f. is left to partly or fully supply the current in the desired direction. One application is shown in Fig. 1, which is a diagrammatic view showing an induction motor with reversing transformers, short-circuiting contacts and regulating solenoid with core in conjunction with an alternating-current source of supply. It is evident that when the upper contact connected with the secondary and the other secondary contact connected to the solenoid are brought together, the secondary winding of the transformer on the left is short-circuited, thereby neutralizing the impedance of the primary of this transformer and applying the full e.m.f. to the primary of the other transformer and hence to the secondary, thereby energizing the circuit in a given direction. An opposite result is obtained when the transformer at the right is short-circuited in the manner described. The movements of the contacts are controlled by the solenoid.

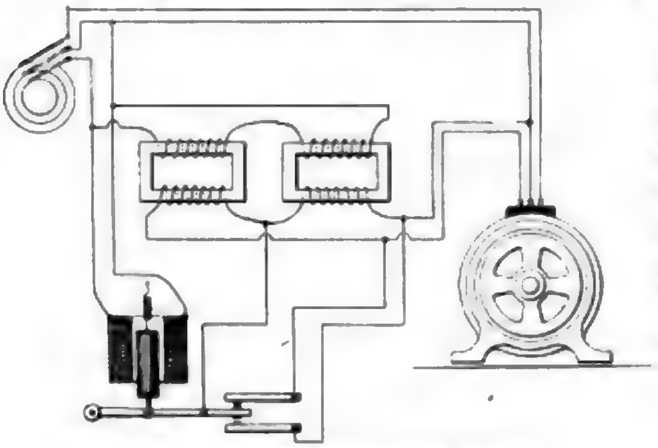


FIG. 1.—ALTERNATING-CURRENT MOTOR REVERSER.

The "Clipper" Belt Fastener.—*Engineering*, of London, describes a method of jointing belts which appears to have decided advantages over many other means of obtaining the same result. The old way of lacing the ends of belts together is unsatisfactory for many reasons, and most of the patent fasteners on the market project from the back of the belt in such a way as to prevent the back surface from working over the pulley. In the method illustrated herewith both sides of the belt are the same and the joint is very flexible. The wire hooks have one side shorter than the other, and a series of them is placed in grooves formed in a brass anvil used in making the joints; the long and the short sides of the pins alternating. The two ends of the belt being equipped with a row of the hooks, a hinge pin of raw hide is drawn through the joint as shown in the lower illustration. It is stated that belts may be rapidly jointed by this method and the fastening is cheap, flexible and very strong.

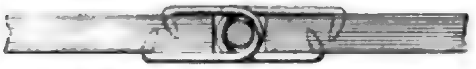


FIG. 2. THE "CLIPPER" BELT FASTENER.

Fuse Plug.—Fig. 3 is a sectional elevation of an improved fuse plug recently patented by H. T. Paiste. A metallic shell, open at one end and closed at the opposite end by a head of porcelain or other insulating material, is provided with an insulating lining. A pair of spring clips, having adjacent faces concave, is electrically connected to a small plate on the top of the plug. A second pair of metallic spring clips which project beyond the open end of the shell are electrically connected with the threaded shell by means of small bolts or rivets. It will be seen that one pair of spring clips engages one of the metallic ends of the ordinary enclosed fuse, while the second pair projecting outside of the threaded shell receives the other end of the fuse case. The porcelain cap is threaded so that it may be screwed over the end of the fuse plug, which has the outwardly projecting clips, the opposite end of the plug being adapted to be screwed into a cut-out. By means of this construction a fuse may be conveniently removed from the plug without the necessity of unscrewing the latter from the cut-out block in which it is used. The condition of the fuse can also be ascertained, since with cartridge fuses of the ordinary construction the indicator opening will be in plain view when the fuse case is in operative position. A modification is shown at the right of the engraving.

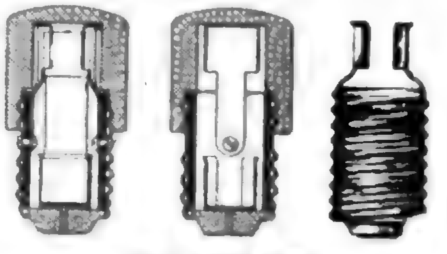


FIG. 3.—FUSE PLUG.

Oil and Water Separator.—Many devices have been introduced at various times for the purpose of separating water or oil suspended in minute form and carried along in currents of steam, as either of these fluids is generally objectionable. Another design added to the list is described in *The Mechanical Engineer*, of London. The general construction will be perceived from the illustrations herewith. Two concentric cylindrical rows of angular strips of metal with slight vertical spaces between them are arranged so that the strips break joint. In this manner the inner row intercepts any suspended matter passing between the interspaces of the outer one. By this means an extensive contact surface is secured, a detail which is an important part in separation, because the water or oil must adhere to it until it drains into the well in the base, which is fitted with the usual gauge glass and blow-off arrangement.

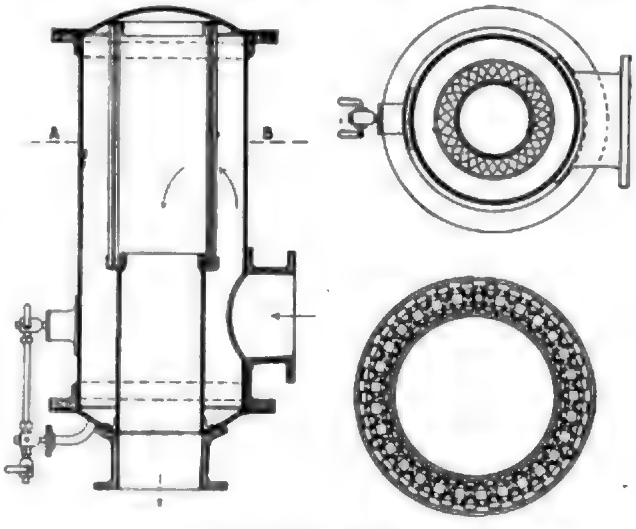


FIG. 4.—OIL AND WATER SEPARATOR.

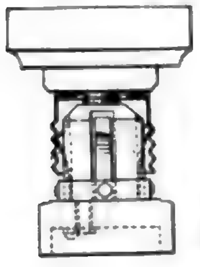
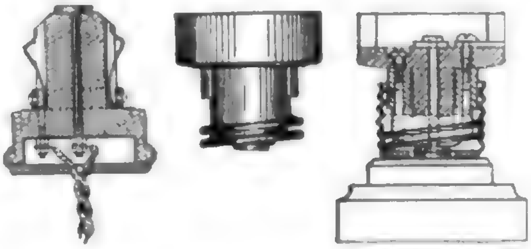


FIG. 5.—DETACHABLE ELECTRICAL CONNECTION.



FIGS. 6 AND 7.—DETACHABLE ELECTRICAL CONNECTION.

Detachable Electrical Connection.—With the purpose in view of providing an electric plug which could be easily inserted in or removed from a socket, A. N. Lawrence, Jr., has patented the device shown in Fig. 5. The plug is provided with a recessed lower face containing the binding post nuts for securing the conductors, while the outer side of the plug is formed with recesses adapted to contain spring contact fingers which are connected to one terminal as indicated. The plug may be shoved directly into the socket to its seating position, the spring contact fingers retiring into their recesses when passing over the projections of the threaded shell and springing out again into contact with the grooves when the plug is seated.

Another device of the same general character, patented by Mr. Lawrence is shown in Fig. 6. The plug has a portion which is smaller in diameter than the internal diameter of the socket, and projecting from the outer surface of this portion is a spring forming one terminal of the plug. This spring is compressed toward the surface of the plug when the latter is inserted and as soon as the plug is seated engages the threads and holds the plug in place, at the same time forming a good electrical connection between the plug and socket. A side elevation of the plug is shown in Fig. 7.

Push-Button Switch.—The *Electrical Engineer*, of London, publishes the particulars of the push-button switch, shown by Fig. 8, herewith. In this switch the "on" and "off" positions are obtained by alternate movements of the button which turns a small ratchet on its axis. Across the diameter of this ratchet is fixed the bridging piece which closes the switch. The porcelain holder is made in two pieces, and the terminals are so arranged that for wiring it is only necessary to remove the top ring and nipple without withdrawing the porcelain from the body.

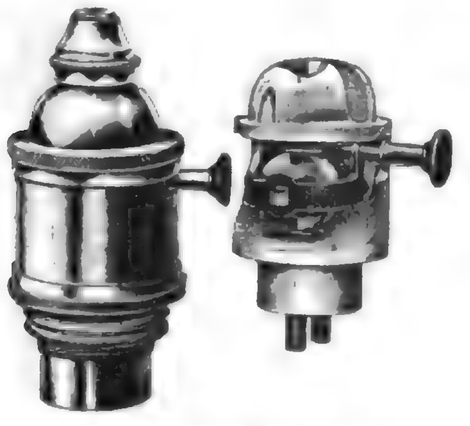


FIG. 8.—PUSH-BUTTON SWITCH.

Fire-Proof Wire.—In order to provide in a single article an armor conduit containing an insulated fire-proof, weather-proof conductor capable of internal and eternal use in all the positions which have heretofore required the usual lead or iron pipes, in which the specially prepared wires have been fished or inserted, Amanda M. Lougee has patented the fire-proof wire shown by Fig. 9, herewith. By reference to the illustration, it will be seen that the wire is covered with a rubber compound, then a protecting fabric, followed by a fire-proof jacket, rubber cement, wire armor and fire-proof compound in the order named. The wire armor is of the closely woven kind, which is capable of repeated bending without injury and may also be woven very tightly in place.

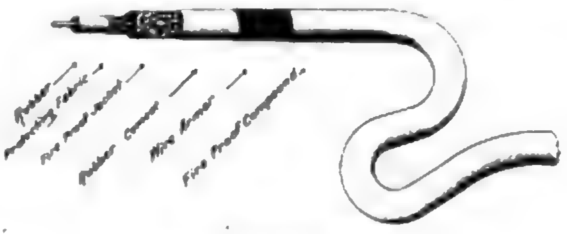


FIG. 9.—FIRE-PROOF WIRE.

Apparatus for Controlling the Feed Water Supply to Boilers.—The accompanying illustration, taken from the *Mechanical Engineer*, of London, shows an arrangement for controlling the supply of feed water to boilers in a simple and effective manner. A piston, *A*, is formed integrally with a check valve, *B*, corresponding to the usual check valve situated on the feed pipe to the boiler. Water from the pump passes to the check valve by way of the passage, *C*, and when the valve is lifted passes to the boiler by the pipe, *D*. The piston is an easy fit within the cylinder connected to the check valve casing, and the whole arrangement is situated outside the boiler. The space above the piston is connected to the boiler by a pipe entering the normal steam space of the boiler. This pipe is, however, so situated that when the water in the boiler rises unduly high, it can pass through the pipe to the space above the piston. Therefore when water is pumped into the boiler, and the check valve rises and falls during the pumping action, the piston has to displace the water above it before it can rise. The piston is forced, therefore, to act sluggishly and the check valve is prevented from opening wide, thereby limiting the supply to the boiler. By means of a valve on the pipe joining the cylinder with the boiler, the retarding action of the water on the movement of the check valve can be regulated.

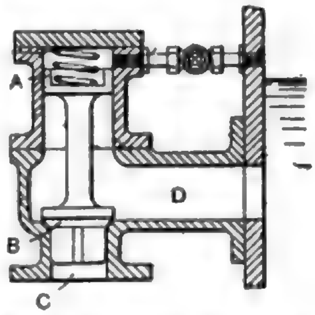


FIG. 10.—FEED-WATER CONTROLLER.

Indicating Fuse.—C. W. Rhoades has patented the indicating fuse shown in section by Fig. 11. The improvement consists in providing the fuse with means for indicating its condition immediately upon blowing. A hinged spring indicator is held against the surface of the fuse casing by means of a thread or wire which passes around the enclosed fuse, as shown. When the fuse blows the thread is released and the hinged spring indicator flies upwards.

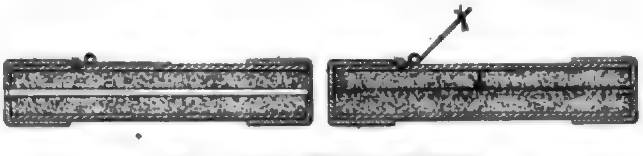


FIG. 11.—INDICATING SAFETY FUSE.

E. L. Ogle has patented improvements in enclosed fuses, which consist in providing the fuse with means for indicating its condition merely by visual inspection and for protecting the heat-affected medium. The tally fuse is exposed on the outside of the shell or laid in a suitable recess and covered with a layer of chemically treated paper, which becomes discolored by heat. This paper is covered by a sheet of mica, so that when the fuse blows there will be no danger of fire.

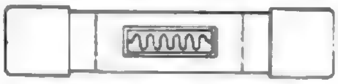


FIG. 12.—INDICATING FUSE.

Blow-Off Valve.—Fig. 13 herewith shows a recently designed blow-off valve, which combines in one casing a rotary valve and a rotary hollow plug or shell in such a manner that both valves are operated by a common spindle, one valve, however, being opened before the other and closed after it. This valve is described in *The Mechanical Engineer*, of London. A rotary disc *A* furnished with an opening *B* works on a seat *C* having a similar opening *D*, which is opened and closed by turning the disc, the opening movement being governed by a stop *F* on the spindle and a corresponding stop *G* on the cover of the valve casing. In combination with the disc and turned by it is a hollow plug *H* working in a seat in the casing and provided with an opening in the wall, which when brought into agreement with the opening *S* in the casing forms the outlet. The construction and arrangement are such that when the spindle is turned for the purpose of opening the valve the outlet in the plug opens first and is fully opened before the outlet through the disc valve begins to open, and conversely when closing the valve the outlet in the plug remains open until the outlet in the disc valve is fully closed; so that the plug is neither being opened nor being closed while there is a flow through the casing. The faces of the plug and seat, upon which dependence is based for securing tightness, are therefore not subjected to the passing currents when blowing through. The mechanism is so designed that as soon as the plug is fully opened it remains stationary in that position until the disc valve completes its opening movement, and also remains stationary while the disc valve is closing. The advantage of this arrangement is that the backing and edges of the openings of the plug or cock, or of its seat, are at no time subjected to the scouring action of fluid.

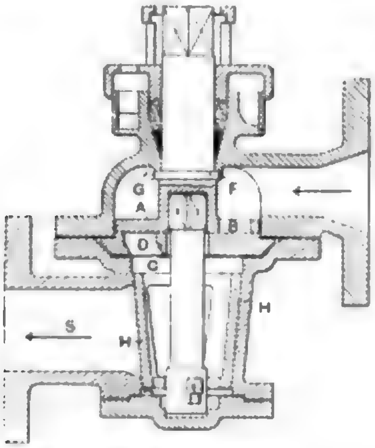
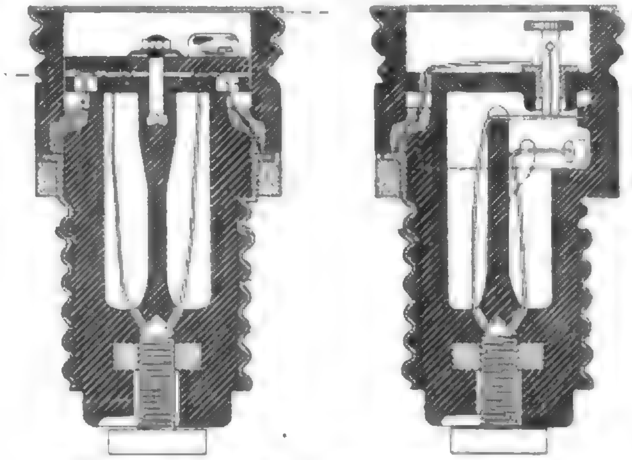


FIG. 13.—BLOW-OFF VALVE.

Switch Plug with Electrical Fuse.—Alexander Hepke and Kurt Diener have jointly invented the fused switch plug shown by Fig. 14 herewith. Two fuse wires are provided within the plug body and are connected to the contact screw shown at the bottom of the illustration. The upper ends of the fuse wires terminate in two contact pieces which are situated in a disc of insulating material. In this same disc are also fixed two other contact pieces which by means of wires are connected to the screw-threaded metal shell forming the contact with the plug socket. Above the disc is a second disc of insulating material, which is provided with a metal plate so constructed as to form an electrical connection between one of the two contact pairs. When the plug is inserted in the socket the current flows from the lower contact screw through the fuse to a contact, to the metal plate on the upper disc, through the other contact to the shell. When the fuse blows the upper disc is turned by means of a handle so that the metal piece on the bottom of this disc comes in contact with the second contact pair. A modification is shown in Fig. 15, where, if the upper fuse blows, the plug is pushed downward so as to engage the under fuse.



FIGS. 14 AND 15.—SWITCH PLUG WITH SEVERAL FUSES.

Crane Motor with Electric Safety Brake.—The *Electrician*, of London, describes a crane motor with electric safety brake built by Dick, Kerr & Co., a view showing this latter attachment being given in Fig. 16. This brake is formed in an extension of the commutator bearing, an annular space being provided in which is carried an exciting coil, *E*. On the extended hub is carried a conical cast-steel ring, *R*, which is free to move laterally. In this ring, steel springs are carried, which normally tend to push the ring away from the face of the magnet. At the extreme end of the motor shaft a malleable iron crown, *C*, is keyed. When the motor is disconnected from the power circuit, the spiral springs thrust the conical steel ring into the crown. If current is switched on the electromagnet becomes energized, and the action overcoming the thrust of the springs, the ring is attracted to the face of the magnet, which leaves the crown, and consequently the shaft free to revolve.

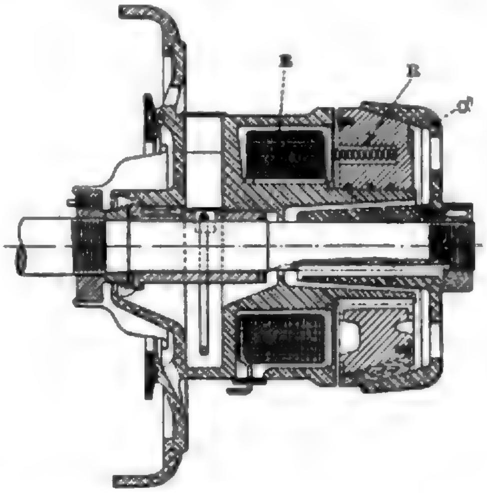


FIG. 16.—ELECTRIC SAFETY BRAKE FOR CRANE MOTOR.

QUESTIONS AND ANSWERS.

We have a 65-kw alternator having 12 poles, 12 armature coils and a speed of 1,400 r.p.m. For special reasons we want to reduce the speed to 700 r.p.m. and place 24 coils in the armature, doubling the number of armature turns. Can we do this and obtain good results? W. J. W.

You may reduce the speed by this means and obtain the same voltage as before, but the machine would deliver only one-half of the former current. The frequency would also be halved.

Can you give me a cheap and practical way of producing a dull black finish on copper, such as is used on switchboard instruments? A. E. B.

Dip the copper in a solution consisting of carbonate of copper dissolved in ammonia, and allow the copper to remain in the solution until the desired tint is obtained. Another solution which is very widely used consists of ¼ lb. verdigris, ¼ lb. sal soda, ¼ lb. carbonate of ammonia and 3 pints of water.

I have a compound-wound motor operating on a 220-volt circuit which takes 6 amperes when starting, and not being able to use a starting resistance there naturally is much sparking. Can I use a condenser in some way to lessen this arcing? F. G. F.

A condenser will have no effect whatever in lessening the arc at the brushes of your motor. We know of no means of lessening this arc except possibly by connecting an inductance coil in series with the motor.

Please give me the dimensions for a spark coil large enough to operate wireless telegraphy outfit for a distance of one mile overland. B. T. H.

At least a 6-inch spark coil should be used. A coil of this size may have the following dimensions: Length of core, 12 in.; diameter of core, 1⅛ in.; primary coil should have two layers of No. 12 B. & S. copper wire, the secondary coil should be made up of 7 pounds of No. 36 B. & S. copper wire; the core should be made of No. 22 B.W.G. soft iron wire; the condenser for the coil should have 60 sheets of tin-foil, each 10 in. x 5 in.

What effect will a decrease in the line voltage have on the amount of current taken by a shunt-wound motor and by a series-wound motor? R. G.

A decrease in the e.m.f. impressed on the motor terminals of either a shunt-wound or series-wound motor, causes a decrease in speed; and with an ordinary load, if the speed at which the load is driven be lessened, the power delivered by the motor is lessened, and, therefore, the watts needed by the motor reduced in value. Whether the current has been decreased or not depends on the relative changes in the value of the power delivered and the terminal voltage.

Why should a coil on a armature burn out when the two commutator segments to which the coil is connected are short circuited? E. B. J.

The coil, segments and the short-circuit between the segments form a complete circuit having a low resistance. The sides of the coil which are on the armature cut across the magnetic lines of the pole-pieces and have e.m.f.'s set up in them. Since the resistance of this closed circuit is very low, it is only necessary to have a low e.m.f. set up in the active portion of the coil in order to force a very large current through the coil and the two short-circuited commutator bars. The heating action of this large current is usually sufficient to burn out the coil.

How may I cut out a damaged coil from an armature? K. K. R.

Disconnect the damaged coil from the commutator and after cutting off the leads insulate the exposed parts with tape. Then connect the bars to which the leads of the damaged coil were connected with a wire, or jumper, as it is commonly called, of the same size as that used in the winding. To remove the coil entirely it will be necessary to cut the band wires or remove the wedges, and raise a sufficient number of leads and coils to permit the removal of the defective coil, after which a new coil may be put in place.

I recently read an account in a daily paper to the effect that a wireless telegraph system may be used to locate precious metals. Is this practicable, or is it merely a daily newspaper yarn? E. K. W.

We doubt the accuracy of the statement. The ohmmeter has been used with success in mining operations by measuring the resistance between two stakes driven well in the ground. A metaliferous vein would of course have a low resistance as compared with the resistance of dry earth, and its direction could be fairly well located by this means. Whether the vein contained precious metal or merely titaniferous iron ore could only be ascertained by the laborious and primitive process of digging

We are running a motor-generator set, the brushes of which give considerable trouble. The copper brushes cut the commutator on one side and reversing the brushes gives no remedy, the outside brush cutting despite all we can do. On another machine the carbon brushes are so noisy in operation that one can hardly hear oneself speak. How may this be remedied? R. F. T.

Since reversing the brushes does not remedy your trouble, it is evident that the fault is in the brush holder and not in the brush. The noise of carbon brushes may be lessened to a great extent by sandpapering the brushes to fit the commutator better and by occasionally lubricating the commutator with a little vaseline.

Kindly inform me as to the principle of operation of the Tirrill regulator. J. C.

The automatic potential regulator devised by A. A. Tirrill rapidly opens and closes a shunt across the generator field rheostat. The regulator has a main control magnet and relay; the former taking power from the bus-bars or from potential wires brought back from the center of distribution, and operating the main contacts. By means of a spring, the magnets are arranged just to open and close these contacts at the desired voltage. By this means one of the differential windings of a relay is opened and closed, thus causing a simultaneous opening and closing of the relay contacts which throws in and out the field rheostat.

A mine haulage plant furnishes current at 270 volts, which is transmitted one mile. Half of the time the load equals 900 amperes and at other times 100 amperes. When using the maximum current the drop is too heavy to give us good service. Would it be better to change the service to alternating current and use rotaries to convert the current at the place of consumption, or float storage batteries on the present system to act as a sort of booster? R. M. E.

The question resolves itself to one of cost. To scrape the direct-current equipment and install an alternator and rotary converter may or may not be advisable; but the addition of a storage battery large enough to take the entire load in case of mishap to the main plant also presents disadvantages. Generally a mixed service should be avoided unless the saving in cost of operation more than justifies it. You will probably find it cheaper and more convenient to use a storage battery.

(1) Recently in unwinding an induction coil, I noticed that the white cotton insulation had become green. Is this due to chemical action between the copper and the shellac, or between the cotton and the shellac? (2) Would this affect the insulating property of the cotton? P. C. P.

A green coil is an evidence of bad construction; that is, so far as the insulation is concerned. Ordinary shellac is composed of from 14 to 17 separate and distinct acids, any one of which acting on the copper would product the result mentioned. In fact when very fine wire is used in a coil and saturated with shellac it is not uncommon to find the copper eaten across. Needless to say, the insulating qualities of the cotton are very greatly impaired, and it would be better to rewind the coil using a paraffin compound having a high melting point instead of shellac.

In wiring a factory supplied with alternating current with insulated galvanized-iron wire would any induction be present? G. A. W.

Two parallel wires carrying alternating current induce in each other inductive e.m.f's which tend to retard the flow of current, and the closer together the wires are, the less is this effect. In the case of an iron wire circuit the effect is about 150 times greater than in a circuit of copper wire. For copper wire the inductance of each wire in millihenrys per foot is equal to $.00001524 + .00014 \log (d \div r)$. For iron wire the inductance in millihenrys for each foot of wire is equal to $.002286 + .00014 \log (d \div r)$; d being the distance apart from center to center of the wires, and r the radius of the wires.

What is the proper size of transformer for the following systems, assuming 100 kilowatts to be the load upon the circuit? Each transformer on a three-phase, three-wire system; each transformer on a three-phase, four-wire system; each transformer on a three-phase system with the Scott method of transformation from three to two-phase? E. J. Y.

The proper size of transformers would be as follows: Each transformer on a three-phase, three-wire system, 33⅓ kw; each transformer on a three-phase, four-wire system, 33⅓ kw; transformers on a three-phase system employing the Scott method of transformation from three to two-phase, one 50 kw and the other 1.7 larger. It will be necessary for you to choose standard transformers having capacities which are nearly proportional to the above.

Organization and Development of a New Business Department.

AT the recent meeting of the Northwestern Electrical Association a paper by Mr. George Williams on the above subject led to a lengthy discussion. In his paper Mr. Williams said that the necessity for a new business department exists in every central station company. The tendency in the past to look upon this department as an extravagance has, he considers, been due to the lack of proper organization and appreciation of its functions. He pointed out the great opportunities for central station business that exist everywhere. Every central station manager has at his very door revenue that can be secured without increase of installation if he only knows how to get it; and his success in getting it will depend upon organized effort. Mr. Williams dwelt upon the necessity of business courtesy, dispatch in trouble cases, knowledge of what one has to sell, its cost and its possibilities. He pointed out the value of midnight and all-night illumination of stores, windows, signs and building cornices. For example, the installation of 100 lamps in residences will not earn the equivalent of a small sign of 10 or 15 lamps. He advocated the use of electric signs by the central station company to advertise itself, with illumination until midnight and in large cities all night.

President-elect Harold Almert, in the discussion of Mr. Williams' paper, outlined a plan of campaign suitable for a small or medium-sized company for getting business. Mr. Almert was emphatically in favor of central station men getting out and advertising their wares, instead, as was too often the case in the past, of being satisfied with what business comes to them unsolicited. "You have," he said, "got to display and advertise your wares, solicit and keep everlastingly after new business, or be numbered among the dead ones in very short order." This branch of central station business instead of improving, he said, seemed to be getting worse with the result that the manufacturers find they are now obliged to take a hand in self-defense.

In setting forth the plan for smaller central stations, he said the first requisite was to maintain an attractive office, and at all times an attractive window display which should be changed frequently, and invitations extended for people to come to the office. A map should be prepared on a suitable scale on which to mark approximately the correct location of every building in town, laying out on the map the distributing system by means of cord of different colors, designating primaries, secondaries, etc. A canvass should then be made by sections and streets of every house in the town, and a user or non-user of electric lights designated on the map by pins with heads of different colors. Information in full detail should also be recorded on cards, including the name, address, location, whether house, flat or store, etc., kind of illumination, whether house is wired or not, whether equipped with fixtures, distance from lines, etc. The four elements of a sale are, first, the introduction, either by letter or personal interview; second, creating a desire for what one is to sell; third, selecting and adjusting what one is to sell to the particular need of the prospective customer and working up the point where he would be ready to sign; fourth, the sale. The first can be cared for by a carefully drawn form letter, general in character; the second by more form letters giving more details and by a personal interview; the third by another personal interview, reviewing what has gone before, adding desirable features and cutting out objectionable ones.

To a prospective customer should be sent the first form letter and at the same time the date stamped in the proper column of a form printed on the back of the subject's card. At the same time a marker should be placed in the file in front of the card having on it the date when the case should again be given attention. Assuming that the date stamped is the 17th, the card marker will then be for, say, the 21st, and when this date arrives, in looking down the file the markers will be so placed that all cards requiring attention on the 21st will be in line. The card is taken out on the 21st and the notation on the back will then show the next move in the matter. If a personal call should be made, the result of the interview should be noted on a sheet of thin paper the same size as the card, which slip should be filed on the back of the card. When the deal is closed the details are transferred to another card printed with the same form but having a different color.

In such systems it is important to keep track of results. There should, therefore, be a monthly report giving in totals at the bottom the number of form and special letters sent out, the number of personal interviews, number of customers secured, together with an estimate of the cost. A comparison of results obtained in one month with those of other months will give valuable data. This, together with a careful estimate of the time to be required, will soon develop the cost required for securing customers by the month.

Mr. Frank B. Rae, in discussing the paper, thought that Mr. Almert was wrong in his general statement that central station men are unprogressive. He thought the correct statement would be that they are busy, and busy because they are unsystematic in the transaction of a vast number of duties. He stated that after figuring out how much money one can spend, all the different plans of publicity should be considered, and that adopted which seems to suit best the particular case. As to the several plans of publicity these consist of personal solicitation, mailing cards and circulars, and the newspaper. While the cost of newspaper space is in some cases almost prohibitive, if a local paper reaches practically all the better class of people in the town, a fair sized space, preferably about 5 inches, double column, should be filled with a series of advertisements planned in advance, and, if practicable, illustrated. The advertisements should deal in definite statements and not in glittering generalities. Advertising will do nothing more than bring an inquiry, and this should be followed up by personal solicitation. The solicitor should know eactly what a man should have, not what he wants or what would be the most profitable for the central station to sell him. In going out for new business the central station should economize for its customer in every possible way, and this can only be done by keeping in close touch with the progress of manufacturers in making new types of reflectors, lamps, etc. In introducing new applications, a sample should be obtained from a manufacturer, or a good picture and description, for submission to a prospective customer. An endeavor should be made to have the local paper print from time to time popular articles on electricity.

Mr. Wright emphasized the importance of using business courtesy in treating all customers from the smallest to the largest as if their business was wanted without regard to size. As to the qualifications of a salesman, Mr. Rae thought that he should go out with a definite purpose rather than be merely a "general mixer." Mr. Adams thought the "mixer" would gain many friends and makes sales frequently without solicitation. Mr. Greer thought that the most successful salesmen were not mixers alone, nor salesmen who presented a business proposition alone, but men with both of these and with other qualifications. President Williams, who is managing a recently established station at Lacrosse, Wis., said that his new company started a new business department before it started construction work. The company has now only been operating seven weeks and it has an average load one half the maximum. He thought that the unprofitable business with which so many companies are now loaded should, so far as possible, be gotten rid of. Mr. Gonzenbach thought it was not profitable to put in lamps merely for display purposes where gas is used, nor for six o'clock store lighting and factory lighting. Mr. Greer believed that central stations should take on every kind of business, and by a proper arrangement of rates and the use of a maximum demand system make every class of business profitable. Mr. Fred M. Kimball said that the aim should be to obtain some income from every foot of wire in the distributing system. Service should be gotten into every house even if it should only be at the start to heat the baby's milk. He believed a prime essential to be the establishment of show rooms in central station offices and that the office should always be located on a prominent thoroughfare. An endeavor should be made to have a description of new installations containing points of interest printed in the local paper and personal items should be contributed noting that this person had put in a motor or that person had put in electric lights, etc.

Mr. Kimball did not consider that central station people as a whole throughout the country are open to the possibilities that lie before them. He divided the possible opportunities of any town into three classes The possibilities of business in the first of these are self-evident and such business comes voluntarily to the central station. The second class of business is illustrated by the case of a grocer, who has been in the habit of grinding his coffee by a hand-operated mill for a good many years, and who should be induced to put in an electric motor. The third class may be illustrated by a concern which had been established a long time, perhaps is using considerable machinery without any thought ever having occurred to have it driven by electric motors, or who have been so situated that they never thought electricity would be available for their purposes. This was further illustrated by the case of a central station manager who had obtained substantially all the business in the first and second classes and finally started in to dispossess steam engines in his territory. He first started with a sawmill in which he finally was able to put a 36-hp, three-phase motor, and one of the inducements that led to obtaining business was working out a scheme whereby the customer added to his business the preparation and selling of firewood. In the case of a sawmill, the load factor is rarely above 40 per cent, the engine and boiler must be run all day, the steam power must be sufficient to overcome the momentarily very heavy loads thrown on the saw, which are easily taken care of by the overload capacity of a motor, and a large proportion of the power is wasted in the engine drive. A motor will easily meet the demands of a momentary excess of power, and when running at light loads power will only cost in proportion to the load, and the expense for power is cut off in the intervals between taking cuts.

Preliminary to getting down to business with a prospective customer, the solicitor should go through his plant, satisfy himself in his own mind just what can be accomplished in the way of saving, fix upon the best disposition of the machinery and, in fact, study the entire matter systematically and thoroughly. Several different plans of service should be drawn up and criticized from the customer's standpoint and then a proposition finally brought before him. The proposition should not, however, be forced to such an extent immediately as to run the risk of being turned down; just as long as one is able to hold a customer's attention without being turned down he has a chance of making a sale. If upon a visit a customer should show a disinclination to talk about business, he should not be pressed.

A class of customers worth going after are those located in by-ways. A great many people manufacturing little devices are tied up to an engine shaft in some back alley with no opportunity to bring the goods to the attention of the public, and who do not advertise. It is a good plan to endeavor to have these people move on to a main street, arranging at the same time to supply them with current in the new location. A good turn will thus be done for the customer in addition to getting his business. Mr. Kimball considered that the wave of manufacture is moving westward and that manufacturing will, to an increasing greater extent, be done in the West. Central station people in that section, therefore, should get their business into shape to take advantage of manufacturing development when it comes.

Mr. John S. Allen, of Beloit, contributed a paper on the proper handling of a new business department, and in opening commented on the unprecedented demand for new business managers and solicitors by public utility companies. The central station new business department, he said, naturally divides itself into three general parts, namely, solicitors, publicity and rates. He considered that no line of business offered better advantages to a young man than that of central station soliciting. He advised that solicitors give much attention to local affairs, study carefully the best technical journals and have files of these in the office for the benefit of prospective customers. In a town of about 10,000 inhabitants he thought it was essential that the company should have for the use of its solicitor at least six journals dealing with electricity and business and publicity methods. He recommend to solicitors Sheldon's course in scientific salesmanship. Of the money spent in advertising a large part should go to the local newspaper, and advertising copy should be changed every day. The copy should be pointed, consist only of interesting facts and be devoid of expressions intended to be catchy, but lacking in thought. A company in organizing its advertising department should select some expression which the public shall come to know as well as the company's name. He recommended the use of a special border around newspaper advertising, and that the location and form of the space should be changed from time to time. He also advocated the use of mailing cards, circular letters and personal letters. As to rates, he stated that from a system of flat rate charging progressive electric companies had swung to the other extreme of placing all customers on meters. Recently, however, some central stations have been making flat rates on various well defined kinds of lighting and upon some kinds of power. He considered it advantageous to give a flat rate on signs, window and other decorative lighting where a switch could be placed on the side of a building to be turned on and off by the company's patrolman. This class of business the company takes on a purely yearly contract. Central station managers, he said, should be careful not to get the idea that a low rate will of itself bring business, for it is a remarkable fact that the price of electrical current has very little to do with the amount which can be sold.

In the discussion of Mr. Allen's paper Mr. Rae said that he disagreed that the location of newspaper advertising should be frequently charged, the best plan being to select a good location on a good page and keep it. Mr. Allen said that while this was true of journals in large cities, in towns below 40,000 inhabitants the space devoted to actual news and to prominent advertisements is so small that much better service is obtained by allowing the publishers the utmost freedom in the location of advertisements changed every day. Newspapers take excellent care of this class of advertisements because it is to their interest to do so. Mr. Rae said that in starting a new business campaign advertising is designed merely to bring out inquiries as material for the solicitor to work on. An inquiry gives the solicitor a chance. As to rates, instead of giving a man a lower rate when he complains, his attention should be called to the subject of lighting efficiency and the central station manager should endeavor to see that his installation is made efficient from the illuminating standpoint.

In a discussion on the payment of solicitors, Mr. Korst reported that his company paid its solicitors salaries plus a commission on new business they obtained. He described a plan he had used with success in getting residence lighting where this is difficult on account of the cost of wiring. Residence owners are induced to put in electric porch lights at the flat rate of 50 cents a month and soon find that they want another light or two, and it is only a question of time when the whole house will be wired. Mr. N. F. Jewett, of Albert Lea and Chicago, said that companies in small towns that cannot afford a solicitor all the year round might secure temporary solicitors for a period of several months. Such temporary solicitors are available. In one small town such a man worked for sixty days and secured 75 customers for the company; he was paid $75 a month, plus $3 per customer secured. Mr. George E. Westover, of Cadillac, Mich., said that every man in his company's employ is made a solicitor. For each customer secured for 10 lights the employee is given either a half day's holiday or an equivalent amount of pay; for every customer for more than 10 lights he gets a day's credit in cash or vacation. His company has not been within 30 houses of being even with its wiring contracts in three years, the company doing its own wiring. Some of its men have obtained as high as two weeks' vacation for the new business they have brought in. Mr. Almert stated that reports of all new business secured by his company include the name of the employee who secured the business, which has the effect of developing talent in this line which otherwise might not be discovered.

Mr Kimball had tried paying solicitors on a fixed salary and on a percentage of sales, and had dropped the latter method for the reason that a solicitor selling on a percentage sometimes sold things customers should not have. President Williams said that Madison, Wis., is divided into several territories with a solicitor and assistant to each territory. The gross revenue each month is compared with that of the month a year ago and 7½ per cent of the gross increase is given to the new business department. Over and above payment of $30 a month to the solicitor, this percentage is apportioned to the different solicitors by means of a credit system, and different classes of business are assigned to a different number of points. As to the assignment of points, residence business for which an extension would have to be made and a new meter set would count only one point, and in taking on some business the solicitor would actually lose points.

The lighting until midnight of window signs counts 7½ points where there is no expense on the part of the company for a meter or for rendering a service. Mr. Williams said that the result of the application of the system referred to was a marked increase in consumption of gas and electricity. The electrical output at Madison increased some 32 per cent during the past year with practically no increase of demand, and this he considered to be due very largely to the system of paying the solicitors. If the business nets the company something, the solicitor gets a proportion of it, and if it is business the company does not want, it is up to the solicitor to make a good customer out of an unprofitable one. It is made as advantageous for the solicitor to retain the business he has secured as to get new business. On the basis of $30 per month, plus commission, some solicitors have drawn over $150, and the company would be gratified if they would draw $250. With a population of 25,000 inhabitants five solicitors are engaged.

Selling Signs in St. Paul.

The system whereby the St. Paul Gas Light Company, through the efficient labor of H. J. Gille, general superintendent, has installed some 200 electric signs of one make alone in its territory within the past two years, is interesting and worthy of study upon the part of lighting managers generally.

So far as possible, the flat rate is used, the lamps being turned on and off per schedule by patrolmen. This, it is the experience of the company, is the most satisfactory method for both parties, for the reason that the company knows just how many hours' service to figure on for the year, and the customer (or "the advertiser," as Mr. Gille cleverly designates the sign owner) knows exactly what he is called upon to pay for his electric advertising for the whole year.

The advertising method of approaching sign customers is worthy of note. Instead of added store expense, the whole subject is presented to the merchant as an advertising proposition, of equal, if not greater, merit, and upon a comparable basis, with newspaper or other well-established publicity methods. Tables can be presented to show the "circulation" of the electric sign (i. e., the number of people who would pass within its range each evening) and such figures show favorably in relative estimate with similar data on billboard, street car and newspaper advertising.

The introduction of electricity for advertising, as Mr. Gille well says, is necessarily an educational campaign to a very large extent, and not only patience but liberality upon the part of the company is essential to the successful development of this class of business. On this account, not only must the rates be favorable, but the solicitor for the company must do all in his power to eliminate technicalities from the preliminary talk and to smooth the way for the installation.

To the writer's mind the St. Paul company might have adopted even simpler methods, especially as regards the forms of contract. These contracts are two in number, one covering the use of current and the other a form of note and agreement stipulating terms and installment payments for the sign. Both of these instruments must seem somewhat staggering to the small merchant, who may want a twelve-light sign, but would be inclined to hedge upon sight of two contracts setting forth such an array of bewildering conditions which he must meet, while the company assumes no responsibility other than to accept his money and to receipt therefor.

The St. Paul company has an arrangement with a sign manufacturer whereby the signs are sold on an installment plan. This plan provides for twelve monthly payments for the sign, the collections being made in connection with the monthly collection for energy on the account of the sign-maker who credits the customer. In this way many signs have been put in service which would otherwise not have been erected, for the reason that the cost of an electric sign looks very large to the average small merchant, yet by splitting the payments he feels that he can pay this cost out of the benefits he receives.

This plan, while it involves a considerable amount of bookkeeping, clerical and collection work upon the part of the lighting company, is eminently fair, and results in much business that otherwise would be lost both to the sign-maker and to the lighting company. It enables the lighting company to place the signs on circuit without investment (as in cases where the free sign plan is used) and enables the sign-maker to carry this installment business on his books by relieving him of the expense of soliciting and collecting. Mr. Gille states that "the arrangement has worked out very successfully," in St. Paul, and the sign-maker points with pride to the fact that 200 of his signs grace the streets of the city. Evidently the success has been mutual.

"In regard to soliciting," says Mr. Gille, "all of the solicitors report prospects for signs and all the information in connection with the prospects are filed at the office and are followed up very carefully. Calls are made on a customer, a solicitor interviews a prospective customer for sign lighting and he suggests that he is not ready to consider the matter finally at that time, but gives some future date at which he will take the matter up. These follow-up cards are kept in date order, the solicitor taking the cards for his territory every morning covering that day and makes notes on the cards of any additional information that he secures. In this way no prospect is lost and they receive all possible attention. Another point to be remembered is the fact that by getting a customer to set a date at which time he will take the matter up, it assists the solicitor materially as it amounts practically to an engagement to talk signs with him on that day."

It will be understood that this business consists not only in signs but in decorative window lighting, and that the 200 odd customers so far connected represent only the first fruits of the preliminary educational campaign. If aggressiveness, persistence and broad business policy will win so much, is it not reasonable to expect constantly increased business when in a few years electrical advertising by merchants becomes the rule instead of the exception as at present?

Central Station Enterprise in Texas.

The following examples of central station enterprise are from Texas. To facilitate lawn lighting and encourage that practice in a certain town, a system of temporary wiring was devised whereby it was possible for two men to wire up 150 or 200 lamps in approximately an hour, the dismantling requiring much less time. Just a short time before a lawn party was to begin a wireman repaired to the house clad in spotless white duck suit, with a cap on which appeared the initials of the company. His duty was to look after the comfort of the guests in every way. For example, if he noticed that an elderly person was inconvenienced by a fan, he would slightly turn the fan in another direction. A burned-out lamp would at once be renewed, and if the affair was at the home of a non-patron, just a little extra attention was bestowed on the work. When lodges or churches had an oyster supper, the company would, if permitted, arrange to keep everything hot with electric culinary apparatus with no cost for service, cutting everything in ahead of the meter. Every case of "trouble" was promptly attended to and a receipt taken as evidence against the time when the man of the house would rise in his wrath and swear the matter had never been attended to. A receipt was also taken when the patron had a course in meter reading. The manager of the central station referred to was Mr. J. G. Boyd.

CENTRAL STATION SALE OF CURRENT

WHAT "COVERING THE FIELD" SHOULD MEAN TO THE AMBITIOUS CENTRAL STATION MANAGER.

A PROMINENT gas man, who was trying to secure a large advertising appropriation from his directors, was met with the reply that he had already covered the field. The answer was extremely characteristic of this gas manager. He replied, "Not so long as the Standard Oil tank wagons are doing business on our streets!"

This spirit electric light managers would do well to emulate, for none of them has the business he ought to have so long as both the Standard Oil wagons are on our streets, and the gas meters outnumber the electric light meters four to one.

The gas people began their publicity campaigns before the electric light interests were aroused. The average earnings of a gas meter are far below that of an electric light meter, and it would seem that the logical conclusion would be, that to secure an electric light customer, more money could be properly expended than to secure the installation of a gas meter.

Last month in this department advertising by printed publicity was classified under two general divisions.

(1) The indirect appeal, which generally consists of newspaper advertising, or any printed kind of advertising, which does not specifically solicit an order; and

(2) The direct form of mail solicitation, which specifically, and directly solicits the addressee's business, just as much as though a salesman had been sent to call upon the man and request his signature on an application blank.

But it is comparatively difficult to get a man to sign an order by mail and, therefore, the highest percentage of business obtained will be secured, not through an attempt to secure the order by mail, but to get "him" sufficiently interested to be willing to talk to a solicitor. If efforts are persisted in to secure merely an appointment for the solicitor, the resultant returns through the solicitor's efforts will be many times what would otherwise accrue.

Serial Number.	Month.	Day.	Year.	Letters.	Self-Addressed Envelope Enclosures.	Plain Envelope Enclosures.	Postal Card Enclosures.	Appointment Card Enclosures.	Return Postal Cards.	Advertising Cards.	Advertising Folders.	Special Pieces.	Small Enclosures with Letters.	Booklet Enclosures for Letters.	Booklets.	Remarks.
1																
2																
3																
4																
5																
27																
28																
29																
30																
Totals																

Going to a man and personally asking him for his business, is a good old-fashioned way of getting that business, and you cannot beat it by any method of advertising, but if the advertising is combined with the soliciting, the advertising will pay handsomely. Any solicitor, be he ever so strenuous, will be affected by rebuffs. In consequence, a good deal of his enthusiasm oozes away by nightfall, if he has been met by a constant stream of negatives all day long. His efficiency will have steadily decreased during the day "inversely as the square of the resistance" he has met.

But if he had been wisely bolstered up prior to his calls upon the prospective customers by the proper advertising literature, which would have rained down upon the prospects a multitude of facts, figures and convincing arguments, as to why some particular form of electricity should be employed by that particular person, the solicitor would have been fortified, in particularly favorable instances, by an answer from the person to whom the advertising has been addressed; or if it were not possible to have secured such answer, he would at least have met a man, warmed up to the electrical proposition by reason of the campaign of direct mail solicitation waged before the solicitor called.

But, just as the solicitor must make a great many calls on the majority of his prospects before he has turned them into customers, just so the advertising matter should make a great many calls; and in making these calls, the advertising matter has a great advantage over the solicitor, in that, if it is prepared in an attractive enough manner, a great many calls can be made by mail without giving the recipient offense, whereas, anything like the same number of calls from the solicitor would probably be resented.

Then again the solicitor may call at inopportune times, whereas the advertising matter, if it does come at such a time, does not annoy the prospect as much as would a personal call, since it can be consigned to the waste basket, and so dismissed, in a much simpler and less annoying manner to the temporarily disgruntled recipient than a salesman could be dismissed.

The next piece of literature, be the reception given its predecessor ever so unfavorable, can probably secure attention a great deal easier than the solicitor could, and a long distance direct campaign can be carried on in this manner until the psychological moment arrives, when the person who has been solicited by mail is in a receptive mood. Sooner or later that time comes, and the continuous, polite, diplomatic, but everlastingly persistent, though always changing interrogatory, "When can we send our man?" is met with a favorable response. Meantime this automatic and systematic campaign has been waged without the loss of any of the salesman's force, and he has been kept busy, as much as possible, among the people who have favorably responded. The receptive attitude of the solicited has much to do with the amount of enthusiasm which the salesman can inject into his work. By this combination of advertising and salesmanship, the salesman's efforts result to much better advantage, for, not only does he work continuously at concert pitch, but his work, to a large extent, can be confined to the relatively favorable prospects, and this means a much higher percentage of contracts secured by the solicitor.

Proper advertising, persistently adhered to, is a magnificent force to be called to the aid of the salesman, but is not so directly productive a force as the salesman, and, therefore, as we have stated, to secure the largest possible returns per dollar expended, it should be wisely used as a direct adjunct to the salesmen or solicitors; but the advertising should never be called upon spasmodically or sporadically, but rather utilized as a steady continuous force, persisted in, not merely month after month, but year after year. The units of an advertising campaign should never be less than yearly units. Do not think of a flier now and then. Do not send out some booklet and expect the customers to flock immediately in upon you.

Secure proper advertising counsel, if you are not yourself equipped, and then set down and block out a campaign, like that indicated in the accompanying diagram.

The best way is to settle down, after filling out the diagram, using great care that no two pieces of similar advertising, either in idea, method of expression, color, or general characteristics, are sent successively. Then prepare all the sketches, dummies and copy for the various campaigns. Don't do this partially, but finish the job, working continuously on it until all the matter is ready. Carefully review the matter to see that it has the logical sequence, and that each letter or piece of printed matter put out, carries forcefully along the general thought; also be sure that you have not presented the subject in a dry, prosy, uninteresting fashion.

When this work has been undertaken in a thorough manner you can sit back with a great deal of satisfaction and watch the execution of your plans. If the work has been done by your advertising agent or whoever has assumed the responsibility of the position, in a thorough manner, you will have a comfortable feeling during the year, as your prearranged plans mature without calling upon you for much expenditure of vital nerve force after the plan is under way.

Your salesmen will be met on every hand with pleasant greetings, and while there will always be the crabbed citizen who objects to your intrusion, even by mail, yet, even this "soreheaded" portion of the community can be approached, and personal apologies very often but start an interview which results in his signature upon the contract—just as you had intended when you went to him to apologize for intrusion.

SYSTEMATIC AND CONTINUOUS PRESENTATION OF ONE LINE OF ARGUMENT

The four main divisions in which business should be solicited, are, perhaps, in the order of their importance, signs, power, arc lights and residences. Local conditions may vary the prestige or prominence given these various classifications, but when a list of eligible names has been prepared, these names ought to be carefully considered with relation to what the prominent need of each individual case may be. Thus, it is possible that one prospective customer might be solicited for a sign, for arc lights and for power. In such a case as this it would be wise to put that particular name upon the sign list, and then for one solid year, pound him steadily upon the question of signs and nothing else. Don't divert his attention; don't weaken your case by talking anything to the receiver of this advertising but signs. Make him believe that without a sign, the front of his store is a great barren waste. If you began to divert his attention to anything else but signs, you will weaken your general cause, but if your advertising man is sufficiently skillful, he will arraign his many different arguments in line for an electric sign, and the subject will never be allowed to grow monotonous, since, though it is presented from twenty to thirty times during the year to the man's attention, it will in each instance be presented *differently,* and moreover, cumulatively.

Many people can be put upon the sign list, who are already customers for interior lighting and on the list should be included every merchant, whose place of business has a show window of any pretension, whatsoever, and, of course, there are many cases of eligible people who have not even a show window, and many instances can, of course, be remembered in each locality, where people, whose places of business are located up side streets, or in the rear of buildings, should find an electric sign an absolute necessity.

To all of these for a period of one year direct an incessant bombardment, ever presenting the subject from a new viewpoint, but always bringing it right home to the inner consciousness of the man, that the quicker he gets up an electric sign, the quicker he is going to increase his business by leaps and bounds, no matter how satisfactory a business he has at the present time.

But before you begin an advertising campaign, put up an electric sign conspicuously, over or in front of your office or plant. The selection of location should insure the greatest prominence possible to the sign. Be liberal in the candle-power and the number of the lamps. Make the sign a live affair. Do not have it conventional in any way. This can be done by borders of colored lamps, preferably red. Never use blue for this purpose, and no other colored light will give you the effect that red lamps will. It would be a good plan to put up several electric signs. If you are going to secure a liberal sign business from your citizens, the best plan is to take your own medicine in liberal doses before you prescribe it to others. After the sign or signs are up, keep the lamps clean and renew dim and burnt-out lamps frequently and systematically.

Just so the subject of electric power should be taken up with the people who ought to be using it, and to this list, a continuous stream of diversified, logical, sequential, and unremitting, forceful facts and figures should be presented.

The arc light lists should be made up of merchants or manufacturers, to which this form of light can be best adapted and the prevailing conditions in any one locality will readily indicate this; but where there is a conflict between signs and arc lamps—that is any indecision as to whether a given name should be put upon the sign list or upon the arc light list—it will be found in nearly every instance that the wisest thing is to first put such a name upon the sign list. A sign is to-day the most attractive leader that a central station can use as an entering wedge to secure a man's business and then, too, signs are extremely profitable for the investment employed if they are put forth under a flat rate for a given number of hours' burning, contracts being signed for one, two or three years, and the signs being turned on and off, either by a representative of the company, or by a time switch.

In this way, long-hour loads are assured, and it is worth while for the contract department to put in a little preliminary additional time geting a contract of this kind, rather than have the sign used for but short periods. A store can do no better advertising than to keep an electric sign burning until 11 or 12 o'clock every night, and experience in many stations has shown that where this is done, practically every sign can be put out on this basis.

If a man knows exactly what the sign would cost him every week and every month in the year, he has before him, not an indefinite number of kilowatt-hours, but a definite amount in dollars and cents which requires no mental labor in order for him to plainly understand what it means. He knows exactly what the cost will be, and if the subject has been skillfully presented, he is glad to sign a contract on a flat-rate basis, especially so since under most methods of charging, he gets a large number of the hours of burning in the "letters of fire" at a much cheaper proportionate rate than he would for a shorter period.

Lists of residences are, of course, easily made up, and they will embrace names along the streets where service already exists, or in nearby localities which are easily reached, unless there is a determination generally to extend the names in the residential sections.

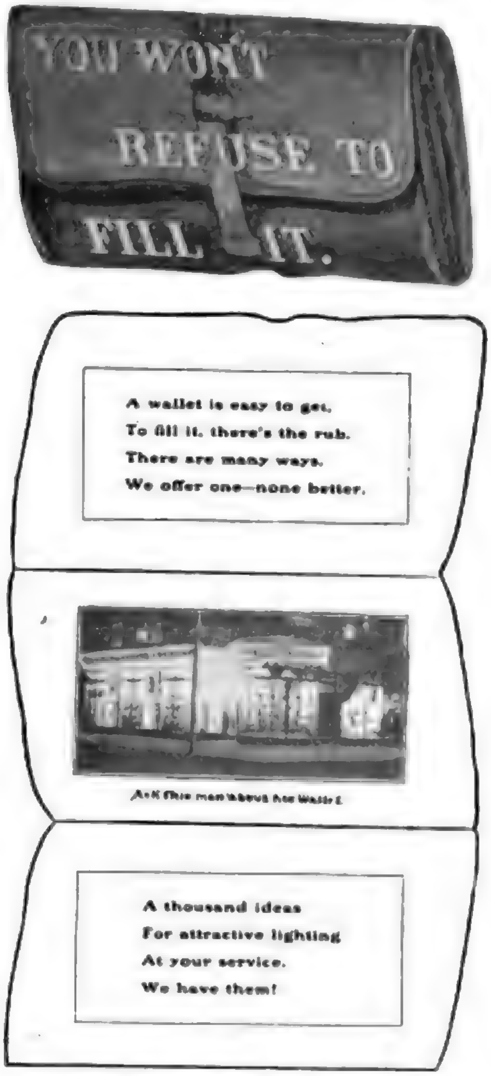
Besides sign, residence, power and arc lists, there are a great many other lists that can be specially worked up, or have special letters written for them, such as window lighting, building outline lighting, ornamental exterior posts to burn all night, or ornamental statues.

Then also, there have been, by some central stations, campaigns waged to induce the more free use of current by residences and stores, and in any central station which has not heretofore taken up the question of flat rate signs, a most excellent and productive campaign can be directed against present sign users; this special work being very closely followed up by the work of solicitors, or if there is a contract department, the head of the department could look after this business.

Such a campaign, intelligently fired at a man, and carefully combined with personal solicitation, cannot fail eventually to carry the day. The returns from the second year of such a campaign in the number of "surrenders" will be much larger than the first year, and the third and fourth years will be even better; but care must be used not to let the list run dry, but new names should be continuously added as business changes occur, and as new people appear. The attention given these lists should be unremitting, changes being entered from the salesman's daily reports.

SOME EXAMPLES OF ADVERTISING FROM DENVER.

Here is an attractive example of advertising from Denver. The folder comes in the shape of a booklet, which on opening, displays three panels inside. The idea is a very attractive one. The middle panel is shown better in the original than our reproduction can make it, but a word of criticism might be offered, by suggesting that a more direct application of the moral might have been printed to insure the driving home of the point into the busy man's brain, who might give the picture but a glance.



A wallet is easy to get.
To fill it, there's the rub.
There are many ways.
We offer one—none better.

Ask this man about his Wallet.

A thousand ideas
For attractive lighting
At your service.
We have them!

WALLET FOLDER.

Instead of asking "Ask this man about his wallet," it might have been better to have said, "Ask this man about his wallet—and how his electrically lighted signs and windows helped fill it." "Be plain if you would be understood," should be tacked right up in front of the advertising man's desk.

CO-OPERATIVE ADVERTISING BY ELECTRICAL MANUFACTURERS.

Last week an article appeared in these columns by Mr. J. Robert Crouse on the benefit of co-operation in electrical development, which subject is now attracting much attention among electrical manufacturers throughout the United States. There is no doubt that if these manufacturers will get together they can be the means of stimulating the use of electricity in many directions. Below are suggested some of the means that could be employed in furthering this end.

If the manufacturers work in the direction of general publicity, and the local central stations take real and full advantage of this general publicity by vigorously advertising, each in its own territory, the cumulative results ought to be of far reaching stimulation to the entire trade.

Here are some of the points of the application of which there should be profit:

1. Advertising co-operation by 607 electrical manufacturers.

2. Daily personal insistence on electrical apparatus and conveniences by the manufacturers' 610 salesmen during their travels. This insistence, if *continuously* applied against hotels, restaurants, cigar stores, etc., would have a far-reaching effect. As an example, let the salesmen patronize the cigar stores having electric signs; let them ask for electric lights, etc., etc. They would then all tend to help each other.

3. Advertising co-operation by the 453 electrical jobbers.

4. Advertising co-operation by the 1,500 electrical contractors.

5. Advertising co-operation by the salesmen of electrical supply houses, along the same lines as indicated for the manufacturers' salesmen.

6. Co-operation by the technical press.

7. Special co-operation by a committee of the National Electric Light Association, or a branch of that organization known as the Commercial Branch.

8. Special co-operation by a committee of the Northwestern Electric Light Association.

9. Special co-operation by the various state electric light associations.

10. United efforts from all the trade to induce co-operation by architects, builders, contractors and real estate dealers.

11. General advertising campaign in magazines.

12. Electrical shows and expositions.

13. United co-operation of the American Electrical Sales Association on the same lines as the manufacturers' salesmen would proceed. (The new organization of salesmen.)

14. Enlisting the co-operation of the Rejuvenated Sons of Jove by the same methods as would be employed by the American Electrical Sales Association. (This is a society recently formed and composed mainly of electrical people.)

15. Direct plans of mail solicitation against the actual prospects by local central stations.

16. Newspaper advertising by local central stations.

17. Systematized follow-up correspondence by central stations against each local specialized trade, which might employ electricity profitably in some form.

18. Let each central station maintain either in connection with its office, or separately, a sales or show room for the display of electrical apparatus; not forgetting an attractive show window and an electric sign to draw public attention.

All these methods, if employed together, and seconded by central stations in soliciting business by an active and continuous canvass in addition to the local advertising could not fail to achieve returns.

Concerted effort always produces results that are larger than can be brought about by individual effort, and the central stations should not be behind hand.

Isolated Plants Abandoned in Chicago.

The Chicago Edison Company and Commonwealth Electric Company have secured some excellent contracts in the past few months for light and power from large concerns formerly operating isolated plants. One of the most notable of these is "The Fair," one of the largest department stores, which occupies an 11-story building covering one-half a city block and has always heretofore operated its own light and power plant. Another large contract is that of the Griffin Wheel Works, a car wheel factory which formerly operated a 550-hp compound Corliss engine. The power of the wheel works is now supplied by three-phase motors.

Business-Building Methods of the Public Service Corporation of New Jersey.

THE light and power territory of the Public Service Corporation of New Jersey, embraces towns and cities of from 2,500 to 300,000 inhabitants and a total population of over 2,000,000. The same general methods of business getting with respect to electric lighting and power are applied in all of the communities, large and small, with equally satisfactory results.

The methods pursued are broadly of two kinds—advertising and soliciting. A little over two years ago the details of increasing the corporation's business were confided to one management with the head office at Newark, N. J. Before this time each local company head had in his own territory personal supervision of the means employed, but in the fall of 1903 a commercial department was established with Mr. Percy Ingalls at its head and Mr. C. W. Lee its advertising specialist.

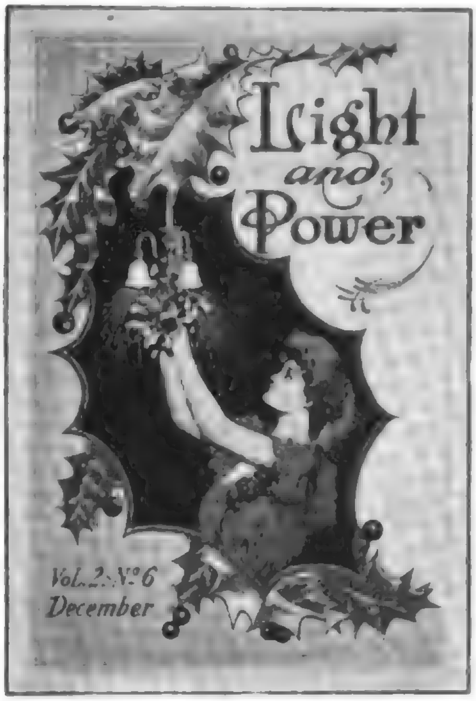


FIG. 1.—COVER OF "LIGHT AND POWER."

Pamphlet, circular, novelty, and newspaper advertising is supplemented by personal solicitation of salaried solicitors who follow up the inquiries that come in as the result of the advertising campaign.

The monthly pamphlet called *Light and Power* was first issued July 1, 1904, and has grown from eight to sixteen pages, containing bright and timely educational matter attractively illustrated, pertaining to electrical subjects of general and local interest. Photographs are given showing power installations and attractive lighting effects obtained by customers, and the fact brought out, that electricity from the various plants of the Public Service Corporation is used more and more every day and in all important buildings, the owners finding it cheaper and more satisfactory than producing their own electricity. The monthly bulletin is sent to users as well as prospective customers, and is considered the most important feature of the plan.

Circular letters in fac similes on special topics signed by the local agent are put out as part of the follow-up campaign, with the intention of stimulating replies. The possibilities of the uses of electricity are brought out very clearly in these letters, as well as in folders and booklets and stickers used in between the mailings of the pamphlets. From twenty-six to thirty mailings a year go to each "Prospect" on the list.

The periodical, *Light and Power*, does not go to all customers, but only to a selected list of names of those judged by the local agent as most likely to help circulate the information contained therein. Folders and novelties are mailed and attractively printed with seasonable artistic designs calling attention to the benefits of electric service. A return postal card accompanying the class of literature is shown in Fig. 2.

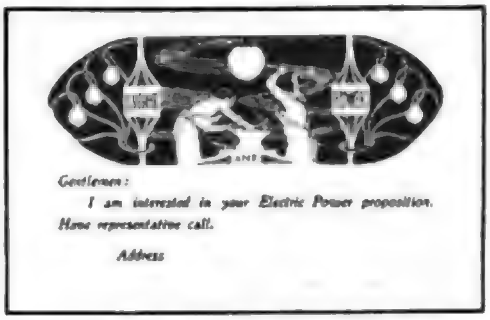

Gentlemen:
I am interested in your Electric Power proposition.
Have representative call.
Address

FIG. 2.—RETURN POSTAL CARD.

Monthly calendars are also used as part of the follow-up campaign for electric power. The calendars are small and rendered artistically attractive by being lithographed in colors. This calendar is the best of the novelties used by the corporation since it is not only attractive, but as a calendar is more likely to be preserved. Slipped in somewhere is a printed circular calling attention to the merits and benefits of electric power. In the specimen illustrated in Fig. 3 the circular is enclosed in the small envelope.

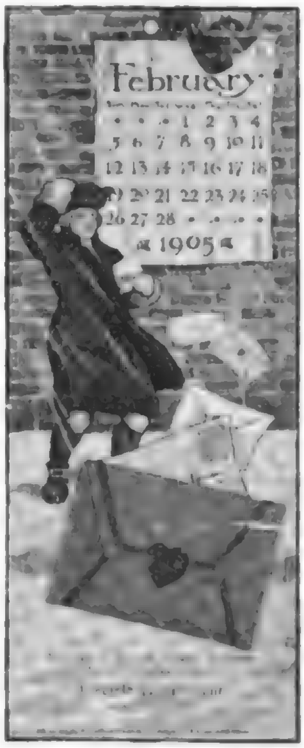


FIG. 3.—CALENDAR.

Pasters are attached to all bills. Those going to private houses have some matter concerning the home. Those going to stores have matter pertaining to store lighting, window dressing and general uses.

Street car advertising is successfully employed by the corporation, seasonable topics being artistically presented.

Sign lighting and brightly lighted and well arranged show rooms at the office of each territorial district are made a feature. Fixed illuminated signs were undertaken on the meadows paralleling the railroads between Newark and Jersey City, but much trouble was experienced in maintaining them. A number of such signs were stripped by wire thieves who took everything, even to the transformers, so after replacing the signs several times the expense was deemed too great and this method abandoned. Illuminated signs at each office, with changeable letters, were adopted, with which the several branches of the business at different seasons is advertised. The signs do not give the name of the company, as the advertisement of some department of the business calls attention to the office as well as the specific thing advertised, thus serving a two-fold purpose.

The free sign proposition is an instance of the aggressive sign campaign. Two classes of signs are supplied by the corporation —panel and monogram. The basis to the customer is the regular local lighting rate and a minimum monthly charge of $5 for the panel sign and $1 a letter for the monogram signs. Flat rate with a patrol system is also used where warranted, the sign current being kept off until 6.30 o'clock in the evening during the winter months. This time limit avoids the peak of the station load and enables an inducement in price to be made to the sign customer. The sign wiring is brought outside the building to a locked box, containing the switch, the current being turned off at stated times, depending upon the contract with the customer.

The corporation supplies the sign complete, including wiring, erection, lamps and maintenance. A 4-cp, 5-watt lamp is used. The average income from panel signs is $7 a month and from monogram signs about $2 per letter per month.

The use of the changeable sign in large sizes, with its ease of enlargement permits of elasticity in supplying the needs of some customers. The units and face plates of the Mobile signs are purchased by the corporation and the signs are then made up by its own staff. It is considered of great advantage to have a standard sign since a special one would serve for but one customer who might go out of business in a year's time. The expense of the sign in that case would be a loss whereas with the standard sign the change necessary for another customer would only amount to from $3 to $5. The free sign proposition has only been in vogue one year. Below is a reprint of a letter sent to prospective sign users:

Six Blistering Weeks.

The weather man says they are coming. An Electric Fan will give you comfort and pleasure during that time. Don't suffocate when relief is at hand. Electric Fans $9.50

A Cool Meal

a cool room is possible on a hot day with a

BLOWER FAN

Price, $9.50

Holiday Suggestions.

Electric Portables for the study table and Electric Lighting outfits for table decoration and Christmas Trees. Exhibition at show room.

FIGS. 4, 5 AND 6.—SPECIMENS OF PASTERS.

"While passing your place of business last night I noticed that you were still without an electric sign. Why?

"Our free sign proposition puts this popular advertising medium within the reach of every merchant in our community.

"There is a time when conservatism ceases to be a virtue. The electric sign has proved itself a magnet to the trade and a money getter, so get in line.

"If you are in business for pleasure you need a sign to make you feel that your place is as good to look at as the one across the street. But if you are there for your bread, butter, jam and automobile you must have a sign to get your share of trade. You see it's a sign which ever way you turn.

"A bright store makes a goodly-sized bank account.

"Let our representative have a talk with you on the store lighting and sign proposition. Ten minutes' time may make a ten per cent increase in the paying capacity of your business. Our interests are one, your success is ours."

As a result of the sign campaign, the business has grown from 35 electric signs in 1904 throughout all the territory, to nearly 600 signs of both kinds to-day, with an income from this source of over $60,000 per annum.

Newspaper advertising accomplishes a double mission. For aside from its commercial value to the corporation it establishes friendly relations with the press. The space is mostly used to appeal to the greatest number of people, which means continuous talks on the subject of household necessities in private houses.

All the advertising matter is prepared well in advance of its actual use. The cost of reaching prospects has been the small sum of between 83 cents to $1 a name per year. No other commercial business would be contented to spend so little in reaching a prospective customer, and yet this relatively small sum has produced results that should awaken every central station man to do something in this advertising line in order to stimulate a further increase in his business.

In the expenditure of an advertising appropriation the results are what count and the follow-up feature is as important as the basic advertisement. The experience gained by the Public Service Corporation shows the necessity of spreading the work done over the whole year and not permit the whole outlay to go out in one effort in one publication.

The soliciting by agents is a necessary and important adjunct. In some of the smaller fields of the corporation the local agent is also the superintendent of the plant, but this is the exception rather than the rule, as the business getting is held to be an entirely different department from the one producing electricity.

The solicitors of the Public Service Corporation are paid on the salary basis, but are encouraged by prizes of $50, $30 and $20 for the best six months' work for obtaining the greatest number of 16-cp equivalent connections. No premiums are offered nor given to their own or to outside wiremen. In the residential districts the greater amount of soliciting has to be accomplished in the evenings in following up inquiries as the result of the advertising campaign. Each solicitor turns in a daily card reporting the different calls made, every one having his own separate district. The commercial department keeps close watch of each solicitor's work. The solicitor is occasionally changed to a different territory with good results.

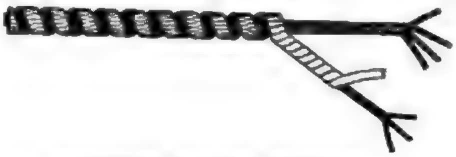
The great success of a solicitor in residential territory was a mystery for many months and until his method was discovered. This consisted, after finding a prospect, in telling all the local wiremen about it, the result being that after a few weeks the prospect requested a visit from the solicitor and a contract was signed.

For the data obtained in this account thanks are due Mr. Percy Ingalls, manager of the commercial department, and to Mr. C. W. Lee, of the C. W. Lee Company, of Newark, the advertising agents for the Public Service Corporation.

New Telephone Patents.

SPIRAL CORD.

Since the success of the steel switchboard cord has been thoroughly demonstrated, it is but natural to find the same general scheme applied to other classes of cords. Such an application of the spiral principle is shown in Fig. 1, in a cord for receivers, etc. The foundation of the cord is a fibrous core or string, about which the conducting strand is wound in a regularly spaced open spiral. This method gives flexibility and strength. The conducting strand itself consists of a metallic ribbon closely spiralled about a twisted fiber core. G. E. Schmidmer, of Germany, is the inventor of this cord.



SCHMIDMER FLEXIBLE CONDUCTOR.

RECEIVER.

C. G. Burke, of Brooklyn, has patented a double-wound receiver. It is his idea to provide a fine and a coarse winding, and by this means produce a substitute for the usual induction coil. He includes the low winding of the transmitter circuit as a primary, while the high winding bears the usual relation to the circuits of the telephone receiver.

PARTY-LINE SYSTEM.

A step-by-step party-line system of a rather novel sort forms the subject of a series of three patents granted to Messrs. A. F. Poole and F. B. Hall, of Wheeling, W. Va. One side of the line is normally cut in two at each station, and the line has to be built up for each call. The instruments are all disconnected until cut across the line by electromagnetic means under the control of polarize electromagnetic means. Provision is made to enable calls to be sent from or to the line or between stations, on the same line. A complete sub-station and switchboard system has been worked out.

INTERCOMMUNICATING SYSTEM.

R. M. Beard, of New York City, has patented an intercommunicating system which involves no common wires in the talking circuit. Each station has a wire incoming from every other, and also a wire outgoing to each other. In talking, the calling station selects one side of the circuit, viz., its wire to the desired station. The called station selects as the other side of the talking circuit its wire to the calling station.

LETTERS TO THE EDITORS.

Efficiency of Lighting Balancers.

To the Editors of Electrical World:

Sirs:—The question raised by Mr. Wilkinson in your issue of January 13 is an old acquaintance. It is the opinion of many engineers that the term "efficiency" should be used exclusively to express the ratio,

$$\frac{\textit{transformer power}}{\textit{transformer power} + \textit{losses}}$$

This seems to be the legitimate use of the word. The substitution of the word energy for power, giving the term "energy efficiency," seems a rational corollary, but further than that the definition should not be extended without the sanction of some authoritative body of scientific men.

Unfortunately the A. I. E. E. standardization report does not deal especially with the case in question, but it does define the efficiency of a motor-generator as the generator output divided by the motor intake. This and the foregoing are my sole reasons for using the terms "motor-generator efficiency" and "balancer efficiency" synonymously. I consider the reasons sufficient, but grant that there is ground for disagreement. In any case the conclusions of the paper in question will not be invalidated, as the efficiencies Eg and Em are used to determine current distribution.

There is much to be said on Mr. Wilkinson's side of the question, however. The operation of a two to one auto-transformer is a close analogue to that of a direct-current lighting balancer. The natural interpretation of the A. I. E. E. standardization report, under the section entitled "Stationary Induction Apparatus," would make the efficiency a ratio similar to that which Mr. Wilkinson uses for the direct-current balancer. It is not an efficiency of conversion. As is true with the direct-current-balancer, less than half of the unbalanced power in the secondary mains is converted by the apparatus. However, the auto-transformer *can* be used as a lighting balancer.

Again, many customers may look at the problem in this way: Here is a piece of apparatus. The output is a certain quantity. The intake is a certain larger quantity. Therefore, the efficiency must be the ratio of the first divided by the second, regardless of whether all or a part of the power be transformer.

The high efficiency as determined by Mr. Wilkinson is attractive to the salesman, but further than that it has no special advantage. The customer is interested chiefly in the number of volts by which his line will be unbalanced regardless of what output is taken as the basis for ascertaining the percentage of regulation, and he seldom asks for an efficiency guarantee. When he does, the efficiency may be given for each unit composing the balancer, the efficiency of conversion may be quoted, or that as calculated by Mr. Wilkinson; but each party to the contract should have a clear understanding of the basis of the guarantee. In lieu of a definite understanding, the efficiency of conversion is safest to use because it is the lowest and leaves no ground for dispute.

As to the term "combined armature efficiency," I meant the ratio of the output of the generator armature divided by the intake of the motor armature; that is, the motor-generator efficiency computed exclusive of the field excitation loss. This was clearly indicated in my article on page 1067 of the December 23d issue.

I thank Mr. Wilkinson for raising this question of definition, and express the hope that our standardization rules may some day be perfected so as to leave no ground for controversy.

Norwood, Ohio. Budd Frankenfield.

Increasing Central Station Business.

To the Editors of Electrical World:

Sirs:—I notice in your issue of January 13 that you have a very interesting article on the electrical distribution system of the Public Service Corporation of New Jersey, occupying four pages. I also notice in the same issue the second part of an article on "Central Station Economics in Massachusetts," and a page and a half devoted to notes on central station business and getting new central station business, in which are advanced suggestions for increasing the central station business. This latter, by the way, is a valuable feature in your paper, aiding as it does the central station man to get ideas for expanding his own business and thus increasing the use of electrical apparatus which will benefit your manufacturing friends.

Having just read the Public Service Corporation article and the business-getting articles above referred to, I was quite interested when I stepped off a train the other evening in one of the cities which is lighted by the Public Service Corporation to note the following condition:

A jewelry store with a flaming gas jet and some paper packages on a shelf some three or four feet above the gas flame, the store evidently closed for the night and the fire danger imminent. Adjoining the jewelry store was a barber shop, also lighted by gas, next door to that a saloon and then a livery stable with more flaming gas jets in dangerous places. Next to that was a newspaper office and a little further on a Chinese laundry, all of which were gas lighted and all of which were dangerous spots. It occurred to me that the insurance rates on that block must be very high, the lighting was decidedly unsatisfactory and it would seem that if the Public Service Corporation were as progressive as some of the other companies whose business methods you have been extolling, they would long ago have shown the proprietors of the various establishments enumerated above the danger and folly of continuing to use gas. There must be scores of other places where central stations are not making the necessary effort to induce their possible customers to try electricity in place of the old gas jet, and I bring this matter to your attention simply as an object lesson

It may be that one reason why the block in question is lighted by gas instead of electricity is the high rates charged by the Public Service Corporation for making a connection. A few months ago a tenant of one of my houses asked me to have his house connected with the Public Service Corporation mains. I asked the latter company what the cost would be and was informed that it would be $100, in consequence of which I did not have the connection made. The tenant in question is a man of means and they have missed a good customer because of their short-sightedness in making so exorbitant a demand for their connection, which does not strike me as being good business. As I said before, these facts are cited merely as examples of neglected opportunities.

East Orange, N. J. W. M. James.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Interpole Construction of Direct-Current Dynamos.—Dettmar.—The introduction of interpoles or commutation poles into practice should result in remodelling the design of direct-current dynamos which was worked out in the past with special reference to the necessity of providing good commutation. Since this result is now guaranteed by the provision of interpoles, it is no longer necessary to take it otherwise into account, and the design may be changed in many respects so as to get cheaper machines. While formerly very strong fields have been adopted with a high flux density in the air space and in the armature teeth (in order to prevent the field distortion) resulting in an increase of the copper on the magnets, it is now possible to reduce the cost by reducing the number of lines of magnetic flux and increasing the number of the armature conductors. It is no longer necessary to give a special form to the main poles. The number of commutation segments, which has been very much increased in recent years, may now be reduced, which reduction will lessen the cost and increase the strength of the commutator. In the choice of the number of poles one was formerly restricted by considerations of good commutation. Since this is no longer necessary it will be possible in many cases to reduce the weight of the machine by increasing the number of poles. It is further possible to improve the efficiency of the machines by the employment of interpoles so as to come nearer the conditions as they obtain with transformers. The efficiency may be increased for low loads and this is of special importance for such motors which do not always run at full-load. It will be possible to admit some distortion of the field, although the so-called additional losses are thereby increasd, the author describing a method of determining them. The loss due to the friction of the carbon brushes is not negligible, especially with 110-volt machines. This may be decreased since it is no longer necessary to select that kind of carbon which is best for good commutation. The carbon may now be selected to get the lowest friction. It may also be possible to introduce now into practice mixtures of carbon with metal which heretofore could not be used on account of their detrimental effect on commutation. Further the commutator may be made smaller. Interpole construction should be especially favorable for low-voltage electrolytic generators and for boosters. The connections of motors to street railway networks are now increasing in many German cities. For instance, in Dresden there are now 350 motors, having a total of 1,900 hp connected to the network of the street railways. Such consumers who have a very intermittent load, are thereby kept away from the lighting network. In connecting the motors to the tramway supply it must be taken into consideration, however, that such systems show considerable voltage variations, sometimes amounting to 40 per cent. This will cause a change in the speed of the motors. In many industries this will not matter much, but where it does, the disadvantage may be avoided by employing motors with a weak field. This is possible without an undue increase of cost, by using interpoles. The provision of interpoles also enables the design of machines in which the speed may be changed within very considerable limits, by simply varying the field. On account of the necessity for obtaining good commutation, direct-current dynamos have been built in the past mainly for electromotive forces not over 700 volts; for large generating sets not over 1,100 volts, or in extraordinary cases 2,000 volts have been employed. With the use of interpoles it will be easy to at least double the voltage. This should have an important effect on direct-current traction and simple power transmissions. If machines with interpoles are built with full utilization of their inherent advantages, it will be found that their price is not higher, and probably somewhat lower, than that of the present standard machines. It may, therefore, be assumed that there will be a tendency in the future to make interpole construction the rule.—*Elek. Zeit.*, January 11.

Alternator Construction.—An illustrated description of a new construction of alternators used by the Felton & Guilleaumme-Lahmeyer Co. The special feature is that the exciter is placed within the bearing case as shown in Fig. 1. The bearing case, therefore, forms at the same time the magnet yoke for the machine. The bearing shield and the magnet yoke are cast in one piece. The four poles made up from iron sheets are screwed to the yoke. A common box is provided for the armature commutator and the slip rings which are placed close to the latter. The whole revolving part of the exciter is independent of the alternator and may be taken from the axle when repairs are necessary without disturbing the alternator. The advantages claimed for this arrangement are a more compact and stronger construction and less weight, although the axle is, of course, somewhat heavier.—*Elek. Zeit.*, December 21.

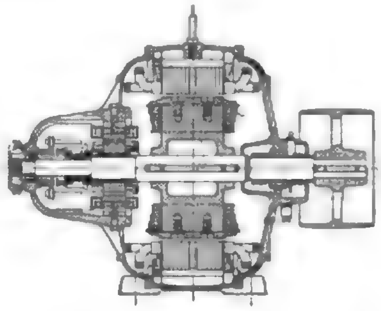


FIG. 1.—ALTERNATOR CONSTRUCTION.

Exhibit.—Reyval.—An illustrated description of a gas-driven generating set exhibited at Liege. The gas producer is of the Ficht-Heurtey type, and a Koerting gas engine drives a 450-kw, three-phase generator, the voltage being 2,000, the speed 125 and the frequency 50. Details are given concerning the design of this generator.—*L'Eclairage Elec.*, December 30.

Lights and Lighting.

Street Lighting.—Harrison.—The conclusion of his paper, the first part of which was recently abstracted in the Digest. Since he considers that the efficiency of street lighting must be judged by the minimum illumination obtained at any point, he has devised fittings with this special purpose in view. He emphasizes the following facts: The rays directed above the horizontal are useless, and therefore can be diverted up and down the street to increase the distant illumination. If the posts are erected on the edge of the footpaths, the raps which would illuminate the adjacent houses or fields are practically useless, unless the houses have a reflecting value, which is very rarely the case. The rays of light illuminating the street near the post should be of small value compared to those directed to a distance up and down the street, in order to obtain even illumination. The author has devised on this basis fittings of such design that the following results are accomplished. The average candlepower of the lamps measured from all parts of the street will be found to be 2.2 times the mean spherical candlepower, and the maximum candlepower measured over the width of the road, some distance from the post is nearly three times the mean spherical, the minimum candlepower measured adjacent to the post being equal to the mean spherical candlepower of the lamps. Results of tests are given from actual practice, and various figures are given on the cost of maintenance of various types of lamps, both electric and gas. From these tables it appears that the use of large units of light for general street illumination is expensive and should be avoided where possible. Further the cost of maintenance is very often as high, if not higher, than the cost of electrical energy or gas. The author finally speaks on the current supply for electric street lighting, and recommends a separate network which is stated to result in a considerable saving. As a suitably designed system, he mentions that of Wilkinson which consists of cables laid in gas barrels situated underneath the flags or paving adjacent to the curbstones. Osmium and tantalum lamps he considers as specially suitable for street lighting, and recommends to use them in the form of low-voltage lamps (10 to 30 volts), with thick filaments, intended to be run in series throughout the street, controlled at the end of each series by a magnetic relay switch connected to the previous series in a manner similar to that used for arc lighting. A very simple cut-out prevents a fault in any lamp extinguishing the series. He gives an estimate of cost, from which he concludes that even when including interest and sinking fund on all materials and mains, street lighting can be carried out at a profit by means of electricity at a price far below the average charge for gas when giving the same result as regards illumination.—Lond. *Elec.*, December 22.—An account of the discussions which followed in Lond. *Elec.*, December 29.

Public Lighting.—Simmance.—A report on the public lighting of Edinburgh, both with gas and with electricity, the results being given in tables and diagrams. The report speaks very favorably of the arc lamp used in that city. "The steadiness of light is very satisfactory; and the light at the angles approaching the horizontal is far greater than in many types of lamps. It must be observed that the value of a lamp for street lighting is not measurable by its mean hemispherical intensity. The bare arc invariably gives its greatest results at angles from 40 to 50 degs. from the horizontal, but at 5 deg. and at 0 deg. the light is very small. With a gas incandescent lamp, the greatest light is, of course, horizontal to the mantle and the depressed degrees from it; and this affords an advantage over arc lighting in most cases. But the arc lamps used in Edinburgh afford a very considerable light at the longer distance, and thus must be looked upon as eminently satisfactory." The greater height of the electric lamps gives the rays forming the more acute angles with the ground a further reaching effect, and thus the more distant lamps afford more useful aggregate distance light than the shorter gas columns can do; "and I, therefore, should have no hesitation in stating that the 10-amp. lamps could do the work of three times the number of 3-ft. incandescent gas lamps in fairly straight streets where the height of the electric columns gives that system the advantage."—Lond. *Elec.*, January 5.

Lens Lamp.—An illustrated note on the Boehm lens lamp. The only difference between this and an ordinary lamp lies in the design of the globe, the glass being not merely corrugated, but being shaped to form an actual lens. The object of this is to concentrate the light in a certain direction (usually in the direction of the lamp axis).—Lond. *Elec.*, December 22.

Power.

Steam and Gas Power in European Stations.—Rubricius.—A review of recent developments. The Berlin electricity works are now installing in one station two reciprocating steam engines, each of 6,500 hp. The steam consumption of one of them was found to be 4.03 kg. per indicated hp-hour. While in the United States vertical engines are generally used, the horizontal type is preferred for large units in Continental Europe and also mostly in England. The following types of steam turbines are now being used in Europe: The Parsons-Brown-Boveri turbine; the turbine of the Allgem. Elek. Ges., which is a result of a combination of the Riedler-Stumpf and Curtis types; the Zoelly-Escher-Wyss turbine; and the Union turbine of the Union Company in Essen. In France the Rateau-Sautter-Harlé turbine is also in considerable use. In the new central station of Essen-Ruhr two 10,000-hp Brown-Boveri-Parsons turbines have been in use for 5,000 to 6,000 hours and have proven perfectly satisfactory. Each turbine has a weight of 100 tons, including the electric generators (a three-phase generator of 5,000 kw and a direct-current generator of 1,500 kw) which are connected to the horizontal axle of each turbine by means of elastic couplings. In spite of this large capacity the dimensions of the turbines are relatively small. The total length of each turbine with the generator is 20 meters, while the height of the set is not over 2.6 meters. The guaranteed steam consumption is not more than 5.08 kg per hp-hour. Two other turbines of the same size are now being installed in Vienna, while a 12,000-hp unit has been ordered. The new power stations in Frankfurt, at Porta Volta in Milan, at Puteau near Paris, at St. Ouen near Paris and the Chelsea station in London, are all equipped with large steam turbines of 2,000 to 6,000 kw. Gas engines of a capacity of 1,500 to 2,000 hp are now no longer anything extraordinary. The operation of gas engines with blast furnace gases has produced important industrial changes and great savings in iron blast furnace districts. The thermal efficiency of the modern large gas engines averages about 30 per cent, and their design has been so improved that they may be directly coupled with the electric generators. For small power stations, suction gas engines have obtained considerable commercial importance.—*Elek. u. Masch.*, January 7.

Steam Turbine Station Design.—Sniffin.—An article pointing out that the steam turbine is no longer a matter of speculation. The reasons for the surprisingly quick introduction of the steam turbine into engineering practice are summarized. While turbines have previously as a rule been installed in power plants more or less conventionally designed on the lines of piston engine practice, there will soon be some typical turbine plants with their various other features and general arrangement co-ordinated to the simplicity and compactness of turbine design, and much of the present day complexity with its attending expense will disappear. Two such plants are now being designed for Ft. Wayne, Ind., and for Hamilton, Ohio. Boilers will be on the ground floor, the turbine located directly overhead; thus the steam and exhaust runs will be short and direct, the initial steam coming up and the exhaust going down, as they should. The exciters are put on the generator shaft, thus eliminating separate exciting units; in fact the stations will contain as little in the way of auxiliaries as possible. There will be some saving in building construction, considerable saving in ground space, and "it would not be surprising if the whole station, including ground, were to show a reduction in first cost per kw of 25 per cent on the usual capital account of such properties."—*Elec. Jour.*, January.

London Conference on Smoke Abatement.—An account of the recent conference and exhibition on smoke abatement in London. An address of Sir Oliver Lodge pointed out the unsanitary effects of fog. While the electrification of air on a large scale would be the proper method for dealing with river and sea mists and in general with fogs of a non-avoidable kind, it would need considerable capital expenditure to try it on a large scale. The right way of dealing with a town fog is not to permit imperfect combustion. The authorities should insist that the material burned should attain a moderate average of purity. Processes involving the use of solid fuel should not be carried on in a big city, but should group themselves round the coal field so that the cost of carriage might be small. The gaseous product, on the other hand, readily lends itself to purification and transmission. Gas is now usually burned under very unsuitable conditions. An important condition for complete combustion is that there must be no cold surface to interfere with the ignition. Gas must be raised to a certain temperature before it will ignite. "In many domestic grates there is far too much iron; by rights there ought to be nothing but non-conducting material within reach of the flame." A paper by Shaw discussed the question whether London fog is inevitable. He pointed out that there is nothing physically impossible in the idea of dispensing with coal smoke; this would dispense with about 20 per cent of London fog while the remainder depends upon physical processes not within human control. Cohen presented a record of the works of the Leeds Smoke Abatement Society. Rideal pointed out the excessive amount of sulphurous acid in the atmosphere found in districts where much coal is burned. Ackerman discussed the distribution of producer gas as a means of alleviating the smoke nuisance. Martin traced the connection between smoke prevention and coal conservation. Sir William Preece in an address emphasized the necessity of improving the methods of combustion. Cahorne called attention to the importance of the employment of only trained men as stokers, stating that the efficiency of several forms of smoke-consuming appliances depends more or less upon careful attention of the stokers. He does not think that mechanical stokers will supersede hand-firing to any extent. Rideal summarized the replies received from 38 factories to a circular letter. Three consumers have substituted gas engines for steam plant. Thirteen firms ascribe their success in preventing the emission of smoke mainly to careful stoking. While not denying the efficacy of many mechanical devices, yet the general consensus of opinion favors skilled and careful stoking as of the first importance. Kershaw discussed the aims and work of the Hamburg Smoke Abatement Society. Several other papers dealt with legal questions.—Lond. *Elec.*, December 22, 29.

Traction.

High-Speed Traction.—Morris.—A paper read before the Engineers' Club of Philadelphia, giving a review of the present tendencies toward high-speed electric traction and dealing especially with the "motor-cycle" railway. Upon the ties of standard road beds a central supporting rail is placed, leaving steam locomotives free to handle freight or other traffic over the two existing rails which also afford support for the balance wheels of the "motor-cycle" trucks. The motor-cycle car is carried on two trucks, the weight of the car body being concentrated on two motor wheels placed tandem in each truck, and running on the central rail. Two balance wheels on either side of each truck travel on the outer rails. The advantages of electric transportation are said to consist not only in concentrating the generating power plant for an entire system at one point, but in concentrating the weight of each car over the driving wheels that propel it instead of at the head of the train, trailing a dead load behind. The motor-cycle system not only concentrates the weight of each car over its four driving wheels, but makes these wheels themselves the motors and places them in direct alignment on a single rail. This is thought to reduce the problem of traction to its simplest and most direct form, and to render "enormously high speeds" possible "with economy, comfort and safety."—*Proc. Engineers' Club of Phila.*, January.

Chicago and Milwaukee Railroad.—A fully illustrated article on extensions and improvements on the Chicago and Milwaukee electric railroad. Plans are being completed for a new power house and a complete overhauling of the high-tension distributing system. The new power house will have an ultimate capacity of 45,000 kw and will be located at the central point of the system. Turbo-generators will be used. Current will be transmitted to sub-stations at 33,000 volts.—*St. R'y Jour.*, January 20.

Installations, Systems and Appliances.

British Central Station Statistics.—The first of the annual "tables of electricity supply and traction undertakings of the United Kingdom." The present table covers central stations with no tramway load. There are now in operation 262 such stations about which a large amount of information is given as to equipment and system. This number is now slightly less than last year, since the number of lighting stations which have added a traction load during the year is greater than that of the new stations opened for lighting supply only. The number of new stations in progress is small; this is largely accounted for by the increasing number of districts in which supply is taken "in bulk" from a large power house outside their area. With regard to the system of distribution there is little change; three-wire direct-current at about 220 and 440 volts continues to hold sway. One more concern has abandoned the old time single-phase system with transformers in favor of the direct-current system. With regard to generating plant, the increasing use of the steam turbine especially for alternators of large size is very noticeable. A few more engineers have installed gas driven plants, but only in connection with small units. There is an almost universal reduction in the price paid for coal, which is partly due to the further perfection of automatic stoking appliances which enable the use of cheaper qualities of coal. The steady reduction in the price charged for lighting supply has continued, but the decreased charge is more marked in the case of supply for power and heating. A number of the London companies, for example, now supply energy for this purpose at two cents per kw-hour. Notwithstanding the keenness of the competition of gas lighting, the increase in electric street lighting is well maintained and numerous Nernst lamps have been installed during the year. The new metallic-filament lamps are beginning to make their appearance in the streets, and in several places the flame arc has been introduced.—Lond. *Elec.*, January 12.

Automatic Control of Large Motors.—James.—A fully illustrated description of an automatic reversing controller recently designed for the handling of a 900-hp, direct-current compound motor. The controller proper is operated by compressed air. The valves to the air cylinders are controlled by electromagnets supplied with current from a separate low-voltage circuit. Each valve is held by a spring in the position which cuts off the air pressure from the cylinder and connects it with the exhaust. When the magnet is energized the exhaust is closed and air is admitted to the cylinder. Thus the force of the air compresses a heavy spring and closes the circuit-breaker, or in the case of the reverser, rotates it in the opposite direction. The construction is described in detail and the advantages of the electropneumatic system of control for large motors are pointed out. "A pressure of several hundred pounds is available for closing the contacts of the current-breaker which permits the use of a powerful spring for opening the breaker, thus causing a quick break of the arc, which reduces the burning and prevents the breaker from sticking. The air valves can be controlled by very small magnets wound for low voltage. This materially reduces the liability to trouble with these circuits and there is practically no burning on the contacts of the master-switch interlocks. The power required to operate these valves is so small that the pilot wires need be only large enough for mechanical strength. This low-voltage circuit can also be used for signal purposes when the master switch is located at a distance from the machine. A strong point in favor of this system is the facility with which friction brakes and mechanical clutches can be operated and controlled with compressed air by using the same magnets and valves which are used on the circuit-breaker. The pressure of the brake or clutch can be varied through wide limits by manipulating the control valve."—*Elec. Jour.*, January.

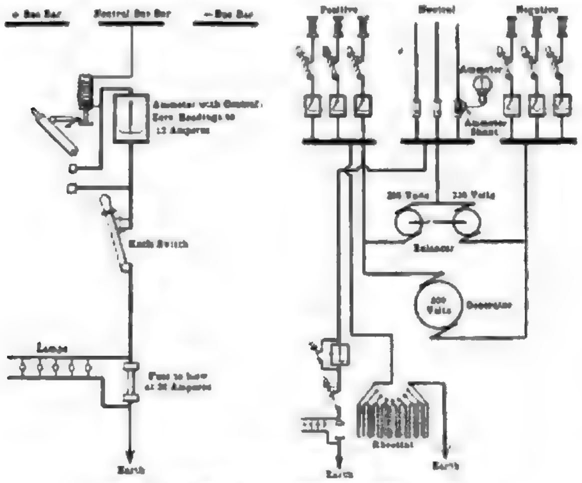
Switch Gear.—Whitcher.—A paper read before the Rugby Engineering Society giving some notes on heavy electric switch gear. The author discusses the special features of the following three classes: The plug type, the lever type and the bridge type. He then takes up the question of arcing tips and carbon brake attachments to switches and circuit-breakers and discusses the reasons for the superiority of the carbon brake over the metallic brake.—Lond. *Elec.*, January 5.

Electropneumatic Controller.—Montpellier.—An illustrated description of the Bouscot electropneumatic controller for operating from a distance the air compressors on tramway cars; it is also specially adapted for controlling electric motors driving pumps. —*L'Elec.*, January 6.

Insulating Material.—A note on a new fireproof insulating material of the Allgem. Elek. Ges. Layers of a fireproof material, like asbestos, are strongly pressed on both surfaces of plates of a good insulating material, "like vulcan asbestos or tenacite." Such a strong pressure is applied that there is produced a gradual transition from the fireproof to the highly insulating material and the resulting plate is one unit. Each plate consists, therfore, of a highly insulating core with fireproof surfaces.—*Elek. Zeit.*, December 21.

Wires, Wiring and Conduits.

Underground Mains.—Black. A paper read before the Glasgow section of the (Brit.) Inst. Elec. Engs. In the first part the author gives a review of the layout of the cable system in Glasgow and its maintenance. The high-tension mains are three-core cables, paper-insulated, lead-covered and armored; for the most part they have been drawn into earthenware ducts laid in concrete. The low tension feeders consist of triple concentric cables, each of 1x1x0.3 sq. in., the smaller sectional area being that of the neutral conductor. Some have impregnated jute or paper insulation with a lead sheathing and others have paper insulation with vulcanized bitumen sheathing. All of these are laid on a solid system in either cast-iron, earthenware or impregnated wooden troughing. Most of the distributing network also consists of triple concentric cables of the same type. After experience with the above cables and troughing for low-tension work, the paper-insulated, bitumen-sheathed cable, laid in wooden troughing filled in with pitch, has been adopted as the standard. The bitumen-sheathing obviates the likelihood of electrolysis of a metallic sheathing, and, what is perhaps more important, leaves no chance for the trouble experienced when the sheathing of lead has become alive owing to a fault, and has caused arcing at a point perhaps far distant where the lead has been in accidental contact with earth. Wooden troughing is cheap and is likely to have as long a life as thin cast-iron troughing. Refined bitumen is no longer used as a filling, since good pitch mixed with a suitable amount of pitch oil has proven satisfactory. The feeders terminate at the distributing end in large cast-iron underground chambers, to which are brought the whole of the distributing cables for the various streets in the neighborhood of the feeding point. The feeder is connected directly without fuses to three main bus-bars and the distributors are connected through fuses to the positive and negative bars, and directly without fuses to the neutral bar. As a rule, eight or ten distributors radiate from each feeding point. They have no connection with one another nor with any distributor connected to any other feeding point. This arrangement conduces to the general safety of supply, and in case of trouble lends itself to a less costly and more scientific system of fault localization.



FIGS. 2 AND 3—UNDERGROUND MAINS.

During the last years a considerable number of section pillars have been erected instead of underground manholes. These pillars have the advantage of being somewhat cheaper in first cost and involving a minimum of disturbance to the street during erection and are drier than underground boxes. Fig. 2 illustrates an arrangement on the low-tension mains which has been devised to meet as far as posible, any contingency arising in respect to an earth coming on either the positive or negative side of the network. In case of such a contingency the ammeter will immediately indicate the faulty side of the system. If the leakage current is less than 12 amperes, the only indication of the disturbance is on the scale of the ammeter. If the current, however, exceeds 12 amperes, the ammeter will be short-circuited, since a solenoid-operated switch in shunt with it is closed; and if the current exceeds 20 amperes, the fuse will be blown and a bank of incandescent lamps in shunt with the fuse will light up so as to draw immediate attention to the fault, and it now becomes necessary to locate the district in which it has occurred. The knife switch is opened and a new fuse inserted and with a longer handle fixed in the knife switch the neutral conductor is flashed to earth by quickly closing and opening the switch. At the same time the feeder ammeters are watched and the fault will be on the feeder or a section of the network attached to the feeder whose ammeter shows a sudden rise in current at the instant the neutral bus-bar is earthed. The neutral conductor being normally at earth potential and therefore not under test, it becomes necessary to ascertain that its insulation resistance is not deteriorating. The arrangement used for this purpose is shown in Fig. 3. A central-zero ammeter, or an ammeter shunt capable of carrying, say, 500 amperes, is connected permanently between the neutral bus-bar in the station and the neutral conductor of each feeder leaving it. A reading of the out-of-balance current (amount and direction) on each feeder is taken and noted. The positive or negative bus-bar is then gradually earthed through a resistance which it cut out step by step until a fairly large current is passing through it. A second set of readings is now taken of the out-of-balance current on the various feeders, and is compared with the first set taken. The difference in the reading is the amount of current passing through any weak spot on the neutral conductor and earth. This test is taken about once a week and has been the means of discovering in Glasgow several cases of mechanical damage to cables. It is specially useful where the outer or neutral conductor only of a triple concentric main has been injured since the warning provided gives an opportunity for having repairs effected before moisture gets in and causes a short-circuit between the outer and inner conductors.—Lond. *Elec.*, January 12.

Electrophysics and Magnetism.

Hysteresis Loss in Alloyed Sheet Iron.—BENISCHKE.—Steel manufacturers have succeeded during the last ten years in reducing the coefficient of hysteresis from 0.002 to 0.001. In order to reduce the eddy currents, special alloys have been introduced into practice which have a very high specific resistance, but the same low hysteresis loss as the usual iron. Such alloys can be made having an eddy-current coefficient about one-third that of the usual iron, while the hysteresis loss is also smaller. This is called in Germany "alloyed sheet iron" (legiertes Eisenblech). The temperature coefficient of the resistance is about one-third of the ordinary value, being 0.0008 to 0.0016 against 0.0047 for ordinary iron. The total loss (hysteresis plus eddy current) for one period is in this case exactly represented by the formula $\eta \mathfrak{B}^{1.6} + \beta \nu \mathfrak{B}^2$. If this value is plotted in the diagram as function of the frequency, ν, a straight line is obtained while with ordinary iron this curve is slightly bent. The author used such iron alloy for determining the influence of the wave shape on the hysteresis loss and found that for the same maximum value of the magnetic flux the hysteresis loss is the smaller the more pointed the form of the magnetic wave.—*Elek. Zeit.*, January 4.

Spark Potential and Gas Pressure.—C. E. AND H. GUYE.—A paper read before the Congress for radiology and ionization in Liege on spark discharges through gases. The experiments were made with nitrogen, oxygen, hydrogen and carbonic acid. The gases were carefully cleaned and dried. Up to about 10 atmospheres the spark potential increases as a linear function of the pressure. If the pressure is further increased the ratio of the spark potential to the pressure decreases. The curves representing the spark potential as function of the pressure are parabolic. In all experiments with nitrogen the curve of the spark potential has a maximum near the maximum of the compressibility of the gas (pv = minimum). A few experiments made with carbon dioxide near the critical point appear to indicate a decrease of the spark potential at that point.—*Phys. Zeit.*, January 15.

Thermo-Electricity.—LECHER.—A note discussing the coincidence of the zero point of the Peltier effect and of the maximum of the thermo-electric force.—*Phys. Zeit.*, January 15.

Units, Measurements and Instruments.

Testing Meters in Situ.—GERHARDI.—In a continuation of his illustrated serial on electricity meters the author discusses the methods of testing meters in situ. Fig. 4 shows the connections for the test of a watt-hour meter in situ using the consumers' lamps as load. The dotted lines indicate the temporary connections. The shunt circuit of the watt-meter is isolated from the main coil and the latter is inserted on the "house" side of the meter under test. The leads from the wattmeter shunt terminals are connected to the supply main terminal and shunt terminal of the meter respectively. If a portable lamp box is used as resistance, the connections are as shown in Fig. 5. The house lead, *A*, is removed from the house terminal of the meter as before, and if connected to the station terminal by a lead, *B*, the test can be made without interrupting the supply. With the connections

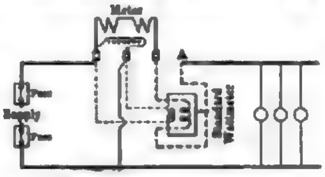


FIG. 4.—TESTING METER.

shown the current passing through the portable lamps passes through the shunt. For large loads this would not be safe but up to about 10 amperes, no harm will be done. Testing in situ, if done properly, also becomes a check on the wiring of the house. It is very often difficult to trace wiring (especially additions),

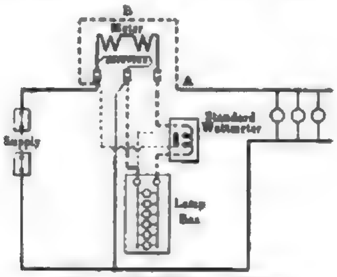


FIG 5.—TESTING METER.

and it sometimes occurs that a lamp or lamps may be connected on the station side of the meter. The tester should, therefore, always be on the lookout for such unmetered circuits, which are easily found out by leaving the end, *A*, out of the meter and trying to turn on suspected lamps, which, of course, would only glow if connected to the wrong side of the meter. Fig. 6 shows

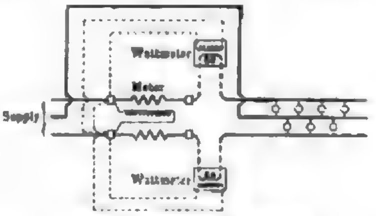


FIG. 6.—TESTING METER.

the connections for the test of a three-wire watt-hour meter in situ, using two wattmeters, and applying a constant of 0.5 to obtain the true power if their shunt currents are normal.—Lond. *Elec.*, January 5.

BOOK REVIEWS.

Traité Pratique D'Electrochemie. By Richard Lorenz. Paris: Gauthier-Villars. 323 pages, 77 illus. Price, 9 francs.

This work is an expansion of the well-known "Elektrochemisches Praktikum" of Lorenz. Mr Georges Histelet has recast the work into French, putting it into the shape of a text-book of electrochemistry, and introducing the experiments at appropriate places to illustrate the principles in the text. A few extracts from the preface will explain this plan:

"We propose to unite a means of practical education with a progressive method of instruction in the laboratory, as much to make felt the spirit of electrochemical theories as to teach how to use them as guides in experimental work."

"The book is divided into three parts. The first studies in an elementary way the fundamental laws and reactions of electrochemistry proper, using the simplest experimental demonstrations; the second treats exclusively of the electrolysis of aqueous solutions, in such manner as to show how, by the aid of physico-chemical theories, one can measure the physical data met with; the third is concerned with applied electrochemistry, and constitutes a study of the preceding principles as applied to practical problems."

The plan of the book is in many ways commendable, as uniting laboratory tests with theoretical discussions; and since the combination is very carefully and judiciously done, the teacher or independent student will find in it a very helpful guide to an intimate knowledge of the principles and theories of electrochemistry.

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Steam Turbines. With an Appendix on Gas Turbines and the Future of Heat Engines. By Dr. A. Stodola. New York: D. Van Nostrand & Co. 434 pages, 241 ills. Price, $4.50.

Prof. Stodola's work on the theory and design of steam turbines is admittedly the best that has been issued to date, and it is gratifying to have an English translation thereof as satisfactory as that prepared by Dr. Loewenstein. Primarily the volume is of interest to turbine builders alone, as the critical analysis of the various factors entering into the design of such machines is carried somewhat beyond the limits within which the average engineer would feel it desirable or needful to be at home for the purpose of intelligently handling the routine problems which he is apt to encounter. No one, however, objects to having a standard reference volume on which to fall back in times of need, and Stodola's book is undeniably entitled to admission in that category.

The principal sections of the work in the order laid down by the author comprise, first, the elementary theory of the steam turbine; second, the theory considered thermodynamically; third, the design of the most important parts of such machines; fourth, a description of typical steam turbine forms; fifth, some of the special problems in theory and construction; and finally, a brief appendix on the future of the heat engine.

The first section seems to have been written as a general introductory exposition of the theory of the steam turbine for the benefit of those engineers who have not had occasion or opportunity to keep in touch with the rapid development of these machines. It is brief, extending over but 42 pages, and is chiefly devoted to the classification of possible variants into different groups and types and an analysis of the characteristics of each. The second section on the thermodynamic theory of the turbine and the laws of energy therein is valuable for its combination of theoretical mathematical deductions with the extensive series of experimental investigations carried on by the author and others on the flow of steam through nozzles and the frictional resistance of rotating discs in and steam from which are derived various formulæ and constants essential to the intelligent design of turbines.

The third part of the volume, that is, the one on the construction of the more important turbine parts is formed, as might be anticipated, of sections on such subjects as the proper form of blade profiles, methods of securing blades to wheels, disc designs and permissible peripheral velocities, shaft and bearing designs, balancing problems, governing means and the like; in other words, the data requisite in turbine design as distinguished from that found in the numerous authorities on ordinary machine design. Part four is largely descriptive, giving illustrations and more or less detailed reproductions of drawings of parts of the various forms of commercial turbines. Aside from the general value of the author's criticisms of the relative advantages and disadvantages of the types, the matter of chief importance is the series of full and carefully tabulated results of experiments on the Rateau and Parsons machines and the effect of varying loads, superheats and vacua on efficiency.

The fifth section on special problems of theory and construction is rather technical and the average engineer who is simply desirous of posting himself in a general way on turbine apparatus and does not contemplate qualifying as a designer will probably content himself with rather a hasty glance through the sometimes involved matter. The sub-headings treat of such things as the distribution of pressures in the cross section of an expanding jet, the stresses in wheels due to uniform heating, velocity caused by the deflection of a uniform shaft due to its own weight, the differential equation for pressure distribution in many staged turbines, etc.

The appendix is a short analysis of the various expedients that have been proposed to date for attaining increased efficiency of conversion of heat into mechanical energy not alone in steam turbines but steam and gas engines and these in combination with turbines. The gas turbine, too, is treated of and the calculations of such devices both graphically and mathematically and with and without the injection of water are given, all however merely as a matter of interest and not of present utility as the author states that only when the mechanical efficiency of gas compression becomes of very high value and when means have been devised of considerably increasing the efficiency of the flow energy in turbines or when substances of sufficient stability and strength at temperatures beyond red heat have been found, will the gas turbine become a commercial factor. In this section there is also a summary of a communication that the author received from Prof. Lorenz setting forth the present status of the efforts that have been made to obtain electricity direct from coal and showing that there is no immediate prospect of success in that direction.

The translator has left all formulas, which in the original were expressed in metric units, as they stood, but given in addition thereto their conversion into the English system. The large steam table curve sheets are also supplied with the book in both units. It is merely to be hoped that the necessity for translating metric language into our barbarous English jargon will before long be rendered unnecessary by favorable action of Congress on one or more of the metric bills now before it.

On the "Reducing" of the Fire Hazards of a Motor Circuit.

By D. J. Burns.

A motor circuit, unless properly protected, presents one of the worst electrical fire risks in existence. It frequently occurs that a motor is installed anywhere that is convenient regardless of the "exposure" risk it will present and is operated by any one regardless of his capability. A motor is strongly built and is not, in itself, a bad risk when running under its proper condition of load and speed, yet it becomes an extremely bad hazard when the motor starting rheostat is improperly constructed or operated.

Great stress should be laid on the requirements of motor starters. The fact is that while even a badly designed or poorly built motor may be run for years if controlled by a good starting rheostat, a bad starting rheostat will cause a breakdown of the best equipment, unless the utmost care be exercised.

The function of a motor starter is, firstly, to insert resistance in the armature circuit of a motor in order to keep the starting current below a certain predetermined maximum; and, secondly, to gradually cut out this resistance, thus gradually increasing the voltage at the terminals of the motor armature and correspondingly decreasing the volts upon the starting rheostat until the full volts are applied to the motor armature and it is operating at full speed.

Consider what will happen if an ignorant, careless or vicious operator starts a motor by cutting out the starting resistance more rapidly than the counter volts of the motor build up. Take a 5-hp, 250-volt, shunt-wound motor, armature resistance 4 ohm motor armature at rest, starting lever moved over the starting contacts in one or two seconds; the motor armature does not have time to move from its position of rest and begin to accelerate and generate counter volts; therefore, this 4/10 of an ohm is directly across 250 volts and, theoretically, 625 amp. (approximately) will pass through the motor armature. This means terrific sparking and sputtering and, if frequently repeated, final destruction. This sputtering and sparking and final destruction are each bad fire risks.

Therefore, the first requirement of the operation of a motor starter in order that the motor will not present a fire risk is that the resistance of the starter be cut out at a proper rate to suit the rise of the voltage at the terminals of the motor. A greater starting current is required when the motor is started under load than is necessary with light load, and the starting arm can be moved faster to cut out resistance for light loads than it can be for heavy loads.

The proper method of accomplishing correct starting is to have in the motor circuit a protective feature which will open the circuit *instantaneously* upon the passage of a predetermined amount of current. A circuit-breaker is the best commercial device to use for this protection. It acts instantly, preventing a too rapid movement of the rheostat lever—and in performing its function it does not destroy or even damage itself.

The Underwriters' quarterly reports of fires show that a large number of fires are due to excessive sparking at the motor commutator, which is caused by successive improper starting.

It is well known to engineers and motor manufacturers that most of the damage which comes to the motor circuit is due to excessive current put through the apparatus in starting the motor or attempting to start it. While the motor is at rest the brushes may have been shifted, the fields weakened, the load upon the motor may have been changed or the type of load may have been changed, the shafting disarranged or a wrench left in the gears of the machine, or a tool set for a too deep cut, or any of the numerous causes which might prevent a motor armature from starting or cause it to start under extreme overloads. An independent circuit-breaker offers a perfect protection if the operator attempts to start the motor under such conditions.

The first requisite of a starter, in order that the motor will not present a fire risk, is that the device which is to open the circuit upon overload shall be able to act during the period of starting the motor, as well as when the motor is running under full speed conditions. It should be borne in mind that in most cases the operators of motor starters are people not technically acquainted with electrical matters, and hence do not know what is necessary in order to properly start a motor and do not know what a bad fire hazard an overloaded motor presents.

The second important requirement of a motor starter, in order that the motor shall not present a fire risk, is that the circuit breaker shall be so mechanically interlocked with the motor starting lever that the circuit-breaker cannot be closed except by moving the starting lever to the open circuit position, thus making it impossible to close the circuit breaker so as to make a short circuit or overload.

The total resistance of the best makes of commercial starters is such that 1½ times the full torque current of the motor will flow when the starting lever is moved to "make" the circuit. (It takes 1½ times the full torque current of a fully loaded motor to start it against the friction of rest and to accelerate it in a reasonably short time to full speed.) So a circuit breaker must be set somewhere above 50 per cent overload and because motors really are started rapidly and, at times, under condition of overload, the circuit breaker is nearly always set at 100 per cent overload, i. e. twice the full load normal current.

A 100 per cent overload is a safe overload for a motor armature during the usual interval required for starting the motor, but a current less than that which is required to operate a circuit breaker set to open at twice the full load current would burn out a motor armature if maintained for an improper length of time. Therefore, there should be in the circuit a device set to operate at about 50 per cent overload, having a sufficiently long time limit in its operation to prevent its acting during the period required for properly starting the motor.

An enclosed fuse fulfills this requirement very well; as an example: It is stated that "an enclosed fuse of the 30-ampere class is designed to operate in about 30 seconds when overloaded 50 per cent."

It is necessary to have a fuse on both sides of a motor circuit; otherwise one side being grounded in one place, and the other side in another place, there might be established a circuit with no fuse in action at all.

For the proper protection of the circuit during the periods other than starting of the motor, two fuses are necessary, one in each pole of the circuit. For the proper protection of the circuit during the period of starting the motor, a circuit-breaker is necessary; which may be single-pole, provided it is so interlocked with the starter that the circuit cannot be closed on short circuit or improper overload.

COMPARATIVE VALUES OF CIRCUIT BREAKERS AND FUSES IN REDUCING FIRE HAZARDS OF A MOTOR CIRCUIT.

A circuit breaker acts quickly enough to protect the motor against overloads during the period of starting and in performing its function does not destroy itself. A fuse is not designed to act quickly enough to offer protection while a motor is being started rapidly and in operation does destroy itself. A fuse (when not supplemented by a circuit breaker) is a bad risk, because when a fuse blows it is frequently replaced by one of a higher capacity or by a piece of copper wire. It is not only the ignorant who will do such bad work, for it is done by any hasty man who does not happen to have extra fuses at hand. A circuit breaker set at 100 per cent overload will always operate quickly enough to prevent the blowing of a fuse rated at 50 per cent overload. A circuit breaker is far more reliable than a fuse.

If a reliable automatic device such as a circuit breaker can be readily arranged for the protection of a motor circuit, it is accepting an unnecessary risk to depend entirely upon the unreliable fuse or upon the intelligence of a careless, ignorant or vicious operator, or to assume that every plant has a proper assortment of first-class fuses and that technically skilled and conscientious workmen will always be available to replace a burned out fuse.

FIRE HAZARD IN STARTING RHEOSTATS.

In starting a motor all of the current carrying parts of the motor rheostat tend to heat up, due to the passage of current through them.

All "open or exposed" resistance types of motor starters present a very serious fire risk. In such types the resistance is wound on bobbins or tubes of so-called "asbestos" board, which contains a large percentage of combustible material. The asbestos board will absorb moisture, producing electric action and also tend to cause a ground on the rheostat frame. The coiled wire wound around the tube is under tension, and when burned out, will become loose and move about, short-circuiting other coils and causing arcing and spitting of molten metal from the rheostat. Asbestos board will ignite when heated by the resistance wire and flames will issue from the rheostat—*there will actually be a blazing fire in the rheostat.* If the lead wires from the resistance to the face contacts are soldered, then molten solder will fall from the rheostat, even before the rheostat burns out. If the rheostat is mounted where filings or inflammable material might get in contact with the heated resistance wire, such materials will produce a bad fire risk.

With such starting rheostats, it is necessary to enclose them in fireproof material, if it is desired that they shall not present a fire risk.

"Enclosed resistance" types of starting rheostats of proper design are constructed, however, with the resistance so entirely enclosed that if the resistive conductor be fused by excessive current or otherwise, the arc is quickly and quietly extinguished, without any attendant fire risk. Among such types can be cited the packed card type, the packed mica and iron type and those types in which the resistance material is imbedded in sand or in cement, enamel, glass, slate, etc.

If a reliable enclosed resistance can be readily obtained that will not present any fire risk whatever, then it is running an unnecessary risk to depend upon the good intentions or the intelligence of a "user" to build a fireproof cabinet for the open type rheostats, in order that they will be safe to use.

FIRE HAZARD OF FACE PLATES OF MOTOR STARTERS.

The fire hazard presented by a face plate of a motor starter consists in the arcing between the movable and fixed contacts (neglecting for the present any arcing which might occur upon the opening of a circuit breaker mounted upon the rheostat). The greatest amount of arcing occurs upon breaking the circuit on the starting contacts.

A great deal of attention has been given in the past to the main line motor switch and but very little to the starter switch. It should be remembered that in starting a motor, the circuit breaker is first closed, then the line switch is closed and then the circuit is really completed by the starting lever making contact with the initial live stationary contact. It is seldom that arcing occurs on the main line switch for it is closed when the circuit is open on the starter and is opened when the motor is developing protective counter volts.

The starting lever and the starting contacts are the elements of a single pole switch, which is closed and opened at the initial live contact and a great amount of arcing will occur at this point, for this switch is closed when the motor armature is at rest, and it may be opened before the motor armature starts to move or when it is just beginning to move. Since the total resistance of the best makes of commercial starter is such that one and one-half times the full torque amperes will flow through the rheostat and motor upon closing this switch, then with a 5-hp, 250-volt starter, the arc caused upon breaking the circuit will be due to 30 amperes at 250 volts or 7,500 watts. (Under normal conditions.)

An ignorant, careless or vicious operator will often move the starting lever to the initial live contact and withdraw it *slowly*, opening the circuit slowly, and an arc due to 7,500 watts will be maintained for a sufficient length of time to cause (1st) a fire, if inflammable materials are in free circulation; (2nd) the burning of the sliding contact, which will cause arcing on each of the stationary contacts when they are next in service.

This fire hazard can be reduced to a minimum by "making" the circuit at a point which is entirely independent of the movable contact and the arc of the stationary contacts and by "breaking" the circuit at this point with a quick snap, independently of the slowness of movement of the operator's hand. When necessary this auxiliary quick break should be supplemented by a magnetic blow out in order that the arc should be effectively extinguished.

The fire hazard presented by the stationary contacts and the movable contact on the motor-starting arm can be reduced to a minimum by having the "stationary contacts" made of renewable segments and the "movable contact" made of self-aligning renewable skate shoes, sufficiently flexible to ride over any projection raised 1/16 in. above the contact surfaces.

If the simple and plain requirements as outlined in this article are followed the "fire hazard" in a starting rheostat will be reduced to a minimum.

A Continuous Steam Engine Indicator.

The demand for a steam engine indicator which will show at all times the indicated horse-power developed by an engine without regard to the variations of steam and exhaust pressure has been developed by Mr. John F. Shreffler, 376 S. Campbell Avenue, Chicago, who has placed the device on the market. The principle of this device is very simple. The indicating fin-

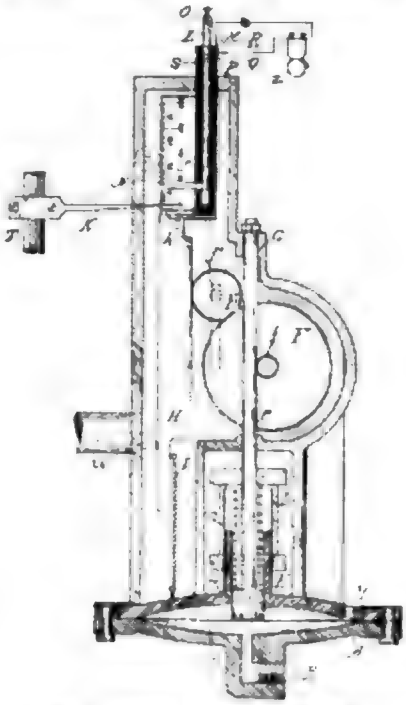
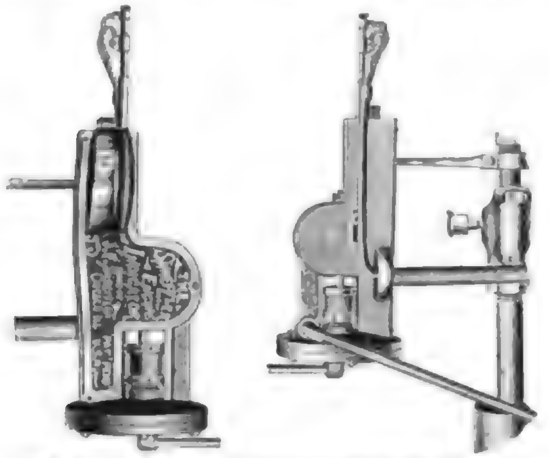


FIG. 1—CONTINUOUS INDICATOR.

ger, *K*, Fig. 1, is attached to a part of the engine, the movement of which varies according to the load, this part being the governor rod on a Corliss engine and the valve stem on a high speed automatic cut-off or marine engine. The indications of the finger, *K*, are read from the scale *h*. The position of this scale depends on the difference between the initial and back pressure on the engine. The movement of this scale to accomplish this is by means of a multiplying gear connected to a rack and pinion, this rack being moved by a diaphragm on one side of which the exhaust pressure is admitted and on the other side of which the initial steam pressure is admitted. The position of the diaphragm and therefore of the scale is dependent on effective initial pressure. Fig. 2 is a front view of the device and Fig. 3 the rear view. The device is calibrated after it is placed on the engine by means of the ordinary steam engine indicator after which the scale is marked to read directly in horse-power. In addition to its purpose as an indicating instrument, it may also be used to give an overload alarm by placing an electrical contact on the scale so that the index finger will strike it upon the predetermined overload for which it is set.



FIGS. 2 AND 3.—FRONT AND REAR VIEWS OF INDICATOR.

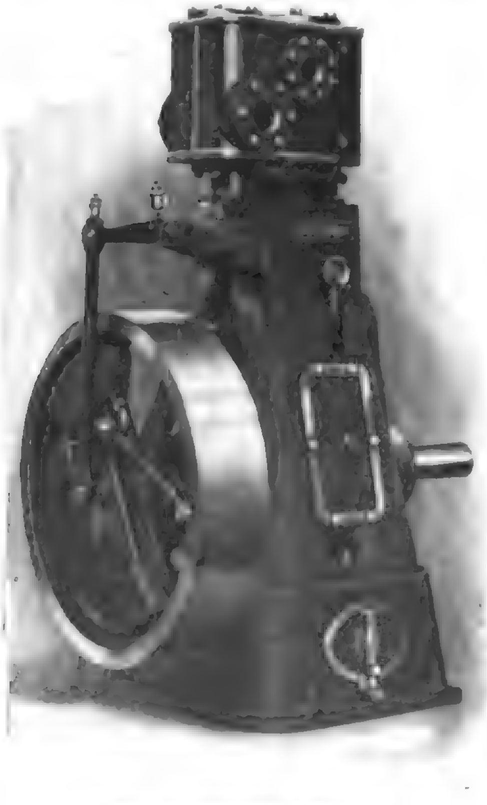


FIG. 1.—HIGH-SPEED ENGINE.

Pure Copper Trolley Wheels.

In order to overcome the difficulties found in trolley wheels made of alloyed copper, the H. W. Johns-Manville Company, 100 William Street, New York, has developed a wheel made of absolutely pure copper, which is purified, and then strengthened by a special process. These wheels are furnished with bushings of a metal whose tenacity is equal to that of steel, and whose ductility and toughness are such that it will not crack when distorted by a load of 130,000 lb. per sq. in.

TROLLEY WHEEL.

◆

High-Speed Vertical Engines

The engine shown in the accompanying illustrations has been especially designed for the driving of direct-connected generators, and in the proportioning of its parts a special effort has been made to obtain the maximum of power in the minimum of space. One of the most striking features of the engine is the system of forced lubrication combined with the complete enclosure of the moving parts.

Within the heavy cast-iron base is placed a submerged oil pump which, being operated by the crank shaft, draws oil from the reservoir and forces it through pipes and internal passages in the moving parts to the crank pin, the wrist pin, and the main bearings. Twice during each revolution the reversal of stress on these parts, due to the double acting feature of the engine, so reduces the pressure that the pump has an excellent opportunity to force between the surfaces a fresh film of oil which is carried around to lubricate the rotating parts when the pressure is greater.

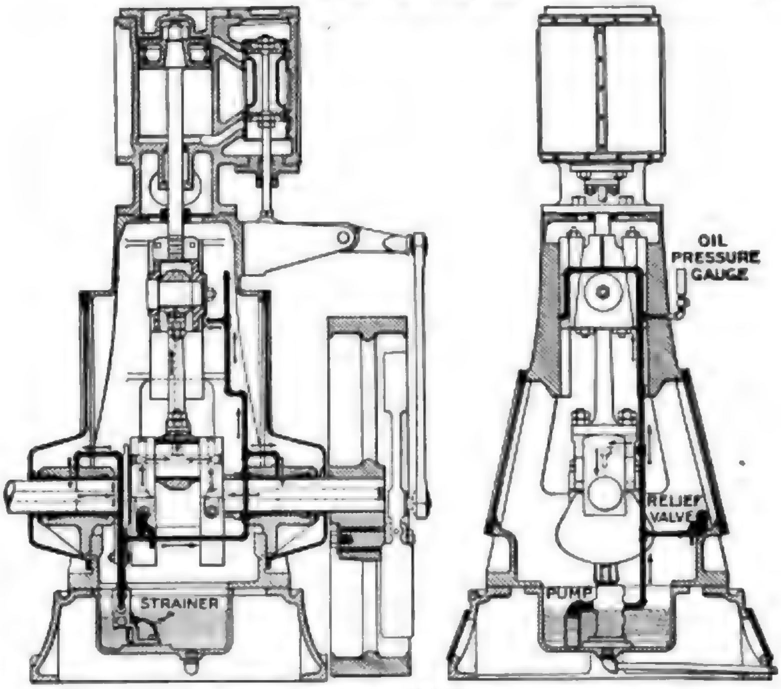


FIG. 2.—SYSTEM OF FORCED LUBRICATION.

These engines are built by the B. F. Sturtevant Company, Hyde Park, Mass.

Sewing Machine Motor.

In the sewing machine motor is to be found an interesting application of electric power for small machines. The motor illustrated herewith is combined with a transmitter, brake and switch on a single supporting bracket which may be attached to any style of table for use with every variety of sewing machines.

The transmitter consists of a friction device and levers giving speed control by purely mechanical means, which replaces the usual speed-regulating rheostat. Pressure on the treadle operates a lever which closes the switch and starts the motor. Further pressure moves the loose wheel along the shaft and engages the tight wheel, and the degree of pressure regulates the friction between the wheels and therefore determines the speed of the driving pulley. When the treadle is released a spring attached to the lever disengages the friction wheels, opens the switch and applies the brake.

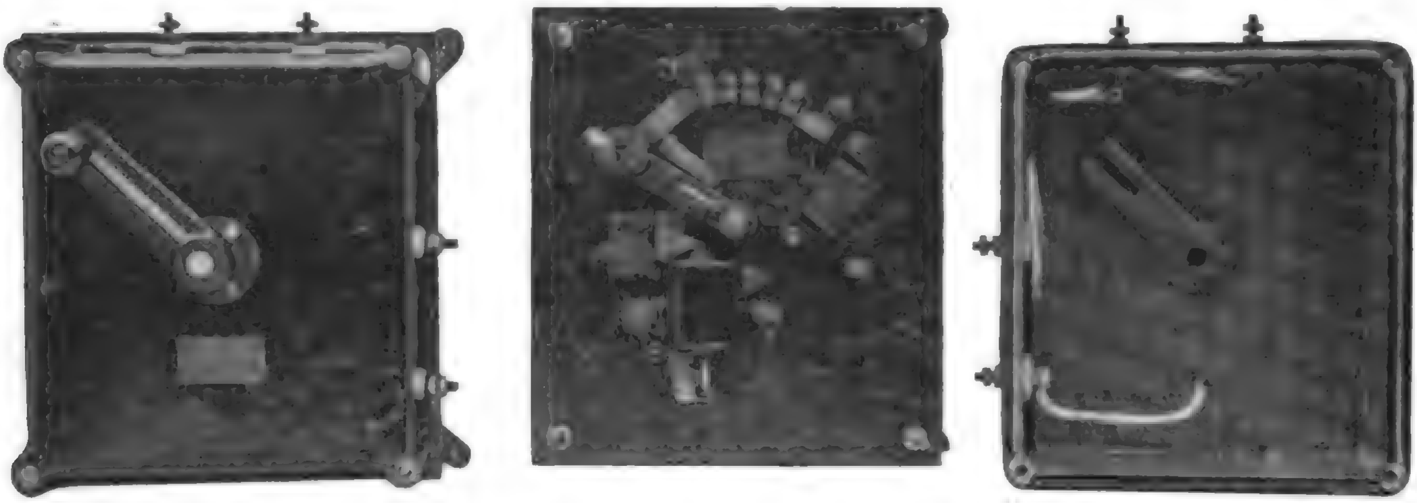
The motor being started without load, requires no starting resistance, and it attains full speed instantly. As a consequence the treadle may be pressed down to its limit in one movement and the machinery rapidly reaches its full speed. This equipment is built by the Diehl Manufacturing Company, Elizabethport, N. J.

MOTOR-DRIVEN SEWING MACHINE.

Enclosed Motor Starter.

At the annual meeting of the Underwriters' National Electrical Association held on December 6, the following was added to the National Electric Code, the changes to appear in the 1907 issue of the Code or in the April supplement:

"Rule 8, Section D, fine print note: Starting rheostats and auto-starters unless equipped with tight casings enclosing all current-carrying parts, should be treated about the same as knife switches, and in all wet, dusty or linty places, should be enclosed in dust-tight, fireproof cabinets. If a special motor room is provided, the starting apparatus and safety devices should be included within it. Where there is any liability of short-circuits across their exposed live parts being caused by accidental contacts, they should either be enclosed in cabinets or else a railing should be erected around them to keep unauthorized persons away from their immediate vicinity."



Figs. 1, 2 and 3.—Enclosed Motor Starter.

The cut herewith shows a motor-starter equipped with a tight case enclosing all current-carrying parts, which has been designed by the Ward Leonard Electric Company to fulfill these requirements. The rheostat controlling lever does not carry current, nor is it alive. Other special features of this box, such as the enclosed resistance, independent make and quick-break switch, etc., have previously been described.

American Vibrator Machine.

Vibratory massage has now come to be accepted by the medical profession as a valuable aid in curing certain disorders and improving circulation. The demand for machines to give such vibratory massage has heretofore been mainly met by large motors. This has even necessitated the use of a stationary motor with a flexible shaft for transmitting the power or a motor which is too heavy for convenient portable use. The American Vibrator Company, 910 Commercial Building, St. Louis, Mo., has just placed on the market a vibrator the motor of which is so small that it can be used directly on the work. This is accomplished by making the motor very light, placing on one end of the shaft an eccentric for producing vibration of the motor itself and placing a spring handle between the motor and the operator.

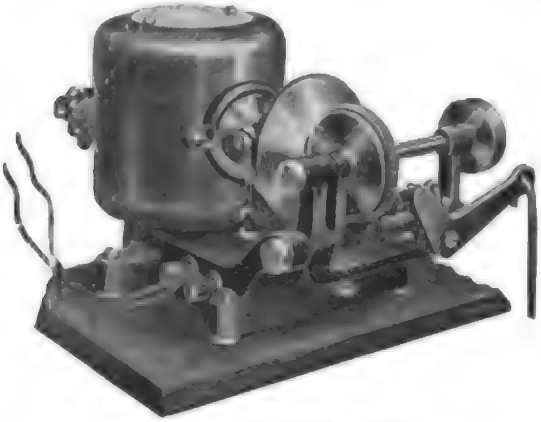
The complete outfit is shown in Fig. 1. The handle in the latest outfits is made of sponge rubber, and between the handle and the motor is a flexible spring for deadening the vibration of the handle. The motor itself is in an aluminum case. The fields are of laminated iron punchings, which surround the armature completely, the armature being removed from one end. The various appliances used in massage are secured directly into a receptacle mounted on one end of the motor. These appliances do not revolve, as might be thought from an inspection of the engraving. The only motion of the massage appliance is that of vibration. The only exposed part revolving is the eccentric on the upper end of the armature shaft. This eccentric can be adjusted to a greater or less degree of eccentricity, thus producing a large or small vibration, as desired.

The whole appliance, to be held in the hand of the operator, weighs less than 2¼ pounds. A regular series commutator motor is used both for direct and alternating currents. The direct-current motor is said to consume about .2 amp., so that it requires only about 22 watts to operate it. Vibratory massage is used not only by physicians, but by barbers and by private individuals. A device of this kind makes a valuable addition to the list of electrical luxuries that central station service puts within the reach of its customers. A small vibratory device of this kind will no doubt be purchased and used by many central station customers who would not think of buying some of the larger equipments used by professional physicians and masseurs, and for that reason it will be welcomed by the central station man striving to increase his output.

VIBRATOR MACHINE.

Sewing Machine Motor Outfit.

By means of the sewing machine outfit, which forms the subject of the accompanying illustration, and which is known as the "Paragon transmitter," there is obtained at all times a positive drive giving a speed variation ranging from a few stitches per minute up to the maximum. As will be noted, a light rod connects the operating switch with the treadle of the machine. Gentle pressure on the treadle opens the switch and starts the machine, and further depression gradually increases the speed of the machine, as desired. This transmitter outfit complete is built by the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass.


SEWING MACHINE TRANSMITTER.

Additional Notes on the Chicago Electrical Show.

In last week's issue of the Electrical World appeared a large number of notes on the Electrical Show then in progress in Chicago, and the subject is returned to in the items given below as to some features left for later treatment. The interest manifested by the general public in this show, as shown by the large attendance, has been remarkable, and has surprised even the most enthusiastic promoters. Plans are already on foot for a similar exhibition next year. It has not only attracted the general public, but electrical men from all the surrounding territory who have been planning trips to Chicago during the winter have made it a point as far as possible to come in during the two weeks of the show. For this reason it has been a good advertising proposition for the exhibitors as well as a financial success as far as the exposition company is concerned. A very pleasant feature of the show was the concert every afternoon and evening by Weil's Band. A better band could hardly have been secured. As the galleries were not occupied by exhibits, it was always possible to escape the crowd in the aisles and find seats in the gallery where the excellent concert could be enjoyed. On account of the great crowd every evening this was a feature much appreciated by the public.

The Hofbrau restaurant in the Annex proved a great convenience during the show. It also demonstrated the feasibility of electric cooking on a large scale, the kitchen being equipped with electric utensils.

The last week of the show part of the general illumination was accomplished with the Siemens' flaming arcs, which, placed high up in the center of the building, had a good opportunity to demonstrate their downward illuminating properties. This arc lamp was described in the January 6 issue.

Among the numerous visitors attracted from surrounding states were Austin Burt, of Waterloo, president of the Iowa Electrical Association, and L. D. Mathes, of Dubuque, of the executive committee of that association. Plans are well formulated for the programme of that association's next convention which will be held at Des Moines in April.

C. H. Thorardson gave frequent demonstrations with his high potential transformer followed by a series of experiments on the fundamental principles of alternating-current apparatus. These experiments were fascinating even to electrical men who had been familiar with the principles involved for years. Mr. Thorardson's demonstrations never failed to pack the aisles in that end of the building, and were beyond doubt the greatest single drawing card in the exhibition.

A meeting of the executive and insurance committee of the Illinois State Electrical Association was held at the Great Northern Hotel, Chicago, January 23, the second week of the show. Those present were Mr. D. Davis, of Litchfield, president; Mr. H. E. Chubbuck, of La Salle, secretary; Mr. E. G. Schmidt, of Springfield; Mr. F. J. Baker, of Chicago; Mr. S. S. Davis, of Rock Island, and Mr. E. B. Hillman, of Quincy, officers and executive committee, and Messrs. J. J. Frey, of Hillsboro, and W. A. Thomas, of Abbington, insurance committee. Plans were discussed for the next convention, but no final decisions were made as to the place of meeting or program.

The Moloney Electric Company, of which Francis Raymond is the Chicago agent, made an exhibit of Moloney transformers in the booth of the Electro-Dynamic Company.

J. P. Sullivan & Co., of Chicago, decorators, had on exhibition in charge of W. H. Strange, the inventor, an electric rotary floor polisher. A one-sixth hp motor drives by a bevel gear a rotary pad which does the polishing. This will be put on the market soon.

Roth Bros. & Co. had a large number of small motors applied to different purposes. One of these was in connection with very small air compressors made by A. S. Comstock, of Evanston, Ill.

The Reynolds Electric Flasher Manufacturing Company was represented not only by its own exhibit which contained some admirable novelties in the flasher line, including a whirler," but by flashers on signs in a number of other exhibits around the show.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Winter trade has practically passed out of consideration, spring business absorbing all the attention. Optimistic reports are current of spring trade, and shipments are freely made, the open weather favoring the railroads. Very heavy buying of agricultural implements is reported at the West, which indicates an excellent condition of farming interests. There is also an indication of heavy acreage in cotton in the South. The railroads are doing an excellent business. Reports of leading roads for the first half of January are the best on record and indicate a gain of nearly 15 per cent over the same period last year. The open season favors demand for structural iron and steel, inquiries coming from all over the country and further large orders are in sight. Steel rails and wire products are in active request. It is stated that an immense amount of money is to be expended for new power plants at the Kleinfontein group of mines, South Africa. An American corporation, manufacturing engineeing apparatus, is making preliminary estimates. The steel and iron and machinery required for the undertaking will foot up in the millions. The electrification of the mine machinery now installed will effect a saving in capital, it is said, of $2,000,000. A local wire manufacturer has been asked to estimate upon long-distance power transmission projects in connection with the same undertakings. Collections generally range from fair to good, and money is easier and in better supply. The copper market was quiet during the week, no sales of importance being recorded. The principal selling agencies hold Lake and electrolytic at 18⅝c. for future delivery. The closing quotations are 18½c. for Lake and electrolytic and 18c. for casting stock. New business in machinery, electrical apparatus and tools is good, and heavy orders are pending. Exports of machinery to Germany are heavy owing to a desire to get supplies into that country before the new tariff becomes operative, on March 1. Bradstreet's reports 276 business failures during the week ending January 25, as against 270 the previous week and 228 in the corresponding week of 1905.

ORDERS FOR RONEY STOKERS.—The Westinghouse Machine Company, of East Pittsburg, Pa., has recently received numerous orders for its Roney mechanical stokers, the largest being from the Interborough Rapid Transit Co., 59th St. Power House, New York, to equip 7,200 hp of boilers; United Railways & Electric Co., Baltimore, Md., 3,600 hp; Twin City Rapid Transit Co., Minneapolis, Minn., 3,300 hp; Midvale Steel Co., Nicetown, Pa., 3,120 hp; Helena Power Transmission Co., Butte, Mont., 2,700 hp; Phoenix Iron Co., Phoenixvile, Pa., 1,800 hp; Union Salt Co., St. Louis, Mo., 1,660 hp; American Car & Foundry Co., Detroit, Mich., 1,050 hp, and St. Louis Portland Cement Co., St. Louis, Mo., 1,050 hp. Stoker equipments will also be installed by the Pennsylvania Light, Heat & Power Co.; Stanley Rule & Level Co.; Chicago & Alton Railroad; North American Chemical Co.; Firth-Sterling Steel Co.; Cedar Point Resort Co.; Coshocton Straw Paper Co., and Marion County (Ind.) Court House. Many of the above customers already have equipments of Roney mechanical stokers in service. Thus the United Railways & Electric Co. is already operating 17,500 hp in a double-deck boiler plant, which is now being extended; the Twin City Rapid Transit Co., 6,600 hp; Midvale Steel Co., 1,650 hp; Pressed Steel Car Co., 5,000 hp; Phoenix Iron Co., 6,700 hp; American Car & Foundry Co., 3,500 hp; Pennsylvania Light, Heat & Power Co., 1,600 hp; Chicago & Alton Railroad, 1,400 hp; Firth-Sterling Steel Co., 1,200 hp.

PABST BREWING PLANT.—In response to a demand for more power in its mammoth brewing plant at Milwaukee, the Pabst Brewing Company has recently placed an order with the Allis-Chalmers Company for three engines, one of the single cylinder, non-condensing type, cylinders 20 x 36-inch, and two of the cross-compound, non-conducting type, 18 and 30 x 36-inch, all vertical and of the heavy duty pattern for direct connection to electric generators. The electrical equipment ordered will consist of three revolving field type, alternating current generators, 25 cycles, one for 300 kw and two for 400 kw capacity; two exciter sets consisting of direct current, constant potential, compound-wound generators, coupled direct to three-phase synchronous motors and fitted with induction type of starting motors, and one exciter set consisting of a direct current generator of the same type as above for steam drive. A feature of the new installation will be a special governing device consisting of an electrical adjusting or synchronizing attachment by which the speed of the engines may be varied within certain limits while they are in operation, the device being under control of the operator at the switchboard. It is expected that the first of the new units will be in operation by the first of May. Mr. C. A. Chapman, of Chicago, has acted as consulting engineer for the Pabst Brewing Company.

ALLIS-CHALMERS ORDERS.—The Lunkenheimer Company, of Cincinnati, placed an order recently through the Cincinnati office of the Allis-Chalmers Company for a 425-kw type A.1. generator unit. The Pittsburg Plate Glass Company, whose complete power and electrical equipment for the new plant at Crystal City, Mo., was purchased from the Allis-Chalmers Company, has recently ordered two additional generators for the same plant. The Watab Pulp & Paper Company, of Sauk Rapids, Minn., whose entire electrical equipment of alternators and motors is being furnished by the Allis-Chalmers Company, has ordered another 100-hp motor for the same installation. The American Car & Foundry Company has recently concluded the purchase of an addition to the present power plant at its Huntington, W. Va., works. John C. Cummings, of Paris, Ill., has recently concluded the purchase of a 20 x 30-inch Reynolds Reliance Corliss engine, and the Gilbert Paper Company, of Menasha, Wis., has purchased an additional power unit for installation in the Menasha mill. The new unit is a 16 x 30-inch Reynolds Reliance Corliss engine.

GAS ENGINE SALES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has sold during the past few weeks 1,247 horse-power of its vertical gas engines to the following customers: A. Zimmerman, McKeesport, Pa.; Edgeworth Water Co., Edgeworth, Pa.; W. R. Morrow, Peru, Kan.; Standard Oil Co., Camden, N. J.; McClintic-Marshall Construction Co., Rankin, Pa.; Warren & Jamestown Street Railway Co., Warren, Pa.; The Wehrle Company, Newark, Ohio; Wm. R. West, New Bedford, Mass.; Sewickley Electric Light Co., Quaker Valley, Pa.; Youngstown Car Mfg. Co., Youngstown, Ohio.

THE LARGEST ORDER FOR OIL ENGINES has recently been awarded to the De La Vergne Machine Co., of New York, by Burnham, Williams & Co. (Baldwin Locomotive Works), Philadelphia, Pa. This is for engines aggregating over 3,300 actual horse power. Some are to be installed in Philadelphia, and the remainder at the steel works, at Burnham, Pa. The installation will consist of 125 and 250-hp "Hornsby-Akroyd" oil engines, some to be used for direct connection to electric generators and to air compressors, while others will be used for operating machine tools by belt.

THE ROBINS CONVEYING BELT COMPANY of New York has recently secured an order through its Boston office for a bucket elevator for the Bon Ami Company, Manchester, Conn. Among other orders now being filled by the Robins Company is one for a system of 14-inch belt conveyors and bucket elevator for the Pennsylvania Sand & Glass Company's plant at Granville, Pa., and an order from the Scofield Company, Philadelphia, for 30-inch and 18-inch conveyors for the Nashville Light, Heat & Power Company.

SOUTHERN POWER DEVELOPMENT.—Mr. F. G. Grove, general merchant at Luray, Va., informs us that Shenandoah River Power Company is installing a hydro-electric plant on the river about two miles west of Luray, and will buy apparatus to develop, at present, 600 hp with a view to enlarging later. The capitalization is $50,000. Mr. T. J. Berry is the president; Mr. C. S. Landram, vice-president; Mr. Lemuel Zirkle, secretary, and Mr. A. L. Jamison, treasurer, all of Luray.

TROLLEY IN PERU.—The work of converting the existing mule lines of the Compania Ferrocarriles Urbano de Lima into an electric road and the building of several miles of new track has been undertaken by W. R. Grace & Company, of New York. The General Electric Company has secured the contract for the electrical equipment. Forty-five cars will be used, the order for which has gone to the Stephenson car shops, at Elizabeth, N. J. They will be of the open summer type.

BIG INDUCTION MOTORS FOR THE ANACONDA.—Four of the largest induction motors ever installed in the West and some of the largest in the country, with the exception of those installed at Niagara, will be used to furnish power at the $9,000,000 reduction plant of the Anaconda Copper Mining Company, Anaconda, Mont. The Allis-Chalmers Company, of Milwaukee, will furnish this electrical equipment for the mammoth 8,000-ton concentrator and the street railway company at Anaconda. The concentrator equipment will consist of four 1,200-horse-power induction motors, three 300-kilowatt motor generator sets, together with the usual auxiliary accessories. This order is only one of many which will follow the determination of the Anaconda Company to substitute Missouri River power, transmitted 90 miles at 70,000 volts, for the present power system installed in the largest smelter in the world. Each of the big induction motors will weigh over forty tons, the weight of the entire equipment when ready for shipment being approximately 259 tons. The motors will be used in the concentration building, which is 600 feet long, through which a main line shaft extends the entire length. The motors will be rope connected to this shaft and will carry the entire power load.

MAYFAIR APARTMENT HOUSE.—A 12-story building of this name is to be erected at the southeast corner of 57th Street and Park Ave., New York City. Henry C. Tinker, owner, 139 Broadway; Charles A Rich, architect, 320 Fifth Ave. Mr. Percival Robert Moses, E. E., 320 Fifth Ave., New York, will act as consulting engineer for the installation of a complete steam, electric, refrigerating and storage battery equipment, consisting of three 216-hp sectional boilers; three simple automatic horizontal high speed engines, two 13 x 12, and one 12 x 12 in., operating at about 300 r.p.m., direct connected to three compound wound multipolar 250-volt generators, two of 65 kw and one of 50 kw capacity, either three-wire machines, or two-wire machines with motor-dynamos for balancing. The refrigerating machine will be of 10 tons capacity. The storage battery will be used to supply electricity in conjunction with engine-dynamo sets for four electric elevators and one sidewalk elevator, and to supply lighting at nights in summer and in emergencies.

LARGE RAIL ORDER.—The United States Steel Corporation has obtained the largest contract ever let in this country for trolley rails for shipment abroad. The contract calls for 20,000 tons of girder rails for use in the construction of an extensive traction system in Rio de Janeiro. The record contract previous to this one was recently placed with the Lackawanna Steel Company for 16,000 tons of rails for the Havana Central Railway. The Rio de Janeiro Tramway, Light and Power Company, which is capitalized at $25,000,000, proposes, among other things, to construct about 200 miles of road. The existing mule lines, about 125 miles long, have already been acquired, and the work of converting them into electric motive power will begin immediately. The company has also obtained lighting, power and telephone concessions. Power to operate the various systems will be generated on the Parahyba and Lages Rivers, waterfalls on which are capable of developing in the aggregate about 150,000 horse power. Mr. F. S. Pearson is actively connected with this enterprise.

POWER PLANT FOR SOUTH.—The Westinghouse Electric & Manufacturing Company have recently closed a contract with the Southern Power Company, at Charlotte, N. C., for a large and complete power equipment consisting of eight 3,000 kw water wheel type alternators, with a complement of transformers, exciters and switchboards. This is the largest contract for electrical apparatus placed in the South for some years. The Southern Power Company's plant being situated in the midst of the cotton mill district will open up opportunities for the use of electric drive by the surrounding cotton mills and other industrial plants, which have heretofore been impossible because of the lack of cheap electric power in that vicinity. The Southern Power Company has full assurance that the cotton mills and other industries in the adjoining territory will make liberal use of the cheap power thus placed at their disposal

MARINE ENGINE & MACHINE COMPANY, 126 Liberty Street, New York City, is busy with its elevator work. It has been rumored that it would give up this branch, but, on the contrary, it is as active as ever in this field, and is pushing vigorously on a number of contracts old and new. To use the words of a leading official, "They are in the elevator business to stay." The company is now making all the three classes of electric, hydraulic and plunger elevators, and reports the outlook as excellent.

9,700 HORSE-POWER HYDRAULIC TURBINE.—An interesting point in connection with the recent purchase by the California Gas & Electric Corporation, San Francisco, of a 9,700-horse-power, single-horizontal spiral case, reaction hydraulic turbine, is contained in the fact that this turbine will operate under a 550-foot head at a speed of 400 r.p.m., which is the highest head under which a turbine of this type has ever been installed. Until recently, manufacturers of secondary machinery have avoided the operation of their apparatus on high speeds. This prejudice, however, has, to a great extent, been overcome and it appears only a question of time when this type of hydraulic turbine will be constructed for still higher heads than the present practice will allow. This turbine and accessories will be furnished by the Allis-Chalmers Company, of Milwaukee, and is destined for installation at Chico, California, where the corporation controls the water rights.

ALLIS-CHALMERS STEAM TURBINE SOUTH.—Following the entrance of the Allis-Chalmers Company into the field of steam turbine manufacture, orders have already been received which will tax the capacity of the manufacturing departments, until the new turbine shops at West Allis can be made ready for use. Several smaller turbine generating units, 500 kw capacity, have recently been contracted for, among them the city of Jacksonville, Fla., which has recently concluded the purchase of additional steam turbine units for the lighting of that city in addition to a 500 unit installed there over a year ago. The new equipment will consist of two steam turbines coupled to two 500-kw, 3-phase, 60-cycle, 2,300-volt generators. These units will be the first steam turbines of Allis-Chalmers manufacture to be installed in the South.

ORGANIZATION OF THE ELECTRIC CABLE COMPANY.—The officers of the Electric Cable Company, of Bridgeport, Conn., which was recently formed to succeed the Magnet Wire Company and the Peerless Electric Company, both of New York, are: Edwin W. Moore, president; Frederick H. Cowles, vice-president; J. Nelson Shreve, treasurer, and H. S. Williston, secretary. The directors include Alfred Skitt, John Carstensen, Russel A. Cowles, Edwin W. Moore, Frederick H. Cowles, J. Nelson Shreve and H. S. Williston, all of New York; G. Tracy Rogers, of Binghamton, N. Y., and George C. Edwards, of Bridgeport. The company's New York office will be at 42 Broadway.

THE SPRAGUE ELECTRIC COMPANY is making a specialty of motor equipments, for driving heating and ventilating apparatus, and among recent orders for such equipments are the following: The First Day & Night Bank, Fifth Ave. and 44th St., the Knickerbocker Hotel, the Broad Exchange Building, the New Women's Hospital, all in New York City, and also the Hoboken terminal of the D., L. & W. Railroad.

BALTIMORE TROLLEY MOTORS.—The Westinghouse Electric & Manufacturing Company have received an order from the United Railways & Electric Company, of Baltimore, for one hundred No. 101-B four motor equipments complete with all details. This is in addition to a recent order for two hundred motors of the same type.

Financial Intelligence.

THE WEEK IN WALL STREET.—There were some irregularities in the stock market, although the tone was strong. The principal advances were in specialties of different kinds, notably Brooklyn Rapid Transit, which touched 94⅛ on favorable reports about the condition and prospects of the company. On the other hand, the formal announcement of the plan for the merger of the Interborough and Metropolitan interests failed to create any positive bullishness on the latter's securities. The United States Steel stocks developed strength on the prospect that the December quarterly report will be very favorable. Allis-Chalmers issues were active. Common touched 27⅜, which is the highest recorded figure in a year or more, but afterwards receded, closing at 25, the latter figure being a net gain of 1½ points. Preferred advanced ⅝ point, closing at 64. General Electric was quiet at quotations ranging between 179¾ and 177, the closing price being 177¼, which is a decline of ¾. Westinghouse common lost 5 points net, closing at 168; preferred closed at 188. The closing quotations of American Locomotive common and preferred were 74½ and 118 respectively. Among the tractions, Metropolitan Street Railway closed at 124¾, which is a net decline of ½ point; Brooklyn Rapid Transit at 91¾, a gain of ¼, and Interborough Rapid Transit at 236, an advance of ¼. Telephone and telegraph stocks were on the downward turn. American Telephone & Telegraph closed at 141, a loss of 2 points; N. Y. & N. J. Telephone, 154½, a decline of ½ point; Western Union Telegraph 93¼, a drop of ¼ point, and American Telegraph & Cable at 90. The curb market was irregular, and, in the main, prices receded under continued profit-taking sales. The mining group was the centre of pressure, with the principal declines in Boston Copper and Greene Copper. The closing quotations on the Stock Exchange January 30 are given in the following table:

NEW YORK

	Jan. 23	Jan. 30		Jan. 23	Jan. 30
Allis-Chalmers Co.	25¾	23¼	General Electric	178	173
Allis-Chalmers Co. pfd.	65¼	62⅞	Hudson River Tel.	...	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	224	222
American Locomotive	72⅝	74¼	Mackay Cos.	63⅝	60¾
American Locomotive pfd.	118	118¾	Mackay Cos. pfd.	75	73
American Tel. & Cable	90	87	Marconi Tel.	..	..
American Tel. & Tel.	140	137	Metropolitan St. Ry.	124¼	121⅝
Brooklyn Rapid Transit	91⅛	88⅝	N. Y. & N. J. Tel.	...	..
Electric Boat	26	25	Western Union Tel.	93⅛	93¼
Electric Boat pfd.	60	60	Westinghouse com.	171	168
Electric Vehicle	16	17	Westinghouse pfd.	...	..
Electric Vehicle pfd.	21	22			

BOSTON

	Jan. 23	Jan.		Jan. 23	Jan.
American Tel. & Tel.	141	139	Mass. Elec. Ry. pfd.	68¼	67¾
Cumberland Telephone	117¼	117	Mexican Telephone	3⅝	..
Edison Elec. Illum.	...	..	New England Telephone	139	138
General Electric	...	...	Western Tel. & Tel.	15	..
Mass. Elec. Ry.	18⅝	...	Western Tel. & Tel. pfd.	88	82⅝

PHILADELPHIA

	Jan. 23	Jan. 30		Jan.	Jan. 3
American Railways	53⅝	53	Phila. Electric	9	9⅛
Elec. Co. of America	12	11⅞	Phila. Rapid Trans.	32⅝	32
Elec. Storage Battery	85	81	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Jan. 23	Jan. 30		Jan. 23	Jan. 30
Chicago City Ry.	...	200	National Carbon	...	80⅛
Chicago Edison	...	...	National Carbon pfd.	...	116
Chicago Subway	58⅝	...	Union Traction	...	..
Chicago Tel. Co.	...	...	Union Traction pfd.	...	..
Metropolitan Elev. com.	...	36			

NORTH AMERICAN ANNUAL.—President Wetmore of the North American Company, which controls streets railways and lighting properties in Milwaukee, Cincinnati, St. Louis, Detroit, and many other cities in the Middle West, makes an encouraging annual report and says: "The business activity and prosperity now prevailing may be interrupted for short periods from time to time, but I do not believe that even in periods of depression the properties in which the North American Company is interested will cease to grow in earning capacity from year to year and to a material extent. So great is the field still undeveloped for the exploitation of the sale of gas and electricity, so rapidly does the taste for riding grow with the continuous improvement of facilities and so constant is the growth of population that business reaction, even severe and prolonged, may well pass without serious effect upon the growth of the earnings of these corporations." Mr. Wetmore says that the properties owned by the company have now passed the difficult and perplexing stages of construction and betterment. The report shows that the Milwaukee Electric Light & Power Company, one of the subsidiaries, has sold for delivery during the present month $2,000,000 of its recently authorized bond issue of $20,000,000. To provide for the completion of its construction work and to reimburse its treasury for capital expenditure the Union Electric Light & Power Company of St. Louis has just issued and sold $3,000,000 of three-year collateral trust notes. The income account for the year, including previous balances, follows:

	1905.	1904.		Changes.
Total receipts	$4,192,728	$2,832,578	Inc.	$1,360,150
Dividends paid	1,252,996	840,834	Inc.	412,162
Commissions paid	127,500	....	Inc.	127,500
Total	$1,380,496	$840,834	Inc.	$539,662
Surplus	$2,812,232	$1,991,744	Inc.	$820,488

AMERICAN LIGHT & TRACTION.—The American Light & Traction Company's annual report for the year ending December 31, 1905, shows net increased earnings over the previous year of $203,657, or 17.98 per cent. The company's earnings for the last three years compare as follows:

Year.	1905.	1904.	1903.
Earnings on stock of sub. companies owned by this company	$1,222,785	$1,007,001	$970,479
Miscellaneous earnings, interest, etc.	150,835	144,502	110,371
Gross earnings	$1,373,620	$1,151,503	$1,080,850
Expenses	37,452	18,993	30,539
Net earnings	$1,336,168	$1,132,510	$1,050,311
Dividends	747,328	669,132	553,060
Surplus	$588,840	$463,378	$497,251

During 1905 the dividends paid on the preferred stock was at the regular rate of 6 per cent per annum. Beginning with August 1, 1905, the dividend on the common stock was increased from the rate of 3 per cent annually to 4 per cent annually. During the year the company added to its list of properties those of the Quebec-Jacques Cartier Electric Company, of Quebec, Canada; the Muskegon Traction & Lighting Company, of Muskegon, Mich., and the Lacombe Electric Company, of Denver, Col. The company has $9,633,200 of preferred stock, and $15,000,000 of common. The investment account is $24,103,177.

REFRIGERATOR CONSOLIDATION.—News comes from New Brunswick, N. J., of the merger of the New Brunswick Refrigerator Company and the Union Refrigerator Company with a capital stock of $2,000,000. This merger went into effect on Jan. 2, but the details of the consolidation and the names of the new directors and officers of the combine were not made public until last week. The new directors of the company are Robert W. Johnson, James W. Johnson, president of the Neverslip Company, of New Brunswick; W. Campbell Clark, Theodore Frelinghuysen, Archibald Cox, A. M. Coats, T. G. Phinny, C. A. McCormick, of New Brunswick, and James Henry Smith. At a recent meeting of these directors the following officers were elected: J. W. Johnson, vice-president; T. Clark, New York City, vice-president; T. G. Phinny, secretary; Theodore Frelinghuysen, treasurer. The new financiers in addition to those who have been already interested in the old companies who have identified themselves with the new concern are: W. Campbell Clark, head of the Clark O. N. T. Thread Company; Theodore Frelinghuysen, head of the thread trust; A. M. Coats, president of the Coats Thread Company, and Archibald Cox, a New York City lawyer. It is proposed to make this one of the largest refrigerator corporations in the country.

AMERICAN LIGHT & TRACTION.—The directors of the American Light & Traction Company have authorized another issue of common and preferred stock to finance the purchase of a large electric light and traction system, the location of which has not yet been made public. The new issue will amount in all to $5,500,000 and will comprise 15,000 shares of common stock and 40,000 shares of preferred. It was only a month ago that the American Light & Traction Company offered stockholders the right to subscribe to $718,900 worth of common and preferred stock to furnish funds for the purchase of electric companies in Michigan and Colorado. The subscription rights expired last week and all the new stock was taken up. The newest issue is offered to stockholders at par in the proportion of ten shares of common and twenty-seven shares of preferred for each 100 shares of their holdings.

MICHIGAN STATE TELEPHONE.—The Michigan State Telephone directors have approved estimates of expenditures for improvement extensions for 1906 aggregating $1,260,000; about 20,000 more telephones will be installed. Dudley E. Waters, president of the Grand Rapids National, was elected vice-president to take the place of Truman M. Newberry, whose duties as assistant secretary of the navy prevented him from giving the office the necessary time. The common stock of the Michigan State Telephone Company has advanced during the past three or four weeks from $35 to $50 per share. The preferred stock is selling at $95 per share. Nearly $600,000 was spent in maintenance for the year ended April 30, 1905, all of which was charged directly to expenses.

INTERBOROUGH-METROPOLITAN.—A holding company to carry through the recent New York merger has been formed, called the Interborough Metropolitan Company, to hold stock and bonds of companies operating transportation lines in New York and vicinity and of corporations holding securities of companies engaged in such business. Capital, $15,000. The directors are Walter G. Oakman, John B. McDonald, Morton F. Plant, New York; James Jordan, Brooklyn; P. A. B. Widener, Philadelphia.

SOUTH SIDE ELEVATED, Chicago, shows for 1905 a gross of $1,713,347 and a surplus after all dividends and charges of $217,470. Eighty-two per cent of the third track is now erected and 150 new cars are arriving. The company's power supply is greatly increased. The total number of passengers carried during the year amounted to 32,959,752. The daily average was 90,301, an increase of 8.47 per cent.

A LARGE BLOCK OF STOCK in the Chicago City Railway was held by the late Marshall Field, and the amount was estimated at his death, last week, at $10,000,000.

WESTINGHOUSE BONDS.—Kuhn, Loeb & Co. have purchased an issue of $15,000,000 convertible sinking fund 5 per cent gold bonds due January 1, 1931, of the Westinghouse Electric & Manufacturing Company. The bonds are to be convertible into "assenting stock of the company at 200 after January 1, 1910, and redeemable after January 1, 1912, at 105 and accrued interest." From the proceeds of the bonds the company will retire all of its outstanding commercial paper and will have left ample capital to provide for extensions and for its continually increasing business. The trust indenture under which the bonds are to be issued is to provide that the property of the company shall remain unmortgaged and is also to contain stipulations as to special security for the bonds. There will be an annual sinking fund of $500,000 beginning with December 31, 1907. Stockholders can subscribe at 98 to the extent of 60 per cent of their holdings. In connection with the new issue, Mr. Westinghouse has issued a circular which shows average net earnings of $3,626,388 a year over the last five years. The following statements have been certified by Haskins & Sells, certified public accountants: The average annual net earnings of the company and its said subsidiary companies for the five years ended March 31, 1905, available for interest and dividends, have been $3,626,388; the earnings available for interest and dividends for the eight months ended November 30, 1905, were $2,488,641; the annual amount required to pay the interest upon the $15,000,000 of bonds and all other interest charges, is $1,231,000.

AMERICAN DISTRICT TELEGRAPH.—The American District Telegraph Company of New York has issued its full report for the year ended December 31, 1905. The income account compares as follows:

	1905.	1904	1903.
Revenue from all sources	$593,694	$561,062	$577,676
Expenses—all classes	498,320	483,699	511,808
Net	$95,374	$77,363	$65,868
Dividends	76,888	76,888	76,888
Surplus	$18,486	$475	*$11,020
Miles wire	1,587	1,584	1,552
Offices	87	87	85
Instruments	32,234	30,881	29,143

*Deficit.

President Clowry reports a gratifying increase in the business of the company, due largely to improved conditions in the financial district, reflected in the earnings for the year, which show an increase of $32,633. The increase of $14,622 in the expenses of the company is principally due to increased business, but the figures include some back taxes which had been allowed to accumulate pending a final decision in the franchise tax cases. Notwithstanding this unusual disbursement, the net earnings show an increase of $18,011. Thirty-three new office buildings were wired during the year, and the number of instruments in circuit on December 31 was 32,234. The cost of this and other new work amounting to $15,528 was paid out of the earnings, and is included in the expenses of the year.

NEW YORK TRACTION MERGER.—Official announcement is made of the plans for the organization of the traction merger under the name of the Interborough-Metropolitan Company. The securities to be issued are $55,000,000 5 per cent cumulative preferred stock, $100,000,000 common stock, $70,000,000 4½ per cent collateral trust bonds. All the common stock is to be held for a term of years in a voting trust. A committee, consisting of E. J. Berwind, chairman, John D. Crimmins, Andrew Freedman, Thomas P. Fowler, Gardiner M. Lane and Cornelius Vanderbilt, has entered into an agreement with August Belmont & Co. under which they represent the stockholders of the old companies in forming the new. Belmont & Co. have agreed, in return for the $8,700,000 common stock not used for exchange of securities, to furnish the new company $2,250,000 cash and bear all expenses of organization, also to subscribe for $3,000,000 of the preferred stock at par in cash. Holders of stock of the old companies may exchange them for securities of the new company on the following terms: For each share of Interborough Rapid Transit Company: collateral trust bonds, $200; common stock, 99. For each share of Metropolitan Street Railway, preferred stock, $100; common stock, 55. For each share of Metropolitan Securities Company ($75 paid) common stock, $93.50. Some strong opposition is developing to the merger.

BOSTON ELEVATED BONDS.—On January 15, 1905, Boston Elevated bonds became a legal investment for Massachusetts savings banks, the Board of Railroad Commissioners having certified to the Savings Bank Commissioners that the road had paid 5 per cent or more in dividends annually for a period of five consecutive years.

ABSORBING PHILADELPHIA COMPANY.—It is announced that the United Railways Investment Company of San Francisco has arranged to make a proposition to the stockholders of the Philadelphia Company to retire a certain amount of the common stock in exchange for bonds in the investment company, which is to become the holding company. The Philadelphia Company stockholders will be asked to accept bonds on the basis of $40 and $15 in common stock in the holding company in exchange for each share of Philadelphia common stock. The Philadelphia Company has a capital of $30,000,000 common and $6,000,000 preferred. The United Railways Investment Company controls all the street car lines of San Francisco. It has a capital of $10,000,000 common and $15,000,000 preferred, and it is proposed to increase the capital stock to $40,000,000 by issuing $15,000,000 more common stock. Thalman Ladenburg, of New York, is president of the investment company. The Philadelphia company stock now pays 6 per cent, while the bonds to be issued will pay but 5.

DIVIDENDS.—The directors of the Michigan State Telephone Company have declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable February 1 to stock of record January 23, 1906. Directors of the New York Consolidated Gas Company have declared the regular quarterly dividend of 2 per cent, payable March 15. Directors of the United Power & Transportation Company have declared a dividend of $3.10 per share, payable January 26. The Boston Elevated Railway Company has declared the regular annual dividend of 3 per cent. The directors of the Lawrence, Mass., Gas Company have declared the regular semi-annual dividend of 3 per cent, payable February 1. The directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¼ per cent on the common stock to stockholders of record February 1.

TOLEDO RAILWAYS & LIGHT.—The Toledo Railways & Light Company report shows a surplus December 31, 1905, of $988,829, as compared with $841,807 the year previous. Its bonded indebtedness December 31, 1905, was as follows:

Underly. 5 per cent bonds maturing July 1, 1909	$5,300,000	
Underly. 5 per cent bonds maturing Feb. 1, 1912	700,000	
		$6,000,000
Toledo Rwys. & Light Co. 4 per cent bonds maturing July 1, 1909		4,854,000
Total		$10,854,000

During 1905 the company operated 107⅛ miles of track, earning $1,407,626, or $13,109 a mile. It is now supplying the city with 1,322 arc lamps and furnishing current for the equivalent of 158,243 16-cp incandescent lamps and for 6,583 hp of motors.

MANILA RAILWAY & LIGHTING.—A part of the outstanding $4,635,000 of the 50-year 5 per cent first lien collateral trust bonds of the Manila Electric Railway & Lighting Corporation are to be put on the market through William Salomon & Co. The bonds are a first lien on the properties of the Manila Electric Railroad & Light Company through the deposit of all of the $3,000,000 first mortgage 6 per cent bonds, as well as by the deposit of the entire capital stock of this subsidiary company. They are secured also by the deposit of 95 per cent of the capital stock of an underlying electric lighting company known as "La Electricista," and the entire capital stock of the Union Trucking Company. Neither of these latter companies has any bonded debt. The Manila trolleys shows a net surplus for six months of $106,203.

PIONEER TELEPHONE'S GROWTH.—The fiscal year of the Pioneer Telephone & Telegraph Company, which ended December 31, 1905, was an exceedingly satisfactory one. The company is capitalized for $3,000,000, has 13,000 regular subscribers and 12,600 miles of toll wire. It has been controlled by the American Telephone & Telegraph system since the early part of May. The stock has been paying 6 per cent during the year and ten months in which the company has been in existence, and there is some possibility of an increase in the rate being made at the meeting of the directors to be held about February 1. The company's stock is very largely owned in Oklahoma and Indian Territory, the district which it serves. It has been the policy of the management to encourage the local stockholders to retain their holdings.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company shows for 1905 a gross income of $4,656,423, expenses of $2,676,072, a net of $1,970,451, and after charges a net surplus of $1,350,284. The gross shows a gain over 1904 of over $600,000, but the surplus gained only $185,116.

General News.

SAN JOSE, CAL.—Work has been started by the San Jose-Los Gatos Interurban Railroad Company on the San Carlos, Thirteenth and San Fernando Street loop branch, which will cover about five miles.

IMPERIAL, CAL.—W. F. Holt states that the Holton Power Company expects to complete its plant at Holtville and get transmission lines up within 90 days. The machinery for four sub-stations has been shipped. The power station at this place will also be installed within the time stated.

BAKERSFIELD, CAL.—Recent high water in the Kern River caused a slight damage to the Edison Electric Company's concrete dam which is being built at the upper end of the company's gravity tunnel for its large hydro-electric station. It is now expected that the power system will be ready for the water to be turned on by July.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company, together with the California Gas & Electric Corporation and other subsidiary companies, has moved its offices from the Rialto Building to the new Shreve Building at the corner of Grant Avenue and Post Street, where it will occupy the eighth and ninth floors.

LONGMONT, COL.—The Longmont Electric Light & Power Company has made arrangements with Lafayette coal fields to supply its power, and the plant here will be put out of commission as soon as the line can be built. The local company will buy electric power from the Lafayette Company and retail light and power to the residents of Longmont.

OURAY, COL.—A meeting of a number of electric light consumers of this city was held recently for the purpose of arriving at some plan for bettering local conditions. Considerable dissatisfaction, it is said, has been expressed regarding the service rendered by the Ouray Light & Power Company, and it has been suggested that the Animas Water & Power Company, located at Silverton, might be induced to run a line to this city and furnish power and light, but no definite action has been taken.

UNCASVILLE, CONN.—It being fully recognized by the residents that street lights are needed in some sections, it has been suggested that arc lamps could be put in and supplied with current from the wires of the Consolidated Railway Company.

HARTFORD, CONN.—It is stated that the Consolidated Street Railway Company, which belongs to the New Haven, has acquired the Hartford, Manchester & Rockville Tramway Company, owning a line from Hartford to Rockville with branches, and that the Consolidated can now run a direct service from Hartford to Worcester without competition.

ROCKVILLE, CONN.—Contractor H. Wales Lines, of Meriden, has a force of men at work on the erection of a power plant at West Street for the Consolidated road. This is to be one of two brick sub-stations, which when equipped with electrical machinery will cost from $8,000 to $10,000 for the new system of trolley cars to be run on the steam road between Hartford and Rockville. The power for running the new line will be supplied by the Hartford Electric Light Company.

ADEL, GA.—A meeting has been held for the purpose of forming an electric light company and subscriptions are being taken to the stock. M. T. Shaw is at the head of the soliciting committee.

HAILEY, IDAHO.—P. H. Hopkins, collections agent of the Rocky Mountain Bell Telephone Company says that the telephone business is growing so rapidly that the company cannot keep up with it. Hailey and Boise are in the Central Idaho district. In this district alone the company intends to spend over $200,000 in betterments; and it will doubtless spend five times as much in its whole territory. There are 9,500 telephones in use in Salt Lake, 2,300 in Boise, 175 in Hailey and 63 in Bellevue.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company, which furnishes light for this city, has just completed the installation of a large motor-generator in its Circle Street station. The new machine will be used in the conversion of 4,000-volt alternating current from the Mill Street and Kentucky Avenue power station into 250-volt direct current.

MILL CREEK, I. T.—The City Council here has granted a franchise to the Mill Creek Electric Light and Power Company.

NEW ORLEANS, LA.—At a meeting of the directors of the New Orleans & Carrollton Railroad Light & Power Company on January 22, the following officers were elected: E. C. Foster, president; Joseph H. De Grange, vice-president; H. A. Ferrandon, secretary and treasurer.

CARTHAGE, MO.—The Empire Electric Power & Supply Company has increased its capital stock from $10,000 to $25,000.

MILO, ME.—The electric light company has purchased a new generator to be used on the Pierce power. As soon as this is installed the company will run this portion of the plant all night.

PORTLAND, ME.—The Maine sanitorium has placed two boilers of 100 hp each in its new lighting and heating plant. These boilers will serve steam to an engine for the electric plant of 600 lights. The pumping for the water supply will be done by electric pumps furnished with current from the generator. The power house has been made large enough for the installation of another boiler of 150 hp in the boiler room, and another engine and generator in the engine room.

WELLESLEY, MASS.—Wellesley has appropriated $5,000 for street lighting by electricity.

NORTH ADAMS, MASS.—A bill has been introduced into the Legislature giving the gas and electric companies in the vicinity of North Adams permission to extend their business into the towns of Monroe, Savoy and Florida.

WRENTHAM, MASS.—Moses T. Farnum, proprietor of the Glenwood Mills, is considering the idea of furnishing electric light for the village. The pond at Glenwood has a fall of 14 feet, which would run a dynamo of sufficient power to light the town.

HAVERHILL, MASS.—A proposition for Welsbach street lighting having been presented, the Haverhill Electric Company has addressed a communication to the Mayor and City Council offering to submit a bid on any desired schedule, giving better light and more light at substantially less cost per annum.

SOUTH DEERFIELD, MASS.—A new electric plant has been erected in this town to furnish power for a private enterprise, but arrangements had been made to furnish current for street lighting. No notice has been given as to when the plant would start, and the recent turning on of the lights was a pleasant surprise for the inhabitants.

HAVERHILL, MASS.—The new $100,000 alternating-current turbo-generator plant of the Haverhill Electric Company on Water Street has been completed and Chief Engineer Charles Monroe, who has installed the plant for the General Electric Company, has turned on all the power and put the old plant completely out of commission. The change includes everything from boilers and engines to switchboards.

GREENFIELD, MASS.—The annual meeting of the Greenfield Electric Light and Power Company shows the affairs of the corporation to be in a favorable condition. There has been a profit of about ten per cent, including the five per cent which the State authorities require to be set aside for depreciation of plant. George W. Lawrence, who was recently elected superintendent, was chosen treasurer to succeed Andrew J. Doolittle.

WINCHENDON, MASS.—State Senator Morton E. Converse, Elisha Whitney, Wendell Clark, Zadoc L. White, W. M. Whitney and C. L. Beale appear as incorporators of the Fitchburg, Ashburnham & Winchendon Street Railway Company, for whose incorporation a petition has been filed in the Senate. It is proposed to build a line through Ashburnham, Winhornham, Winchendon, Winchendon Springs and Waterville to the town line of Fitzwilliam, N. H. Another route is also proposed, running through Gardner. It is stated that the road will be capitalized at $250,000.

TEMPLETON, MASS.—The selectmen have been presented a petition signed by 20 citizens, asking for a special town meeting to see what action the town of Templeton will take toward having the streets lighted with electric lights. The H. B. Rust Co., of Providence, offers to construct an electric light and power plant, and to furnish electric lights, heat and power, provided the town will vote to use 75 25-cp street lights at a cost of not more than $20 per light per year, and if the citizens will subscribe for 2,000 16-cp incandescent lights for lighting purposes in residences, factories and stores. The selectmen will call a special meeting at an early date. The H. B. Rust Company offers to have the plant in running order by July 1.

MANKATO, MINN.—Farmers of Danville, Vivian and other townships north of Minnesota Lake have organized the Farmers' State Telephone Company. A line will be constructed to connect with the Northwestern at Minnesota Lake. Work will begin at once.

WILLMAR, MINN.—Negotiations have been closed whereby the Northwestern Telephone Company secured control of the Minnesota Central Telephone Company, whose offices are located in this city. The Minnesota Central Company was organized in 1897, with D. N. Tallman as president, with $50,000 capital and lines covering an area of about 200 miles. At the present time the lines cover 2,000 miles of territory and the capital invested amounts to nearly a million dollars.

LAMBERTVILLE, N. J.—The Lambertville Heat, Light & Power Company has elected the following officers for the present year: President, H. C. Case; vice-president and secretary, S. C. Case; general manager, H. M. Moorhead.

NEW YORK, N. Y.—It is authoritatively announced that the Consolidated Railway Company, acting for the New York, New Haven & Hartford Railroad, has purchased the Hartford, Manchester & Rockville Tramway Company, the Stafford Springs line, and the rights to complete the Hartford & Worcester Street Railway. This will in no way affect the electrification of the present steam road between Hartford and Rockville, which will be carried out as proposed in the original plan.

NEW YORK, N. Y.—Mr. William C. Gotshall, president of the New York & Portchester Railroad, has declared to the New York City board of estimate that the purchase by the Westchester interest of the New York Railroad & Development Company did not carry with it all the rights of the Port Chester Company. He alleged that Gates and the others who sold out the New York Railroad & Development Company that had been organized to build the New York & Port Chester Railroad, had simply sold a gold brick. Chas. D. Barney & Co. are in physical possession of the stock of the Port Chester, and the Port Chester is going ahead to build notwithstanding the action of Gates and his associates.

ROCHESTER, N. Y.—The first section of the Rochester, Syracuse & Eastern Railway has been completed for operation. The road is a double track interurban electric railway and the part completed from Rochester to Lyons is 36 miles long. The whole road will be 80 miles long. Two transmission lines have been provided and lines for carrying the high tension current are carried around the towns on the route. The contract for the construction is being carried out by the engineering firm of J. G. White & Co. This line parallels the New York Central. The Rochester, Syracuse & Eastern Ry. Co. has an authorized capital of $2,500,000 6 per cent non-cumulative preferred and $1,000,000 common stock.

KEENE, N. H.—The Citizens' Electric Company of this city has filed with the city clerk a certificate stating that the full amount of its capital stock of $50,000 has been paid in.

NASHUA, N. H.—The price of gas and electricity in this city is to be reduced after March 1. The present net price of gas is $1.40 per 1,000 cu. ft. It will be $1.30. The net price of electricity per kilowatt hour is to be reduced from 16 to 14 cents.

CHARLOTTE, N. C.—Superintendent M. B. Spier, of the Charlotte division of the Southern Bell Telephone Company, has succeeded in purchasing for his company the local exchanges at Laurinburg and at Gibson, N. C.

CINCINNATI, OHIO.—Bids will be received until February 23 by the Board of Trustees, Commission of Water Works, for furnishing, delivering and erecting three direct-connected electric units of 150-kw capacity each, driven either by a turbine or reciprocating engine; one switchboard; two air pump and condenser units, and all necessary appurtenances.

TOLEDO, OHIO.—The F. Bissell Company, of Toledo, O., has a contract with the Ohio Cultivator Company of Bellevue, O., for two Northern generators, five Northern motors, switchboard and twenty-five Jandus arc lamps. It also has a contract with the Zaner Bros. Company, of Toledo, for one Northern generator of the engine type, switchboard and 15 motors. In addition to above, it is also furnishing the Toledo-Massillon Bridge Co. one 150-kw Northern generator, switchboard and several motors.

CLEVELAND, ORE.—A meeting of the citizens has been called to consider the advisability of establishing a telephone system between Cleveland and Roseburg.

PORTLAND, ORE.—At the annual meeting of the Portland General Electric Company, held in Portland, Ore., January 17, directors were elected for the ensuing year. The directors will at their first meeting re-elect the present officers of the company. The last year's progress made by the Portland General Electric Company has been great, and its plans for the coming year are extensive. During the year 1905 it completed a new steam plant in Portland, practically doubling its power-producing capacity. The steam plant, producing 12,000 hp, was utilized largely in lighting the Lewis and Clark Exposition, and now that the fair is over the power will be turned into the regular channels of commercial lighting, where all of it is needed. By an issue of $6,000,000 new bonds the company refunded and consolidated its indebtedness, at a lower rate of interest, and had a surplus to spend for improvements and extensions. During the present year about $1,000,000 will be spent in Portland in the erection of a 5-story office building and reconstruction of the arc lighting system. The present coke-carbon lamps will be taken down and magnetic arc lamps will be installed. About 1,200 arc lamps are required to light the city on the present plan of distribution. The new lamps will require new apparatus at the power station and a renewal and rearrangement of the lighting circuits. The alternating current used primarily will be changed to a direct current by means of mercury tube rectifiers. These rectifiers and new transformers will be installed. The company's architects are now at work on plans for the new office building, and these will be completed in about a month. Work will be commenced on the building early in the spring.

DOWNINGTON, PA.—Engineers representing the Philadelphia & Western Railroad have been at work in Chester County for some days past, and it is understood that work on the line will be pushed west of Strafford as soon as that section of the road is completed. It is expected that the line between Philadelphia and Strafford will be in operation by July 1.

ANDERSON, S. C.—Negotiations are in progress for the absorption of the Anderson Telephone Company by the Bell Company. The Bell interests will operate under the franchise of the local company, it is stated.

LAURENS, S. C.—The Reedy River Power Company has been organized under a charter granted by the General Assembly of South Carolina. The capital stock of the company is $50,000, and every dollar is subscribed. The board of directors is J. O. C. Fleming, J. H. Sullivan and N. B. Dial, all of this city. Mr. Dial is president and treasurer. The company will engage in generating and transmitting electrical power, and the plant will be at Boyd's Mill, on Reedy River, ten miles east of Ware Shoals. Bids for doing the construction work have already been received and the development of this splendid water power will begin as soon as some preliminaries can be arranged.

MIDDLEBROOK, VA.—H. McGraty, secretary and treasurer of the Virginia Valley Traction Company, says that his company proposes to build an electric railway 27 miles long from Staunton, Augusta County, into Rockbridge County, by way of Middlebrook. It is expected that the company will be ready for bids in April.

BRADFORD, VT.—The power house of the Bradford Electric Lighting Company has begun operations, and Bradford and Newbury are now lighted. The dynamo is driven by a 400-hp water wheel.

Construction News.

STEPHENS, ARK.—The Council has granted to T. A. and G. Lewis a franchise to build and operate a telephone exchange at Stephens.

HARRISON, ARK.—An agreement has been reached between the City Council and Mr. Quigley for an electric light plant, water works system and an electric railway. It is proposed to construct an electric railway from Harrison to Bergman, the nearest point on the new White River line, ten miles from this place.

SPRINGDALE, ARK.—Plans, specifications and final estimates have just been completed for an electric lighting plant and lighting system for Springdale, Ark. W. K. Palmer, consulting engineer, 718 Dwight Building, Kansas City, Mo., has prepared the plans and specifications and these are on file at his office in Kansas City for the examination of prospective bidders.

NAPA, CAL.—The Supervisors have granted a franchise for an electric light and power line and system along certain roads of this county, to J. S. McDonald, whose bid was $302.50.

NAPA, CAL.—The Board of Supervisors has resolved to grant the franchise for 50 years to construct and maintain telephone lines in Hot Springs precinct, as applied for by R. F. Grigsby, and the clerk was ordered to advertise for bids to be opened on March 13.

HAYWARDS, CAL.—The Suburban Electric Company has decided to construct its own plant on the Bay Shore, instead of taking power from an outside source. William Angus, of San Leandro, is manager of the company.

ALAMEDA, CAL.—J. W. Gillogly, City Clerk, writes that Charles E. Moore & Co., of San Francisco, have secured the contract for an engine for the municipal electric light plant at $8,718, and that the National Electric Company, of Milwaukee, Wis., was given the contract for a generator at $4,670.

SAN FRANCISCO, CAL.—The North Mountain Power Company, of San Francisco, which has a hydro-electric plant near Junction City, Trinity County, has awarded Hunt, Mirk & Co., of this city, a contract for an additional generating unit, consisting of a Westinghouse-Parsons steam turbine. This will be installed in the auxiliary steam plant of the company at Eureka, which carries a good deal of the lighting load of Eureka.

LOS ANGELES, CAL.—The Pacific Construction & Supply Company, Examiner Building, Los Angeles, has recently come into existence with the object of carrying on a business in general building. The organization is complete, in that each of the directors and officers is also a departmental superintendent, of whom there are seven. Mr. J. C. Green is at the head of the electrical department and Mr. A. C. Dale of the sanitary and heating. These and the other officers are also supervisors of all work that comes under their respective departments and to them is left the buying and ordering of material.

MERIDEN, CONN.—The Jennings & Griffin Company's factory in Tracy with the Indianapolis Northern at Logansport.

WILLIMANTIC, CONN.—It is reported that engineers are looking over the line of the Shetucket River below South Windham. A good water privilege is located in that vicinity and the surmise is that the Consolidated railway company have an eye on it for electrical purposes.

MIDDLETOWN, CONN.—It is said on good authority that the Consolidated Street Railway Company is planning to lay a trolley line for some distance along the river and connect it with the main trolley lines now in use in the city. It will be mostly for the purpose of carrying freight.

GEORGETOWN, COL.— A. Maxwell, of this city, engineer for the East Argentine Mining Company, writes that the specifications have not yet been completed for the proposed power plant. It is planned, however, to construct about 80 miles of transmission lines, and the probable cost of the work is estimated at $4,000,000. Bids for the construction will probably be called for in March.

GUNNISON, COL.—It is stated that bids will be received until February 14 by F. W. Harper, town clerk, for constructing a complete electric lighting plant.

ALBANY, GA.—Preparations are being made to extend the municipal lighting system to Arcadia.

WALLACE, IDA.—It is stated that the Federal Mining Company will build a big power plant at Thompson Falls, Idaho, to supply the mines and mills of that district. The plans include electric railways to all camps of the district.

QUINCY, ILL.—A. J. Thomas and W. S. Freeman are interested in a project to construct an electric railway from Quincy to Hardin.

PEORIA, ILL.—Independent telephone owners of the State met at Peoria recently to discuss plans for extension. One of the objects of the meeting was to arrange for connection with the toll lines which the Inter-states' Company will build immediately to Washington and from there connect with the through circuit north and south from Springfield to the outskirts of Chicago. In order to bring the toll business to Peoria, the Inter-states people now have in process of construction a line to Hanna City and Trivoli. When spring opens the poles will be set into Elmwood, Yates City and through Galesburg to this city.

CHICAGO, ILL.—To take care of its rapidly increasing business and also to install new apparatus to add to the efficiency of its service, the Chicago Telephone Company has planned a large addition to its present downtown office building and central exchange, as well as new exchanges in outlying districts. According to specifications the new building will be 14 or 16 stories high and will cost from $750,000 to $1,000,000. The building has been proposed to anticipate requirements of a franchise renewal ordinace with the city, negotiations for which are now under way. It is one of the features of the company's plans to broaden, popularize and cheapen telephone service throughout the city. The new building will be erected on the rear portion, 80x80 feet, of a lot east and adjacent to the present structure of the company at Franklin and Washington Streets. The front end of this lot is at present occupied by the Forbes building, which will ultimately be razed and its site occupied by an addition to the building now proposed, fronting on Washington Street. Among other equipment, an elaborate new toll board will be installed. Work on the structure will be rushed as soon as an equitable agreement with the city is made. The present ordinance expires in 1900. The new branch exchanges planned are one between Lake View and Rogers Park, and one on the West Side, between the west exchange and Austin. Enlargments of other exchanges are also being considered.

LEESBURG, IND.—A franchise has been granted by the Town Council to John E. Armstrong, William R. Wood and Walter H. Stanley, to furnish electric light, heat and power in this city.

CENTERVILLE, IND.—Steps have been taken by the Town Board and the citizens generally toward the building of an electric light plant here. Nimrod Parrott, H. H. Peele and Harry Anderson constitute the building committee.

MONROE CITY, IND.—G. W. H. Roush has entered into an agreement with the town trustees for the construction of an electric lighting plant. Mr. Roush will build and install similar plants in Algiers and Atwell, towns in Pike County.

RICHMOND, IND.—The Indianapolis, New Castle & Toledo Traction Company proposes to petition the City Council and the Board of County Commissioners for franchises to construct and operate street and interurban lines through Richmond and across the county.

FORT WAYNE, IND.—The Commissioners of Allen County have granted the Fort Wayne & Winona Interurban Company a franchise through the county and town of Arcola. This completes the right of way of the entire distance between this city and Winona.

ATTICA, IND.—Improvements are being made by the Attica Telephone Company. A new toll board is being installed, to which will be connected a number of new circuits reaching out into the surrounding country. A line has been built to Riverside and will be extended to Independence.

EVANSVILLE, IND.—A petition has been filed with the County Commissioners by property owners for an election to vote on a 1½-cent subsidy for the proposed Vanderburg & Posey Electric Railway Company, recently incorporated to build from Evansville to New Harmony, with a branch to Mount Vernon.

TERRE HAUTE, IND.—The Board of Public Works is said to have prepared a report, recommending that the contract with the water works company be cancelled on the ground that the service is insufficient for the needs of the city and fails to give stipulated fire pressure. It is understood that steps will be taken to build a joint water and electric light plant for the city.

CRAWFORDSVILLE, IND.—J. W. Farrell, in charge of an engineering corps, has begun the survey of the Crawfordsville & Northwestern Traction Company's line between Crawfordsville and Hoopeston, Ill., by way of Attica and numerous towns along the line. Spencer J. Hunt represents the capitalist building the road and is arranging to let the contract as soon as the survey is completed.

INDIANAPOLIS, IND.—It is understood that eastern capitalists plan to build an electric railway to connect Grand Rapids, Mich., with Indianapolis. It is proposed to touch South Bend, which has a connecting link with the Indianapolis Northern at Logansport.

VALLEY JUNCTION, IA.—The Hawkeye Telephone Company is planning improvements and extensions to its local system.

BOONE, IA.—The Boone County Telephone Company is planning to make extensive improvements to its system. The plans include about 20,000 feet of cable work.

DUBUQUE, IA.—The Dubuque, Iowa & Wisconsin Railway Company has raised the necessary $125,000 for the construction of its proposed interurban line of railway, and active steps toward the building of the road will probably be taken at once.

GARDEN CITY, KAN.—An electric road is projected to connect Garden City with Deerfield and Lakin.

ELLINWOOD, KAN.—A. H. Schaeffer is asking for a franchise for putting in an electric light plant here.

LEAVENWORTH, KAN.—James Stanton, of the firm of McGuire & Stanton, of this city, has just been granted a 20-year franchise to build a street railway in Coffeyville.

BELLEVILLE, KAN.—W. K. Palmer, consulting engineer, Kansas City, Mo., has secured the contract for engineering services in connection with the proposed municipal electric lighting plant for Belleville, Kan. Plans and specifications are in course of preparation at present in the office at Kansas City.

LINCOLN CENTER, KAN.—W. K. Palmer, consulting engineer, Kansas City, Mo., has been engaged as engineer in consultation with the firm of Burns & McDonnell, hydraulic engineers, to prepare plans and specifications for the municipal lighting plant for Lincoln Center, Kan. Plans and specifications are in course of preparation.

OWENSBORO, KY.—The contract for the erection of the new power house for the Owensboro City Railway Company has been let to Farnsworth & Hall, of Henderson, Ky. The power house will be erected on Sixth and Hathaway Streets.

DANVILLE, KY.—W. R. Meyers and associates have been granted a 20-year franchise for an electric lighting plant in Monticello, Wayne County, upon the condition that the work of installing the plant begin at once and be completed within six months.

MORGAN CITY, LA.—It is proposed to construct an electric light and power plant here at a cost of $25,000.

NEW ORLEANS, LA.—Because of the great increase in business within the past few years, the New Orleans Railway & Light Company is preparing to enlarge its Claiborne power house in order that the capacity of the generating machinery may be increased from 1,500 to about 3,000 horse-power.

NEW ORLEANS, LA.—St. Barnard will have an electric railway from the slaughter house to Borgnemouth. The franchise has just been sold to William J. Kelly, president of the Louisiana Lime Company and manager of the Lake Borgne Canal Company, who represents a number of Chicago and New York capitalists. Mr. Kelly states that he is not yet ready to make any announcement concerning the construction of the line, but gave out the positive assurance that work will begin in a short while.

DEXTER, ME.—W. E. Hazleton, superintendent of the Dexter Electric Company, states that C. H. Bachelder, of Dexter, was awarded the contract for constructing the new power house, bids for which were opened January 20.

ELLICOTT CITY, MD.—The contention over the lighting of Elkridge and vicinity has been settled by the commissioners notifying the Patapsco Electric & Manufacturing Company, which has the contract for furnishing the lights, to replace the incandescent lights with arc lights. The lights were formerly all arc lamps and were furnished by the United Electric Light & Power Company, of Baltimore, but when the contract was let last spring the Patapsco Company secured it and represented that they could light the section in question more satisfactorily by using smaller lights and increasing the number. The change was made, but did not prove satisfactory to the residents of Elkridge and vicinity, and the protests made resulted in the recent order.

LOWELL, MASS.—The Lowell Electric Light Corporation has petitioned for pole locations in various parts of the city.

ATTLEBORO, MASS.—Tappan Brothers are said to be contemplating the construction of a central light and power generating plant for the business section of Attleboro.

TEMPLETON, MASS.—A proposition to light the town, presented by the Rust Company, Providence, is to be given consideration, and the prospects for more light in the future are bright.

WESTBORO, MASS.—At a special town meeting, Melvin H. Walker, Richard F. Parker and John W. Slattery were appointed a committee to investigate and report as to the advisability of establishing a municipal lighting plant.

GREENFIELD, MASS.—The Greenfield Electric Light Company has held its annual meeting and the annual report presents a very favorable condition of the company's affairs. A portion of the system is to be reconstructed this coming season.

WESTBORO, MASS.—At a special town meeting held recently, a committee of three was appointed to investigate the matter of establishihng or acquiring a municipal lighting plant. The committee is composed of Melvin H. Walker, Richard F. Parker and John W. Slattery.

BELLINGHAM, MASS.—The Board of Selectmen have given a final hearing to the Edison Electric Light Company. After some changes the franchise was granted for the streets of Caryville and North Bellingham, according to the plans filed by the company. It is expected that the wires will be strung right away.

GREENFIELD, MASS.—D. J. Oakley, of Greenfield, is making a survey for a canal for the Lamson & Goodnow Co. at its storage reservoir on the Deerfield River some distance above Shelburne Falls village. The canal is for the purpose of drawing off the water in the reservoir, which has been of little use to the company. An electrical plant will probably be installed.

SAGINAW, MICH.—The Saginaw Electric Light Company has secured the contract for lighting Morrice, Bancroft and Perry. A power house will probably be constructed at Shiawassee.

DETROIT, MICH.—The Common Council has adopted the resolution appropriating $1,500 to enable the Public Lighting Commission to emplay an expert to prepare plans for building a conduit or subway for all overhead electric wires.

BENTON HARBOR, MICH.—The St. Joe River Traction Company and the Southeastern Michigan Light & Power Company have filed articles of consolidation with the Secretary of State, under the name of the Benton Harbor-St. Joe Railway & Light Company, with a capital stock of $1,000,000.

GRAND RAPIDS, MICH. The Central Michigan Railroad Company, it is reported, has been merged by sale into the Grand Rapids Electric Railway Company, which owns right of way for a line of railway from Grand Haven to Grand Rapids, thence through several other towns to Alpena. The purchase also includes a right of way from this city through Battle Creek, Coldwater and Camden in Michigan, to Pioneer, and other places in Ohio. Surveys have been made for 300 miles, 175 miles of which are graded. Jeremiah W. Boynton is president of the Grand Rapids Electric Company.

MANKATO, MINN. The Mankato Gas & Electric Light Company has increased its capital stock from $225,000 to $500,000 for the purpose of making extensive improvements.

CASS LAKE, MINN.—W. G. Schroeder, of Bemidji, writes that it is proposed to construct a dam across the Mississippi River to develop power, which will be transmitted to Bemidji and Cass Lake. M. D Stoner and E. Bourgeois, of Bemidji, are said to be interested. The probable cost of the proposed work is estimated at $20,000.

WESSON, MISS.—Citizens of Wesson are planning to build an electric railway to connect Wesson with the Mississippi Central Railroad. The power will be furnished by the Wesson electric light plant.

JACKSON, MISS.—The Jackson Street Railway, Light & Power Company has awarded to the Leonard & Martin Construction Company, Chicago, Ill., the contract for constructing its proposed new power house.

BILLINGS, MONT.—The franchise of the Billings Water Power Company expires during the present year. The plant supplies both water and light to the city. It is probable that the city will take steps toward installing a system of its own. Plans are being discussed, which include the construction of a headgate 15 or 20 miles up the river, with mains leading to reservoirs or settling basins to be placed high on the cliffs.

JACKSON, MO. Bids will be received until February 19 by Mayor Edward D. Hays for furnishing material and installing a complete water and light plant for the city. Hiram Phillips, 615 Frisco Building, St. Louis, Mo., is consulting engineer.

ST. LOUIS, MO.—The St. Louis & Hillsboro Electric Railway Company, which is to construct a road from St. Louis to Hillsboro, is now arranging to finance a proposed extension of the road from Hillsboro to Bismarck. It is understood that the company has secured sufficient funds for constructing the road from St. Louis to Hillsboro and the work of building will be started next month.

GRAND ISLAND, NEB.—Plans, specifications and estimates of cost have been prepared by W. K Palmer, consulting engineer, Kansas City, Mo., for a combined electric lighting and water works plant at Grand Island, together with a complete electric lighting system for this city. Plans and specifications are on file at Grand Island and at the office of the engineer at Kansas City.

LOVELOCK, NEV.—The citizens are in favor of installing an electric light system in connection with the new water works now being installed.

CAMDEN, N. J.—City Engineer L. E. Farnham is said to have estimated the cost of a lighting plant for supplying 602 arc lamps and 2,000 incandescent lamps at $127,000.

SEABRIGHT, N. J. William Tabor Parker, of Little Silver, has been engaged in getting rights of way for the construction of an electric railway between Red Bank and Seabright. It is said that a spur from Seabright to Long Branch and Highland Beach may also be undertaken.

PASSAIC, N. J.—Assemblyman Wright has introduced a bill to enable the city to issue $100,000 bonds for the construction of a municipal electric lighting plant. The point has been raised that this amount would not be enough to construct such a plant as would be able to compete with the Public Service Corporation, and the question is creating a lively discussion.

CAMDEN, N. J.—Work has been started on a power house for the West Jersey & Seashore Railroad for the electric line to be constructed between Camden and Atlantic City. The Stirling Consolidated Boiler Company, which has the contract for installing 12 boilers in the power house, has begun work. The General Electric Company is drafting specifications for the generators.

SERGEANTVILLE, N. J.—The committee of farmers, composed of Wesley A. Bodine, D. O. Merrill and Frank W. Venable, all of this vicinity, is meeting with unexpected success in canvassing the property owners for rights of way for the proposed electric railway between Lambertville and Flemington. Practically all the rights of way will be donated, it is expected, or sold for a nominal figure.

SOUTH ORANGE, N. J.—The village of South Orange has decided to take steps toward establishing a municipal electric light plant for lighting the streets of the village and furnishing current to private consumers on the same plan as water is supplied to householders. The legislative committee of the village board of trustees has been instructed to proceed without delay to draw up a bill for introduction in the State Legislature which will give the village authority to construct and maintain a municipal plant. Lately the village authorities have been allowing the Public Service Corporation to lay conduits and do business in the village without a franchise or without its paying the village anything or even guaranteeing it against harm.

LANCASTER, N. Y. The Village Trustees have granted a 5-year contract to Mr. Feyler for lighting the streets.

YONKERS, N. Y. The Board of Aldermen have voted in favor of the city owning, equipping and operating a municipal electric light plant.

JAMESTOWN, N. D.—The Northwestern Telephone Exchange Company is contemplating an extension of its service to Spiritwood Lake.

SHARON, N. Y. The Shenango-Midland Street Railway Company is planning to construct seven miles of road in the vicinity of Sharon.

BROOKLYN, N. Y.—The Board of Aldermen has passed an ordinance for an issue of corporate stock to the amount of $175,000, as authorized by the Board of Estimate for placing electrical conductors underground in Brooklyn.

UTICA, N. Y.—Announcement has been made by the Central New York and Empire State Telephone Companies, that jointly they will expend $1,500,000 in 18 counties this year. A sum of $200,000 will be set aside for the establishment of the stations and the rest of the amount will be devoted to extending subways and otherwise developing the existing system. The Central New York Company will spend from $35,000 to $50,000 at Utica, mostly in subways.

BROOKLYN, N. Y.—A plan for a municipal electric railway in the eastern district of Brooklyn and Greenpoint has been inaugurated by Borough President Coler. The scheme may be the means of relieving one of the congested parts of the eastern district, and if carried out, will establish a direct electric railway from Queens County to the Borough of Manhattan. It embodies the extension of Grand Street and the opening of an electric railway into one of the rapidly growing sections of Queens Borough.

LYONS, N. Y. At the quarterly meeting of the Wayne-Monroe Telephone Company, General Manager John A. Driscoll presented the quarterly report of the company, showing net earnings of the quarter to be at the rate of 12 per cent on the capitalization of $200,000. Director Kelley secured the adoption of a resolution to expend part of the surplus under direction of President Dirscoll in extending toll lines.

CARRINGTON, N. D.—A bond issue of $10,000 has been voted by the citizens for the construction of a municipal electric light plant.

NEWARK, OHIO.—The Licking Electric Light & Power Company, of this city, in which a number of Columbus parties are interested, has decided to erect a new power house at a cost of about $100,000.

COLUMBUS, OHIO.—The Fairfield Traction Company has filed an amendment to its charter, which provides for the construction of an electric railway from Lancaster to Millersport, on Buckeye Lake.

MT. VERNON, OHIO.—An ordinance has been prepared and introduced at the Council proposing that the city issue bonds in the sum of $35,000 for the purpose of building and operating a municipal electric light plant, and that the matter of the bond issue should be submitted to a vote of the people on March 20.

DELAWARE, OHIO.—The stockholders of the Citizens' Telephone Company at their annual meeting re-elected the board of directors. It was decided to build more lines. The financial report showed the finances of the company to be in excellent condition. At the beginning of 1905 there were 1,321 telephone in service and during the year 347 were installed. Seven years ago the company was started with 150 telephones.

STROUD, OKLA.—The election to vote for bonds for the construction of water works and an electric light plant was carried by a large majority. The plants will be operated by the city.

WATONGA, OKLA.—M. A. Earl, consulting engineer, of Muskogee, I. T., writes that the date of opening the bids for constructing an electric light plant and water main extensions at this place has been extended. The bids were to have been opened on February 9. G. F. Moore is City Clerk.

SHAWNEE, O. T.—The City Council here has under consideration the matter of granting a franchise to the Shawnee Lighting Company for a period of twenty-one years. D. T. Flynn is president of the company. It looks as if the franchise will be granted. The new franchise reduces the price of incandescent lights from 25 cents to 15 cents and of arc lights from $8 to $7 per month.

McMINNVILLE, ORE.—H. S. Maloney, City Recorder, writes that bids for the construction of the electric light plant have not yet been called for. The probable cost of construction is estimated at $13,000.

PORTLAND, ORE.—The Pacific States Telephone & Telegraph Company is considering plans for the entire remodelling of the system. It is proposed to install the central energy system, and the overhead steel wires will be replaced by copper wires. The cost of the proposed improvements is estimated at $250,000.

THE DALLES, ORE.—The Interior Development Company has made a filing on water to be taken from Deschutes River, near Shearer's bridge, about 30 miles from the mouth of the river. It is the purpose of the company to take the water out of the river at the point where it has made its filing and carry it in flumes about two miles, which will give it a fall of some 50 feet, and there establish a hydro-electric power plant. The power plant at White River, owned by the Wasco Warehouse & Milling Company is now taxed to its full capacity, furnishing light and power for The Dalles and Dufur, and there is a good field for another plant.

HARRISBURG, PA.—Mayor Gross has signed the belt line ordinance of the Central Pennsylvania Traction Company. Construction work will begin in the spring.

DANVILLE, PA.—The Danbury & Sunbury Electric Railway Company has been granted an extension of its charter, which gives it the right to extend its line from Danville to Catawissa.

MONONGAHELA, PA. Surveyors are now at work on the West Shore trolley line to be constructed between Donora and Black Diamond, and the assurance is given that the road will be rushed to completion

WILKESBARRE, PA. The Wilkesbarre & Hazleton Railway Company states that as soon as it receives permission from the Council, it will begin the construction of the proposed extension to Ashley.

DUNLO, PA.—Samuel Lemhart and Dr. C. E. Hannon, of Johnstown, and John Powers, of this city, are reported to have purchased the plant of the Dunlo Electric Light Company and will extend the system to Llanfair and Salix.

DOYLESTOWN, PA.—The Perkasie, Doylestown & Newhope Railway Company's ordinance for a right of way through certain streets in this borough was passed by the Common Council at its last session and will doubtless be accepted by the company.

LANCASTER, PA.—Construction work on the Philadelphia, Coatesville & Lancaster Electric Railway, now in operation between Coatesville and Parkesburg, is to be resumed in the early spring. It is expected to have it in operation as far as Atglen by mid summer. The line will ultimately be built to Lancaster.

MEDIA, PA.—The Media, Middletown & Aston Electric Railway Company expects to extend its lines to Village Green and Rockdale, where connection will probably be made later on with a branch of the Philadelphia & West Chester Traction Company's line, which it is expected will be built at an early date.

NEWTOWN, PA.—The route of the proposed extension of the New Jersey & Pennsylvania Traction Company's line from this borough to Hatboro and Willow Grove has been practically decided upon, and it is expected that work will begin in the spring. When completed to Willow Grove this will afford the most direct and quickest connections between Trenton and Philadelphia, though not the shortest line.

MECHANICSBURG, PA.—The Secretary of the Borough Council writes that all bids received for lighting have been returned unopened and that nothing further will be done until the reorganization of the Council in March.

READING, PA.—Thomas Searles, of Pottstown, and Cyrus Q. Guldin, of Reading, representing a syndicate, recently purchased the property of the Ringing Rocks Electric Railway Company, for $23,000 at public auction. In addition to the $23,000, the purchasers will have to satisfy a $4,000 mortgage and about $1,000 interest. This company was originally formed by twenty residents of Pottstown, with a capital stock of $50,000, and the line was opened June 15, 1894. Inability to complete the system by extending lines to Swamp and Boyertown in order to get a suitable terminus has always handicapped the corporation. After title has been passed on February 16, it is the intention to reorganize the company under the name of either the Ringing Rocks Traction Company or the Montgomery line to Boyertown, there to connect with the system of the United & Berks Traction Company. It is then the purpose to extend the Traction Company.

COLUMBIA, S. C.—The Columbia Street Railway, Light & Power Company is having plans drawn for a handsome new power plant, and the architects will be ready with their specifications in a short time. The new power house will be located on the banks of the canal near the city.

ABERDEEN, S. D.—It is rumored that the citizens and business men of Watertown have raised a bonus of $200,000 for the northwestern extension of the Minneapolis & St. Louis Railway from Watertown, provided the road runs up to Groton instead of Aberdeen.

COLUMBIA, S. C.—Application has been filed here for a charter for the Augusta & Columbia Railway Company, which is a definite step toward the long-talked-of extension of the Augusta-Aiken electric railway to Columbia. The applicants are James U. Jackson, general manager of the Augusta-Aiken Railway & Electric Company, and others. The new corporation proposes to take over the Augusta-Aiken line, 23 miles long, connecting Augusta, Ga., and Aiken, S. C., and to build 52 miles of road into Columbia. It asks for authority to use steam or electricity as motive power.

MIDDLEBROOK, VA.—The Virginia Valley Traction Company held its annual stockholders' meeting last week in Staunton and elected the following officers: J. Frank Clemmer, president; J. M. Smiley, first vice-president; P. H. Hantsch, second vice-president; H. G. McGary, secretary and treasurer. The capital stock will be increased from $100,000 to $250,000. It is intended to push the enterprise to completion.

BRADFORD, VT.—The power plant of the Bradford Electric Lighting Company has been put in successful operation and Bradford and Newbury are now lighted from the new plant. The plant is run by water power and its present equipment has a capacity of 5,000 lights. Negotiations are under way with the neighboring villages of Haverhill, North Haverhill and Fairlee to supply current for light and power, and it is probable that the necessary extensions will be made.

SEATTLE, WASH.—Plans are said to be in course of preparation for the erection of a sub-station for the Fremont District of the city lighting department.

SPOKANE, WASH.—The Rockford & Mount Hope Telephone Company has applied for a franchise to construct, operate and maintain telephone lines on the county roads near Rockford.

OLYMPIA, WASH.—The management of the Olympia Light & Power Company announces that the company is enlarging its plant to a capacity of 3,000 hp. The improvement will be completed this coming fall.

COLUMBIA, WASH.—A telephone franchise has been granted to the East Mill Plain Telephone Company. The line will start east of Vancouver Barracks and follow the Mill Plain road, with branches running to Fisher's Landing and the Harmony neighborhood.

CHEYENNE, WYO.—Plans are being discussed for the formation of a company for the purpose of purchasing and combining the electric power plant at Boulder with others in the larger towns in northern Colorado. William J. Barker, of the electric department of the Denver Gas & Electric Company, and Joseph J. Henry are the Denver representatives of the syndicate, which, it is said, will be prepared to spend $2,500,000 in carrying out its plans. It is also proposed to build an electric railway from Denver to Cheyenne, Wyo.

VANCOUVER, B. C.—The British Columbia Railway Company is preparing the site for its new sub-station and car barns, bids for which will be invited immediately.

PORT ARTHUR, ONT.—The Town Council has made application to the provincial legislature for permission to build a belt line street railway through the residential portion of the town.

FORT WILLIAM, ONT.—It is said that $12,000 will be expended this year in improving the telephone system of Fort William.

OTTAWA, ONT.—The improvements which the Ottawa Electric Railway Company intends making at Britannia-on-the-Lake will include the extension of the pier, erection of a club house and the enlargement of the auditorium.

ST. JOHN, N. B.—The sub-committee of the Safety Board has decided to employ Ross & Holgate, of Montreal, Que., to prepare estimates for the construction of a lighting plant for the streets and public buildings. An estimate will also be prepared for procuring water power from Silver Falls.

ST. JOHN, N. B. At the annual meeting of the Maine & New Brunswick Power Company, at St. John, January 23, it was decided to begin work at once on the construction of a dam, and it is expected that by November 1 power will be supplied to Andover, Perth, Florenceville and other points on the St. John River. J. D. Seely, of St. John, is secretary of the company.

ALBUQUERQUE, N. M. The Colorado Telephone Company is planning to erect a new building. The line between Denver and this city is nearly completed.

ESTANCIA, N. M.—The Board of Trade at its last meeting took up the matter of organizing a company for the purpose of building a local telephone system. A committee consisting of J. W. Corbett and N. S. Rose was appointed to look into the matter.

CARBERRY, MAN.—The Town Council is reported to be considering the question of constructing an electric light plant.

WINNIPEG, MAN.—The date of opening of bids for supplying two 500-hp electric generators has been extended from February 12 to February 26. Address all bids to Alderman J. C. Gibson, Chairman of Fire, Water and Light Committee.

WINNIPEG, MAN. C. Chamberlain, manager of the Great Falls Power Company, of Manitoba, states that it is proposed to develop at present 50,000 hp, which may be increased ultimately to 150,000 hp. The cost of the work will be about $3,000,000. Bids for construction will probably be received about March 15.

New Incorporations.

LITTLE ROCK, ARK.—The Ozark & St. Paul Telephone Company has been incorporated with a capital of $3,000 by A. C. Blaylock and others. They will construct and operate a telephone line in the northern part of Franklin County and the southern part of Madison County.

COLORADO SPRINGS, COL.—The Empire Water & Power Company has filed articles of incorporation, stating its capital stock to be $1,000,000. The company will construct reservoirs above Green Mountain Falls, the power thus secured to be used for manufacturing, lighting and other purposes. William A. Otis and George A. Taft are among the incorporators.

NAMPA, IDAHO.—A recent concern to file a certificate of incorporation is the Dewey Electric Light & Power Company, having a capital stock of $1,000,000.

BLUFFTON, IND.—Articles of incorporation have been prepared by Attorneys Merriman & Dailey for the Tocsin Telephone Company, the incorporators of which are Henry Plummer and A. P. and C. K. Kelley. The company's capital is $10,000.

CHICAGO, ILL.—The Block Light Company has been incorporated here with a capital of $1,000. Russell Wiles is among those interested in the new concern.

KINSMAN, ILL.—W. D. Lindsay, Thomas Drinan and E. J. Phelan recently filed articles of incorporation for the Kinsman Independent Telephone Company, capitalizing it at $2,500

SPRINGFIELD, ILL.—The Patterson-Stewart Company, of this city, has been incorporated for the purpose of conducting a heating and lighting business. The company is capitalized at $10,000. Frank U. Patterson is one of the incorporators.

CHARLESTON, ILL.—The Mattoon, Shelbyville, Pana & Hillsboro Traction Company has been incorporated and its principal office will be located in this city. The company is capitalized at $10,000, and will construct a line from Mattoon to Hillsboro. W. T. Craig and W. T. Patton are among the incorporators.

SPRING GROVE, ILL.—The Spring Grove Telephone Company, with a capital of $10,000, has been incorporated by Joseph E. Meredith, Anton Schaefer and Henry C. Sweet.

EL PASO, ILL.—The Grand Telephone Company has been incorporated with a capital of $1,100. The incorporators are E. P. Armstrong, J. C. McGraw and C. A. Gull.

JASONVILLE, IND.—The Indiana Electric Transmission Company has filed its certificate of incorporation, indicating its capital stock to be $250,000, and naming the following directors: Thomas Duncan, Howard L. Hyatt and William H. Hornberger. The company will build and operate an electric plant to furnish heat, light and power in Jasonville, Coalmont and Hymera, and also to the coal mines.

GARNETT, KAN.—The Garnett Telephone Company has been incorporated, with a capital stock of $25,000.

HUTCHINSON, KAN.—The Hutchinson Interurban Railway Company has been incorporated and is capitalized at $100,000.

NEW CAMBRIA, KAN.—The New Cambria Telephone Company, with a capital of $5,000, has filed articles of incorporation.

LAKE BENTON, MINN.—Articles of incorporation have been filed by the Lincoln County Telephone Company, stating its capital stock to be $50,000.

MILLBROOK, N. Y.—The Northern Electric Railway Company has been incorporated with a capital of $600,000. The following are the directors: E. H. Rippee, Jr., C. C. Ferber and F. L. Fuller.

TROY, N. Y.—The Champlain Valley Traction Company was formed at a recent meeting held at Middleburg, Vt., for the purpose of constructing and operating a trolley line. The proposed road will run from Vergennes to Fair Haven and will be equipped for both passenger and freight service.

NORWOOD, N. C.—The Norwood Electric Light Company is reported to have been incorporated with a capital of $25,000, by J. N. Lilly and others.

CLEVELAND, OHIO.—The Oliver Electric Company, with a capital of $10,000, has been incorporated by E. C. Mullen, A. H. Parrott, H. A. Mullen, Sherman Arter and M. Barnes.

XENIA, OHIO.—The Columbus & Miami Valley Railway Company, of this city, has been incorporated by G. Dennis, W. H. Thompson, J. M. Dawson, Charles Follett and J. M. Jones.

TOLEDO, OHIO.—The Toledo & Columbus Electric Railway Company has been organized with the following officials: D. H. James, president; William Finlay, vice-president; H. R. Klauser, treasurer, and Mark Winchester, secretary.

LAMONT, OKLA.—The Deer Creek & Lamont Telephone Company has filed articles of incorporation. The company is capitalized at $1,200.

WEATHERFORD, OKLA.—The Northern Mutual Telephone Company, with a capital of $3,000, has been incorporated by W. S. Wood, Joseph Wolverton and W. A. Coddington.

OREGON CITY, ORE.—W. H. Bonney, C. G. Huntley, Dr. H. S. Mount, E. G. Caufield have incorporated the Oregon City & Farmers' Independent Telephone Company, with a capital stock of $5,000.

PORTLAND, ORE.—The Standard Heat & Power Company, having a capital of $5,000,000, has been incorporated by M. W. Baldwin, J. J. Herman, J. L. Brophy, W. F. Crummett and H. E. Mason. M. W. Baldwin is president and J. J. Herman, treasurer.

HAZLETON, PA.—The Consumers' Electric Light & Power Company has been organized and will soon apply for a charter to construct an electric light plant in Hazleton. David Benjamin, James H. Loughran and Harry A. Mohr are among those interested in the new company.

HITCHCOCK, S. D.—The Pioneer Rural Telephone Company has filed articles of incorporation with a capital of $5,000.

LILLY, S. D.—The Lilly Local Telephone Company has been incorporated, with a capital of $3,700 and will conduct a local telephone business.

MENNO, S. D.—Articles of incorporation have been filed for the Menno Rural Telephone Company by G. W. Mummer, H. H. Claggett and Peter Gudmunson. The company has a capital of $25,000.

BELLE FOURCHE, S. D.—The Belle Fourche Electric Light, Heat & Power Company has been incorporated with a paid-up capital stock of $25,000. A. A. Moody is president, and T. H. Gray, vice president, of the new concern.

MEMPHIS, TENN.—The Memphis Electric Company was recently incorporated with a capital of $5,000

READSBORO, VT.—The Readsboro Electric Light Company has filed articles of incorporation, showing a capital stock of $2,000.

STANDWOOD, WASH.—The Stanwood Light & Power Company has been incorporated with a capital of $4,000.

SEATTLE, WASH.—Articles of incorporation of the Montana Miners' Electric Railway & Power Company have been filed by W. A. Sharp, of Tacoma; A. J. McCorkle, of Libby, Mont.; H. W. Leuders, of Tacoma; H. H. Howard, of Auburn; C. R. Fairman, of Tacoma. The capital stock of the corporation is given at $150,000. Seattle is to be the principal place of business. The incorporators are named as trustees.

BELOIT, WIS.—The articles of incorporation for the Beloit Water, Gas & Electric Light Company have been filed. The company is capitalized at $600,000 and is a consolidation of the water, gas and electric power plants. The new company, it is said, will expend about $200,000 in improvements and extensions.

New Industrial Companies.

THE ELECTRICAL SUPPLY & FIXTURE COMPANY, of Long Beach, Cal., has been organized by E. A. Wilson, A. A. Towne and George L. Curtis. The company has an operating capital of $25,000.

MERCHANTS' ELECTRIC PROTECTION COMPANY, of Chicago, has been incorporated by T. B. Hall, A. White and W. J. Creighton. The company will manufacture and install automatic signal systems.

THE CONSTENTINE STORAGE BATTERY COMPANY, of New York, has filed articles of incorporation. Its capital stock is $8,000, and the following are named as directors: E. B. Constentine, W. H. Smith and J. A. MacEwan.

THE BOSTON LIGHT & EQUIPMENT COMPANY, of East Orange, N. J., will make a business of equipping buildings and establishments for lighting. The company has a capital of $250,000. J. P. Crosby is among the promoters of the enterprise.

THE MEIGS COUNTY HOME TELEPHONE COMPANY, of Pomeroy, Ohio, has filed articles of incorporation, with a capital of $50,000. The incorporators are Arthur B. Kratz, C. E. Peoples, George Schwegman, O. A. Rowley and W. E. Stansbury.

THE ARC SPARK MANUFACTURING COMPANY, New York, has been incorporated and will manufacture automobile sparking plugs. The company is capitalized at $10,000, and the following comprise the board of directors: K. C. Wideen, C. J. Pearson and F. T. H. Bacon.

THE AMERICAN ELECTRIC CONSTRUCTION COMPANY, of Chicago, Ill., has been organized with a capital of $2,500, and will manufacture insulation and other electrical supplies. The company was incorporated by Henry Martin, William H. Duval and Alice E. Gorman.

THE LAUBE ELECTRICAL COMPANY has filed its articles of incorporation and will commence operations on a capital stock of $15,000. E. M. Beuhl, Charles A. Laubenberger and Cleveland Babcock are the incorporators. The company is located on Elm Street, Buffalo, N. Y.

ENGINEERING OF LIGHT & ILLUMINATING COMPANY, of New York City, has filed articles of incorporation and will engage in the manufacture of apparatus for light, heat and power. The company is capitalized at $20,000, and is incorporated by A. A. Ernst, Edgar Beekman and Cornelius C. Beekman.

LAFAYETTE, IND.—The Indiana Electric Transmission Company has filed articles of incorporation, capitalized at $250,000. It is the purpose of the corporation to operate in Sullivan County and furnish heat, light and power to Jasonville, Coalmont and Hymera. Power and light will also be furnished to the extensive coal mines tributary to these towns. The incorporators are Howard L. Hyatt, William H. Hornberger and Thomas Duncan.

Legal.

FESSENDEN LIQUID BARRETTER. Action has just been taken by the United States Circuit Court for the Southern District of New York in enjoining the Wireless Telegraphy Company, Limited, of Berlin, Germany, known there as Gesellschaft fur Drahtlose Telegraphie, m.b.H., from infringing letters patent of the United States, Reissue No. 12115, granted to Reginald A. Fessenden, May 26, 1903. It will be remembered that Judge Wheeler filed an opinion on October 16, 1905, upholding the validity of this patent and adjudging it infringed by the American De Forest Wireless Telegraph Company and others and directing a decree for an injunction and an accounting. The opinion was noted in this paper at the time. The injunction now issued restrains the German Company, which it was alleged had been importing the apparatus from Germany and selling it to the Goverment under the name "Slaby Arco System," "Telefunken System," etc., from further making, using or selling the infringing apparatus and "also especially from the manufacture, use and sale of the three forms of device referred to in said moving papers, namely, first, the adjustable silver-coated platinum wire form, secondly, the silver-coated platinum wire sealed in glass form, and, thirdly, the platinum wire sealed flush in glass form."

OLD TELEGRAPH SUIT.—Judge Hazel, in Buffalo, has rendered a decision in favor of Thomas A. Edison in a suit brought nearly thirty years ago against Jay Gould. Originally damages were asked in the sum of $300,000. The suit hinged upon the refusal of Gould to pay for patents sold to the Automatic Telegraph Company, of which the Western Union is the successor. It is charged that for thirty years this latter company has been using devices owned and patented by Mr. Edison. The litigation in all probability is not ended yet, as this is not a decision by a court of last resort.

RULES ON TELEGRAPH BLANKS.—Last week a jury in Part II of the Supreme Court, Brooklyn, decided that a telegraph company is responsible for damages when in transmitting a message intrusted to it the company makes a mistake. The sum of $2,200, the full amount sued for, was awarded E. S. Halstead & Co., bag manufacturers in Manhattan, against the Postal Telegraph Company. A message was sent by Armour & Co., of Chicago, to Halstead & Co., inquiring the price on a contract for 25,000 bags. Before replying the plaintiff telegraphed to the Cannon Manufacturing Company in Concord, N. C., for prices on cloth for the bags. Replying, the Cannon Company gave 3.80 cents a yard for wide material and 2.80 cents for narrow cloth. This message when received by the Halstead concern read 3⅛ and 2⅛ cents a yard. The total difference on the contract was $2,200. As soon as the message was received the contract was accepted, and the bag-making company was compelled to stand the loss. It is said the case will be carried to the Court of Appeal, and possibly to the United States Supreme Court, as the company claims that the printed notice on the back of each telegraph blank exempts it from responsibility for any mistakes in transmission of messages.

INJURY FROM WIRE.—The Supreme Court of Michigan, in the action of Stark versus the Muskegon Traction & Lighting Company has affirmed the decision of the lower court in favor of the defendant. The main points were: (1) Negligence of an electric light company in violating an ordinance requiring wires to be strung 25 feet above the ground will not be presumed to have caused or contributed to an injury to a child who came in contact with a loose telephone wire, which had been thrown over the wires of the light company. 2. The fact that a child who seized a telephone wire, suspended over a defectively insulated electric light wire, was not aware of the danger of so doing, is not sufficient of itself to charge the electric light company with responsibility for injury to the child. 3. Electric light wires were suspended only 19 feet above the ground, whereas the city ordinance required them to be suspended 25 feet above the ground. There was also evidence of their defective insulation. Plaintiff, a boy 10 years of age, was playing with other children on the ground beneath the wires, when a telephone wire, strung on the same posts with the light wires, became broken and was thrown by one of the children over the light wires, where it came in contact with defective insulation. Plaintiff took hold of the telephone wire in order to experience the shock which another boy had received and to show his valor, and was injured. Held, that neither the defective insulation nor the distance of the wires from the ground was the proximate cause of the injury to plaintiff, but such injury was the result of his own wrongful interference with the wires.

Obituary.

MR. THEODORE SPENCER, vice-president and general manager of the Bell Telephone Company, of Philadelphia, and of the Delaware & Atlantic Telegraph & Telephone Company, died of acute Bright's disease, January 28, at his home in Philadelphia. He was born at Fort Snelling, Minn., in 1870. Mr. Spencer graduated from the Massachusetts Institute of Technology in 1891 as an electrical engineer, and after a short service with the General Electric Company at Lynn, Mass., entered the employ of the American Bell Telephone Company in Boston. In 1894 he came to Philadelphia in the same employ, first as superintendent of installation, afterward becoming successively engineer, general superintendent and general manager. Recently he was made vice-president and one of the directors. It was largely through Mr. Spencer's ability that the Bell Telephone Company, of Philadelphia, has reached its present development. He is survived by a widow and two children.

Educational.

WORCESTER POLYTECHNIC.—A new electrical engineering building will shortly be erected at the Worcester Polytechnic Institute, on the grounds immediately north of the Salisbury Laboratories. The architectural features will be such as to provide for an attractive addition to the notable buildings of Worcester. For some time the Salisbury Laboratories have been overcrowded by the physics, chemistry and electrical departments, and the construction of the building will bring much relief. The new building will contain the usual recitation rooms and laboratories, including as special features a lecture room capable of seating 300 persons, a standard laboratory fully equipped, a department library and reading room with a stack capacity for 2,000 volumes, a design room, photometric, high potential and electric railway engineering laboratories. The electric railway laboratory will be equipped on a scale which will enable both theoretical investigations and practical tests to be made with the utmost facility.

UNIVERSITY OF WISCONSIN LECTURES.—Announcement has just been made by the College of Engineering University of Wisconsin, of the complete list of non-resident lectures who are to address the students in engineering during the coming year. The lectures selected include some of the most prominent authorities on special phases of engineering in the country. The lectures are not confined strictly to engineering topics, but include the consideration of various industrial and commercial problems with which the engineer is brought in contact. Among the subjects pertaining to electricity, "High Speed in Modern Engineering" will be discussed by Mr. B. A. Behrend, chief electrical engineer of the Allis-Chalmers Company.

Personal.

MR. A. C. GARRISON, president of the Columbia Incandescent Lamp Company, of St. Louis, was a visitor to New York City last week.

MR. A. E. WINCHESTER, the superintendent of the municipal electric light plant at South Norwalk, Conn., has been unanimously elected chief of the fire department of that city, and took office February 1.

MR. W. A. BIXBY has tendered his resignation as manager of the Quincy Gas & Electric Company, Quincy, Ill., to accept the general managership of the properties headed by George B. Macomber, of Portland, and popularly called the "Main Syndicate," which are located at and near Springfield, Mo.

MR. WARREN P. BRISTOL, general manager of the Meriden Electric Railway, of Meriden, Conn., has been appointed acting general manager of the Hartford lines of the Consolidated Railway Company, to succeed Mr. Frank Caum, who has accepted the position of general manager of the Scranton Railway.

MR. JAMES A. STORER, after eighteen years of service, has severed his connection with the Richfield Springs Electric Light & Power Company. Mr. Storer has ably filled the post of general manager for the company, but his various other interests now occupy so much of his time that he has decided to give up this responsibility.

MR. WARREN BICKNELL has retired as president of the Lake Shore Electric Railway Company, to become president of the Cleveland Construction Company, with offices in Cleveland, Ohio, succeeding Mr. Will Christy. The company makes a business of building and financing properties and is now identified with several important projects.

PRESIDENT F. P. FISH, of the American Telephone & Telegraph Company has just returned from a trip, covering three weeks; to the Pacific Coast. He made a careful investigation into the affairs of the Pacific States Telephone Company, and was greatly pleased with the telephone development in the Far West, the Pacific Coast territory of the company showing 200,000 telephones, or 1 to every 12 of the population.

MR. JOHN F. GILCHRIST has been appointed by President Blood of the National Electric Light Association, as reporter on the "Installation of Electric Signs Free." Mr. Gilchrist's large experience with the Chicago Edison Company will enable him to prepare a very interesting and instructive report on this subject for presentation at the twenty-ninth convention of the association, to be held at Atlantic City, N. J., June 5, 6, 7 and 9 next.

GEN. EUGENE GRIFFIN, first vice-president of the General Electric Company, has been elected a member of the board of trustees of the Engineers' Club, New York City, to serve for a term of office expiring 1910. General Griffin has been a member of the club for some years, and when he took his volunteer engineer regiment to Porto Rico, was presented by the club with a stand of colors, now preserved in the club house since the regiment's return.

MR. JAMES B. OLSEN, manager of sales of the India Rubber & Gutta Percha Insulating Company, has just returned from Chicago, where he made a great success of the handsome exhibit of his company in the Electrical Show. He speaks enthusiastically of the Show as a success financially and in many other ways and says it has been a splendid educational factor locally. As to the business outlook, Mr. Olsen, who is a close, shrewd judge, says it is excellent, and that trading, although enormous, is on a sound basis. Orders and inqnuiries run into very large figures.

MR. W. K. PALMER, consulting engineer, Kansas City, Mo., has established a branch office in Memphis, Tenn., at 52 Porter Building. Mr. L. C. Wilson, formerly chief engineer of the office in Kansas City, is in charge of the Memphis office, which is directing the construction of an important plant for the Standard Box Company at Memphis. The office is equipped with all the necessary facilities for the engineering work connected with power plants and factory construction in the southern territory.

MR. E. F. CANNON, president of the E. F. Cannon Company, Portland, Oregon, has sufficiently recovered from a month's illness to enable him to depart for the Hawaiian Islands. Mr. Cannon will sail on the steamer "Mongolia" from San Francisco, Feb. 6, to be absent three or four months. The after effects of a severe attack of "Pyemia blood poison," which Mr. Cannon passed through in 1900, left his constitution in a shattered condition from which he has never fully recovered. Mr Cannon has decided to spend his winter months in a more temperate climate.

MR. D. E. EVANS.—At a meeting of the directors of the Maryland Telephone Company, Baltimore, last week, Mr. H. W. Webb resigned as president and Mr. David E. Evans, vice-president, was elected to fill the vacancy. Mr. B. S. Joslyn was chosen vice-president to succeed Mr. Evans. In addition to resigning the presidency, Mr. Webb resigned from the Board of Directors, and Mr. Joslyn was elected in his place. Mr. Webb also resigned as vice-president and director of the Baltimore Electric Power Company, and Mr. Joslyn succeeded him there. Mr. Joslyn, the new vice-president of the company, is a Philadelphian, and represents the Philadelphia interests in the company. He has been in the president's office about three months. Mr. Evans is a veteran in the electric lighting field in Baltimore, where he was once connected with the old Brush interests, and he is widely known in the electrical field.

Trade Publications.

THE NATIONAL CARBON CO., of Cleveland, O., has issued a very attractive calendar for 1906, following its accustomed plan. Interleaved in the monthly calendar pads are terse and forceful advertisements of the National products.

ELECTRICAL SUPPLIES.—The United Electric Company, Wichita, Kan., is distributing the first of a series of blotter calendars for 1906, calling attention to its complete stock of electric and telephone supplies, the assortment and quality of which are stated to be equal to those of any supply house in the West.

INDICATOR COCK.—The Schaeffer & Budenberg Manufacturing Company, 66 John St., New York, has issued an illustrated pamphlet devoted to a four-way indicator cock which has been designed as a convenient means of taking cards from the throttle and exhaust-pipe line, as well as from the receiver space of compound engines.

ELECTRICAL CONSTRUCTION SUPPLIES.—Catalogue No. 555 of the Fletcher Manufacturing Company, Second and Canal Streets, Dayton, Ohio, is a 60-page publication devoted to electrical construction supplies, including wire holders, automatic suspension pulleys, sleet-proof pulleys, windlasses, mast arms, iron pins and brackets.

THE INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY, manufacturers of Habirshaw wires and cables, 13-15 Cortlandt St., New York City, Mr. J. B. Olson, sales manager, has just issued a very dainty and pretty line of blotters, of the Indian Maiden and Floral type, each bearing the monthly calendar. Like the wires and cables they are good to have around the place.

COLUMBIA UNIVERSITY, N. Y.—The 1906 catalogue of Columbia University shows the total number of officers of administration and instruction to be 571, and the total number of resident students 4,755, as against 4,833 last year. These figures do not include the extension students, of whom there are nearly one thousand.

SHEET-METAL ROOFING.—In a well-prepared publication having the title "Roofing Rules," the Merchant & Evans Company, Philadelphia, Pa., presents in a plain and simple form the various points about metals in building construction. In addition to describing the various materials used for roofing, and the method of manufacturing them, numerous instructions are given for constructing a metal roof.

INTERIOR ILLUMINATION.—The General Electric Company, Schenectady, N. Y., has issued as bulletin No. 4,431, a well-illustrated article discussing illuminating engineering as applied to interior lighting, which serves to show the desirable features of the concentric diffuser and the light balancing selective diffuser ceiling. These improvements used with arc lamps make the illumination obtained ideal for interiors.

THE PIRELLI FACTORY.—The journal *L'Automobile* of Milan, Italy, contains an illustrated description of the Pirelli factory in that city, devoted to the production of insulated wires and cables, as well as automobile tires and rubber goods of all kinds. The establishment is one of the largest of the kind in Italy and in all Europe. Dr. Alberto Pirelli, of the firm, is well known and a frequent visitor on this side of the Atlantic.

INCANDESCENT LAMPS.—Publication S. M. 4002 of the Sawyer-Man Electric Company, New York, is an attractively illustrated catalogue dealing with incandescent electric lamps for all kinds of service. In the standard lamps the filament is anchored to the mount so that when necessary the lamp may be burned in any position without excessive drooping. Lamps of this design are made in sizes from 2 to 50 candle-power, and for from 6 to 130 volts. Each lamp which is intended for from 190 to 250 volts has a double-coil filament, doubly anchored to the mount. Lamps of from 45 to 60 volts have short, thick filaments which do not require supports. For lighting a limited area at a minimum cost for power, a filament consuming 35 watts is given a double-coil form and placed in a door-knob shaped bulb, which is silvered in such a manner as to reflect all the light directly downwards giving 28 candle-power over an area 8 feet in diameter. It will be noted that in effect the consumption corresponds to 1.25 watts per candle. This lamp is exceedingly economical and satisfactory for places where all the light is required directly at the work. The use of frosted lamps is recommended, particularly in connection with handsome electroliers, side brackets, ceiling fixtures and for general illumination, from the fact that it results in more evenly diffused and more pleasant light. The light emitted from the incandescent filament in any direction is in proportion to the surface of the filament exposed in that direction, and for the small surface of the filament it is intense. By frosting the lamp the whole surface of the bulb becomes the radiating surface, without appreciably decreasing the total volume of light emitted from the filament, and the light is rendered softer and more agreeable.

HIGH-SPEED LATHES.—A well-executed publication, designated as Catalogue No. 59, devoted to high-speed lathes, has just been received from the Tangye Tool & Electric Company, Limited, Birmingham, England. These lathes have been designed expressly for use with high-speed steel tools. In order to overcome the troubles encountered in high-speed operation, each lathe is equipped with a single-pulley headstock. This headstock has no cone pulley, but is provided with a single pulley carried on a side shaft, and the changes in speed can be quickly made. This construction removes the pull of the driving belt from the spindle to a separate shaft running in long gun-metal bearings with oil-ring lubricators which will work for long periods without attention. The catalogue contains numerous illustrations of special, high speed and electrically-driven machine tools.

STORAGE BATTERY FOR REGULATION.—Bulletin No. 6 of the Gould Standard Battery Company, 1 West 34th St., New York, gives a complete description of the battery installation of the Edison Electric Illuminating Company, of Topeka, Kan., as an example of the most recent storage battery practice. This installation consists of 280 elements, each having a capacity of 640 amperes for one hour, and a booster set which controls the operation of the battery so that the generator load does not vary, even under extreme conditions, more than 2.5 per cent from any mean value for which the booster may be adjusted. The battery serves to equalize the loads arising from a 600-volt railway and motor system, a three-wire, 125-volt lighting system, and a 2,300-volt single-phase system supplying power to lamps in the outlying districts. Several charts, which are reproduced, show that the plant is at all times operating under economical conditions and rendering satisfactory service.

INDUSTRIAL RAILWAYS.—Catalogue No. 0511 of the C. W. Hunt Company, West New Brighton, Staten Island, N. Y., is a neatly illustrated 64-page publication dealing with the "industrial" railway, which is built with a 21.5-in. gauge for use in manufacturing establishments. Every part is especially designed with the idea that a railway for this purpose is as much a "machine" as a "lathe," a "steam hammer," or a "loom," and requires the same care in design, and the same quality of machine work. The track is made up with steel cross ties securely riveted to the rails, and, with the switches, curves, crossings, and turn tables, is ready to lay when received from the manufacturers. The cars have running gears so arranged that they pass around a curve of 12-ft. radius as easily as a wagon turns a corner.

News of the Trade.

THE ROBINS CONVEYING BELT CO. has recently opened an office in the Frick Building, Pittsburg, Pa. Mr. G. R. Delamater, its resident engineer, is prepared to receive inquiries from the vicinity of Pittsburg relating to conveying and hoisting machinery.

THE ABNER DOBLE COMPANY, of San Francisco, announce that it has opened a branch in Los Angeles at 447 Pacific Electric Building. The company's business in the water wheel and machinery line had increased to such an extent that it became necessary to have better representation in the Southwest. The new branch will have for its field Southern California, Arizona and New Mexico and parts of Nevada and Mexico. Mr. L. Cummins will have charge of the office.

S. F. ALDEN & CO.—On December 1, S. F. Alden & Co., Rialto Building, San Francisco, Cal., celebrated the second anniversary of their organization. The company's business for the year increased threefold as compared with the year preceding, which was a very successful one. The largest single order secured was in the gas department, the contract calling for one gas holder of 1,000,000 cu. ft. In the railway department numerous sales were made, included among which were orders for the equipping of several electric railways with the protected rail bond made by the Mayer & Englund Co., of Philadelphia, Pa. In the electric light department the largest single order secured was for cedar poles, requiring four complete train loads to fill. This was the largest single order for long cedar poles for shipment by rail ever placed on the Pacific Coast.

COMMON BATTERY TELEPHONY.—We are advised by the Sterling Electric Company, of Lafayette, Ind., as follows, as to an important recent decision: "The United States Circuit Court of Appeals has handed down the decision in the suit of the Western Electric Company vs. The Galesburg Union Telephone Company, which suit involves the common battery multiple circuits known as the Fowler system, which is manufactured by the Sterling Electric Company, of Lafayette, Indiana; the Sterling Electric Company having defended these suits. The case has been fought very bitterly for the past three years, the first hearing being before Judge Siemans, of Milwaukee, in the United States Circuit Court, at Chicago, his decision being in favor of the Galesburg Union Telephone Company, or the Sterling Electric Company. The case was appealed to the United States Circuit Court of Appeals, where it was again bitterly fought, the Court handing down the decision January 10th, affirming Judge Sieman's opinion." The Sterling Company considers that this decision by a court of last resort places it in a unique position as to common battery multiple systems in the "Independent" field.

THE EAGLE ELECTRIC WORKS, Peoria, Ill., has increased its capital stock from $15,000 to $25,000.

THE PARKER BOILER COMPANY, of Philadelphia, Pa., has developed a new type of double-end steam boiler that promises to meet with favor for electric railway and lighting plants, several stations of the Philadelphia Rapid Transit Company having used this type for some time with excellent results.

SCHUSTER & RICHARDSON, electrical contractors of Freeport, Ill., have sold their business and transferred all contracts, tools, fixtures, etc., to the Ridgway Electric Company, which will finish up all uncompleted work contracted for by the former company. The Ridgway Electric Company began business two years ago. It recently moved into new quarters on Van Buren Street.

THE NATIONAL ENGINEERING CO., successor of McGrew & Bruning, consulting and construction engineers, Brunson Building, Columbus, O., has organized with a number of departments. Mr. F. C. Caldwell is the chief engineer of the electrical department, and Mr. E. A. Hitchcock of the mechanical.

BUFFALO TESTING LABORATORY.—The Buffalo Testing Laboratory has been incorporated at Buffalo, N. Y., for the purpose of furnishing expert engineering and chemical services to large industries, with offices at 702 Ellicott Square and a laboratory for physical, chemical and electrical work on East Ferry St. The president of the company is Mr. George A. Ricker, C. E., formerly representing the Pittsburg Testing Laboratory in Buffalo; Vice-President Prof. Nathaniel W. Shed, chemist and metallurgist of the Buffalo Foundry Company.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York.

Association of Edison Illuminating Companies. Secretary, W. S. Barstow, 56 Pine St., New York City, and Portland, Ore.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electrical Contractors' Association of New York State. Secretary, F. Fish, Rochester, N. Y. Next meeting, Buffalo, Jan. 16, 1906.

Electric Salesmen's Association. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago.

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago.

Electrical Trades Association of Philadelphia. Secretafy, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa.

Electrical Trades Association of Canada. Secretary, J. A. Mann, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electric Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Ottawa, Ill.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia. Next meeting, Des Moines.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, second Thursday in March, 1906.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich.

Missouri Independent Telephone Association. Secretary, Frank S. Leach, Sedalia, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Net meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

New York State Independent Telephone Association. Secretary, T. S. Lane, 536 Ellicott Square, N. Y. Next meeting, Elmira, N. Y., June, 1906.

Northwestern Electrical Association. Secretary, T. R. Mercein, 1142 Wells Building, Milwaukee, Wis. Next meeting, Milwaukee, Wis., third Wednesday in January, 1906.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, O.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, F. W. Bullard, Cleveland, O.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, O.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D. Next annual convention, Sioux Falls, S. D., second Wednesday in January, 1906.

Southwestern Electrical and Gas Association. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, second Tuesday in May, 1906.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electrical Light Company, Middlebury, Vt.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

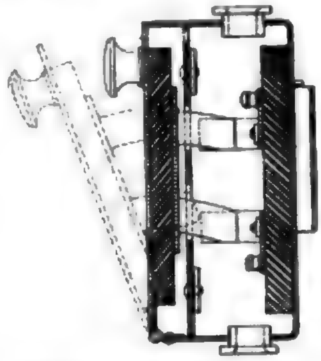
Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JAN. 23, 1906.

[Conducted by Rosebaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

810,384. ELECTRIC LAMP LIGHTER; Peter W. Arduino and Amedeo A. Arduino, Stamford, Conn. App. filed Apr. 22, 1904. A fine platinum wire is stretched across the surface of the wick and in circuit with a bi-chromate plunge battery, the zinc element of which can be depressed into the electrolyte by a plunger. The bi-chromate cell forms a part of the lamp base.

810,389. END CELL SWITCH; Joseph Bijur, New York, N. Y. App. filed Oct. 14, 1904. The contact arm is moved by a lead screw which has a planetary or differential gear connection with a continuously rotating motor. A magnet operated brake is operable to engage the differential gear when desired and reverse the rotation of the lead screw.



810,527.—Electrical Switch.

810,444. ELECTRIC DRILL; Charles W. Theil, Milwaukee, Wis. App. filed June 1, 1903. The motor armature is co-axial with the drill casing and has an arm with a loose planetary gear thereon. This planetary meshes with a fixed internal gear and a corresponding differential gear fixed to the drill chuck.

810,473. ADAPTER FOR INCANDESCENT-LAMP SOCKETS; Samuel E. Doane, Cleveland, O. App. filed Mar. 27, 1905. An adapter for incandescent lamps comprising sleeves formed to receive the lamp base and having contact members to engage the contacts of the socket, one of said members being rotatable independently of the other.

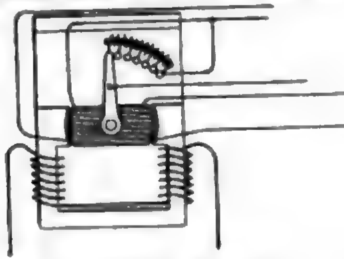
810,501. ELECTRIC FIRE ALARM AND THERMO INDICATOR; Alfred H. McNeil, Clapton, London, England. App. filed May 1, 1905. A slightly bent thermal strip has its end rigidly secured to a supporting block which carries a contact opposite the center of the thermal strip. This contact has a micrometer adjustment so as to vary the temperature for which the indicator operates.

810,536. TURNING SWITCH WITH LIGHTED HANDLE FOR ELECTRIC LINES; Hans Holzer, Frankfort-on-the-Main, Germany. App. filed Apr. 10, 1905. A pivotally mounted switch member for closing the circuit through the line contacts, said member having relatively long and short contact arms. Has a lamp in the switch hanndle connected with the line, and with an auxillary contact in the path of the long arm of said switch member.

810,522. VOLTMETER SWITCH; George N. Eastman, Chicago, Ill. App. filed Apr. 26, 1905. The switch arms are geared to the operating handle by reduction gearing so that a slight movement of the handle causes a considerable movement of the switch arms. The purpose is to enable the readings of the different circuits to be made on the volt meter expeditiously, the rapid movement enabling a change of circuits before the volt-meter pointer has time to swing appreciably toward the zero reading.

810,527. ELECTRICAL SWITCH; Joseph F. George, New York, N. Y. App. filed Oct. 7, 1904. A protected switch particularly designed for theatres, etc., in which the usual knife blade arm has an insulating plate which forms the cover of a box surrounding the switch contacts.

810,560. ELECTRIC RAILWAY SIGNAL; Helen W. Parkes and Stella L. Vincent, Cleveland, O. App. filed Oct. 17, 1904. A pair of special trolley rails are laid along the track and contact with wheels or brushes depending from the train. When two trains are upon the same block section alarm circuits are closed through the special trolleys to signals within the respective engine cabs.



810,687.—System of Automatic Signalling for Electric Railways.

810,596. SPRING-JACK WEDGE; Gustave A. Zundel, New York, N. Y. App. filed Nov. 17, 1904. Comprises metallic strips separated by an insulating body conducting wires being electrically connected with said strips and sewed to the body.

810,609. ELECTROFLUID PRESSURE MECHANISM FOR OPERATING RAILROAD APPLIANCES; Walter J. Bell, Los Angeles, Cal. App. filed Dec. 1, 1903. A fluid pump is located at the various switches and serves to continuously maintain pressure in a fluid reservoir. A pair of solenoids have poppet valve connections for opening and closing the pipes from said reservoir to the cylinder which operates the switch point, and the additional cylinder for the semaphore arm.

810,618. INSULATOR-CLAMP; Walter G. Clark, Seattle, Wash. App. filed Apr. 13, 1904. A wire strap has semi-circular portions adapted to embrace the usual groove of the insulator, and U-shaped uprights to engage the usual conductor and hold it in the insulator saddle. The device is drawn into clamping relation by a pair of split clamp nuts.

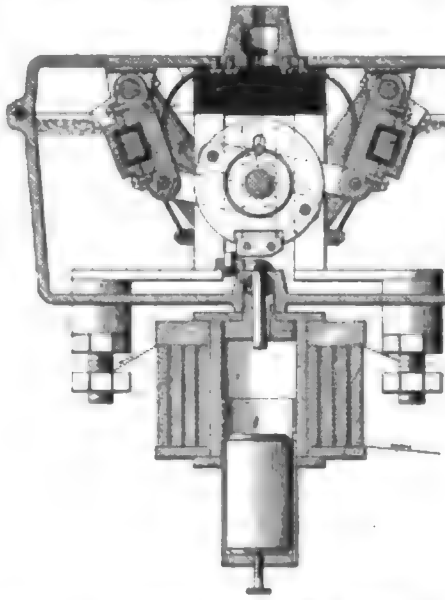
810,651. ELECTRIC GENERATOR FOR BICYCLES; Frank X. Hofbauer, West Orange, N. J. App. filed June 14, 1902. A small generator is pivoted to the frame of the bicycle and is normally held out of contact with the rear wheel by a detent. When the detent is released the generator falls by gravity so that its pulley contacts with the rear tire and is driven threby.

816,664. ATTACHMENT FOR ELECTRIC CONDUCTORS; David B. Mills, East Orange, N. J. App. filed Apr. 13, 1905. The extremity of the conductor from which the insulation has been removed is inserted through a hollow rivet in the bottom of a cap or ferrule, which rivet also serves to secure the usual terminal washer to the cap or ferrule.

810,687. SYSTEM OF AUTOMATIC SIGNALING FOR ELECTRIC RAILWAYS; Fitzhugh Townsend, New York, N. Y. App. filed Nov. 10, 1905. An inductive bond system in which the bonds for the separate rails have means for compensating for the effect of different currents therein by means of automatically varying the resistance of said bond in inverse proportion to the power current in the rails.

810,705. BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; Abram L. Bower, Boyertown, Pa. App. filed Jan. 10, 1903. Details of a turn-out system having insulated track sections at the turn-outs which make circuits to set the signals alternately by means of a ratchet wheel which is intimately stepped around by an electro-magnet.

810,751. ELECTRIC CIRCUIT BREAKER; Frank O. Hartman, Mansfield, O. App. filed Apr. 6, 1903. The switch arms are brought together in an oil bath and are impelled apart by a powerful spring. A hammer operated detent serves to hold the switch arms together by a toggle jointed arrangement which gives a multiply effect so that a light blow of the solenoid core on the detent is effective to release the spring and separate the arms.



810,751.—Electric Circuit Breaker.

810,836. ELECTRIC-LIGHT FIXTURE; John F. Barrett and Nat C. Collins, Chicago, Ill. App. filed June 3, 1905. The lamp is supported by a flexible cord which depends from a spring drum within a casing. The drum has a pair of contact rings thereon through which the electric circuit is completed to the lamps.

810,841. MAGNETIC SEPARATOR; Henry F. Campbell, Melrose, Mass. App. filed July 29, 1902. The chute or tray has a flexible cover sheet extending over its surface through which the magnetic poles project. The purpose is to prevent the particles from attaching themselves to the sides of the pole pieces, and further to insure the distribution of the ore in a uniform thin layer on the tray.

810,855. MANHOLE FOR CONDUITS AND THE LIKE; Winfield A. Haller, New Orleans, La., and James W. Billingsley, Tivoli, N. Y. App. filed Feb. 21, 1905. The walls of the manhole have shelves with annular grooves on their surfaces. The shelves are located in a position to support the conductors or cables at their point of entrance through the walls, and serve to protect other cables in case of a burn-out of those above.

810,878. SELECTIVE CALL FOR TELEPHONES AND TELEGRAPHS; William Palmer, Jr., Rincon, N. Mex. App. filed July 18, 1902. Details of a magnet operated selective telephone arrangement having a ratchet wheel with a deep notch which varies in different instruments, and pallets for stepping around said ratchet wheel.

810,880. PROCESS OF ELECTROLYTICALLY PREPARING METALS OR ALLOYS FOR LITHOGRAPHIC PURPOSES; Otto C. Strecker, Darmstadt, Germany. App. filed May 12, 1902. A method of preparing lithographic surfaces which consists in painting the lithographic design on to the usual prepared zinc surface and then depositing a layer of metal on to the parts of the zinc not coated by the design so as to produce a water attracting, grease-repelling surface at such parts.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office one week in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the ELECTRICAL WORLD 16,500 *copies are printed. The total circulation of the* ELECTRICAL WORLD AND ENGINEER *for the year* 1905 *was* 712,500 *copies, an average of* 13,702 *copies per issue.*

NEW YORK, SATURDAY, FEBRUARY 10, 1906.

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A YEAR'S EXPORT TRADE.

A month ago we stated in this column that judging from appearances, the electrical export trade of the country would reach over $12,000,000. The figures are now available for the whole of 1905, and we are glad to note that they substantiate the prophecy. The exports of electrical appliances, including telgraph and telephone instruments, reached a total of $5,648,435; and the exports of electrical machinery amounted to not less than $7,409,242. The aggregate is $13,057,677. This compares with a grand total in 1904 of $11,039,758, or a gain of $2,017,919, or about 20 per cent. Such a condition of affairs is healthy and encouraging, and shows that the export of electrical goods from America can be made successful if steadily and intelligently pushed. Part of the increase may be due to the higher cost of material, such as copper, but the figures as a whole reflect genuine gains. This is the more notable because so many American electrical manufacturers have factories or arrangements for the production of their apparatus abroad. An analysis of the returns shows that England and her colonies colonies remain our good friends. Of electrical machinery British North America took $2,023,914; the United Kingdom, $885,095; British Australasia, $252,028; British Africa, $161,449; British East Indies, $109,944. Wherever the English flag flies a similar welcome awaits our goods. We also have generous patrons in Japan to the tune of $1,239,878, and excellent customers in Mexico to the extent of not less than $1,057,023. South America generally was good for about $500,000. The figures of electrical instruments are not subdivided geographically in the returns, but they follow broadly the same lines of distribution, and show a very universal widespread appreciation of American electrical products.

RAIN OR SNOW VELOCITY A POSSIBLE LIMITING FACTOR IN WIRELESS TELEGRAPHY RANGE OF TRANSMISSION.

The article by Capt. Wildman, on page 320 of this issue, suggests very pertinently that the weather at a sending station may have a distinct influence upon the strength of the signals at the receiving station. He bases this suggestion upon a record which shows both the wind velocity by anemometer and the relative weakness of received signals at the same receiving station in Alaska. It is to be supposed that the wind at the distant sending station matched that recorded at the receiving station. There seems to be a general agreement in the record between the two curves, going to show that when the wind velocity was marked the weakness of the signals was also marked. Nevertheless, this does not seem to have been always the case, if we may judge by the deviation between the curves under the date of November 3. It is quite conceivable, however, that when snowflakes or raindrops are being driven in large numbers across the sending mast wires by a high wind, that the potential of the waves thrown up the wires would be reduced. The effect would probably be greater for snow than for rain, because rain having a much lesser surface per unit mass than snow, is apt to have a more nearly vertical trajectory, and so a rain stream would not be intersected by the wires so much as a snow stream, in a given horizontal wind velocity. If this reasoning is sound, the weather conditions in Alaska are more likely to be unfavorable to the sending station than they are in more genial and more customary latitudes. In any case it would only mean that more power would have to be employed in the sending aerial during a snowstorm than under clear skies.

POWER PLANT ECONOMICS.

We have been much interested in the consideration of Mr. Stott's Institute paper upon this fruitful theme, an abstract of which appeared last week. That the economics of power plants can be very greatly improved is a point beyond argument—the mere analysis of the losses makes the present situation clear. But in what direction one should work for improvement is not so fully evident, and we must admit that Mr. Stott's discussion of the matter does not, through any practical suggestions, give us much light on the subject. Certain facts stand out very prominently, as they have for a long time past, but the improvements suggested do not carry the weight that comes from well defined experimental data. To begin at the beginning, there is considerable room for gain in the matter of boilers and furnaces. The ultimate test of operative economy is the coal required per kilowatt-hour at the switchboard, and the first thing in a programme of reform is to see that the coal is forced to make steam efficiently. As Mr. Stott very truly remarks, the difference in ultimate efficiency between well designed boilers of various types is not great. The criticism, however, can be offered upon all the types in common use, that the units are inconveniently small. In these days of large plants, we find in the generator room direct-coupled units of so great individual output that there is very little needless reduplication. Step, however, into the boiler room and you find "batteries" of small boiler units, with correspondingly small furnaces, taking up a large amount of space, requiring a complicated system of piping and causing large additional expense which reacts seriously upon the fixed charges and maintenance.

When one is using 5,000-kw generating units, it would certainly appear to be good policy to use much larger boiler units than ordinary, with furnaces and mechanical stokers to match. The result of such increase should be the minimizing of incidental losses, a material increase in boiler efficiency, and a very considerable reduction in operating and fixed charges. When it comes to a consideration of prime movers, the situation just at present is chaotic. We agree with Mr. Stott that the coming of the steam turbine has been a good thing. Whatever its final place in the art may be, it has made no inconsiderable place for itself already and is serving as a valuable stimulant to prime-mover design in general. It came at a time when engine-building had sunk into a complacent period of standardization, and it has not even yet shocked the engine builder into full activity, at least in this country. We think that Mr. Stott errs in ascribing the efficiency which he does to steam turbines as they now are. The figures he quotes are not to our knowledge justified by any tests made *in situ* after, let us say, a year of commercial operation, and in fact they are not within a good many per cent of any such tests. Very few commercial turbine tests would show better than 20 lbs. of steam per kw-hour including all the auxiliaries. No turbine tests of any kind, even when made *ex parte* in the shops, have shown the thermal efficiency reached not infrequently in the tests of some reciprocating engines using superheated steam. On the superheat in commercial use abroad and with proper condensation, it is feasible to deliver the kw-hour at the switchboard on the consumption of less than 15 lbs. of steam used in reciprocating engines. Until the turbine is prepared to meet some such figure commercially, it must depend for its popularity on virtues other than extreme economy. As to the advantage claimed for the turbine with respect to high superheat, it should not be lost sight of that the multiple-expansion reciprocating engine can in its several stages utilize a high aggregate charge; and as to high vacuum, it is yet to be demonstrated whether there is any final commercial economy in the extra inch or thereabouts that may be utilized with the turbine.

That the steam turbine has virtues is undeniable, but Mr. Stott's table—based on assumed turbine efficiency not confirmed in practice, as compared with a very modest reciprocating engine efficiency which has been repeatedly surpassed—is for these reasons a most fallacious guide. If he had taken his turbine consumption at 20 lbs. per kw-hour and his engine at 15 lbs. per kw-hour, an hypothesis certainly as well justified as the one he actually used, the final summation would have taken on a very different appearance; and if he had had actual experiments with his proposed low-pressure turbine, we are inclined to think that his proposed economy would never have been suggested. And it should be noted, in addition, that the familiar assumption of bad engine efficiency at partial loads is not borne out by the facts when the engine is probably designed for high pressure and superheat. A reciprocating engine undeniably has higher friction than a turbine, but even so, as in the famous engine tests in England last year, it may easily have at partial loads an efficiency far below anything ever recorded for a turbine. When Mr. Stott can find a turbine for low pressure, or any pressure for that matter, capable of giving the brake hp-hour at half load on less than 10 lbs. of steam, he may consider himself lucky. On any present showing we cannot take his exhaust turbine plan very seriously. Nevertheless, the steam turbine has enough efficiency taken in conjunction with its great compactness, freedom from vibration, ease of operation, and general convenience, to justify extensive use, especially since direct-current turbo-generators are now available; and if our American engine builders do not busy themselves with improvements they will find cause for repentance, and that at no late day.

The gas engine situation is somewhat of a different matter. The engine itself is undeniably far more efficient than any form of steam motor has any reasonable chance of being, and the question of its general utility in power plants turns on entirely different causes. As Mr. Stott admits, the earlier difficulties of bad regulation, uncertainty of action and large maintenance have in great measure been overcome, leaving as the principal objection the inability to carry overloads. There is, however, a relation between what one is pleased to call full load and the rating of the engine. With a given gas engine there is a certain point of output that cannot be exceeded, just as there is in a steam engine with a fixed maximum cut-off, as in many Corliss engines. The "overload" capacity of the engine depends on how near to this maximum one cares, in view of working economy, to rate the machine. The 400-hp gas engine of Mr. Stott's paper has substantially the same thermal efficiency on the basis of brake horse-power at 300 as at 400 hp. On the latter rating, it has practically no overload capacity but excellent efficiency between half load and full load. At a 300-hp rating it would be said to have a good overload capacity with remarkable efficiency, but considerable losses when worked below three-quarters overload. Anything that helps the low load efficiency of the internal combustion engine practically helps its overload capacity, as in the case of other prime movers; and when large gas engines are turned out in a quantity, the cost per rated horsepower will still be reasonable at a conservative rating. We had hoped ere this that the first of the great gas engine units of the California Gas Electric Co. would have been put into operation, but the event has been delayed, so that it may be several months before results from this notable plant are available. Until such large work has been done, the issue as regards internal combustion engines will remain somewhat obscured. As to the other rivals, the turbine contingent seems for the moment at least to have the engine men somewhat on the defensive, to put it mildly. American engine builders have been very slow to take advantage of high superheat and great expansion, and even in the face of turbine competition, a request for engines built up to advanced foreign practice in these particulars usually meets a very cool reception. The frequent loss of large contracts ought to spur them into a course of active improvement; if not, let their sorrows be upon their own heads—the makers of turbines will not weep for them, and builders of power stations will extend them meagre sympathy.

A STANDARD KILOWATT FOR METER TESTS.

There is a well-known difficulty in determining the constant of a watt-hour meter connected with a variable line pressure. If the voltage between the mains is so nearly steady that it can be regarded as constant, the testing of a registering watt-hour meter on customer's premises is not a difficult operation. The usual plan, in this country, is for the tester to carry about with him a portable form of rheostat load, and either a standard wattmeter or a voltmeter and an ammeter. The time occupied in making a definite number of revolutions is carefully noted for the meter under test, when the known portable load is applied. A table then shows whether the meter is fast or slow. If, however, the voltage across the mains is very variable, and the range of variation is, say, from 5 per cent above normal to 5 per cent below, then the load on the meter with a constant rheostat in circuit will vary from about 10 per cent above normal to 10 per cent below, and it is difficult to assign the quantity of energy which has passed through the meter, within several per cent.

Dr. Martin Kallmann has recently published an article upon this difficulty in the *Elektrotechnische Zeitschrift*, an abstract of which appears in the Digest. He describes a form of portable rheostat which automatically maintains a nearly constant load on the meter tested, despite 5 per cent pressure variations in the mains above or below the normal. The gist of the contrivance is in the employment of ballast wire, of the same character as is used in a Nernst lamp. As is well known, the glower of a Nernst lamp is electrically unstable on constant-potential circuits, and the expedient is adopted of inserting in the glower circuit a glass-enclosed resistance of iron wire, in nitrogen or other inert gas. The iron wire is worked at a current density sufficient to raise it to a dull-red temperature. At this temperature the variation of the resistivity of iron is very rapid, so that a 1 per cent increase in current strength may increase the resistance of the glowing iron wire by 15 per cent. A suitable amount of this sensitive ballast resistance, in circuit with the glower, renders the combination electrically stable, at the expense of a slight drop in pressure at glower terminals. In a similar manner Dr. Kallmann employs a number of these ballast glow-tubes in parallel with each other, a suitable group of such tubes being connected in series with the resistance of manganin, or other constant-resistivity alloy. The ballast glow-tubes then serve to absorb nearly all of the variations of pressure in the mains, provided that the latter do not exceed, say, 5 per cent of the normal. This leaves both the current and the drop in the alloy resistance very nearly constant. The meter to be tested is loaded by being connected in series with the alloy resistance, and in parallel with the drop of pressure across the same.

If, for example, the mains had a normal pressure of 220 volts, the coil and ballast would be so proportioned as to take 5 amperes, or 1,100 watts, from the main at this pressure. There would be, say, 10 ballast tubes in parallel, all working at dull-red heat. The drop in the ballast would be 20 volts, leaving 200 on the coil with 5 amperes and 1 kilowatt developed therein. If now the main voltage should rise to 230, it is reported that the ballast would drop about 28.5, leaving 201.5 volts on the coil, with 5.038 amperes and 1,015 watts developed in it. That is to say, the power liberated as heat in the coil would increase only 1.5 per cent, when the main pressure increased 5 per cent; whereas, without the ballast compensation, the power in the load would have increased 10 per cent. This increased steadiness of load is obtained at the sacrifice of 9 per cent in voltage, the meter tested being worked at 200 volts drop on the coil, instead of 220 volts, the normal line voltage. According to the results reported, the automatic compensation in load afforded by the ballast is much closer if the voltage variation is of lower range. Thus, for a change from 220 to 226.6 or to 213.4, i. e., 3 per cent above or below, the variation in the coil power will be kept to about ½ per cent above or below.

It is open to discussion whether a compensated load is desirable, or whether the convenience secured in testing meters by employing a compensated load is sufficient to call for the use of ballast glow-tubes. In most cases the variations of pressure occurring on the mains are not sufficiently rapid or great to introduce much difficulty in determining the mean pressure of supply during a test. Again, the ballast glow-tubes must be more sensitive to overload than the ordinary uncompensated alloy load coil, or rheostat. If not safeguarded, they are liable to be melted, since they run red-hot at working current strengths. The only conditions that ordinarily give rise to serious fluctuation of main pressures are where a long main runs radially out from the district supplied by the central station, and is only fed at one end, while electric elevators are connected to it, thus rapidly throwing heavy loads on and off. Whatever opinion may be entertained concerning the practical need for a compensated kilowatt, there can be no doubt that occasions must occur in which such compensated loads are both useful and convenient. The apparatus provides in a certain sense a new standard for the convenience of the electrical engineer, namely, a standard kilowatt with automatic compensation. A standard cell provides a portable volt, a standard wire provides a portable ohm, and the ballast-compensated wire provides a portable kilowatt, when connected to mains of normal assigned voltage, undergoing the ordinary range of variation. As to the construction of the apparatus, all that is needed is a sufficient number of ballast glow-tubes, such as are used in Nernst lamps, freely supported in such a manner as to dissipate their heat readily, and also so as to withstand shipment without danger of being fractured. These are simply connected to and with the ordinary tester's load coil.

The Institute Election.

The nomination blanks for the presidency of the American Institute of Electrical Engineers, for 1906-7, and for other offices, have just been sent out to the members of the Institute. The constituency appealed to has a voting strength of over 3,100. Several candidates are suggested or are already in the field. They include Dr. S. Sheldon, the efficient chairman of the committee on papers; E. W. Rice, Jr., third vice-president of the General Electric Company, an engineer and an inventor of distinction; Mr. John J. Carty, chief engineer of the New York Telephone Company, who has served the Institute with signal loyalty and success in various capacities; Dr. F. A. C. Perrine, long actively connected with Institute affairs, and well known as a consulting engineer; and Mr. Ralph Mershon, former chairman of the Institute Transmission Committee. This affords an excellent range of choice, and may result in a considerable splitting of the vote. Indeed, it is understood that some attempts have been made, but fruitlessly, to concentrate on some of these candidates and their supporters, or to substitute a candidate upon whom all could unite.

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Underwriters' National Electric Association.

The first conference meeting of the Underwriters' National Electric Association will be held in March, 1907. Heretofore the meetings have been held in December, but at the request of Central Station men, who represented that it was very inconvenient for them to attend the meetings during the busy holiday season, the change to the month of March was decided upon. Following is the list of committees of the association appointed at the meeting in December:

Specifications for Electric Cranes.—A. L. Jacobs, chairman, 31 Milk Street, Boston, Mass.; J. G. Emery, Jr., Shaw Electric Crane Company, Muskegon, Mich.; A. G. Wilbor, 95 Pearl Street, Hartford, Conn.

Outlet Boxes.—E. N. Davis, chairman, Brookline, Mass.; E. McCleary, 213 Jefferson Avenue, Detroit, Mich.; Alfred Stone, 49 Westminster Street, Providence, R. I.; E. A. Fitzgerald, Syracuse, N. Y.; W. S. Boyd, 382 Ohio Street, Chicago, Ill.

Specifications for Metal Mouldings.—A. M. Paddon, chairman, 382 Ohio Street, Chicago, Ill.; J. E. Cole, 11 Wareham Street, Boston, Mass.; Wm. McDevitt, 151 South Fourth Street, Philadelphia, Pa.

Rheostat Rules and Specifications.—Geo. E. Bruen, chairman, 32 Nassau Street, New York City; J. C. Forsyth, 32 Nassau Street, New York City; George E. Fisher, 55 Kilby Street, Boston, Mass.

Wiring and Construction of Fan Motors.—George E. Bruen, chairman, 32 Nassau Street, New York City; J. C. Forsyth, 32 Nassau Street, New York City; W. H. Merrill, Jr., 382 Ohio Street, Chicago, Ill.

High-Tension Motors.—A. M. Schoen, chairman, 339 Equitable Building, Atlanta, Ga.; H. O. Lacount, 31 Milk Street, Boston, Mass.; Ralph Sweetland, 55 Kilby Street, Boston, Mass.

Electric Railway Wiring and Equipment.—Ralph Sweetland, chairman, 55 Kilby Street, Boston, Mass.; Wm. McDevitt, 131 South Fourth Street, Philadelphia, Pa.; B. E. Loomis, 19 Liberty Street, New York City; Frank T. Sloane, 85 Clinton Street, Brooklyn, N. Y.; O. B. Johnston, 55 Kilby Street, Boston, Mass.

Double and Single-Pole Switches.—Ralph Sweetland, chairman, 55 Kilby Street, Boston, Mass.; A. L. Jacobs, 35 Milk Street, Boston, Mass.; R. J. Daly, 245 Fourth Avenue, Pittsburg, Pa.

Construction and Wiring of Electric Signs.—W. H. Merrill, Jr., chairman, 382 Ohio Street, Chicago, Ill.; J. R. Strong, 35 South William Street, New York City; H. S. Wynkoop, room 33A, Municipal Building, Brooklyn, N. Y.

Series Lamps.—W. H. Merrill, Jr., 382 Ohio Street, Chicago, Ill.; F. W. Wilcox, manager, General Electric Company, Harrison, N. J.; A. M. Schoen, 330 Equitable Building, Atlanta, Ga.

Ground Connections.—C. M. Goddard, chairman, 55 Kilby Street, Boston, Mass.; F. E. Cabot, 55 Kilby Street, Boston, Mass.; E. V. French, 31 Milk Street, Boston, Mass.

Committee on Switches and Cut-outs.—H. O. Lacount, chairman, 31 Milk Street, Boston, Mass.; W. H. Merrill, Jr., 382 Ohio Street, Chicago, Ill.; J. E. Cole, 11 Wareham Street, Boston, Mass.; E. V. French, 31 Milk Street, Boston, Mass.; Ralph Sweetland, 55 Kilby Street, Boston, Mass.

Variable-Speed Motors.—H. O. Lacount, chairman, 31 Milk Street, Boston, Mass.; C. E. Skinner, Westinghouse Electric & Manufacturing Company; H. C. Wirt, General Electric Company.

Signaling Systems (Rule 64).—F. E. Cabot, chairman, 55 Kilby Street, Boston, Mass.; Ralph Sweetland, 55 Kilby Street, Boston, Mass.; E. A. Fitzgerald, Syracuse, N. Y.; C. H. Hill, 316 Walnut Street, Philadelphia, Pa.; C. J. H. Woodbury, 125 Milk Street, Boston, Mass.; F. W. Jones, 253 Broadway, New York City; C. C. Johnson, 44 East Twenty-third Street, New York City.

Theatre Wiring.—J. E. Cole, chairman, 11 Wareham Street, Boston, Mass.; H. C. Harris, Ohio Inspection Bureau, Columbus, Ohio; W. D. Carroll, city electrician, Chicago, Ill.

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The Great International Power at Niagara.

From time to time note has been made in these pages of the attempts to regulate and restrict the electrical development on both sides of the Niagara Falls. Several measures are now pending in Canada, at Albany and in Washington, and the New York *Times* summarizes the situation in the admirable review quoted below: "It is not likely that the State of New York will adopt the recommendation of President Roosevelt to confer upon the United States the ownership of its park reservation at Niagara. This would, of course, simplify the problem of effective joint action with the Canadian Government toward preserving Niagara Falls from the spoilers planted on both sides of the river. Nor, we may safely say, will the present Legislature view with favor Gov. Higgins's suggestion further to limit the amount of water to be taken from the American side, and to repeal all dormant charters from the statute books, although the Governor may certainly be counted on to veto any bill that may be jammed through granting the electric companies more power. Meanwhile the Merchants' Association of New York, in conjunction with the American Civic Association, has been agitating the question of Federal protection of Niagara Falls by a treaty stipulation with Canada.

"Concurring opinions have been obtained by the Merchants' Association from former Attorney-Generals Griggs and Knox and from Attorney-General Moody, which leave no doubt that under our present Federal boundary law, action to preserve the Falls may very properly originate with the President. Gov. Griggs points out that the jurisdiction of the State is subordinate to the power of the National Government in two respects: 1. With respect to navigation, as to which the laws of Congress are supreme. 2. As to the subject of boundary between this nation and Canada, in respect to which the United States and Great Britain have the right, by treaty stipulation, to impose such conditions and regulations upon the use of the river and its waters as they deem mutually proper. Gov. Griggs further holds that 'A treaty duly negotiated between these two powers and ratified by the Senate of the United States would be the supreme law of the land, and if in such treaty it were provided that no such use of the waters as is contemplated should be hereafter made, and this regulation were enforced by act of Congress, the treaty and the legislation would be valid, the rights of the State of New York and all private riparian owners to the contrary notwithstanding.' Attorney-General Moody has counseled the President that international consideration and agreement on this point were desirable and necessary, and that he is 'fully authorized to invite concert of action with the British Government as representing the Dominion of Canada.' Senator Knox's opinion coincides with that of the Attorney General.

"The power plants do not threaten the navigability of the river. On the American side the companies are authorized to divert into their chutes from the crest of the cataract a maximum total of 48,400 cu. ft. of water a second, whence, having lent its force to the generation of electricity, it is poured into the rapids below. At present about 20,000 cu. ft. a second are actually used. Franchises held on the Canadian side in the Queen Victoria National Falls Park allow a total of 33,000 cu. ft. a second, and further developments have been planned which will require the use of 70,000 cu. ft. a second for power purposes. Above and below the falls the river remains navigable as before. The proposed treaty with Canada must, therefore, be aimed directly at the progressive spoliation of the falls by the power companies, on the ground that Niagara is a boundary river on the frontier of a foreign country upon which the United States has paramount jurisdiction in matters of the general welfare and of high public concern.

"Congress will probably enact the legislation necessary to this end. It is reported that nearly every member of that body has heard from constituents requesting that action be taken to protect Niagara. Senator Platt has introduced a joint resolution setting aside $20,000 for the expenses of a commission of four members to be appointed by the President, who are to meet similar commissioners from Great Britain to investigate and report on the matter, employing the necessary surveyors and clerks. The International Waterways Commission will probably investigate independently and report upon all questions of fact involved in the proposal. Such investigation would, of course, insure intelligent and proper regard for the separate rights vested by New York in its State Park Reservation; only the destructive use for commercial purposes of the great waterfall may justly be restricted by an international arrangement."

Automobile Testing Plant of Purdue University.

At a meeting of the Indiana Engineering Society, January 18, Prof. W. O. Teague read a paper describing the automobile testing plant recently installed at Purdue University under the direction of Prof. W. F. M. Goss. The plant forms a part of the engineering laboratory and is primarily intended for instructional purposes in the experimental engineering side of automobile work. The general design of the plant is similar to that of the locomotive testing plant at Purdue.

The power exerted by an automobile in moving itself on the road is the tractive pull of the machine times the distance passed over by the machine. In order to determine these two quantities it is necessary to support the automobile so that the draw bar pull and the revolutions of the driving wheels may be measured. For purposes of test the automobile must remain at rest and the power delivered at the driving wheels, which would ordinarily drive the machine forward, must be absorbed by some form of brake. According to the arrangement in the laboratory, the front wheels of the automobile are supported by a fixed platform. Two pulleys fixed to a common shaft free to revolve are provided to support the driving wheels of the automobile and a Prony friction brake is placed on this shaft to absorb the power delivered by the driving wheels of the automobile to the supporting wheels.

The Prony brake used consists of a cast-iron wheel with a wide flanged rim. Two iron straps fitted with strips of wood forming the friction band extend around the pulley rim and this may be tightened or loosened by means of a screw clamp, thus increasing or decreasing the friction on the pulley rim. The pulley is prevented from heating by running water into the flanged rim where it takes up heat from the rim and is evaporated. With the machine mounted in this manner the draw bar pull is measured by a spring balance attached to the driving axle of the automobile by means of the draw bar and to the frame of the testing machine.

The draw bar is fitted with a dash-pot to reduce vibration. The machine is kept centered over the supporting pulleys by means of a hand wheel. A pointer on the side of the frame and attached to the driving axle of the automobile guides the operator in keeping the automobile in its proper position. The space passed over by the automobile is obtained by counting the revolutions of the supporting pulleys by means of a revolution counter and since the pulleys are of a fixed diameter the distance traversed will equal the space passed over by a point on the rim of the pulley. From this can readily be derived the speed of the automobile in miles per hour.

A motor-driven pressure blower placed below the platform and fitted with the necessary piping and discharge hood supplies air to cool the circulating water in the radiator of the automobile. A motor-driven exhauster takes air from a point at the end of the fixed platform and the exhaust gases from the automobile are led into its suction pipe and are thus discharged from the testing room.

The testing apparatus is located in a room which is provided with large doors to permit automobiles being placed on the testing platform. The machines are hauled upon the platform by means of a block and tackle, two movable runs being placed at the end of the platform for the wheels to roll upon. Safety stops made of wood are placed in front of and behind the front wheels to prevent movement of the machine in case it should release itself from the draw bar at the rear. These blocks are placed in position after the machine has been mounted upon the supporting wheels.

The Erie Railroad Electrical Commission.

The Erie Railroad has been studying for some time past the possibilities of electric traction for its suburban service in the neighborhood of New York City, but the equipment of these lines has been delayed for a number of reasons, among them the construction of an open cut in place of the present Jersey City tunnel and the rearrangement of the terminal station at Jersey City. Nevertheless, the directors of the company have recently authorized vice-president Graham to organize an electrical commission to study the subject in detail, and it is thought that one of the branch lines, either the Northern Railroad of New Jersey or the Greenwood Lake Division, will be equipped with electricity within the next year. The electrical commission which was appointed Feb. 2 consists of the following: J. M. Graham, vice-president, chairman; Bion J. Arnold, L. B. Stillwell, E. A. Williams, general mechanical superintendent; A. J. Stone, assistant general manager; C. H. Morrison, acting electrical engineer and secretary of the commission.

The commission will make a study of the proper system to be adopted and will report to the directors at an early date.

Worcester Polytechnic Institute Electrical Engineering Laboratory.

One of the finest engineering laboratories in this country will shortly be erected by the Worcester, Mass., Polytechnic Institute for its Electrical Engineering Department, the plans for which have been prepared by the Electrical Engineering Department. Prof. French, of the Civil Engineering Department, will have superintendence of the erection of the building, the architects for which are Messrs. Peabody & Stearns, of Boston. The building will be about 115 by 200 ft., three stories in height and enclosing three sides of a court 50 by 100 ft. The main laboratory room will be spanned by a 10-ton crane with two galleries on one side and one on the other the entire length of 200 ft. Among the features are a laboratory for the study of high-potential phenomena and high-potential power transmission, and an electric railway engineering laboratory on a larger scale than has heretofore been attempted. There will be a lecture room fully equipped for experimental demonstration instruction; a standards laboratory; designing room; photometric laboratory; a general electrical laboratory, and a department reading room and library.

Prof. Harold B. Smith is director of the Department of Electrical Engineering. Prof. Smith's staff consists of Prof. Joseph O. Phelon, assistant professor of electrical engineering; Prof. Albert S. Richey, assistant professor of electric railway engineering; Messrs. Harry C. Walter and Carl D. Knight, instructors in electrical engineering, and Francis J. Adams and Ernest C. Morse, assistants in electrical engineering.

Construction and Electrical Equipment of the New York Central Tunnel Under the Detroit River

Bids for the construction of a double-track tunnel under the Detroit River to connect Windsor, Ont., with Detroit, Mich., have been requested by the New York Central Railroad and will be opened March 8. The tunnel will be operated by electricity and bids for the electrical equipment will be called for about February 15. The advisory board of engineers which has charge of the engineering and award of contracts consists of W. J. Wilgus, vice-president, chairman; H. A. Carson, of Boston, and W. S. Kinnear, of Detroit. The tunnel will have a length, including approaches, of 12,800 ft., the length of the terminal proper being 7,860 ft. The grade in the tunnel on the Detroit side will be 2 per cent and on the Windsor side 1½ per cent.

Central Station Advertising.

In connection with the twenty-ninth convention of the National Electric Light Association to be held at Atlantic City, June 5, 6, 7 and 8 next, it is proposed to repeat on a more extensive scale the exhibit of central station advertising that was given so successfully last Spring at Denver, and which, together with the extended discussion to which it gave rise, did much to awaken the present interest in the subject of central station business getting. Steps are now being taken to carry out this purpose, and it is believed that the exhibit will prove attractive and instructive to central station managers. It is proposed to divide the exhibit into two sections, one showing the work done by the larger companies which maintain their own force for such work, and issue and prepare their own bulletins; and the other comprising bulletins and material furnished by the new concerns that have sprung up lately to supply the smaller stations with this class of matter, many of which have already done very effective work. In addition to this a display will be made of posters, large newspaper advertising and many original drawings and sketches employed in bulletins.

Public Lighting in New York City.

In expectation of a largely increased business in connection with the lighting of the city's streets, schools and other public buildings, the New York Edison Company last week, in submitting its bids for the eleven months ending February 1, 1906, tendered a yearly rate as low as $80 per arc lamp. At the present time there are in the boroughs of Manhattan and the Bronx something less than 5,000 lamps, as compared with 10,297 in Philadelphia, with that city's population only 1,023,000, and 3,090 lamps in the Metropolitan district of Boston, where the population is about 200,000.

Under the law which was passed by the New York Legislature, and which went into effect on July 1, 1905, the New York Edison Company is authorized to charge $100 for each standard arc lamp of 450 watts, and $130 a year for two lamps per post, such as seen in Fifth Avenue, and 10 cents a kilowatt-hour for incandescent lighting and power in the public buildings. The New York Edison Company now agrees to charge the city $100, or the legal rate, for 5,000 lamps; the price of each lamp in excess of 5,000 is $95 until the total number of lamps reaches 7,500, when the price of all the lamps becomes $95, including the original 5,000. When the number of lamps reaches 10,000 the price of all the lamps is reduced to $90; when 12,500 lamps are reached the price becomes $85, and when the number of lamps reaches 15,000 the price of all the lamps is reduced to $80 per lamp per year. This is a reduction of $20 per lamp below the present legal rate, as fixed by the Legislature.

Equally marked is the reduction that the New York Edison Company offers in connection with the lighting of the schools and other public buildings. The present legal rate for this service is 10 cents a kilowatt-hour, and a reduction of 25 per cent is now made under the new bid, reducing the city's price to 7½ cents a kilowatt-hour. This price includes incandescent lamps, the supply of carbons and the trimming of arc lamps. The price for power service in the public buildings, under the New York Edison Company's new bid is reduced from 10 cents to 6 cents a kilowatt-hour—a very material reduction.

Governor of New York Discusses Public Utility Question.

In a recent message to the Legislature, Governor Higgins gave some views on the subject of high rates for public service. He said:

"Private companies control our railroads, telegraphs, telephones, gas and water supplies and other services which have become necessary to the daily lives of many of our citizens. Such companies are quasi-government agencies, vested with the sovereign power to condemn private property for their uses. They are permitted to exist because the State delegates to them its own functions for convenience and economy and to promote industrial development. Such corporations should be tolerated only so long as their rates are reasonable and their service prompt and efficient.

"It has been suggested by a learned justice of the Supreme Court of the United States that such companies have not even the constitutional right to a profit on their investments and that, while they cannot be required to do business at a loss, they may be compelled to content themselves with a return equal to the cost of operation and maintenance. So radical a theory has not been adopted, but that it should be declared from the bench of our most eminent and conservative tribunal is a significant suggestion of the power of the people to regulate public service companies, or failing therein, to exercise their functions directly through government—State or local."

This statement is interesting in connection with the recent decision of the Supreme Court whereby the Hudson River Company was compelled in one instance to maintain the lower rate granted by a company which afterward became a sub-licensee.

A Central Station Interruption.

An item was given publicity a week or two ago to the effect that the supply of current had been interrupted at the Kennett sub-station of the Northern California Power Company. Mr. W. W. Wheeler, engineer of the company, at Redding, Cal., in an interesting letter states that there was virtually no foundation for the story, and he furnished us the subjoined details: "The facts were, as near as we can learn, that a transformer on our 2,000-volt distribution blew its fuse and put a portion of the town in darkness. This fuse was replaced within ten minutes, but in the meantime a reporter for a local paper rushed to a telephone and telephoned to a Redding paper that the power was off at the smelter and that the same was rapidly 'freezing up.' This in turn was telegraphed to San Francisco. A correction was sent in a few hours later, but did not overtake the original article. Now, as we have two power lines entering Kennet from opposite directions and from two independent power houses, there is small chance for a shut down in that neighborhood. Further, we have the record of having supplied the Mountain Copper Company Smelter at Keswick from a single pole line carrying two circuits and fed from one of the two power houses above mentioned. This double circuit line is thirty-five miles long, operates at 20,000 volts, and was delivering 1,500 and 1,600 kw for a period of three and a half years, with a total shut down during that period of eight hours and thirty minutes, five hours of that being a voluntary shut down and occurring on two Fourths of July."

Organization of the Central Station Business Department.

Owing to lack of space, the conclusion of the discussion at the recent Chicago meeting of the Northwestern Electrical Association on Central Station business-getting methods was omitted from the issue of last week and is now given below.

Mr. J. R. Cravath said he heartily agreed with the remarks of Mr. Almert that the great majority of central station companies are not yet awake to the importance of the new business department. The gentlemen assembled at the convention represented the more progressive element, not the average. He could not help noticing as he visited a large number of plants in the course of the year, the great difference in the development of the business in different towns. He wished to emphasize one point made in the discussion, that it is not always low rates that count in the getting of new business. He had in mind a town in central Illinois where power had been selling for some time at five cents per kw-hour, and yet it is one of the poorest towns for power load that he knew of, not because the business was not there, but because the company had not got the business. That was only an isolated case, but there were plenty more like it. He thought there were more opportunities for great development in the central station business than most of us have any idea of at the present time.

Mr. Utley, of Watertown, Wis., said he thought it better to pay solicitors a commission on the increase of business rather than on the sale of appliances, since it was increase of load and not new appliances that the company wished to get on its lines. Another plan that helped his company was to sell gas fixtures to any one wishing them, allowing them whatever gas they used the first year free. The profit made on the fixtures was sufficient to cover the loss for the first year on the gas consumption.

Electric Power for the Rand.

In a recent interview in London Mr. Robert Hammond gave further details concerning the plans for the steam generation of electric power for the Rand, which scheme has previously been noted in these columns.

Mr. Hammond said that all the money necessary for the preliminary expenses has been subscribed and some leading financiers have expressed their willingness to find the bulk of the capital for the entire undertaking as soon as it is required. An agent is now on the ground looking after the matter of coal contracts, the choice of site and right of way. A bill now before Parliament includes the right to supply electrical energy throughout the Transvaal Colony.

The plan is to lay down works at Vereeniging on the line of railway from Johannesburg to Bloemfontein, and situated on the Vaal River where a dam insures an ample supply of water for condensation purposes. The site is rendered the more desirable from the fact that it is the center of a coal district, in which coal of very fair quality is mined. The electric current will be conveyed at high tension to a central point for distribution over a radius of 25 miles to all the mines. It is estimated that electrical energy can be delivered to the mines and converted to any pressure at a cost a trifle under 1.4 cents per kw-hour, the calculation being based upon the very large consumption of 300,000,000 kw-hours per annum, which, however, is the estimated requirements of the mines. While the mines would be the principal consumers, current would be available for general use, as, for example, to supply the contemplated railway between Johannesburg and Pretoria.

The plan provides for seven steam generating sets, each of a capacity of 10,000 kw., and each set being capable of sustaining an emergency overload of 20 per cent. On the assumption that one set would be occasionally laid off for overhaul, there would always be available for active use six sets with a total normal capacity of 60,000 kw and an overload capacity of 72,000 kw, thus being amply sufficient to meet the estimated present requirements and the estimated output of 300,000 kw-hours per annum. The total cost of the power-house and plant is calculated to absorb nearly one-half of the entire capital outlay, which would be about $10,000,000.

Provision is made for a storage reservoir containing 100,000,000 gal. of water, which would be drawn upon for the condensation water, and be pumped from one spot and returned to the reservoir at the most distant point from the intake. In preparing the estimate of the costs of working, it is presumed that a matter of 470,000,000 gal. of water per annum for making up the losses by evaporation will be available at a cost of 87 cents per thousand gallons. By the selection of Vereeniging, however, as the generating site the outlay of $1,500,000 on the storage tank would be avoided, presuming that favorable arrangements are made for the use of the Vaal River. On the other hand, $400,000 must be set down as the cost of the weir dam to provide a reservoir as a stand-by in times of drought, and for the laying down of the necessary line of inlet and return pipes.

Development of New York Subway Travel.

There seems every prospect that the recent traction merger in New York City will be followed by a rapid development of new electric subways. Members of the Rapid Transit Commission have been told by representatives of the allied traction interests that the engineers of the Interborough-Metropolitan have decided that the subway traffic has become so heavy that the present trunk line from the Battery to Grand Central Station will be unable adequately to handle the traffic of the proposed Lexington Avenue line by the time such a line can be completed.

The complete Lexington Avenue line was laid out by the commission at the request of the Metropolitan interests when they were fighting the Interborough for control of the subway situation and runs south to Thirty-fifth Street with the lines then running west through Thirty-fifth and Thirty-sixth Streets, south through Broadway, Fifth Avenue and connecting streets to the Battery. The Metropolitan Company intended to make a hard fight for this line to compete with the present subway. The Interborough Company merely intended to bid on the section north of Forty-second Street to connect with the present line at Grand Central Station. Now they are understood to be willing to construct the entire line, and the Seventh and Eighth Avenue lines in addition.

Assurances have been given to the Rapid Transit Board that the Interborough-Metropolitan people are willing to construct these lines as well as the crosstown lines connecting with the new Pennsylvania Railroad Station, with their own money if they can obtain profitable rental terms. A bid on such a basis will, it is said, be welcomed by the board. Meantime there are hours when the liberal resources of the existing subway system are sorely taxed by the pressure upon them of travel developed so suddenly and so enormously.

Production of Aluminum in Europe.

The output of aluminum by the Pittsburg Reduction Company in Canada and the United States is placed at 4,200 tons. The high price of copper has recently developed new interest in the production of the metal, whose price has risen in spite of the growing quantity available, and which has come into large demand in the electrical field. United States Consul Guenther, of Frankfort, sends the following German report on the European situation:

"The companies at present producing aluminum are: 1. Aluminum Industry A. G., in Neuhausen, Switzerland, which also has works at Lend-Gastein, Austria, and at Rheinfelden, Baden. The total annual production of the three works of this company was estimated at 3,675 tons (at 2,204 metric pounds), employing 88 bureau officials and 661 workmen. It paid last year on its stock an 18 per cent dividend, and recently raised its share capital from 16 to 26 million francs. The new shares were taken by a bankers' syndicate at 250 per cent. The Neuhausen company secured territory in the Swiss Canton of Wallis, where it has the use of 50,000 hp of water power. New works are to be erected there. It has also purchased the stock of and now owns the chemical works of H. Bergins & Co., in Deutsch Lissa, Silesia, where about 200 workmen are employed, mainly in making salts of aluminum.

"2. British Aluminum Company, at Feyer, Scotland, which has also works in Sarpsfos, Norway; its total production per year has been estimated at 2,250 tons.

"3. Société Électro-métallurgique Française, a French company, with works at La Praz and Les Sordrettes, in Savoy, produces about 2,325 tons of aluminum per year.

"4. Société des produits chimiques d'Alois et de la Camargne has works at Calypse and at St. Felix, in Savoy, whose combined annual production is stated to be 2,100 tons. The French aluminum works were closed for some months owing to a strike."

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The Old Western Union-Bell Telephone Contract.

Advices from Boston state that the long-drawn-out case of the Western Union Telegraph Company vs. American Telephone & Telegraph Company for an accounting involving from $2,000,000 to $4,000,000 has been before Everett W. Burdett as master for two years, and in that time only one side of the case has been heard—namely, the evidence of the Western Union. The Western Union Company completed its evidence a month ago, and it is expected that the American Telephone & Telegraph Company will at once proceed to present its evidence, in which event a report to the court may be made this summer.

The present case has been in the court in one form or another for twenty-two years, and if appeal is taken to the Supreme Court of the United States, it will be some time before a conclusive decision is reached. The Western Union Company seeks an accounting for certain shares of stock in the companies licensed by the old Bell Telephone Company under a contract entered into in November, 1879. The defendant was then known as the National Telephone Company.

Under this contract the Western Union Telegraph Company was to go out of the telephone business and turn over all its telephone property and exchanges to the Bell Company, the latter agreeing not to interfere with the telegraph business. The Bell Company in consideration was to pay the Western Union upon all telephones used in the United States under license from the Bell Company a royalty, or bonus, of 20 per cent for the term of 17 years. After the contract was made, however, the Bell Company began to give exclusive licenses to sub-companies in various parts of the United States, in consideration of which the companies gave the Bell Company a certain percentage, generally 35 per cent, of their stock, as a payment for the license. It is in respect to this latter mode of procedure that the Western Union is securing an accounting.

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CURRENT NEWS AND NOTES.

CENTRAL STATION PRIZES TO SCHOOL CHILDREN.—The Janesville (Wis.) Electric Company has offered prizes aggregating $17.50 to the pupils of the Janesville high school, to be awarded for the three best papers on the subject, "Electricity in the Household."

BANQUET COOKED BY ELECTRICITY.—The biggest dinner ever cooked by electricity was served January 31 by the Ontario Power Company, which had for its guests the members of the Canadian Society of Civil Engineers, the commissioners of the Queen Victoria Niagara Falls Park, and a number of others. Covers were laid for 225. The Ontario Power Company has recently installed a very large electric kitchen for its own use, which absorbs about 40 hp. A meal for 300 can be prepared with ease.

CHICAGO MUNICIPAL TROLLEYS.—A cable dispatch from Chicago of February 3 says: "Mayor Dunne and his advisers have planned a temporary trolley system for the downtown parts of the cable lines. The city will pay for the work if constructed by the companies, the latter paying the city rent for the use of the system. Within one year the city is to acquire ownership of the equipment. W. W. Gurley, chief counsel of the Union Traction Company, is in New York to lay the plan before the controlling interest in the company."

BREAKING OF PORTO RICO CABLE.—Cable communication with Porto Rico and all islands east of the American dependency was suddenly cut off a few days ago by the breaking of the two cables in use by the West India & Panama Cable Company. Whether the break was caused by a volcanic disturbance is not as yet known. Islands now out of telegraphic touch with the world are St. Thomas, Santa Cruz, Antigua, St. Kitts, Montserrat, Nevis, Dominica, St. Lucia, Barbados, St. Vincent, Martinique, Grenada, Tobago and Trinidad. Porto Rico has communication by wireless telegraphy.

THE ILLUMINATING ENGINEERING SOCIETY will hold its regular monthly meeting on Tuesday evening, February 13, at the Hotel Astor, New York City. The programme of the evening consists in an inaugural address by the president, Mr. L. B. Marks, which will outline the general scope and policy of the society, and a discussion of the topics by those present. Tables will be reserved in the grill room as before for those who wish to dine at the hotel on the evening of the meeting. These dinners are entirely informal, and it is hoped that as many as possible will be present to add the social feature to the technical.

CANADIAN NIAGARA FALLS.—Before the Canadian government can enter into a proposed agreement with the United States government with respect to the preservation of Niagara Falls, it will be necessary for it to take over the jurisdiction of the Falls at present held by the Province of Ontario, and the Canadian electric companies are stated to favor such action, for the reason that if the jurisdiction remains as at present, there is danger that the Ontario government may endeavor to take the matter of Niagara power development out of the hands of the individual companies and enter into the business itself. It is also reported that the power companies on the American side of the Falls are, for similar reasons, anxious to have the Federal government take over the control of the American Falls from New York State, and that these companies are exerting influence to this end at Washington.

REVERSE-CURRENT CIRCUIT-BREAKER.—A difficulty which has been encountered in the use of reverse-current circuit-breakers resides in the fact that the potential across the terminals of the apparatus may fall to a value insufficient to furnish the potential coil of the cut-out with the proper amount of current for operation. A patent issued January 30, 1906, to Mr. Leonard Wilson, describes a method by which this difficulty may be overcome. A commutator is driven synchronously and in phase with the electromotive force of the machine. This commutator serves to rectify the current obtained from the secondary of a series transformer connected in the supply leads of the generator. The rectified current is passed through the movable coil of an electrodynamometer which is provided with field magnetism of constant strength. According to the phase position of the current in the series transformer at the time when it is rectified, the movable member of the electrodynamometer will tend to be deflected in the one or the other direction. When it moves in a direction determined by the reversal of flow of energy from the generator, it closes a circuit from a battery through a tripping coil of a switch arranged to open the circuit of the generator. The circuit-breaker is readily adjustable for changes in operating conditions by shifting the brushes on the commutator.

TANTALITE PENS.—We note that Siemens & Halske, who have done so much to develop the tantalum lamp, have taken out German letters patent for a new writing pen made of tantalite. It is expected to supercede or compete with steel and gold nibs.

THE ELECTRICAL SALESMEN'S ASSOCIATION.—Mr. George H. Erich, secretary of the Electrical Salesmen's Association, has established permanent headquarters at 401 Monadnock Block, Chicago. The constitution and by-laws of this association which held its first convention in Chicago January 20, have been printed in booklet form and can be obtained by those interested.

THE IOWA CONVENTIONS.—The Iowa Electrical Association will hold its annual convention this year at Des Moines, Iowa, April 18 and 19. The Iowa Street & Interurban Railway Association will have its convention April 19 and 20, so that managers interested in both properties can attend both conventions. The headquarters of the Street & Interurban Railway Association will be at the Kirkwood Hotel.

APPARATUS IN ARGENTINA.—Government statistics from the Argentine Republic show that of incandescent lamps imported in the period 1900-4 the American percentage was 40.2, although in the period 1896-8 it was 42.3. The importation of electric light carbons was a percentage of 33; arc lamps, 12.5. This business would seem susceptible of increase, and in many other branches the growth of American importations into the Republic is notable.

WATER POWER DEVELOPMENT DAMAGE.—An interesting question has been raised in a United States Court in a suit for damages caused by a dam in one state flooding lands in an adjoining state. The Berkshire Power Company has a dam across the Housatonic at North Canaan in Connecticut, and it is alleged that because of the high water thus caused meadow lands owned by the complainants in Massachusetts have been flooded, pasturage ruined, property damaged and the health of the complainants' families endangered. Compensation is asked for the damage and also an injunction to restrain the company from maintaining the dam.

BAVARIAN POWER.—The Munich municipality has under consideration a proposition for the generation of electric power, to be distributed throughout Bavaria, at a cost of $5,000,000. It is proposed to dam up the River Tear near Wallgorn, and form a huge lake, which will be connected to the Walchen and Kochel Lakes by tunnels. From the immense supply of water thus obtained, estimated at a hydro-electric capacity of 96,000 hp, it is thought that sufficient electricity could be obtained to work the railways and factories. The initial expenses of the work would be about $3,750,000, which is the sum Bavaria now spends abroad every year for coal used on the government railways.

THE LIGHTS OF BOGOTA.—United States Consul Snyder, of Bogota, United States of Columbia, does not speak very enthusiastically of the local lighting. Being consulted as to the introduction of acetylene, he said: "Owing to prevailing conditions here, and as a result of my personal observations, I am inclined to believe that such systems, properly introduced, would ultimately become very popular. Bogota, for its size and apparent importance, is one of the worst-lighted places I have ever been in. There is no public service at all. But one local electric light company exists, and the high prices charged for its service put it beyond the reach of the great mass of the people, who, together with those in the surrounding villages, have to depend for lighting purposes on oil lamps, generally of a very poor quality, and wax candles. Some time ago I induced a large dry goods merchant here to send to the States for a trial order of acetylene burners, but shortly after their arrival he had to leave for England, so nothing came from it; and I very much doubt if he could have given it the attention necessary, in connection with his other business, for its successful introduction." There ought to be very good and cheap water power available around Bogota.

PUBLIC SERVICE FRANCHISES.—The People's Institute, of New York City, is planning to conduct in the latter part of February a series of public conferences on municipal ownership and operation of public franchises. The dates and titles are: February 20, "Municipal Ownership and Operation in Europe"; February 22, "Municipal Ownership and Operation in America"; February 23, "Public Ownership and the Spoils System."

A GREAT GROWTH.—In its excellent Bulletin for February, the New York Edison Company reports the figures of its new business taken on during 1905. The company secured 19,800 separate contracts for electrical service. Of incandescent lamps there were 992,782; of arc lamps 6,870 and of motors 37,719 horsepower. Some additional apparatus of a miscellaneous character brought the ttoal up to 1,657,408, equivalent of 16-cp lamps of 50 watts each. Such a rate of growth applied to the whole country would make the present national statistics of electric light and power sink into insignificance.

TERRITORIAL RIGHTS OF NIAGARA, LOCKPORT AND ONTARIO POWER COMPANY.—The rights of the Niagara, Lockport & Ontario Power Company to operate beyond the limits of the Counties of Erie, Orleans and Niagara was the subject of recent court proceedings. The matter came up in connection with the proceedings for the condemnation of certain property in Genesee County for the uses of the Power Company. Judge Truman White decided that the preliminary objections were not well taken and the issues raised were referred to a referee to hear, try and determine.

OUR FOREIGN COMMERCE.—It is brought out in the Government figures that the foreign commerce of the United States approaches surprisingly near to the three-billion-dollar point in the calendar year 1905. The total imports and exports of merchandise, as shown by the Department of Commerce through its Bureau of Statistics, is 2,806 million dollars, against 2,307 millions in 1900, an average increase of 100 millions a year in the five-year period. If to the 2,806 millions of foreign commerce in 1905 were added the figures of trade with Hawaii and Porto Rico, formerly foreign territory and included in the statements of foreign trade prior to 1901, the total would approximate 2,900 million dollars, or about 600 millions more than five years ago, and 1,200 millions more than ten years ago. The growth in exports during the year was 175 million dollars and in imports 143 millions.

BIDWELL AGAIN.—Benson Bidwell has bobbed up again, this time as the inventor of a "cold motor." In a half-page advertisement in daily papers offering stock for sale at 40 cents per share, the statement is made "I have made millions of dollars for thousands of people by my patents. I have never made an unsuccessful invention." This is followed by the claim that Bidwell invented the electric fan, the electric trolley car system and the "water electric generator." As illustrated, the "cold motor" has the appearance of an enclosed electric motor; a small pipe leads from one end of the shaft to a cylinder with a valve, and a similar pipe from the other end of the shaft to a cylinder with a valve and a pressure gauge. The resemblance to an electric motor is increased by two electric wires entering the casing. It is stated that this device "is guaranteed nof to burn out and is exactly the kind of a motor the steam railroad people have been looking for. It will change all the steam railroad systems over to electric roads, because it will be cheaper to run than steam, and can be run faster and more safely than any present method. By using the Bidwell cold motor a train of cars could be run from New York to San Francisco without a stop at the rate of 60 or 80 miles an hour and not even warm up and without a hitch. Besides running faster they would be more safe and sure than steam, cost less to operate and would last longer than any other motor now known. The Bidwell cold motor is the greatest invention out since I invented the trolley car." Investors are warned that they must come quick or not at all, as the stock is selling like hot cakes.

ST. PETERSBURG STREET RAILWAYS.—A cable dispatch from St. Petersburg of February 3 says: "Another section of the contract for the electrification of the street car system of St. Petersburg was awarded to-day to the American Westinghouse Company. It involves the expenditure of $1,675,000. The power will be generated at Imatra Falls, Finland, and will be transmitted 120 miles."

COST OF TROLLEY DEVELOPMENT.—Last week members of the Brooklyn League, escorted by officials of the Brooklyn Rapid Transit Company, made a tour of inspection over the company's lines. President Winter, of the company, informed the League members that the company had expended about $20,000,000 for improvements since he took office, in July, 1902, and that other work costing $12,000,000 was now under way. Of the sum expended, he said, $8,653,000 had gone for car equipment. The other improvements included new elevated shops and stations, elevating and depressing tracks, new Williamsburg power station, car storage depots and track construction.

UNDERGROUND FOR BUFFALO.—Another city for which an underground road is proposed is Buffalo. The Buffalo Subway Railroad Company has been incorporated with a capital of $1,000,000. It is the intention of the company to build a subway similar to the one in New York City. It is understood that Philadelphia capitalists have agreed to furnish all the money necessary to build the proposed road. The city officials are said to be in favor of the enterprise. The road is to extend from a point on Carolina Street, southwest of the lands of the New York Central & Hudson River Railroad Company, thence easterly beyond the easterly city line to a point about 2,000 ft. beyond the lands of the Terminal Railway of Buffalo in the town of Cheektowaga. A branch will run from the main line at William Street and Fillmore Avenue to the intersection of Curtiss and Lovejoy Streets.

CENTRAL STATION ADVERTISING.—In connection with the meeting of the National Electric Light Association at Atlantic City next June, it is proposed to repeat on a more extensive and complete plan the exhibit of central station advertising that was given with so much success last year at Denver for the first time. Steps are now being taken to carry out this purpose, and it is believed that the exhibit will prove attractive and instructive to central station managers. It is proposed to divide the exhibit into two sections, one showing the work done by the larger companies which maintain their own force for such work and issue and prepare their own bulletins, and the other bulletins and material furnished by the new concerns that have sprung up lately to supply the smaller stations with this class of service and many of which have already done very effective work. In addition to this, a display will be made of posters, large newspaper advertising and the original drawings and and sketches employed in the bulletins.

INDIANA LIGHTING ORDINANCES.—The last Indiana Legislature passed a law providing that a city or town may command by ordinance that steam and interurban railroads shall provide electric lights at street crossings to burn twenty minutes before and twenty minutes after the passage of trains. The town of Salem passed an ordinance and attempted to penalize the Monon railroad for its violation, and the case was appealed to the Supreme Court, where the judgment penalty was reversed. The court held the ordinance invalid for its failure to designate what kinds of light should be provided. The court said that neither the railroad company in obeying such an ordinance nor the courts in enforcing it can be required to know what kind and power of lights are used by a town at a particular time, and that the lighting ordinance must be specific and complete in itself, so that it can be known from the consideration of its terms and the acts of a defendant railroad, whether or not the ordinance has been violated.

MURGAS WIRELESS SYSTEM.—A special telegram of February 3 from Wilkesbarre, Pa., says: "Father Joseph Murgass, of the Slavonic Catholic Church of this city, who has invented a system of aerial wireless telegraphy, announced to-day that experiments in underground wireless telegraphy have reached a stage when he can promise soon to send a wireless underground message to Europe. He will spend $20,000 on experiments. A shaft 3,000 ft. deep will be sunk here and a similar one in Europe. Each will be concreted to guard it from dampness, and the wires running from the receiving and dispatching points will be encased in iron or steel tubing. His aerial wireless system, which replaces the Morse code with musical tones, each indicating a letter or a code word or group of words, will be employed. Father Murgas worked seventeen years to perfect his system now in use between this city and Scranton." The Murgas system has already been described in the Electrical World.

RECEPTION TO OSTWALD.—To mark their esteem and respect, a number of the chemists of America gave a reception to Prof. W. Ostwald, the distinguished German chemist, on the occasion of his return home this week. The reception occurred at the house of the Chemists' Club, New York City, on Friday, February 2, and was in the hands of the New York Section of the American Electrochemical Society. It was preceded by a banquet at the Hotel Savoy, given by a number of intimate personal friends. The reception was a crowded affair. The audience hall was profusely decorated with flags and evergreens, and a great many notabilities were present. The speakers were Dr. C. A. Doremus, presiding; Prof. J. W. Richards, on behalf of the American Electrochemical Society; Prof. C. F. Chandler, for the 4,000 chemists of America; and Prof. Morris Loeb, for the many old and recent students of Ostwald. Prof. Loeb, also presented a beautifully illuminated vellum album, containing portraits of a few Americans distinguished in electrical development and in chemistry, and containing the autographs of a great number of American admirers. Prof. Ostwald replied in admirable English, but regretting his poor command of the language recommended very warmly the study and adoption of such a universal medium as "Esperanto." The close of his charming speech was followed by enthusiastic applause. The members then commingled, and the steins clinked freely, with many a "hoch" and "prosit" and student song, until the night was far—and well-spent.

GERMAN TECHNICAL EDUCATION.—U. S. Consul Harris, of Mannheim, Germany, says that the German Empire is rapidly building up a class of men for whom it has no employment at fair wages, and for whom the demand does not increase as fast as the supply. The Consul writes: "The question of erecting a school for the building trades in Mannheim being at present under discussion, a prominent constructing engineer has contributed an article to a leading newspaper of the city in which he aims to show that technical education in Germany has gone beyond actual needs. He contrasts the number of those taking such training with the number in other professions, and concludes that the ranks of technically trained are at present much overcrowded. Statistics show that the increase in numbers in the technical ranks has gone far beyond the demand—200 per cent against about 50 per cent on the average. The consequence of this overproduction in technical resources is a constantly diminishing rate of wages, as the law of supply and demand applies here as elsewhere. Wage statistics, which were compiled from inquiries made of 20,000 members of the German Technical Association and which were presented in the Reichstag by Dr. Heinz Potthoff, a member, show the following picture: Almost one-fourth of all city and other trained appointees receive a salary under 1,800 marks ($428.40) per year, 35 per cent receive from 1,800 to 2,400 marks ($428.40 to $571.20), only 24 per cent receive from 2,400 to 3,000 marks ($571.20 to $714), and only 19 per cent receive over 3,000 marks ($715). It is to be noted that among those considered was a large number of office men who are engaged with public officials, which gives to the total a more favorable aspect, because among officials so employed a rate of salary from 2,100 marks ($499.80) to 2,700 marks ($642.60) generally prevails. From all this it appears that for an increase of technical resources and schools there is at present no pressing demand. There is an increased and, as it were, artificially created proletariat, and the various industries are not in a position to pay for these superfluous powers."

Generating Station for the Electric Railways in Belfast, Ireland.

THE municipality of Belfast has recently placed in operation a modern electric generating station for supplying power to the street railways, which had previously been run by means of horses. When it is known that this city has a population of almost half a million, and that street cars have been in use there for more than 30 years, the significance of the recent changes will be appreciated.

The station is designed to deliver power to a rolling equipment consisting of 170 single-truck, double-deck cars operating over the equivalent of 80 miles of track. Each car weighs complete about 10 tons, including electrical equipment, and will carry 22 passengers inside and 32 outside.

The building is situated on the bank of the River Lagan, which is navigable for barges, and will provide an unfailing supply of water for the steam condensers. Owing to the soft nature of the ground some 1,750 piles had to be driven through 30 ft. of river mud down to the rock. The foundations on top of the piles are formed with cement concrete in which is embedded a steel grill work made of old rails. The framework of the building is of steel and the roof and floors were completed before the brickwork was commenced, so that the coal bunkers, boilers and engines were installed while the building was being erected. This arrangement allowed the electric cars to be placed in service within the time allotted for the completion of the work, although the building is not yet completed.

The generating station (shown in Fig. 4) forms an extension of the electric lighting station, which was erected in 1898 and is likewise owned by the city. All of the equipment installed has been arranged for both lighting and traction supply. The new generators have, therefore, been provided with compound windings for tramway supply at 550 volts, and can supply lighting current at from 440 to 500 volts on the outers of the three-wire system. The plant in the original station consists of high-speed dynamos, with a total capacity of 3,400 kw. Three of the large lighting generators can be run on the tramway load, if required.

A view of the interior of the power station is given in Fig. 1. The equipment in the railway extension consists of three 1,000-kw. direct-current units. The engines are of the vertical inverted three-crank, triple-expansion, enclosed type, with forced lubrication, made by Combe Barbour, Limited, of Belfast, and constructed to run at a speed of 180 r.p.m. with steam pressure of 170 lb. per sq. in., and 150° F. of superheat. The cylinder dimensions are 22 in., 33 in. and 50 in. by 24-in. stroke. The steam consumption at full load condensing under the above conditions of steam pressure and temperature, and with 25 in. of vacuum, is guaranteed at 16¾ lb. per kw-hour, subject to additions or deductions of £250 per engine for every pound of steam per kilowatt-hour below or above that figure.

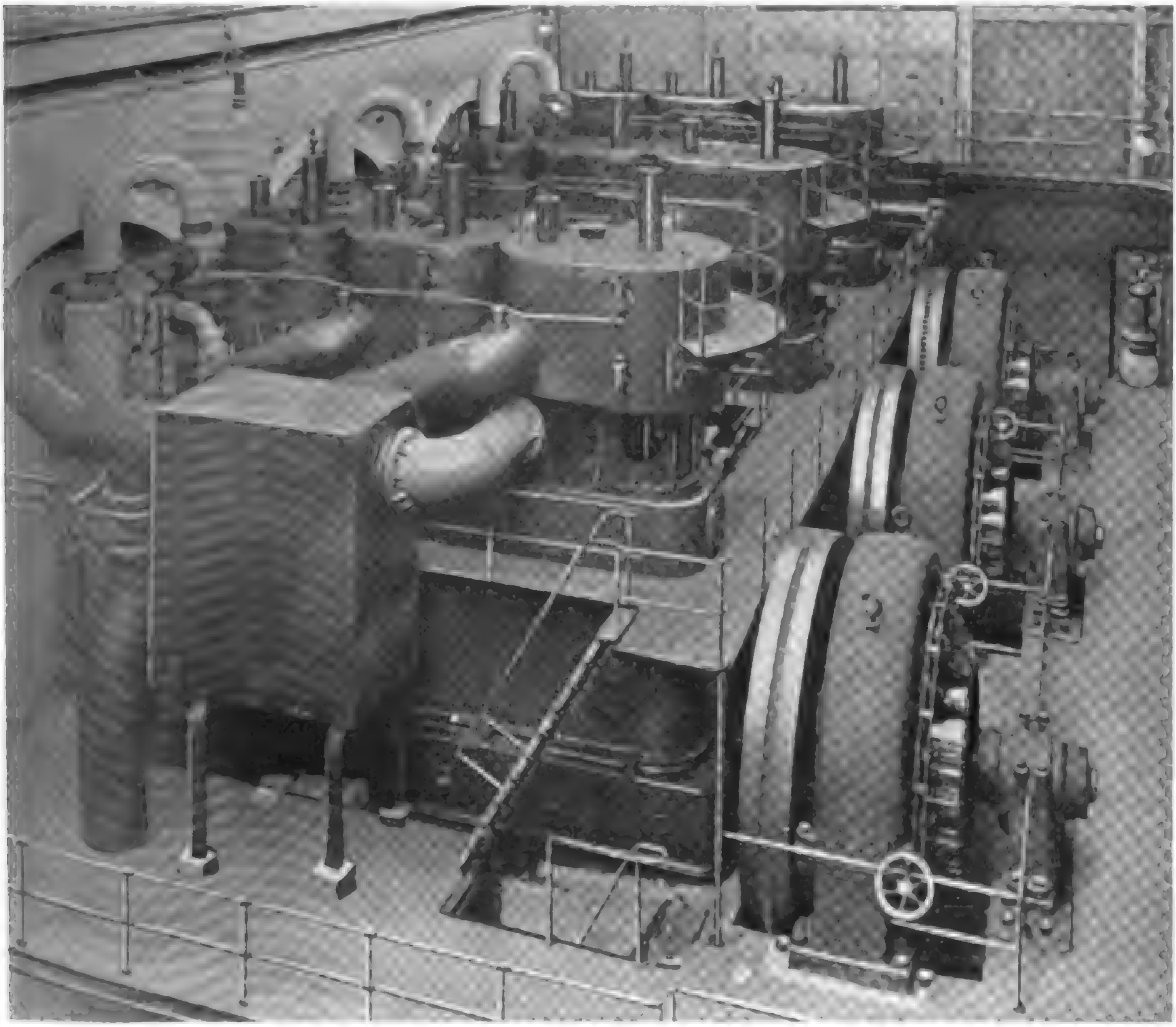


FIG. 1.—INTERIOR OF NEW ENGINE HOUSE, BELFAST ELECTRICITY WORKS.

The generating station also contains two 250-kw motor-generators, which are supplied with current from either the traction or the lighting circuits at a pressure of from 500 to 550 volts, and deliver 60-cycle, three-phase current directly at 6,000 volts for transmission about three miles to a sub-station at the Fort William Depot for the operation of the portion of the system in that district. The continuous-current motor of each unit is directly coupled to the three-phase generator, the two machines being placed on a common bedplate. A small continuous-current generator is provided on one end of the shaft for supplying field current to the three-phase machine. The sub-station equipment consists of three 125-kw. three-phase, synchronous motors directly connected to direct-current traction generators. Each of these

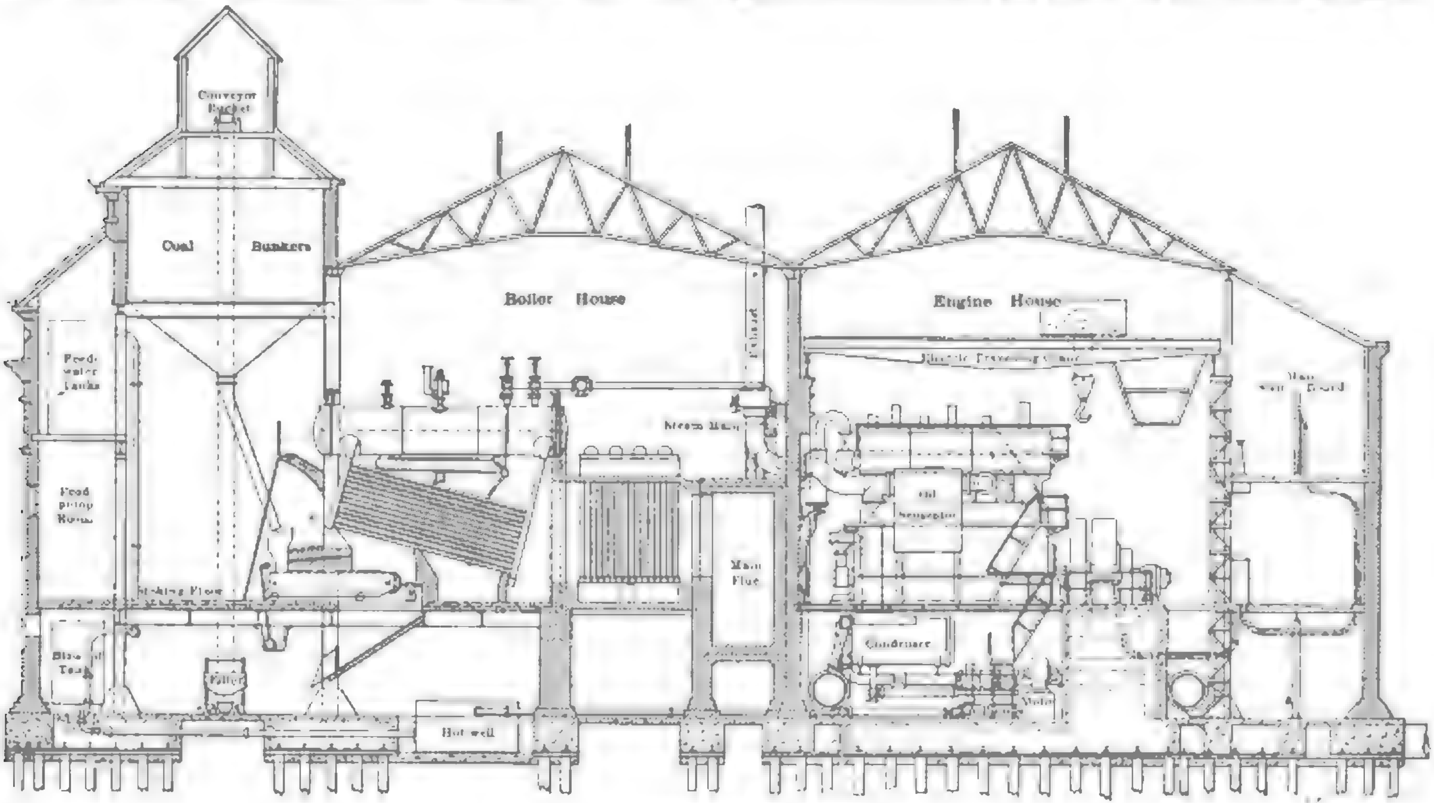


Fig. 2.—Cross-section of Extension of Power Station, Belfast.

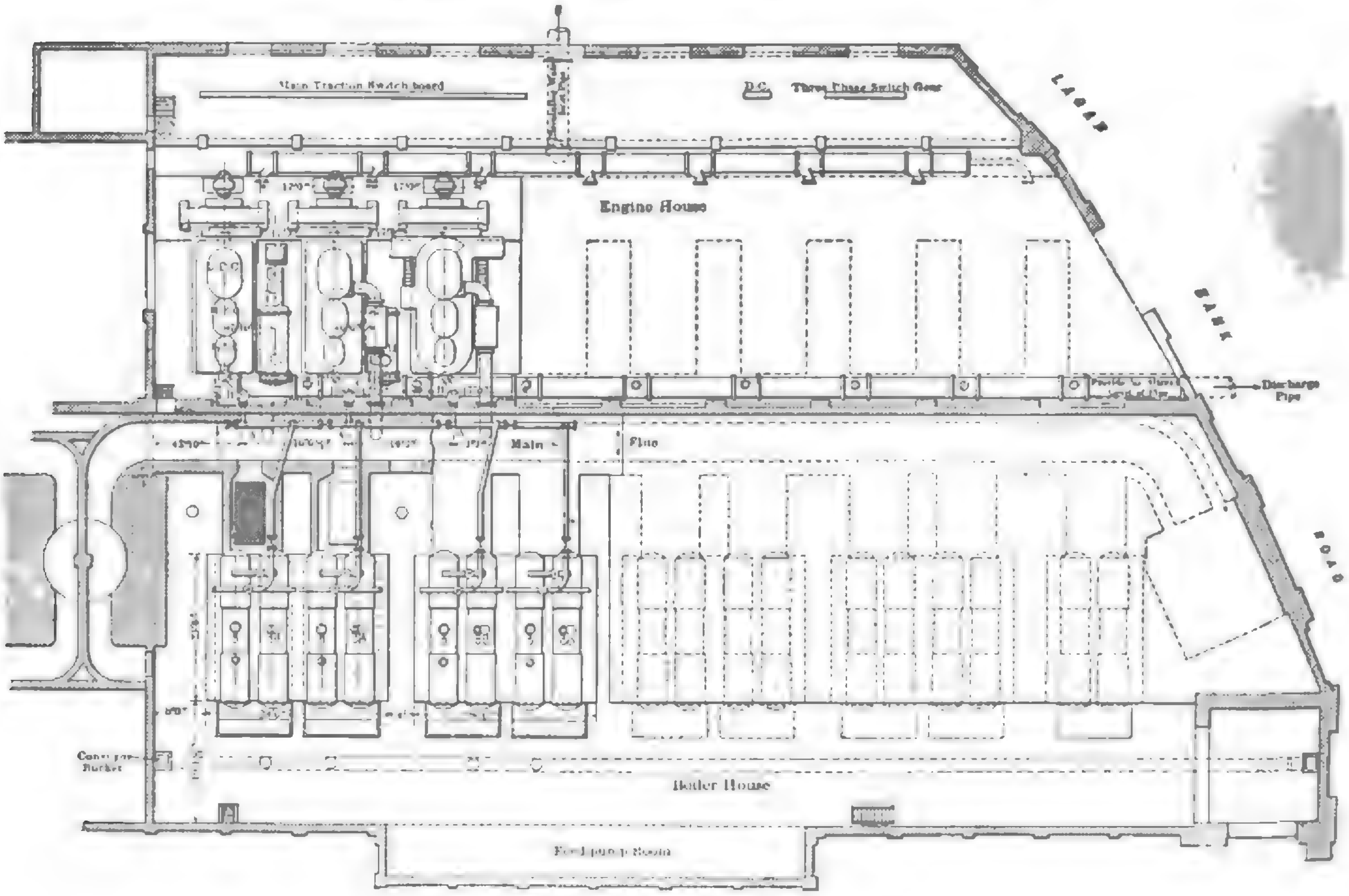


Fig. 3.—Plan of Extension of Power Station, Belfast.

latter motor-generators is provided with a small starting induction motor mounted on one end of the shaft, in addition to an auxiliary exciting dynamo mounted on the other end of the shaft.

The chief feature of the high-tension switch gear is that all live parts are isolated from the operator, and the fire risk is reduced to a minimum. All metal conductors are entirely enclosed in masonry compartments. The oil switches are of the remote-control type, with a separate double-break switch in each phase. The switches are automatically opened by means of a trip coil, receiving its current through series transformers placed in the main circuit. Duplicate three-phase bus-bars are provided to which the various generators and feeders are connected through selector switches, so that either bus-bar can be made dead for cleaning or other purposes.

Provision is made in the sub-station for starting the motor-generators from the direct-current side. The sub-station is connected wtih the generating station by means of a duplicate three-core trunk main, the section of each core being 0.075 sq. in. These cables are lead-covered and armored and laid in earthenware troughs filled in solid with bitumen.

The main traction switchboard and the three-phase operating switchboard in the generating station are erected on a gallery which runs the full length of the engine room at a height of 12 ft. above the main floor level. The main switchboard contains the usual apparatus, including a Board of Trade panel. All panels are of white Sicilian marble 2 in. thick. The over-all height is 92 in., and the total length of the board is 50 ft. The Board of Trade panel is equipped with Elliott instruments. A main three-pole throw-over switch in the circuit of each generator is mounted on a pedestal on the floor below the switch gallery, for connecting generators to the traction switchboard as compound machines, and to the lighting switchboard as shunt machines. The field circuit resistances are mounted below the gallery floor, and are operated by means of hand wheels erected in convenient positions in front of the switchboard.

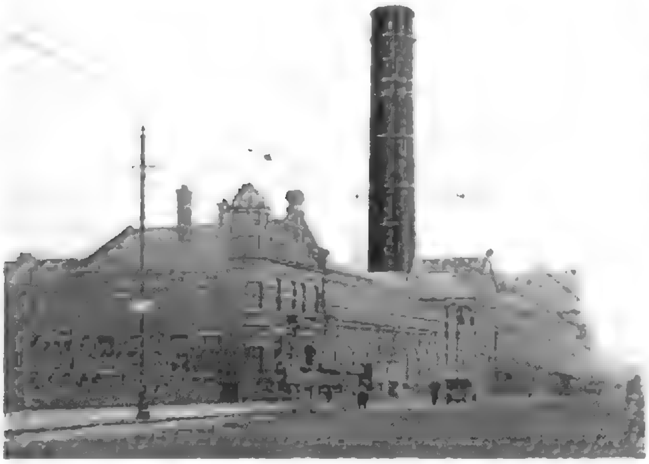


FIG. 4.—VIEW OF EXTERIOR OF BELFAST ELECTRICITY WORKS.

Most of the auxiliaries in the boiler house are electrically driven. Each boiler is provided with a B. & W. chain grate stoker, the speed of the travel of which can be varied between wide limits, so as to meet any variable demand for steam. All of the stokers are operated by a line shaft beneath the stoking floor and connected by clutches to duplicate electric motors driving by means of worm reduction gear. The scraper gear of the economizers, which are of Green's make, are also driven through worm gearing by means of an electric motor.

Two of the three feed water pumps are electrically driven. These two pumps are of the Hayward-Tyler variable-stroke type, for which the following advantages are claimed: The pump can always be started at "no stroke," thus avoiding heavy starting current; no variation in speed is required; no electrical complications are introduced, and variations in delivery are made while the pump is running, without interrupting the feed supply, and by the simple movement of a small hand lever, which is held in position until the required rate of delivery is obtained. In order to enable the attendant to regulate the pump to the requirements of the boilers, an automatic indicator is fitted to the end of the shaft, which shows either the stroke in inches or the equivalent discharge in gallons per hour.

There are also installed at present three Guynne electrically-driven centrifugal pumps, two 12-in. and one 15-in., and provision is made for the erection of two more when required. Two sets of motor-driven charging apparatus are also provided for priming the pumps. These centrifugal pumps are used for raising water from the river for use with the condensers. The condensing plant is of the counter-current surface type, with three-throw Edwards air pumps, manufactured by Mirrlees-Watson Company.

Each main engine is provided in the basement with a separate condenser and an electrically-driven, three-throw Edwards air pump. The discharge from the air pump gravitates into a large cast-iron tank in the boiler house basement, and is lifted from there to the hot-well over the feed pump house by means of electrically-driven centrifugal pumps.

An exhaust steam grease separator is placed between the engine and the condenser. Each engine is also provided with an atmospheric exhaust controlled by an automatic valve which opens in the event of the vacuum failing, so that the sets can run non-condensing.

An electric locomotive crane is employed in transferring coal from the barges into a hopper of an "Ingrey" automatic weighing and recording machine, which discharges it into a receiving hopper underneath. From this hopper the coal passes by means of a chute with regulating valves into an automatic filler which fills the buckets of the conveyor without spilling. The coal is then elevated vertically (by means of the conveyor, which is of the continuous gravity bucket type) to a suitable height to cross the public road through a covered way into the building, above the level of the overhead bunkers, each bunker being provided with a pair of suitable dumping cams, so that the coal can be deposited where required. The conveyor is directly driven by a direct-current motor of the enclosed type.

The electrical car equipment, which was mentioned above, was supplied by the British Westinghouse Electric & Manufacturing Company. The overhead equipment was installed by J. G. White & Co. The general manager of the railway is Mr. Andrew Nance. Mr. V. A. H. McCowen is the city electrician and Mr. H. A. Cutler is the city engineer.

Luminosity of Electric Lamps.

In a recent issue of *Comptes Rendus*, Mr. P. Vaillant reports the results of some interesting observations on the relation between the power consumed and the spectrum luminosity in various types of electric lamps, including the mercury lamp, the carbon and tantalum incandescent lamps and the Nernst lamp. In the Cooper Hewitt mercury vapor lamp he made the curious observation that the greater the power the lamp consumes the yellower is the light. Measuring the luminous intensities at wave lengths 577, 546 and 492 $\mu\mu$, respectively, he found that when the power fell from 200 watts to 99 watts, the luminosities in those three regions fell from 1,000 to 341, 398 and 449, respectively, thus leaving a distinct advantage to the blue light at the lower power. Since the blue light preponderates at the higher temperatures in all other glowing bodies, the author is forced to the conclusion that the less the power consumed the hotter is the vapor. It is certainly true that the mass of mercury evaporated diminishes as the consumption of power increases. As regards the other lamps, they all shift their maximum of luminosity toward the blue at the higher powers, and the shifting of the luminosity occurs most suddenly in the Nernst lamp. Taking the luminosity of the carbon filament for each wave length as a standard, the Nernst lamp at ordinary working shows a deficiency both at the red and blue ends, and the tantalum lamp a great preponderance of blue over red.

Transmitting Distance in Wireless Telegraphy.

By Capt. L. D. Wildman, U. S. A.
Signal Corps, U. S. Army.

In the *Electrician* of London, for December 15, 1905, there is a very interesting article on the recent advance in wireless telegraphy, by J. Erskine-Murray, D.Sc., in the course of which the writer has attempted to deduce a formula for indicating the limit of distance in transmission.

After deducing the equation

$$C = M\left(\frac{k}{\sin\theta} - 7^{\theta}\right)$$

where C = received current.
M = minimum current that will actuate receiver.
θ = angle subtended at center of earth by arcs over which transmission is taking place.
k = a constant.

he quotes Duddell's and Taylor's experimental results and ends by saying that this formula is doubtless very rough, and in many parts incomplete.

Many different formulas have been presented by different experimenters, but none of them appears to be of much value in designing a wireless plant to transmit a given distance. It is probably impossible to introduce into any formula the amount of absorption in the electromagnetic wave, by its propagation over any terrain where there exist natural objects. In other words, it is probable that no formula can be devised at present for wireless telegraphy over land. We must, therefore, confine Dr. Murray's formula to transmission over water, and probably over salt water.

From experiments conducted in Alaska, between the army stations at Fort St. Michaels and Safety Harbor, the present writer is of the opinion that Dr. Murray has left out one very important factor, which seems to have been generally neglected by everyone who has written upon the subject of wireless telegraphy. That factor is the absorption of energy from the aerial wire at the sending end, due to particles of water vapor, ice or snow driven against it (while charged to a high potential) by winds.

The experiments covered an entire year, during which were charted all of the atmospheric variables which appeared to have any effect upon this phase of the question, with the single exception of the percentage of moisture suspended in the air. This exception is an extremely important one, but during the major portion of the time in Alaska, the temperature was below 32°. no instruments by which the amount of percentage of moisture, ice or snow could be determined was available.

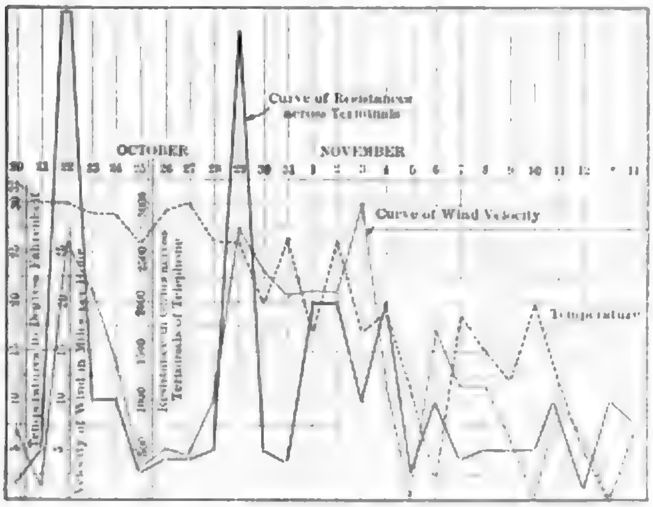


FIG. 1.—RECORD OF TESTS.

The chart (shown in Fig. 1) covers a period of about a month, from October 20 to November 14, and it will be seen that the strength of the signals received decreased with the velocity of the wind to a very marked degree. The device used for determining the strength of the signals was very simple, but is believed to have been fairly accurate. It consisted of a variable resistance, placed across telephone cords, as shown in Fig. 2.

By reducing the resistance when signals were being received, the strength of these signals could be cut down to a point where they were just intelligible. The amount of this resistance varied on different days, and by recording the resistance a comparative record was thereby obtained. For instance, on the 21st of October there was little or no wind, the temperature of the air was just below freezing, and signals could be heard with a resistance of only 400 ohms across the receiver cords. On the next day the velocity of the wind was 30 miles an hour, the temperature was about the same as that of the previous day, but the signals could not be distinguished with less than 8,000 ohms across the cords. This day was an exceptional one, in that the air was full of driving snow. Similar occurrences show all the way through in a fairly constant manner, and the record for 365 days seems almost conclusive proof that the factor of moisture and wind velocity must be taken into account in any formula. The instruments used in these tests were very crude, as it was not originally intended to carry on this experimental work in Alaska. The moisture had to be judged without instruments, but the anemometer used was reliable.

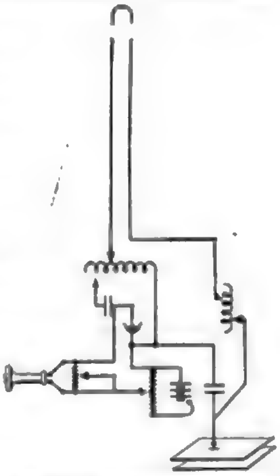


FIG. 2.—TESTING CIRCUITS.

The electrical constants of the sending mechanism were recorded at both stations, but these were so uniform that they have been left off the chart. It was impossible to make these experiments at both stations at the same time, for the instruments were sufficient for one only. The effect, therefore, upon the receiving antenna, as well as upon the sending antenna, is as yet an unknown quantity, and there is much room for experiment upon this subject.

Concerning the method of obtaining the relative strength of signals, the writer is also quite well aware that the method used is somewhat crude, for the operator's hearing is probably less acute on some days than upon others, and he was also bothered by the fact that the operating room had no doors between it and the rooms where the squad lived. The operator could also hear the land line telegraph sounder, and in the next room was the 6-hp gasoline engine used to drive the generator. The building was also of poor construction for that climate, and had a corrugated-iron roof which made much noise during high winds.

The results, however, show such uniform fluctuation between the signals and the wind velocity that there seems to be no room for doubt concerning the general effect.

One important change was made on account of these experiments. The poles for the aerial in Alaska were planned and erected with an idea that 50 or 100 wires would be suspended from the cross stay, for the purpose of getting a large capacity for radiation. The aerial was, however, cut down to a small grid about 10 ft. in height, with but two wires connecting it with the sending apparatus. For, if it is correct that the energy of the aerial is lessened by the number of particles charged by it (and carried away) the effectiveness of the aerial is decreased in direct proportion to the number of wires in the aerial.

The mechanical difficulties with a two-wire aerial are very much less than those connected with a 50 or 100-wire aerial, particularly in regions where there are, at times, wind velocities of 90 miles an hour, and where the aerial may be thickly coated with ice and frost.

Referring again to Dr. Murray's formula, it is believed that in designing any two stations the maximum factor of dissipation of energy due to wind velocity and particles of moisture, ice or snow, must be taken into account when determining the value of C.

Advantageous Use of Highly Magnetic Metal in Radiation Conductors.

By James Foster King.

THE employment of a structure having great magnetic inertia as compared with the admittance, for the radiator or reflector in a space telegraph transmitter constitutes quite an innovation in this method of communication, and as I have had occasion to perform some qualitative experiments along this line I feel constrained to offer the following deductions from the effects obtained.

With great reactance as compared with ohmic resistance, the effect of an excessive susceptance developing abnormal pressures in radiating antenna—especially at the free end and loops of the fundamental pressure waves—is well known in the art, and in referring to this particular method it may be said that owing to deficient electromagnetic inertia certain portions of the wave developed are liable to serious distortions due to foreign influence, although it is possible to develop an integrally perfect wave by increasing the relative distances through which foreign forces must work.

In order to secure good working efficiency with the approximation to a necessary sine wave shape it is of importance to have appreciable inductance per unit length of circuit traversed, and in the practice of the art it is held that in linear oscillators, the ratio of interior to exterior inductances along their length should be constant in order to secure uniform velocity of electrical redistribution along the reflecting surface. In closed circuit oscillators it is desirable to abruptly change this ratio along the length of circuit traversed in order to vary the velocity and thereby secure maximum kinetic energy from the potential energy involved.

It may be said that any method of increasing the kinetic energy without decreasing the admittance of the oscillator has the desirable effect of increasing the persistance of its oscillations.

In the use of bare copper wires of commercial conductivities for prime reflectors of oscillating currents, I have found, for sizes most generally employed, appreciable amounts of the current leaking into and uselessly heating the interior at frequencies higher than 10^6 per second. Usually when the strands in a cable reflector are numerous, thereby presenting a maximum amount of radiating surface to the surrounding medium, which in the case of air has inappreciable magnetic hysteresis, the amount of energy per cycle lost by radiation more nearly approaches that admitted from the supply so that this localized absorption is negligible.

The effect of plating the reflector with metals less dense than copper, offering less resistance to a high velocity distortion, allows a more perfect surface current conduction to take place. Plating a copper reflector with such a dense metal as silver, offering greater resistance to high velocity distortion, arrests penetration of the exciting energy and thereby produces a more perfect surface current. Each of these methods has effects limited by the physical constants of the metals employed and not by the controlling force of the exciting energy.

In order to develop maximum radiation per unit surface exposed for a defined amount of impressed energy it is essential to secure a strictly peripheral distribution of current on the reflector.

When charging an uninsulated cable suspended in air the electrical distribution on individual copper strands cannot be considered as strictly peripheral, for the ratio of the squares of the velocities of an electrical redistribution in air and in the mass of copper is smaller than infinity.

To develop a strictly peripheral current distribution and so obtain accurate values for both reactances per unit length of conducting shell, it is imperative that the velocity of propagation of electrical effects in the enveloping medium should be exactly approached by that of the surface current redistribution, and the velocity in space be infinitely great as compared with the rate of an actual change of state in the interior of the metal.

The linear ratio for a pure copper circuit immersed in an elastic medium of specific inductive capacity equalling unity is of the magnitude $3 \times 10^{10} = v$.

As it is impossible at the high frequencies employed to secure uniform current densities throughout the entire cross section of copper conductors of commercial conductivities and sizes owing to the demagnetizing fields developed in the interior by currents in the external layer of metal; it becomes possible to secure better efficiency by increasing the ratio of the square of the velocities of propagation of electrical effects on the two surfaces bounding the conducting layer in question to a value greater than v^2 thereby compelling a more perfect surface distribution of exciting current.

When the ratio of the reactances at the bounding surfaces is greater than the square root of the higher velocity, owing largely to the retarding effect of the magnetic field developed by the exciting current, there is imparted to the medium offering least resistance to high velocity distortion more energy than resides on the metallic surface.

One way to simulate this effect is to encase the metal reflector in a dielectric covering of greater specific inductive capacity than that of air and thereby increase the charge given to the local electrostatic field. All energy not expended in radiation and heating effects of resistance and hysteresis is in this case recoverable in the form of a dielectric discharge and reverse current on the metallic surface.

Where there is total recovery of effective energy from the electrostatic field, only the external magnetic field developed by current redistribution along the extended reflector is available to induce secondary effects in the distant receiving circuit.

A more effective way, however, is to retard the electrical redistribution and thereby force a moving charge to traverse a surface layer of minimum thickness which may be effected by an increase of constraining magnetic flux in the interior developed by unit exciting current.

In the use of highly magnetic metals for high frequency oscillation reflectors, the magnetic reluctance of the mass of the metal is very great owing to the naturally large value for coercive force. The magnetic reluctance to high velocity distortion, exhibited by metals having appreciable coercive force, so limits the lateral freedom to distortion of the interior structure as to render it electrically non-conducting.

A limiting feature of this method is in the great increase in effective resistance due to the decrease in cross section of the actively conducting surface layer.

By thinly plating a soft iron reflector with a more perfect alternating-current conductor such as tin the great increase in conductivity of the surface layer will allow a maximum exciting current for a given charge to traverse the surface metal—also strictly limiting appreciable current conduction to the reflecting surface.

Best efficiency may be obtained from a plated iron reflector if it is incased in a perfectly insulating cover having both inappreciable magnetic hysteresis and high specific inductive capacity.

A very important factor controlling the redistribution of the effective charge received by the reflector is the mode of application of the exciting energy. There are in general two modes of application employed in the various systems using alternating-current excitation.

Where the source of exciting energy is permanently connected to the reflector the charge received has time to permeate the reflector structure. In cases where the first effective oscillation is started by a fall of potential along the length of the reflector, caused by a sudden release from constraint of the surface component of the impressed charge, the swamping effect of interior currents coming into phase with the surface redistribution currents will blur very sharp sonority. The best way to reduce this swamping effect is to use insulated plated iron instead of bare copper for the reflecting structure.

When the reflecting structure is periodically connected with the exciting apparatus through a small spark gap by the formation of a highly conductive spark which makes connection only at the peak of the exciting wave, the redistribution of energy along the length of reflector depends on the instantaneous pressure value of the impressed charge and the reciprocal of the square of the velocity of surface current redistribution.

With reflectors of metal having appreciable specific heat capacity there is not time for an electromagnetic current penetration to occur in the natural period of oscillation of the exciting currents in the conducting shell.

It is best to employ a magnetically rigid metal such as iron or steel for the reflecting core and by plating this core with a superior electromagnetically conducting metal such as tin, it is possible to develop highest efficiency, irrespective of the mode of application of charge, in the reflection of sonorous electric oscillations from a radiation surface.

Another Electric Power Scheme for London.

Another plan for the general supply of power to London will form the subject of a bill to be put before Parliament this year, and which is stated to have strong financial backing. The plan in brief is to generate electric energy at a convenient spot outside London, under the most economical conditions attainable, and to transmit it to London at high pressure along a private right of way after which it will be distributed along the railways and canals to bulk consumers. By this means it will be possible to reach every part of London without breaking up the streets or coming into contact with local authorities.

Two other schemes with similar objects in view have previously been discussed. One is to build large generating stations at the coal fields, suggested by Mr. B. H. Thwaite, but which has been criticized on the grounds that it would be too costly. The other is to build a large generating station in London, against which it has been urged that owing to the high cost of land, high wages, high rates and taxes and high cost of fuel and water in the Metropolitan area, the installation of huge generating stations within that area is impossible; and that even on the banks of the Thames a convenient site would be too costly, and strange as it may seem the cost of fuel at such a site would be too high.

The present scheme has taken an intermediate position; and involves the selection of a site where coal and water can be obtained at the lowest possible rates while the cost of the transmission line would still not be unduly heavy. It was estimated that, balancing the cost of haulage of coal against the capital charges of the transmission line the minimum annual expenditure could be approximately attained at a site between 40 and 60 miles from the Metropolis; and, after exhaustive investigation, such a site was found near St. Neots on the river Ouse.

Not only were the conditions favorable here as regards both fuel and water supply, but the Great Northern Railway Company, which naturally looked with a most friendly eye upon the scheme, possessed a large tract of land at this spot which could be had at a low price, and possessed a private right of way from Stevenage in Hertfordshire to Enfield in Essex, originally acquired for the construction of a railway, but not yet utilized.

St. Neots is 51½ miles from King's Cross, which is the London terminus for the Great Northern Railway; Stevenage is 28½ miles, and Enfield 9½ miles from King's Cross. The nearest available coal fields lie between 40 and 75 miles from St. Neots so that the railway company obviously stands to profit by the haulage of the coal; nevertheless it is calculated that the coal will be delivered into the company's bunkers at an inclusive price of 7 shillings ($1.75) per ton or even less. To accomplish this result, special means will have to be adopted, the coal being hauled in large bogie wagons and handled by machinery.

Besides the coal traffic the railway company would benefit in various other ways. The sleepy little town of St. Neots would be roused into activity, and with the prospects of cheap power, it is natural to suppose that manufacturers will be eager to secure sites for factories in the neighborhood of the power station and along the transmission line, just as they have done at Niagara, and are expected to do in the case of the Lancashire and Yorkshire Power companies' stations. The Great Northern Railway will want electric power for operating its suburban traffic in the near future and other railways will be equally ready to take a supply. Further, the Metropolitan Borough Councils may confidently be counted upon as bulk consumers, for their position as distributors will not be affected except favorably. Most of the power stations in the London area are situated upon either railway or canals and will, therefore, be directly accessible to this company's transmission line.

The engineers of this scheme are jointly Messrs. Harper Bros., and Messrs. Kincaid, Waller, Manville and Dawson, both firms of mature experience and high capacity for the organization of such an undertaking. It will be remembered that Messrs. Harper Brothers are engineers for the North Wales Power and Railway Scheme, which is now nearly completed, and that Mr. Philip Dawson, of the latter firm, is the consulting engineer entrusted with the electrification of the London-Brighton and South Coast Railway.

Most probably steam turbines will be adopted for the generating plant, the power station being of 60,000 kw capacity to start with and having an overload capacity of 90,000 kw. The power will be generated at 20,000 volts pressure in the first instance, though most likely it will afterwards be raised to 50,000 or 60,000 volts. There has been much discussion as to what is the highest pressure that is safe in the old country, taking into consideration the climatic conditions. Some engineers state that 30,000 volts is the highest pressure practicable; but others think that 50,000 or 60,000 could be used safely, as England has not the extreme ranges of temperature, the violent snow storms and blizzards, or perpetual fogs met with in some places where this pressure is used, such as the Sierra Nevada Mountains in California, the "Houille Blanche" region in Savoy, or other Mexican, Canadian, Italian or American districts; and the London area is almost the driest in the Kingdom. It is, therefore, anticipated that while operations may be commenced with a pressure of 20,000 volts, when the load increases the pressure will be raised to 40,000 volts at least.

The transmission lines will be carried overhead along the railway and along the private right of way above mentioned to Enfield, at which point a receiving sub-station will be erected. Thence underground mains at 20,000 volts will be employed, laid in a 6-ft. way, or along the towing paths of the canals.

These propositions have all been put forward with the approval of the Board of Trade, which, of course, is absolutely necessary in England with a scheme of this nature.

With regard to the financial aspect it is estimated that the works costs will not exceed .25 cent per kw-hour generated (reckoning on a load factor of 35 per cent). Under these conditions, the selling price to bulk consumers will be well under 1 cent per kw-hour, after providing amply for depreciation and reserve, and allowing for a dividend of 10 per cent upon the capital invested, which is estimated at $10,000,000 to begin with.

The project is stated to be well backed, and will have the support of the railway companies, most of the supply companies, many of the borough councils and a number of well known financiers, whose names will be a guarantee for the financial soundness of the scheme.

Explosion of Radium Tubes.

In the issue of *Physikalische Zeitschrift* for January 15, 1906, Mr. J. Precht describes some experiences with radium which tend to show the enormous force of the emitted gaseous products when they are confined to a limited space. He reports that a small glass tube with walls 0.5 mm thick, containing 25 milligrammes of purest radium bromide, exploded after 11 months' use with a loud report. Three minutes before the explosion it had been removed from a bath of liquid air and placed on a wooden table. It had been used several times before. The force of the explosion was such that the glass was shivered into almost microscopic particles which were strewn all over the room, the radium being seen in the dark like a starry sky. The pressure in the tube must have been at least 20 atmospheres, and was no doubt due to the evolution of gaseous decomposition products of radium.

Gasoline-Electric Car.

The need, especially in sparsely settled districts where the cost of maintenance of a steam drawn train is prohibitive, and the investment of capital for an electric service is unjustified, for a self-contained car which shall be independent of a feeder system, and at the same time be cheaper to operate than the ordinary locomotive and train, has led the General Electric Company in conjunction with the American Locomotive Works, at Schenectady, N. Y., to design a gasoline-electric car as a solution for this go-between.

The first trial run of this experimental car took place February 3d, when a successful trip was made from Schenectady to Saratoga, N. Y., and return, over the lines of the D. & H. railroad. During the trip several important features of this method of driving were demonstrated. While the car was not designed for high speed, the average running time was about 35 miles an hour, and several times the car attained a speed of 40 miles an hour. The smooth and rapid acceleration was most favorably commented upon by the engineers present, as well as the complete absence of vibration which might be thought to accompany the use of a gasoline engine.

This car consists essentially of a gasoline-driven electric generator furnishing current to electric motors geared to the driving wheels and controlled by a method similar to that employed in the ordinary straight electric car equipment. The car in question, shown in the illustration, is of the combination type, comprising a passenger compartment, smoking room, a baggage room, engine room, toilet and a motorman's compartment. A complete controller equipment is located at each end of the car, the forward controller being located in the engine room. The car has seating capacity for forty passengers, including seats for twelve in the smoking room. In general it is built on the lines of a standard D. & H. passenger coach, and is handsomely finished.

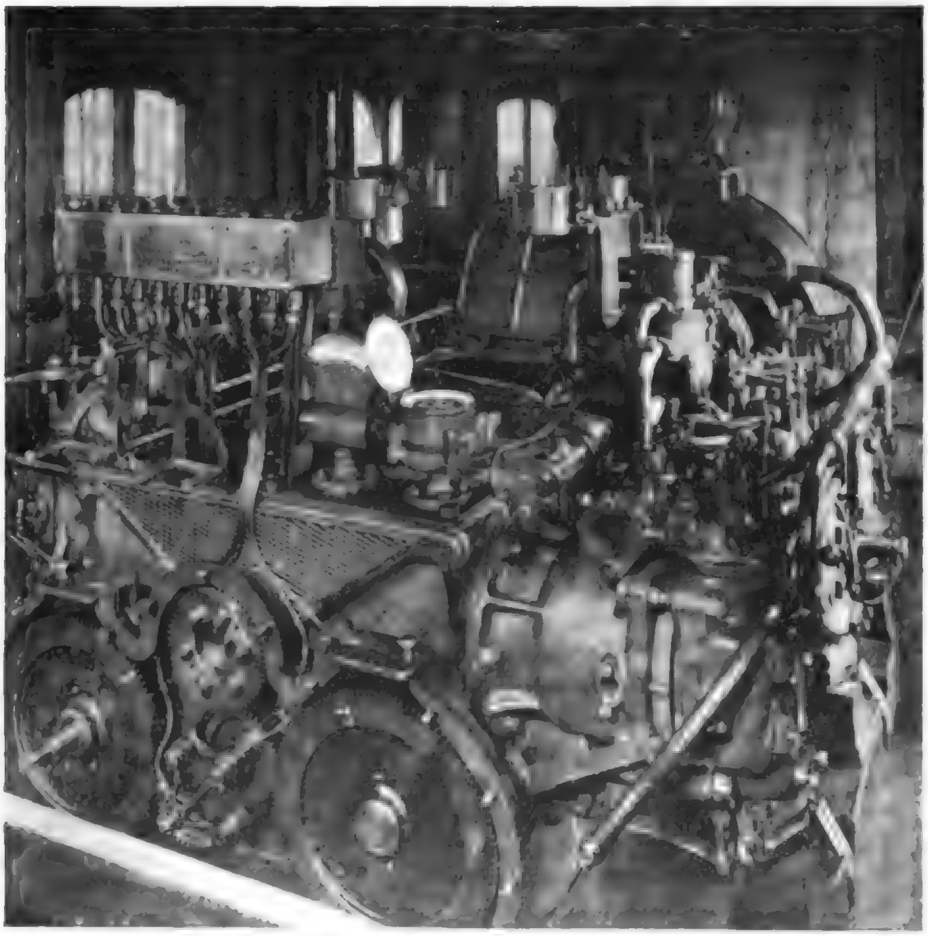


FIG. 1.—ENGINE ROOM OF GASOLINE-ELECTRIC CAR.

The gasoline engine for this car was built by the Wolseley Tool & Motor Company, Ltd., of Birmingham, Eng., and is considered the most powerful unit yet constructed for this class of work; it develops 140 brake horse-power when running at 450 revolutions per minute. The cylinders are horizontal, six in number, and arranged in three pairs, the two cranks forming a pair being at an angle of 180°. All valves are mechanically operated, and the cylinders are water-cooled. Hitherto difficulty has been experienced in starting internal combustion engines of this size, but in the present case this has been entirely overcome by using shells filled with black powder to provide the initial charge in one cylinder. On starting the engine the shell is fired by a hand trigger, the whole being similar to the breech mechanism of a gun. Jump sparks and low-tension ignition are both provided, current being furnished to the latter by a small magneto driven from the engine shaft. When speed is up the jump spark is cut out.

The volatilization of the liquid fuel is produced in two carbureters which form an integral part of the engine. Each carbureter supplies three cylinders, and is equipped with two float feed chambers, one for use with gasoline and the other for kerosene if its use is found desirable. The chambers are identical and are of the usual needle valve type. Very flexible arrangements are provided to govern the air supply so that it may be taken from the atmosphere or from the crank chamber, or from both, according to the temperature required. The mixture is heated to the required temperature in a small chamber which itself is warmed by the exhaust. The whole design is so planned that kerosene may be substituted for gasoline by simply turning a three-way cock.

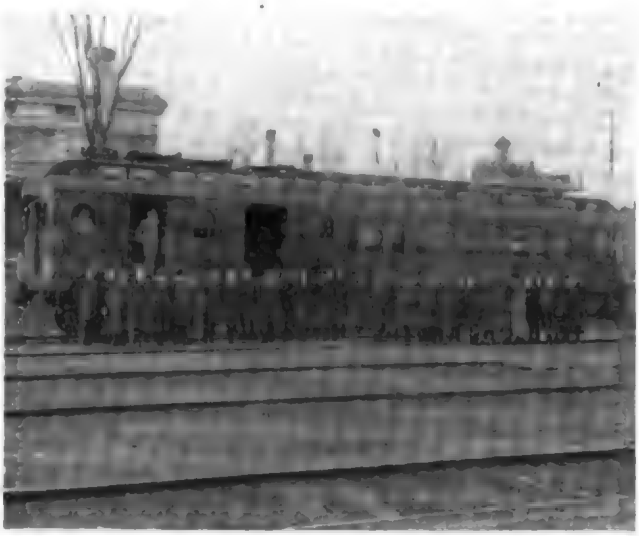


FIG. 2.—GASOLINE-ELECTRIC CAR.

In all details the engine is very complete. The lubrication is especially so, being force feed for main bearings and pistons and drip feed for all other working parts. Gasoline is stored in steel tanks beneath the car, and the burnt gases pass through the roof into mufflers from which they exhaust into the air. The cooling system for the cylinders consists of two sets of radiating tubes, one located on the top of the car, the other within, cooled by chain driven fans. Water for cooling is contained in the engine base. The heating system for the car forms a shunt with the cylinder cooling system.

Current is furnished by a 120-kw direct-connected General Electric six-pole unit, designed for 600 volts. This generator is provided with commutating poles, which in connection with the method of voltage control, permits a very flexible operating system. The advantage of commutating poles is evident when it is considered that the field excitation at starting is weak, and the large current at low voltage is required to give the necessary starting torque at slow speeds. Owing to the peculiar operating conditions of this system, the geenrator, while retaining the characteristics of a shunt-wound machine, is separately excited by a 5½-kw, two-pole, compound-wound exciter, working at 110 volts. This is located on top of the generator and is driven by a Morse silent chain.

There are two motors for the car, each designed to give 200 hp. These are of standard railway construction and need no special description.

For regulating the speed of the motors, as mentioned above, voltage control has been adopted; in other words, the speed of the car is governed by varying the field strength of the generator. With this method the speed of the engine remains constant after acceleration. The controller is semi-automatic, and can be set for any predetermined maximum acceleration. It is arranged for series-parallel control, the motor connections being changed from series to parallel by the reversing handle. This latter has five positions, "series ahead," "parallel ahead," "off," "series reverse" and "parallel reverse." Arrangements are provided to prevent the motor connections from being changed from series to parallel until the resistance is put into circuit.

Further operating details comprise a General Electric combination straight and automatic air brake equipment, and a special lighting equipment. Meridian lamps are used, equipped with "Holophane" reflectors, the whole affording a very satisfactory system for car lighting. The headlights are supplied with 100-cp incandescent lamps of the stereopticon type, one for each end of the car.

The trial trip demonstrated the practicability of this car equipment, and was entirely satisfactory to the engineers of both companies so far as the tests indicated. The opinion was expressed that this was merely a step toward the final electrification of all service. A gasoline car would be useful in establishing a passenger traffic, but eventually the motive power for operation would be electricity.

Protection of Telephones From Wireless Disturbances.

By C. R. Siegel.

The sending of wireless telegraph messages in some instances seriously affects the transmission of speech from telephones, protected by lightning arresters, located in the vicinity of wireless stations. The Morse signals cause a series of sparks, varying in length according to the signals sent, to jump from one or both arrester carbons through air-gap to grounded carbon. The signals are reproduced so plainly at the arrester and in the telephone receivers on the line effected as well as at other telephones connected therewith through an exchange, that one having knowledge of the Morse code can easily decipher the signals at either place.

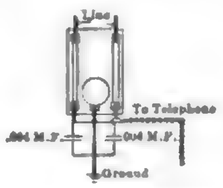
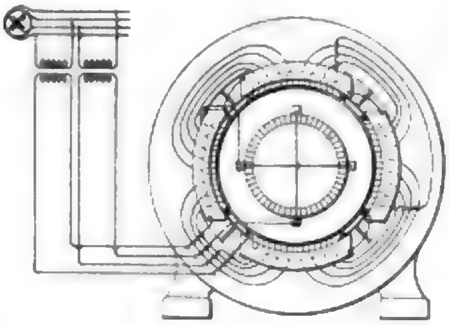


DIAGRAM OF CIRCUITS.

One remedy is to change the route of the telephone line from the zone of the ether disturbance, oftentimes at considerable expense. The sketch herewith shows a simple and at the same time inexpensive method of overcoming this trouble which has proved to be satisfactory. By its use the discharges are entirely eliminated, or rather dissipated, signals cannot be heard in the telephone receivers, and the transmission of sound is not impaired either locally or when connected with long-distance lines. Condensers of low capacity, approximately .002 to .005 microfarads, are connected between each side of line and ground, at or near arrester or point of discharge. Where two or more telephones are on the same line, the condensers are placed only at the instrument nearest the wireless station. The same results may be obtained by the use of Leyden jars.

Polyphase Commutator Motor.

In a patent issued January 30, 1905, to Mr. B. G. Lamme, is shown a method of operating a commutator motor by means of polyphase currents. One embodiment of the method is indicated in the accompanying illustration. The armature is of the four-pole type. It is connected in series with a stationary winding located in slots in the fuses of the field-magnet pole pieces and so distributed that the number of its ampere-turns in each pole face is equal to the number of ampere-turns in that part of the armature which is covered by the winding in such pole face. Thus the reactance of the two windings is reduced to a very low value. The armature and its compensating winding are supplied with current from one phase of a two-phase generator while the field winding of the machine is supplied with current from the other phase. The field magnetism is in electrical-time quadrature with the voltage impressed upon the field circuit, while the armature current is in phase with the voltage across its circuit. Therefore, the field magnetism and the armature current are in electrical-time phase, and being in electrical space quadrature they produce a torque at the armature. The machine possesses shunt motor characteristics with high power factor at the armature. The power factor of the field circuit is unaltered by the speed of the armature and since it is very low the polyphase circuits would always be out of balance. The inventor proposes to use low resistance plates to bridge the spaces between the tips of adjacent pole-pieces for the purpose of assisting in neutralizing the armature reactance and of preventing the "hunting" of the armature.



POLYPHASE COMMUTATOR MOTOR.

The inventor states that experience has demonstrated that the effect of the magnetomotive force of the armature current on the field magnetism may be so great under certain conditions as to set up a hunting action in the machine, during which the armature current rises and falls periodically. In such operation the magnetic effect in the interpolar spaces will also rise and fall periodically, and there will be a distorting effect in the field which will tend to cause the hunting action to continue. The low-resistance plates prevent the distorting effect, thus eliminating the hunting. The damping devices act also as a closed secondary to the armature as primary at the interpolar space, and hence they assist in neutralizing the armature reactance

Modern Underground Construction.

At the recent meeting of the Northwestern Electrical Association at Chicago Mr. W. D. Burford presented a paper on underground construction as used by a new electric lighting and power plant at La Crosse, Wis. This paper is especially valuable because it gives the cost of such construction as actually carried on in the small city where the placing underground of electric light and power cables is done only to a very limited extent. Numerous companies throughout the country are in cities approaching a size which will soon call for a consideration of underground circuits. The following is an abstract of Mr. Burford's description of the construction employed and its cost:

The power house, which is located two miles from the center of distribution, contains two 400-kw Westinghouse, three-phase, 2,300-volt, 60-cycle generators, driven by steam turbines. The switchboard is arranged with separate light and power panels and all power feeders are kept entirely independent from the light feeders through the entire system. The wires leading from the power house are supported for a distance of two miles on 65-ft. Idaho cedar poles, each three-phase circuit being arranged in an 18-in. delta. The top arm has four pins and the second arm two pins, so arranged that each circuit occupies its side of the pole. At the extreme edge of the brick paved district the overhead line is dead-ended and the underground cable system begins.

The conduit used is the McRoy salt-glazed vitrified clay conduit containing four or six ducts. This conduit is laid in a trench on a 2x12-in. hemlock plank treated with a preparation of Carbolineum. On this plank and at right angles to it are 2x2-in. hemlock cleats 12 in. long laid at intervals so as to bring them four inches each away from the joints in the conduit. The conduit is then laid on the cleats and the joints between two sections of conduit are wrapped with a muslin strip four inches wide, saturated in water and overlapped in such a manner as to prevent the entrance of cement into the conduit. An iron mould eight inches wide and two inches thick is slipped down beside the conduit and tamped into position. The space thus formed between the mould and the joint is poured full of neat cement composed of equal parts of clean, sharp sand and Portland cement. Two more cleats are placed on top of the conduit four inches each way from the joint and filled with cement. This now forms a complete bond of cement two inches thick and eight inches wide, hermetically sealing the joints in the conduit. A 2x12-in. hemlock plank is placed on top of the completed work resting on the top cleat and serving as a protection to the conduit in case of future excavation.

The manholes having dimensions five feet in diameter by five feet deep from the street grade to bottom of manhole, are built of sewer brick laid in cement mortar. The circular brick work is eight inches thick resting on a concrete foundation seven feet in diameter and six inches thick. The bottom of the manhole is drained by means of three inch vitrified bell-end pipe twelve inches long imbedded in the center of the concrete foundation. Manhole covers are of cast iron of the standard size and ventilated type.

The lateral pipes which are used for conducting the cables from the manholes up the distributing poles are 3-in. wrought iron, bent in a 90-degree curve, painted with asphaltum varnish, and brought to a point three feet above the ground and securely stapled to the sides of the poles. They are fitted with a 3x25-in. reducer at this point and the pipes from here up to the discharge bells or pot heads are 2½ inches in diameter, painted and stapled in the same manner. The top of the pipes are fitted with a wooden bushing which is driven in around the cable in halves in such a manner as to prevent the entrance of water into the top of the pipe. These pipes are carefully cemented where entering the manhole in such a manner as to make it water tight.

The cables are furnished by the John A. Roebling Son's Company, of Trenton, N. J., and are of the three-conductor, paper-insulated type, especially designed for three-phase systems of an e.m.f. of not less than 5,000 volts between conductors. Each wire is separately insulated with paper 3-32 of an inch thick, which is saturated with a heavy insulating oil. The interstices are filled with jute and the whole core is protected from the lead by a paper belt 2-32 of an inch thick. The lead sheath is ⅛th of an inch thick and contains three per cent of tin. The copper conductors consist of stranded wire to insure flexibility. The insulation resistance of these cables on the reels was guaranteed to be not less than 60 megohms per mile at 60 degrees.

The primary service boxes were furnished by the H. W. Johns-Manville Company. Each consists of a cast-iron box with a hinged cover, fitted with lugs which engage a toggle bolt and thumb screw, allowing the cover to be bolted firmly down to a rubber gasket. The box contains a porcelain lining in which are mounted the spring clamps for holding "Noark" fuses, the porcelain cover of the inner box being equipped with the lobster claw clutch which permits of the fuse being removed while under load without any danger to the lineman. The inner box is also fitted with rubber gaskets and the rubber covered wires are led in through the bottom through porcelain tubes, the whole making a perfectly water-tight box.

At various points in the outer limits of the underground districts are lateral poles where the cables connect with long aerial lines supplying the residence districts. At all such lateral poles the cables are terminated in discharge bells as above described, the rubber-covered leads being directly connected to three-phase Westinghouse outdoor-type oil switches, which are mounted in a similar manner to the transformers. This construction allows the linemen to disconnect any section in case of repairs or extensions.

In addition to bonding the cables in every manhole there is a No. 4-0 wire strung aerial from the end of the underground district to the grounded side of the generators of the street railway company, this conductor being securely bonded to the sheath of the cables in the first manhole. This precaution is taken to prevent damage to the sheath of the cables from electrolysis.

Table I.—Cost of Laying Multiple Duct Conduit per Lineal Foot.

No. of ducts.	Labor.	Mat'l.	Repaving Brick.	Repaving Macadam.	Sand.	Total.
4	$.25	$.39	$.39	$.20	..	$1.23
6	.28	.57	.39	.20	..	1.44
8	.45	.65	.39	.20	..	1.69

These prices are based on 2x12-in. hemlock planks for foundation for the conduit with a similar plank covering the work—hemlock at $20 per thousand; Portland cement at $1.60 per barrel. Conduit layers at 30 cents per hour; trenchers and common laborers at 17½ cents per hour; conduit at 5 cents per duct foot.

Table II.—Cable Cost per Foot.

	Underground Cable cost	Underground Cost of Pulling	Underground Total	Laterals Cable cost	Laterals Cost of Pulling	Laterals Total
100,000 C. M. 3 conductors cable	.473	.12	.593	.473	.17	.643
No. 4 B. & S. conductors cable	.253	.12	.373	.253	.17	.423
No. 6 B. & S. conductors cable	.209	.10	.309	.209	.17	.379
No. 8 B. & S. conductors cable	.178	.10	.278	.178	.17	.348

Following is a table of costs on distributing poles fitted with 2-2½ inch pipes 25 ft. from the ground and fully equipped and wired ready for transformers and service wires, not including cost of transformers:

Table III.

	Equipped for light Transf's.	Equipment for power Extra cost	Total.
50-foot 8-inch top Idaho pole set including steps, ground plate and wire ready for cross arms	$19.36	....	$19.36
Cross arms, pins, glass and braces for both distribution and transformer arms. All arms special Washington fir	12.87	$5.06	17.93
Service boxes and lightning arresters and connections	19.52	19.52	39.04
Wire, material and labor for connecting transformers to distributing arms	8.58	9.20	17.78
Angle iron platforms complete	7.90	....	....
2-2½ inches iron pipes complete with staples and wooden bushings	17.00	....	17.00
2-3-inch iron pipes from manhole to distributing pole complete with curved staples, reducers and alley repaved. Based on average of 14 feet from manhole wall to pole	35.46	....	35.46

The question of costs as it presents itself to the average manager is too generally answered off hand without any engineering consideration, and the underground proposition is turned down on the ground of excessive first costs.

It is a fact, however, that the question of costs is one which must be met sooner or later, and a careful analysis, taking into consideration interest, depreciation and maintenance, may reveal an entirely different situation than that which may first be imagined. To this end, and in order that a tabulated form may be had by means of which central station men may arrive at the actual cost of contemplated work, the above figures taken from the daily labor reports and material sheets are furnished for their information.

Mr. G. B. Springer, civil engineer of the Chicago Edison Company, in discussing the paper gave the following data on conduit construction in Chicago: The principal qualifications of a good conduit are practical indestructibility and freedom for disintegration from fire, water, acids, alkalies or electrolysis. A smooth inside surface is desirable to permit of easy drawing in of cable; also a style of conduit permitting of economical installation in crowded streets. The vitrified clay conduit has so far been found to be the kind most nearly attaining these requirements. These conduit are made in both single and multiple duct, the single being about 3.5 in. in diameter, or 3.5 in. square, and 18 in. long. Multiple conduit is made in two, three, four, six and nine duct sections, two to three feet long.

The single-duct conduit is best adapted for use in streets crowded with gas, water and other pipes, as the conduits may be divided into several layers crossing over or under the many obstructions found in the streets of large cities. A conduit construction which is made up of single ducts where each horizontal and vertical joint is broken, also has the additional advantage of preventing fire from spreading from one duct to another as might occur in multiple conduit. The multiple conduit is, however, well calculated to be used in outlying communities where there are not many obstructions, particularly in lines of from two to four ducts. This style of conduit is somewhat cheaper to lay than the single duct.

In laying the conduit a trench is dug sufficiently wide to allow three inches of concrete to be placed on each side of the ducts, and of sufficient depth to allow at least 30 in. of concrete on top of the top layer of concrete. Three inches of concrete is laid in the bottom of the trench also, thus insuring a concrete protection of three inches on all sides of the ducts. The trench is graded from some point near the middle of the block to the manhole at each intersection, or from one manhole to the other, as the case may be, at a gradient of about 2 in. or more to 100 ft. of trench.

In laying the single duct tile the ducts are placed close together, the joints and triangular spaces in the corners being plastered and filled with cement mortar, of a mixture of one part cement to one part of sand. A wooden mandrel about four or five feet long and three inches in diameter with a rubber or leather washer from three to eight inches larger on one end is drawn through each duct as the conduit is being laid; this is to insure any foreign particles or cement which may have gotten into the joints being drawn out. It also insures a good alignment.

A bricklayer is generally used in installing the single-duct conduit, the cost being slightly more for a bricklayer and helper than for three ordinary laborers as used in placing the multiple conduit. A good man, however, will lay from 1,600 to 2,200 duct feet of single-duct conduit in an eight-hour day.

Practically the same standard of construction is followed on all lines from two ducts up to twenty-five ducts, as many of these small duct lines, say from four to six ducts, extend for miles to outlying districts and frequently contain transmission lines of 9,000 volts.

In regard to the cost of conduit construction, as Mr. Burford says, there are many varying figures given off-hand. Indeed the vast difference in local conditions makes it very difficult to give a set of figures which will hold good in many places or in fact in the same place under different circumstances. There are often obstructions causing several feet difference in depth of trench, additional material and labor required, etc., to be considered as well as variations in cost of material, labor and number of ducts installed.

The following table, however, is submitted as a guide in approximating the cost of work of this character as a result of conduit construction covering ten years in Chicago. The cost of manholes is not included in this table, but is given in the one following:

Table for estimating cost of conduit, per duct foot, in different groups, in various pavements:

Kinds of pavement.	Number of ducts.								
	2	4	6	9	12	16	20	25	30
No pavement	$.18	$.18	$.18	$.18	$.18	$.18	$.18	$.18	$.18
Macadam	.24	.21	.20	.20	.19	.19	.19	.19	.19
Cedar	.26	.22	.21	.20	.20	.19	.19	.19	.19
Cedar reserve and granite......	.31	.24	.23	.21	.21	.20	.20	.20	.19
Granite reserve	.43	.31	.28	.24	.24	.23	.22	.21	.21
Asphalt and brick reserve	.68	.43	.37	.31	.29	.26	.24	.24	.23

The following table contains approximate figures based on conditions prevailing in Chicago, and may be used as a guide in estimating the cost of conduit construction in connection with the table preceding:

Table for estimating total cost of manholes in different kinds of pavements:

Kinds of pav't.	Size of manholes in feet									
	3x3'	3x4'	4x4'	4x5'	5x5'	6x6'	6x7'	7x7'	8x8'	9x9'
No pavement ..	$41	$47	$53	$64	$109	$133	$142	$160	$189	$222
Macadam	42	48	55	66	111	135	146	163	193	226
Cedar	43	49	56	67	112	136	146	164	194	227
Cedar reserve and granite ..	44	50	57	68	113	138	149	167	198	231
Granite reserve.	46	53	60	72	117	144	155	174	207	243
Asphalt and brick reserve..	50	58	67	80	126	156	168	188	224	264

The above figures are based on the same prices for repaving, labor, bricklayers, cement and sand, as given in the table for conduit, and upon the following unit prices:

Brick work including labor and material....	$12.50 per cu. yd.
Concrete tops and bottoms	$7.50 per cu. yds.
Back water gates	$6.50 each
Sewer grates	30 cents each
Sewer connections	$12.50 each
Sewer permits	$5.50 each
Manhole frames and covers.................	$15.00 each

Mr. Lukes said that there was a tendency to force electric light companies to put wires underground not only in cities of 25,000 to 50,000 inhabitants, but in smaller villages. It is rarely in these smaller towns justified by the income per mile of main, but it is necessary to please the public. The value of Mr. Burford's paper is apparent, in that it describes in detail a system of underground construction, telling not only how the work is done, but what it costs. The method described of having distributing poles located in the center of each block is by far the most economical and is practically standard in small towns. In congested city business districts it is necessary to put in a system of mains on the streets for individual service. It had been the policy of his company not to economize on main conduit lines. If it must economize, it did so in the outlying districts. For instance, in suburban districts where it is a matter of getting one or two feeders underground, it had used new sewer pipe to a large extent with cement around the joints. For main lines consisting of from four to twelve ducts, he believed it a good plan to surround the conduit entirely with concrete. If this is done, the conduit should be in shape to be used 25 years from now. He spoke favorably of the G. & W. pot-head for connecting overhead lines to cables on the poles. (This was recently described in the Electrical World and Engineer.) He said the cost of pot-heads made up as described by Mr. Burford was from $18 to $22 each, but the G. & W. porcelain pot-heads can be put up for very much less.

Mr. George Cutter asked for the opinions of central station men as to the best methods of connecting arc circuits in poles when coming from underground service and whether they favored a cut-out switch at the base of the pole or at the top near the lamp.

Mr. Lukes said that his company did not put in any switch at all. It connected the cable with the overhead wire by means of porcelain pot-heads of the type above referred to.

Mr. H. B. Gear, one of the inventors of the porcelain pot-head mentioned, upon request, gave further details about it. He reviewed some of the troubles experienced by the Commonwealth Electric Company in Chicago with ordinary pot-heads. The practice had been to take the cables off the pole in an iron pipe and make the joint to the overhead wire in a piece of 2-in. lead pipe filled up with "Mineralac." In some cases, these joints were enclosed in wooden boxes to protect them from the weather and in others they were left outside. The wooden boxes were found to be a source of more danger than protection. In case one joint broke down, the fire inside of the wooden box would burn the top off the entire pole, so that the pole would have to be reconstructed. In developing the new pot-head, the idea was to get a porcelain sleeve instead of a lead sleeve and so keep the grounded lead sheath further away from the live conductor. Furthermore, it was desirable to have some means for readily disconnecting the overhead and underground line for testing and other purposes. He then described the methods of installing his pot-heads, some 300 of which were placed in service in Chicago last year. The expense of installing these devices is nominal, both for labor and material, because any ordinary lineman can do the work.

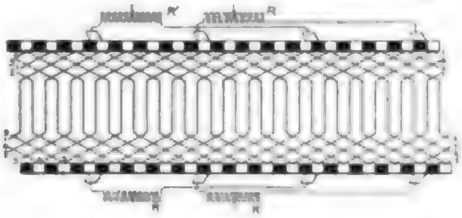
Mr. Cutter described a case in which trouble had been experienced with cut-out switches for arc lamps located in the base of iron poles due to the condensation in the pole, and to the moisture and rust which covered the switch.

Mr. Almert called attention to the trouble sometimes experienced from the freezing of water in the bend of the iron pipe in which the cable is led up the pole. When water collects in this bend and is allowed to freeze, it will in time compress the lead sheath enough to break down the insulation. He said that, as a general thing, arc lamp cut-outs located in poles where there was cheap construction were not successful and had been omitted because of the troubles with them, no work being done on live arc lamps under such circumtances. The later types of switches which were made entirely of porcelain with sufficient distance from the current carrying contacts to ground had been fairly successful.

Attention was called by President Williams to the boiling out of the insulating compound which sometimes occurs at pot-heads, no reason being apparent. Several others had noticed the same phenomenon, but no one could explain it to his satisfaction. Mr. Burford, in the case of some cables, thought it might be due to the oil insulation of the cable, and the contraction of the lead sheath forcing the oil into the pot-head. This did not explain many cases, however.

Non-Sparking, Alternating-Current Commutator Motor.

Mr. Marius Latour on January 30, 1905, obtained a patent for a method of preventing sparking in commutator motors. The inventor arranges the brushes so that no coils are short-circuited and yet the armature is not open-circuited as the brushes pass from segment to segment. The commutator has alternate live and dead segments, and several brushes of each polarity are distributed around the commutator, each brush having a width no greater than that of a commutator segment as shown in the illustration herewith. The circuit through the armature is always closed, although the circuit through each brush is alternately opened and closed, because there is employed a second set of brushes connected in parallel with the first, so arranged that one set is in engagement with live segments at the instant that the other set is in engagement with dead segments. Sufficient resistance is inserted between the parallel-connected brushes to limit the short-circuit current to any desired amount, and provision is made to decrease the amount of this resistance as the motor comes up to speed.



DEVELOPMENT OF ARMATURE WINDING.

High-Potential, Large-Capacity Water Rheostats.

The accompanying illustration shows two water rheostats used to dissipate the energy delivered by a 2,000-kw, 2,200-volt, two-phase turbo-alternator, in a test to determine the heating of the machine under continuous load. Each rheostat consists of about 1,000 gallons of water contained in a canvas-lined wooden tank 10 ft. long, 4 ft. wide and 3 ft. high, constructed in such a manner that it can be easily set up and taken down, thus making it comparatively portable. In the center of each tank are placed two iron plates electrically connected to form one terminal of the rheostat. At each end of each tank is placed a similar plate of iron, the two plates being joined together to form the other terminal of the rheostats. The resistance of the rheostat is adjusted by moving the end plates toward or away from the center plates, as desired. After the plates have been placed in the proper position, the resistance remains constant without any further adjustment on account of the fact that the quantity and quality of water are kept constant by providing a continuous flow through each tank at such a rate that the height is unaltered by the rapid evaporation.

These interesting rheostats were devised by Mr. F. M. Farmer, of the Electrical Testing Laboratories, for use in connection with an acceptance temperature test on a 2,000-kw turbo-alternator, sold by the Westinghouse Electrical & Manufacturing Company to the New York & Queens Electric Light & Power Company, of Astoria, Long Island City. Two tests were made in which these rheostats were used, one at normal load—1,000 kilowatts and 2,200 volts per phase for nine hours and the second at 25 per cent overload—1,250 kilowatts and 2,200 volts per phase for nine hours. The service conditions were such that nine hours was all the time that the machine was available for testing purposes, arrangements being made to connect in the water rheostats immediately after the night light went off in the morning. Furthermore, the fluctuating load in the power house would have been unsatisfactory for the test.

WATER RHEOSTATS IN SERVICE.

In the conduct of the test, the change in resistance of the armature and field windings of the alternator was taken as a measure of the rise in temperature of the machine, thermometers placed in the air intake and outlet being also employed to serve as a check on the resistance measurements and to indicate the service performance of the machines. The path of the air through the machine is completely enclosed, and the air is forced through the windings and core by the motion of the rotor.

It has been found desirable to enclose the generator in order to eliminate from the engine room the excessive hum which accompanies the high speed incident to direct connection with a steam turbine. By use of forced draught with well designed intakes and outlets the decrease in the capacity of the alternator in comparison with what would be obtained in an open structure is inappreciable, while the noise is rendered unobjectionable.

We are indebted to Mr. Wilson S. Howell, of the Electrical Testing Laboratories, and to Mr. E. H. Witherall, of the New York & Queens Electric Light & Power Company, for numerous courtesies extended in the preparation of this description.

LETTER TO THE EDITORS.

High-Voltage Direct-Current Traction.

To the Editors of Electrical World:

SIRS:—The recent articles that have been printed setting forth certain claims as advantages of alternating current over direct current for railway purposes have, of course, attracted universal attention, owing to the national reputations of the two gentlemen, Messrs. Westinghouse and Sprague, and the writer merely asks the privilege of "cutting in" at this time to incidentally suggest to the gentleman on the alternating side that, in view of the fact that they are strict believers in "cycles," it may not be out of place to call their attention to the fact that Mr. Sprague is now approaching the second "cycle" of prophecy, if I may be allowed to use such a phrase, and history may repeat itself.

Those of us who were fortunate enough to know Mr. Sprague in the early 80's will not soon forget his prophecy in regard to electric transmission of power, and his first success as a prophet, as far as the public recognizes the fact, became known in 1887, and about everything that he had been told so universally that he could not accomplish, he was in a fair way to demonstrate that he could. In 1897 his second prophecy developed; we are now approaching 1907, and the writer, for one, believes that, before the close of that year, it is very probable that the public may once more become acquainted with Mr. Sprague's prophetic instincts, and recognize the fact that although Mr. Sprague cannot "run a train around a square corner, nor possibly climb a tree," he can satisfy the general public, that he has a slight idea of what he is talking about when he touches on the subject of electric transmission of power.

It may be presumption to attempt in the slightest degree to outline the possibilities that lie within Mr. Sprague's intellectual capacities, but the writer believes that Mr. Sprague will surprise some of our alternating friends on the subject of direct-current railway work.

The writer is a thorough believer in Mr. Sprague, when it comes to a question of transmission of power for railway purposes, and having known him for many years, has yet to learn of his making any serious break, when he took it upon himself to talk on the subject matter in hand.

NEW YORK CITY. FRÉMONT WILSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Calculation of Electric Machines.—SOLBERG.—A note giving a formula of universal application for the calculation of all kinds of electric machines, operating on the principle of electromagnetic induction. This formula for direct current states that the capacity in kilowatts, $Kw = 4n \phi AW \times 10^{-11}$, and for alternating current, kilovoltampere, $Kva = \sqrt{2} \pi f_u f_w n \phi AW \times 10^{-11}$. In this formula n is the frequency, ϕ the magnetic flux surrounded by one winding, AW the total number of ampereturns of armature or stator or transformer core, f_u the form factor of the e.m.f. wave and f_w the winding coefficient. This formula is of general validity. To apply it in practice, it is preferable to replace the total flux, ϕ, by cross-section multiplied with flux density and to substitute ampere-turns per cm. multiplied by length for the total ampere-turns. The formula enables one to make useful comparisons between machines of different types, for instance between direct-current motors and polyphase induction motors.—*Elek. Zeit.*, January 18.

Calculation of Dynamos.—ISAMBERT.—A mathematical article giving a method for predetermining quickly the approximate dimensions which the principal elements of a dynamo must have in order to make the cost of the material a minimum. The method is stated to have proven useful in practice for an approximate advance calculation or for checking in a general way the dimensions which have been arbitrarily chosen.—*L'Ind. Elec.*, January 10.

Single-Phase Commutator Motors.—NIETHAMMER.—The first part of what promises to be a long paper illustrated by diagrams giving "the exact theory of the commutation and exact diagrams of single-phase commutator motors." The author first gives the general theory of single-phase commutator motors, without making any distinctions between the different types. He then discusses the torque and deals with the problems of commutation and the methods of avoiding sparks.—*L'Eclairage Elec.*, January 20.

Calculating the Coefficient of Self-Induction of Coils Embedded in Iron.—WITTEK.—For the determination of the dimensions of alternators it is very important to calculate as exactly as possible the armature stray field and the e.m.f. induced by it. The author gives a mathematical method which enables a calculation of the coefficient of self-induction of coils embedded in iron with an exactness sufficient for practical work.—*Elek. Zeit.*, January 18.

Induction Motors.—SUMEC.—The first part of a mathematical paper on the armature reaction in polyphase induction motors. After general introduction the author gives the voltage diagram of the generator and formulas for calculating the excitation.—*Elek. u. Masch.*, January 21.

A 500-Volt Generator Set.—NUTTING.—An account of a generator set arranged to make the use of storage batteries unnecessary for all kinds of vacuum-tube work and even for accurate conductivity tests. The set consists of 10 units, each of 500-volt bipolar shunt-wound 110-watt dynamos driven by a 2-hp motor.—*Bull. Bureau of Standards*, No. 3.

Lights and Lighting.

Spectra of Electrical Conducting Gases.—NUTTING.—The third of a series of papers on the subject of the preponderance of one spectrum over another in a mixture of two spectra. The two spectra discussed in the present case are that of the electrodes and that of the gas atmosphere in an arc. The results show that the same general laws hold for the distribution of the spectral energy between electrodes and gas as hold for other mixed gases. The amount of electrode vapor present depends upon current and electrode fall of potential, being a surface effect proportional to the energy used in metal gas conduction. The conditions favoring a pure gas spectrum, free from the spectrum of the electrodes used, are (1) small current density at the electrodes, (2) substance of electrodes to be of some metal like aluminum, copper, or platinum showing small vaporization, (3) electrodes to be at a considerable distance apart and only the middle portions of the discharge are to be used. Gas density, capacity, inductance, series spark, and other conditions have but little effect, and hence may be adapted to other requirements. All three conditions above stated are realized in the Plücker tube, the loss in luminosity caused by the use of small currents being compensated for by the central constriction. In the ordinary arc or spark under the most favorable conditions, it is difficult to obtain a gas spectrum more than 80 per cent pure, whereas by decreasing the current and separating the electrodes, practically 100 per cent purity may easily be realized. To obtain a pure electrode spectrum, we must have (1) large current density and (2) electrodes near together. Oxygen appears to be the most favorable gas to use with the majority of metals, probably on account of the greater cathode and anode fall of potential in this gas. The above conditions are realized in the arc and spark, 95 per cent purity being easily obtainable.—*Bull. Bureau of Standards*, No. 3.

Mean Hemispherical C. P.—STEINHAUS.—For the comparison of the different types of lamps the mean spherical or hemispherical c.p. must be used. But with arc lamps a comparison on the basis of mean hemispherical c.p. may lead to entirely different conclusions for practical purposes. The author begins to discuss an example showing that even with one and the same type of arc lamp—in which the position of the maximum of emission of light is changed by varying the diameter of the carbon or the material of the globe—a comparison on the basis of the mean hemispherical light intensity may lead to erroneous results.—*Elek. Anz.*, January 20.

Power.

Water Power in Switzerland and Other Countries.—The Federal Councils of Switzerland have presented to the assembly a proposition to forbid the selling of electrical energy generated from water powers from Switzerland to other countries without special authority from the State. This authority will be granted only as long as there is no use for the power in Switzerland itself and shall be granted for limited periods not over 20 years. The Federal Councils may revoke the franchise, but must then grant an indemnity.—*L'Industrie Elec.*, January 10.

Pumps.—HERZOG.—The first part of an illustrated article on Sulzer high-pressure centrifugal pumps for which an efficiency of not less than 80 per cent is claimed.—*Elek. Zeit.*, January 14.

Traction.

Alternating-Current Traction.—BELL.—A general discussion of the problem. Alternating-current traction has its chief and commanding advantage in the greatly simplified distribution, an advantage that rises in importance with every extension of electric traction into wider fields. Concerning the Leonard system the writer says that it has a very perfect and delicate speed control and a high efficiency. "It is, however, open to the objection that the equipment required cannot be stowed away under a car, and gives considerable weight to be carried. If the very ingenious 'permutator' recently developed abroad should meet the hopes of its friends, the weight situation would be very greatly relieved, and the fact is that for the heavy railway work in which locomotives are desirable the Leonard system has some extremely strong points which it is not the part of wisdom to overlook." For ordinary routine work it has been necessary to turn to the single-phase commutator motor. The general principles of its design are outlined. "The single-phase alternating-current motor has two inherent difficulties which no amount of finesse can entirely circumvent. In the first place, there is necessarily a loss from hysteresis in the iron and from residual eddy currents that renders the machine clearly less efficient than a direct-current motor of the same output, by an amount that may be roughly estimated at between 5 and 10 per cent. Secondly, owing to the fact that the energy supply derived from a simple alternating current is intermittent, the output of such a motor is, other things being equal, less than that of a direct-current motor of the same effective weight of material, by 25 per cent, more or less. As single-phase motors are practically built, the great care in design and the high grade of magnetic material used tend to lessen the differences both of efficiency and of weight here referred to, the inherent disadvantages being thereby transferred to the cost." If the experiment on the New Haven road succeeds and "if the single-phase locomotives now under construction come fully up to their requirements, the work of heavy electric traction is likely to be revolutionized."—*Eng'ing Mag.*, February.

Combined Gasoline and Electric Automobile.—HOSPITALIER.—An illustrated article on the type of automobile in which a gasoline engine is employed in combination with a dynamo and storage battery, the dynamo and battery being used only as reserve and for furnishing power at starting and on grades. An automobile of this type recently exhibited by Pieper in Paris is described in detail. The gasoline engine and the dynamo are mounted on the same axle, and the latter, which is shunt-excited, is connected to a storage battery. The dynamo operates either as motor or generator according to whether its e.m.f. is smaller or greater than that of the battery. A great variation of power is therefore obtainable. The battery is always maintained in state of charge in the same manner as in tramway stations. The dynamo is supplied with interpoles and this construction permits variation of the speed by changing the excitation by means of the controller. The speed may thereby be changed from 400 to 1,600 revolutions per minute. The construction is described in detail and illustrated.—*L'Ind. Elec.*, January 10.

Installation, Systems and Appliances.

Central Station and Tramway Statistics in England.—The second sheet of annual statistics. It contains a table of 19 towns in the United Kingdom taking electricity supply "in bulk," and another table of the 122 electricity works supplying both lighting and tramways. A large amount of information concerning equipment, system, connections, etc., is given. In an article in the same issue diagrams are given showing the increase of the connections to British electricity stations. An interesting result of the statistics is the large proportion of connections to municipal undertakings in the Provinces, compared with the connections to plants owned by companies, while in London the situation is reversed. The figure for connections to stations which supply both continuous and alternating currents has greatly increased. This is partly accounted for by the number of cases by which additional alternating plant has been installed in stations, formerly generating only direct current, in order to supply outlying districts, and the cases where additional direct-current plant for traction purposes has been installed in stations from which previously only alternating supply was given. The general tendency, however, of grouping together existing direct current networks through sub-stations to large high-tension two-phase and three-phase generating stations, both in London and in the Provinces, is perhaps the largest factor in this direction. Another interesting result of the statistics is the much higher proportion of motor load to lighting load in the case of companies than in the case of municipal stations in the Provinces.—Lond. *Elec.*, January 19.

Direct-Current Testing Room for Central Stations.—JOHNSON.—An article advising central station engineers to equip a special room for making regular tests. As "most meters now in use on consumers' premises tend to read slower as their life increases, the saving effected by these tests would probably account for a large portion of the missing units generally attributed to distribution losses." The author describes the testing room of the Burnley station. The scheme consists mainly of a variable motor-generator or booster and a storage battery. The motor receives current through a high-tension plugged board which is also used for lamp tests, etc. The generator feeds another plugged board, by means of which any standard ammeter and choking resistance can be plugged in circuit with any instrument to be tested or with any cell to be charged. The arrangement is described in detail and illustrated by diagrams. It is thought that the whole capital invested in this testing plant could be recovered in a very short time from the revenue of the testing of large station watt-hour meters.—Lond. *Elec. Rev.*, January 19.

Avoiding the No-Load Loss of Transformers.—BOURGUINON.—An illustrated description of an apparatus of Mariage for automatically connecting and disconnecting several transformers with a network according to the changing load.—*La Revue Elec.*, December 30.

Wires, Wiring and Conduits.

Cable Insulating.—MAYES.—An article pointing out that by far the larger proportion of interruptions of supply of current in electric lighting systems are directly attributable to the developments of faults in the outside distributing mains. The author has had some experience with systems carried out upon the culvert principle with bare conductors supported upon insulators. In such a system it is not always practicable to maintain the continuity of the culvert, for instance when passing over the top of a cellar recourse is usually had to insulated cables carried in cast-iron pipes. Experience has proved that when an earth develops upon such a system, it is located either in one of the runs of iron pipe just mentioned or else in one of the house service wires which are also carried in iron pipes. The inference is that the combination of an insulated cable or wire drawn into a metal pipe and buried in the soil is very unsatisfactory. The fact is that moisture will make its appearance inside of the iron pipes. The author says that infinitely better results would be obtained by substituting creosoted elm trough for the pipe and filling in solid with a bitumen. The troughing must not be near together, but must be joined by means of oak pins. Several cable insulating systems on the market would give equally good or possibly even better results.—Lond. *Elec. Eng.*, January 5.

Distribution Network.—Prohaska.—The first part of an article describing a method of projecting and estimating the financial prospects of a small distributing network (for instance of a small village) connected by a transmission line to a high-tension system.—*Elek. Anz.*, January 11.

Alternating-Current Networks.—Lichtenstein. The first part of a theoretical article in which the author proposes to discuss the most fundamental conceptions used in the calculation of alternating-current networks. In the present installment the author discusses especially the proper definition of the self-induction of a single wire.—*Dingler's Polyt. Jour.*, January 20.

Electrophysics and Magnetism.

Constitution of Electron.—Kaufmann. An account of experiments in which he has repeated his measurements of the mass of the electron at various speeds with greatly increased accuracy, in order to decide, if possible, between the rival theories of Abraham, Lorentz and Bucherer with regard to the structure of the electron. As a source of electrons he used radium, and instead of an electromagnet he used two highly-aged permanent magnets. He photographed the magnetic and electric deflection curves on films cast on plate-glass, and compared them with the curves demanded by the three theories. The final result is stated as follows: The value of e/m for infinite slowness, as derived from cathode-rays experiments, is 1.885×10^7. The curves of deflection of the beta-rays of radium, interpreted according to the theories of Abraham, Lorentz and Bucherer respectively, give 1.823, 1.660 and 1.808×10^7 for the same ratio. The theory of Lorentz, according to which the electron in motion is reduced in the direction of motion, but not laterally is, therefore, least probable. The experiments do not, however, decide between the theory of Abraham, who assumes an absolutely rigid electron, and that of Bucherer, who assumes that the electron in motion becomes a Heaviside ellipsoid with unchanged volume, and thus incompressible. But so far, the figures support Abraham's theory.—Lond. *Elec.*, January 19; from *Sitsungsber. der Akad.*, Berlin, November 16, 1905.

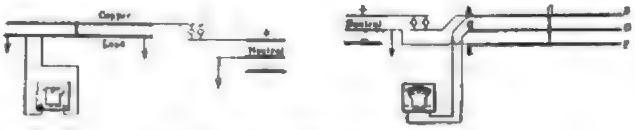
Infra-Red Emission Spectra.—Coblentz.—An account of an investigation of infra-red emission spectra having for its aim the study of the region of the spectrum lighting beyond 2 μ which heretofore had never been examined. Two classes of radiation were investigated, viz.: the arc between metallic electrodes and the chlorides of the alkali metals in the metallic arc and the discharge through a vacuum tube using different vapors and gases. It was found for the arc between metal electrodes that the oxides emitted a black-body spectrum of sufficient intensity to obliterate any emission lines if any were present. Seven different gases were studied in a vacuum tube. Among the same, nitrogen was the only one which has strong emission lines in the infra-red. The changes due to a variation of pressure or current were studied. The emission spectrum of C_2H_5OH shows that the vapor in a vacuum tube can emit continuous spectrum.—*Phys. Rev.*, January.

Frequency in Discharge Tubes.—Reiger.—In the case of non-continuous discharges through gases it is usual to employ a telephone in series with the discharge tube and to consider the sound in the telephone as an indication of the frequency of the discharges in the tube. The author shows that this is wrong, since the period of a discharge may be different in the discharge tube and in the connecting wires. The number of discharges in the same time may be different for different parts of the discharge tube itself.—*Phys. Zeit.*, January.

X-Rays.—Sagnaz. Two papers read before the International Congress for radiology and ionization in Liege. The first paper describes experimental methods for investigating the transformation of X-rays and the resulting secondary rays. The second paper deals with the classification and mechanism of various electric effects due to X-rays.—*Phys. Zeit.*, January 15.

Units, Measurements and Instruments.

Localization of Faults.—Black.—In the second part of his paper on maintenance of underground mains in Glasgow (the first part of which was abstracted in the Digest last week), the author deals with the localization of earths by the loop test. The faulty main is disconnected from the network and the loop made up in the usual way. The slide wire and a millivoltmeter or galvanometer are connected across the loop, and current for the test is provided by connecting the positive outers of the network to the slider of the bridge through a couple of incandescent lamps. Sometimes in opening at the spot indicated at the test, no sign of the fault is seen. It may be only a yard or so away, but there may be nothing for a guide to indicate in which direction to open up further. If the main be lead-covered, Fig. 1 shows the connections for a simple test to indicate this. It is presumed that the lead sheathing is earthed at both ends of the cable. A small bank of lamps taking about 2 amperes is connected to the core of the main at the nearest disconnecting box. The current on getting to the fault will split in two, and travel along the lead to the two ends of the cable. A low reading millivoltmeter connected across, say, 3 ft. of the exposed lead will indicate in which direction the current is passing, and will show the side the fault is on. Short circuits, which are also "earths," may also be found by the loop test, if a loop can be made by some adjoining cable or other means. Owing to cross streets intervening, it is not always possible to stretch a temporary cable along the street, and Fig. 2 shows a test which has been successful in such cases in finding "shorts" in triple-concentric cables. *AB*, *CD* and *EF* are the three conductors in the cable, *EF* being the neutral. *H* is the point of short-circuit. *EF* is coupled up at one end to the general neutral of the system. Two or three incandescent lamps are connected between the nearest positive live main and the positive conductor of bad cable. A millivoltmeter or galvanometer is connected across *AC*, its reading being g^1. The test is repeated at the other end, the lamps being connected to *B* and the reading, g^2, taken across *BD*. The length, *AB*, is known; then $AH = AB \times g^2 \div (g^1 + g^2)$. The author then mentions an interesting device used in Glasgow for indicating the presence of water in manholes on the route of the high-tension mains. A multiple core cable containing a wire for each manhole has been run from the generating station, where there is an indicator board and electric bell. In each manhole is a float, which closes the current when the water rises to a certain height. The corresponding indicator drop falls, and the bell rings, giving warning of the presence of water in the manhole. (In an editorial note this device is called a luxury which will be appreciated when the expense of putting it in is warranted. There is, however, a cheaper alternative, used in Berlin, in which the ordinary low-tension pilot wires have done the duty of the multiple signalling cable in addition to fulfilling their usual function.)—Lond. *Elec.*, January 12.



FIGS. 1 AND 2.—LOCATING FAULTS.

Automatically Changing Resistance.—Kallman.—In electric stations it is important for testing purposes to have as constant a load as possible on the testing circuit. On the other hand, if the current is taken from the supply network, the voltage in the latter may fluctuate 3 or 5 per cent above or below the normal value. The author has designed the following device for getting a constant power supply for testing. The fundamental idea is the same as is used in connection with the Nernst lamp to protect it against voltage fluctuations of the network by the use of special resistances. These resistances are made from a metal with a very high temperature coefficient, especially iron, so that within certain limits the resistance is changed by the heating effect of the current in such a way that the current is maintained automatically constant in spite of the fluctuations of the voltage. These resistances are made of very fine iron wire enclosed in spiral form in glass globes in an atmosphere of hydrogen. A certain number of such resistances are used in parallel, and the whole set is connected in series with a resistance of zero temperature-coefficient, made for instance of constantan. At the terminals of this resistance the voltage will be constant, while the current in the same resistance is also constant, so that the same is the case for the power. Results of practical tests show that arrangements based on this principle do all that is needed in practice. The article is fully illustrated.—*Elek. Zeit.*, January 18.

Thermo-Galvanometer.—An illustrated description of the Duddell thermo-galvanometer for measuring alternating currents of small magnitude, in cases where the high resistance of electromagnetic instruments is an objection, and where a sufficient potential difference does not exist to render an electrostatic instrument suitable. Duddell's instrument has practically no self-induction, and can be used to measure currents down to 20 micro-amperes at frequencies up to about 120,000 periods per second. Another important advantage of the instrument is that it can be accurately standardized by continuous current and used without error on circuits of any frequency or wave form. At the same time, it is very dead beat, and is unaffected by magnetic fields. The apparatus is shown diagrammatically in Fig. 3. In the field between the pole pieces, *N S*, of a permanent magnet is suspended by means of a quartz fibre, *Q*, a single-turn coil or loop of wire, *L*, to the lower ends of which is fixed a thermo-couple. This loop is surmounted by a glass stem, *G*, which carries a mirror, *M*. Beneath the lower junction of the thermo-couple is fixed the heating resistance or "heater," one end of which is connected to the frame of the instrument to avoid electrostatic forces. The current to be measured passes through the "heater," raising its temperature, causing the lower junction of the thermo-couple to rise in temperature above the upper, thus producing a current round the loop, *L*, which is deflected by the magneto field against the torsion of the quartz fibre, *Q*. The deflections of the instrument are practically proportional to the square of the current when the heater is central under the junction. The sensibility of the instrument depends on the resistance of the "heater," and on its distance from the thermo-junction. The "heaters," are set up in small protecting cases with contact rings, so that they can be interchanged quickly when it is desired to greatly alter the sensibility of the instrument. An adjusting screw is provided so that the distance between the "heater" and thermo-junction can be varied, and by this means small changes in the sensibility can be made without altering the "heater" or changing the shunts in use for the experiment. Shunts may be used with the instruments for measuring low-frequency (under 1,000 periods) and continuous currents, but for high-frequency currents, such as those employed in wireless telegraphy, there is great uncertainty as to the ratio in which the current will divide between the instrument and shunt circuits. In actual use, the thermo-couple is protected by a heavy metal plate, and a cover is used to protect the instrument from dust and radiation. The mirror, *M*, is plane, but the instrument is used in conjunction with a lens, which gives an image on a scale at a distance of 1,000 cm, when used with the ordinary lamp and scale. A number of different heaters can be used, varying in resistance from 1 to 1,000 ohms, so that the sensibility of the instrument can be varied from 22 micro-amperes per 10-mm. deflection to 2,000 micro-amperes per 10-mm. deflection. The heaters from 40 ohms downward are metal wires, those above 40 ohms consisting of a deposit of platinum on quartz. The instrument can be used for measuring the currents in the receiving aerial in wireless telegraphy, for telephone currents, for the currents used in X-ray tubes and medical induction coils, and a variety of similar purposes.—Lond. *Elec.*, January 19.

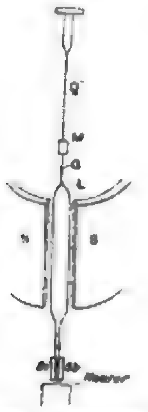


FIG. 3.—THERMO GALVANOMETER.

Induction Watt-Hour Meters.—ROSA, LLOYD AND REID.—A preliminary account of a long series of experiments on the influence of wave form on the reading of induction watt-hour meters. The results show that with suitable precautions induction meters may be made to repeat their readings very accurately, so that precision methods may be applied in studying them. The variations due to wave form depend not only on the harmonics which are present and their magnitude, but also on their phases. For commercial purposes all the meters so far studied may be considered accurate on any ordinary wave form where only the third harmonic enters appreciably, although two meters show variations of about three per cent when the harmonic amounts to as much as 50 per cent of the fundamental.—*Bull. Bureau of Standards*, No. 3.

Miscellaneous.

Electric Clocks.—An illustrated description of several electric clocks devised by Sallin.—*L'Elec.*, January 6.

Surveying Deep Bore Holes.—PORTER.—An illustrated description of a new instrument for surveying deep bore holes. It contains a compass, plummet, small cameras, and electric light, the whole connected with a small adjustable clock, so that the light may be turned on for a given period after the apparatus has been lowered into the hole. It has been used in surveying a number of holes in South Africa and has proven very satisfactory. Both dip and deviation are recorded by means of photographs of the positions of both a plumb-bob and a magnetic needle at any desired point in the bore hole. The photographs are taken by means of two small electric lamps lighted by a time contact. —Lond. *Elec. Rev.*, January 19.

Export of General Electric Apparatus.

A group of recent orders taken by the General Electric Company, through its foreign department is interesting as illustrating the part taken by the electrical interests of the United States in the foreign markets of the world. The variety of uses for which this electrical apparatus is intended is also significant.

From Australia, through the Australian General Electric Company, an order for Wellington, New Zealand, calls for a Curtis steam turbine generator of 500 kw capacity for use in furnishing electric light and power.

Japan furnishes orders through Bagnall & Hilles for the electrical equipment of a large coal mine, including a generator of 180 kw output, to furnish power for a number of induction motors aggregating 200 hp. In addition other Japanese orders for induction motors amount to 575 hp in sizes from 20 to 50 hp.

South American orders include electric railway apparatus for the Bahia Tramways, Bahia, Brazil, through Guinle & Co., of Rio de Janeiro, consisting of three motor-generator sets of 300 hp each and three sets of 225 hp each, with necessary switchboard and electric car equipments for 36 cars of a total capacity of 80 hp each.

For a lighting plant at Lincoln, Argentine Republic is included a gas engine-driven 130-kw generator ordered through the South American General Electric Supply Company, Buenos Ayres. For Lima, Peru, one order includes 16 two-motor equipments of 80 hp each for electric cars.

For use in Africa the South African General Electric Company, Johannesburg, has ordered nearly 100 induction motors of an aggregate capacity of 2,175 hp. One order from India consists of four water wheel-driven 1,000-kw electric generators, and two of 150 kw each; six 60,000-volt transformers, each of 1,000 kw capacity, in addition to line material, such as wires, insulators, lightning arresters, etc., for a 65-mile transmission system and a complete outfit for 2,000 kw of sub-station equipment. This is for the Jhelum River Power Installation at Kashmir, India.

For the Prussian Government Railways of Germany there are being constructed six Sprague-General Electric control equipments each for two 125-hp motors and thirty Tirrel voltage regulators. The Metropolitan Railways, London, England, has ordered through the British Thomson-Houston Company, electric car equipments for twenty cars, each consisting of four 200-hp motors and Sprague-General Electric Type M control system and for forty trailer cars. The French Thomson-Houston Company has ordered three 1,000-kw Curtis steam turbine generators for installation at Marseilles, France.

The foreign markets nearer home have been equally active, is is shown by the following orders, which are typical of this part of the General Electric Company's foreign business. The Canadian General Electric Company has ordered a 500-kw Curtis steam turbine generator for the Winnipeg Electric Railway in Manitoba. From Mexico through the Mexican General Electric Company, orders have been received for apparatus consisting of two 300-kw generators complete with exciters and generating station equipment for the Cananea Consolidated Copper Company, Sonora, Mexico; for the Winas Tecololes y Aneas, Chihuahua, Mexico, a lot of induction motors totaling 1,000 hp and two mining locomotives; for Negociacion Minera de Guadeloupe, Mazatlam, Mexico, two 200-kw generators with exciters and switchboard and 19 induction motors aggregating 400 hp; for Mexico Electric Tramways, Mexico City, four two-motor, 40-hp railway equipments.

The Cooper-Hewitt Single-Phase Converter.

Historically speaking the Cooper-Hewitt converter is a result of the development of the Cooper-Hewitt lamp. The devices made by Arons and others, which antedated that of Mr. Hewitt, were not capable of continuous operation as lamps. They served merely to study certain aspects of the physical phenomena involved in this novel apparatus. Mr. Hewitt showed that in order to get an operative lamp it is necessary to provide an adjustment of the cooling surface to the quantity of heat generated, which result is accomplished by providing a chamber out of the path of the current in which there might be a dissipation of heat without a corresponding development of heat. Increasing the length of the tube of a lamp does not serve the same purpose as this condensing chamber, since with the increase of length there is also an increase of heat generated. In the six or more years, during which time Mr. Hewitt has been giving attention to these phenomena, he has developed a practical lamp well adapted to general use, which has become an important factor in commercial electric lighting. Mr Hewitt has further made extensive investigations as to the general character of the phenomena of his apparatus, and has determined many of the laws governing them. Much of these data has been given to the public in various publications. Several important patents, covering a portion of his work, were issued on September 17, 1901, applications having been filed April 5, 1900, and January 25, 1901.

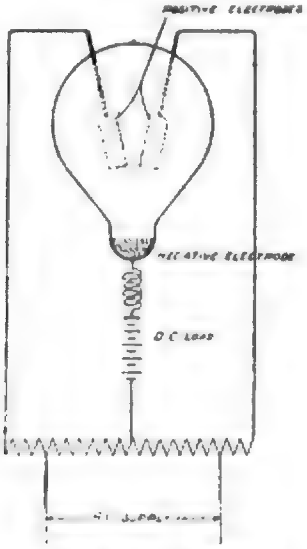


FIG. 1.—DIAGRAM OF CIRCUITS.

An indication of the nature of the investigations was first publicly given by Mr. Hewitt before the American Institute of Electrical Engineers on April 12, 1901, at which time mercury-vapor lamps of various sizes and shapes were shown in successful operation, and their high efficiency demonstrated. On this occasion it was explained that in a tube of uniform section the resistance varies inversely with the current, the volts tending to remain constant; and that the proper voltage for the lamps varied directly as the length and inversely as the diameter of the tube. It was shown that the resistance of the vapor in the lamp can be made to vary in a predetermined manner within wide limits by varying the proportion of the vapor subjected to the current and the heat-radiating capacity of the lamp.

The peculiarity exhibited by the vapor apparatus in respect to initial reluctance to the establishment of current, which is the most striking characteristic of the apparatus, was the subject of systematic experimental investigation undertaken at an early stage of the work. On January 3, 1902, Mr. Hewitt presented before the American Institute of Electrical Engineers a paper in which the difficulty in causing the first rush of current was attributed to a negative electrode resistance which must be overcome before an appreciable value of current can be caused to flow through the vapor. The fact that the lamp was not directly operative by alternating current was attributed to the existence of this negative electrode resistance, which has an inappreciable value so long as the current flows but immediately increases enormously when the current ceases.

The Cooper-Hewitt vapor-converter, with which this article primarily treats, was, as stated, the direct outcome of the Cooper-Hewitt lamp. Although the character of the circuits and the function performed by the converter differ in many respects from those of the lamp, nevertheless, as regards the degree of vacuum required, the use of a mercury negative electrode, the general character of the positive electrodes and other features, the two types of apparatus are similar. In the lamp the reluctance to starting was in some respects an obstacle; in the converter the whole function depends upon this resistance, and the invention of the converter was an extremely ingenious means of rendering useful this troublesome characteristic of the lamp.

Although the operation of the converter depends upon the perfection of the negative electrode resistance of the positive electrodes, no current at all can be passed until the electrode resistance of the negative of the converter is overcome. This result may, of course, be accomplished by any of the methods used in the mercury-vapor lamp. For a short time the lack of automatic means of accomplishing this purpose economically at each alternation, as would at first glance appear to be necessary, retarded the development of a practical type of apparatus. Mr. Hewitt soon realized, however, that the use of a three-phase, or other polyphase supply of electromotive force connected to three positive electrodes would return current from the negative of the converter to the neutral point of the supply and when once the apparatus was started it would operate continuously, since at no instant would there fail to be an e.m.f. in the right direction upon at least one of the positive electrodes.

The announcement of the polyphase converter was made in these columns on January 17, 1903, at which time the characteristics of the device were discussed in detail. In the polyphase converter there is never any interruption of current at the negative electrode, and, therefore, no trouble is experienced in keeping the converter in continuous operation. In a simple single-phase converter, however, the current would be interrupted at the end of the first alternation, whereupon the negative electrode resistance would assert itself

The first announcement of a commercial single-phase converter was made at the Niagara meeting of the American Institute of Electrical Engineers in June, 1903 In this converter two modifications of the simplest form of single-phase circuit are sufficient to cause continuous operation Two positive electrodes are provided, connected to the terminals of a transformer winding whose middle point is connected to the negative electrode of the converter, thus furnishing substantially two single-phase e.m.f's oppositely directed, connected respectively to the two positives. A choke coil is connected in the negative lead, the result of which is to delay the decreasing current from one positive electrode, until the increasing current in the other is sufficient to maintain the converter alive. Although the details of the converter shown at Niagara have been somewhat changed, its general operating features have been retained in the present commercial type. It is with the constructional features and operating characteristics of the device as now used that the present article deals more particularly.

This outfit is primarily a battery charging outfit, and as such must work against a counter e.m.f., and must be provided with means for adjusting the strength of the current. This latter function is accomplished by means of adjustable inductance placed in the supply circuit. An auto-transformer is used for adjusting the voltage of the supply to that required for the particular battery to be charged, at the same time providing the neutral point for connection to the negative electrode through the battery. The choke coil placed in the negative, which is called the "sustaining coil," is located as shown in Fig. 1. By referring to Fig. 1 it will be easy to trace the course of the currents in the auto-transformer. Assume for this purpose, that this auto-transformer is replaced by a separate primary and secondary, the secondary winding having the same voltage as the auto-transformer shown. Evidently during all the positive alternations one-half of the secondary will be passing current through one positive electrode, the converter itself, the sustaining coil, storage battery, and back to the neutral point of the secondary winding; and during all negative alternations the other positive will supply current through the converter itself, the sustaining coil, storage battery and back to the neutral point of the secondary. The current in either half of the secondary, since this is a transformer, will be balanced by current from the supply in the primary winding. It will be noticed that both halves of the secondary have the same primary, so that though current is intermittent in any part of the secondary winding, there is practically an alternating current in the primary. Assuming that the transformer is changed to an auto-transformer, the current in any portion of the winding will be the vectorial sum of the currents flowing in primary and secondary, as already described. From this it will be seen that no portion of the auto-transformer is traversed by intermittent currents, provided the supply voltage is that across the positive electrodes.

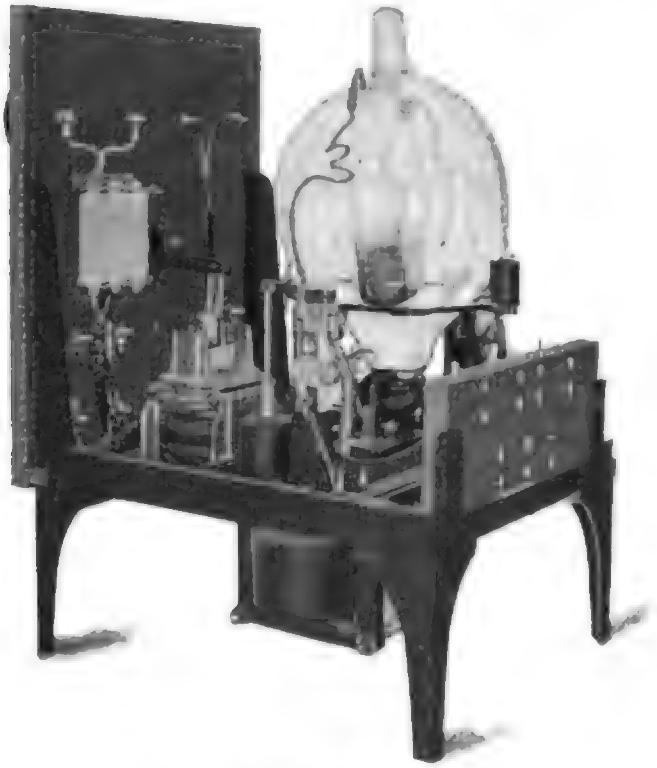


FIG. 2.—VIEW SHOWING DETAILS OF CONVERTER.

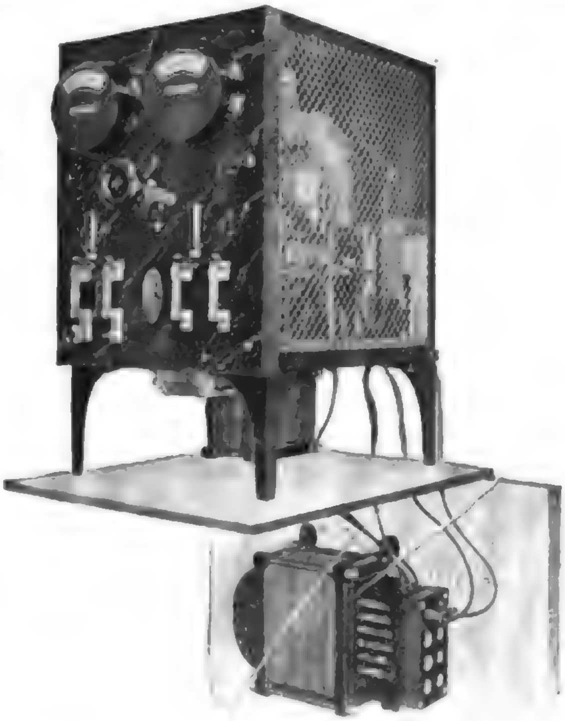


FIG. 3.—FRONT VIEW OF CONVERTER EQUIPMENT.

The efficiency curve of a mercury vapor converter has unusual characteristics, since the energy loss in the converter is proportional to the current and not to the square of the current; that is, regardless of the value of the current, the converter consumes a constant e.m.f. of about 15 volts across itself. The efficiency will remain constant for all loads, except for the effect of the heat losses in the auto-transformer, the sustaining coil, the regulator and other incidental apparatus. This is an important feature of an apparatus which is often used at less than full load. It is evident, further, that the higher the direct voltage of the battery, the higher the efficiency of the apparatus. It is found that including the auto-transformer, inductance coil, etc., the efficiency of this commercial type of vapor converter when delivering direct-current at 115 volts, is about 80 per cent.

Views of the converter in its present form are shown in Figs. 2 and 3. The bulb is supported in a circular framework which is mounted upon trunnions allowing the bulb to be tilted when desired. The object of tilting the bulb is to cause the mercury from an auxiliary positive electrode to come into contact with that of the negative electrode and thus to start an arc which will destroy the initial electrode resistance at the negative, thereby allowing the main positive electrodes to come into operation alternately. The tilting is accomplished automatically by an electromagnet which comes into play immediately when the switches are closed. A cut-out device operated by the main current of the converter serves for interrupting the circuits to the tilting magnet and to the supplementary electrode, when the bulb is in normal operation.

For the purpose of controlling the strength of the current there is used a reactance coil, the inductance of which is variable at will by means of a handle which serves to change the position of the magnetic core within the coil as desired. By this means it is possible to get a continuous adjustment of current throughout the range of the apparatus even with a wide variation of battery and supply voltage.

It is worthy of note that, when the converter is used for supplying current to storage batteries, it is impossible for the batteries to discharge back through the converter, due to the fact that the positives electrodes cannot become negative on account of the presence of the initial negative electrode resistance. When the alternating voltage decreases below a certain value, or fails entirely, the converter ceases to operate, but it starts again automatically when the voltage return to its normal value.

A Self-Exciting Alternator.

Our issue for last week contained an account of the theory upon which depends the operation of the self-exciting alternator devised by Mr. E. F. Alexanderson and described by him before the recent meeting of the American Institute of Electrical Engineers. We give below a discussion of the practical features embodied in the construction of this interesting type of machine.

The revolving field of a 100-kw alternator with its segmental rectifying commutator is shown in Fig. 1. The field poles and their windings differ in no respect from what are used with any ordinary type of alternating-current generator. The commutator is built on a straight shell, and the segments are held together by two steel rings shrunk on the ends of the bars. These rings serve as an electrical connection between the different segments, one of the rings being connected to every other segment, and the other ring to the rest of the segments. The two terminals of the field winding are connected to two segments of opposite polarity, and consequently to the respective end rings. In this way the end rings can be used at any time as collector rings for separate excitation. The spaces between the segments are electrically equivalent to air-gaps, but in order to support the brush mechanically the dead spaces are filled with a number of small copper bars separated by mica insulation.

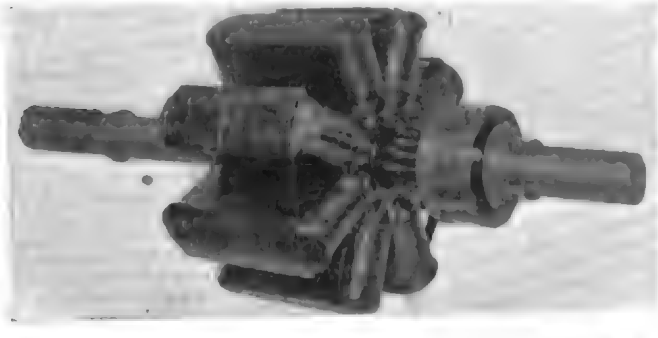


FIG. 1.—REVOLVING FIELD OF 100-KW, SELF-EXCITING ALTERNATOR.

The current which passes through the commutator to the field winding is derived from a special exciting winding placed in the same slots with the main armature winding. The exciting winding is of the three-phase type and is connected in "star," the neutral point of which is formed by a three-part rheostat. Thus in series with each coil of the exciting winding is connected a certain resistance the effective value of which is varied automatically according to the load. Each section of this rheostat is in effect connected in circuit also with one coil of a three-phase series transformer, the primary of which carries the load current.

The circuits as joined to one section of the rheostat are indicated in Fig. 2. The series transformer sends a current through the rheostat in a direction more or less opposite to the field current, thereby eliminating the proper proportion of the voltage drop in the rheostat. The elimination of the voltage drop in the rheostat changes over more or less of the field current from the rheostat to the series transformer. The secondary current of the series transformer is in phase with the line current, while the field current is practically in phase with the voltage. The amount of boosting in the field current will, therefore, depend not only upon the value of the secondary current, but also upon the power factor of the load. A function of the rheostat which is just as important as the field control is its influence on the commutation, as explained in our last issue. As far as commutation is concerned, the full resistance of the rheostat may be considered as always being in circuit, although the larger part of the field current may flow through the series transformer.

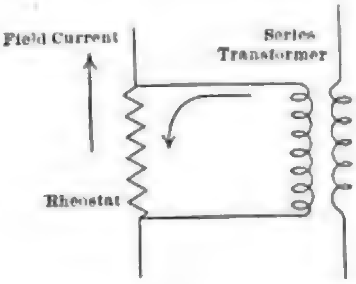


FIG. 2.—CIRCUITS OF COMPENSATING RHEOSTAT.

The commutation consists in changing over the direct current from one phase of the exciting circuits to another, and should occur a little later than at the moment in which the induced voltages are equal in the two phases undergoing commutation. The moment of commutation should be delayed to such an extent that the difference in voltage between the two phases begins to force through the completed circuit formed by the two phases and the rheostat a cross current, which is superimposed on the field current, and will weaken the current in one of the phases and strengthen it in the other phases, so that one of the phases will carry the entire current and none will pass through the brush which is leaving the segment.

It is stated that these machines have shown favorable results in parallel operation with ordinary machines, and also with other self-exciting alternators. The machines can also be used as synchronous motors. A self-exciting synchronous motor can be either shunt connected or compounded. Compounded synchronous motors will be found to be especially useful for boosting the voltage at the ends of long transmission lines. In this case the series transformer which is used for compounding is connected in series with the main line, so that an increase of current in the rest of the system raises the excitation, with a consequent increase of leading current in the synchronous motor.

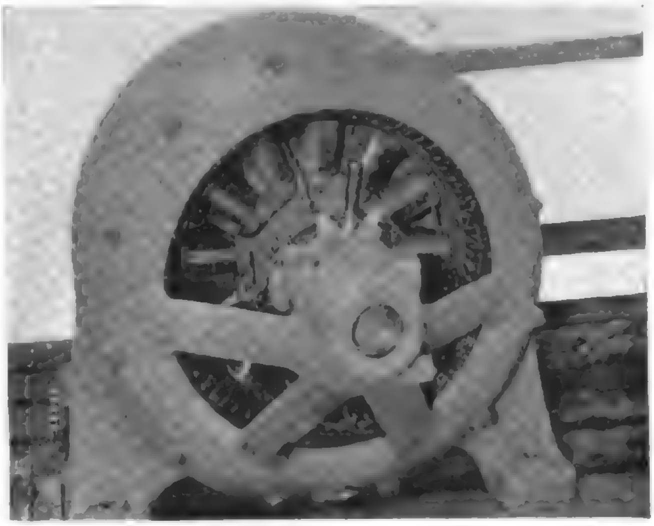


FIG. 3.—200-KW, SELF-EXCITING ALTERNATOR.

The method of starting a self-exciting synchronous motor is the same as that of starting an ordinary synchronous motor until the speed approaches synchronism. The ordinary synchronous motor is an induction motor brought up to an approximately synchronous speed through the inductive relation of stator and rotor windings. When the field is excited the revolving part receives alternately positive and negative impulses as the poles slip over the synchronous positions, until one positive impulse is strong enough to pull the machine into step. In synchronizing the self-excited synchronous motor, the same phenomena will occur as in the self-excited generators. When the torque due to inductive effect begins to decrease on account of the decrease of slip the excitation impressed through the commutator becomes active, and the field will receive a series of impulses—all in the same direction—which increase in strength with the decrease of slip until synchronism has been reached.

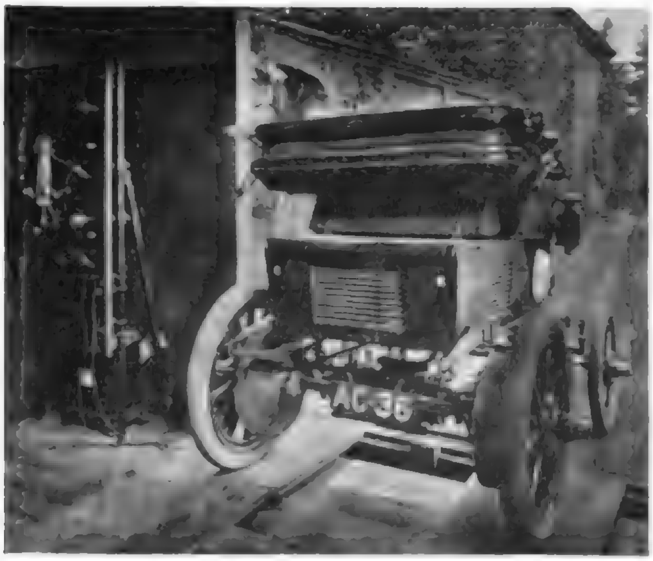
The fact that the machines described have passed the experimental stage, and that one of the leading electric concerns is manufacturing them as standard apparatus, gives promise that more data regarding the practical and commercial operation will soon be available.

Automobile Mercury-Arc Rectifier Set.

The accompanying illustration shows a mercury-arc rectifier set installed by the British Thomson-Houston Company installed for charging automobile storage batteries from alternating-current supply mains. The principal parts are the panel, tube and holder, and compensatory reactance.

The panel is of slate, 4 ft. x 2 ft. x 1½ in. with ⅜-in. bevel, mounted on 1-in. supporting pipes. It contains a voltmeter, ammeter, double-pole switches for connecting to battery and alternating-current mains, and the necessary double-pole and single-pole switches for starting and operating the rectifier. Fuses and circuit breaker are supplied for protecting the rectifier against heavy overloads. A starting resistance is mounted on one of the pipe supports, and is connected in multiple with a pilot lamp mounted on the front of the board. The starting resistance is used to start the rectifier before the load is thrown on. The pilot lamp connected in shunt across the starting resistance remains lighted until the load is substituted for the starting resistance.

The mercury vapor tube has two anodes, one cathode and one starting anode, and is provided with metal caps for the terminals, which protect the electrodes, thus reducing to a minimum the liability to breakage and burn-out. The leads from the anodes are connected to a compensating reactance, while the lead from the cathode forms the positive side of the direct-current circuit. The holder consists of a moving member mounted on the face of the panel and provided with spring clips for holding the tube. Terminals for connecting the various parts of the tube to the panel are mounted on the panel.



AUTOMOBILE-CHARGING OUTFIT.

The compensating reactance is connected directly across the alternating-current supply mains and is either mounted on the back of the panel or placed on the floor under the panel. Leads are brought out from the reactance to a dial switch mounted on the front of the panel. By means of this switch the voltage and current may be varied within the limits of the rectifier. A tap is brought out from the center of the reactance and forms the negative side of the continuous current circuit.

The complete outfit occupies a floor space of approximately 24x18 in., and is 76 in. high. This type of rectifier is designed for operation on either 110 or 220-volt, 50-cycle, alternating-current circuits. It has been found that for batteries requiring a range of voltage from 45 to 115 volts continuous current, approximately 220 volts alternating current will give the best results, while for smaller batteries requiring a range from 16 to 45 volts continuous current, approximately 110 volts alternating current is most satisfactory. The direct-current voltage may be said to range from approximately 20 to 55 per cent of the applied alternating supply, according to the connections used; while the alternating current, under similar conditions, is from 40 to 65 per cent of the delivered direct current. The outfits operate satisfactorily on any frequency from 25 to 150 cycles. The efficiency of the mercury arc rectifier, on account of a constant loss of approximately 15 volts in the arc, depends largely on the direct-current voltage used. Thus, although the efficiency is only about 60 per cent at 30 volts output, it is 80 per cent at 115 volts. The shape of the efficiency curve differs from that of the motor-generator set in this important particular, namely, that the efficiency at partial loads is as high as the full load efficiency. The same is true of the power-factor, which is extremely high for a converting apparatus of this capacity and seldom falls below 90 per cent, and often considerably exceeds this value.

Where it is desired to charge at a higher rate than 30 amperes, it has been found that two or more rectifiers can be operated in multiple very satisfactorily. The standard panels are readily adaptable for multiple operation by a few slight changes.

High-Pressure Blower.

An interesting form of high-pressure air blower is shown in the accompanying illustration. The blower consists of a cast-iron shell or housing in which are two rotating members or "rotors." One of these, the impeller, which revolves in the larger portion of the casing, does the real work of compression. The other rotor, known as the idler, does no work. It successively provides spaces or chambers of proper shape at the desired points in the revolution, so that the impeller blades may return to the suction side of the blower without allowing the escape of compressed air.

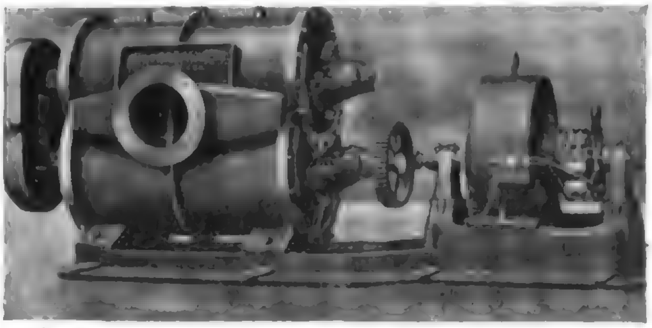


FIG. 1.—HIGH-PRESSURE BLOWER.

The idler or drum, revolving in the smaller part of the casing, is symmetrical and has a periphery nearly a complete circle. It consists of three hollow vanes or blades cast in one piece with the shaft, and is turned at the same speed as the impeller by means of two spur gears running in oil and encased for protection against dirt and accident.

The impeller, mounted on the driving shaft, is made up of three diamond-shaped bars or blades and a central web which is keyed to the steel shaft. As it revolves three separate pockets are formed in the annular space between the shell and a core extended lengthwise of the lower part of the casing.

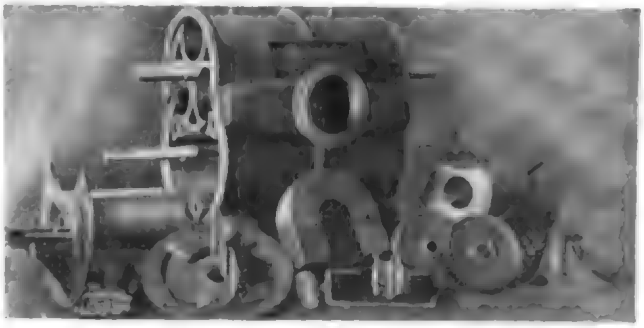
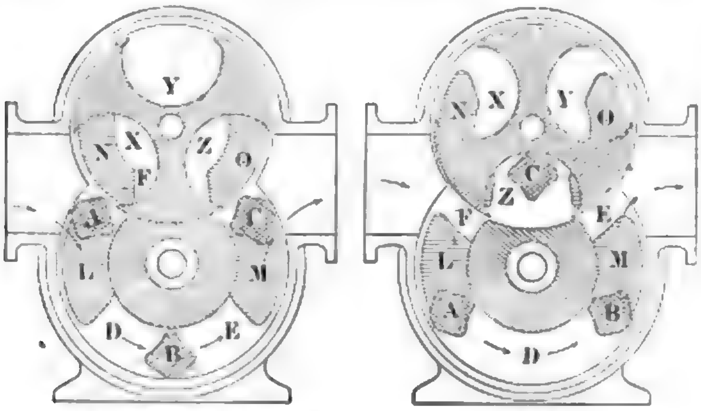


FIG. 2.—PARTS OF BLOWER.

Air at atmosphere pressure entering the blower at the intake is successively imprisoned in the three pockets formed by the three blades of the revolving impeller and discharged at any desired pressure up to ten pounds per square inch. The volume of free air delivered varies directly with the number of revolutions, while the pressure varies with the resistance met in the delivery pipe.



FIGS. 3 AND 4.—CROSS-SECTION VIEWS OF BLOWER IN OPERATION.

The principle upon which the blower operates is clearly shown by sectional views of Figs. 3 and 4. This blower is manufactured by the B. F. Sturtevant Company, Hyde Park, Mass.

◆

Crocker-Wheeler Annual Convention.

The annual meeting of the heads of departments and of branch offices of the Crocker-Wheeler Company was held recently at Ampere, N. J., when there was a large gathering from all parts of the country. The business proceedings were conducted at the Ampere factories, and on January 25, the gentlemen in attendance were guests of Dr. S. S. Wheeler, president of the company, at dinner, at the University Club, New York City.

The record of the year's business as shown by the annual reports of the branch managers of the Crocker-Wheeler Company indicates not only an increase over the business of 1904, but an increase over that of the year 1903, which was up to that time the record year of the company. The progress of the company has been marked in the alternating-current field, and it has also maintained its enviable place in the direct-current field. During the past year the company has developed a line of core-type transformers the first publication in regard to which appeared in the Electrical World of January 6, and which has been commercially introduced with signal success. The prospects for a very greatly increased business during 1906 were considered bright by all the branch managers present. Great satisfaction was expressed with the line of transformers, and much is expected from two other new lines of electrical machinery that the company is about to put on the market.

Among those present were F. W. Kreps, W. C. Appleton, H. M. Gassman, H. Fuller, B. A. Schroder, S. Russell, Jr., C. W. Startsman, J. R. Wilson, H. A. Brown, H. J. Sage, H. C. Petty, H. C. Baker, Harold Lomas, R. N. C. Barnes, H. B. Hussey, Julian Roe, L. M. Ward, Rodman Gilder, C. N. Wheeler, M. E. Weissblatt, J. S. Horner, E. Heitmann, A. Hartmann, W. F. Sullivan, H. Pikler, J. B. Milliken, H. L. Patterson, W. L. Brownell, A. L. Doremus, S. S. Wheeler, G. S. Dunn, W. A. Doble, F. B. De Gress and G. W. Bower.

◆

High-Speed Corliss Engines.

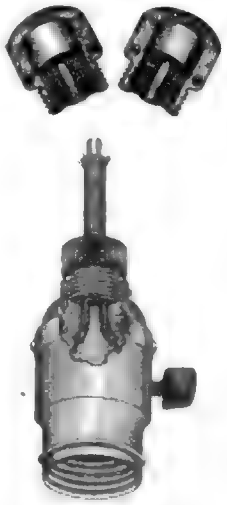
The Hooven, Owens, Rentschler Company, Hamilton, Ohio, has recently placed upon the market a type of Corliss valve engine especially designed for direct connection with electric generators. This type of engine is made from the regular Corliss patterns with the exception that the strokes are shorter, the dashpots are eliminated, the valve gear is directly driven and the governor is of the inertia type located in the fly-wheel.

The range of speed for this type of engine will be from 125 to 200 r.p.m. These engines will be made in all sizes from 50 hp up in the single-cylinder, tandem and cross-compound types of both the horizontal and vertical styles.

◆

Strain Bushings for Sockets.

The Frank H. Stewart Electric Co., 35 N. 7th Street, Philadelphia, is placing on the market a new device known as "Knostrain" bushings, designed to take the strain off electrical connections in ⅜-in. sockets and ceiling rosettes. The latter type can also be used as a handle bushing. The bushings are made in two pieces with corrugated grooves so arranged that they firmly grip ordinary lamp and show window cord and act as an insulator at the same time. The underwriters naturally favor the use of a device that overcomes the knotting of cords as now practiced. The apparatus as applied to sockets is here shown complete and in section.



STRAIN BUSHINGS.

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Soldering Flux Tube.

The Climax Manufacturing Company, Boston, is placing on the market a soldering paste contained in a collapsible tube provided with a stiff aluminum spout. The outfit can thus be carried in a pocket like a screw driver, and the aluminum spout allows the paste to be applied directly to the joint at the same time as the solder, as illustrated in the accompanying cut.

METHOD OF USING FLUX TUBE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Retailers have become reconciled to the mild winter weather and are now giving more attention to spring trade, in which there is a decided activity. The absence of severe and sudden weather changes has been beneficial so far to the winter wheat crop, which does not show any ill effects from the lack of snow covering. General industry is favored by the weather conditions, but the demand for anthracite coal is slack, and bituminous is lower in price. Collections are reported irregular, and money is easy. There is great activity in building operations due to the continued mild weather, and this despite record prices for building material. Lumber, paints and hardware are generally active. Lack of cars and vessel room checks Southern shipments. In the iron and steel markets there is a heavy demand for structural shapes and for steel rails, sales of the latter during the week amounting to 80,000 tons and for the month of January over 250,000 tons. Official figures show that 22,992,380 tons of pig iron were produced in 1905, 6,493,347 more than in 1904. The increase in 10 years was 160 per cent. The domestic market for electrolytic and lake copper of the best brands is firm at 18⅝c. Large producers who dispose of more than a third of America's products of electrolytic slabs and bars give it as their opinion that 18⅞c. will be the ruling price for months to come. Casting copper in small lots is reaching the hands of metal dealers. It is quoted at 18½c to 18⅝c. It turns out that the amount of copper coming back from China has been greatly exaggerated by the London bears at the London Metal Exchange. Consumption goes right along at a quick pace, and manufacturers continue to receive orders for their finished product to an extent which indicates a bright and healthy situation. Copper for electrical equipment will undoubtedly be in greater demand as the rapid development of new projects in this field will require plentiful supplies of the metal. Electric power of all descriptions is being substituted for old methods and being introduced on a scale suggestive of heavier requirements of copper for electrical purposes. Boston advices state that the copper market is dull, but the metal situation has not lost one whit of its strength. Lake and elecrolytic are held at 18¼ to 18¾ cents by all the important producing interests. Almost no sales are being made, either at these or lower prices. Fully 80 per cent of all the copper that can reach market in February, March and April has been sold. It is believed that the remaining 20 per cent will be sold before it is ready for delivery. There is no sign of any decrease in consumption. *Bradstreet's* reports 228 business failures during the week ending February 1, against 270 the week previous and 239 in the corresponding week last year. January returns show more failures and larger liabilities than a year ago. There were 1,213 suspensions, involving $15,360,188, an increase of 1 per cent in number over last year, and of 38 per cent in failure damage. Compared with January, 1904, the number shows an increase of 8 per cent, but the liabilities are 10 per cent smaller.

APPARATUS FOR ATHENS TROLLEYS.—United States Consul Horton, of Athens, reports on the electric tramway extension for Athens and Piræus, to be developed from the present horse and steam system by Franco-Belgian capitalists. Delay was caused in granting the new concession because of the change in the Greek ministry, all such matters having to be ratified by the Chamber of Deputies. The present 25-mile line will be transformed into a 30-mile electric line, with 60 per cent of it double-tracked. The electrical apparatus will be manufactured in Paris by the Thomson-Houston Company. Further information can be secured from G. S. Albanese, care the Greek Electric Company.

TELEPHONY FOR RAILROADS.—The International Telephone Manufacturing Company, of Chicago, has recently furnished for the St. Louis & Springfield Railway Company and the Illinois Traction Company, an up-to-date modern switchboard equipment, specially arranged for despatching service for their joint offices at Staunton, Ill. This board is of the desk type with special top cabinet and is so constructed as to enable the attendant to supervise carefully the despatching of trains over the various lines. The International Company, during the past year, has made quite a specialty of furnishing this class of apparatus for interurban lines.

NAVY SUPPLIES.—Bids will be received until February 13 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards at Portsmouth, N. H., Boston, Mass., Newport, R. I., New York, N. Y., League Island, Pa., Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 344, drum controllers, arc lamps, etc., electrical supplies, etc.; schedule 345, rheostats, contact makers, etc.; schedule 346, motor, incandescent lamps, etc. Applications for proposals should designate the schedules desired by number. H. O. B. Harris, Paymaster-General, U. S. N.

ALLIS-CHALMERS MOTORS FOR COAL FIELDS.—We note the installation of a new Allis-Chalmers electrical power plant equipment for the McKell Coal & Coke Company, of Glen Jean, W. Va., at its properties at Kilsyth, West Va. The new equipment will consist of a 26-in. by 42-in. heavy duty Allis-Chalmers engine and generator unit, 500 kw, 25 cycles, with switchboard, lightning arrester, rotary converter and transformer equipment complete. The Allis-Chalmers Company will superintend the erection of the plant at Kilsyth and the sub-stations which are expected to be ready for operation in April.

ALLIS-CHALMERS SALES.—Recent sales of Allis-Chalmers electrical apparatus to prominent Wisconsin firms include a generator to the Creamery Package Company, Lake Mills, Wis.; a generator with switchboard, etc., to the Badger Brass Company, Kenosha, Wis., and generators to F. Hamill, et al., Spooner, Wis. The Buffalo office of the Allis-Chalmers Company reports the recent sale of a 100-kw type "I" generator to the Magnus Beck Brewing Company, Buffalo, and two 100-kw, type "I" generators to the Robertson Electrical Construction Company, also of Buffalo.

THE ALLIS-CHALMERS-BULLOCK, LTD., Montreal, the Canadian representative of the American Company, received recently an order from the Canadian Forty-Mile Gold Dredging Company, of Toronto, Can., for a special gold dredge equipped complete with 5⅓ cu. ft. buckets. The contract covers the entire machinery equipment complete, ready for operation, including electric light plant, two boilers, 100 hp each, engines, pumps, etc. The dredge will be ready for use early in May.

APPARATUS FOR GROTON, CONN.—The borough of Groton, Conn., has recently installed a municipal plant from the Crocker-Wheeler Company, of Ampere, N. J., as follows: One 165 K.V.A. engine type alternator and 13 kw belted exciter, the switchboard and an induction motor of its own manufacture; the whole to be set up before May 1. The current generated will be used in lighting the town of Groton and vicinity, and for driving the municipal water works pumps.

THE ROBINS CONVEYING BELT COMPANY, of New York, has recently secured an order from the Imperial Japanese navy for a 12-inch belt conveyor for its arsenal at Tokio. Among other orders the Robins Company now has on hand is one from the Solvay Process Company, of Syracuse, for conveyors for its stone crushing plants, and one from its agents in South Africa for a conveyor for use in tailing stacker in one of the large gold mines in the Rand.

SHIP WIRELESS EQUIPMENT.—The Panama Railroad have authorized the Atlantic De Forest Wireless Company to instal their wireless telegraph system on the steamers *Advance* and *Finance*, so that the whole fleet now plying between New York and Panama will thus be equipped. The De Forest Company has also equipped recently the *Ligonier* of the J. M. Guffey Petroleum Company plying South.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY is installing ten 500-hp Edgemore boilers in the basement of its new office building in Milwaukee. These boilers will furnish steam for a central heating system, and during the peak of the lighting also will supply steam for three 1,500-kw turbo-lighting units which the company has just ordered from the Allis-Chalmers Company.

APPARATUS WANTED.—The city of Crowley, La., is in the market for a 200-kw single-phase, 133-cycle, 1,100-volt generator; and a second-hand machine will be purchased if in proper condition. Mr. A. Durio, the superintendent of the city lighting and water plant, would like to receive bids with details.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was a heavy break in prices on the stock market early in the week from which, however, there was a sharp recovery, and at the close the market was firm in tone. There was strength in the United States Steel stocks as a result of the favor with which the figures of the December quarter and of the year were regarded by the traders. Standard railroad stocks were fairly uniform. Electric securities were weak and neglected, comparatively little business being done. Both the Allis-Chalmers issues declined 1 point, common closing at 24 and preferred at 63. General Electric fell to 172 during the week, but recovered some of the loss and closed at 175¼, which is a net decline of 2 points. Westinghouse closed at the lowest price of the week—166—this being a net loss of 2 points. Although there was an active business in Brooklyn Rapid Transit the course of prices was downward, 86⅝ being the closing quotation, a decline of 5 points. Metropolitan Street Railway lost 4 points, closing at near the lowest quotation of the week, 120¾, and Interborough Rapid Transit lost 2⅛, the closing price being 233⅞. The telegraph stocks show gains on the week's business, Western Union closing at 93⅝, an advance of ¾, and American Telegraph & Cable at 93, a net gain of 3 points. American Telephone & Telegraph was steady at 139, closing at that figure, which represents a decline of 2 points. On the curb market Mackay Companies closed at 60½, a net loss of 2 points. The principal feature of the week's trading on the curb was a sharp rise of more than 13 points in United Copper common stock, to a new high record. The preferred rose half as much. Pools in the other copper stocks took the opportunity to run up their specialties so as to get a better chance to distribute them. But at the end of the week, as many "coppers" showed declines as advances. United Copper lost some ground in the absence of confirmation of the reports about its absorption by the Amalgamated Company. Contracts for new Interborough Metropolitan stocks were weak, as a result of some dissatisfaction with the plan and misgivings in regard to the financial position of the Metropolitan Securities Company. Following are the closing quotations on the Stock Exchange February 6:

NEW YORK

	Jan. 30	Feb. 6		Jan. 30	Feb.
Allis-Chalmers Co.	23¾	24¾	General Electric	173	175
Allis-Chalmers Co. pfd.	62¾	63¾	Hudson River Tel.	..	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	232	233
American Locomotive	74¾	76	Mackay Cos.	59¾	60⅛
American Locomotive pfd.	112½	116¾	Mackay Cos. pfd.	73	74⅛
American Tel. & Cable	87	91	Marconi Tel.	..	..
American Tel. & Tel.	137	138¾	Metropolitan St. Ry.	121¾	121¾
Brooklyn Rapid Transit	88¾	88	N. Y. & N. J. Tel.	...	..
Electric Boat	25	25	Western Union Tel.	93¾	93¾
Electric Boat pfd.	60	60	Westinghouse com.	166	168
Electric Vehicle	17	16	Westinghouse pfd.	..	..
Electric Vehicle pfd.	22	19			

BOSTON

	Jan 30	Feb. 6		Jan. 30	Feb 6
American Tel. & Tel	139	138¾	Mass. Elec. Ry. pfd.	67⅝	67
Cumberland Telephone	117	...	Mexican Telephone	..	..
Edison Elec. Illum.	...	.	New England Telephone	139	137
General Electric	...	..	Western Tel. & Tel.	..	14
Mass. Elec. Ry.	...	18¾	Western Tel. & Tel. pfd.	93¾	..

PHILADELPHIA

	Jan 30	Feb. 6		Jan. 30	Feb. 6
American Railways	53	53	Phila. Electric	8¾	7⅞
Elec. Co. of America	11¾	11¾	Phila. Rapid Trans.	32	32¾
Elec. Storage Battery	81	81	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Jan. 30	Feb. 6		Jan. 30	Feb. 6
Chicago City Ry.	200	200	National Carbon	80⅛	81⅛
Chicago Edison	...	...	National Carbon pfd.	118	117¾
Chicago Subway	...	...	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd.	...	...
Metropolitan Elev. com.	25	25			

OTTAWA TROLLEYS ANNUAL.—President T. Ahearn is able to make a splendid showing for the Ottawa (Can.) Electric Railway Company last year. The statistical statement of the company from the year 1891 to 1905, inclusive, presented at the recent annual meeting, was very complete and most interesting, showing the great strides annually made by the company since its inception. For purposes of comparison the business of the old horse car line was produced, which showed that in the year 1885 the total earnings of the Ottawa City Passenger Railway Company (horse cars), were $19,186, and the number of passengers carried was 383,720. Ten years later, in 1895, the Ottawa Electric Railway Company carried 4,583,000 passengers, and its receipts swelled to $212,000. During the past year the number of passengers carried was 9,891,000, and the receipts increased more than 100 per cent to $440,633, the net profit for the past year being 14 3/10 per cent, from which 10 per cent was paid in dividends and bonus, leaving $44,000 to be applied to the reduction of plant and profit and loss accounts. The system was operated at a net profit of 14 3/10 per cent, said to be the largest percentage shown by any Canadian road.

BELL TELEPHONE GROWTH.—During the past three years the outstanding capital stock of the American Telephone & Telegraph Company has increased from $87,836,100 on January 1, 1903, to $131,551,400 on January 1, 1906, a gain of $43,715,300, or 49 per cent. In the same time the growth in the number of stockholders has more than kept pace with the increase in the amount of stock. Stockholders on January 1, 1906, numbered 17,565, against 10,802 on January 1, 1903, a gain of 6,763, or 62 per cent. The following table gives the number of stockholders as of January 1, 1903, 1904 and 1906, and the amount of capital outstanding on those dates, together with the average number of shares held by each stockholder:

	Outstanding capital stock.	No. of stockholder.	Aver. shares per stockholder.
Jan. 1, 1903	$87,836,100	10,802	81.3
Jan. 1, 1904	127,668,900	15,743	80.7
Jan. 1, 1906	139,551,400	17,565	74.8

The average holdings per stockholder have decreased 6.5 shares, which indicates a constantly growing constituency of shareholders.

CUMBERLAND TELEPHONE.—The Cumberland Telephone Company has issued its full pamphlet report for the year ending December 31, 1905:

	1905.	1904.	1903.	1902.
Gross	$4,656,423	$4,027,117	$3,480,042	$3,070,163
Expenses	2,976,971	2,585,807	2,170,919	2,068,184
Net	$1,679,450	$1,441,309	$1,309,123	$1,001,979
Interest and taxation	320,166	267,142	269,031	219,814
Surplus	1,359,284	1,174,167	1,040,092	782,165
Dividends	940,691	818,674	766,382	623,203
Surplus	$418,592	$355,492	$273,710	$158,962

DIVIDENDS.—Directors of the North American Company have declared the regular dividend of 1¼ per cent on the stock of the company. It is payable March 1. The directors of the Pennsylvania Telephone Company have declared a quarterly dividend on 1½ per cent. Directors of the American Graphophone Company have declared a quarterly dividend of 1¼ per cent, payable March 15, to stockholders of record March 1. The directors of the Philadelphia Company declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable March 1.

WESTERN ELECTRIC REPORT.—According to the annual report, the gross earnings of the Western Electric Company for last year were $44,146,000, an increase of 36 per cent. The stockholders have voted to increase the capital to $25,000,000 and $3,000,000 of treasury stock will be issued immediately. Stockholders may subscribe in proportion of 25 per cent of their present holdings. The company's sales are now averaging $4,500,000 monthly.

CANADIAN BELL TELEPHONE.—The Bell Telephone Company of Canada is applying to the Dominion Parliament for the right to increase its capital over and above the present authorized amount of $10,000,000. At present the company has issued $9,000,000 of common stock, although that will not be fully paid until next July. The last issue was $1,000,000, made on May 31, 1905.

MANILA ELECTRIC RAILWAY.—The operating department of J. G. White & Company reports the earnings of the Manila Electric Railway & Lighting Corporation for December and January as follows: December, railway department, gross, $48,750; net, $24,750; lighting department, gross, $28,500; net, $12,900; total net, $39,600. January, railway department, gross, $44,450.

PURCHASE OF DETROIT GAS.—The American Light & Traction Company has acquired control of the Detroit City Gas Company. It is for the purpose of securing funds for the purchase of this property that the Light & Traction Company is now offering 15,000 shares of common stock and 40,000 shares of preferred stock.

WESTINGHOUSE EARNINGS.—Advices from Pittsburg state that the orders booked in its railway department by the Westinghouse Electric Company for the month ending January 31 amounted to $2,000,000, the largest for any month in its history. Semi-official estimates place the probable total business for 1906 at $40,000,000.

SOUTHERN NEW ENGLAND TELEPHONE.—The capital stock of the Southern New England Telephone Company is to be increased by $1,000,000, making the total issue $6,000,000. President Tyler, of the company, believes the new issue will be disposed of at not less than $120 a share.

General News.

NORTH BIRMINGHAM, ALA.—The Mayor will probably soon be asked to call an election to vote on an issue of $50,000 bonds for improving the water and light plants.

PRAIRIE GROVE, ARK.—The Prairie Grove Light & Power Company has closed down its plant for the reason that there was not sufficient demand for power to justify its continued operation. The plant will either be sold or moved to some more favorable location.

RIO VISTA, CAL.—A franchise was granted to the Rio Vista Electric Light & Power Company by the Board of Town Trustees at their last meeting, which gives the company the right to operate and maintain an electric light and power plant in the town of Rio Vista.

HOLTON, CAL.—The Holton Electric Company, El Centro, Cal., has concluded the purchase of new electrical equipment through the San Francisco office of the Allis-Chalmers Company, Milwaukee, consisting of type "AN" induction motors, transformers of the oil-filled, water-cooled type, and transformers of the self-cooled type.

SAN FRANCISCO, CAL.—An offer has been made to this city by J. E. Russell to furnish San Francisco with a supply of water and electric energy from the American River near Auburn. The cost of fully equipping the plant is put at $500,000, and the promoters of the scheme say that it would yield an income sufficient to pay the interest on $20,000,000.

SAN FRANCISCO, CAL.—What is said to be the largest telephone switchboard in the United States outside of New York and Chicago, will soon be installed in the new main "Central" Exchange building on Bush Street. All the apparatus has arrived and the work of making the connections will begin at once. The board is of the improved multiple type and is capable of accommodating lines for 22,300 telephones. There will be 15,000 incandescent signal lamps.

ALTA, CAL.—The power plant of the old Central California Electric Company, now owned by the Pacific Gas & Electric Company, is again running at its full capacity. For a number of weeks past the power house has been doing only a small amount of work, owing to the scarcity of water. There is now plenty of water all through the mountains. The reservoirs and ditches of the South Yuba Water Company are full almost to overflowing and the snowfall farther up the mountains promises a good supply next summer.

YREKA, CAL.—The Siskiyou Electric Power Company has completed the branch pole line to Hornbrook and is now lighting and supplying power in that town. A 1,000-kw generator has arrived in San Francisco and will be installed as soon as the weather conditions permit. This is the second generator to be installed at the Fall Creek plant. From present indications there will be installed in and about Yreka during the coming summer four new gold dredgers which will be operated with electricity furnished by the company.

SOUTH NORWALK, CONN.—The municipal lighting plant of the city of South Norwalk has closed another satisfactory year. It is stated that the gross profit for 1905 amounted to $11,208, an increase of nearly 100 per cent. over the previous year.

WINDSOR LOCKS, CONN.—It has been learned recently that it is the intention of the new management of the electric light company to make all of its future lighting contracts on the meter basis instead of a flat rate. All of the places now having light on the one-payment system will probably be asked to change to a meter in the course of the next month.

NEW HAVEN, CONN.—The United Illuminating Company, which has to do with lighting New Haven and Bridgeport electrically, has issued letters to its customers in the Whitney avenue section of the city, notifying them that on and after February 15 a day service will be afforded such customers. This will greatly help the sale of electricity and apparatus.

SMYRNA, DEL.—It has been decided by the Town Council not to sell the electric light plant to the Smyrna, Kent County & Delaware Bay Traction Company, and improvements will now be made in the plant, including the installation of a new boiler and a 60-kw dynamo.

ALBANY, GA.—Because of the fact that the city of Albany owns the electric lighting plant, the municipality has rejected the applications of private parties for gas privileges, as it is not desired that the city shall have competition in the lighting business.

POCATELLO, IDAHO.—The American Falls Power, Light & Water Company, Ltd., has sustained a $15,000 fire loss at its sub-station in Blackfoot.

BATH, ILL.—A Jacksonville company has been awarded the contract for installing an electric light plant here.

CHICAGO, ILL.—The Abbott Alkaloidal Company has added a power house to its plant, equipping it with an Erie 125-hp water tube boiler, Hawley furnace, Chuse 125-hp engine and a Jenney 75-kw generator.

PONTIAC, ILL.—The large flywheel at the Pontiac Electric Company's plant broke recently, and for an indefinite period traffic on the interurban railroad between this city and Odell will be suspended. It will probably take thirty days to make repairs. The Pontiac Shoe Manufacturing Company's plant, which is furnished power by this company, was also closed down. The loss is estimated at about $6,000.

EDWARDSVILLE, ILL.—The deal for the sale of the Edwardsville Electric Light & Power Company's plant to the McKinley syndicate has been closed and the new management has taken charge of the affairs of the company. The McKinley people have secured a fifty-year franchise from the city, and will assume the public lighting contract between the local company and the city, which has about four years to run.

LAFAYETTE, IND.—The Fountain Warren Traction Company has made application for a franchise for entrance to the city.

ALEXANDRIA, IND.—The Alexandria Electric Light & Power Company has been placed in the hands of the Anderson Trust Company, as receiver. The plant has valuable contracts, with a large local patronage, and is solvent. Disagreement among the stockholders brought about the complications. The receiver will add some new machinery and keep the plant in first-class condition.

ROCK ISLAND, IA.—At a recent meeting of the City Council it was decided to ask the Central Union Telephone Company to present a new ordinance. The company and council have been in dispute ever since the council repealed the telephone ordinance in 1902, and left the company without a franchise.

OSKALOOSA, IA.—Harry O'Neill and J. Springfield, principal owners of the Oskaloosa Traction & Light Company, have sold their interests to J. B. Sax, Samuel Mahon and other Ottumwa stockholders. It is understood that the whole property will be sold to the same company that recently bought the Ottumwa property. Mr. O'Neill will now devote his entire time to building the Oskaloosa & Buxton Interurban Railway, of which he is president.

MASON CITY, IA.—The People's Mutual Telephone Company, which operates toll lines and exchanges between and at several towns in Franklin and Cerro Gordo counties, has been sold to a new syndicate headed by Charles F. Johnson, a former member of the Legislature of Iowa. Associated with Mr. Johnson in the new deal are E. N. Egge of Rockwell and C. M. Felland of Joyce, Ia. The towns connected by this system and maintaining exchanges are Chapin, Latimer, Coulter, Alexander, Sheffield, Rockwell and Thornton.

HUGO, I. T.—William Busby has been granted a 50-year franchise to construct and operate an electric light system in this city.

LOUISVILLE, KY.—This city is considering the placing of all telephone and electric light wires in the central part of the city underground, and has consulted with Engineer D. J. T. Jeup, of Indianapolis, Ind., with regard to the matter.

LOUISVILLE, KY.—The Louisville Gas Company, through its directors, has been cited to appear before the General Council to show the exact relations existing between this company and the Louisville Lighting Company.

LOUISVILLE, KY.—The North American Company is an applicant for a franchise for lighting and heating privileges in Louisville and copies of the charter which it desires will be presented to the General Council after such changes as are deemed necessary have been made in the original charter copies.

LOUISVILLE, KY.—The lower board of the Louisville General Council has opened the way for competition in the electric light and power field by passing an ordinance providing for the sale of a franchise for furnishing light, heat and power in the central portion of the business district. The ordinance forbids any other company or individual now holding a franchise for this territory to purchase or acquire the franchise, and gives the General Council authority to control the rates. It is understood that the North American Company is asking for a franchise covering the whole city.

WINNFIELD, LA.—The Winnfield Electric Light & Power Company has been given a franchise to construct and operate an electric light and power plant.

BANGOR, ME.—The Bangor Electric Light Company is to replace its present power equipment with new apparatus, which will be furnished by the General Electric Company.

PRESQUE ISLE, ME.—Mr. A. R. Gould, general manager of the Maine and New Brunswick Electrical Power Company says that negotiations are in progress with contractors for the necessary ledge excavation, which will be the first step in the actual work in the development of the power at the falls.

BANGOR, ME.—The Bangor & Northern Railway, formerly the Penobscot Central, an electric line extending from Bangor to Charleston, a distance of 26 miles, has been sold to the Bangor Railway & Electric Railway Company, which now controls all the local and suburban electric railways.

MELROSE, MASS.—Petitions are being prepared for presentation to the Board of Aldermen, requesting that an all-night lighting service be established.

WINCHESTER, MASS.—At a recent meeting of the Selectmen a number of citizens expressed considerable dissatisfaction with the rates and service of the electric light company, and a good deal of discussion was heard which seemed to favor establishing a municipal lighting plant.

DANVERS, MASS.—The additions and extensions at the municipal electric plant, for which the town appropriated $20,000 at the last annual meeting, are practically completed. The new engine and a large new arc dynamo will increase the street lighting capacity to about 225 enclosed arc lamps, the present number being about 125.

MARLBORO, MASS.—The Marlboro Electric Company, we are informed by Mr. C. B. Russell, treasurer, has established a 24-hour service and will push the power end of the business. It has secured an additional 100-kw generator, General Electric make. The contract with the city requires the company before August 1 to replace its open-arc street lamps with enclosed arcs. This will require the installation of a 150-kw generator unit.

PARMA, MICH.—It is understood that at the spring election the question of electric lighting will be voted upon.

SHERMAN, MICH.—A dam for the development of power is to be constructed across the Manistee River near this place. The Manistee Engineering Company, of Manistee, is in charge of the work.

MORRICE, MICH.—Morrice has signed a contract with the Saginaw Electric Lighting Company for electric lighting; Bancroft and Perry will also be supplied. The lamps are to cost $50 each per year.

CADILLAC, MICH.—Manistee River Power Company has received its franchise from the Supervisors. The dam and power house on Manistee River are to be in readiness for business by April 1, 1910.

GRAND RAPIDS, MICH.—At the meeting of the stockholders of the Grand Rapids Edison Company, recently held in this city, the following officers were chosen: President, Daniel McCool; vice-president, Mc George Bundy; secretary and treasurer, Thomas F. Bechtel; general superintendent, A. F. Walker. It is said that the company contemplates increasing the present capacity of the plant within the next year.

DETROIT, MICH.—The city will not be taxed very heavily this year by the Public Lighting Commission, as most of the work done will be the carrying out of plans undertaken last year, for which $149,000 bonds were issued, and which include an enlargement of the plant, extension of trunk lines, the establishment of a branch station in the West End and the equipment of 200 new lamps. The new lamps will be installed in the spring and an outlay of some $20,000 will be made in the new Eighteenth Ward, which will be served by the proposed McKinstry Avenue branch station. The existing contract with the Solvay Process Company will probably be renewed until the proposed extensions and improvements have been completed

CROOKSTON, MINN.—The Tri-State Telephone Company is asking for a franchise in this city.

ST. JOSEPH, MINN.—A municipal lighting business is about to be conducted by the Sisters of St. Benedict, of this place. The St. Benedict Sisters have been operating a power plant to light the academy, and on petition of the residents of the town they have agreed to extend the service to the streets and business houses of the municipality. Plans for the extension have been completed and the necessary work of stringing the wires, etc., has begun.

LITCHFIELD, MINN.—The city council held a special meeting to consider the request of the Tri-State Telephone Company for a reduction of the rate of electricity for telephone use. The company is being charged the regular rate of 10 cents per kw-hour, same as is paid by all users of electricity for lights. After some talk a motion was passed unanimously that the rate be left as it is. The Tri-State Company threatens to put in a gasoline engine and dynamo of its own if the rate is not reduced

ST. LOUIS, MO.—At the last meeting of the Board of Aldermen of Kirkwood, a suburb of St. Louis, all ordinances recently enacted pertaining to the sale of the municipal electric lighting plant to the General Service & Development Company, a subsidiary institution of the North American Company, and the granting of a twenty-year franchise to an allied gas company, were repealed. An election was to have been held February 17 to determine by popular vote the sale of the plant. This was declared off. The action was a surprise to the whole community as it was thought that there would be no difficulty about selling the plant for $25,000. It is said that the reason for the repeal was that the General Service & Development Company had failed to comply with the ordinance, which demanded that the sum of $4,000 be deposited with the Bank of Kirkwood within three days after the drafting of the ordinance. The concern deposited $4,000 about three days ago with the St. Louis County Trust Company at Clayton

CAPE GIRARDEAU, MO.—At the annual meeting of the Cape Girardeau Water Works & Electric Light Company all the directors and officers of the company were re-elected. A new schedule of rates was arranged whereby large consumers will pay 7 cents per kw-hour instead of 10 cents. The schedule is as follows: Consumers using less than 250 kw-hours a month, 10 cents; 251 to 300, 9 cents, 301 to 500, 8 cents; 501 and over, 7 cents. The company also voted to install new lamps.

KIRKWOOD, MO.—A special election will be held February 17 at which the people will decide whether or not the lighting plant shall be sold for $25,000 to the General Service & Improvement Company, an alleged subsidiary concern of the North American Company.

MISSOULA, MONT.—At a special meeting of the City Council, the contract for lighting the city of Missoula was granted to the Missoula Light & Water Company, the only bidder, for a term of ten years.

RENO, NEV.—The latest report concerning the consolidation of the various electrical and public utility companies of Reno and Sparks is to the effect that every electrical power plant and power site of importance on the Truckee River from the fountain head of the stream to Vista, ten miles below Reno, is to be taken over by an Eastern syndicate which wishes to get control of the electrical facilities of Western Nevada. According to the report, an option on all their properties has been given by the Fleishackers, and if the price is satisfactory to the syndicate the deal will soon be made. If the sale goes through it will transfer property worth five or six million dollars and carry with it not only the two big power plants which light Reno and Sparks, but the immense stations at Marmel and Floriston, which run the Floriston paper mill and furnish power to drive the machinery and pumps of the Comstock mines, as well as to light Virginia, Gold Hill, Carson, Dayton and Empire. Capitalists are awakening to the possibility of the Truckee River for the development of electric power. The fall of the river makes the fluming of water for a great distance unnecessary and as the country is developing at a rapid rate the demand for power increases. Not only are new mines opening up east of Reno that will be consumers of many hundred horsepower, but the Western Pacific contractors in their tunnel work are within easy distance of several of the large generating stations.

BERLIN, N. H.—By the middle of February, the Cascade Light & Power Company of Berlin will have installed a new generator at its power plant in Gorham which will increase the capacity of the plant to double its present amount. The order for the generator has been placed with the Stanley G. I. Electric Manufacturing Company. This company already has two generators, one of a hundred odd kilowatts for the use of the Berlin Electric Railway Company, and one of 200 kilowatts for lighting and power in Berlin. The company has elected the following officers: R. N. Chamberlain, president; Giles O. Holt, treasurer; C. C. Gerrish, clerk; directors, Messrs. Chamberlain, Gerrish, R. S. McKenzie, Berlin; A. B. Libby, Gorham, and Mark A. Twitchell, Milan

BLOOMFIELD, N. J.—The Town Council has renewed the lighting contract with the Public Service Corporation for a term of five years, beginning February 1. Under the new contract a saving of $2 a year on each arc lamp is secured, the price stipulated being $70 per lamp of 1,200 cp. The incandescent rate is the same as heretofore, $16 per lamp. A discount of 25 per cent is granted on all lights used in the Council chambers and the police station. This represents a saving to the town of $1,000.

SALEM, N. Y.—The town board of Salem met recently at Shushan for the purpose of letting a contract for the lighting of that village by electricity. L. C. Fise was awarded the contract for furnishing thirty-eight incandescent lamps, the same as the last contract, at $8.50 per lamp for every night and all night for the term of five years commencing January 1, 1906.

DUNKIRK, N. Y.—The Dunkirk & Fredonia Street Railway Company has been sold for $375,000 to H. W. Noble, of Detroit, Mich., who is believed to be acting for the Buffalo, Dunkirk & Western interests

ITHACA, N. Y.—The Ithaca Telephone Company has recently completed arrangements for connections with several smaller companies which have broken off their associations with the Bell Company for this purpose.

TICONDEROGA, N. Y.—In the matter of the application of the Ticonderoga Electric Light & Power Company for consent to issue bonds to the amount of $50,000, and in which a hearing was held recently, the State Commission of Gas & Electricity has granted consent to the issuance of bonds to the amount of $35,000.

NIAGARA FALLS, N. Y.—Another transmission company is said to be preparing to enter the American field. This is the Electrical Development Company, getting its power from the Electrical Development Company of Canada, which was formerly known as the Toronto & Niagara Power Company. The plant of this company will not be completed for several months, but it is stated that it will apply for entrance to Buffalo and will compete with the Niagara Falls Power Company. It has also a transmission line to Toronto.

ROCHESTER, N. Y.—Mayor Cutler has approved the ordinances directing the corporations maintaining overhead wires in University Avenue, Merriman Street and Clinton Avenue North to remove the poles from the streets. The formal notifications have been sent. The Rochester Railway & Light Company has already expressed a willingness to remove the poles and a gang of men in the employ of the company has been at work for two days removing the poles on University Avenue. Conduits have been constructed in all the streets mentioned and all the wires will be buried.

FULTON, N. Y.—The report is current in this city that the Fulton Light, Heat & Power Company and the Fulton Fuel & Light Company are about to combine and that the two concerns will be run under one head. The Fulton Heat, Light & Power Company supply the electricity for the street lighting and also for domestic lighting and heating and also for power in different of the manufacturing places in this city. The gas company furnishes gas for commercial lighting and heating, having built a plant at the southern end of the city. The two companies about split up the business and it is the desire of many of the persons interested in each to combine. The matter, it is understood, has been under consideration for some time, though the report is not confirmed.

YOUNGSTOWN, OHIO.—Two new companies are said to have applied for a charter for an electric railway from New Castle to Ellwood City via Pittsburg, to cost $1,000,000.

STEUBENVILLE, OHIO.—A new traction company is said to have made application for traffic privileges, which will probably be granted. The new line will start at Minerva and touch Osnaburg, Sparta, Carrollton, North Industry, Waynesburg and other towns in that section.

TOLEDO, OHIO.—At the annual meeting of the Toledo & Western Railway, Judge C. M. Stone, of Cleveland, was elected president and counsel in place of the late Hon. Luther Allen. Other officers are J. R. Seagrave, vice-president; F. E. Seagrave, secretary and treasurer; C. E. French, auditor, and C. F. Franklin, general manager.

CINCINNATI, OHIO.—An ordinance has been prepared by the General Council, asking for bids on an electric light franchise. At least 250 arc lamps are required, and the bids will be received in two forms—one fixing the price for the arc lamps and asking for a bonus and the other a straight bid on the price of street lighting.

YOUNGSTOWN, OHIO.—Youngstown may in a few years own its own electric light plant. The City Council has taken the preliminary steps for a municipal lighting plant by referring the matter to a committee, which will make a report on the cost of a plant. The city now pays nearly $40,000 a year for a very unsatisfactory system of street lighting.

LIMA, OHIO.—The Bell Telephone Company announces a cut in rates for resident service here to $1.50 for individual telephones and $1.25 per month for two party lines, and will discontinue the use of all four and ten party lines. All the wires have been placed under ground and an active canvass is to be made for subscribers against the independent system which has secured a great lead in patronage during the past five years.

TOLEDO, OHIO.—The Toledo Gas, Electric & Heating Company has accepted the nine-cent commercial electric lighting rate fixed by the former City Council. The Rail-Light accepted this rate some time ago, and with the action of the Heat-Light, consumers will soon be enjoying the benefits of a reduction in prices. The companies have, in past years, been charging as high as 13 cents a kw-hour.

CALDWELL, OHIO.—A deal has been closed by which the largest of the telephone companies operating in Noble County have consolidated under the name of the Noble County Telephone Company. The companies in the combine are: The Caldwell Independent Telephone Company and the Farmers' Telephone Company of Caldwell; the Summerfield Telephone Company of Summerfield and the Caldwell & Marietta Telephone Company of Washington County. The system will be managed by the United States Telephone Company. The company will have 200 miles of toll line.

COLUMBUS, OHIO.—At a meeting of the Board of Directors of the Columbus Gas Light & Heating Company, the holding company of the Central Ohio Natural Gas & Fuel and the Columbus Gas Companies' plans for the consolidation of the underlying companies were perfected. Accordingly the consolidation of the two companies took place, instead of a merger of the three, and the Columbus Gas Light & Heating Company will pass out of existence. To supplant this it was decided to form the Columbus Gas & Fuel Company, with a capital stock of $9,000,000. The liquidation of the Columbus Gas Light & Heating Company and establishing in its place the Columbia Gas & Fuel Company was thought better than the merger plan, since under this arrangement no transfer of franchise privileges is necessary.

BAKER CITY, ORE.—The Rock Creek hydro-electric plant of the Baker Light & Power Company, situated in the mountains 18 miles west of Baker City, is now supplying electricity for light and power purposes to this city and several mines in the vicinity. As an adjunct to this plant the company is erecting an auxiliary steam plant at South Baker City, which will furnish power and lights to the city in cases of emergency.

PITTSBURG, PA.—The contract between the city and the Allegheny County Light Company expired February 1, but the company will continue to furnish lights at the contract price, $96 per year, until a new arrangement is made. Director E. M. Bigelow advocates making the term of the new contract four years, claiming that it will mean a saving of $50,000 a year to the city.

YORK, PA.—The Merchants' Electric Heat & Light Company, of this city, has been awarded the contract for lighting the borough of North York for the ensuing year. The cost of each light will be 11 cents per night, or 3 cents less on each light than the borough is at present paying. There were only two bids for the contract considered, the other being from the Edison Electric Light Company. The present contract with the Merchants' Electric Heat & Light Company, which has been in operation for three years, will expire March 1.

PHILADELPHIA, PA.—The Philadelphia Electric Company is now considering making a general reduction in the price of light and power in the district covered by the Edison Company. This district embraces the territory bound by Lombard and Callowhill Streets and the Delaware and Schuylkill Rivers. When the announcement was made Thursday that all territory in the city excepting this section would be granted a general reduction in price it brought forth a general protest from storekeepers, manufacturers and others in the central district. Andrew J. De Camp, manager of the Philadelphia Electric Company, discussing the matter said that the fact that the distributing cables in the territory named were under ground added largely to the cost of maintenance, and also referred to the interest on the investment. The company is figuring, however, on the cost of furnishing light and power within that area at a reduction if it is practicable. Until that investigation is completed it cannot be said whether it would be commercially possible to reduce the price below the present rate of fifteen cents per kilowatt-hour. The reduction in price for all other districts made on February 1 establishes a uniform rate for the whole of Philadelphia outside of the Edison district. For some time prior to February 1 only ten cents per kilowatt-hour was charged in several parts of the city, including the district south of South Street, north of Callowhill to Lehigh Avenue, and east of Broad and in some sections west of Broad on this side of the Schuylkill. Under that uniform rate of ten cents per kilowatt-hour domestic electric lighting in this city is placed on a par with gas.

UNION, S. C.—At its regular annual meeting, the Union Manufacturing & Power Company, which recently completed its big power plant at Neals Shoals near here, elected directors who subsequently elected the following named officers: Edwin W. Robertson, president and treasurer; Emslie Nicholson, vice-president; W. P. Heineken, secretary and general manager. This may terminate the proceedings for receivership which have been pending for several weeks, and if nothing untoward happens it is likely that the electrical power will be turned on in the mills in a short time.

ANDERSON, S. C.—The Savannah Power Company, capitalized at $1,000,000, has been organized in this city by the election of the following named officers: H. A. Orr, president; C. Elmer Smith, of York, Pa., vice-president; Dr. S. M. Orr, treasurer; E. K. Chapman, secretary. The company will develop the water powers at Cherokee and Gregg shoals in Savannah River. Work on the new plant will begin within thirty days.

COLEMAN, S. D.—Miller Brothers are said to have purchased the telephone business of the Coleman Electric Company.

STURGIS, S. D.—The Allison Bros., of Lead City, are negotiating for the purchase of the Sturgis electric light plant from S. A. Oliver, but the deal has not yet been closed. The transfer is held up pending the adjustment of some matters which have to do with the future plans of the purchasers. If the sale is consummated, possession will probably not be given until March 1.

BROWNSVILLE, TEX.—Mayor F. J. Combe has returned from Corpus Christi and other Texas points where he has been investigating the electric light matter in order that the City Council may be prepared to more intelligently consider the question of granting a franchise for lighting Brownsville. The matter will be taken up at the next meeting of the Council..

SALT LAKE CITY, UTAH.—The Jordan Narrows power plant, formerly owned by the Salt Lake City Water & Electrical Power Company, has been transferred from W. S. McCornick & Co. to L. L. Nunn, of the Telluride Power Company. The consideration is $16,863.25. The ground involved in the transaction includes 16.3 acres. The power house is of brick and steel with equipment sufficient for generating and transmitting 4,000 horse-power. There is a spur track to the Rio Grande Western road, and water rights in the Jordan River and Utah Lake.

RICHMOND, VA.—An interesting debate is still in progress here regarding the matter of granting a lighting franchise to the Gould interests. Special Expert E. W. Trafford has prepared a pamphlet on the subject of municipal ownership, especially in Richmond. The paper is in part a reply to the argument of Henry W. Anderson, counsel for the Gould interests. Mr. Trafford states in reply to the claim that Richmond gets lighting at a cheaper rate than any city of its size in the country, that there are 262 cities getting cheaper lighting than Richmond, according to the report of the National Electric Light Association. The fight over the franchise has been on for quite awhile and there seems to be no immediate possibility of settlement.

LAKE PADDEN, WASH.—The Valley Shingle Company is installing an electric light plant in its factory, which will supply lights to the village.

BALLARD, WASH.—The Ballard Electric Company, which holds a fifty-year lease of the present pumping plant of the city, has made a proposition to sell the city its lease for $15,000, and the building for $3,900. These terms were rejected by the Council, however, and it is possible that the city may install its own plant, which, it is said, can be built and equipped with pumps for about $4,000 or $5,000.

CHIPPEWA FALLS, WIS.—It is reported that a deal has just been closed, whereby the Bell Telephone Company assumes control of the Cadott, Thorpe and Ludington lines.

BELOIT, WIS.—The Beloit Water, Gas & Electric Light Company, which is a consolidation of the Beloit public utilities, has obtained a contract to supply the Atwood-Davis Company, of South Beloit, with electric power for five years at $1000 a month, or a total of $60,000. A special line will be constructed to the gravel lands of the Atwood-Davis Company.

WAUSAU, WIS.—The municipal lighting plant, installed by Mr. Jacob Cloos, of Milwaukee, is reported to have made a good showing last year. The report shows that the total cost of the plant was $12,062.66. The cost of maintenance and repairs was $190.80. The cost of electric current was $3,224.19. The salary of the electrician was $600. The total number of hours the lamps burned was 3,293, and the average number of lamps in use was 104½. Interest and depreciation on the plant are each figured at 4 per cent. On this basis the cost per lamp is put at $47.65 per year.

MORGANTOWN, W. VA.—At the last session of the Common Council a franchise was granted to the Dunkard Valley Railway Company, which proposes to operate a trolley line between Morgantown and Mannington.

INGERSOLL, ONT.—The Council has entered into an agreement with the Ingersoll Electric Light & Power Company to furnish 45 arc lamps of 2,000 nominal candle-power, all night, for $2,500 per annum, the contract to date from July 1, 1906. In the meantime the present contract will be continued. A clause in the agreement promises that should Niagara power cheapen the cost of electric light any time during the life of the contract the company is to furnish the corporation with light as cheap as any town in the province similarly situated.

PORT HOPE, ONT.—The lighting contract between the city and the Port Hope Electric Light & Power Company, Ltd., expired in December, since when the company has been supplying light without contract or agreement at the old rate. The Council has been considering the possibilities of a municipal lighting system before making a new contract with the lighting company, and when on presentation of the company's bill for the January lighting, the Council refused to pay the full amount, the arc lamps were turned off. The company states that if the pole franchise is cut off, it will shut off the incandescent lamps also.

Construction Notes.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company, which expended $500,000 in improvements last year, announces that probably $800,000 will be expended this year.

MONTGOMERY, ALA.—The Citizens' Light, Heat & Power Company is preparing to expend about $50,000 this year in improvements to its plant and system. P. R. Whiting is manager of the company.

ANNISTON, ALA.—The Anniston Gas & Electric Company has accepted the franchise recently granted by the City Council of Oxford for the building of an electric railway to Hobson City, and the company will make immediate application to the authorities of Hobson City for a franchise to extend the line to Hobson Park.

ROGERS, ARK.—The Rogers Electric Light Company has decided to construct an addition to its plant, and will install a 200-hp boiler, motors, etc.

HALFMOON BAY, CAL.—A franchise has been awarded to W. J. McFarland for a gas and electric light plant.

SANTA ROSA, CAL.—The surveyors of the Petaluma & Santa Rosa Railroad are now engaged in surveying a line for the road from the Washoe House north to this city.

SAN FRANCISCO, CAL.—A project is on foot to use the waters of the Sutro tunnel for power in the mines of the Comstock. It is planned to erect a power plant at the town of Sutro.

KLAMATH FALLS, CAL.—C. N. Hawkins, president of the Klamath Canal Company, has asked for a franchise for an electric railway from the north city limits to connect with navigation on the water front of the Lower Lake.

PALO ALTO, CAL.—A municipal bond issue of $75,000 has been voted by the citizens of Palo Alto, $50,000 of which will be expended on the extension and improvement of the municipal water and electric lighting plant.

SANTA BARBARA, CAL.—The Pacific Coast Railway is planning an electric railway from Santa Maria to Guadalupe. The new road will receive power from the Valley Electric Company which is about to enlarge the capacity of its plant.

SAN FRANCISCO, CAL.—A special meeting of the stockholders of the Pacific Gas & Electric Company will be held at the office of N. W. Halsey & Co., 320 California Street, March 20, for the purpose of authorizing an increase in the company's bonded indebtedness from $10,350,000 to $14,850,000.

RED BLUFF, CAL.—Manager F. V. D. Johnson, of the Northern California Power Company, has announced that his company is about ready to commence the construction of a power line from Chico to the new sugar beet town of Hamilton in Glen County. The line will carry from 80,000 to 100,000 volts.

LOS ANGELES, CAL.—The Erchenbrecher Syndicate, of Los Angeles, has offered a right of way through its extensive holdings to the Pasadena Railway company for an electric railway from Pasadena to Eagle Rock, Glendale, and Griffith Park, to connect with the system of the Los Angeles Railroad Company at Ivanhoe.

OAKLAND, CAL.—The Sunset Telephone & Telegraph Company has been given permission to lay an underground telephone conduit on East Fourteenth Street. The company also contemplates extensive improvements to its system in the vicinity of Truckee, this state, part of which will consist of changing all ten-party lines to two-party lines.

BAKERSFIELD, CAL.—The Board of Directors and other officials of the Edison Electric Company of Los Angeles recently inspected the work on the large hydro-electric power plant which is being built in Kern River Canyon. As soon as work on this plant is completed the Edison Company will begin work on two additional large plants, one just above the intake of the new eight-mile tunnel and the other above Kernville.

ALAMEDA, CAL.—The contract for the high-speed engine for the additional unit to be installed in the municipal electric plant here, has been awarded to Charles C. Moore & Co., of San Francisco. The engine will be direct-connected to a 250-kw three-phase, 60-cycle generator, to be supplied by the National Electric Company, of Milwaukee. This generator is practically a duplicate of a generator recently installed in the same plant. There is also a Westinghouse generator in operation there.

LOS ANGELES, CAL.—Property owners have offered the Huntington street railway interests of Los Angeles a 40-foot right of way for a line between Eagle Rock and Verange Park, a distance of about three miles. According to Chief Engineer George Kahrts, the road between Los Angeles and Eagle Rock will be completed within the next sixty days and ninety days more would run the line into Verange.

LEADVILLE, COL.—The Leadville Telephone Company is to build a line to Denver.

PUEBLO, COL.—Local capitalists are asking for a franchise to operate a street railway system in Pueblo.

FORT MORGAN, COL.—At a recent election held for the purpose, the citizens voted for the establishment of a municipal electric light plant.

DENVER, COL.—While in Colorado recently in connection with plans for the development of certain water powers, Bion J. Arnold, of New York and Chicago, made a study of the possibilities of the use of electric power on the Denver & Rio Grande Railroad. He has rendered a report on this subject to the officers of the company.

GUNNISON, COL.—Bids will be received until February 21 for constructing a complete water system, including weir and dam on the Gunnison River, intake, flume, excavations, backfills, penstocks, pumps, connections fittings, turbines, generators, pipe, hydrants, etc., together with a building for the pumping machinery; also buildings and complete wiring for the installation and operation of an electric light plant, including wires, poles, transformers, etc. T. L. Thompson is Mayor, and John J. Huddart, of 41 Bank Block, Denver, is consulting engineer.

MIDDLETOWN, CONN.—The recent scare over the low grade kerosene oil has been the means of increasing the business of the Middletown Electric Light Company. Several residents of Portland and nearby places where the wires of the company extend, have had their residences wired. One man has had his barn wired as a precautionary measure.

MOODUS, CONN.—The Moodus & East Hampton Tramway Company is making an effort to finance its undertaking for the construction of an electric railway to connect Moodus and the manufacturing village of East Hampton, where connections could be made with the New York, New Haven & Hartford Railroad. Water power is available midway between the two towns mentioned, which are 10 miles apart.

PUNTA GORDA, FLA.—The Mayor has been asked to call an election for the purpose of deciding upon an issue of bonds of $18,000 for the construction of a wharf, water works and an electric light system.

LINCOLN, ILL.—There is said to be a good opening here for an electric light plant.

PARIS, ILL.—General Manager Farwell has received bids for the erection of a new telephone exchange.

CLINTON, ILL.—A survey is being run from Champaign to Decatur for an interurban railway to be built by the Interurban Syndicate next season.

QUINCY, ILL.—Engineers are preparing plans for a number of new telephone lines which will put Quincy independent subscribers in communication with important outside points.

AURORA, ILL.—C. C. Hinkley, City Electrician, writes that the proposed electric light plant will cost about $20,000. Bids for the construction have not yet been called for.

JACKSONVILLE, ILL.—Samuel B. Stewart, City Clerk, states that the City Council on February 1 voted not to make any appropriation for new machinery for the electric light plant, so that no improvements will be made in the plant during 1906.

FREEPORT, ILL.—Mr. A. J. Goddard, president of the Freeport, Ill., Railway, Light & Power Co., informs us that the city expects to install about 50 additional arc lamps on its new contract, which will involve an extension of about ten miles of pole line, including the essential lines that the company will put in to cover portions of the city not already served. A water power plant of about 700 hp down the river is contemplated as an extension.

BEDFORD, IND.—It is stated that the Indianapolis, Vincennes & Evansville Traction Company intends to begin the construction of its road in the spring.

PORTLAND, IND.—The work of making the survey for the extension of the Portland & Muncie Traction Company's line from Portland to Celina was begun January 30.

SOUTH BEND, IND.—Bids are wanted for three turbine water wheels, each capable of developing 200 hp at 10 ft. head, and all the accessories for the same. A. J. Hammond is the city engineer.

CRAWFORDSVILLE, IND.—The James H. Watson Company intends to erect a plant for the manufacture of galvanized iron products. It will need boilers, engines, dynamos and electrical supplies.

LOGANSPORT, IND.—The Indianapolis, Logansport & South Bend Traction Company has asked the Board of Public Works for entrance to the city. The enterprise is being promoted by Logansport and South Bend capitalists.

FORTVILLE, IND.—The Town Council is negotiating with the Indiana Traction Company to furnish electricity for lights and power for the town. If the negotiations fail a local company will be organized to build and operate a plant.

INDIANAPOLIS, IND.—The Indianapolis Southern Railway Company is preparing to install a new water plant at its shops in the southern part of the city and will make other improvements that will pave the way to the erection and installation of a light and heating plant subsequently.

WARSAW, IND.—The Peru-Warsaw division of the Winona Interurban Railroad will be built by the company instead of by a construction company under general contract, the sub-contracts being let for the actual construction. Bids, however, will soon be asked for the equipment. Dr. S. C. Dickey is president.

AFTON, IA.—The City Council has decided to install an electric street lighting plant for the town.

DES MOINES, IA.—A new switchboard is to be installed at the local exchange of the Iowa Telephone Company, and other improvements to the system will also be made.

FREMONT, IA.—The Farmers' & Traders' Telephone Company has sold its plant to W. D. Dinsmore, of Oskaloosa, Ia., and others. The new owners will make considerable improvement in the system.

FORT DODGE, IA.—The Newton & Northwestern Railway Company acquired the property of the Fort Dodge Street Railway January 31. The purchase includes the rolling stock and franchise. The price was $70,000.

CEDAR RAPIDS, IA.—The Albia & Centerville Railroad, between Albia and Centerville, is to be converted into an electric line and will connect with the present city lines at Centerville. The line will also be extended through Albia to Buxton and branches will be built to Mystic and Hiteman.

SIOUX CITY, IA.—The board of directors of the New State Telephone Company at the recent annual meeting voted to issue $100,000 worth of securities, as common and preferred stock, for improvements and extensions in its toll service. Work on the improvements will begin at once. They will include a trunk line to Council Bluffs and South Omaha, through lines to Sioux Falls, Yankton and Elk Point, a line to Worthington, Minn., to connect with the Tri-State Company's line from Minneapolis, and an extension from Randolph to Lincoln, Neb. The exchanges of the New State Company will undergo extensive improvements wherever they are needed. At Cherokee a new switchboard and copper circuit will be installed.

WYNNEWOOD, I. T.—It is stated that bids will be received until February 14 for constructing a combination water works and electric light system. J. O. Swingley is Mayor.

OTTAWA, KAN.—The Ottawa Telephone Company is to spend between $30,000 and $40,000 in improving its plant at Ottawa.

PITTSBURG, KAN.—The Pittsburg Railway and Light Company, Pittsburg, Kan., many of whose stockholders are Carthage (Mo.) capitalists, has recently purchased a 22x36-in. Reynolds Corliss engine, suited for left-hand drive, and a 300-kw engine type, direct-current generator for the enlargement of the present plant. The new unit will be furnished by the Allis-Chalmers Company, Milwaukee.

HOPKINSVILLE, KY.—Hilliard M. Dalton is reported to have purchased a franchise for a street railway and electric light plant.

CLOVERPORT, KY.—D. Stewart Miller, Jr., of Owensboro, has petitioned for a franchise to construct and operate an electric light plant.

MT. STERLING, KY.—The Mt. Sterling Water & Light Company is contemplating extensive improvements this coming season. A new plant will be installed and new street arc lamps will also be put in.

LAFAYETTE, LA.—An appropriation of $35,000 has been made for the purpose of making improvements in the water works system and the electric light plant.

WINFIELD, LA.—The Town Council has granted a franchise to the Winfield Electric Light & Power Company, Ltd., to establish an electric light and power plant in the town.

DEXTER, ME.—Mr. Charles H. Batchelder, the local builder and contractor, has been awarded the contract for building the new electric power plant.

LEWISTON, ME.—One of the latest enterprises in the telephone field is the Lewiston, Greene & Monmouth Telephone Company. It is said to have planned to build and maintain a system which will operate in various cities and towns in Androscoggin and Kennebec counties. The capital stock of the corporation is $10,000. The officers of the corporation are: President, R. Alden, of Winthrop; treasurer, H. M. Blake, of Monmouth; directors, R. Alden, Eli Hodgkins, A. H. Bailey, H. M. Blake, J. H. Gilman and H. F. Foster.

BALTIMORE, MD.—The directors of the Maryland Telephone Company met recently, and it is understood that they are planning to refinance the company in order to provide for the proposed installation of an automatic exchange system.

CUMBERLAND, MD.—J. A. McHenry, secretary and treasurer of the Cumberland & Mt. Savage Railway Company of Allegheny County, says the company has been incorporated and has obtained a valuable franchise to build its road on the public highway, 8 miles. No organization has been effected as yet.

LAWRENCE, MASS.—The Lawrence Gas Company, having reached the limit of $1,000,000 allowed under the statutes, has petitioned to be allowed to increase its capital stock to meet the growing demands for gas and electricity in Lawrence, Andover, Methuen and North Andover.

PITTSFIELD, MASS.—The International Power Company has received orders for four of the largest size Diesel engines. Two of them are to go to the Pittsfield, Mass., Electric Light Company. Manager Hughes, of the New England Telephone & Telegraph Company, has arranged to install 40 interior stations in the plant of the Stanley Electric Manufacturing Company.

HOLBROOK, MASS.—At a special meeting for the purpose of hearing the report of the committee chosen to ascertain the cost of lighting the town by electricity, Mr. McLaughlin, in behalf of the committee, stated that the only company available that they could do business with was the Randolph & Holbrook Electric Light & Power Company. That company would light the town with six arc lamps and 125 candle-power incandescent lamps for $2,000 per annum and for a term of five years.

FALL RIVER, MASS.—The contract between the city and the electric light company expires in October, 1907, and the company apparently does not fear any diminution of its business with the city. General plans and specifications for the foundation work of the proposed big new generating station at the foot of Hathaway Street have been given out and the specifications for the building itself will shortly follow. It is proposed to erect an entirely fireproof structure of steel, brick and cement, 120x120 feet in dimensions and from 50 to 75 feet in height.

NEW BEDFORD, MASS.—The State Board of Gas and Electric Light Commissioners are considering a petition presented by a committee of the Board of Trade for a reduction in the price of gas and electricity in this city and Fairhaven. It is claimed that the company can afford to supply gas at $1 per thousand cubic feet, with 10 per cent off for payment within ten days, and that 15 cents per kilowatt-hour should be the cost of electricity. The present rates are $1.10 with a discount of 10 per cent for gas, and 18 cents per kilowatt-hour for electricity, with a discount proportional to the amount used.

WORCESTER, MASS.—The New England Telephone & Telegraph Company on account of its increased business, finds it necessary to make arrangements for larger quarters. Negotiations are under way for the purchase of a piece of land adjoining the company's present exchange, and if this is secured the company proposes to erect a building as large as that now in use to provide for future expansion. If the adjoining land cannot be secured, the Telephone Company will establish a sub-exchange in some other part of the city. The company has recently been granted a franchise to establish a new main line between Adams and North Adams along the East Road from East Hoosac Street.

BROOKLINE, MASS.—At a special town meeting, on January 31, the town of Brookline, Mass., voted to appropriate $35,000 to erect a consolidated heating, lighting and power plant under the direction of the gymnasium and school committees to supply the Manual Training High School, the Municipal Bath House and the proposed gymnasium and high school. Early in the study of plans for the new gymnasium, which will cost $100,000, the question of heating and lighting came up. From the close proximity of the public bath house, the necessity of soon installing some steam laundry machinery in the latter and the large number of lamps that should be used in both buildings, it was evident that a considerable saving would be effected by a combined heating and lighting plant. It was found that the entire group of four buildings could be heated and lighted from one plant located partly in and partly behind the manual training building. By this arrangement one chimney would take the place of four, unnecessary duplication of parts would be eliminated, and several thousand dollars saved annually. It was decided not to install the heating plant in the gymnasium as first considered, on account of the expense and encroachment upon valuable space.

JACKSON, MICH.—The Michigan State Telephone Company is contemplating improvements this next year amounting to $200,000.

THREE RIVERS, MICH.—The Michigan & Indiana Traction Company has been granted a franchise by the City Council to operate an electric road through the city.

MUSKEGON, MICH.—Mayor Flemming proposes an easy plan for municipal ownership, whereby the old water works building might be equipped for a lighting plant at an expense not greater than $15,000.

WYANDOTTE, MICH.—The Pennsylvania Salt Mfg. Company, Wyandotte, Mich., with head offices in Philadelphia, has purchased a new power equipment to supplement the one already in use in order to meet the demands of increased business. The new units are a 36x48-in. simple, heavy-duty Reynolds Corliss engine, direct coupled to an 800-kw, direct-current Bullock generator. The engine will run in parallel with other units, and the load from the generator, which is of the engine type, will be used in part for light and power, but for the most part for electrolytic purposes. The entire unit, steam and electrical, will be furnished by the Allis-Chalmers Company, Milwaukee, and is to be ready for service early in June.

INTERNATIONAL FALLS, MINN.—E. W. Backus is said to be making arrangements to establish an electric light plant here.

DULUTH, MINN.—The Duluth General Electric Company has recently reorganized as the Duluth-Edison Electric Company, with a capital of $2,000,000. The company proposes to expend about $150,000 in changing from steam to water power.

CORINTH, MISS.—The Corinth & Shiloh Electric Railway Company proposes to construct an electric railway in Corinth. The company has a capital of $250,000.

CASSVILLE, MO.—The Cassville Mill & Supply Company is about to install a system of electric lighting for the city. The facilities of the company's present plant will be enlarged to meet the increased demand.

JEFFERSON CITY, MO.—Plans are being prepared by a local firm of architects for the construction of a new central light, heat and power plant for the penitentiary. The new plant will cost between $200,000 and $250,000.

CHILLICOTHE, MO.—At the election held January 29 for the purpose of deciding the question of bonding the city for $100,000 for the purpose of establishing its own water and light plant, the proposition carried 5 to 1. The city has been lighted by a private corporation for twenty years.

CLINTON, MO.—The Council has rejected the terms made recently by the Lighting Company and the Mayor has been investigating the conditions of the electric light plant at Harrisonville, with a view to gaining ideas for establishing a plant here, but no definite steps have been taken in the matter.

SEWARD, NEB.—The Seward Independent County Telephone Company is arranging to build a line from this point to Milford.

RED CLOUD, NEB.—Bonds have been voted, the proceeds of which will be utilized in installing an electric light plant for the town.

NASHUA, N. H.—Engineers are making surveys of the Nashua River bed in this city with a view, it is said, of establishing a large electric plant for the Jackson Manufacturing Company, to be operated by water power. It is also reported that a new dam may be constructed below the present structure.

ORANGE, N. J.—Bids willl be received until March 1 for lighting the streets of the city for a period of either three or five years. Address F. T. Crane, city engineer.

TRENTON, N. J.—A contract has been awarded by the New York-Philadelphia Company, operating the New York & Philadelphia electric railway by way of Trenton and Elizabeth, for building the second section of the proposed air line to the Schuykill Stone Company, of Philadelphia. This section extends from Rahway to Metuchen and will be double-tracked. Specifications for the third section between Metuchen and Milltown are being drafted and a contract will be awarded within a few weeks. The Atlantic City & Suburban Company, it is reported, contemplates extending its line from Somers Point to English Creek, along the Great Egg Harbor River road to May's Landing, across to Egg Harbor City and through to Tuckerton.

FARMINGTON, N. M.—The Sunshine Electric Power & Railway Company plans to build a large power plant at Fruitland, N. M., for the purpose of furnishing power and light and for operating an electric railway between Farmington and Jewett.

ROME, N. Y.—The Central New York & Empire State Telephone interests propose to spend $1,500,000 in the improvement of their system.

MONROE, N. Y.—There is some talk of the Sterling Lake Railroad being continued to Warwick and converted into an electric line.

FULTON, N. Y.—Louis W. Emerick has been granted a franchise in Fulton. He will organize a company which will install a modern telephone system.

TUPPER LAKE, N. Y.—The Robinson Telephone Company of Potsdam has been granted a franchise to build and operate a telephone system at Tupper Lake.

OSWEGO, N. Y.—It is announced that the extension of the Syracuse, Lakeside & Northern Railway from Phoenix to Fulton on the east side of the Seneca River, will be built in the spring.

NEW YORK, N. Y.—Bids will be received until February 13 by C. B. J. Snyder, Superintendent of School Buildings, for installing electrical equipment in the addition to School 71, borough of Manhattan; also an electric bell system in School 5, borough of Bronx.

WATERTOWN, N. Y.—The Public Works Committee on Street Lighting is considering plans for a new system of street lighting for the city. Three different plans are under discussion—one for straight electric lighting, one for straight gas lighting and the third for a combination of the other two.

BUFFALO, N. Y.—Henry J. Pierce, president of the International Traction Company, of Buffalo, says the steam railroad companies are planning to jointly build a staton at William and Curtis Streets, and that the New York Central proposes to electrify its belt line and establish convenient local passenger stations at different points, to which the International Company will loop its lines so as to handle traffic expeditiously. If the Union Station is established at William and Curtis Streets the International Traction Company undoubtedly will run belt lines to it direct from the Elmwood district, through Elmwood Avenue and Utica Street, via William Street, and back through Broadway, as well as belt lines from other parts of the city.

NEW YORK, N. Y.—The Great Eastern Telephone Company, a new independent concern in New York City, has made an application to open the streets to lay new subways under the franchise recently declared valid. D. A. Reynolds, president of the company, says: "We secured over 29,000 contracts for telephones during January, and now have more than 67,000 as the result of fourteen weeks' canvass. We have filed maps with the department for one exchange in lower Manhattan and one in the Bronx, which will be followed by others. Our orders for material will be placed at once upon receiving our permit."

TROY, N. Y.—The Hudson River Electric Light & Power Company, which is installing a series of plants in and around Fulton County, has purchased a piece of property between the cities of Johnstown and Gloversville, on which will be erected a sub-station to serve both places. The purchase includes the franchise of James H. Cross of Johnstown, which gives the company the desired privileges in that city. Application will be made at an early date for a franchise in Gloversville. The line will be a branch of the trunk line which extends from Spier Falls through Saratoga Springs and Ballston Spa to Troy, Albany and Schenectady. From the sub-station at Ballston Spa another line is being constructed, which will extend through the western territory of the company and will be known as the Utica line. This line will extend across country to Amsterdam and thence to Johnstown, Little Falls, Herkimer and Utica. The material is all on the ground for the line from Ballston Spa to Amsterdam. At the latter city a sub-station will be located on Church Street. The company proposes to furnish electricity in all the cities and villages along its route. The company secured the contract for furnishing power for The Utica & Mohawk Valley Railroad Company a year ago.

HAMILTON, OHIO.—The Hamilton Home Telephone Company expects to spend $35,000 in improving its system.

CANTON, OHIO.—Reports state that eastern capitalists are interested in a project to construct a new interurban road from Canton to Carroll.

GEORGETOWN, OHIO.—The City Clerk writes that the citizens voted January 29 to issue $15,000 bonds for the construction of an electric light plant.

TOLEDO, OHIO.—The Toledo & Columbus Railway Company is securing right of way between Fremont, Tiffin and Bucyrus. George D. Everett is in charge of the work.

LANCASTER, OHIO.—The Fairfield Traction Company is planning to build a line north to Buckeye Lake, giving Lancaster direct connection with that famous resort.

CHILLICOTHE, OHIO.—General Manager A. G. Moser, of the Chillicothe Electric Railroad, Light & Power Company, informs us that the company intends to rebuild all the outside overhead work.

EAST LIVERPOOL, OHIO.—The East Liverpool Traction & Light Company is planning to build an extension to Vanport, Pa., where connection will be made with an extension of the Pittsburg Railways Company.

ELYRIA, OHIO.—The Lake Shore Electric Railway Company will make extensive improvements in its lines this year. Part of them have already been planned in detail and orders placed, including a power plant which will cost about $60,000.

CLEVELAND, OHIO.—Farmers in the neighborhood of Berea and Elyria have submitted a proposition to the Cleveland & Southwestern Traction Company for the building of a new line from Berea through Olmstead Falls, Columbus and Eaton to Abbeys Corners, where it would connect with the Grafton spur line owned by this company

COLUMBUS, OHIO.—President John G. Webb, of the Columbus, Delaware & Marion Railway, announces that his company will make important extensions in the spring. The main line will be extended from Marion to Bucyrus, 21 miles; a spur will be run to Richwood, 6 miles and 3 miles of city track will be laid in Marion. The main line is to be double-tracked from Columbus to Glenmary Park, 12 miles. Two additional 2,000-kw Curtis turbines are to be placed in the main power station at Stratford.

WATONGA, OKLA.—G. E. Moore, City Clerk, writes that bids will be received until February 23 at his office for furnishing material and constructing complete an electric light plant and water main extension. M. A. Earl, 1416 First National Bank Building, Chicago, Ill., is the engineer.

SPRAY, ORE.—A movement has been started among the ranchers of the John Day River district for the installation of a local telephone system.

PORTLAND, ORE.—The Portland General Electric Company has secured the contract for lighting St. Johns, Ore., for a term of five years. A sub-station will probably be constructed at that point.

ALBANY, ORE.—George E. Pusey, who is believed to act for the Portland General Electric Company, has filed a claim in the county recorder's office for 100,000 miner's inches of the waters of the North Santiam River, above Mill City, where he owns land along that stream. He proposes to run five ditches out of the stream, the ditches to be 10 feet deep, 40 feet wide at the bottom and 70 feet at the top; in lieu of ditches he may use flumes 10 feet deep and 48 feet wide, or pipe lines, the pipe to be 11 feet in diameter. The purpose is to secure power for the purpose of generating electricity for light and power. The Santiam River above Mill City is said to be capable of developing 780,000 hp between Detroit and Mill City.

GETTYSBURG, PA.—The United Telepnone & Telegraph Company is to entirely rebuild its system at this place.

WEST CHESTER, PA.—It is stated that the management of the Philadelphia, Coatesville & Lancaster Electric Railway Company expects to continue construction work in the spring and to have cars running at Atglen before the middle of the summer.

EASTON, PA.—Sealed proposals will be received at the office of the City Clerk until 4 p. m., Wednesday, February 14, for 250 series enclosed direct-current arc lamps. Address John Mutchler.

BUTLER, PA.—Superintendent Palmer, of the Butler Passenger Railway Company, has received orders to start work immediately on a 4,000-ft. extension of the company's lines through the Lyndora district.

YORK, PA.—The Dillsburg & Mechanicsburg Railroad, eight miles long, with a two-mile branch, was sold at public auction recently to the Cumberland Valley Railroad under the foreclosure of a mortgage of $100,000 held by the latter company. The purchase price was $50,000. The line has been operated for years by the Cumberland Valley Railroad Company. It will now be turned into an electric road.

ALLENTOWN, PA.—The Taylor Engineering Company, New York City, has recently purchased for the Taylor Manufacturing and Construction Company, Allentown, Pa., a 14x24-in. Reynolds Corliss engine, direct coupled to a 100-kw engine type "Bullock" generator, operating at 150 r.p.m. The new unit, which will be used for power and lighting purposes, will be furnished by the Allis-Chalmers Company, Milwaukee.

HARRISBURG, PA.—The Central Pennsylvania Traction Company, Harrisburg, Pa., recently contracted for three Reynolds horizontal, heavy-duty, cross-compound engines, cylinders 22x48 in. in diameter and 42-in. stroke, for direct connection to three 650-kw railway typr generators, 600 volts. Both engines and generators will be furnished by the Allis-Chalmers Company, Milwaukee.

PHILADELPHIA, PA.—An ordinance is being prepared for presentation to the City Council by George R. Sheldon and Pliny Fisk, of New York, representing a strong group of capitalists, which proposes that the Commonwealth Electric Company shall be granted franchises satisfactory to the city, enabling it to use the conduits of the Keystone Telephone Company and to do an electric lighting business in Philadelphia. The Mayor has appointed a sub-committee of his Advisory Committee to investigate the question. If this ordinance is passed, it will mean competition for the Philadelphia Electric Company, which has had a monopoly of the lighting in Philadelphia for years.

PIERRE, S. D.—The City Council of Fort Pierre has granted the franchise asked for by Messrs. Newbanks and Fischer for the right to build and operate a street railway.

MILBANK, S. D.—The Grant County Telephone Company is to spend $30,000 in extending and improving its system.

SIOUX FALLS, S. D.—The Sioux Falls Interurban Electric Railroad Company, which was recently incorporated, announces that the funds necessary to construct the road have been raised and that work will begin as soon as the snow is off the ground

BELLE FOURCHE, S. D.—The Belle Fourche Electric Light, Heat & Power Company, Belle Fourche, S. D., has recently placed orders with the Allis-Chalmers Company, Milwaukee, for extensive new equipment for the company's plant. The new machinery to be installed will consist of a 16x42-in. heavy-duty Reynolds Corliss engine, adapted for right-hand drive; two new 66x16-ft. Chandler & Taylor Boilers, duplex feed pumps, feed water heater, etc. The new engine will be belted to a countershaft to drive a 150-kw alternator, the load being practically all used for lighting purposes. Mr. A. A. Noodie, paymaster of the Homestake Mining Company, is president of the company, and Mr. J. S. Moodie, general manager of the Belle Fourche Power & Water Company, is vice-president.

PIERRE, S. D.—W. H. Rowe has petitioned for a franchise, and if granted same, will construct an electric light plant here at a cost of $10,000 to $15,000.

DAYTON, TENN.—Mr. W. G. Holman, the superintendent of the Rhea County Electric Light Company, informs us that it bought out the Dayton Light & Power Company recently. The management intends during the next sixty day to tear out the present machinery consisting of a high speed Frick engine and a 50-kw Wood alternator, and to replace them with a 150-hp Corliss engine and a 100-kw, 2,300-volt, 60-cycle, single-phase generator. The present plant has become too small to carry the load that has to be handled.

DALLAS, TEX.—The Southwestern Telegraph & Telephone Company is contemplating establishing a telephone exchange in South Dallas in a few months.

AUSTIN, TEX.—Stone & Webster, of Boston, are said to have sent Mayor Shelley a report on rebuilding the Austin dam. It calls for an expenditure of $555,200 in replacing the dam, and $186,800 for rehabilitating and equipping the power plant.

HOUSTON, TEX.—F. L. Dana, secretary of the Houston-Galveston Interurban Electric Railway Company, says that work will begin within thirty days on the company's line to connect Houston and Galveston, 48 miles distant. In addition to this, a line will be built at La Porte, 12 miles. The power station and repair shops will be located at Genoa. The company will furnish power for lighting purposes also.

MONTPELIER, VT.—A special meeting of the Board of Directors of the Consolidated Lighting Company has been held, at which time it was voted to make extensions to the system which will amount to the neighborhood of $100,000. A new building will be constructed at Bolton Falls and other improvements made, including a new switchboard to cost $10,000. The company has in the neighborhood of 50 stone sheds employing 2,000 or more men depending on it for power, and to insure power at all times this large increase in the company's plant is made. Additional water wheels will be put in the Bolton Falls plant and will increase the capacity of that plant from 2,000 to 4,200 horse-power, which, with the 3,000 at the Pioneer plant, will give 7,200 horse-power.

SPOKANE, WASH.—The Inland Empire Railway Company, which was recently organized here with a capital of $20,000,000, is making plans to build an electric road from Spokane to Phoenix, B. C.

GOLDENDALE, WASH.—The County Commissioners have granted permission to the Eastern Klickitat Telephone Company to erect and maintain a telephone system along the public highways of Klickitat County.

GOLDENDALE, WASH.—The Goldendale Telephone & Telegraph Company has decided to make several improvements in its system. A new switchboard will be installed and several new farmers' lines will be built.

FAIRMOUNT, W. VA.—A contract has been signed for work to begin soon on the Fairmount & Mannington Railroad Company's line. The company will purchase and take over the Mannington light and power plant and a small railroad about a mile long. In all, the company will build 14½ miles of line. Thomas W. Fleming is president of the company.

SHEBOYGAN, WIS.—The Citizens' Telephone Company, of Sheboygan, is to spend $30,000 in improving its system.

LETHBRIDGE, ALB., CAN.—The Lethbridge Electric Light Company will erect a new building and make extensive improvements in its plant.

FORT STEELE, B. C.—The Bull River Power, Light & Mining Company will start construction on a lighting plant for this town as soon as weather permits in the spring.

INDIAN HEAD, CAN.—The town is seeking authority to borrow $100,000 for a municipal lighting plant. Address J. A. McCaul.

CARBERRY, MAN.—The Council is considering plans for a municipal electric lighting plant. Address Mayor Eaton.

WINNIPEG, MAN.—The Canadian Pacific Railroad Telegraph Company has made an appropriation of $250,000 to be used in improvements to its lines in the Northwest during the coming summer.

WINNIPEG, MAN.—Work will be commenced on the construction of the civic lighting and power plant at Lac du Bonnet as soon as weather permits in the spring. The power will be transmitted over 60 miles from the falls to the city.

YEBABITO, MEX.—The Sinaloa Land Company will install an electric light plant and telephone system at Yebabito.

COLONIA JUAREZ, MEX.—The Mormon colonists of Colonia Juarez have taken steps towards installing an electric light plant for the town.

CHIHUAHUA, MEX.—The Compania Industrial Mexicana, which operates an electric light and power plant at Chihuahua, is preparing to increase the capacity of its plant.

PARRAL, MEX.—The Veta Colorado Mining and Smelting Company will install an electric power plant for the purpose of operating the machinery of its mines. H. R. Gardner is chief electrician for the company.

CITY OF MEXICO, MEX.—Eduardo Vinas, of the City of Mexico, is arranging to establish a hydro-electric plant near the city. He is said to be representing Miguel Cervantes y Estanillo in promoting the enterprise. The waters of the Xalapango and Papalota Rivers will be used for generating the electrical power.

CHIHUAHUA, MEX.—The Municipal Government of Chihuahua, aided by the State Government, has under consideration the installation of a large electric power plant at the proposed great dam that is to be built across the river near town.

JALAPA, MEX.—Angus H. McLean, of Jalapa, has made application to the Federal Government for a concession to install an electric power plant near here. The water of the Grande Misantle River will be used to furnish power. Transmission lines will be built to the principal towns and industrial centers of the district.

CITY OF MEXICO, MEX.—The Mexican Light and Power Company, of the City of Mexico, is still having trouble with bold thieves who do not hesitate to cut and carry off sections of the transmission cable which runs from Necaxa to the city. Recently this cable was cut and portions of it, which weighed 1,500 pounds, were carried away by the thieves. The theft caused a serious interruption of the services of the company. Efforts are being made to apprehend the thieves.

PARRAL, MEX.—Mr. Rodriguez, head of the well-known mining company of Ignacio Rodriguez Ramos, has been given a sixty-day option on a federal concession to develop the water power of the Conchos River in the State of Chihuahua, which was issued by the Federal government several months ago to Paul Tuinter and Joaquin Cotazar, Jr. In about a month a report will be completed as to the feasibility of the project. If the engineers report favorably, it is said that Mr. Rodriguez will at once take steps to organize a company with a capital of $5,000,000 for operating the concession and furnishing electricity to the whole of the State of Chihuahua. It is said that the site is capable of developing 25,000 hp.

GRAND FALLS, N. B.—The Grand Falls Power Company, which is proposing to develop the water power at Grand Falls, N. B., for the purpose of generating electrical power, has forwarded plans and specifications to Ottawa and is awaiting the approval of the Governor-General in council. It is understood that as soon as the documents have been passed work will be commenced. The company proposes to construct a concrete dam at a point 750 feet above the falls across a narrow part of the river. It will be 38 feet high and 540 feet long between abutments and founded on solid rock.

GODERICH, ONT.—A dam, costing $250,000 and capable of developing 2,575 hp. is to be built across the Maitland River about four miles from here. The work will be commenced in a few months. The power will be used not only for industrial purposes, but will also operate the town's water and lighting plant and probably a system of railway

SHERBROOKE, QUE.—At the annual meeting of the Sherbrooke Power, Light & Heat Company the directors' report showed a substantial increase in business in the electric lighting department. The report also stated that extensive improvements to the power house and plant are contemplated, which, when completed, will give the company a large reserve of power with which to meet the steadily increasing demands for its services.

New Incorporations.

OZARK, ARK.—The Ozark & St. Paul Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are: C. B. Blaylock, Joseph Hill, S. Davis, J. A. Bateman, L. G. Bristow and other well-known business men.

QUINCY, CAL.—The Northern Sierra Power Company has filed articles of incorporation, showing a capital stock of $1,500,000. Among the incorporators are C. H. Goodhue, J. G. Niggle and C. F. Phelan.

NORWICH, CONN.—Former State Treasurer Henry H. Gallup and E. W. Jackson, of Norwich, and William Segar and James M. Pendleton, of

Westerly, R. I., are the incorporators named in a resolution which is now pending before the Rhode Island Legislature, and which grants a charter to the Westerly & Connecticut Railway Company. The proposed corporation has an authorized capital stock of $400,000. The Norwich & Westerly Company is authorized to build an electric railway from Norwich to the Connecticut State boundary at Westerly.

BOISE, IDA.—The Idaho Telephone Company has been incorporated with a capital of $5,000. The company's headquarters will be at Rupert, Idaho. The incorporators are Marion Mackey, Alice Mackey, Llouellyn M. Zug, Ailie D. Ash and Frank Copening. Construction will commence at once, part of the material having already been ordered.

CHICAGO, ILL.—The Ottawa & Streator Power, Light & Traction Company has filed articles of incorporation, with a capital stock of $50,000. Among the incorporators are M. Thorne, William E. McLean and M. W. Kelly.

PALOMA, ILL.—The Central Exchange Telephone Company, of Gilmer Township, capital $2,500, has been formed. Incorporators: J. R. Henry, O. H. Lawiess and J. Dickhut.

BELVIDERE, ILL.—The Belvidere, De Kalb & Southern Railway Company has filed articles of incorporation and been granted a charter. The company will construct a railway from the northern line of McHenry County to Joliet. The principal offices of the company, which is capitalized at $1,500,000, will be in Chicago. The incorporators and first board of directors are: W. H. Zimmerman, J. B. Huling, J. D. Harvey, J. C. Williams and Millard R. Powers.

FORTVILLE, IND.—The Fortville Electric Company has been organized and will construct an electric light plant here.

CRANDALL, IND.—The Crandall Telephone Company has been incorporated and will soon ask for bids for the construction of a telephone plant here.

CRANDALL, IND.—The Excelsior Telephone Company, with a capital of $6,000, has been incorporated by W. E. Yenawine, B. F. Markwell and others.

EVANSVILLE, IND.—The Citizens' Telephone Company has filed its articles of incorporation and will apply at once for a franchise to erect an exchange here at a cost of from $300,000 to $400,000. The company will make connections with all the independent lines in Southern Indiana.

TOCSIN, IND.—The Tocsin Telephone Company has filed articles of incorporation. The company is capitalized at $10,000, and will operate in the northern part of Wells County, with home office in Tocsin. It takes over the business of a partnership having a large number of telephones in the territory. Extensions will be made and new equipment installed in the exchange.

INDIANAPOLIS, IND. Articles of incorporation have been filed by the United Traction Coal Company, with headquarters in this city. The capital stock is $300,000. The company has leased coal lands in Green and Sullivan Counties, soon to be reached by interurban lines, and will sink shafts and make provisions for transporting the product. The directors are J. V. Van Osdell, William Sampson, H. C. Carpenter and C. H. Allen.

RICK VALLEY, IA.- The Klein Rural Telephone Company has been incorporated by J. E. Quintan and others, with a capital stock of $2,000.

DES MOINES, IA.—Articles of incorporation of the Indianola Interurban Railway Company have been filed with the Secretary of State. Des Moines is made the principal place of business and the capital stock is fixed temporarily at $50,000.

BURRTON, KAN.—The Burrton Inman Telephone Company was recently incorporated with a capital of $12,000.

HOXIE, KAN.—The Hoxie-Northwestern Telephone Company is the name of a recently incorporated concern with a capital of $1,200.

MENLO, KAN. -A telephone company, with a capital of $2,200, was recently incorporated under the title of the Farmers' Mutual Telephone Company.

POMONA, KAN.—An Independent telephone company has been organized at Pomona, and the following temporary officers elected: E. G. Swayze, president; F. E. Dyer, secretary and treasurer; Fred Baldwin and Carl Hoopes, executive committee.

BERNICE, LA.—The Bernice Telephone Company, Ltd., has been incorporated with a capital stock of $3,000. W. H. Wise is president, L. N. Holmes, vice-president; S. J. Beaird, secretary and treasurer.

JESSIE, MICH.—The Farmers' Telephone Company has been organized at Shepardsville, with a capital of $1,000, all subscribed.

SEDAN, MINN.—Articles of incorporation have been filed by William Wolfe, Henry Hess, W. E. Martin, A. Woodhall and M. C. Whitney. The company is capitalized at $2,000.

HALLAM, NEB.—D. W. Sherwood and others have incorporated the Star Telephone Company with a capital of $1,440.

ALBANY, N. Y.—The Fishers Island Railroad Company has been incorporated with a capital of $12,000, to operate a cable or electric railway on Fishers Island, Suffolk County. The directors are Walton Ferguson, A. L. Ferguson, of New York, and Frank N. Heim, of Fishers Island.

BUFFALO, N. Y.—The Buffalo Subway Railroad Company has been incorporated to construct an underground electric railway eight miles long in Erie County. The company has a capital of $1,000,000, and the following are the directors: Frank S. McGraw, A. W. Bonynge, Edward McInnes and H. M. Spencer.

OSSINING, N. Y.—The Hudson River & Eastern Traction Company has been organized and incorporated to operate an electric railway nine miles long from a connection with the New York Central Railroad in Ossining through Briar Bluff Manor, Pleasantville and Sherman Park. The company is capitalized at $400,000, and the following named gentlemen comprise the first board of directors: Ashley T. Cole, Arthur McConsland, Peter C. Schutrum and Howard E. Keeler.

NEW LEXINGTON, OHIO.—The Citizens' Independent Telephone Company has been incorporated with a capital of $50,000.

CARR, OKLA.—The Carr Gin, Milling & Telephone Company, having a capital stock of $6,000, has filed articles of incorporation.

ESCATADA, ORE.—The Escatada Light & Power Company, having a capital of $3,000, has been incorporated by George F. Martin, W. M. Brewster and W. T. Muir.

FOREST GROVE, ORE.—The Forest Grove Transportation Company, which recently obtained a franchise to build and operate an electric railway from the depot to the business part of the city, has filed articles of incorporation. The incorporators are Mrs. A. F. Rogers, E. W. Haines, George Hancock, John Templeton, George F. Naylor, F. A. Watrous and J. E. Loomis.

FRIEND'S COVE, PA.—The citizens have organized the Friend's Cove Mutual Telephone Company, with the following officers: Samuel Hunt, president; Clayton Smith, vice-president; S. F. Whetstone, secretary; John Whetstone, treasurer. Connections will be made with the rest of the country through the Bell Company and the County Telephone Company.

ANDERSON, S. C.—The Savannah River Power Company has been organized and the following officers elected: H. A. Orr, president; C. Elmer Smith, of York, Pa., vice-president; S. M. Orr, treasurer, and E. K. Chapman, secretary. The other directors are H. H. Watkins and J. E. Sirrine. This is the million-dollar company, which will develop electric power on the Savannah River, and bring it to this place. Actual work will begin as soon as details can be arranged.

HOT SPRING, S. D.—The Fall River Telephone Company has been incorporated with a capital of $30,000. The company will operate principally in Fall River County, with headquarters at Hot Springs. The incorporators are D. O. Kimball, Jacob Burg, W. C. Timma and Thomas Getty, all of this place.

PIERRE, S. D.—Articles of incorporation have been filed by the Langford Telephone Company, at Langford, with a capital of $22,500. The company will do a general telephone business in the counties of Marshall, Day, Brown and Roberts. The incorporators are C. A. Platt, J. F. D. Cook, Howard Platt, C. B. Hersey, W. H. Sherrard and others at Langford.

NASHVILLE, TENN.—A charter has been granted to the Home Telegraph Company, which was incorporated for the purpose of constructing a telegraph line from Franklin to Goodlettsville. The company has a capital stock of $10,000 and the following are named as incorporators: R. E. Cooper, W. C. Polk, L. S. Miller, Louis Dupont and Luke Lea.

GROVETON, TEX.—The Groveton Light & Power Company has been incorporated, with a capital of $15,000, by John R. Collins, A. J. Wood, C. H. Kenley and others.

HOUSTON, TEX.—The Houston Lighting & Power Company has been reorganized and articles of incorporation filed. The company's capital is $1,000,000. It will take over, improve and operate an established plant.

PECOS CITY, TEX.—The Reeves County Telephone Company, with a capital stock of $20,000, has been incorporated by C. W. Kelley, R. S. Johnson, R. G. Sage, F. W. Johnson, W. D. Cowan and G. B. Laudman.

EL CAMPO, TEX.—A stock company has been organized here with $15,000 fully paid in capital to install an electric light, ice and water plant at this place. The following officers have been elected: E. L. Correll, president, Frank Koenig, Jr., vice-president and general manager; J. W. Leach, secretary and treasurer. The electric light plant formerly operated by E. L. Correll has been purchased by the new company and will continue to furnish light until the new company can be installed.

LURAY, VA.—The Shenandoah River Light & Power Corporation has filed its articles of incorporation, with the following officers: T. J. Berry, president; C. S. Landram, vice-president; John W. Grove, secretary and treasurer, all of Luray. The minimum capital stock is stated as $20,000 and the maximum amount is placed at $50,000. The company will construct a dam and a power plant for the generation of electricity.

TACOMA, WASH.—The Home Telephone Company, of Puget Sound, has filed articles of incorporation, showing a capital stock of $5,000,000. Edward E. Webster and Charles E. Sumner are among those interested.

MILWAUKEE, WIS.—Articles of incorporation have been filed for the Chicago & Milwaukee Electric Railway Company by J. H. Marchutz, J. C. Stevens and L. Quarries. The capital is $100,000.

EASTMAN, WIS.—The Western Crawford County Farmers' Telephone Company, Eastman, has been organized. Incorporators: James Fisher, J. F. Maney, J. R. Maney, G. H. Harvat and M. Lennehan.

NORTH MILWAUKEE, WIS.—The North Milwaukee Light & Power Company has been incorporated with a capital stock of $50,000. Dr. J. Thiemann, J. J. Schissler and P. V. Schissler are the incorporators.

MONTREAL, QUE.—The Central Heat, Light & Power Company, Ltd., has been incorporated, with a capital stock of $500,000. Its chief place of business will be in Montreal. It will conduct a light, heat and power business in all its branches.

New Industrial Companies.

THE CHEROKEE ELECTRIC & MANUFACTURING COMPANY has been incorporated at Cherokee, Okla., with a capital stock of $16,000.

THE UNITED ELECTRIC & APPARATUS COMPANY, of Boston, Mass., has been formed; capital, $25,000, by J. McCloskey, Wm. H. Knight and J. H. Dorman.

OREGON ELECTRIC FINANCE COMPANY, of Brooklyn, has recently been incorporated to conduct a general trust and fiduciary business. The company's capital is $2,000.

HIGH SPEED ELECTRIC COMPANY, New York, has filed articles of incorporation, with a capital stock of $58,000. Leswig Zeisler, H. Schwarz and E. V. Miller are named as directors.

ATLAS ELECTRIC COMPANY, Chicago, Ill., has been incorporated by H. G. Hill, S. H. Meyers and James C. Hood. The company has a capital of $2,500 and will do a manufacturing business.

UNITED STATES ELECTRIC PROTECTION & CONSTRUCTION COMPANY, of New York, has filed articles of incorporation. Its capital is $30,000, and the following are the directors: G. M. Treiber, R. C. Bennett and C. F. Bruckner.

THE RUSSELL ELECTRIC COMPANY, Danbury, Conn., has been incorporated by William E. Russell and others, of this city. The company has a capital of $20,000. It will engage in the manufacture of electric toys, medical batteries, telephones and electric bells.

HORTO ELECTRIC COMPANY, Chicago, Ill., has filed articles of incorporation and will engage in the manufacture of electrical appliances. The company has a capital of $10,000 and was incorporated by Benjamin C. Bachrach, Benson Landon and Henry A. Berger.

THE F. P. MORRISON ELECTRIC & MANUFACTURING COMPANY, of New York, has been incorporated with a capital of $5,000, and will engage in a general electrical contracting business. F. P. Morrison, W. H. Morrison and O. J. Morrison are the directors.

THE J. W. LATHROP COMPANY, INC., of Groton, Conn., has filed a certificate of incorporation. It has a capital stock of $10,000 and will engage in the manufacture and sale of engines and conduct a general machine business. The incorporators are James W. Lathrop, Edgar A. Rathbun and Elsie M. Lathrop.

THE ELECTRIC MACHINERY COMPANY, Chattanooga, Tenn., has been recently organized here. John Pruiss, an electrical engineer of Germany, will be manager of the new concern. Mr. Pruiss and A. W. Lehmann, Sr., have applied for a patent for a simple system of underground electric railway conduits, which will be manufactured and marketed by the company. The new company will also deal in all kinds of electrical machinery.

THE ELECTRICAL CONSTRUCTION COMPANY, of St. Louis, has been incorporated with a capital stock of $125,000. The stockholders are Arthur W. Lambert, Max Koehler, trustee for Hugo A. Koehler, C. Marquand Forster, S. B. Jeffries, Edward A. Faust, Max Koehler, Jesse W. Barrell and James S. Brailey, Jr. The object of the company is to construct telephone and electric light and power plants and to manufacture and deal in electrical instruments and equipment used in such plants.

THE F. P. HARRISON ELECTRIC & MANUFACTURING COMPANY, New York, N. Y., has recently been organized, having taken over and absorbed McLear & Co., of the same city. It has a well equipped shop for the manufacture of armature coils and rewinding of armatures. The company will also do a general railway supply business and will carry a line of such supplies and specialties as are needed in electrical construction work. The officers of the company are: F. P. Harrison, president and treasurer; W. H. Harrison, secretary; A. E. Meixell, vice-president and general manager.

Legal.

STORAGE BATTERY LITIGATION.—The Electric Storage Battery Company has filed papers in a suit against the Universal Storage Battery Company, manufacturer of the Morrison battery, claiming $50,000 damages for infringing the Knowles patent, owned by the Electric Storage Battery Company. Suit has been brought in Wilmington, Del., the Universal Storage Battery Company being a Delaware corporation.

SUDDEN VALUE FOR STOCK.—Last week in this city, Judge Holt of the United States District Court reopened the bankruptcy case of William J. Griffiths and appointed Frederick B. Campbell receiver with a bond of $3,000. The reopening of the case was occasioned by the discovery that some shares of telephone stock which were inventoried as of no value are worth more than $6,500. Mr. Griffiths filed a petition in bankruptcy on April 1, 1904, and received his discharge on May 10, 1904. There were only two creditors, the Guaranty Trust Company, $6,257, and Elizabeth Griffiths, mother of the bankrupt, $5,120. Mr. Campbell was appointed trustee, but no assets came into his possession. It now appears that 115 shares of stock of the New York and Eastern Telegraph and Telephone Company belonging to Mr. Griffiths are held by the Hamilton Trust Company in escrow and Adam Frank, attorney for Mr. Griffiths, has found a purchaser for this stock at $56.75 per share, amounting to $6,526.25. The purchaser is Reon Barnes. Mr. Campbell is authorized to sell the stock and to pay Mr. Frank half the proceeds as compensation for bringing about the sale. The receiver is also authorized to sell 25 more shares of the stock formerly standing in the name of Abraham Norden and to pay the proceeds to Mr. Norden. It is said that a majority of the stock is now owned by the Coast Line Telephone Company.

Obituary.

MR. HENRY T. HOPPE, a well known citizen of Richmond, Va., died recently at the Virginia Hospital in that city. Mr. Hoppe was for a number of years general superintendent of the Virginia Passenger & Power Company, and at the time of his death was identified with a number of enterprises in Richmond, among which was the Citizens' Rapid Transit Company. He was 40 years old, and is survived by a widow and four children.

MR. F. T. TOWNE.—We regret to note that Mr. Frederick T. Towne, younger son of Henry R. Towne, of New York, President of the Yale & Towne Manufacturing Company, died of Bright's disease at Stamford, Conn. Mr. Towne was general superintendent of the company's plant there. In the afternoon he addressed the employes and made the semi-annual distribution of the $1,200 offered yearly by the company for suggestions calculated to be of mutual benefit. He fainted a few minutes after finishing his address. Mrs. Towne, who was at the factory for the ceremony, hurried him home in a carriage, but he never regained consciousness. The widow was Miss Constance Gibbons, daughter of William T. Gibbons, of Wilmington, Del. There are two children. Mr. Towne was a member of the Engineer's Club of New York, the Weeburn Golf Club and the Suburban Club of Stamford. He was a graduate of Tufts College. It was his ambition to make the Yale & Towne plant an ideal factory from the standpoint of the employed as well as the employers.

Educational.

TELEPHONE ENGINEERING AT ARMOUR.—By some unaccountable slip the notes on the Chicago Electrical Show in our issue of Jan. 27 mentioned the telephone engineering work at Armour Institute of Technology as being under Professor Kelsey, whereas, as in well known, this work at Armour is carried on by Prof. G. W. Wilder, Prof. Kelsey being of Purdue University.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—A remarkable series of photographs of the canals on the planet Mars is on exhibition at the Massachusetts Institute of Technology. The work was done by Mr. C. O. Lampard, of the Lowell Observatory, at Flagstaff, Arizona, and the photographs are the first which have ever been successfully taken of this subject. The Martian Canals have been studied for over twenty years at Flagstaff, but until recently the only illustrations available have been made from observers' drawings. The photographs were taken with a 24-inch telescope whose feature had been diaphragmed down to 12 inches, the plates being very fine grained. The exposures varied from 4 to 10 seconds; a special Wallace colored screen was used for sifting all the rays of light except those which could be focused on the plate, and an astronomical clock of great accuracy was used for following the planets' motion. The exhibit is beautifully illuminated by eleven 16-cp incandescent lamps of the bunghole type, spaced around three sides of a concave frame lined on the interior with a reflecting surface. From 12 to 15 cp per sq. ft. is a rough estimate of the brilliancy of the illumination, which is even more effective when the photographs are exhibited as transparencies. Electricity doubtless also played an important part in the securing of the photographs at the Observatory.

Personal.

MR. ANDRES HORCASITAS has resigned his position as Government inspector of electric light plants in Mexico.

MR. C. H. BEDELL, of the Electro-Dynamic Company, read a paper January 23, at the Modern Science Club, Brooklyn, before the Association of Steam Engineers, on variable speed motors.

MR. H. E. RYDER.—Mr. Hurbert E. Ryder, superintendent of the Marlboro Electric Light Company, has been appointed assistant superintendent of the Fall River Electric Light Company, Fall River, Mass.

MR. FRANK H. FOOTE has been appointed general manager of the Vermont Power & Manufacturing Company and of the St. Albans Street Railway Company, succeeding Mr. W. H. Vorce, who recently resigned, as noted elsewhere in this column.

MR. ALEX. DOW, vice-president of the Detroit Edison and Peninsular Electric Light Companies, has sailed with Mrs. Dow this week for England, to take two or three months of vacation. Virtually the whole time will be spent quietly in one of the old cathedral cities.

MR. HENRY FLOY returned last week from a month's absence in Mexico where he went to investigate and report on a [illegible]-hp proposed hydro-electric development and a [illegible]-mile transmission. The prospects are that the work of installation will be undertaken in the near future.

MR. WILLIAM B. WOODBURY has resigned as assistant general manager of the Cuyahoga Telephone Company, of Cleveland, Ohio, and on February 15, will take charge of the Co-operative Telephone Company in Detroit, Mich., which has been bought by the Kaeler-Brailey syndicate.

Mr. FRANK N. JEWETT has been made district manager for the Wagner Electric Manufacturing Company for the states of Minnesota, Wisconsin, eastern Iowa, northern Illinois and Indiana, and northern and western Michigan, with offices at 1623-1624 Marquette Building, Chicago, Illinois.

MR. R. L. DONALD.—The firm of Barstow & Chambers, consulting electrical engineers of Portland, Ore., and New York City, have just added Mr. R. L. Donald to their staff. He is a resident engineer of the Southern Pacific and will have charge of all roadbed construction for the firm.

MAJ.-GEN. A. E. BLISS, who has been for many years general superintendent of the Malden Electric Company, Malden, Mass., has now been made general superintendent of the Malden & Melrose Gas Light Company, the Suburban Gas & Electric Company, the Haverhill Electric Company, and the Springfield Gas Company.

MR. W. A. SHARP, of Tacoma, Wash., has resigned as assistant superintendent of the Seattle-Tacoma Interurban Railway to accept the superintendency of the Montana Miners' Electric Railway & Power Company, which is building an electric railway from Libby, Mont., for a distance of 25 miles into the Cœur d'Alene mining district.

MR. WM. T. DEAN, for the past four and a half years chief electrician for the Illinois Steel Company, of South Chicago, Ill., resigned February 15 to enter the service of the General Electric Company. He will devote his time to the iron and steel industry in the Chicago district, where a large amount of electrical apparatus is required constantly.

MR. P. N. NUNN, chief engineer of the Niagara Power Company, has sailed this week on the Clark winter cruise steamer "Arabic," accompanied by Mrs. Nunn, with the intention of taking rest and recreation for several weeks in this agreeable manner. Before leaving Niagara Mr. Nunn was able to take a share in receiving and entertaining the Canadian Society of Civil Engineers.

MR. WILLIAM L. CLARKE, formerly superintendent of the Atlantic Coast Electric Light Company, of Asbury Park, N. J., has severed his connection as general manager of the United Gas, Electric Light & Fuel Company, of Sandy Hill, N. Y., to accept the general managership of the Citizens' Electric Light, Heat & Power Company, of Paris, Ill. He entered upon his new duties February 2.

MR. W. N. CLIFFORD, who for the past two years has filled the position of New England sales manager for the Shepherd Engineering Company, has resigned his position and accepted a similar one for the Russell Engine Company, of Massillon, O., which has opened an office at 141 Milk St., Boston, Mass. The Russell Engine Company manufactures engines for every service, high and low speed, single and four-valve types, direct connected or belted.

MR. H. H. VREELAND.—The welfare department of the National Civic Federation has issued the admirable address delivered by Mr. Vreeland, the chairman of the department, at the meeting of the New England Cotton Manufacturers' Association at Atlantic City last year. He spoke as one who had had 15,000 men under his direction for some 15 years, directly, and some 15,000 more indirectly. The address has a portrait of Mr. Vreeland, and illustrates a number of instances of successful welfare work.

MR. G. T. HEWES.—The Independent Clearing House Company, which was organized some time ago to check telephone toll line message business and apportion the earnings of interchanged toll business, has secured a suite of rooms at 410 Locust St., Boone, Ia., and has engaged Geo. T. Hewes as manager. It is now starting its work. Arrangements have been made with a large number of Iowa telephone companies to have their business checked, and arrangements are fast being made with others for this same service.

MR. R. H. WATSON assumed charge of the Chicago office of the Gould Storage Battery Company as western manager on February 1, Mr. P. B. Yates, who formerly was at Chicago, having moved to the New York office. Mr. Watson is well known to the electrical trade through having been eleven years with the Gregory Electric Company as salesman, before that with the old Knapp Electrical Works. His territory will include all between Pittsburg and Denver, and his headquarters will be in the Rookery Building, Chicago.

MR. WILBUR H. TRAVER, formerly connected with the Rand Drill Company for a period of 12 years as manager of the Chicago territory until the consolidation of the Ingersoll Rand Companies, after which time he was manager of the railroad department with headquarters in Chicago, has now severed his connection with the Ingersoll Rand Company, and has accepted service with the Chicago Pneumatic Tool Company as manager of the mining and contract department. Mr. Traver will devote his time and attention principally to the sale of air compressors, rock drills and mining machinery.

MR. W. H. VORCE, general manager and treasurer of the recently organized Vermont Power & Manufacturing Company, which developed the electric plant at Fairfax Falls and furnishes light and power to St. Albans, Vt., has resigned the position of general manager and entered the employ of the American Optical Company. He will have charge of its lighting, heating and power department at Southbridge, Mass. Mr. Vorce will retain the office of treasurer of the Vermont Power & Manufacturing Company until other plans are made. He has also resigned the position of general manager of the St. Albans Street Railway Company, but will for a time continue as receiver.

MR. C. S. BRADLEY has been appointed to an acting professorship in the department of chemical practice in the Carnegie Technical Schools, Pittsburg. This engineer and inventor is well known in the electrical field, and his career has been noted in these pages. His devices and processes in electro-chemistry alone include more than 70 patents, and he is closely associated with the fundamental work in the reduction of aluminum and the fixation of atmospheric nitrogen. His inventions are also of very early date in regard to electric lighting, electric generators, transmission systems, rotary transformers, electric furnaces, etc. Beyond question the students in the schools will find great stimulus from contact with a mind so fertile and alert.

Trade Publications.

LIVE CONSTRUCTION MATERIAL.—Bulletin No. 17 of the Kellogg Switchboard & Supply Company, Chicago, Ill., contains a condensed price list of the main items used in the outdoor construction of telephone lines.

WATER WHEEL GOVERNORS.—Bulletin No. 8 of the Ludlow Valve Mfg. Company, Troy, N. Y., contains a description of a new type of vertical water wheel governor. The bulletin also announces the consolidation of the Sturgess Governor Engineering Company with the Ludlow Valve Manufacturing Company.

AIR COMPRESSORS.—Bulletin No. 30 of the Bury Compressor Company, Erie, Pa., gives much valuable information on the properties of air under pressure, and describes in detail duplex and compound air compressors of the steam and belt-driven types. The belt-driven machines are especially adapted to operation with electric motors.

HAMMERS.—The David Maydole Hammer Company, Norwich, Chenango Co., N. Y., has issued an exceedingly well-executed catalogue describing solid crucible cast steel hammers. In a pocket-size catalogue also issued by this company, there are contained decriptions of the principal varieties of hammers which it now manufactures, to which is added much useful information for mechanics and others.

LATH MILLS AND BOLTERS.—Bulletin No. 1704 of the Allis-Chalmers Company, Milwaukee, Wis., is devoted to lath mills and bolters, the description of each machine being accompanied with an illustration showing its working parts. One of the machines is provided with ten saws 22 inches in diameter. The smallest machine shown is equipped with a single 12-in. saw which runs at a speed of 1,700 r.p.m.

TELEPHONE TRANSMITTERS.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has issued an exceptionally neat folder describing in detail its new type of telephone transmitter which has been designed to give soft and pleasing transmission over short distances, and still be capable of transmitting speech over very long lines with the least possible exertion on the part of the speaker.

MISSOURI AMERICAN ELECTRIC COMPANY, of 3327 Locust Street, St. Louis, Mo., has just issued a handsome, illustrated little pamphlet in regard to its Miller incandescent lamps, and its McDonnell controller, electric bell ringing device and electric sign flasher. Details are given as to all these, and special note is also made as to the patent arrangement with the General Electric Company on the Miller lamps.

ADDING MACHINES.—The Felt & Tarrant Manufacturing Company, Chicago, Ill., has issued an illustrated folder calling attention to the new duplex "comptometer." This machine is so constructed that the operator may strike at one time as many keys in separate columns as are convenient. This eliminates errors which may occur on other key-operated machines when the operator fails to depress each key in independent time.

RECORDING PRESSURE GAUGE.—An illustrated circular recently issued by the American Steam Gauge and Valve Manufacturing Company, 208 Camden St., Boston, Mass., gives a brief description of the American combined pressure and recording gauge. The value of a recording gauge to steam plant is aptly expressed in the following sentence: "The recording gauge is to the coal pile what the time clock is to the pay roll."

HYDRAULIC TURBINES.—An illustrated folder recently received from the Trump Manufacturing Company, Springfield, Ohio, in addition to containing a brief description of various types of turbines for different duties, contains several tables showing the power which can be obtained from the turbines of different diameters when operating under specified heads and using a certain volume of water. The turbines vary in size from 25 hp to 932 hp.

STEAM SPECIALTIES.—The 1906 illustrated catalogue and price list of the Lunkenheimer Company, 221 E. Eighth Street, Cincinnati, Ohio, is a 572-page publication filled with much information of value to the steam engineer. In addition to describing brass and iron valves, whistles, cocks, gauges, injectors, lubricators, oil pumps, oil and grease cups, etc., adapted to the requirements of all classes of machinery, the book contains a 30-page section devoted to tables and useful data.

POWER PLANTS.—Bulletin No. 3 of the A. D. Granger Company, 95 Liberty Street, New York, gives a description of the methods used by this company when acting as contracting engineers in the erection of com plete power plants, including steam and electrical transmission for industrial and manufacturing projects, hotels, office buildings, apartment houses, central station and isolated lighting and power installations. Numerous views are given of completed installations and of component parts, such as boilers, engines and generators.

ELECTRICAL WIRES AND CORDS.—The 1906 catalogue of the Belden Manufacturing Company, 194 Michigan Street, Chicago, Ill., is a well prepared booklet containing 31 pages giving valuable reference tables of copper and German silver wires, in addition to describing switchboard and jumper wire, flexible telephone and electrical cords, self fluxing solders, bare and tinned copper wires, bare German silver wire, electromagnetic winding, braided sleeving, electromagnet winding machines and revolution registers.

AUTOMATIC SPRINKLERS.—A recent catalogue of the Manufacturers' Automatic Sprinkler Company, 56 Liberty St., New York, gives an interesting description of automatic sprinkler protection. The sprinkler equipment consists of automatic sprinkler heads, valves, pipes and other appliances to protect buildings against loss by fire. The automatic sprinkler head consists of a valve held in place by fusible solder, to be released by the action of heat when fire occurs. The solder melts at temperatures varying from 105° F. to 400° F., according to the normal temperature of the space protected.

CLEATS.—The Blake Signal & Mfg. Company, 246 Summer St., Boston, Mass., has issued an illustrated folder dealing with insulated staples and compressed cleats. An extract from a letter received by the company from Prof. A. B. Smith serves to show how these articles are being received. "The cleats seem to be what I have often longed for when directing work in the field. For many places these are superior to your very excellent saddle staples, as where it is necessary to run the wires on lath and plaster work. They are superior to the staples in that they may be removed subsequently without damaging the insulation."

THE CLEVELAND RUBBER WORKS of the Mechanical Rubber Company have long been known to consumers of packing by the success of their "Saturn" sheet packing and "Jupiter" rod packing. Now, however, their packing business has grown so large and varied that the necessity has arisen for a trade-mark that shall identify all their packings. They have adopted the trade-mark "Marco." This trade-mark, as we understand it, does not supersede the old brands but is attached to all their packings, coupled with the well known names. This company has in the press a new packing catalogue descriptive of their complete line of packings, which will be sent upon application.

STEAM SPECIALTIES.—The Crane Company, Chicago, Ill., has just issued the following advance circulars, which are quite interesting, and contain a great deal of valuable up-to-date information: No. 01, steam and oil separators; No. 2, "Butterfly" hot-water radiator valves; No. 3, easy cutting pipe dies, No. 4, renewable spring disc valves; No. 5, combination back pressure and exhaust relief valves; No. 6, extra heavy flanged pipe joints; No. 7, various styles of Crane joints used in attaching flanges to wrought pipe; No. 8, automatic exhaust relief valves; No. 9, "Craneweld" flanged pipe joints; No. 10, reversible stop and waste cocks; No. 11, brackets, hangers, supports, rolls, and anchors; No. 12, "Cranetilt" non-return and direct-return steam traps; No. 13, pipe hangers; No. 14, balanced, unbalanced and swivel expansion joints; No. 15, drip pockets, No. 16, railing fittings; No. 17, lever-handle, quick-opening hot-water radiator valves; No. 18, emergency and automatic stop valves; No. 19, sediment traps; No. 20, pipe bends; No. 21, "Cranejunior" and "Cranesenior" steam traps.

News of the Trade

COLUMBIA LAMPS are in excellent demand all over the country and several changes have been made to meet the situation and the prospects. At Memphis, Tenn., the office of the Columbia Incandescent Lamp Co. has been moved from the Scimitar Building to 480 Randolph Building to provide better facilities for the growth of orders in that vicinity.

THE DIEHL MANUFACTURING COMPANY, of Elizabethport, N. J., has opened a new office in Chicago at 207-211 East Jackson Boulevard. The office will be in charge of Mr. Hayden Hobart Smith and will be a distributing point for the West and Northwest of the well-known apparatus made by this company. A complete line of fans and motors will be carried.

THE INTERNATIONAL TELEPHONE MFG. COMPANY, Chicago, it is reported, is having remarkable success with its "leader," the new permanently adjusted bi-polar receiver. It is said that furnishing these to small and large buyers alike at a uniform low price has proved one of the best methods that could be adopted for more widely introducing "International" apparatus.

OHIO ELECTRIC WORKS.—The partnership between A. C. Fletcher and H. M. Buchman, under the name of the Ohio Electric Works at Cleveland, O., was dissolved on January 29 by limitation, Mr. Buchman retiring and Mr. Fletcher assuming every obligation. The wholesale department of the business will have increased attention in the future, and the interests of dealers in the trade will be protected. The new catalogue and discount sheets are now ready to distribute and can be had on application.

CEDAR POLES.—In pursuance of a resolve made many years ago to retire from active business at his present age, Mr. E. H. Valentine, president of The Valentine-Clark Company, Chicago (cedar poles, etc.) has disposed of his interests in said company to Mr. E. L. Clark, formerly secretary and treasurer, and who now succeeds him as president, the corporate name of the company continuing as heretofore. The Valentine-Clark Company has long occupied a commanding position in the cedar industry, and enjoys an extensive volume of business in all lines of electric construction requiring the use of poles for power transmission. Mr. Clark has been identified with the company since its formation, possesses an extensive acquaintance with producers and consumers, as well as an intimate knowledge of the trade in all its details.

ELECTRIC GOODS MANUFACTURING CO.—Mr. H. C. Thomson, vice-president and manager of the Electric Gas Lighting Company, has issued the following circular notice, which is not without a special interest to many of those who have watched the growth of the concern for so many years: "During an active career of a quarter of a century the name 'Electric Gas Lighting Company' has become historical and we believe a synonym of quality and business integrity throughout the country. This name at one time indicated the nature of the business of our company, but it no longer describes the varied and extensive lines now manufactured by us and carried in our large jobbing business. We have, therefore, although with much reluctance, decided to end the confusion caused thereby, and have incorporated under the name of 'The Electric Goods Manufacturing Company' and will do business under that style on and after this date, February 1st. No change whatsoever in the policy or personnel of the business will be made. We shall endeavor as hitherto, as regards our output and methods, to keep in the front rank both in the manufacturing and in the jobbing departments."

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JANUARY 30, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

810,897. APPARATUS FOR COMPOUNDING TIN; Charles E. Acker, Niagara Falls, N. Y. App. filed June 8, 1903. An apparatus for producing chlorine compounds of tin, comprising a dissolving vessel for effecting a solution of the tin and a reaction tower, and means for circulating the solution through said dissolving vessel and the reaction tower.

810,912. AUTOMATIC NON-INTERFERING REPEATER FOR FIRE-ALARM CIRCUITS; Frederick W. Cole, Newton, Mass. App. filed Jan. 31, 1905. Details of construction of repeater having a locking magnet by which it is prevented from repeating any signal until the preceding signal has been concluded.

810,914. PROTECTIVE APPARATUS; Frank B. Cook, Chicago, Ill. App. filed Dec. 4, 1904. A thumb or protector for telephone circuits having certain detail features of construction, including a pair of superposed springs mounted flatways upon a ground plate, but insulated from the same and from each other.

810,915. AUTOMATIC CUT-OUT MECHANISM FOR ELECTRICALLY OPERATED BULKHEAD DOORS; William B. Cowles, Cleveland, O. App. filed July 11, 1904. The transmission gearing from the motor to the bulkhead includes a gear driven by a connection capable of relative rotative movement under the torque stresses. In case the bulkhead encounters an obstruction, the increasing torque produces a relative angular movement which opens the motor's circuit.

810,929. STORAGE BATTERY; William Fennell and Wm. O. Perry, Leytonstone, England. App. filed Mar. 17, 1904. A storage battery comprising a honeycombed mass, an active material on the exposed surfaces of said mass, and an unobstructed passageway formed therein in addition to the interstices of the mass, for the purpose of facilitating the egress of gases.

810,930. STORAGE BATTERY; William Fennell and William P. Perry, Leytonstone, England. Filed Mar. 6, 1905. An electrode comprising a non-conducting mass insoluble in electrolyte and pierced in more than one direction with inter-communicating passages, the walls of the passages being lined with active material.

810,931. ALARM FOR INCUBATORS; Williard S. Freeman, St. Cloud, Minn. App. filed May 6, 1904. A lever on top of incubator is connected with a thermostat within and serves to operate alarm circuits in case the temperature becomes greater or less than certain fixed values.

810,958. END CELL SWITCH; Lamar Lyndon, New York, N. Y. App. filed Oct. 17, 1904. Provides means for automatically cutting in or out the end cells of a storage battery depending on their electrical condition.

811,017. PROCESS OF MAKING MANTLES; Oscar Wiederhold, Jersey City, N. J. App. filed Mar. 6, 1905. In order to avoid the unfavorable influence of dust and iron particles caused by the knitting of Welsbach mantles, the fabric is bleached after being knitted into shape, rather than before, as previously.

811,029. TELEPHONES FOR SHIPS, MINES, ETC.; Arthur F. Boardman, Sommerville, Mass. App. filed Apr. 10, 1905. Detailed construction of a telephone apparatus with a receiver, transmitter and several push button calls, all enclosed in a circular case and adapted for use on ship board.

811,037. DANGER SIGNAL; William C. Creveling, St. Louis, Mo. App. filed Dec. 8, 1904. A storage battery on the car is maintained charged by the power circuit so as to be effective to illuminate a danger signal in case the car is stalled by the failure of the power circuit.

811,052. TELEPHONE CALL; Peder T. Guverman, Brewster, Minn. App. filed Mar. 14, 1905. A normally closed selecting circuit including a contact spring and a revoluble wheel which is stepped around by a pawl and ratchet mechanism so as to make the desired local circuit.

811,063. ANNUNCIATOR; Walter R. Horning, Cleveland, O. App. filed Dec. 5, 1904. In an annunciator, the combination of a pivoted shutter, a vibratory retaining and releasing device for said shutter comprising a pair of forks adapted in one position of said device to permit the passage there between of the adjacent portion of the shutter and in another position to engage such portion of the shutter, and means for vibrating said device.

811,064. AIR BRAKE; Edwin T. Hughes, Gladstone, Col. App. filed Oct. 9, 1905. In order to avoid exhausting the auxiliary cylinders at service applications of the brake, the service applications are made by an electro-magnet so that the train pipe pressure is not reduced and remains effective to keep the auxiliary reservoirs charged.

811,083. ANNUNCIATOR; Halvor M. Olsen, Chicago, Ill. App. filed May 16, 1901. Comprises an electro-magnet, two plates separated by four short members and rigidly connected with the forward end of the magnet, and a convex cap secured to the outer of said plates and provide with an opening, a pivoted target arranged back of said cap and an armature having a forwardly extending arm adapted to engage said target.

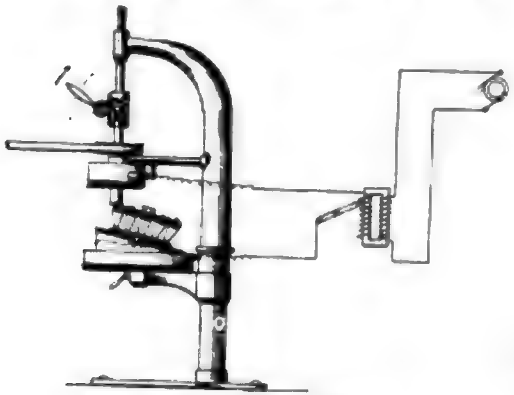
811,088. ELECTRIC DRYING AND IRONING APPARATUS; George W. Richardson, Wissahickon, Pa. App. filed Mar. 28, 1905. A series of presser rolls geared together and provided with internal heating coils.

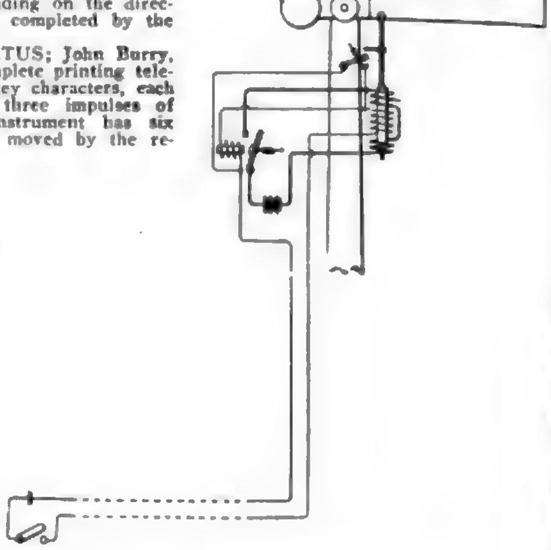
811,098. TELEPHONE TRANSMITTER; Michael Setter, Chicago, Ill. App. filed Dec. 30, 1904. Details of a telephone transmitter having a front plate composed of two sheet metal parts pressed into the desired shape and rigidly secured together, one of said parts having a boss to which the mouthpiece is secured.

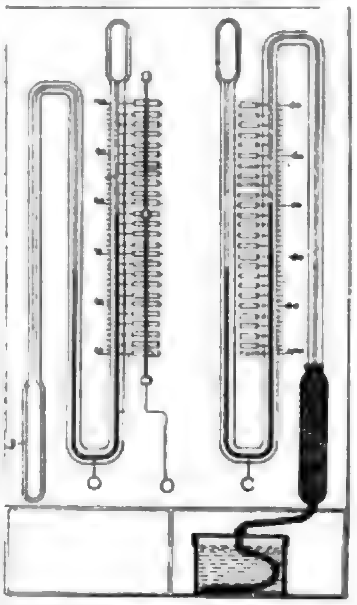
811,101. ELECTRIC SURFACE AND ELEVATED TROLLEY RAILWAY; Charles D. Smith, Fond du Lac, Wis. App. filed Mar. 2, 1903. The third rail is laid between the usual tracks and has an inverted V-shaped housing thereover, the two walls of which are capable of separating at their apex so as to connect the passage of the usual collector shoe on the car.

811,105. RAILWAY SIGNALING; Samuel D. Strohm, Philadelphia, Pa. App. filed Aug. 29, 1891. The track is provided with contact plates and cam inclines which engage a depending lever upon the train. The lever is moved in one direction or the other depending on the direction of the train, and different alarm circuits are completed by the contact plates.

811,127. TELEGRAPHY AND TELEGRAPH APPARATUS; John Burry, New York, N. Y. App. filed Oct. 7, 1893. A complete printing telegraph system having a piano transmitter with 80 key characters, each one of which makes a different combination of three impulses of different signs and polarities. The receiving instrument has six notched bars, different combinations of which are moved by the received impulses, so that the appropriate key falls into the aligned notches.


811,137.—Electric Riveter.


811,238.—Signal.


811,383.—Hygrometer for Regulating Humidifying and Heating Systems.

811,137. ELECTRIC RIVETER; Samuel Eveland, Philadelphia, Pa. App. filed Sept. 13, 1904. A riveter comprising a form of sensitive drill in which an electric circuit is complete at the point of the revolving tool. The rivet is heated by the current and headed by the combined pressure and rotation of the tool.

811,140. TELEPHONE OR OTHER BOOTH; Edythe P. Garney, Scranton, Pa. App. filed Apr. 1, 1905. A telephone booth having a ventilating opening and a sound breaking device located in such opening and including an exhaust fan.

811,153. TROLLEY POLE; John E. Lagergren, New York, N. Y. App. filed May 25, 1905. The trolley wheel is journaled on a supplemental arm or lever whose relative movement when the pole leaves the wire is effective to apply a brake or lock which prevents upward movement of the pole.

811,154. DYNAMO ELECTRIC MACHINE; Pierre A. J. Lapeyrade, Paris, France. App. filed Feb. 8, 1904. In a dynamo electric machine the combination of means for producing a magnetic field, a stationary armature and windings therefor so placed as to always lie in the magnetic field, a revoluble armature and windings therefor adapted to enter and leave the magnetic field during the movement of revolution and means for supporting the fixed and revoluble parts.

811,161. INCANDESCENT LAMP SOCKET; Normal Marshall, Newton, Mass. App. filed Mar. 31, 1904. The socket is made of two sheet metal parts, one of which has circumferentially spaced openings and the other of which has correspondingly spaced spring tongues which enter said openings to lock the parts in proper relation.

811,186. CLEAT AND SOCKET; Charles M. Waite and Charles F. Fralick, New York, N. Y. App. filed Apr. 14, 1904. A cleat and socket comprising a two-part cleat and a socket carried by one side of said cleat, and a pair of weather-proof rings, one of which lies between one of said terminals and the walls of said socket, and the other of which encircles said socket.

811,266. LIGHTNING ARRESTER; Walter C. Jones, Chicago, Ill. App. filed Dec. 7, 1901. In a lightning arrester, the combination of two continuous paths for the current, a non-inductive resistance arranged in one of said paths, and an arrester coil and a resistance arranged in the other path.

811,231. ALTERNATING CURRENT MOTOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed June 30, 1904. An electric motor having armature and field magnet pole pieces provided with slots parallel with the armature axis, a neutralizing winding located in said slots and connected in series with the armature winding and low resistance plates located in the inter-polar space.

811,238. SIGNAL; Karl Moller, Charlottenburg, Germany. App. filed June 12, 1905. The semaphore arm is operated by a solenoid in a local circuit controlled by a relay magnet operable from the distant station. The arrangement is such that the local circuit is energized only for the movement of the solenoid core, the more feeble current from the transmitting station being sufficient to hold the arm in position after it has once been raised.

811,247. ELECTRICALLY OPERATED TYPE WRITER; Willis J. Roussel, New Orleans, La. App. filed Mar. 28, 1903. Details of a key wheel typewriter having a type wheel which is positioned by a power magnet, and a magnet operated stop which swings into position after a predetermined movement of the wheel.

811,253. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; Albert P. Seymour, Syracuse, N. Y. App. filed Jan. 30, 1905. Details of construction of a socket having two porcelain blocks, one of which carries the spring contacts, and the other the contact plates, and between which is journaled the cam by which the springs are separated to complete the circuit.

811,263. PROTECTION AGAINST REVERSAL OF ENERGY; Leonard Wilson, Pittsfield, Mass. App. filed May 2, 1904. A main alternating current circuit, a device energized by a constant flux, means for producing in said device a second flux, reversible in direction when the current in the main circuit reverses in phase relative to the electro-motive force, and a switch in said main circuit controlled by said device.

811,277. ELECTROMAGNET; Fred B. Cory, Schenectady, N. Y. App. filed July 13, 1004. Two separate semaphore arms are operable by the same power magnet by virtue of a pair of selector magnets which respectively engage the separate semaphore arms.

811,304. ALTERNATING CURRENT MACHINE; Marius C. A. Latour, Paris, France. App. filed June 25, 1904. A multipolar field magnet, a wave armature winding, a commutator composed of alternate live and dead segments, and a plurality of brushes of each polarity distributed around said commutator, the width of a brush being not greater than a segment.

811,312. DYNAMO ELECTRIC MACHINERY; John H. St. H. Mawdsley, Taunton, England. App. filed Nov. 30, 1903. A dynamo electric machine having magnetizing coils each surrounding a pole piece, placed with their sides in the neutral zones and close to the armatures and at or about the middle of the interpolar spaces of contiguous poles and spaced away from the pole cores.

811,340. ATTACHMENT FOR ELECTRIC CONTROLLERS; Ferdinand Volk, Pittsburg, Pa. App. filed Sept. 12, 1905. The usual controller handle has a permanently connected cam plate with inclined teeth or notches thereon, providing a sinuous passage there between. The arrangement is such that a detent on the controller handle must be manipulated to pass each notch in starting, but the controller handle can be moved freely to off or zero position.

811,364. OZONE GENERATOR; Charles F. Birtman, Chicago, Ill. App. filed June 9, 1905. An apparatus for generating ozone including a generating chamber and two sets of circuit terminal windings in said chamber, the terminal windings of one set alternating with those of the other, and a source of electric supply comprising conductors each of which has parallel connections with the circuit terminal windings of one set within the generating chamber.

811,375. WIRED PLATING AND DIPPING BACK; James P. Clark, Newark, N. J. App. filed June 26, 1905. Has a center bar with a series of transverse bars secured thereto and a series of hooks supported by one of said transverse bars, and protected conducting wires in electrical connection with said hooks and with a suspensory conducting wire.

811,383. HYDROMETER FOR REGULATING HUMIDIFYING AND HEATING SYSTEMS; Stuart W. Cramer, Charlotte, N. C. App. filed Dec. 28, 1904. An apparatus for automatically regulating the air humidity comprising a dry and wet bulb thermometer in the tubes of which are fused a series of platinum terminals. The electric circuits are so arranged as to open or close the moist air dampers depending on the relation of the mercury in the respective tubes.

811,405. ELECTRIC MOTOR; Paul Jigouzo, Vanves, France. App. filed Oct. 18, 1904. An arrangement for automatically starting polyphase motors with a rotating field, in which the current is induced in the armature by short circuiting its coils, including a series of conducting rings adapted to short circuit the armature, and a series of flexible conductors adapted to short-circuit said rings by centrifugal force.

811,415. REGULATION OF ELECTRIC MOTORS; Johan G. V. Lang, London, England. App. filed June 28, 1904. By the ordinary regenerative system the motorman is required to vary the position of his controller in order to secure the proper braking effect for the different speeds. In order to avoid depending on the motorman who is uncertain for this purpose, the patentee provides an automatic system for properly connecting the motors.

811,519. ELECTRIC SWITCH FOR STREET RAILWAYS; Jones A. Posey, Midlothian, Tx. App. filed Mar. 14, 1905. The switch point is moved by a connection from a shoe adjacent the track rails which is depressed by the approach of a car. The direction in which the switch point moves is determined by a pair of selector magnets operated by a special trolley circuit, and under the control of the motorman.

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The Cost of Illumination.

One of the first things that a new society of any kind has to do is to justify its existence, and having done that it will have little trouble in living and growing. Of course, it needs membership as one indication of the sphere of usefulness that exists for it, but that membership cannot be held long unless it "makes good," and it has been significant indeed to see how the growth and fortunes of some of the large national societies have fluctuated just as they lived up to or fell short of their opportunities and responsibilities. We are glad, therefore, that at the very outset President Marks, in his address to the new Illuminating Engineering Society, at its first regular meeting, gave at once a programme and a justification for this latest comer among the technical societies of America, one which while working in close touch and harmony with the older, more comprehensive bodies, has obviously a mission and a career of its own.

The figures that Mr. Marks gave as to the national bill for light and of the waste involved must be startling to many people, and in themselves if at all true constitute a platform. It will be noted from our abstract of his admirable address that Mr. Marks places the annual American expenditure on light at not less than $200,000,000, of which electric light amounts to $100,000,000, coal and water gas, $35,000,000; natural gas, $1,700,000; acetylene, $2,300,000, and oil, $60,000,000. The figure for electric light may seem disproportionately high, but the facts approve it. Our own estimate printed here in the first issue of the year as to the production of central stations and isolated plants was $210,000,000 for 1905. The United States census statistics of 1902 showed that of the total income of $85,700,000 of the central stations that year, 18.2 per cent was from other sources than lighting, and the percentage is a rising one on account of the development of the day stationary motor load and of the heating and automobile charging load. With an ordinary gain over 1902, therefore, it will be seen that Mr. Marks' figures are extremely conservative for electricity. As to gas, we have an idea that the data are perhaps equally low; but it is a field where our personal information does not go very far, and Mr. Marks has made a close study of it.

But the great point is the one made by Mr. Marks, namely, that on this lighting bill of $200,000,000 upwards the waste and loss in bad illumination is at least $20,000,000. To reclaim that is, briefly, the mission of the new society; and it is a noble object, by no means so utilitarian as it sounds. Every new illuminant has a measure of civilization in itself; every refinement of lighting is a social reform; every closer adjustment of conditions that help the eye make infinitely for the welfare and comfort of us all.

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Automobile Electric Charging Service.

Some years ago when the electric automobile was first introduced, the prospect seemd bright that the charging of electric automobile batteries would become a profitable part of the business of central stations. That this hope has not been realized has, of course, been due to the successful rivalry of the gasoline and steam vehicle, which has relegated the electric vehicle to a subordinate position. That the situation is not, however, entirely hopeless, is shown in the article printed elsewhere on the Rockford, Ill., central station, where automobile charging has been developed into a profitable item of business. Although local conditions are favorable to the electric automobile in Rockford, it is entirely safe to assume that in spite of these favorable conditions, no such development of automobile business would have taken place were it not for the watchful eye kept by the company on the electrical and mechanical condition of customers' vehicles. The very fact that the electric automobile requires little attention for its ordinary operation leads to its neglect by the average owner of such a vehicle. He is furthermore usually in ignorance of the equipment, and his efforts in righting troubles are frequently misdirected. The maintenance of an inspection of customers' vehicles in Rockford costs the company but little, and without doubt has been the balancing factor between success and failure of the electric automobile business in that city. Central stations having alternating-current distribution until lately have been somewhat handicapped when they attempted to cater to this class of business on account of the expense of motor-generators for battery charging purposes, but the advent of the mercury vapor rectifier has reduced the first cost of a customer's installation somewhat. Automobile charging, when done under the conditions specified in the Rockford contracts—that it shall not come on the evening peak load—is an exceedingly desirable class of business. This has been generally recognized by central station managers, but how to get this business has been the problem. The work done at Rockford offers some valuable suggestions. The electric automobile owner in most towns is at the mercy of every tinkering so-called electrician, who poses as an expert in electric vehicle and storage battery maintenance. The policy at Rockford virtually takes the business out of the hands of irresponsible parties of this class and puts it in the hands of men who are known to understand the business. As a rule there will be a vast difference between the kind of attention given a vehicle by the kind of man a central station will employ and the tinkerer who so frequently gets a chance at an expensive vehicle.

WAVE SHAPES IN THREE-PHASE TRANSFORMERS.

It is well known that a delta-connected, three-phase alternator armature, or a delta-connected set of three single-phase transformers, connected to three-phase mains, will permit a current of triple-phase frequency to circulate around the delta. For other frequencies of harmonics there is a mutual balance between the several c.e.m.f's in the delta sides or phases, and consequently there will be no circulation of current around the delta. But for the triple harmonic there is no such barrier or opposition. The only way to stop the circulation is to connect the transformers in star. Ordinarily, the triple harmonic frequency current in delta-connected transformers is not seriously large, and does not waste a serious amount of energy in heating the primary windings. Still occasions may develop in which the triple harmonic current may happen to have exaggerated importance, and give rise to very appreciable loss.

An experimental study of some of the conditions entering into the production of these triple-frequency circulating currents in delta transformers has been published by Mr. R. C. Clinker in a recent number of the London *Electrician*. The article shows that when the transition is made gradually from the delta to the star connection, by a combination of delta-core and star-arms from the corners of the delta, with gradually increasing arms and dwindling delta-core, the triple harmonic circulating current in the delta increases. At first sight this seems to be paradoxical, because when there is no delta left at the center, i. e., when the connection of the coils between three-phase mains is entirely in star, there can be no central circulating harmonic current. Nevertheless, it is easy to see, on closer examination, that in order to set up a sinusoidal flux in the star branches with central delta, a certain strength of triple-frequency, alternating current is necessary. The component of current which can circulate will diminish directly as the turns in the delta core, but also inversely as the square of the turns, since it will increase as the e.m.f. of the delta, but inversely as the reactance of the delta. Consequently it tends to increase as the delta diminishes until arrested by ohmic resistance. The method should be useful for generating triple-frequency currents.

SOME FOREIGN CENTRAL STATION PRACTICE.

We present in the Digest this week an instructive account of the great new Saint-Denis station in Paris which includes some rather interesting features. Some of these are quite in accordance with American practice, others strike one as departures, and not always valuable ones. In general it is evident enough that station design here and abroad is proceeding along similar lines and shows need of improvement in about the same directions. Paris, like most of the large cities of other countries, has electric service which has grown up piecemeal, and which at no time has been practicable to reorganize according to any systematic plan of procedure. Perhaps such is the necessary fate of these enterprises; certainly it has been that of electric supply in all the large American cities. They started with low-tension Edison networks laid mostly in iron tubes, and as the business grew so did the feeder losses. When these became absolutely intolerable changes began, not remedial but palliative, new stations, storage battery sub-stations and the like. With still further growth the conditions again waxed intolerable, but the weight of investment and of habit prevented any reorganization of service upon a coherent plan, and it is only within a very few years that large alternating supply stations have been erected with any broader view than supplying at heavy loss in the conversion the same old low-tension current to the same old wasteful distribution system.

The same conditions have, to some extent, indeed a great extent, applied in Paris, so that we see in the new Saint-Denis station three kinds of current being supplied—three-phase at 25 cycles, two-phase at 42 cycles, and continuous current through rotaries at 550 volts, to say nothing of the direct current at 230 volts for use in the station. The supply of alternating current at two frequencies was a concession to local conditions such as has spoiled the design of many a station elsewhere. The result in this case is considerable extra complication and cost, with need of a considerable extra reserve. The corresponding gain is dubious; in most cases a mere concession to bad practice elsewhere. The continuous current, obtained from rotaries, is for railway service. The result of the whole arrangement, with the several devices for interchange and control of current, is that the greater part of the station, apart from the boiler rooms, is taken up by accessory plant of various kinds to which are added an accumulator plant and a switchboard annex literally five stories high. The boiler plant is in three separate sections, each with four rows of boilers, and back of each section is its own coal storage pocket. The main generating units are 10 turbo-alternators of 6,000 kw each. Each unit is fed by six boilers, and there is a wonderfully intricate steam piping system to correspond. The utter inadequacy of the ordinary "standard" boiler in the matter of capacity is one of the weakest points in modern station design. One designs a great turbo-generator unit of the highest efficiency and then feeds it from a long file of tea kettles. It would be interesting to compare the cost of the intricacies of Saint-Denis with that of a station built with homogeneous units for use on a homogeneous distributing system.

And yet the equipment of the plant is in many respects admirable. The main generators, seven for three-phase currents and three for two-phase, are otherwise homogeneous, being Brown-Boveri-Parsons turbo-alternators running at 750 r.p.m. The generators proper are high-voltage machines, the three phasers giving 10,250 volts, and the two-phasers 12,300. Both turbines and alternators are designed for very high efficiency, the expected consumption of steam being per kw-hour, 15 lbs. at full load, and about 18 at half load. The steam pressure for which these efficiencies are reckoned is 170 lbs. per sq. in. with a superheat of a trifle over 200° F. It is hardly necessary to say that if these estimates of steam consumption are verified by the results, the steam turbine will have no further apologies to make on the score of efficiency. Oddly enough, however, the half-load efficiency falls off just about as it would in a reciprocating engine under similar conditions. We shall watch with great interest for further reports on these turbo-generators, since their success would put the turbine on a plane of economy as yet quite unattained, and which has been most earnestly desired. The arrangements of the plant for labor-saving seem to be very complete, there being a full equipment of mechanical stokers and ash-handling machinery, and every effort has been made to make the whole operation as nearly automatic as possible. The whole station force, in fact, for operation 24 hours per day amounts to about 70 men including superintendence, or about one man for each 860 kw of capacity. Without knowing the arrangement of shifts, it is not easy to compare this result with that obtained in large American stations, but considering the lay-out of the plant it seems a rather satisfactory one. In general, the design of this Paris station has much the same virtues and faults as that of the recent large American stations, although at first sight it seems somewhat intricate. Station design cannot reach a thoroughly satisfactory stage until the output is homogeneous, larger boiler units are available, and the methods of control and distribution are simplified. Often the conditions imposed on the engineer are such as absolutely forbid simplicity in the result.

Terrestial Magnetic Surveys in the United States.

The Department of Commerce and Labor of the United States includes the U. S. Coast and Geodetic Survey, presumably owing to the labor which that survey must involve, and a branch of the Survey is the Division of Terrestial Magnetism. This division has recently issued an interesting and valuable report upon the results of terrestial and marine magnetic observations during the year ending June 30, 1905. There are two principal directions in which systematic magnetic observations are important. One is purely utilitarian, and the other at present purely scientific. It is important to the mariner that the magnetic declination should be determined with reasonable precision, over the surface of the seas, in order that he may steer a correct course, after allowing for the deviating influence of the iron in his vessel. It is likewise important to the surveyor on shore that the magnetic declination should be determined with a considerably greater degree of precision, in order that surveys run by compass should be reliable, and should be comparable at different dates. From a scientific standpoint, it is most necessary that accurate data concerning the variations in the earth's magnetic field should be accumulated systematically, in order to lay the foundations for any satisfactory theory that may be found applicable. Even the utilitarian value of the scientific side of the work has large potential magnitude, because a satisfactory theory of the earth's magnetism might enable the earth's magnetic elements to be forecasted locally in advance, thereby saving the labor of long-continued multiplied observation; just as the scientific study of the tides had to be pursued for several centuries before a finally satisfactory working theory enabled navigation to effect "the establishment of the port" for each locality, or permitted of forecasting the tides, so that tide-tables may be printed many months in advance.

We learn from the report that magnetic observations were undertaken during the year, at nearly 300 stations on land, and some 50 positions at sea, some in the Atlantic Ocean and some in the Pacific. An endeavor is made to keep the error in land observations to 0.1 per cent in horizontal intensity, and not exceeding 2' of arc in declination and in dip. This is a relatively high standard, and if it can be maintained it is a very creditable performance. No such high degree of precision can, of course, be looked for in marine observations, but the marine precision actually attained is not stated. Magnetic intensities are recorded in terms of "gammas," the gamma being one hundred thousandth part of a gauss. Fortunately for the memory, both units have the first two letters in common. The gamma has an awkward decimal relation to the gauss, being neither a milligauss, nor a microgauss; but appears to owe its existence to the fact that the observations of intensity are usually recorded to five significant digits. We have previously commented upon this unfortunate and entirely unnecessary creation of a new magnetic unit. Five magnetic observatories have been in continuous operation during the year. Two of these are in what has been called the United States proper (in Maryland and Kansas), while two are in our subject-countries, Hawaii and Porto Rico, and a third in Alaska. If a magnetic declination map of the United States be drawn, showing the lines of successive degree divergencies between the compass needle and the meridian, these lines radiate fanwise over the North American continent from the magnetic pole in northeastern Canada. These lines change steadily in position, moving, in general, slowly westwards, like the center of population. It so happens that the agone passes not far from the U. S. center of population. But the recent observations show that the movements of the different lines of the fan are different, and irregular in detail. At present, the agone or zero-declination line, running near Cincinnati and Michigan, is about stationary, while the eastern coast lines are moving westwards and the western coast lines eastwards. In other words, the fan just now is slowly contracting. The maximum annual rate of change recorded anywhere in the United States proper is about 5'; so that, at this rate, the magnetic meridian would shift one degree with respect to the geographical meridian in about twelve years.

The Institute Nominations.

Last week note was made in these pages of the various candidacies in connection with the presidency this year of the American Institute of Electrical Engineers. We have now received an open letter from Mr. John J. Carty requesting that his name be taken from any such list as he is not a candidate, but on the contrary supports heartily the nomination of Mr. E. W. Rice, Jr. In favor of Dr. Sheldon a circular has been issued pointing out his strong claims and qualifications. A new name has also been brought forward during the past week—Mr. J. G. White—who has always taken a warm interest in Institute affairs, has served on its committees and has been a liberal supporter of its work, particularly as a member of the Land and Building Fund.

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Electrifying the New York, New Haven & Hartford Railroad.

A number of details have already been given in these pages as to the electrification of the New York, New Haven & Hartford Railroad. It may now be stated that between Woodlawn and New York the trains of the company will run over the tracks of the New York Central & Hudson River Railroad, and power for train operation will be purchased from the New York Central Company by the New Haven Company. After reaching Woodlawn the trains pass on to the New Haven tracks and will then take current from a new power station which is to be erected by the New Haven Company on the west bank of the Mianus River at Cos Cob. The site selected is just south of the main line of the company and on tide water, which will permit the use of sea water for condensing and a dock will be built for the reception of tide water coal. A spur will also be run from the main tracks so that fuel may also be received by rail. The station will be of concrete construction and will be built by Westinghouse, Church, Kerr & Co.

The steam generating equipment will consist of water-tube boilers of 9,000 nominal hp capacity. The generating equipment will be four Parsons steam turbines, each rated at 3,000 kw capacity. The generators will supply single-phase current at 11,000 volts and 25 cycles, but they will be wound so as to deliver three-phase current if desired. The equipment of the station will also include two 125-kw steam-driven exciters and the 12-panel switchboard on the engine room floor. No step-up transformers will be used as power will be distributed at 11,000 volts. The design of the station is such that it can easily be extended as the requirements for power of the company increase in the future.

As already stated, overhead wires are to be used, and electric locomotives of Westinghouse build. The locomotives will weigh approximately 72 tons each and all of the axles will be driving axles. The locomotives consist essentially of a steel frame mounted upon two swivel trucks, each of which is equipped with two Westinghouse 250-hp single-phase gearless motors. These motors are carried on an ingenious form of suspension by which not only the weight of the field but also that of the armature is supported on springs. The motors are capable of operating either on single-phase current to be used on the company's own lines, or on 300-volt direct current when the locomotives operate over the lines of the New York Central Company.

The cost of the work between the Woodlawn and Stamford limits is placed at $1,130,000 for the power house, including real estate; $570,000 for 21 miles of overhead construction, and $1,050,000 for locomotives, making a total of $2,750,000 as the cost of the initial stage in the complete electrification of the system.

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A New Metallic Filament Lamp.

In the issue of February 4 of the *Elektrotechnik und Maschinenbau*, the organ of the Vienna Electrical Society, Mr. Joh. Kremenezky, of Vienna, gives some results obtained in his factory with a new metallic filament lamp, for which patents have been applied for by Dr. Hans Kuzel, of Baden, near Vienna.

So far more than 100 lamps have been tested, partly in the factory and partly in a testing laboratory. The first tests in the factory showed an average power consumption of one watt per Hefner candle (.88 British candle) with a useful life of at least one thousand hours, the average decrease of candle-power being not more than 15 per cent of the original value. The author points out that these results were obtained with a testing current not furnished from a storage battery, but from the ordinary supply mains. The results, therefore, represent what may be expected from the new lamp in actual practice, where the lamps are subjected to variations of voltage.

Later tests have shown steadily improving results, some of which are quite remarkable. The following table refers to a 19-volt lamp:

Hours.	Hefners.	Amp.	Watts per c.p.	Difference in c.p. in %.
0	29.0	1.48	0.97	0
503	28.8	1.48	1.02	— 0.7
1110	26.2	1.49	1.08	— 9.7
1686	25.2	1.48	1.11	13.1

After 1,686 hours the voltage was raised in order to see how much increase of voltage the lamp would stand. At 60 volts the filament was disrupted, but spontaneously "soldered itself" and the lamp continued to burn.

The behavior of a lamp with increased voltage is shown in the following test of a normal 20.2-volt, 19.5-cp, 0.97-amp. lamp consuming one watt per candle-power.

Volts.	Hefners.	Amperes.	Watts per c.p.
20.2	19.5	0.97	1.00
25.8	50.0	1.14	0.588
32.7	100.00	1.30	0.425
34.5	125.00	1.34	0.370
39.0	180.00	1.44	0.312
40.6	211.00	1.475	0.283

The author states that the development of the lamp has not yet reached finality and that the consumption of power may be reduced to one-half watt per hefner candle-power with a useful life of 1,000 to 1,500 hours.

The new lamps will be made for voltages up to 110. "The cost of manufacture of the lamp will be comparatively small, since the raw material required for its manufacture are available in unlimited quantities and are inexpensive." The author expects to place the lamp on the market before the next season begins.

Nothing is said concerning the nature of the filament. As a reason for this reticence it is stated that the patents are still pending. It is probable that the lamp is the new tungsten-filament lamp, about which some vague reports have recently been published, as noticed in the Digest of December 23.

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The Municipal Ownership Investigation.

The special public ownership commission of the National Civic Federation, to investigate the subject of municipal plants has begun actual work. Mr. Milo R. Maltbie, one of the expert members of the commission, has sailed for London, where he will be joined by Mr. William J. Clark, of the General Electric Company's Foreign Department, another member of the commission. These two will arrange for the coming of the entire commission in May.

A sub-committee consisting of Prof. Frank J. Goodnow, of Columbia, Mr. Walton Clark, third vice-president of the United Gas Improvement Company of Philadelphia, Prof. Edward W. Bemis, superintendent of Cleveland's water works; Mr. J. W. Sullivan, editor of the Garment Workers' Journal of New York, and Mr. Maltbie have charge of the arrangements for the work of the commission in this country.

Two engineers, Messrs. Alton D. Adams of Worcester, and J. C. Humphreys of this city, will begin a study of the municipal electric lighting plants of Massachusetts this week. Accountants will also start work on the accounts of the municipal electric light works of Allegheny and the municipal gas plants of Wheeling. Messrs. A. E. Forstall of New York, and probably L. L.

Morrison of Toronto, gas engineers, will investigate the Wheeling plants. Mr. Dabney Maury of Peoria, Ill., will begin a study of the Chicago water works this week, and Prof. John H. Gray, of the Northwestern University will begin a study of the social and political conditions in connection with quasi-public undertakings in Chicago, New York, Philadelphia, Boston, and other large cities. These experts represent both sides of the great question.

It is proposed to have the experts finish their work by the time the general commission visits the plants under investigation. The commission will investigate about twenty representative cities in this country before going abroad.

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Report of the New York State Lighting Commission.

The first annual report of the New York State Commission on Gas and Electricity was presented to the Legislature this week It embodies a number of interesting points. In all cases of application for authority to issue stock and bonds, the commission has required testimony as to the needs of the companies and the purpose to which the proceeds were to be devoted, resulting in a reduction of $2,120,000 of stock from a total of $5,668,000 applied for, and of $1,380,000 of bonds from a total of $2,815,000 applied for—about 40 per cent. The effect, the commission believes, is bound to be far-reaching on the price for gas and electricity by those companies.

Four hundred and seventy-five reports have been received, 399 of which were from operative companies, 50 gas and electric, 188 electric, 51 coal and water gas, 17 oil gas, 38 natural gas, 22 acetylene gas, 30 municipal electric, and a municipal gas. Of 156 electric companies, only 34 pay dividends, and of 50 gas and electric companies only 14 pay dividends. The coal and water gas companies make even less favorable showing in this respect, for of the 51 reporting only 8 are producing returns to stockholders.

The bonds and stock issued by all lighting and power companies of the State amount to $531,251,468.33, equal to about $75 for each inhabitant of the State. The individual and municipal plants represent an investment of $1,101,348.92. The amount of gas of all kinds sold annually to consumers is 36,397,747,816 cu. ft. and the amount sold for public lighting is 1,569,446,124 cu. ft.

The report presents some interesting figures showing the growth of the lighting business in the State since 1900, the year of the last census returns. The preferred stock of gas companies has increased from $15,538,400 to $23,716,000, and the common stock from $101,492,116 to $130,837,111, and the gas sold from upward of 20,000,000,000 cu. ft. to upward of 30,000,000,000 cu. ft. These figures all show an approximate increase of from 4 to 50 per cent within five years.

Municipal lighting industries in the State show comparatively small increase, there being thirty municipal stations, compared with twenty-eight in 1900, with an authorized issued bonded indebtedness of $563,978, as compared with $519,340 in 1900.

New York City companies furnish 78 per cent of the total amount of bonds and stock issued in the State by companies furnishing gas only and 93 per cent of the total sales to consumers. Of purely electric companies, New York City furnishes 71 per cent of the capitalization and 77 per cent of the commercial incandescent lamps. Nearly half the public inclosed arc lamps in use in the entire State for street lighting are in use in New York City, and 3,250 open arc lamps, as against 2,045 in the rest of the State.

Senator Stevens, chairman of the legislative committee which last year recommended the creation of the New York State Lighting Commission, has introduced a bill to abolish that body. He says that the commission has proved of no value to the public and is an expensive luxury, and that its report is in large measure a compilation of facts and figures familiar to all, and is unaccompanied by any recommendations. He also criticized the personnel of the commission, which he said should be composed of men acquainted with the subject with which they have to deal.

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Platinum in the United States.

The director of the Geological Survey, Mr. Charles D. Walcott, has submitted a report to the United States Senate concerning the recent investigation of the black sands of the Pacific Slope, which is of considerable importance to the electrical industries in general. The immediate necessity for the investigation has been due to the scarcity of platinum in the United States, occasioned by the Japanese-Russian war. Although it is not likely that this scarcity can be relieved without persistent investigation, covering considerable time, yet it appears probable that a supply of platinum sufficient for the needs of the United States can be developed in this country, and that the production of this valuable metal will not be limited to the Pacific Coast.

Early in the year 1905 the Survey sent copies of a circular to all of the placer miners of the United States (about 8,000) inviting them to submit samples of the heavy sands collected in placer gold mines. More than 1,000 samples were assayed for gold and platinum. These samples were also scrutinized closely to detect the presence of various other minerals which have become industrially useful within the last five years. Among them are chromic iron ore, for the manufacture of paints, chrome steel and bichromate of potash; monazite and zircon, for the manufacture of incandescent gas and electric lamps; magnetic iron ore, for the manufacture of steel, and especially tantalite and columbite, which have recently become very valuable in incandescent electric lighting.

Sands were examined from thirty-four States and Territories, and it was quickly recognized that the distribution of valuable minerals in these sands is vastly greater than had previously been supposed. It was discovered that platinum occurs at many localities where its presence had not been suspected, and the majority of the specimens were found to contain gold in appreciable amount. In order to determine whether these valuable minerals could be extracted at a profit, several concentrating machines of the best type were assembled at Portland, Ore., during the Exposition. It was found that from 95 to 98 per cent of the gold and platinum could readily be extracted from the black sands by concentration on tables of the Wilfrey, Pinder, Christonsen and Woodbury types.

These concentration experiments attracted from the placer miners very much more attention than was expected. Concentration tables had never been used in placer mining to any extent, but several hundred mines are now being equipped with machines of this character. It was found in the course of the examination that much larger supplies of high-grade magnetic iron ore could easily be made valuable by concentration of this character from the sands of the Pacific Coast beaches, and from the sluice boxes of placer mines. This addition of wealth would be great if suitable means for smelting these sands could be found, notwithstanding the high price of fuel on the west coast, and the prejudice against these sands on account of their finely divided character. On the other hand, the abundance of water power on the coast has developed electric power at very low rates at many points. To determine whether electric smelting of these ores is practical or not, an electric smelter was built, and steel of good quality was made directly from the ore, with as high a specific output as 18 pounds of steel per hp-day—an output equal to the best electric smelting practice in foreign countries, where such processes have been established.

The director states that there is little doubt that the investigation, if continued during the present winter, will lead, within two years, to an addition of from two to five millions of dollars to the output of the placer gold mines of the West, in addition to an adequate supply of platinum and the allied metals, osmium and iridium, and to the development of valuable industries at many points in the West to handle the by-products which this examination shows to be present in these sands.

Society of Illuminating Engineering.

The first regular meeting of the Society of Illuminating Engineering was held in the College Room of the Hotel Astor on February 13. The attendance was large and enthusiastic and the presentation of President Marks' inaugural address was followed by a lively and interesting discussion. Dr. C. H. Sharp, chairman of the Committee on Papers, reported that at the next meeting to be held March 13, three papers will be presented. One of these will deal with the inverted gas burner, which, it is claimed, is now developed to the practical stage and will be put forward as a formidable competitor of electric light. The second paper will have for its subject the flaming arc lamp, which type has in the past few years met with so much success in Europe and is now being introduced in this country. The third paper will treat of the subject of illumination from the standpoint of the architect. Secretary E. L. Elliott reported that the membership, without the aid of any systematic solicitation, has passed the 50 mark. Mr. George H. Guy has been appointed corresponding secretary of the Society and will take charge of a systematic canvass for enlarging the membership. Owing to the present great interest in the subject of illuminating engineering, it is thought that the membership may reach 500 or more before the end of the year. A large quota is expected from central stations, not only on account of the information which the *Transactions* will contain relating directly to electric lighting, but also because of the opportunity its pages will afford for keeping track of competing illuminants.

The evening was devoted to the presentation by President L. B. Marks of his inaugural address and to its discussion. The statistics compiled by President Marks attracted particular attention at the meeting and the following day in the newspapers, as the data given are the first ever compiled in this country including all illuminants.

In opening President Marks said that applying the term of illumination to the *use* in contradistinction to the *production* of light it may be truly said that while great strides have been made in recent years in the development of almost every detail concerned with the production of light, illumination, particularly from an economical standpoint, has been sadly neglected.

Broadly speaking, the electrical engineer has concerned himself with improving the efficiency of the generating apparatus and cutting down losses in the transmission of power, but when his wires reach the point at which the electricity is to be transformed into light, his engineering skill has not as a rule been applied. Similarly the gas engineer has been busy with questions involved in the manufacture and distribution of gas while the problem of obtaining the maximum value or most effective use of the illumination delivered at the burners has been relegated to a secondary position.

So far as interior illumination is concerned the lighting layout has been left largely to the architect. It is he who usually prescribes the number and location of outlets for the light sources, specifies the number and candle power of the lamps and designs or selects the lighting fixtures and accessories. The natural tendency of the architect is to make the economical side of illumination subservient to the æsthetic, while on the other hand the tendency of the engineer is to consider only the question of economy.

Though much attention has recently been given to the subject of globes, shades and reflectors, the fact still remains that unshaded or inadequately shaded lamps are the rule rather than the exception. In considering the present status of the science and art of illumination there is perhaps no question that is in need of more immediate attention than this one. The practice of placing lamps of excessive intrinsic brightness within the ordinary field of vision is so common as to cause great apprehension among those who have studied the question from a physiological point of view that our eyesight is suffering permanent injury. That the percentage of children with defective eyesight is growing year by year, is a well known fact. According to oculists the strain on the eye caused by bright lights is in a large measure responsible for this condition. Those who have been subjected to the painful glare of the bare lamps used for illuminating our electric cars will attest to the visual discomfort caused by the subjection of the eye to an unshielded source of light even as small as a 16-cp lamp.

The performance of lamps for street lighting and illumination of large open spaces has not been adequately recorded in papers bearing on this phase of the science of illumination. In view of the lack of complete data on this subject there is a wide difference of opinion to-day as to which of several illuminants is best suited for certain cases of street and country road lighting, illumination and economy being considered.

President Marks gave the following figures as representing the approximate amount of money spent by the consumer annually in the United States for illumination by electric light, gas and oil:

Electric light	Between	$100,000,000	and	$120,000,000
Coal and water gas	"	35,000,000	"	40,000,000
Natural gas		1,700,000		
Acetylene	"	2,500,000	"	3,000,000
Oil		60,000,000		

At a conservative estimate, the consumer at the present time is spending a total over $200,000,000 a year for lighting in the United States. Of this amount fully $20,000,000 is wasted—absolutely wasted, so far as the amount of useful illumination delivered for the money is concerned. No one who has made a study of the subject can fail to see glaring examples of this waste at every hand. It is not at all uncommon to find in electric lighting that 25 per cent of the light that is furnished is lost so far as any useful purpose is concerned, by reason of improper disposition of the light sources or unsuitable equipment of lamps, globes, shades or reflectors. In gas lighting though the conditions are quite different, the same criticism in a measure holds true.

It is one of the aims of the society to assist in remedying the conditions just referred to. To point out in what way the best illuminating result may be obtained from any source of light, be it electric, gas, oil, or candle. With this object in view the theoretical and the practical side of lighting will be given full consideration and the æsthetics of the question studied alongside of the economics. The Society will aim to gather into its fold the various interests that are identified with the development of the science and art of illumination in all its phases. The specialist in illumination, the electrical engineer, the gas engineer, the architect, the designer of electric and gas fixtures, globes and reflectors, and the decorator will meet on common ground to discuss the question of illumination from all standpoints. The views not only of the engineer but of the practician will be courted. The keynote of the organization will be co-operation in all that makes for the good of the cause.

The Society will undertake to gather authoritative data on the subject of illumination and render it readily accessible to those interested. It will hold monthly meetings during the year 1906, except in the months of July, August and September. At these meetings papers dealing with all sides of the question of lighting will be read and discussed. These papers and the discussions thereon, together with reports of special committees and data collected, will be published in the *Transactions* of the Society and distributed among the members.

The question of candle power rating and of nomenclature will receive the attention of the Society. At the present time it must be confessed that the rating of lamps often leads to a great deal of confusion. Some lamps are rated on the basis of horizontal candle power; some according to the downward candle power and some according to other standards. The Society will endeavor to assist in bringing about a uniformity of candle power ratings and the general acceptance of definite nomenclature.

One feature of the work of the Society will be the consideration of special cases of lighting as, for instance, the proper illumination of the assembly hall or auditorium, of the library, of the drawing room, of the factory, of the store, of the show window. The degree of illumination best suited to the individual conditions will form the basis of an investigation to be made at the instance of the Society.

While the general subject of illuminating engineering comes within the purview of several other organizations, such as the American Institute of Electrical Engineers, the American Gas Light Association and the National Electric Light Association, the special field of work that has been mapped out for the Illuminating Engineering Society can hardly be said to fall within the province of any one of these organizations. In the Illuminating Engineering Society, as has already been stated, the electrical engineer, the gas engineer, the architect, the fixture maker and the decorator will meet on common ground. The work of each of these interests in the Society will be concentrated on the subject of illumination. By such specialization the advancement of the art can best be furthered. Illumination is but a very small part of the field that must be covered by the American Institute of Electrical Engineers The American Gas Light Association and the National Electric Light Association are both concerned largely with questions of generation and distribution rather than utilization of the light produced. These latter societies meet only once a year. To adequately cover the ground and keep abreast of the times a society devoted to the advancement of the science and art of illumination must meet frequently. The Illuminating Engineering Society is thus in no sense antagonistic to other organizations having to do with lighting. On the contrary, the Society aims to co-operate with such organizations to advance the interests of all concerned.

DISCUSSION.

Among those who joined in the discussion of President Marks' address were Dr. C. H. Sharp, Dr. A. H. Elliott, Prof. C. F. Chandler, Messrs. Arthur Williams, T. C. Martin, E. C. Brown, F. M. Alcott, R. M. Searle, W. D'A. Ryan, W. J. Clark, John Campbell, J. S. Codman, A. L. Large and E. L. Elliott. Dr. C. H. Sharp pointed out the importance of the work which the society had undertaken to perform. It is concerned with the final product of the lighting companies, and its object is to insure that the product is used to the best advantage. In the generation of electrical current there is no longer much opportunity for economy, and what there is refers to the prime-mover and not the electrical apparatus. On the other hand, there are many opportunities for increased economy in the production of illumination and in the proper use of illumination after having been produced. The economy following a change from 3.5-watt to 2.5-watt lamps is enormous and just as important as an equal increase in the efficiency of the generating equipment. Dr. A. H. Elliott said there is a pressing need for workers in the field of illumination. In ordinary homes only about two-thirds of the gas purchased is utilized and the enormous aggregate loss should be eliminated. The society should endeavor to bring about a proper appreciation of the importance of the efficient use of illuminants and of the advantage to be derived from a good distribution of light. Although many predicted that gas would suffer when electric lighting was introduced, the fact is that the new illuminant created a desire for more brilliant illumination and people used more gas. During the past two years the increase has been 18 per cent. Dr. Elliott thought that the figure given for the annual expenditure for illuminating gas, $40,000,000, was too low. Mr. Arthur Williams remarked that the lamps employed in sign lighting perform the double duty of serving as an efficient advertisement and as a source of illumination. He considered that a real need existed for the society for the reason that the subject of efficient illumination had been much neglected. There is much room for the choice of lamps and their distribution and for the determination of the quality and quantity of light.

Prof. C. F. Chandler related in an extremely interesting manner the early history of illumination from the time when sperm oil was considered a luxury and coal oil was unknown as an illuminant. He recalled the circumstances connected with the introduction of turpentine, alcohol, photogen and kerosene, and outlined the conditions under which the first oil wells were drilled, told of the first arc lamps put in use, and dwelt on the brilliant pioneer work of Edison He also gave an account in detail of the enormous amount of research work done by Welsbach before he brought the incandescent gas mantle to a stage where it increased by five times the amount of illumination from a given quantity of gas. Mr T C. Martin stated that while possibly the figure given by President Marks of the amount expended annually for gas is low, the value given for electricity is safe and conservative. He thought that the relatively large increase in values in New York City could not be taken as an indication of the increase elsewhere, for in few other places had the percentage increase been so great. He suggested that the new society should keep close to the older ones, and that its members could, with profit to all, present papers on subjects connected with illumination before the older societies. He outlined the difficulties which might be encountered in bringing all parties into line in the new society and especially architects, who do not seem to appreciate the need of illuminating engineering. Mr. Martin paid a tribute to the excellent work in illumination done by the late Luther Stieringer, whom he designated as the first illuminating engineer, and expressed a desire that the society should take appropriate steps to show its appreciation of his pioneer work. Mr. E. C. Brown endorsed the statements made with reference to Mr. Stieringer and also paid a tribute to his memory. He criticised the figures given by President Marks on gas consumption in the United States, and said that in merely the largest cities of the country at least $30,000,000 is paid for illuminating gas per year, and that including the rest of the country the value would be much in excess of the estimate of the president.

Mr. R. M. Searle recalled a case of illumination where, when the lamps were originally installed, the walls and ceilings were white and the illumination adequate. Later the decorative color scheme of the building was changed, the walls being darkened to shades varying from pink to chocolate, and to illuminate the house then required an excessive increase in the consumption of electricity. Mr. W. D'A. Ryan stated that the attitude of architects toward illuminating engineering had changed considerably within the past few years. Formerly it was impossible to obtain an audience with them, but now they do not hesitate to call for information. Mr. E. L. Elliott believed that the society would serve a useful purpose in producing harmony among all the interests it represented. Mr. W. A. Clark related some experiences in educating the people to the proper use of gas. Through the use of incandescent mantles numerous families had been able to use gas both for cooking and for illumination at a cost not exceeding what had formerly been paid for an unsatisfactory lighting service.

At the conclusion of the discussion Mr. T. C. Martin was appointed a committee of one to prepare a memoir for the *Transactions* of the society setting forth the nature and value of Mr. Stieringer's contributions to the art of illumination.

Tesla Split-Phase Patent Litigation.

On January 19 Judge Kohlsaat rendered an opinion in a suit on final hearing involving the validity of the 1893 Tesla split-phase patents, the parties to the suit being the Westinghouse Electric & Manufacturing Company, complainant, and the Electric Appliance Company, defendant. The defenses in the suit were, first, that the claims at issue in the two 1893 patents are void for double patenting by reason of the grant to the same inventors of an earlier patent dated April 16, 1889, and second, that each of the patents in suit expired in the year 1903 by the reason of the expiration in that year of two British patents granted in 1889

The court in its opinion stated that according to established judicial precedents, if the difference between the claims of the 1893 patents and those of the 1880 patent are only colorable, then either the former patents are void or the latter patent is void, but in fact, the later American patents were entirely unlike the earlier American patent, the latter being on means and the former a method. Assuming that Tesla had taken out the 1893 patents in advance of the 1889 patent, he would in them have disclosed all the elements of the latter patent, but being the inventor in both cases he would have had a right to proceed in this particular manner. To hold the two 1893 patents in suit to be identical with the 1889 patent would be to do violence to the facts and the rule of law; the contention of double patenting does not apply since the earlier patent covers a method for operating a motor by the means disclosed in the later patents This being so, the 1893 patents were also in no wise affected by the expiration of the English patents, since these were nothing more than improvements upon the 1893 patents. The finding of the court was for the complainants.

CURRENT NEWS AND NOTES.

$1,800 *FOR* $63,000 *MUNICIPAL PLANT.*—C. P. Cartwright was the only bidder before the Service Board of Columbus, Ohio, recently for the machinery of the old electric light plant. He bid $1,800 for machinery that cost the city $63,000 about seven years ago.

INFIRMARY LIGHTING PLANT.—The lighting system installed in the County Infirmary at Wooster, Ohio, several years ago having been found too expensive to operate day and night, the county commissioners have closed a contract with the Worcester Electric Light Company to light the building.

MUNICIPAL OWNERSHIP IN ST LOUIS.—The supervisor of city lighting in St Louis, Mo., has been instructed to collect and tabulate data concerning the cost and feasibility of a municipal electric light plant of sufficient capacity to light the entire city. The present contracts with the electric light and gas companies expire August 31, 1910.

ARTIFICIAL WOOD TIE.—The Western Ohio Railway is making experiments with an artificial wood tie, the invention of J. F. Laufer, of Lima, Ohio. The tie closely resembles wood and is made by compressing waste products of various descriptions. It is claimed to be indestructible, non-soluble in water and a non-conductor of electricity. Thus far it is proving satisfactory.

MUNICIPAL OWNERSHIP IN BUCYRUS, OHIO.—The committee appointed by the City Council to investigate the question of municipal ownership of the public utilities of Bucyrus, Ohio, has recommended that the city buy the water and lighting plants. The franchises of the gas and electric companies expire soon and the water company franchise has only a few years to run.

'FARMERS' TELEPHONES.—A movement toward the organization of a rural telephone system throughout the section in the vicinity of Ashtabula, Ohio, is meeting with much success. Already eighteen townships are included in the system. An independent co-operative company, composed entirely of local men, is formed in each township and incorporated. Through the agency of the eighteen companies now organized over 1,800 telephones have been installed. Each company gives the free exchange of service over its wires to the other companies in the system.

OUR CHINESE FRIENDS.—The Imperial Chinese Commission now in this country has technical members, and these have taken a great interest in electrical work. This week Messrs. Y. C. Tong, of the Chinese telegraphic administration, and T. Y. Luk, secretary of the Commission, with Mr. Lung, another member of the party—a statistician—visited the works of the Safety Insulated Wire & Cable Company at Bayonne, N. J., where they evinced the deepest interest in the manufacture of insulated wire and cables. They were received and escorted by President Leroy Clark, and Messrs. A. P. Eckert and R. C. Coples. Some two hours were spent in the tour of inspection.

DAYTON LIGHTING PLANT.—The new power plant of the Dayton Lighting Company has been put in successful operation. The power equipment has been entirely renewed and increased and includes a 2,000-hp direct-connected generator, a 1,000-hp alternator and an Allis Chalmers horizontal steam turbine. The company is installing a conduit system which represents a cost of $510,000. A banquet was recently given by the Dayton Lighting Company to the Electrical Contractors and allied electrical interests of Dayton. The affair was an innovation, but it proved a success and will be followed by others at irregular intervals.

MUNICIPAL OWNERSHIP IN LOS ANGELES.—The committee of the City Council of Los Angeles has recommended that no action on municipal ownership of a lighting plant be taken at the present time.

INDEPENDENT TELEPHONISTS MERGE.—A meeting of the representatives of the 200 or more independent exchanges in Missouri will be held at the Hotel Kupper, Kansas City, Mo., February 22 and 23, at which steps will be taken to merge all the exchanges in Missouri that are not controlled by the Missouri & Kansas Telephone Company. This action was determined upon at a meeting of the Missouri Independent Telephone Association, brought about by the purchase by the Missouri & Kansas Company of several exchanges. The main object of the conference, held early this month in Kansas City, was to effect the merger, and the resolution setting forth the advantages of such action in the matter of lessened expenses, etc., was adopted. A committee of three was appointed which will appraise the property of the various exchanges to be merged, and on the value and condition of these plants the stock in the new company will be based.

TO EXAMINE ELECTRICIANS.—In the New York Legislature Senator G. A. Davis has introduced a bill "to secure the registration of master electricians." The bill is now in the hands of the Senate Judiciary Committee, and there is to be a hearing on it next Wednesday, February 21, at Albany. It applies to any person engaged in the business of installing, erecting or repairing plants for furnishing electric current in buildings, etc., or installing, placing, altering or repairing wires and apparatus. It is proposed to appoint an examining board of three members in each county in which there is a city, which shall, upon proper examination, issue certificates of competency, and $25 is to be charged for each case. No one shall be allowed to do electrical work who is not thus certified, and each year the charge of $2 is to be made for the renewal of the certificate. There is a penalty for overstepping the provisions of the act of from $10 to $250 fine or imprisonment for from thirty days to one year, or both fine and incarceration. Apparently the bill contains no regulations whatever for standardizing the qualifications, so that the widest extremes of fitness or unfitness could prevail in case the measure became law. There is also no provision for the compensation of the boards of examiners, each of which is to do this work in its respective county. All present "master electricians" are eligible, apparently, on producing evidence that they have been engaged in the business for five years immediately preceding the passage of the act.

HIGH SPEED.—Mr. B. A. Behrend, chief electrical engineer of the Allis-Chalmers Company, recently delivered an address before the College of Mechanics and Engineering at the University of Wisconsin, Madison, Wis., entitled "High Speed in Modern Engineering." In this lecture Mr. Behrend laid stress upon the remarkable change that has been wrought during the past ten years in the field of prime movers and the fact that the reciprocating steam engine, which held its own for over one hundred years, has gradually yielded, in a number of important fields of operation, to the rotating steam turbine—a change so radical that it may be said to have inaugurated a new epoch in engineering. Mr. Behrend discussed the conditions to be fulfilled for grappling with the difficult task of designing machinery for such high peripheral speeds as three and four miles per minute, and he showed how rotating bodies had to be shaped in order to uniformly distribute the stresses and minimize them so as to meet these conditions. The lecture was illustrated with slides representing the stresses in rotating discs, and details of steam turbo-generators. Mr Behrend made the statement that the size of the generating unit in large power plants is going to increase considerably, and that during the next few years units of from 10,000 kw to 25,000 kw, wound for potentials of from 10,000 to 30,000 volts, are likely to be installed, as the steam turbine and generator lend themselves particularly well to units of very large capacity, and units of such capacity can be more readily wound for high potentials.

FRANCHISES IN NEW JERSEY.—The commission appointed by Governor Stokes to investigate the granting of franchises to public utility corporations has submitted its report to the Legislature. The commission advises against municipal ownership of street railways, recommends that the power to grant franchises remain with municipal authorities and that all franchises be limited to a period of thirty-three years, unless a majority of the citizens of a municipality vote to extend the time to a period which shall not exceed sixty-six years. The report also advises that power be given to renew franchises at their expiration and that excessive bond issues be prohibited by law.

RATE REGULATION IN CHICAGO.—The Chicago City Council on February 8 passed an ordinance fixing the rate for gas in Chicago at 85 cents per 1,000 cu. ft. The rate has heretofore been $1.00. This rate was virtually agreed upon at a conference between the council committee and the representatives of the gas company with the further understanding that the several points in controversy between the city and the gas company be dropped. The committee is now turning its attention to electric light rates and representatives of the Chicago Edison Company and Commonwealth Electric Company are having the usual difficulty in showing the committee how the maximum demand of a customer influences the cost of supplying him with a given amount of power. The companies last year voluntarily reduced their rate for first 30 hours' use on maximum demand contracts from 20 to 16 cents per kw-hour.

WELFARE WORK.—The New York Civic Federation held its annual meeting on Wednesday evening, February 14, at the Park Avenue Hotel, New York City. The subject for discussion was "Welfare Work." Members representing the employers, the employes and the public were heard. Charles A. Moore, of Manning, Maxwell & Moore, on behalf of the employers, read a paper on "The Duty of the Employer to Provide for the Welfare of Employes." H. H. Vreeland, president of the New York City Railroad Company, presented a paper on "What New York Employers May Do to Meet the Needs of the Employes." Papers were also read on behalf of the employers by John Huyler, on "The Beginning," and by Orrin S. Goan, of the National Biscuit Company, on "How We Found Space for Welfare Work." Papers were read on behalf of the employes by six representatives of labor organizations, including one by Timothy Healey, president of the International Association of Stationary Firemen, on "The Needs of Stationary Firemen and Hotel Employes."

A. I. E. E. IN CINCINNATI.—The first monthly meeting of the Cincinnati chapter of the A. I. E. E. was held at the Grand Hotel, Wednesday, February 7. Prof. C. W. Marx, consulting engineer of the new Sinton Hotel of that city, gave a talk on "Engineering Practice in Modern Hotels." He said he had visited the principal hotels and office buildings in New York and Chicago to see how successfully the requirements at these places were met. The power plant for this hotel, including lighting, power, heating, ventilation and refrigeration, will cost over $200,000. The proposition was presented to the local chapter to affiliate with the local chapter of the American Society of Architects, American Society of Mechanical Engineers and the Engineers' Club. The local chapter voted that it was the sense of the body to favor the affiliation. The articles of agreement provided that each organization shall retain its individuality and that all the members of the affiliated bodies shall be invited to the meetings of each organization at which professional subjects are under discussion. It is intended to secure a suitable building at which all meetings can be held and which shall be accessible to the members for informal meetings. It is further intended to create a library which shall be available to all the members. The new officers of the local chapter are as follows: Mr. C. S. Reno, chief engineer of the Triumph Electric Company, president; Mr. A. G. Wessling, engineer of the Bullock Electric Manufacturing Company, vice-president; Mr. Laurent Lowenberg, of the Reliance Engineering Company, secretary and treasurer.

NEW YORK ELECTRICAL SOCIETY.—The next meeting of the New York Electrical Society will be held on the evening of February 21 at the Edison Auditorium, 44 West Twenty-seventh Street. Mr. Robert T. Lozier will lecture on "The Fundamental Principles of Gas Engines and Gas Producers." He will give analyses of the gases used, of the products of combustion and the distribution of losses, and note the best points of foreign practice.

NEW RESISTANCE MATERIAL.—A patent granted February 6 to Albert L. Marsh describes an electric resistance material which is claimed to be particularly high in resistance, with a melting point exceeding that of copper, and which may be easily drawn or otherwise shaped to form durable resistance strips, wires, etc. The material consists of an alloy of preferably less than 25 per cent chromium and more than 75 per cent of nickel. A metal alloy consisting of 15 per cent chromium and 85 per cent nickel drawn into a No. 26 B. & S. wire is stated to have a resistance of about 2.3 ohms per foot.

WORKMEN'S INSURANCE.—The U. S. Bureau of Labor is preparing a report covering the various systems of workingmen's insurance and employers' liability both in this country and abroad. The report will cover insurance against sickness, accident, disability, old age, death and unemployment. In this connection it is endeavoring to secure information concerning the existence in the United States of what are usually known as establishment funds—that is, mutual relief or insurance funds organized and maintained by the employees of an industrial establishment, or relief funds supported either wholly or in part by the employers themselves. It is desired to obtain, wherever possible, copies of constitutions, rules and by-laws, blank certificate forms, and any other matter relating to funds of this character. In the absence of other data the name and location of establishments in which such funds exist are desired."

AN APPEAL TO CONSUMERS.—An interesting appeal was made last week to its customers by the Trenton, Mo., Gas, Light & Power Company. The facts are set forth in the document itself as follows: "Some weeks ago, this company proposed to the mayor and city council that they select a commission consisting of two or three of its members, and a like number of private light consumers, and that this committee, together with one representative from the light company enter into a five-year contract not only for street lighting, but for the private consumers, as well. Since then the city has seen fit to enter into a contract with us without taking this offer, and we have decided to make our consumers the following proposition: First, that they shall select a committee of three of the representative, honorable, business men of Trenton. This committee shall be empowered with authority to contract with us for five years, and shall have power to represent the light consumers of Trenton as a whole. There shall be nothing binding on the individual consumers, however, and they shall be free to discontinue their service at pleasure. It shall be the duty of this committee to investigate all phases of the light question and to investigate and procure statistics and statements of what other towns are doing, and the prices they are making, whether or not the meter proposition is to be recommended universally or in part, whether or not the large consumer is entitled to a lower rate than the small consumer, whether it would be best to have a summer rate, and a correspondingly lower rate for the different seasons of the year. And it shall be the duty of this committee to be a standing grievance committee who shall obtain some knowledge of electric wiring, and shall be in position to make recommendations and meet all emergencies which might arise in the future. To this end, we will agree to make the above contract, and that the committee appointed shall investigate the lighting rates and the general lighting business of other towns in this State, and this company will agree to pay all expenses of this investigation, and to contract on a basis not to exceed the average of the towns selected and agreed upon. Or, in other words, we will agree to make a contract based on the recommendation of this committee which you shall select."

GRINDELWALD ROAD.—The Swiss Federal Council has submitted a bill to the National Legislature for building an electric railroad from Grindenwald to the upper glacier.

IOWA TELEPHONE ASSOCIATION.—The next meeting of the Iowa Telephone Association will be held at the Chamberlain Hotel, Des Moines, on March 13, 14 and 15. Mr. Charles C. Deering, Boone, Iowa, is secretary of the association.

SNOW TEST OF LOCOMOTIVE.—Electric Locomotive No. 6000, built for the New York Central in connection with its electrification plans in and around New York City, was given a snow test last week. With eighteen inches of snow on the level and many huge drifts, the engine plowed through them easily and made good speed. No difficulty was encountered with the third rail.

THE DENVER MUNICIPAL OWNERSHIP LEAGUE proposes to press the issue of municipal ownership at the next city election The League also promises to submit ordinances regulating the rates which may be charged private consumers by the light companies and other public utilities. It is said that the Lacombe electric light plant can be purchased on March 1 for $150,000, and there seems to be a very strong sentiment in favor of its purchase by the city.

POWER MOTORS ON CAR LINES.—It may not be generally known that in several of the German cities, contrary to American practice, power motors are connected to the street railway systems. It is stated that in the city of Dresden, for instance, 350 motors of a total of 1,000 hp are thus connected, in spite of what would appear to be the large and inevitable variations in the voltage.

ELECTRIC LIGHT IN PARAGUAY.—U. S. Consul Ruffin, of Asuncion, transmits a copy of the recent act of the Paraguayan Congress calling for bids for the electric lighting of the capital city and for motive power. The city decision to give the lighting over to a private company is thus rescinded and the city ordered to ask for public bids, which will be opened April 2. This will afford an opportunity not only to American contractors, but for electric appliances for buildings and industrial plants as well. The complete translated text of the electric-lighting law can be examined at the bureau of manufactures, Washington.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.—At the February meeting of this society a paper was read by C. Edward Magnusson, assistant professor of electrical engineering in the University of Washington, entitled "Recent Development in Electrical Engineering." The paper dealt very largely with the advantages afforded by alternating single-phase currents for heavy traffic on suburban lines, and was discussed by Elbert G. Allen, electrical engineer for the Seattle Electric Company; H. Day Hanford, formerly superintendent of construction of the Indianapolis Interurban Railway Company; Cyrus A. Whipple, electrical engineer at the Puget Sound Navy Yard, Bremerton, Wash., and W. S. Wheeler, inspector of franchises for the city of Seattle.

PROPOSED UNITED STATES CABLE.—If a bill introduced at Washington by Congressman Wanger, of Pennsylvania, becomes a law, the Government will embark in the telegraph and cable business in the West Indies. The bill appropriates $1,000,000 to construct a cable from Key West, Fla., to Guantanamo, Cuba, and thence to the canal zone on the Isthmus of Panama. A branch line from Guantanamo to Porto Rico is also provided for. The commercial rate is fixed at not less than 40 cents a word, and reduced rates made for press matter The Government has already done a great deal of Signal Corps cable work in the Philippines

HARNESSING NIAGARA.—Mr. D. W. Marvin, in a letter to the New York *Times*, on "preserving" Niagara Falls, says: "I believe that the falls were formed for the use of man in his evolved state, and that now is an appropriate time to utilize them. Every year they are wearing away, and there is no way to save the greatest power in the world but to stop the overflow. If we use the water we save the falls; if we do not use the water we lose the falls. We have arrived at this point in the progress of the arts and sciences that we are able to utilize this great power for the good of mankind. Coal and gas will in a few years become scarce and expensive. Electricity is the only power that can take the place of these." As a matter of fact, a good deal of water might be taken from the falls without "losing" them. With less water going over the brink they will more slowly develop into the rapids already forming.

INITIATING ELECTRICAL APPARATUS.—A novelty in the way of invention is the subject of a patent issued last week, the device described being an "initiating apparatus to be used in initiating candidates to membership in secret organizations." A casing having the appearance of a book has a portion of the top cover pivoted so that it may be revolved through 180°. On the outer side of this cover is inlaid the emblem of the organization and on the reverse side is similarly inlaid a device "symbolic of the principle or virtue which it is the object and aim of the society to promote"—each plate being illuminated by a small electric lamp. In an interior case is a cartridge. When the candidate for initiation places his hand upon the book a button is pushed, the cartridge is fired and a spring instantaneously carries the section of lid through 180°, thus apparently transforming the illuminated "emblem" into an illuminated "mystic symbol."

THE CHICAGO SUBWAY is as remarkable for showing what electricity can do underground in freight haulage as the New York Interborough is in demonstrating what electricity can do with passenger traffic. In a few weeks the Chicago Subway will be in full operation. By July 1, the president says, it will be handling 30,000 tons of freight daily and earning at the rate of $5,000,000 net per year. The minimum estimate of the earning capacity is 12 per cent on the full amount of the stock, according to official figures. There has been spent in the extraordinary undertaking $17,000,000 in construction and $2,000,000 or more in equipment, while its entire cost exceeds $20,000,000, not one dollar of which is Chicago capital. The tunnel base is small, 7 ft. 6 in. high and 6 ft. wide. The franchise covers practically the entire city. It is not intended to carry anything but freight, but there is plenty of room for a passenger subway above the present tunnel, which is 40 ft. below the city datum, an average of 41 ft. below the city streets. The freight cars are built to fit the warehouses and storerooms they enter, and can be taken up by elevators to any story.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—The annual convention of the National Electric Light Association will be held at Atlantic City on June 5, 6, 7 and 8. The meeting hall will be in the small auditorium of Young's Pier, and the large exhibition room on the front of the pier has been secured for the exhibits of the associate members. The present programme is to open the exhibition hall on Monday evening, to hold a reception and ball in the new Blenheim on Tuesday evening, and a banquet, at which will be present the Governor of the State and many other notables, on Thursday evening. A part of the entertainment of the ladies will consist of a trip to Philadelphia in a special car, lunching at the Bellevue-Stratford, and returning in the late afternoon. The entertainment of the members will be confined to other than meeting hours, as it is intended that this, like all recent ones, shall be a working convention. A feature of the banquet will be the cooking of the menu by electric current. This is now being arranged, and it is expected that all the prominent manufacturers of electrical heating devices will take part. The attendance during the last two conventions has been about 1,300, and it is expected that Atlantic City will increase the number to not less than 2,000. It is hoped that a good many ladies will be in attendance.

The Burlington, Vt., Municipal Electric Plant.

Burlington, Vermont, has recently begun to operate the largest municipal electric plant in that State, for both street and commercial lighting, in competition with the private gas and electric supply corporation there. The new municipal generating station is located close to the pumping station of the city water supply system, on the shore of Lake Champlain, near Lake Street, and the steam railway, and perhaps one mile from the business center of Burlington. At this location the city has a wharf, and the supply of coal comes mainly or entirely by boat. Water for condensing and also feed water for the boilers is pumped from the lake. The steam-driven electric equipment is housed in a one-story building with basement under the engine room floor, solid brick walls, and a timber roof covered with tar and gravel. In the boiler room, which is on the lake side of the station, and whose floor is about on a level with that of the basement under the engine room, there are two horizontal water-tube boilers with a nominal rating of 150 hp each. Connected with these boilers is an induced-draft plant and an economizer.

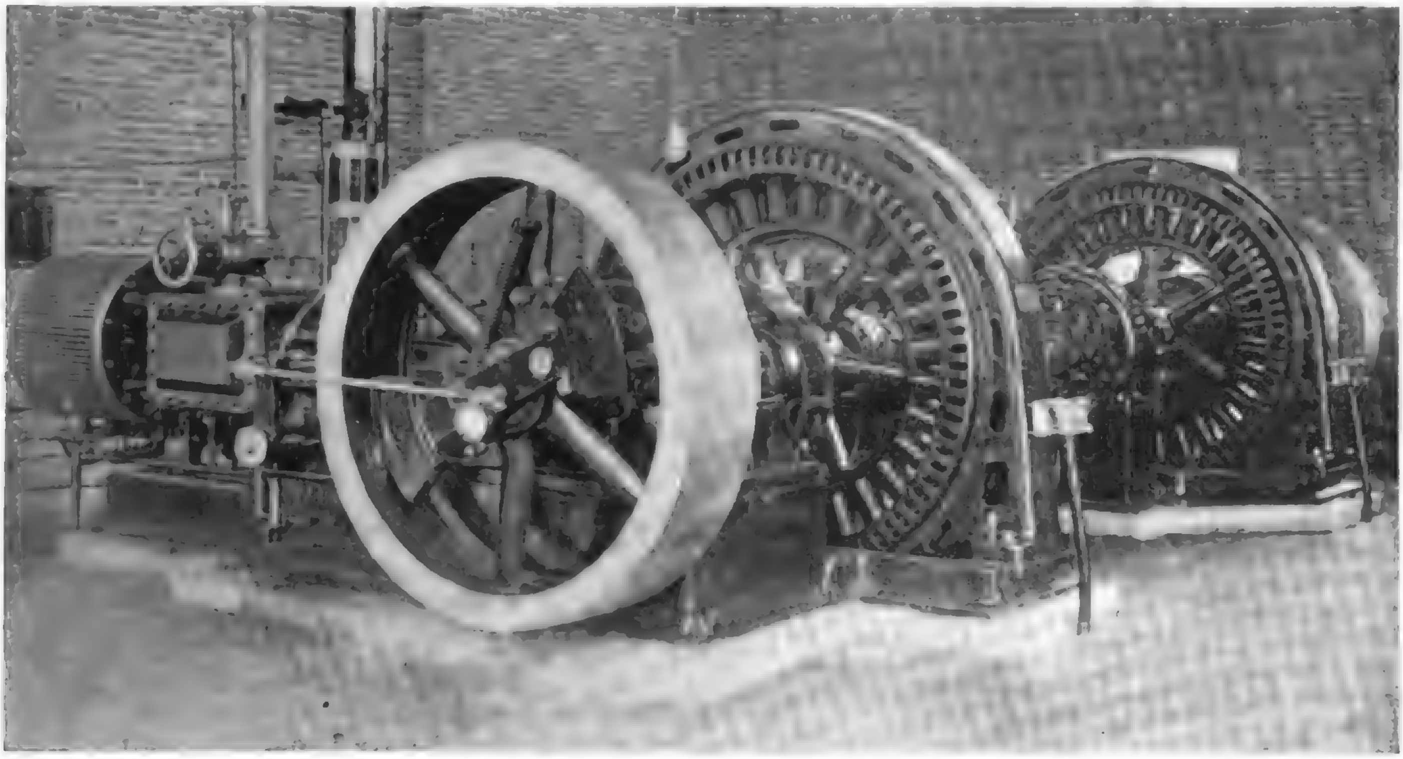


Fig. 1.—View of Engine Room of Burlington Municipal Plant.

Each boiler is rated on the basis of 30 lb. of water at 100° F., converted to steam of 70 lb. gauge pressure per hp-hour; there must be at least 10 sq. ft. of heating surface and not less than 1/65 nor more than 1/35 as much grate surface, per rated horsepower. The induced draft equipment includes an engine-driven fan, flues and a steel smokestack. When the load is 300 hp the induced draft outfit is required to burn 15 pounds of 12,500 heat-unit coal, and with a load of 400 hp 20 pounds of this coal must be burned, per square foot of grate area, per hour. In the economizer the specifications require that the temperature of feed water be raised from 100 to 200° F. by the reduction of the temperature of the flue gases from the 300 hp boilers from 550 to 300° F.

In the condensing and feed water outfits are one jet condenser, two duplex feed pumps, and one air pump. With injected water at a temperature of 50° F. the condenser is required to maintain a vacuum of 26 in. of mercury while condensing 9,500 pounds of steam per hour. The duplex air pump with this condenser is capable of delivering 400 gal. of water per minute when its temperature is 100° F., with steam pressure of 150 lb. and a piston speed of not more than 60 ft. per minute. Each of the two boiler feed pumps is required to deliver 20 gal. of water per minute, at 100° F., against 150 lb. pressure per square inch, when working under steam at this pressure.

In the engine room of the station are two horizontal tandem compound engines, operated condensing and rated for 200 hp each with steam at 140 lb. per square in., and a vacuum of 26 in., at 257 r.p.m. Under the contract for these engines they are limited to 19 lb. of steam at full load, 19½ lb. at half load, and 21½ lb. at one quarter load, per hp-hour, under the conditions named above. The speed of each engine must not vary more than 1½ per cent above or below the normal, and the fly-wheel action must be such that the displacement of a direct connected armature will not exceed 1/36 part of the angular distance between adjacent poles, at any time.

Direct-connected to each of these two engines is a 125-kw, 2,300-volt, 60-cycle, three-phase alternator of the internal revolving magnet type. On a power factor of 90 to 100 per cent each alternator is required to have an efficiency of 92 per cent at full load, 90.5 at three-quarters load, and 87.5 per cent at half load. The efficiency here indicated is that calculated from the measured resistance of the electric windings, and from the measured power required for core losses. After 24 hours of operation at 2,300 volts and 31 amperes per terminal, the permissible rise of generator temperature is put at 40° C. Change in voltage at each generator may not be more than 7 per cent when the entire load is thrown off or on, with constant speed and separate excitation.

At the end of each engine shaft, near its generator, there is a direct connected 5.5 kw, 125-volt exciting dynamo, which thus operates at 257 r.p.m., like the engine. The exciting dynamos are compound-wound. On a gallery floor above a space in the rear of the switchboard, in this station, there are three constant current transformers, each designed for two circuits of 50, 6.6 amp. enclosed arc lamps, giving a capacity of 100 such lamps per transformer. These transformers are of the air-cooled repulsion coil type, each being designed to maintain currents of 6.6 amperes in the two secondary circuits, while the primary circuit is connected to one phase of a 2,300-volt, 60-cycle generator. An efficiency of 96 per cent at full load and 92 per cent at half load is specified for these transformers. For operation under full load during 12 hours the rise in temperature of these constant current transformers is fixed at 55° C. Arc lamps for use with these transformers were required to have a total voltage of 76 and an arc voltage of 72 each, with a consumption of 430 watts at 85 per cent power factor.

At some distance from that outside wall of the station which is nearest to the generators, a gray marble switchboard of seven panels is mounted in a steel frame, and carries the switches and instruments for two three-phase generators, six series circuits for the constant current transformers and the street lamps, one three-phase, 2,300-volt lighting circuit, and one power circuit of like phase and voltage. The connections are such that the two generators may be operated independently or in parallel. Each generator panel has among other instruments a triple-pole double-throw oil switch, three ammeters for the three phases of the generator, and one voltmeter with plug connections to give the voltage on each phase. On each arc lighting panel there is an ammeter for each constant-current circuit, and a double-pole oil switch, besides the six plug switches. Lightning arresters are provided for every circuit leaving the station, and are mounted on one of the walls.

The erection of the station building on land owned by the city, and its complete equipment including all of the apparatus above named, together with the erection of the lines, poles and 218 arc lamps on the streets, were all covered by a single contract, in which the total money consideration was $53,218.90.

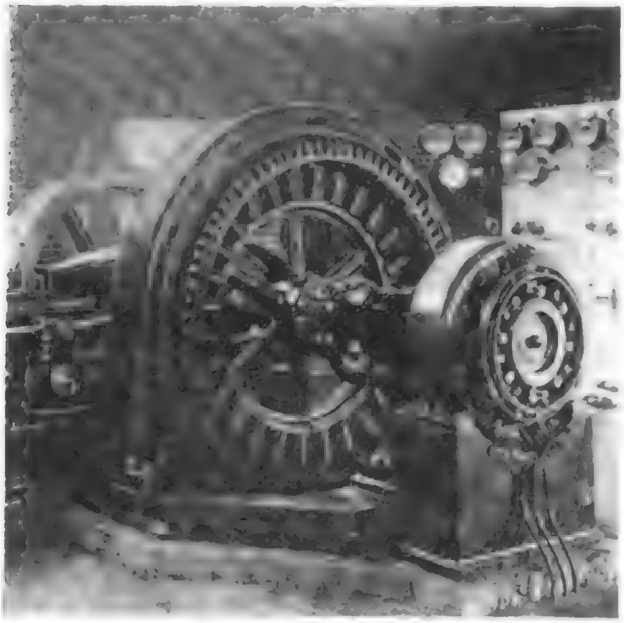


FIG. 2.—ONE OF THE THREE-PHASE ALTERNATORS.

On April 29, 1905, the plant was started for street lighting service only, and about November, 1905, it began to do commercial lighting. At this time the plant has connected about 1,000 commercial incandescent lamps of 16 nominal candle-power, and six commercial arc lamps on the series circuits. It is stated that the demand for the municipal lighting service is at present in excess of the extent and capacity of the commercial circuit.

Clearfield coal is used in the generating station, at a cost of $3.90 per ton. Four men, two engineers and two firemen, operate the electric station 24 hours daily, working 12-hour shifts, and this is the only labor employed regularly at the station. Each engineer receives $2.50, and each fireman $2 for 12 hours work, so that the regular labor item at the station amounts to $9 per day or $3,285 per year. Besides the four men just mentioned, the regular management and operation of the municipal system includes at present the services of a superintendent and a lamp trimmer. The wages of these persons are not stated. In addition to this regular operating force, there are now several linemen employed in the construction of commercial circuits and the installation of lamps. What rate of wages is paid to these linemen was not learned.

For commercial service the rates of the municipal electric plant as fixed by city ordinance, include renewal of incandescent lamps, and are the same to all consumers under like conditions as to amounts of energy used per month. These net rates are 10 cents per kw-hour for the first 100 kw-hours consumed per month, 8 cents for the next 200 kw-hours, and 6 cents for the next 300 kw-hours or more per month. For 300 kw-hours per month the average charge is thus 8.66 cents, and for 600 kw-hours per month the average charge is 7.33 cents.

The rates of the former private companies in Burlington were 10 cents per kw-hour for less than 166 kw-hours per month, 9 cents for less than 333 kw-hours per month, and 7.5 cents for less than 666 kw-hours per month, and 6.5 cents for more than 666 kw-hours. On the basis of these figures the rates for electric lighting from the municipal plant appear to be lower to some small consumers and higher to large consumers, than those previously made by the supply company, as follows:

GAS AND ELECTRIC SUPPLY COMPANY.

Less	than	166	kw-hours	monthly	@	10	cents.
"	"	333	"	"		9	"
"	"	666	"	"		7.5	"
Over	"	666	"	"		6.5	"

MUNICIPAL PLANT.

100	kw-hours	monthly	@	10.0	cents.
150	"	"	"	9.33	"
200	"	"	"	9.0	"
300	"	"	"	8.66	"
600	" & over	"	"	7.33	"

After the plant was ready for operation exhaustive tests were made by the consulting engineer and a large corps of students from the University of Vermont. Several days were occupied in these tests and all of the apparatus was tested to its fullest capacity and found to meet the specifications in all details. Mr. C. W. Taggart is superintendent of the municipal electric plant, and Mr. W. H. Freedman acted as consulting engineer in its construction.

The general contractors for the station building and its equipment were Bellman & Sanford, of New York City. Boilers named above are of the Atlas make, the induced draft equipment is from the Sturtevant works, as is also the economizer. The pumps and condenser are of Snider-Hughes make. Watertown engines are used in the generating sets, and the alternators connected to these engines were made by the Crocker-Wheeler Co. The constant-current transformers, switchboard and arc lamps are Westinghouse products.

Commutation in High-Speed Generators.

A recent issue of the London *Electrician* gives an abstract of a lecture delivered by Prof. S. P. Thompson at the Society of Arts on January 25, in which he outlined the requirements of turbo-dynamos for continuous current. The lecturer pointed out that one of the chief factors determining the absence of sparking is the duration of the period of commutation. It was shown how the introduction of the carbon brush had made all the difference between success and failure in this direction, for "natural commutation" was made possible within wide limits of working only by the peculiar properties of the contact resistance of carbon and copper. The lecturer was emphatic in his condemnation of the method sometimes proposed of putting resistance in the connections between armature coils and commutator, which was clearly proved to have no effect on sparking. The subject of forced commutation, although of greater importance in high-speed machines, was not so fully dealt with, the speaker showing briefly the way in which difficulties at high peripheral speeds had been overcome by providing auxiliary poles, which produced an opposing flux at the right moment to accelerate the reversal in the armature coil. It was mentioned how the introduction of auxiliary commutation poles had improved these machines, but no reference was made to the remarkably ingenious system used by Parsons until comparatively recently, when he caused the brushes to be shifted at different loads by variations in the initial steam pressure. Referring to the possibility of using carbon brushes alone up to peripheral speeds of 7,000 ft. to 9,000 ft. per minute, the lecturer described the new Morganite brush, which not only had different resistance in the longitudinal and transverse directions, but had a higher resistance at the trailing than at the leading portion. There is, however, another method of dealing with the question, and that is the use of "homo-polar" machines, in which there is no commutation at all.

Warren and Jamestown, O., Railway Power Station.

A PLANT of exceptionally modern design and equipment is that recently erected at Stoneham, near Warren, Ohio, to supply power for the needs of the Warren and Jamestown electric railway system. The system comprises a single-phase railway, 22 miles long, between Warren and Jamestown, and the Warren city lines comprising 9 miles of single track with 7 cars in normal service. The latter is a direct-current system and formerly had its own generating plant. The particular interest of the plant, aside from its single-phase railway feature, is that it uses gas engines exclusively for driving the generators. Power for the alternating-current line is transmitted at 22,000 volts, which at points located about one and one-half miles from the two termini is reduced to 3,300 volts and further reduced within the city limits of Warren and Jamestown to 550 volts. In Warren the alternating-current trolley line for the interurban service parallels the city service direct-current trolley line.

For the generating plant the old city railway power house at Stoneham was utilized and greatly enlarged for the reception of the new machinery. Owing to the abundant supply of cheap fuel gas in the neighborhood, it was decided several years ago to experiment with gas power for running the city system, and the results obtained were so satisfactory that it was decided to use gas engines exclusively in the modern plant just completed. The old gas engine plant is still maintained as a reserve in case of emergency, and consists of a 300-hp vertical type Westinghouse gas engine, which was installed to drive a double-current generator, the machine first supplying the direct-current city load and later the alternating-current interurban road until the main power units could be placed in service. This machine is now employed as a rotary to good advantage for supplying the city with direct current from the main alternating-current plant. In case either side of the alternating or direct-current plant requires assistance, this machine will be belted to a reserve engine and operate either as a direct or an alternating-current generator. A 150-amp.-hour storage battery assists in absorbing the fluctuations of the city load. It floats on the system without a booster and was first installed for the purpose of regulation to assist the old gas engine plant.

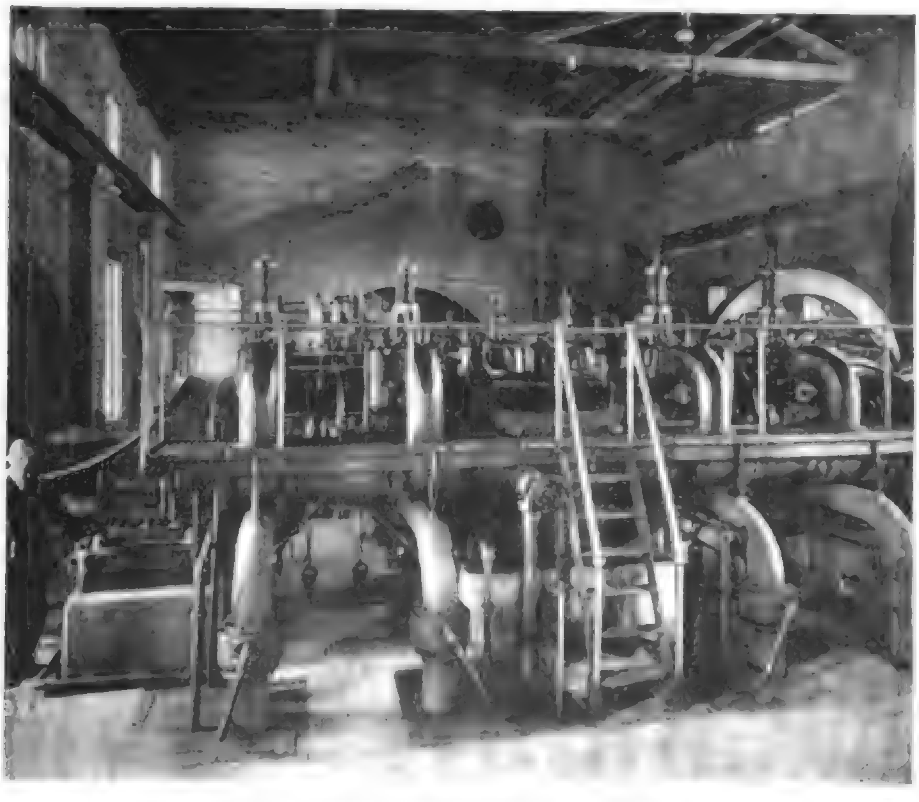


FIG. 1.—GENERAL VIEW PLATFORM SIDE OF ENGINE.

The new generating plant consists of two Westinghouse gas engine units with space for a third of equal size, the rating being 260 kw, or 470 brake hp nominal. These are of the single tandem type, which was adopted in place of the twin tandem in order to give greater flexibility of operation. The units are without spring couplings between engine and generator, and operate in parallel on the station load precisely in the same manner as an ordinary steam-driven unit.

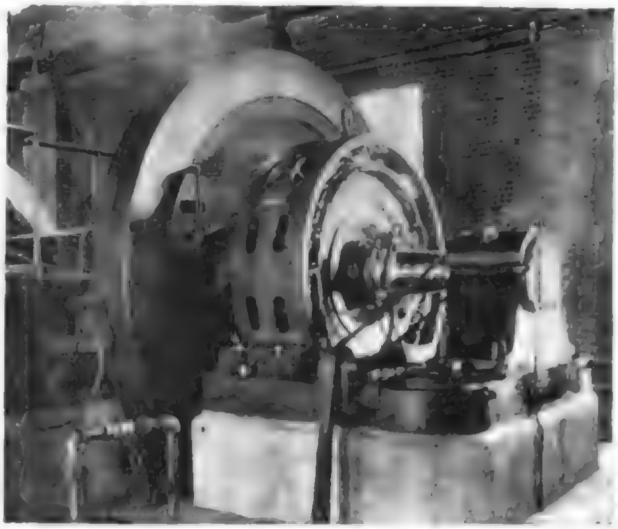


FIG. 2.—DETAIL VIEW OF GENERATOR END.

A noteworthy feature of the plant is its ability to cope with the violent fluctuations in load due to the demand of current on heavy grades and simultaneous starting of cars. Owing to the small number of cars in service at any one time—usually three on the interurban line and seven on the city line—the power demands are exacting and rarely overlap in such a manner as to smooth out the station load curve. A voltage regulator has proven of assistance in overcoming the fluctuations, and regulation is obtained by a sensitive relay system of governing which holds the speed of the engines so close that variations can scarcely be detected by the ear, which, as is well known, is extremely sensitive in this regard.

In the design of the gas engines the frame and cylinder structure of the horizontal tandem Corliss engine has been closely followed. Owing to the tandem cylinder arrangement one power impulse is obtained on each stroke, the resulting crank effort thus being equivalent to that of a single-cylinder, double-acting steam engine. The engine is actually rated at 470 hp with a guaranteed maximum of 520 hp. Another interesting construction feature of the engine is that all of its parts are above the floor level, as shown in Figs. 1 and 5. Inspection and cleaning, especially of cylinders, is thus facilitated, and in case of necessity any cylinder may be isolated for repairs during operation. A distinctive feature of the cylinder design is the location of valve chambers for vertical access at each end of the cylinder structure. By removing a valve at each end of the cylinder the interior is readily accessible for cleaning through spacious openings. The pistons are cast in one piece without internal ribs, and the rods are of forged nickel steel with a water duct drilled through the center. The pistons float absolutely clear of the cylinder walls, the piston rings alone being in contact with the cylinder surface. Both exhaust and inlet valves are of the poppet or mushroom type, their material being steel. The inlet valve performs the functions of both admission and governor valve, but the gas and air are only mixed in proper proportions when they reach the interior of the valve, the possibility of premature firing being thus reduced to a minimum. There are two operations in the working of the valves; first, a vertical motion opening the gas and water ports to the cylinder; and second, rotation by which the quantity of mixture admitted is proportioned to the load on the engine. As each valve is directly under governor control, the engine can take only such volume of mixture as is needed at the instant to maintain speed. A feature of the valve design is that a somewhat richer mixture is obtained on very light loads to secure greater certainty of admission. The governing is accomplished by an oil relay system in which a reciprocating piston operating under 40 or 50 lb. pressure does the actual work of inlet valve movements, being controlled by a small pilot valve which is alone actuated by the regulator, the latter being of the centrifugal type and geared direct to the main line shaft. To obtain a small speed adjustment for synchronizing and for distributing loads on the generators, a device is used consisting of a spring pulling on the dash-pot arm of the regulator, the lever arm of which may be shifted by a hand wheel. Through the corrective action of this spring and the dampening action of the dash-pot, the governing system may be controlled to a nicety, and from one point.

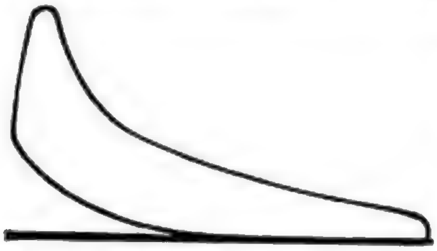


FIG. 3.—CARD OF DOUBLE-ACTING GAS ENGINE.

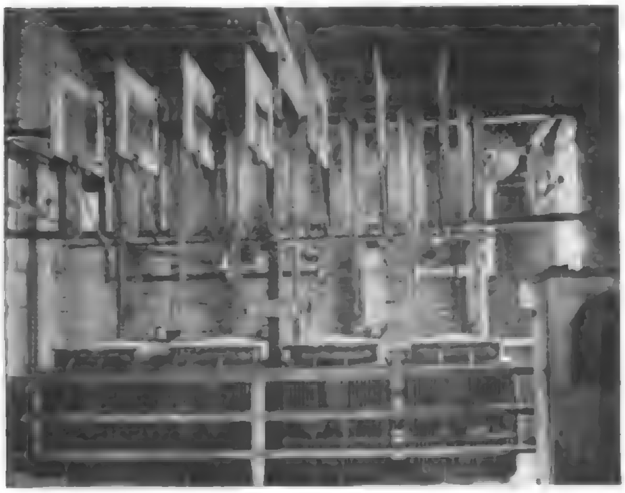


FIG. 4.—RAISING TRANSFORMERS, LIGHTNING ARRESTERS AND CHOKE COILS IN POWER STATION.

To insure the greatest degree of reliability a duplicate ignition system is employed in the combustion chamber, and any igniter may be replaced while the engine is running. They are of the hammer-break type and are in duplicate with two independent sources of current for each. One source of current is at 125 volts from a small generator belted to an exciter engine, and another source is a current at 8 volts with a spark coil from a set of storage batteries charged from the exciter bus. For the purpose of increased security four separate switch cabinets are used, two to an engine, and the igniter circuits are so wired that each cabinet controls one end of each cylinder, thus making possible four separate igniter combinations in each combustion chamber. The plant can be shut down by a small switch which opens both igniter circuits. Another switch in series is mounted near the fly-wheel rim in connection with a centrifugal speed device. The point of ignition is changeable.

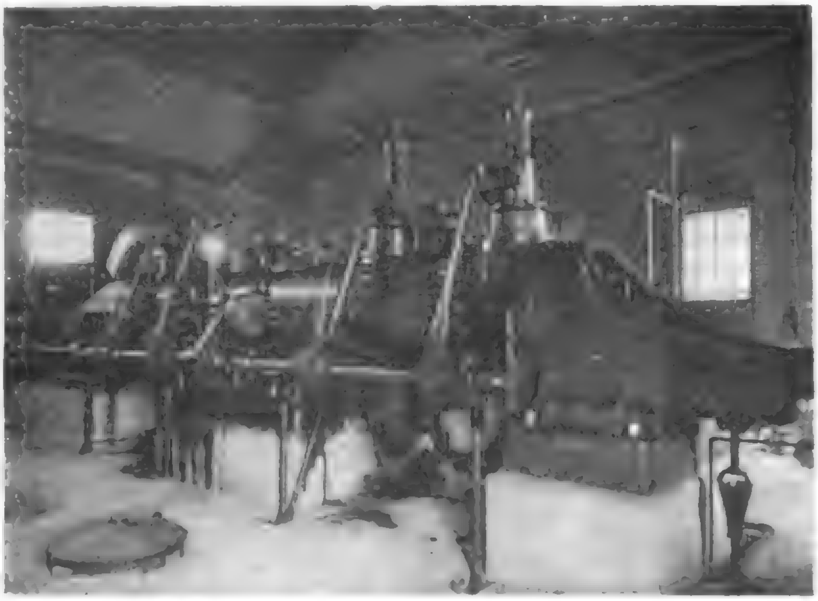


FIG. 5.—VIEW OF ENGINE FROM VALVE GEAR SIDE.

Storage tanks in the basement furnish compressed air at 200 lb. pressure for starting. In starting there are but two operations: first, opening the compressed air throttle, which sets all starting valves; and second, opening the gas throttle. When the engine comes up to speed the compressed air system is automatically shut off. The engines can be started in a half minute. Natural gas is used, the supply being very uniform in quality, entirely clean, and averaging from 1,000 to 1,100 B.t.u. The cost of the gas is 15 cents per 1,000 cu. ft. Fig. 3 is an indicator card of one of the engines taken at three-quarters load.

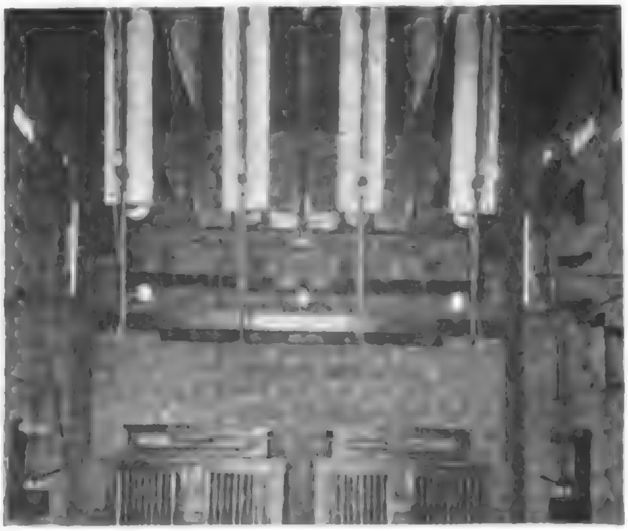


FIG. 6.—TRANSFORMERS, ETC., SUB-STATION.

Each gas engine is connected to a 260-kw, 380-volt, 25-cycle, alternating-current generator of the revolving-field type (Fig. 2). The two units are connected in parallel and run with remarkable smoothness. The current passes from a switchboard of blue Vermont marble panels, completely equipped with apparatus and controlling devices, to oil-immersed, self-cooling transformers, which step-up the potential from 380 to 22,000 volts, as shown in Fig. 4.

The two feeders which leave the station are protected by circuit-breakers of the fused type, disconnecting switches, lightning arresters and choke coils. The high-potential lines are of No. 6 bare copper wire carried on Locke porcelain insulators made by the Ohio Brass Company. As stated previously, one feeder goes to a transforming station just outside of Warren and the other to a similar station, which is located just beyond the limits of Jamestown.

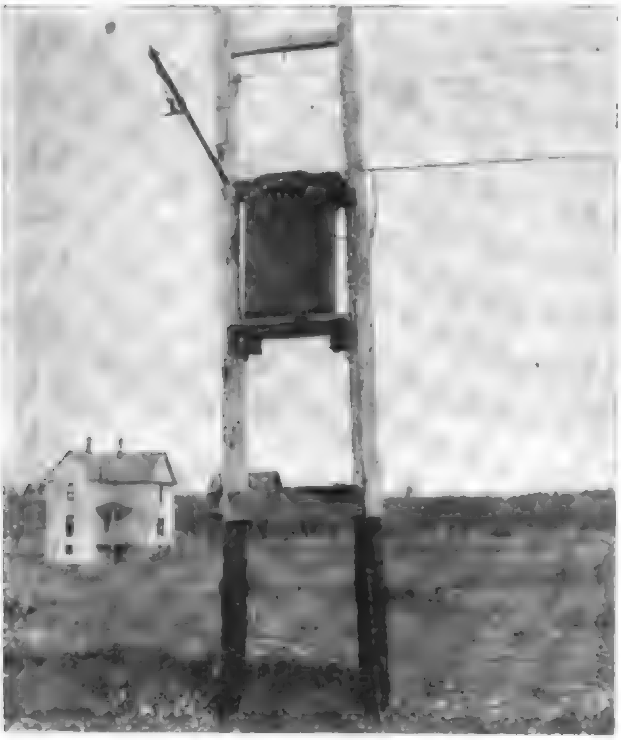


FIG. 7.—AUTO-TRANSFORMER SUPPLY, LOW-POTENTIAL TROLLEY ALTERNATING CURRENT.

The transformer stations are built of concrete blocks and each contains two 150-kw, 22,000-3,300-volt step-down transformers of the oil-immersed, self-cooling type, which are controlled and protected by fuse type circuit-breakers and disconnecting switches in the high-potential circuits, and by oil switches and enclosed fuses in the secondary circuits. One of the latter is connected with the 3,300-volt trolley line and the other feeds the city section of the suburban trolley line through auto-transformers along the track, which reduce the potential from 3,300 to 550 volts. Both high and low-potential feeder circuits are protected by choke coils and lightning arresters mounted at the transformer stations. The apparatus is symmetrically arranged that mounted on one side of the station being exactly duplicated on the other side. The two transformers are connected in parallel and each has sufficient capacity to carry the entire normal load, and either may be readily cut out of service.

The transformer stations are operated entirely without attendants and require only occasional inspection. As the building is fire-proof and contains no moving machinery or apparatus and has adequate automatic protection, there is no likelihood of trouble other than the opening of a circuit-breaker because of excessive load. Examination of the illustration of one of these stations (Fig. 6) will show the marked contrast it presents in comparison with the familiar rotary-converter sub-station of direct-current operation, and exemplifies the simplicity of the single-phase system. The high-potential feeders enter the transformer houses through protected openings under the roof, as shown in the illustration.

The high-voltage feeder leading to the Jamestown transformer station is carried upon the pole line which supports the overhead construction. The trolley line is divided into a central and two terminal sections. The central section is connected direct to the transformer stations receiving alternating current at 3,300 volts. A No. 3-0 figure 8 trolley wire is swung by catenary suspension from a 7/16-in. messenger cable which is carried on heavy porcelain insulators mounted on angle-iron brackets supported on the chestnut poles (Fig. 8). The poles measure 7 in. at the top and are 35 ft. long. They are painted white and black and present a very attractive appearance. The white upper portions serve as useful guides to the line of track during the darkness of night. All poles will be numbered to facilitate the location of line faults and other troubles.

The overhead construction may be seen by reference to the illustrations. A detail is the slight raising of one trolley wire at switch turn-outs, as indicated in the illustration, so that the bow trolley easily passes from one wire to the other without impairment of contact. The overhead structure follows the standard practice of the Westinghouse Company, by whom all the material was furnished and installed. At frequent intervals the messenger cable is anchored and steady-strain brackets are used at curves and turn-outs. A few of the curves are constructed with pull-outs, without brackets.

The catenary overhead line construction is substantial and reliable, and has not given the slightest trouble since erection. With such a line 3,300 volts is as easily handled as the lower potential of direct-current service with the usual overhead construction.

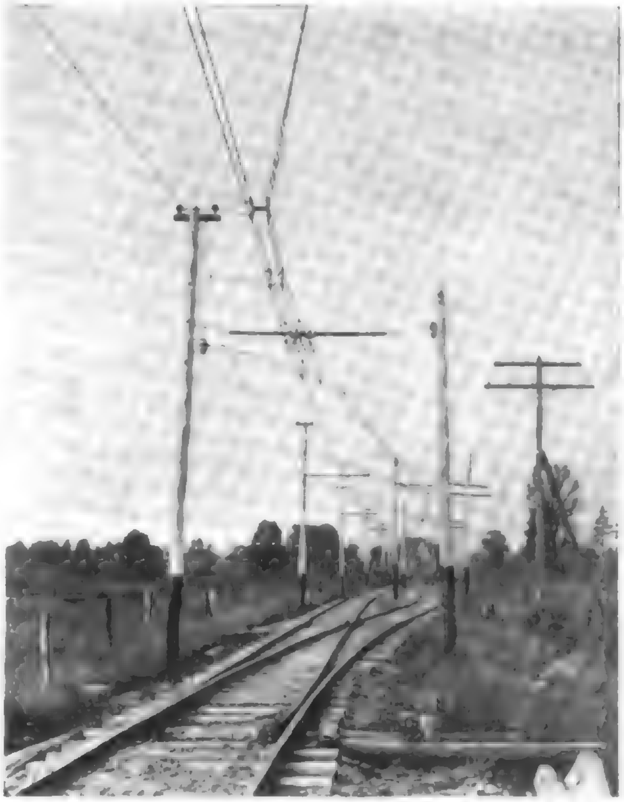


FIG. 8.—TURN-OUT, SHOWING OVERHEAD CONSTRUCTION.

The central high-voltage trolley line is separated from the terminal sections by section insulators. Within the limits of the terminal cities the trolley lines are supplied with alternating current at the low potential of 550 volts. A feeder from each transformer station leads to three 75-kw auto-transformers which are located along the track and connected to a No. 4-0 secondary feeder, which supplies the trolley. The auto-transformers reduce the potential from 3,300 to 550 volts. They are swung between pairs of poles.

The low-potential trolley line is supported from span wires by insulating hangers, in accordance with the practice standard for direct-current work. In Warren the new cars run over the tracks of the Warren Street Railway Company, which is equipped with the direct-current system. The two trolley wires—alternating current and direct current—are suspended side by side from the same spans without appreciably complicating the structure or in any way impairing the service of either system.

The operating company has at present five passenger cars and one baggage car. Each is equipped with four Westinghouse 50-hp motors of the single-phase, alternating-current, compensating series type, mounted one on each axle and connected by single reduction gears. The motors are connected permanently in multiple and are operated by the hand control system by means of taps from an auto-transformer which supplies a varying e.m.f. at the motor terminals.

The controllers are of the drum type and in external appearance closely resemble those of direct-current practice, though they occupy somewhat less space. They are mounted upon the platform at each end, so that the car may be operated in either direction. A feature of this installation is its great simplicity and the small space required by the electrical apparatus. It consists only of one bow trolley, two standard wheel trolleys, two controllers, two canopy switches, one auto-transformer, two preventive coils with resistance, two fuse boxes, one change-over switch and the necessary connecting cables.

The bow trolley is used on the 3,300-volt section, the wheel trolleys on the terminal sections of the line. The change-over switch is arranged to cut out the bow trolley and transfer the connections of the wheel trolleys from the low to the high-voltage service taps of the auto-transformer, so that in case of accident to the bow trolley the wheel trolleys, which are mounted on heavy insulators, may be used on the 3,300-volt section of the line. The bow trolley is pneumatically operated, the controlling valve being mounted on the platform within easy reach of the motorman. The wheel trolleys are handled in the ordinary way with ropes in which suitable insulators have been inserted to guard against the possibility of ground when used on a high-voltage circuit. The preventive coils and resistances eliminate arcing at the controller contacts, when passing from one transformer connection to another.

The Warren plant was started on October 19, 1905, and has since been in continuous service, averaging 17½ to 18 hours per day without developing the least troubles of a serious nature. The only prolonged shut-down was made after a two-months' run for the purpose of examining the condition of the interior of the first unit started. Every part was found to be in perfect working order without the least evidence of deterioration from wear or excessive strains.

Daily observations of the gas consumption of the plant furnish a striking indication of its extremely high economy. During the month of December, 1905, the cost of gas consumed by the interurban system averaged less than 50 cents per hour, or about 16 cents per car-hour for 35-ton interurban single-phase cars. At present the large gas engines operate both interurban and city systems, totaling 10 cars. During the week ending January 12 the cost of gas averaged less than 75 cents per hour, or 7½ cents per car-hour for three interurban and seven city cars. With this combined operation there has been realized a saving of approximately 20 per cent in cost of gas over the independent operation of the interurban and urban plants, the former by the new horizontal and the latter by vertical type engines.

The present service of the Warren & Jamestown Street Railway Company requires a total of but eight employes, outside the general officers and car crews. It is made up of four men in the car barns, three power house attendants and one lineman. An additional lineman is occasionally borrowed from the Warren Street Railway Company. There are no attendants in the transformer stations.

The officers of the company are: Mr. D. H. Siggins, president; Mr. H. M. Preston, vice-president, and Mr. S. Q. Smith, secretary. Mr. Siggins is assisted in the management of the property by his son, Mr. H. A. Siggins, a director of the company and general manager of the Warren Street Railway.

Central Station Work at Rockford, Ill.

AUTOMOBILE DEVELOPMENT.

ONE of the notable things about the business of the Rockford (Ill.) Edison Company is the extraordinary development of electric automobile charging load. Rockford is one of the important manufacturing and wholesale centers of northern Illinois, and has been named the "Lowell" of the West. Its population in 1900 was 31,051, and it is enjoying a healthy growth. In this little city there are no less than 60 electric automobiles, the unusual number of electric vehicles being a matter of note by anyone who has been in the town a few hours. There are about 160 automobiles of all kinds, so that the electric vehicle is a more important part of the total than is usual. Mr. M. A. Beal, manager of the company, attributes this development in part to three things: first, the level country and good roads around and in Rockford; second, the existence of direct-current service in the residence district, where most of the automobiles are housed, and third, favorable rates for automobile charging. Another still more important reason for the successful development of this business in Rockford is the care given by the Rockford Edison Company, free of charge, to its automobile customers' vehicles and batteries. While the three conditions named, good roads, direct current and favorable rates have been favorable to the electric automobile business, they alone would not have brought about such a development. The care and attention given to customers' vehicles by the company may be taken as the completing element which brought about this success.

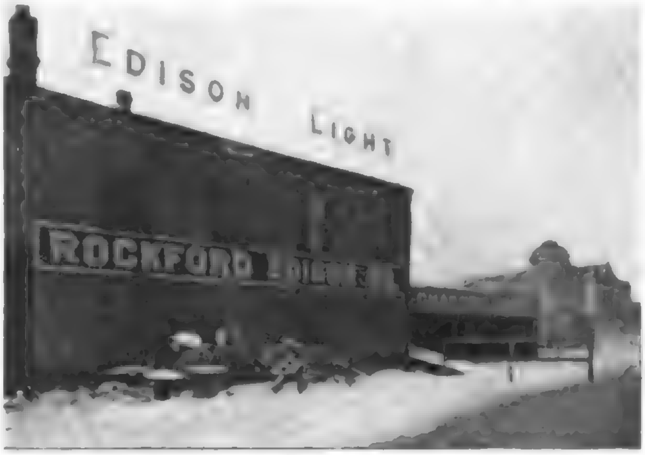


FIG. 1.—STOREROOM, SIGN AND CHARGING DEPOT, ROCKFORD.

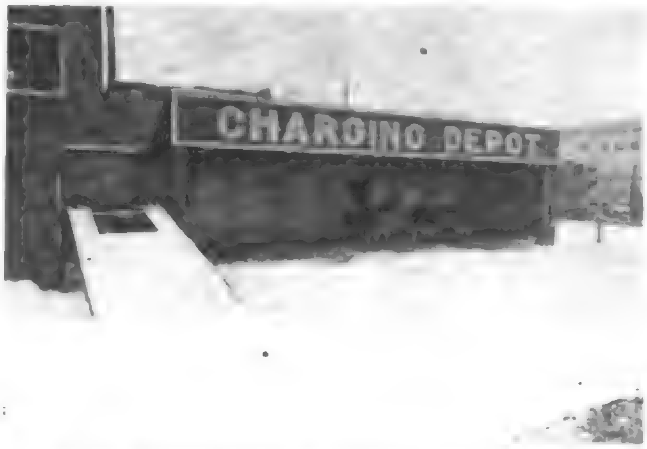


FIG. 2.—CHARGING DEPOT AND BATTERY HOUSE, ROCKFORD.

In the rear of the company's offices, which are in the downtown district, is a battery house and general storage and repair shop for the company. In this battery house is a battery used on the peak load about which more will be said later. Adjoining this battery house the company has built a shed which is used as a charging depot. Views of this charging depot and the company's store room and repair shop are shown in Figs. 1 and 2. The location is on the west bank of the Rock River and for this reason large signs are put up which are visible both to people coming across the main bridge and to those on the east side of the river. The company invites all of its customers to run their automobiles into this charging depot whenever they are down town. This is not only for the purpose of charging, but in order that the company's own expert may look over the batteries and vehicles and remedy anyone of the many little troubles that electric vehicles are heir to before they become serious enough to annoy the customer.

One great trouble with the electric automobile business in most places has been the entire ignorance on the part of the customer of the electric and mechanical equipment, the result being that the customer invariably runs his vehicle until it positively refuses to go any longer, by which time considerable damage may have been done. A great deal of the work done by the company's expert is simply in the character of "a stitch in time," and if no new material is involved no charge is made to the customer for this service. If repairs are needed calling for new material the customer is consulted before anything is done, as a charge is made for time and material in such a case. The company's expert, Mr. Burt, who looks after this, is a man thoroughly posted in storage battery work, and he also takes care of the company's peak load battery in the battery house adjoining the charging shed. When a customer's vehicle is brought in for inspection, he or his assistant looks after the specific gravity, the condition of the terminals and wires, the motor commutator, etc. This work does not take anywhere near the time of one man. As seen in Fig. 2, there is an elevated platform next to the charging shed on to which vehicles can be run for convenient work from below upon motors and running gear. As said before, the secret of the success with the automobile business is very largely due to the kind of attention given to customers' vehicles, to the end that customers may be saved the annoyances arising from the many petty breakdowns of cells or other parts of the equipment, which in time cause the customer to become disgusted and finally result in ruining entire batteries.

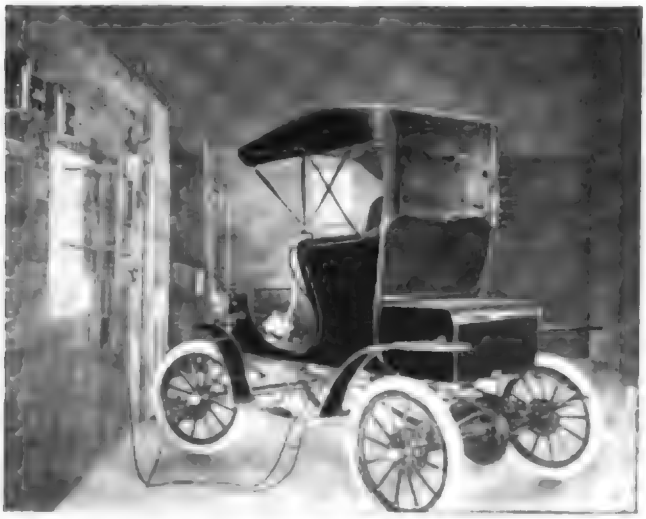


FIG. 3.—INTERIOR OF A ROCKFORD GARAGE, SHOWING METERS FOR LIGHT AND CHARGING.

The average income per automobile in service in 1904 when there were 26 electric automobiles in Rockford, was $5 per month. The average income in 1905 per automobile in service was $4.93. This figure of course includes the entire 12 months, the income in summer being high and in winter low. The average would be higher but for the fact that two customers owned two automobiles each and one customer owns four automobiles, thus bringing down the income per automobile. Livery stables in Rockford charge $16 per month for feeding and keeping a horse, so that the expense for power for electric automobiles in Rockford in practice is very small compared with the expense of keeping a horse. The automobile run by Mr. Beal has made 15,000 miles on one set of batteries, which, however, have now reached the limit of their useful life. One customer, manager of the gas company in Rockford, who uses his vehicle for business purposes, made 4,600 miles last season, which of course is more than would in practice be traveled with a horse.

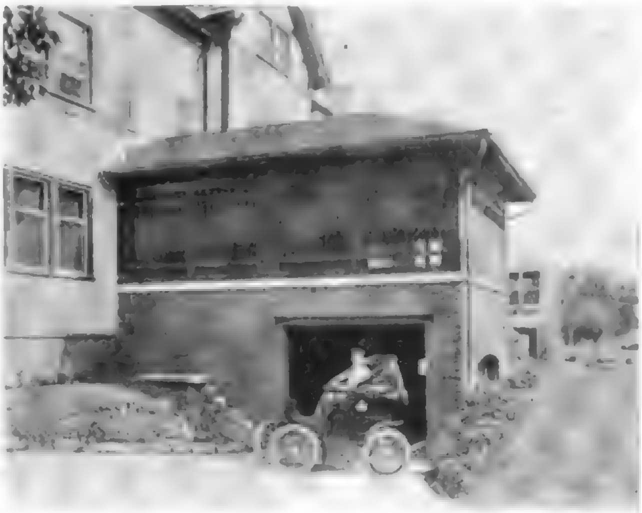


FIG. 4.—AN ATTRACTIVE AUTOMOBILE HOUSE.

Two employes of the Rockford Edison Company are local agents for the Pope-Waverley electric automobiles, this agency being taken with the full consent and encouragement of the Rockford Edison Company. A handsome poster has been prepared by the Pope Motor Car Company, of Indianapolis, showing some of the neat and artistic garages in Rockford in which these vehicles are housed. The photographs used in preparing this poster are here reproduced in Figs. 3, 4, 5, 6, 7 and 8, as being of interest to central station men desiring to develop this business elsewhere and as containing some good suggestions.

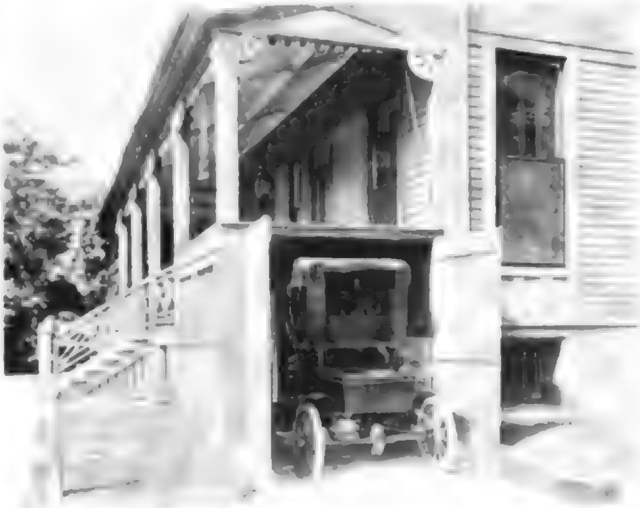


FIG. 5.—INCONSPICUOUS AUTOMOBILE SHED.

The company makes a rate of 6c per kw-hour for automobile charging, the contract providing that no charging shall be done between the hours of 5 and 8.30 in the evening in winter, and no difficulty has been experienced in obtaining compliance with this clause of the contract. At one time, the company was troubled with low voltage in the residence district where most of the automobiles are located, due probably to the fact that some automobiles were being charged during the peak. A letter was addressed to automobile customers saying that the company had received some complaints of lights being dim in that district and that it had reason to believe that these complaints were due to the fact that some customers were charging automobiles during the evening. Their attention was called to the fact that the low rate given for automobile charging was in consideration of the observance of the rule not to charge between 5 and 8.30 p. m. The trouble immediately stopped. Some customers even went so far as to apologize and explain that they did not know there was such a clause in the contract.

Most of the battery charging is in a residence district extending north from the business district along the west bank of the Rock River. The direct-current, three-wire system supplying this district extends as much as three miles from the power station.

PEAK-LOAD BATTERIES.

The company formerly used a battery to secure regulation on its railway generators which were driven by water wheels. The company sells power to the Rockford & Interurban Railway Company.

Later the load on the station grew so that all of the water wheel capacity was needed for the lighting generators and the railway load is now supplied by steam-driven generators. When the necessity for a battery for regulating purposes on the railway bus-bars was thus obviated, the battery was taken from railway service and put in commission on the 110-220-volt, direct-current lighting system. The battery as now divided consists of four sets of H19 Chloride cells in parallel, each set consisting of a series of 66 cells including end cells. There are nine end cells in each series, leaving 57 floating on the line. For charging purposes a booster is used, consisting of a 45-hp motor, the speed of which can be varied from 800 to 1,150 r.p.m. On each end of this motor shaft is a 25-volt, 600-amp. booster generator. The voltage at the battery room at the peak load is 119.

FIG. 6.—ARTISTIC AUTOMOBILE HOUSE.

POWER SUPPLY.

The company operates a combined water and steam plant. The water power is sufficient to carry all of the day load and part of the evening load on the lighting system. The railway is supplied entirely by direct-connected 550-volt railway generators driven by steam engines. The boiler house is separated from the generator house by a narrow railroad right-of-way, generators being located close to the river on account of the nearness to the water wheels. The water wheels drive a long-line shaft from which are belted a large number of small Edison bipolar dynamos, and Brush series arc dynamos. This arrangement, while not efficient, involved at the time it was put in much less investment than large generators, and efficiency was of secondary consideration because of the water power. The life of belts in this plant has been about ten years. Steam turbines will be placed in an extension of the generator room. In the boiler room Jones underfeed stokers are in use.

MISCELLANEOUS.

The company operates only two classes of service outside of the power supplied to the railway, namely, three-wire, direct-current lamps and motors and direct-current series arcs.

The peak load on the three-wire system was this year 6,500 amperes at 145 volts. The voltage at the lamps is 115. The power house is about five blocks from the company's office and battery room, which is just at one side of the principal down-town district. The drop in voltage between the power house and battery room during peak load is about 26 volts.

FIG. 7.—EXAMPLE OF AUTOMOBILE HOUSE.

The connected load consists of the equivalent of 25,756 16-cp incandescent lamps, 1,278 hp in motors and 291 low tension multiple enclosed arcs mainly of 5 amperes capacity. There are also 34 automobile charging rheostats and plugs.

The series enclosed arc lighting load consists of 449 street arcs and 170 commercial arcs, all of 6.6 amperes at 72 volts and minimum bill of 50 cents. In the down-town district, wherever competition with an exhaust steam-heating plant exists, the rate is 4 cents per kw-hour. The series arc-lighting load consists of 449 street arcs and 170 commercial arcs, all of 6.6 amp.

FIG. 8.—WELL-LIGHTED AUTOMOBILE HOUSE.

Because of the limitations of the three-wire system, the company has not been able to reach out into the residence district to any great extent except in one direction where there are a large number of large residence consumers. Plans are under consideration for supplying outlying districts with alternating current, although just how these will be carried out has not yet been determined. Besides residence lighting, there is considerable power load to be obtained in the outlying districts.

The company has not entered as yet very extensively into a business-getting campaign. It sends out circulars once a month on various electrical devices, these circulars being supplied by the manufacturers of the devices, with the Rockford Edison Company's imprint, or in some cases this is printed by the central station company.

Customers' meters are brought in every twelve months for test. Large meters are brought in oftener than this. The company has 1,309 meters connected and three men are employed in bringing these in and testing them.

The Steam Consumption of Reciprocating Engines.

By T. Stevens and H. M. Hobart.

Four representative firms of reciprocating engine builders in England, which will be designated as firms A, B, C and D, respectively, have very kindly furnished the writers with the guarantees of their machines as regards steam consumption. Firm A builds small engines. The guarantee of these engines, expressed in terms of the kilograms of steam consumed per kilowatt-hour output from a hypothetical direct-connected generator, have been plotted in the curves of Fig. 1. Firms B and C manufacture fairly large sizes of engines, and the guarantees of these machines are to be found in the curves of Figs. 2 and 3.

Firm D also builds engines up to large sizes. Guarantees of these engines have been obtained with superheat of 55.5° C., and also of 111° C. These guarantees will be found plotted in the curves of Figs. 4 and 5.

The conditions under which these various guarantees have been made, correspond closely with what in the first instance will be adopted as a standard basis of reference, namely, an absolute steam pressure of 13 kgs. per sq. cm. (185 lb. per sq. in. absolute) with 50° C. (90° F.) of superheat and a vacuum of 86.6 per cent. (26 in.). The steam consumption under these standard conditions for full, half and quarter loads are, for these four firms, set forth in the curves of Figs. 6, 7 and 8. The dotted-line curves in these three figures will be taken as representing the mean steam consumption for engines of the four firms, A, B, C and D.

The data in Figs. 6, 7 and 8 have served as a guide in the production of the three curves *I*, *II* and *III* of Fig. 9, which are shown dotted in the three previous figures, as fairly representing the steam consumption for this group of modern piston engines at one-quarter, one-half and full loads respectively.

In an article entitled, "Die Dampfturbinen der Allgemeinen Elektricitäts-Gesellschaft, Berlin," (*Zeitschr. des Vereines Deutscher Ingenieure*, August 13, 1904, p. 1,209, Fig. 5) Lasche has published a curve which he states represents the rated full-load steam consumption of good modern reciprocating engines at an absolute admission pressure of 13 kgs. per sq. cm., with "some superheat and good vacuum." Lasche's curve is given in Fig. 11 as curve *L*, and the rated full-load curve of Fig. 9 is reproduced as curve *III*.

In Fig. 10, the published results of a large number of tests of piston engines are plotted as circles. These have been derived from various sources and relate to 33 reciprocating engines of 19 different manufacturers of five different countries. After reduction to the assumed standard conditions of pressure, superheat and vacuum, these results have been plotted as crosses in Fig. 10. In Fig. 11, these reduced results are again given, where they may be compared with curves *L* and *III*.

With these groups of data available, the next question that arises relates to the curve to be adopted as representative of the average steam consumption of the best types of modern reciprocating engines. It is believed that Fig. 11 affords ample evidence that even Lasche's curve (*L*) hardly does justice to the reciprocating engine, since considerably better results have frequently been obtained, sometimes under less favorable conditions of pressure, temperature and vacuum. That curve *III* lies so much higher than many of the plotted published results may be partly due to its representing a rough mean instead of the best amongst the guarantees which have been received, and also to the necessity on the part of the manufacturers, to make sufficiently conservative guarantees to leave themselves a margin of safety.

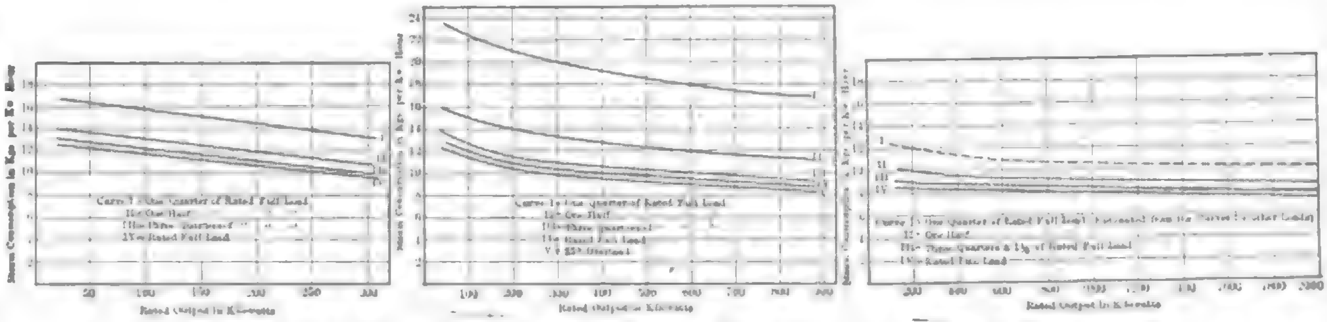
As the representative curve for the steam consumption of reciprocating engines, when operated at rated full load, with an absolute admission pressure of 13 kg. per sq. cm., 50° C. of superheat and a vacuum of 86.6 per cent, the curve shown dotted in Fig. 11 has beeen selected. With regard to this representative curve, it should also be noted that Lasche's curve was deduced from full-load tests run probably with a better vacuum and a greater superheat than those of the assumed standard conditions, the admission pressure being about the same. A curve derived from Lasche's, but under the assumed standard conditions, would lie above curve *III*. Taking this fact into consideration, and noting also the low positions of some of the results plotted previously, it is believed that a fairly representative curve for the assumed standard conditions can be obtained by embodying a portion of Lasche's curve for a range of outputs from 500 kw to 1,200 kw. The portion of the curve for the smaller ratings has been placed somewhat lower than the corresponding portion of Lasche's curve, in consideration of the low steam consumptions often obtained with reciprocating engines within this range of rated outputs. The curve then passes into that of Lasche's up to the limit of the range considered by him, the continuation of the curve beyond this point taking the form of a straight line, very gradually falling as the ratings of output increase. This curve, which is reproduced separately in Fig. 12, may be taken as a basis for the investigation of the effect on the steam consumption of modern piston engines resulting from variations in the admission pressure, vacuum and superheat.

In order to obtain representative curves for half load and quarter load there have been deduced from an investigation of the curves in Fig. 9, relating to the engines of four English manufacturers, the result that the steam consumption in kgs. per kilowatt hour at half and quarter loads may be taken at 16 per cent and 40 per cent, respectively, above the values at rated full load. Applying these values to the standard full-load curve of Fig. 12, the three curves drawn in Fig. 13 have been obtained, and in subsequent comparisons these curves will be considered as representative values for the steam consumption of modern reciprocating engines when operating under the specified conditions of an absolute admission pressure of 13 kgs. per sq. cm., 50° C. of superheat, and a vacuum of 86.6 per cent (26 in.).

To investigate the dependency of the steam consumption of the modern reciprocating engine on the admission pressure, estimates of the relation between steam consumption and admission pressure have been obtained from two leading English manufacturers of piston engines. Representing as 100 the steam consumption under the assumed standard conditions of an absolute admission pressure of 13 kgs. per sq. cm., a superheat of 50° C., and a vacuum of 86.6 per cent, then for the same number of degrees of superheat and the same vacuum the figures representative of the consumption for other admission pressures may be obtained from Fig. 14 for the reciprocating engines of these two manufacturers. It is proposed to take the dotted line as representative for piston engines in general.

As to the effect of superheat on piston engines, useful data, obtained from seven firms, have been embodied in the curves of Fig. 15, and the dotted-line curve will be taken as representative of the effect of superheat on the steam consumption of reciprocating engines for the assumed standard conditions of admission pressure and vacuum.

The mean is replotted separately in Fig. 16, and it is again plotted in Fig. 17, in terms of the average percentage decrease in steam consumption per 1° C. of superheat above the temperature of saturated steam. It should be noticed that the percentage of gain by superheat is well sustained up to very high superheats, and hence manufacturers of piston engines have a great incentive to adopt for a given pressure as high a steam



FIGS. 1, 2 AND 3.—STEAM CONSUMPTION OF ENGINES MADE BY FIRMS A, B AND C, RESPECTIVELY.

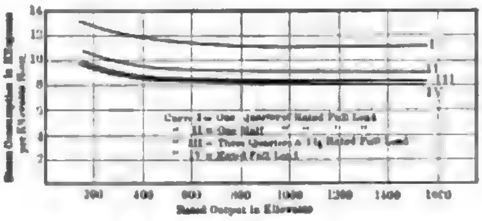


FIG. 4.—CONSUMPTION OF FIRM D ENGINES, ABSOLUTE PRESSURE, 13.4 KG., VACUUM 86.6%, 55.5° C SUPERHEAT.

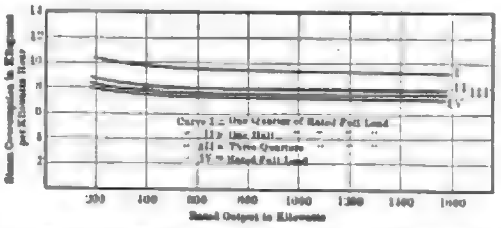
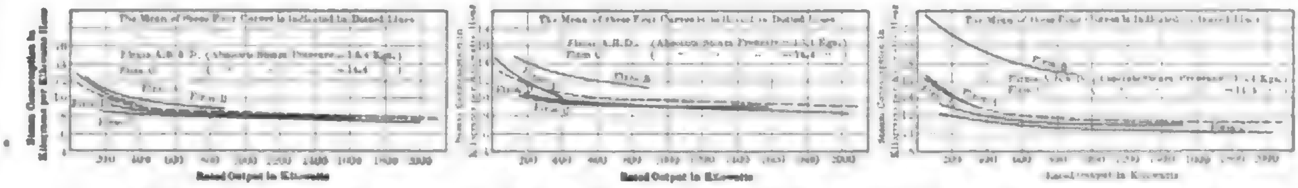
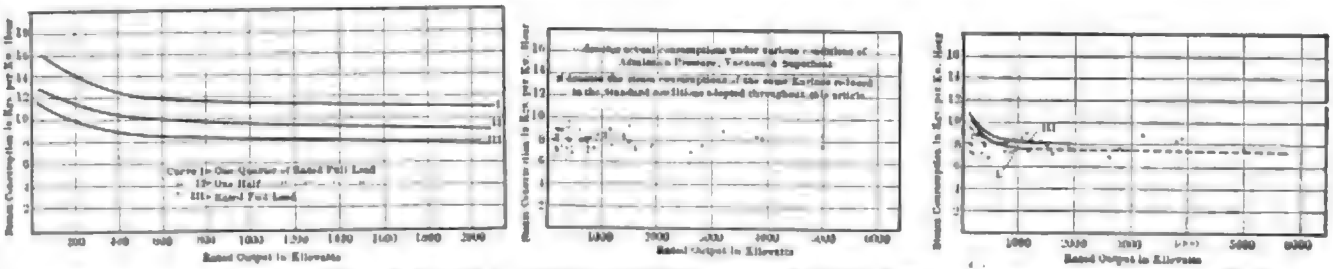


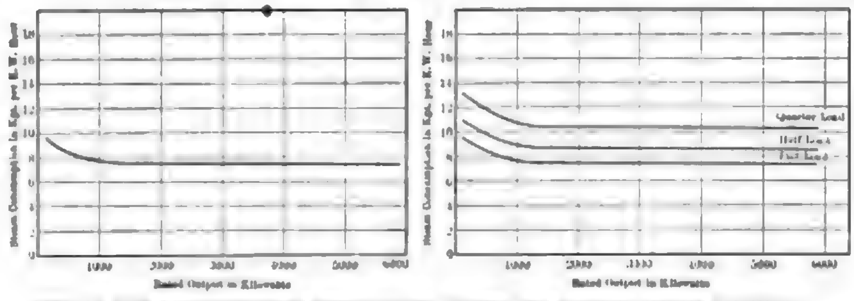
FIG. 5.—CONSUMPTION OF FIRM D ENGINES, ABSOLUTE PRESSURE, 13.4 KG., VACUUM 86.6%, 111° 3. SUPERHEAT.



FIGS. 5, 6, 7 AND 8.—STEAM CONSUMPTION OF FOUR MAKES OF ENGINES AT FULL, HALF AND QUARTER LOAD, RESPECTIVELY.



FIGS. 9, 10 AND 11.—STEAM CONSUMPTION OF VARIOUS ENGINES.



FIGS. 12 AND 13.—REFERENCE CONSUMPTION CURVES FOR MODERN PISTON ENGINES.

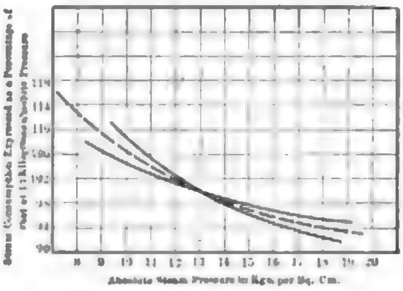
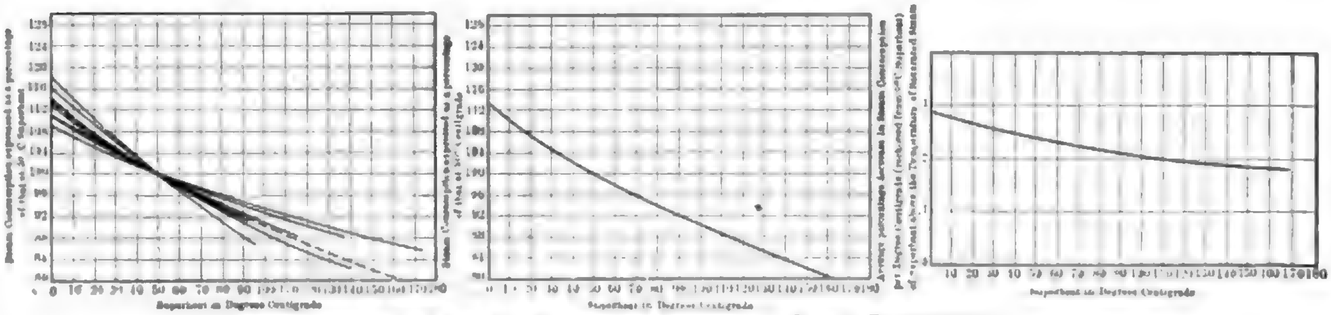


FIG. 14.—EFFECT OF PRESSURE ON CONSUMPTION.



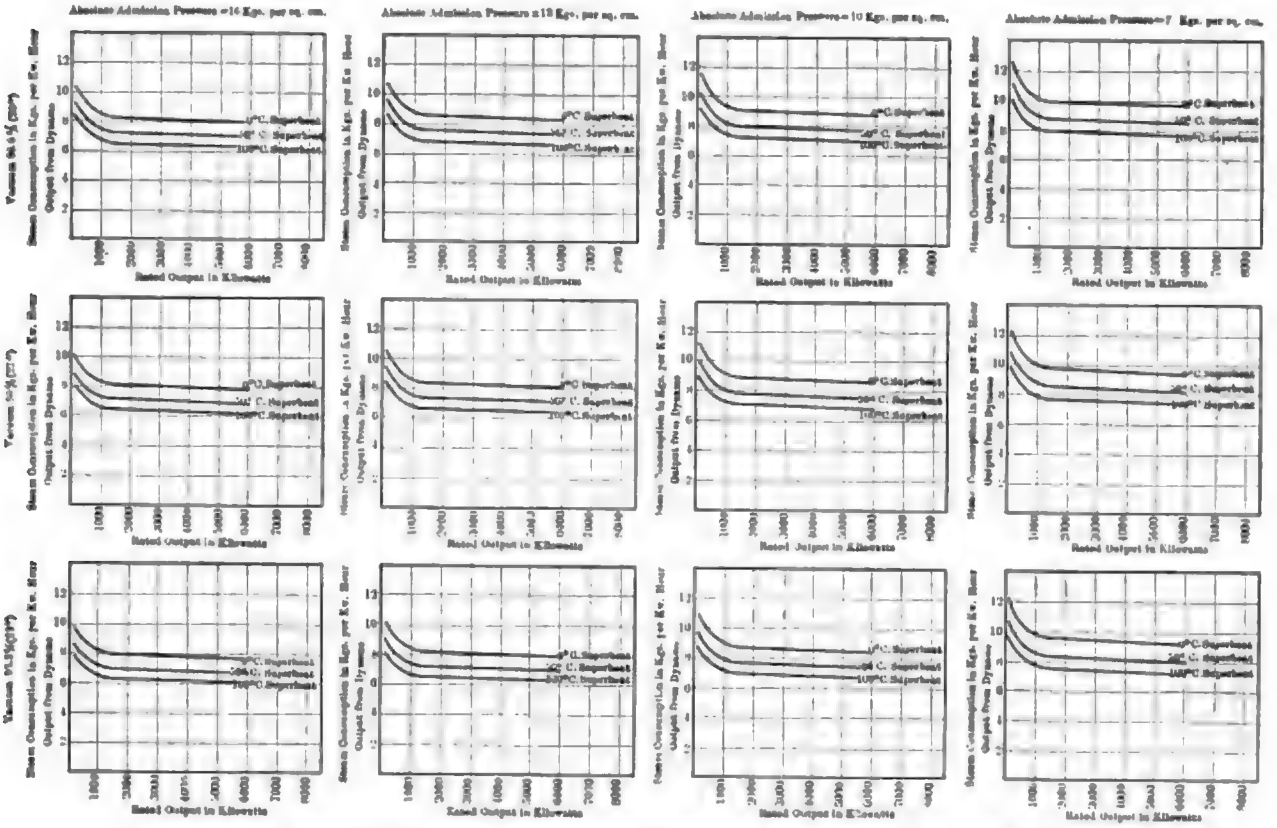
FIGS. 15, 16 AND 17.—EFFECT OF SUPERHEAT ON STEAM CONSUMPTION.

STEAM CONSUMPTION OF RECIPROCATING ENGINES.

temperature as is permitted by other considerations, such as those relating to lubrication.

The effect of the degree of vacuum on the steam consumption of the reciprocating engine will now be considered. A limitation to the use of high vacuum relates to the design of the low-pressure cylinder and piston, which obtain abnormal dimensions when proportioned for a high vacuum. In the neighborhood of the assumed standard vacuum (86.6 per cent = 66 cms., or 26 inches), the improvement in the steam economy of the reciprocating engine with higher vacuum may be taken at about 0.8 per cent. per cm. improvement in vacuum (2 per cent per inch of vacuum), or about 0.6 per cent for each 1 per cent improvement in vacuum for the range from 26 in. to 28 in. (i. e. 86.7 per cent vacuum to 93.3 per cent vacuum). In a great many cases the gain is even smaller than this. Thus Weiss*, in his experiments arrived at the formula $D = \frac{3.5}{P}$, where D = percentage decrease in steam consumption per cm. increase of vacuum, and P = abs. pressure in kgs. per sq. cm.

This works out at about 0.3 per cent. per cm. for normal cases.



FIGS. 18 TO 29.—STEAM CONSUMPTION CURVES FOR RECIPROCATING ENGINES.

This formula is applicable to compound and triple-expansion engines. For single-cylinder machines the decrease is smaller still, namely: $D = \frac{1.7}{P}$.

These results tend to show that the influence of improved vacuum on the economy of reciprocating engines is not underestimated if a 2 per cent decrease in steam consumption is allowed in changing from 86.6 per cent vacuum to 90 per cent, and a further 2 per cent is allowed in changing from 90 per cent to 93.3 per cent. The reason for this small decrease, compared with the theoretical decrease, lies largely in the impossibility, or at any rate the impracticability, of so constructing the low-pressure cylinders as to conform to the conditions entailed by the low vacuum. The losses due to cylinder condensation play a very important role, and the cost and weight of the whole set is increased considerably in striving to make the best use of so very good vacuum.

With the data showing the effect of admission pressure, superheat, and vacuum on the steam consumption, from the mean curve (Fig. 12), for piston engines, designed for the assumed standard conditions, there can be obtained a series of curves of full-load consumption of reciprocating engines designed for other conditions. Such a series of full-load steam-consumption curves is given in Figs. 18 to 29. In this diagram (Figs. 18 to 29) the upper rows correspond to low, and the lower rows to high vacua. The left-hand vertical rows correspond to high, the right-hand vertical rows to low steam pressure.

Water and Electrical Machinery.

All of our readers, we feel confident, are thoroughly familiar with the importance of keeping all types of electrical machinery as dry and clean as possible in order to maintain the insulation in good condition and prevent sparking or short-circuiting. Dirt and dampness are the two worst enemies of electrical machinery and the necessity of continually fighting against them is an injunction upon which, says *Vulcan*, surveyors have in the course of their daily duty to continually lay stress. Occasionally some extraordinary cases of ignorance in respect to the use of water about electrical machinery are met with. Quite recently, says our contemporary, an instance came under its notice in which a firm deliberately poured water over the armature of its dynamo when it began sparking, because, as they naively remarked, they thought it was getting too hot, with the result that the armature was irretrievably ruined. Another case quoted is that of a motor which was allowed to lie under water for three months, when it was fished up and after drying was expected by the firm to work as if it had been well cared for; an expectation which, it need hardly be stated, the motor did not fulfil.

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* "Die Turbine," July, 1905, article by A. Lapouche, entitled "Einfluss des Vakuums auf den Dampfverbrauch der Dampfturbinen."

The Design of an Isolated Power and Lighting Plant.

At a meeting on February 8 of the Electrical Engineering Society of Columbia University, Mr. Putnam A. Bates read a paper on "Isolated Plant Engineering," which, after discussing the various economic and engineering features of isolated plants illustrates their application by an account in detail of a specific plant.

This plant consists of several machine shops for doing both heavy and light work, a forge shop, a pattern shop, a storage loft for patterns and an office building. Power for the operation of machinery in the various shop buildings was originally supplied by two steam engines located at different points in the works, each supplied with steam from a single boiler nearby and each driving a long line of shafting by means of a belt.

In time these engines became worn out and were discarded and a number of electric motors were substituted for them, a semblance of individual drive being installed in some of the shops. Current for these motors and also for some lighting was obtained from the public service mains in the street, and distributed from a switchboard in one of the shop buildings.

The two old boilers, however, were retained and kept in commission as the steam was needed for driving a couple of small air compressors in the boiler plate shop, a high pressure hydraulic pump used to furnish water under pressure for the operation of hydraulic tools, and a steam hammer in the forge shop, and for heating the various buildings.

This arrangement was obviously uneconomical both in operating cost and in space occupied, and it was therefore decided to install a central power generating plant where all of the power required by the works could be economically generated, and without occupying valuable space in the shops with boilers, feed pumps, coil piles or non-productive machinery. The space allotted to the power plant building was approximately 35 ft. wide by 60 ft. deep running back from the street to one of the shop buildings.

These, then, were the conditions, and the problem was how best to meet them to secure the greatest economy of operation and the greatest return on the necessary investment. The first question to be answered was with regard to the type of plant to be installed.

The high pressure steam-driven hydraulic pump and, if necessary, the steam-driven air compressors could be replaced by electrically-driven apparatus, but no suitable substitute for the steam hammer has as yet been marketed and no form of heating is so well suited to the conditions which prevail at these works as that using direct radiation from steam or hot water.

As the advantage gained by the operation of the steam hammer, and the saving which could be accomplished during about six months of the year, by the use of exhaust steam for heating purposes, far outweighed any possible saving in the cost of power production which internal combustion engines might perhaps be able to show in comparison with steam-driven apparatus, the latter type was chosen in preference to the former.

The next point to be decided was the total capacity required and the most advantageous sub-division into units. In order to obtain as much information as possible which would serve as a guide to help in determining this question, careful observations were made of the power consumption at different times of the day and under different conditions, and of the size, number and character of the various motors and tools in the shops. A careful study was also made of the coal, water and electric bills for the preceding five years in order to ascertain as nearly as possible how the load conditions changed from month to month and year to year.

As a result of this analysis, it was decided to install three electric generating units, two of 60, and the third of 30 kw capacity, and a single steam-driven air compressor, it being unnecessary to provide a reserve machine of this type as the temporary crippling of this machine would shut down only a small portion of the works and would not interfere in any way with the other portions.

The type of prime mover and the relative advantages of operation with or without condensers came up next for consideration. A careful comparison of operating efficiency, first cost, floor space occupied and general suitability of the various types of high speed reciprocating engines and steam turbines, showed a very decided advantage in favor of the vertical compound reciprocating engine as applied to the conditions which were found to exist.

To determine the total boiler capacity required, it simply remained to ascertain the amount of steam which the engines selected will consume when furnishing the requisite power, as determined by the manufacturers' guarantees, and to add to this the amount of steam which will be consumed by the steam hammer. In this manner it was found that 300 hp in boiler capacity would be sufficient, the horsepower rating being based upon the well recognized standard of 34½ lb. of water evaporated per hour from and at 212° F. The desirability of reserving some space for future enlargement of the boiler plant led to the choice of two boilers each rated at 150 horse-power set in a battery.

A cross drum type of boiler with 14-ft. tubes was used in order to make it possible to set the boilers across the building, which arrangement was the most economical of floor space and lent itself best to the steam piping arrangement, and at the same time to remove and renew tubes as occasion should require. The boilers are built for a working pressure of 200 lb., but only 150 lb. will be carried. They are equipped with a superheater designed to give 100° of superheat.

The building for housing the apparatus decided upon is a two-story brick and steel fireproof structure having the boiler and engine room on the first or ground floor, and a 100-ton steel coal bin on the second floor, the remaining portion of the floor being available for manufacturing or other purposes. A steel plate chimney 4 ft. in diameter, and with its top 125 ft. above the boiler room level, also rests upon the second floor and is connected with the flue openings of the two boilers by means of a steel plate flue and breechings.

Coal is delivered by means of a chute from the sidewalk to a bucket conveyor running from a pit in the first floor, into which the chute opens, to a point above the coal bin on the second floor. This conveyor is entirely enclosed and provided with a spout at the top by means of which the coal is deposited near the center of the bin. A motor on the second floor drives the conveyor by a belt.

The boilers are located in a room by themselves, the side wall of the setting being carried out to form a partition wall between the engine room and the boiler room. This arrangement necessitates the cleaning of one of the boilers from the engine room, but was necessary in order to obtain sufficient room for a possible future increase in boiler capacity.

The coal bin is located directly over the firing space in front of the boilers and has two pockets, from the bottom of each of which hoppers are carried down to a height of about 5 ft. above the boiler room floor and terminates in valves.

Under these hoppers a small coal charging car runs on rails sets in the cement floor, and from this car the furnaces are supplied. This arrangement makes it unnecessary to carry any coal upon the floor of the boiler room, and, therefore, it is possible to keep this portion of the plant in a neat and cleanly condition.

Owing to cramped space and the nature of the soil, which prevented excavating to any great depth, it was not possible to make any special provision for the removal of ashes, even if the quantity of these were sufficient to warrant the necessary expense, which would be involved in providing for this in any other way than by hand, through the ash pit doors.

The feed-water heater is of the open type, the steam entering through an oil separator and mingling with cold water trickling over trays. Two boiler-feed pumps are installed, one being steam-driven and the other electrically-driven. Although the latter is much more costly than a steam pump of the same capacity its much higher economy of operation amply warranted the additional expenditure.

The three generating sets are installed in a row along one wall and on the other side of a central aisle is the air compressor, the electrically-driven boiler-feed pump, space for an additional electrical generating set and a controlling and distributing switchboard.

The generators are direct-current, 240-volt, compound-wound machines. The primary reason for the choice of this current and voltage was that all of the motors installed throughout the works were wound for that and the use of it makes it possible to take advantage of the public service as an auxiliary should it ever prove desirable to do so.

The lighting is taken care of by means of a three-wire system, fed from a rotary balancer installed near the switchboard. This arrangement was considered preferable to the use of a 240-volt, two-wire lighting system for the reason that this higher voltage does not lend itself well to the operation of many of our higher power illuminants, such as the arc lamp, so useful in the economical lighting of large enclosures.

The switchboard consists of seven panels of marbleized slate mounted upon an angle iron frame, and set 3 ft. from the wall. There is a generator panel for each of the three dynamos, a total output panel, an equalizer or balancer panel and a lighting feeder and power feeder panel.

Each of the generator panels is equipped with a single lamp bracket, an ammeter, a field rheostat, a three-pole switch, the middle pole of which performs the functions of an equalizer switch, and double-pole, double-arm, laminated contact circuit-breaker with carbon breaks.

Upon the total output panel are two single lamp brackets, a power ammeter, a light ammeter, a recording ammeter for the total current, a two-pole, double-throw switch, controlling the total current, one side being connected to the bus-bars and the other left blank for possible future connection to the public service, a registering watt-hour meter for showing the total amount of electrical energy generated, a double-pole power switch and two smaller double-pole switches, one controlling the supply of current to the equalizer panel and the other to the circuit feeding the electrically-driven boiler-feed pump.

The equalizer panel is equipped with two single light brackets, an ammeter for indicating the amounts of current flowing in the neutral wire of the three-wire system, and its direction, and a voltmeter for indicating the voltage on either side of this system—each of these instruments has the zero in the center of the scale and reads to the right and left—a voltmeter switch, the balancer field rheostat, a three-pole, double-throw switch for the control of the supply of current to the lighting feeder panel, one side being connected to the bus-bars and the other left blank for possible future connection to the public service, a switch and starting box for the control of the balancer and a double-pole circuit breaker.

The circuit-breaker embodies a construction which is rather peculiar in that the actuating coil is connected to the neutral wire from the balancer, while the blades are connected to the positive and negative wires, respectively, of the three-wire system. By this arrangement an excessive unbalancing of the lighting circuits which would overload the balancer would trip the breaker and open the outside legs of the system, thus protecting the balancer from overloads without running the risk of an abnormal increase of potential of one side or the other of the system, which would, to say the least, be detrimental to the life of the lamps.

Each of the feeder panels is equipped with two single lamp brackets and a number of feeder switches from which feeders are run to various points through the works.

On top of the switchboard a large illuminated dial voltmeter and a potential indicator of the same size and type are mounted. These are connected to a voltmeter switch on one of the generator panels, and to the main bus-bars respectively.

To this switchboard are connected the circuits for controlling the generation of the current and its distribution throughout the works.

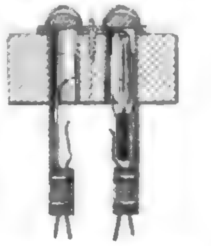
A somewhat knotty problem was presented in connection with the air compressor. The amount of water necessary to cool the air compressor was estimated at 50 gal. per minute. The only available supply of water was from the city mains, and the cost of this amount from that source was too great to be considered. It was finally decided to install a cooling tower upon the roof through which the water could pass, after becoming heated in the jackets of the compressor, and be cooled and used again. By this arrangement only sufficient water is drawn from the street mains to make up the loss by evaporation, which is about 5 per cent, and the cost of the necessary electrical energy for moving the water is trifling compared with the saving accomplished.

The total investment necessary to accomplish this result was about equal to the cost of the water for one year if this water were allowed to run to waste after being used in the jackets.

New Telephone Patents.

IMPROVED LAMP JACK.

The lamp signal switchboard usually requires lamps mounted under such varying conditions that it has been customary to use several styles of lamp jacks. S. A. Beyland, of Elyria, Ohio, has, however, designed a socket adaptable to all conditions. This socket is formed of a tubular body having an extension on one side, upon which extension the springs of the socket are mounted on insulating slabs and bushings. The cut shows a sectional view of such sockets. For jack panel work the sockets are mounted upon a supporting strip. The lamp cap for such sockets is a revolving escutcheon plate pivoted between two jacks, and arranged to carry bull's eyes. The Dean Electric Company has been assigned Mr. Beyland's patent.


BEYLAND LAMP JACK.

RELAYS.

Mr. E. A. Terpening, of Geneseo, Ill., has made an adaptation of the D'Arsonval galvanometer to telephone work in the form of a very sensitive relay. He provides the usual oscillating coil, between electromagnets, and a liquid damper and other refinements. No practical application for such a device, however, suggests itself.

COMPOSITE SYSTEM.

An improved system of composite telephone and telegraph working has been invented by C. Turchi, of Ferraro, Italy, in which the non-interference of the two types of current is accomplished through the agency of an apparatus he calls a "separator." This consists of a pair of coils associated in non-inductive relation on a single core, in combination with two adjustable inductances. One of these latter is in series with each coil and the circuit of each is led through a condenser to a common point. This point is inductively connected to the transmitting line by the use of a transformer. From the other side of the transformer the circuit is led to a second common point to which are also connected the two separator windings. It will thus be understood that this circuit at one point has two parallel branches through the two limbs of the separator. A third winding is put upon the main separator core which is included in the telephone circuit. This winding is, of course, sensitive to the resultant flux changes in the core, under the influence of the two separator windings which, as explained above, are in opposed relation. It will be readily understood that by properly adjusting the inductance of the two separator branches, the resultant flux may be adjusted so that current between certain limiting periodicities only affects the telephone circuits sufficiently to produce audible results. This is the main principle, but there are introduced, of course, a number of refinements.

LETTER TO THE EDITORS.

Wattmeter for Saving Horse-Power.

To the Editors of Electrical World:

SIRS:—I am glad to note that out of the 28 patents on electrical inventions issued January 16 a choice was made of the Wilson wattmeter patent as the subject matter for an article in your columns. This prominence is appreciated by the solicitor of patents in the case, and will also doubtless be appreciated by Prof. Wilson. While the ELECTRICAL WORLD paid this compliment to the invention, it did not appear to identify the "Mr. Ernest Wilson," as Prof. Wilson, of Kings College, England. Nor did the writer of the article published, apparently, know that the meter is in actual use, judging from the words, "Mr. Ernest Wilson . . . *would* obtain." He *did* obtain the results.

The history of the invention is interesting. Mr. J. S. Highfield, chief electrical engineer of the Metropolitan Electric Supply Company, of London, and a former pupil of Prof. Wilson, asked the latter if it were not possible to measure the watts in their large generating stations without the waste of power through the usual non-inductive resistance in the work circuit. Prof. Wilson, after numerous tests, experiments and constructions, solved the problem successfully. The meter has been, and is now, used by the company. To indicate the enormous saving (the most sensitive commercial instruments requiring 1 to 2 volts across the shunts), suppose 2,000 amp. have to be carried. The power dissipated would vary from 2.7 to 5.4 hp. Prof. Wilson's invention saves all this, with the exception of the inappreciable power required to drive the small generator involved in his meter, and to overcome the slight frictional resistances common to all meters.

The invention is radically novel, too, the broadest possible claims being allowed without any opposition by the Patent Office. The invention need not be set forth further here, as it is so accurately described in the ELECTRICAL WORLD of January 27. My object is to complete that article by showing that the invention was not a mere proposition by an amateur, but a practical solution of an important problem by a prominent electrical engineer and professor.

NEW YORK. E. P. THOMPSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Turbo-Alternators.—MEYER.—An article in which the author shows how to calculate in practice the main points in the design and construction of high-speed alternators driven by steam turbines. As an example the author deals with a 1,500 to 2,000-kw alternator built by the British Thomson-Houston Company and connected with a Curtis turbine for use in a British power station. The turbine runs at a speed of 1,000 revolutions per minute, and the alternator has six poles. In view of the vertical arrangement of the steam end, it is laid out to work with a vertical shaft on top of the turbine. The author first discusses the electrical design and then the mechanical design and construction, giving numerous diagrams and illustrations and numerical data.—Lond. *Elec.*, January 12.

Commutation.—HAHMEMANN AND BIERESELL.—Two letters of a mathematical nature on a special point in the theory of the short-circuiting of coils and of the phenomena during commutation in a direct-current dynamo.—*Elek. Zeit.*, January 18.

Brush Holders.—ZINGELMANN.—An illustrated article on the construction of various types of brush holders.—Lond. *Elec. Rev.*, January 12.

Power.

Crane Motor with Magnetic Brake.—An illustrated description of crane motors built by a British Company. They are semi-enclosed, series wound and similar to the traction-motor type. The brake is formed in an extension of the commutator bearing, an annular space being provided in which is carried an exciting coil, *E*, as shown in Fig. 1. On the extended hub is carried a conical cast-steel ring, *R*, which is free to move laterally; in this ring steel springs are carried, which normally tend to push the ring away from the face of the magnet. At the extreme end of the motor shaft a malleable-iron crown, *C*, is keyed. When the motor is disconnected from the power service, the spiral springs thrust the conical steel ring into the crown. If current is switched on, the electric magnet becomes energized, and by the action overcoming the thrust of the springs, the ring is attracted to the face of the magnet, which leaves the crown and consequently, the shaft free to revolve.—Lond. *Elec.*, January 12.

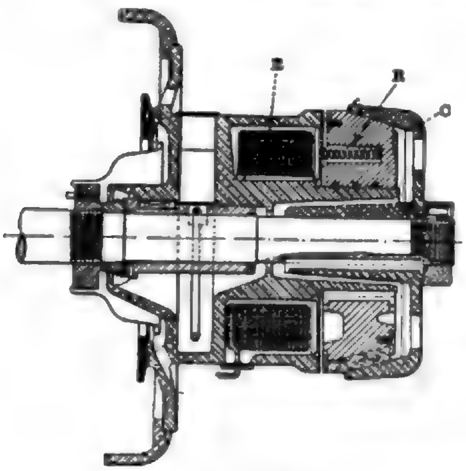


FIG. 1.—MAGNETIC BRAKE.

Producer Gas.—WYER.—An article discussing in a general way the specific advantages of producer gas for electric power stations. He also briefly discusses how, in certain cases, producer gas may compete with electric power stations—first, for traction purposes through producer-gas-engine driven cars versus electric-motor-driven cars, and secondly, by central producer-gas plants furnishing gas for scattered gas engines versus central electric-power plants, furnishing current for scattered motors.—*Cassier's Mag.*, February.

Electric Drive.—CROCKER AND ARENDT.—After a brief discussion of group driving and individual motor driving and of the suitability of the various types of motors for different requirements, the authors give a concise tabulated review of the different advantages which may be obtained from electric drive in workshops and factories. The increased output which should accompany introduction of the use of electric power, is attributed to the many advantages mentioned by the authors, but mainly to the clear head room for crane service and to convenient speed control.—*School of Mines Quarterly*, November.

Prevention of Explosions in Mines.—GOETZE.—The first parts of a long article on the prevention of explosions in mines due to the sparking of electric machines, etc.; especially on the construction and design of protective wire nets for this purpose.—*Elek. Zeit.*, January 4 and 25.

Draft.—RICHARDS.—In a continuation of his serial on metallurgical calculations the author discusses chimney draft and forced draft and gives several problems illustrating the principles explained.—*Electrochem. and Met. Ind.*, February.

Traction.

Brakes.—FELL.—A paper read before the (British) Tramways and Light Railways Association. The author has made a series of comparative tests with a great number of brakes. These brakes are first described. They comprise hand brakes, the "peacock brake," mechanical slipper brakes, pneumatic slipper brakes, air brakes, momentum brakes, emergency electric brakes, rheostatic brakes, electromagnetic disc brakes and electromagnetic track brakes. In the latter, two types are distinguished; in type A the track shoes act direct on the track only, while in type B the track shoes are coupled to and act in conjunction with the ordinary track shoes on the wheels. The results obtained in these tests are given in a series of tables and a great number of diagrams. The author concludes that the hand and rheostatic brakes are not to be compared in their results with electromagnetic track brakes. Hand brakes are too slow in action, and entail much necessary labor on the part of the motorman. Rheostatic brakes are cheap as regards first cost, but the maintenance charges owing to the shorter life of the motor and resistances are very much increased. With this type of brake the efficiency is very low, and the power developed by the motors can be used to a much greater advantage in connection with magnetic track brakes. The results obtained with the momentum brake are very good. The author thinks that the pneumatic slipper brake for use on long steep gradients is a development which will be watched with interest. The trials with both the A and B types of magnetic track brake show excellent results, and although as far as the tests are concerned, there is no doubt that the latest form of type B brake, with the supplementary wheel brake attachment, gave the best results. There are two important points which must also be taken into consideration, viz., the first cost and the cost of maintenance. The cost of the A type of brake is naturally much lower than that of the B type of brake, as the arrangement is simpler, and for the same reason, in all probability, the cost of maintenance of the A type will be less as there are fewer working parts. It is, therefore, a question of experience as to whether the cheaper brake is sufficiently good for all practical purposes. With a more powerful brake it is, of course, possible to increase the speed and this is a far-reaching advantage. The chief advantage of the latest forms of electromagnetic brake is that they can be used in the thickest traffic when the cars are traveling at very low speeds. In the improved designs with longer magnets, the ampere-seconds are very much lower, and the motors are not overheated, as was the case with the older forms of magnets. If these brakes are adopted several very important points require attention. In the first place, the controller should be designed with not less than seven brake notches, so that the brakes may be applied gradually; also that the brake connections in the controller are entirely disconnected from the power circuit. The controller connections have to be arranged specially, so that when one motor is cut out the brake-winding will not be short-circuited. Electromagnetic track brakes are useless if applied at junctions where manganese rails and special work are used throughout. The new brakes are very powerful in their action, and great care has to be exercised in teaching motormen how to use them.—Lond. *Elec.*, January 19 and 26.

Traction in England.—Some statistical data on "street and road tramways and light railways" in the United Kingdom. Some of the figures are abstracted in the following table:

Details.	Electric period 1904-5.	Electric period 1903-4.	Steam Period. 1898.	Horse Period. 1879.
Length of route open in miles....	2,116.78	1,839.01	1,064.19	321.27
Total number of passengers carried	2,068,913,226	1,790,342,673	858,485,542	150,881,515
Capital expend. per mile of single track open	$77,095	$80,000	$52,345	$49,385
Percentage of net receipts to total capital outlay	6.36	6.27	6.38	3.97
Percentage of working expenditure to gross receipts	66.19	66.15	76.93	83.81

The electric road mileage has increased from 1,462 in 1903-4 to 1,780 in 1904-5, the mileage of other methods of traction has decreased in the same time from 377 to 336.—Lond. *Elec. Rev.*, January 12.

Energy Losses.—An article giving statistical data on energy losses on tramways from the experience of English lines.—Lond. *Elec. Rev.*, January 12.

Surface Contact System.—An illustrated description of the "G. B." surface contact system in experimental use on some three miles at Lincoln.—Lond. *Elec. Rev.*, January 12.

Installations, Systems and Appliances.

Paris Power Plant.—Blondin.—A fully illustrated description of the generating station of Saint-Denis of the Société d'Electricité of Paris, which is one of the most modern French stations. It supplies power for lighting, traction and other purposes. In view of the different requirements both three-phase currents at 10,250 volts with a frequency of 25 and two-phase currents at 12,300 volts with a frequency of 42 are generated as well as direct current at 230 and 550 volts. The 230-volt direct current is used for excitation and for lighting the station. The 550-volt direct current is used for traction. Labor-saving devices are made use of to a great extent. All the prime movers are steam turbines. There are ten main generating sets, each consisting of a steam turbine and an alternator of 6,000 kw normal load. The speed is 750 revolutions per minute. The steam consumption per kw-hour is not over 6.8 kg at full load and 8.25 kg at half-load with steam at 12 kg per square centimeter at 300° C. Each generating set has a length of 1.45 meters and breadth of 4.15 and a height of 3.5 meters. Of the 10 groups, 7 generate three-phase currents and 3 two-phase currents. A single turbo-generator of 300 kw gives direct current at 230 volts, the speed being 2,700 revolutions per minutes. There is also a booster and a storage battery of 126 cells with a capacity of 1,300 ampere-hours for a one-hour discharge rate. The 300-kw direct-current generating set is used only for starting the main machines; afterwards it is disconnected and the current for excitation is supplied by motor generators, each consisting of a 375-kw, 10,250-volt, three-phase motor and a 230-volt direct-current generator. To make the use of three-phase, two-phase and direct currents interchangeable, the following type of machine is employed. It consists of a 10,250-volt, 25-period, three-phase alternator and a 6,150-volt, 42-period, two-phase alternator, mounted on the same axle revolving with a speed of 500 revolutions per minute. According to the requirements of the moment any one of the two alternators is employed as a motor and the other as a generator. This same set is also used for giving the direct current for traction at 550 volts. For this purpose at each end of the axle a direct-current generator of 750 kw is mounted.—*La Revue Elec.*, January 15.

Gas and Electricity in Germany.—An account of the recent annual meeting of the Association of Gas, Electrical and Hydraulic Engineers of Rhineland and Westphalia. From the annual report it appears that in spite of the competition of electric central stations, which have almost throughout reduced the rates, the use of illuminating gas has steadily increased in the cities of larger and medium size, the use of gas being rapidly extending especially for cooking. The electric central stations are also increasing, but it is remarkable that during the last years the increase was limited rather to the use of electricity for power purposes while the use for lighting showed rather a decrease. The increased use for power purposes is in many cases due to a very considerable reduction in the rate for electricity for such work. It is stated that in future a reduction of the use of electric light can be prevented only by a very essential reduction in the price of electrical energy, which will, however, be almost impossible in view of the financial condition of central stations. It is stated that in smaller and medium cities in Germany, central stations do not earn profits, while the financial condition in larger cities is quite satisfactory. "Considerably used and very satisfactory are the Nernst lamps for direct current on account of the long life and their high efficiency at 220 volts and the osmium lamp for alternating current for low voltages up to 50 volts."—*Jour. f. Gasbel. u. Wass.*, January 20.

Electrophysics and Magnetism.

Magnetic Hysteresis.—Duhem.—A paper illustrated by diagrams in which, without any mathematics, the methods of the author for applying the principles of thermodynamics to various phenomena are applied to the special case of magnetic hysteresis. The present article refers to a field which changes very slowly, the treatment being very simple.—*Revue Gen. des Sciences*, January 15.

Capacity Inductance.—Lichtenstein.—A further contribution to the discussion of the proper definitions of capacity and inductance of one or more conductors.—*Elek. Zeit.*, January 4.

Electrons.—Tommasina.—A paper read before the International Congress of radiology and ionization in Liege on the kinetic theory of the electron as a basis of the electron theory of radiations. The paper is essentially speculative.—*Phys. Zeit.*, January 15.

Electrochemistry and Batteries.

Current Density.—A discussion of the role of current density in electric furnace processes and in electrolytic processes. In electric processes, the watts per cubic inch are the fundamental item determining the operation. The watts per cubic inch equal the square of the current density multiplied by electric restivity. Hence, instead of the watts per cubic inch it is possible to consider the current density as the fundamental determining factor, the square of the current density multiplied by electric resistivity. changes with the mechanical pressure and especially with the temperature. In electrolytic processes, in which a number of different reactions are a priori possible, the voltage (or the electrode potential at each electrode) determines which reaction sets in, but under the conditions as experiments are often carried out the current density in electrolytic processes is directly determined by the voltage. The main effect of current density in electrolytic processes is, however, found in the tendency of the current to continually change the system by introducing new products at the electrodes into the system. The greater the current the larger is the amount of new products formed at the electrodes. Further, the smaller the electrode surface the less is the quantity of the electrolyte which is in contact with the electrodes and the greater is the liability of the newly formed products to displace the original electrolyte.—*Electrochem. and Met. Ind.*, February.

Carborundum Furnace. FitzGerald.—An illustrated description of the construction of the electric furnace for making carborundum. The author gives briefly the mathematical theory of the design and some notes on the efficiency. With the data on hand it is not possible even to make approximate estimates of absolute efficiency, but the progress which has been made can be judged from the fact that in 1893 9 kw-hours were used to produce one pound of carborundum, while in 1902 3.8 kw-hours are sufficient for the same purpose.—*Electrochem. and Met. Ind.*, February.

Refractory Uses of Bauxite.—Aubrey.—An article in which the author first described the method of making refractory bricks from calcined bauxite. Bauxite bricks may be used to advantage in open hearth steel furnaces and have already found successful application as a lining in Portland cement kilns and as a lining for lead refining furnaces.—*Electrochem. and Met. Ind.*, February.

Units, Measurements and Instruments.

Ammeter.—An illustrated description of the Ayrton-Perry-Duddell twisted-strip ammeter which consists essentially of a very sensitive Ayrton-Perry twisted strip on which the mirror is mounted, and a temperature-compensation device to minimize the zero-creep when the temperature of the whole instrument changes. The instrument is shown in Fig. 2. In the center is seen the Ayrton-Perry twisted strip, of which the upper part is twisted in one direction and the lower part in the opposite. The mirror with a very thin mica damping vane is fixed at its center. The strip is stretched in a frame formed of the lower brace block, which forms one terminal, and a piece of ebonite, the sides of the frame being formed by the compensating wires. This frame itself is stretched by means of a spiral spring fixed to the upper terminal block. The twisted strip and the compensation wires are made of the same metal; in fact, the strip is actually rolled from a piece of the same wire, so that they all have the same temperature-coefficient of expansion. If the wires and strip rise in temperature equally, then the whole frame simply gets longer and no twist of the mirror ensues. If, however, a current be sent through the twisted strip, then it is caused to heat and twist up, deflecting the mirror. Owing to the fineness of the strip (0.025 mm.) which is heated by the current, the instrument is very quick in action. The mechanical periodic time is very short, about 1/15 second, so that it is able to follow currents which vary over a small range as rapidly as 1 or 2 cycles per second. An instrument with a resistance of 20 ohms will give a deflection of 250 mm. at 1,000 mm. scale distance with a current of 0.022 amp. or with a potential difference of 0.44 volt. The instrument requires screening from quick vibrations of the order of 1/15 second. This is accomplished by standing the instrument in a heavy metal block, shown in the illustration, which is suspended by means of three wires. This form of apparatus, which has very small self-induction and capacity, can be used for observing the quick variations of the voltage in supply stations produced either by cyclic irregularity of the engine or by phase swinging between alternators or converters and other similar purposes. By working to a false zero a sensibility of 10 mm. change in deflection for 1 per cent change in the potential difference may be obtained. By observations of this kind it is often possible to trace the causes of alternators not operating properly in parallel, and to find which engine and which particular defect is the cause. The apparatus can be used as a voltmeter down to 0.1 volt and in series with high resistances up to 10,000 volts; it can also, of course, be used with a shunt to measure large currents. The robust nature of the construction renders the instrument suitable for carrying in the pocket.—Lond. *Elec.*, January 19.

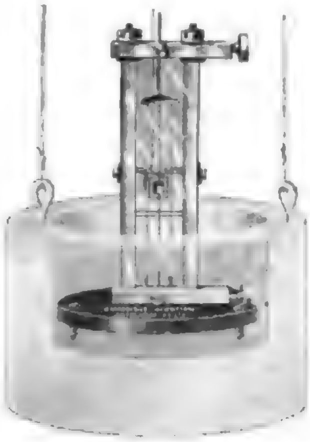


FIG. 2.—AMMETER.

Magnet Construction for Measuring Instruments..—Busch.—A description of a new arrangement of the field magnets for direct-current, watt-hour meters, the object being to obviate the deteriorating effect of the remanent magnetism on the readings of the meter. The arrangement is shown in Fig. 3. *A* is the winding supplied with the exciting current, *B* and *E* form the iron frame with the air-gap, *C*, in which the disc-formed armature revolves, of which *D* represents the axle. The special feature of the arrangement is the magnetic shunt, *F*. When no current flows, this shunt sucks off the flux of remanent magnetism, so that no magnetic flux passes through the air-gap, *C*. In order to cause the shunt to suck off the lines of flux which disturb the propor-

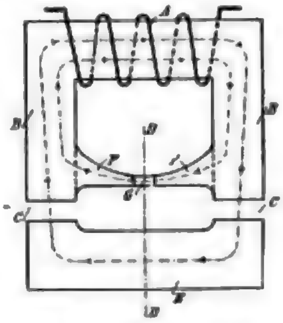


FIG. 3.—MAGNETIC CIRCUIT.

tionality under all conditions of current, the artificial poles, *F*, must have a proper cross-section and length. If these conditions are fulfilled, the number of lines of flux passing through *F* decreases with increasing saturation, but on account of the increasing saturation of the iron, *B*, the number of lines of flux produced also decreases somewhat and the dimensions can be chosen in such a way that in spite of high saturation of the main iron the lines of flux in the active air-gap, C, remain proportional to the exciting current. Diagrams are given which show this proportionality to be sufficient for all practical purposes.—*Elek. Zeit.*, January 11.

Spherical Photometer.—Ulbricht.—A mathematical paper on the determination of the hemispherical candle power by means of the spherical photometer. An article by Bloch on the determination of the spherical candle power by a single measurement with this instrument was recently abstracted in the Digest. The present author makes some remarks on this article. The same issue contains a letter by Bloch supplementing his former article.—*Elek. Zeit.*, January 18.

Magnetic Effect of the Current Flowing in Plates.—Arldt.—The first part of a mathematical paper on the magnetic effects of the current flowing through a plane surface (meaning, of course, a plate the thickness of which is small compared with its length and breadth) and on the action of the currents flowing through the iron frame of a ship on the field of the compass.—*Elek. Zeit.*, January 25.

High-Frequency Currents and Electric Waves.—Fleming.—The first parts of a complete reprint of his recent Cantor lectures on the measurement of high-frequency currents and electric waves. The first lecture deals with the measurement of high frequency, capacity, inductance and resistance.—Lond. *Elec.*, January 12 and 19.

Determining the Momentum. Roehle.—A note on the determination of the momentum of the rotor of an induction motor by means of a starting and stopping (running out) test.—*Elek. Zeit.*, January 25.

Meters.—Gerhardt.—Continuation and conclusion of his long illustrated serial. The author describes the erection of meters on consumers' premises and gives rules as to meter cleaning and repairs.—Lond. *Elec.*, January 12 and 26.

Flux Meter.—An illustrated description of the Grassot flux meter which is a suspended ballistic instrument and has the important advantage that its indications are determined solely by the total flow which has traversed the suspended coil, and are independent of the suddenness or slowness with which that flow has taken place. It has the further advantage over the ordinary ballistic galvanometer that the index, or spot of light, comes permanently to rest at the limit of its deflection. If an exploring coil be connected to the terminals of the instrument and brought into some definite position in a magnetic field, the instrument can be used to measure the flux of magnetic induction embraced by the turns of the coil. When the exploring coil is moved to a position where it is traversed by a greater or less flux than that in its original position, the induction of the instrument starts it into motion, and it comes to rest again in a new position, the reflection registered being determined solely by the change in the total flux of induction embraced by the coil. Whether the exploring coil is moved suddenly from its initial to its final position, or whether it is moved gradually, the deflection observed is precisely the same. When the exploring coil is withdrawn to its original position, the index returns once more to the zero reading, where it comes to rest. In place of the usual type of suspension, possessing some appreciable torsional stiffness, a single cocoon fibre is employed, the upper end of this fibre being attached to a flat spiral spring, *R* (shown in Fig. 4), to minimize the effect of shocks. The arrangement of the stiff-wire frame, *E*, fixed upon the coil, *B*, allows of a central attachment of both *s* and *s'*, which are very thin silver strips, serving to lead the current to and from the coil, *B*. The soft-iron core, *A*, is supported within the coil, between the pole pieces, *N*, *S*, of a permanent magnet, the field in the air-gap being of great and uniform intensity. An arrestment, controlled by a milled ebonite button in front of the instrument, serves to lock the coil when not in use, at the same time bringing the pointer back to zero. The circuit being closed, if the coil is displaced from its zero position and then left to itself, so small a controlling force is exerted by the silk-fibre suspension and the two silver-strip spirals that the index creeps back excessively slowly towards zero. The restoring forces due to torsion in the suspension are practically negligible, the excursions of the coil when once set moving being limited only by damping influences—chiefly electromagnetic damping. The mathematical theory of the instrument is briefly given. The flux meter is useful for measuring field strength in air-gaps, for investigations of the distribution of magnetism in various forms of permanent magnets, for measurements of permeability and hysteresis as well as the quantity of electricity discharged by a condenser.—Lond. *Elec.*, January 19.

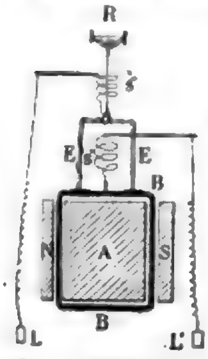


FIG. 4.—DIAGRAM OF FLUX METER.

Measuring Instruments.—An illustrated description of a new type of electromagnetic measuring instrument made by the Allgem. Elek. Ges. The advantage of the new type over the old one of the same company is the provision of air damping for the moving portion of the instrument. The fundamental idea is as follows. If the two soft iron rods, *A* and *B*, are placed within a solenoid, *S* (Fig. 5), they are magnetized by the current in such a way as to repel each other. If one of these rods is stationary and the other mounted on a revolving axle, the current will produce a revolution of this axle. In practice not rods but parts of cylindrical surfaces are used, as indicated at *A* and *B* in the right-hand diagram, where *S* is the solenoid. *B* is stationary, while *A* is connected to the needle of the instrument and to a spiral spring, *F*, which furnishes the resisting force. Air-damping is obtained by means of a light aluminum disc in a closed air-chamber. The instruments may be used for either direct or alternating current. The influence of the frequency and the wave form of e.m.f. is said to be smaller than with the older type of instrument of the same company.—*Elek. Zeit.*, January 25.

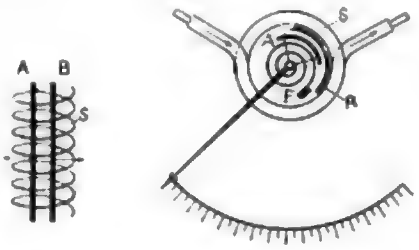


FIG. 5.—MEASURING INSTRUMENT.

Determining the Power Factor.—An article pointing out that the double-wattmeter method of three-phase power measurement offers a simple indication of the power factor of the circuit in question. The principle of the method is that the sum of the readings of two wattmeters connected as in the upper diagram in Fig. 6 is equal to the power supplied or delivered—as the case may be—at all power factors. But the ratio between these two separate readings varies with the power factor, and in balanced systems this ratio is a direct indication of the power factor. A simple graphical method of determining the power factor is as

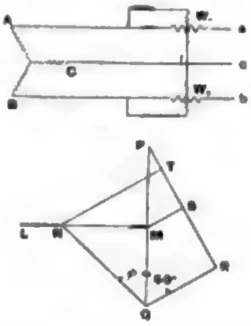


FIG. 6.—DETERMINING POWER FACTOR.

follows, reference being had to the lower diagram: To determine the angle of lag or lead, having given the readings of the two wattmeters only, proceed as follows: Draw any right-angled triangle $P\ Q\ R$, having the angle $P\ Q\ R = 60°$, and the angle $P\ R\ Q = 90°$. From $R\ P$ cut off $R\ S$ proportional to the mean of the two readings, and again from $R\ P$ cut off $R\ T$ proportional to the reading on wattmeter 1. If the current is leading, this will be the lower of the two readings, but the same construction holds good. Now draw $S\ M$ perpendicular to $P\ R$ to cut $P\ Q$ in M. Draw $M\ L$ perpendicular to $P\ Q$ and $T\ N$ perpendicular to $P\ R$ to cut $M\ L$ in N. Join $N\ Q$; then $P\ Q\ N$ is the angle of lag (or lead) required. The method is very handy in many cases where it is desirable to know the approximate power factor of a circuit and a power-factor meter is not available.—Lond. *Elec. Rev.*, January 5.

Dynamometric Brake.—An illustrated description of the Krebs electric dynamometer which is stated to avoid the inconveniences of the prony brake, mechanical friction being replaced by electromagnetic reaction.— *La Nature*, January 13.

Telegraphy, Telephony and Signals.

Telegraphic Cable.—An illustrated description of the new London-Glasgow telegraph cable. In the cable from Warrington to Glasgow the conductor pairs are laid up on the Dieselhorst-Martin principle. The 100-lb. per mile conductors, after being insulated with paper, are laid up in pairs, then the pairs are "twinned" together into a two-pair cable, and finally a pair of these two-pair cables are laid up together. This is shown diagrammatically in Fig. 7. There are seven of these sets of four pairs in each cable, and they are surrounded by 29 screened 70-lb. conductors, but first six ordinary pairs of 150-lb. conductors are laid in to fill up the interstices. The whole arrangement is shown diagrammatically in Fig. 8. It is seen that this cable gives 65 circuits. A maximum wire-to-wire capacity of 0.06 and 0.065 microfarad per mile was specified for the 100-lb. and 150-lb. pairs, respectively, 0.12 microfarad per mile between each screened single conductor and all the others earthed. The object of laying up the pairs in the manner described is to employ them in parallel if the equivalent of a heavier conductor be required. For instance, if two of the pairs are used in parallel, the equivalent of a 200-lb. copper conductor is obtained, but the capacity is less than if two pairs of an ordinary 28-pair cable were used in parallel. The outer screened single wires of the cables are employed for ordinary telegraph traffic, in many cases for comparatively short distances only, while the paired wires serve for high-speed transmission of the longer distances. The constructions on other parts of the cable are somewhat different—Lond. *Elec.*, January 12.

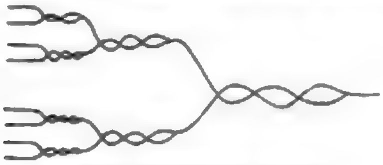


FIG. 7.—TELEGRAPH CABLE.

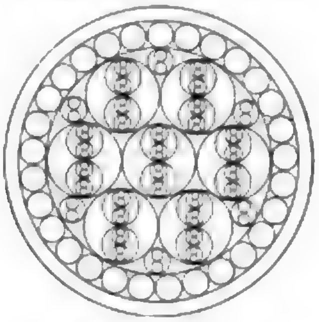


FIG. 8.—TELEGRAPH CABLE.

Telegraphic Relay.—Jensen and Sieveking.—It has occurred to many inventors that a relay might result from simply placing a microphone contact against the vibrating disc of a telephone. It was soon realized that the excursions of such a disc were too small to actuate efficiently such a microphonic contact; moreover, the pressure of the contact on the disc interfered with the vibration of such a disc. The present authors have taken up the general subject of microphonic contacts with the view of using them in some form of telephonic relay. In order to shun disturbing vibrations the microphonic contact was placed on a Julius suspension consisting of a heavy board or table hung from the ceiling with the usual arrangement of supporting wires. They found this suspension very useful. No mention, however, is made of the singing of microphonic contacts, a trouble which is very difficult to overcome in the practical use of any microphonic contact. Possibly the currents employed by these investigators were too feeble to cause this singing. The paper contains a great many measurements of microphonic resistances and concludes with the following questions which were suggested by the investigation. What sensitiveness must one desire in order to obtain a practical working telegraphic relay? In avoiding shaking or other disturbances, within what limits is it safe to work without the necessity of too delicate adjustments? What pressure is it best to select? What electromotive force at the contact should one employ? The authors did not succeed in supplanting the galvanometer by a microphonic contact for the detection of very feeble currents.—*Ann. d. Phys.*, No. 14, 1905; abstracted in *Am. Jour. of Science*, February.

Phase-Shifted, High-Frequency Oscillations.—Braun.—The author's scheme of sending wireless telegraph messages in a certain direction only was recently noticed in the Digest (Dec. 16, 1905, p. 1041). It was essentially based on the possibility of producing two oscillations vibrating with any desired phase difference. Methods for achieving this result are discussed in the present article, which is chiefly theoretical, although all the theoretical conclusions are confirmed by experiments of the author. After describing a method for measuring phase displacement, he discusses phase displacement by ohmic resonance, phase displacement by resonance, and the use of inter-linked oscillatory circuits.—Lond. *Elec.*, January 19.

Wireless Telegraph Station.—Monckton.—An illustrated description of the wireless telegraph station for communication between the islands of Trinidad and Tobago in the West Indies. The Lodge-Muirhead system is used.—Lond. *Elec.*, January 12.

Progress.—Houston.—A popular article on half a decade of progress in electricity and magnetism.—*Cassier's Mag.*, February.

Miscellaneous.

Thawing Pipes by Electricity.—Dann.—An illustrated description of several types of thawing transformers, their construction and application.—*Elec. Jour.*, January.

BOOK REVIEWS.

Das Elektrische Bogenlicht. By Walther Biegon von Czudnochowski. Second Section. Leipzig: S. Hirzel. 95 pages, 36 illustrations. Price, 4 marks.

The author has written a treatise on the development and physical properties of the electric arc lamp in six sections, of which this is the second. This section deals with the history of the development of the electric arc from the date of its discovery by Davy in 1808 to the date of 1879. The various regulators employed are described and illustrated. The dynamos used are also described but much more cursorily.

The principal value of the treatise is in its historical classification of the physical researches on and physical data of the arc lamp. The pamphlet is interesting to students of the history of the arc lamp on this account.

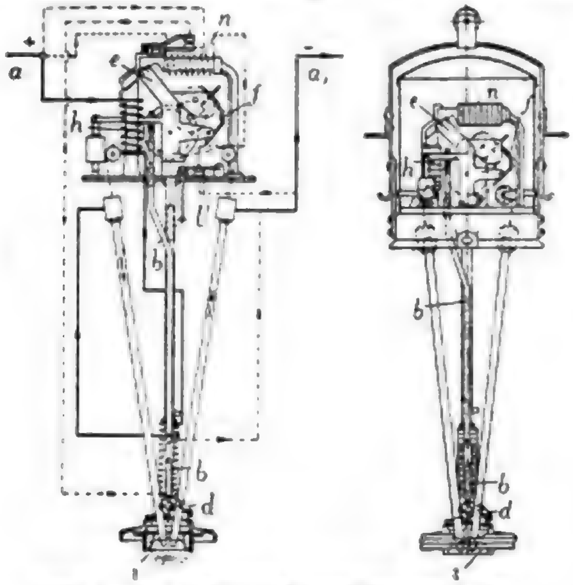
La Séparation Électromagnétique et Électrostatique des Minerais. By Désiré Korda. Paris: *L'Éclairage Électrique.* 210 pages, 54 illustrations. Price, 6 francs.

Considering how much use is made in the aggregate of the principle of magnetic and electric screening of minerals, it is remarkable how little has been written upon the subject. The present volume has been prepared by an engineer from an engineering point of view.

Although the practical descriptions are rather cursory and the mathematical theory is necessarily only an outline of the subject, yet the author is to be congratulated on collecting a large amount of information upon a subject so little known. The various types of electric and magnetic separators more generally known are described and illustrated. The nature of the processes employed is discussed in some detail. Two chapters are devoted to the theory of magnetic separators. The final chapter is also devoted to the theory of paramagnetic substances.

The work will be welcomed by students of mineral separation as a text-book and by electrical engineers as a reference book.

Flaming Arc Lamp.



FIGS. 1 AND 2.—DETAILS OF DIRECT-CURRENT LAMP.

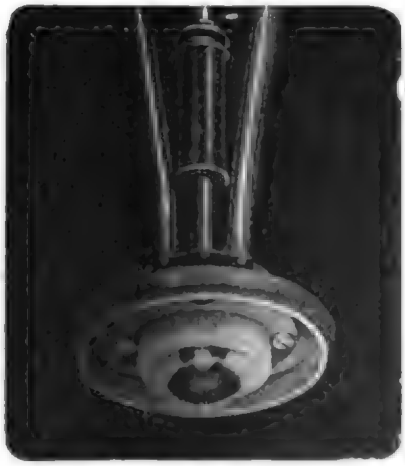


FIG. 3.—VIEW OF "ECONOMIZER."

The accompanying engravings illustrate the Excello "intensive-flame" arc lamp marketed by the Excello Arc Lamp Company, 24 East Twenty-first Street, New York. Both the direct and alternating-current lamps are differentially wound. The electrical and mechanical details of the direct-current lamp are shown respectively in Figs. 1 and 2. The series and shunt magnets are set at right angles to each other and the armature controlling the feeding gear swings between them. An "economizer," *i*, is fixed at the lower end of the supporting rods and supported in a ring held to the metal base. Fixed on the top of this base is the mechanism for striking the arc. The carbon rods are first separated owing to the action of the series magnet, and when the shunt magnet is energized it draws the armature, *e*, over, thereby lifting the rod and causing the slider, *d*, to bring the carbons together and strike the arc. When the carbons have burned their full time and no longer feed downward, on circuits having a potential of 125 volts or less, the shunt circuit is automatically broken by a carbon-faced switch mechanically operated by a small detent on the chain connecting the carbon holders. This break in the shunt circuit causes the series magnet to draw the carbons apart and extinguish the arc. Fig. 3 shows the "economizer" and the ordinary distance between the burning carbons. On higher voltages a blow-out magnet is utilized to extinguish the arc. This consists of a magnet having its series winding always in circuit and a shunt winding automatically thrown in circuit, when the shunt magnet of the feeding mechanism is cut out in the manner already described. Fig. 4 shows how the arc is extinguished by this double-wound magnet.

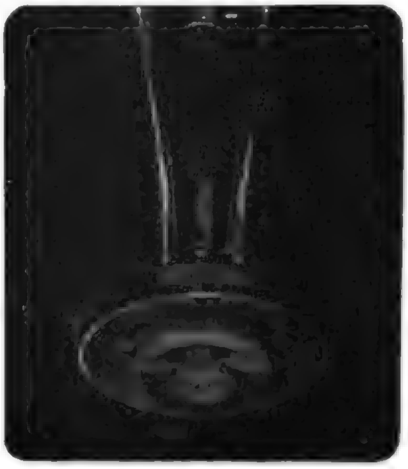
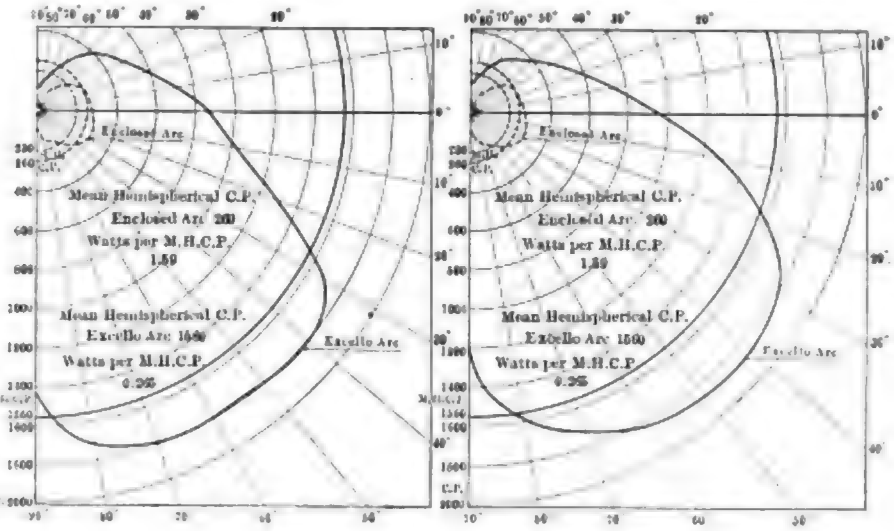


FIG. 4.—EXTINGUISHING ARC BY DOUBLE-WOUND MAGNET.

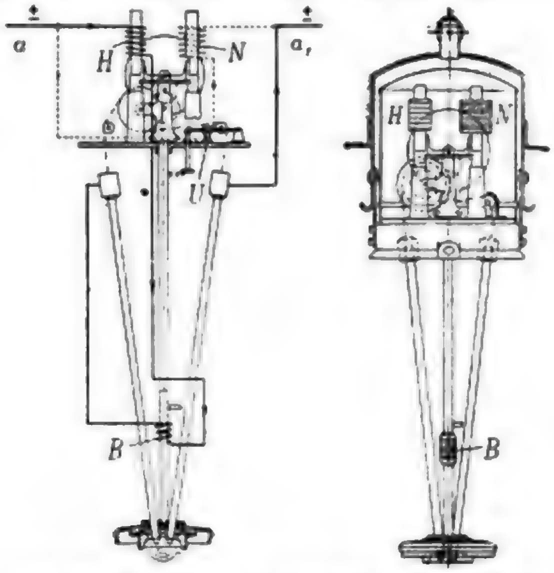
The electrical and mechanical details of the alternating-current lamp are shown respectively by Figs. 7 and 8. When the lamp is placed in circuit the series magnet, *H*, is excited causing a disc to rotate rapidly and thereby lift and separate the carbons gradually. As the carbons are separated the shunt magnet, *N*, is energized and causes a gradual slowing down of the rotor until the arc is of the correct length. As the carbons burn away the shunt magnet becomes more powerful and the rotor disc is caused to revolve in a reverse direction and feed the lamp. The shunt breaker, *U*, operates as in the direct-current lamp. The alternating-current lamp is not fitted with an additional coil on the



FIGS. 5 AND 6.—CANDLE-POWER CURVES.

blow-out magnet as in the case of the direct-current lamp, it being a simple matter to regulate the voltage to exactly suit the requirements of the arc lamp circuit.

The lamps are most satisfactorily burned two in series on 110-125 volts, or four in series on 220-240 volts. Four sizes are made for both direct and alternating-current circuits, the former consuming 6, 8, 10 and 12 amp. and the latter 8, 10, 12 and 15 amp. Like most lamps of this type impregnated carbons are used, but Excello carbons have in addition a metallic core arranged to give good electrical contact along the entire length of the carbon and reducing the resistance of the carbons. This core is clearly shown in the broken carbons illustrated by Fig. 9. The carbons are 12½, 15¾ and 23½ in. long and 6, 7, 8, 9, 10 and 11 mm. in diameter. The carbon life is 17 hours with carbons 23½ in. long.



FIGS. 7 AND 8.—DETAILS OF ALTERNATING-CURRENT LAMP.

The results of tests made by the Electrical Testing Laboratories are plotted in the accompanying curves. Fig. 5 shows the intensity measured throughout a circle in the plane of the arc, and Fig. 6 shows values throughout a circle in the plane perpendicular to that of the arc. The mean hemispherical candle-power was found to be 1,560, and the watts, 0.265 per mean spherical candle-power.

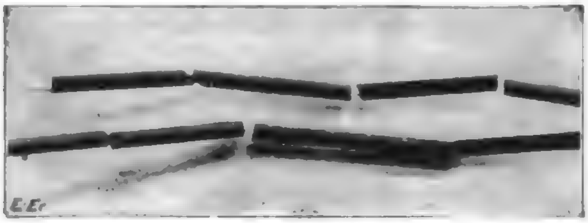


FIG. 9.—BROKEN CARBONS, SHOWING CORE.

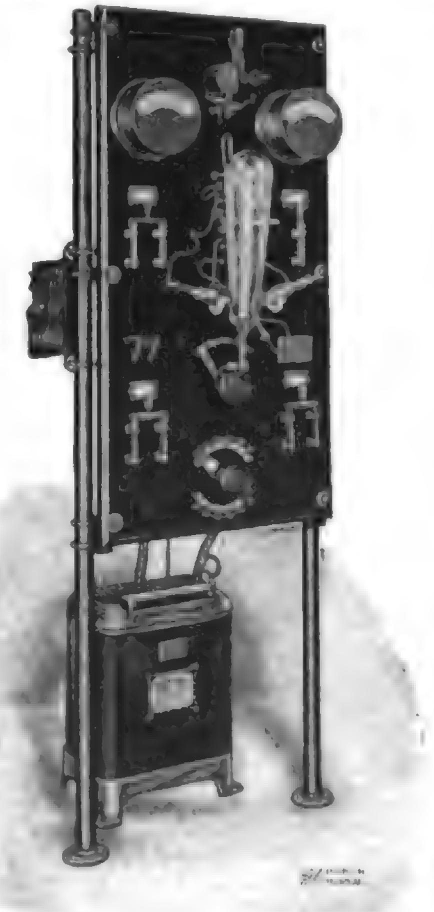
Charging Telephone Batteries.

The same reasons which have led to the adoption of the mercury arc rectifier for charging automobile batteries also adapt it to the requirements of telephone battery charging, and for this purpose a telephone charging panel outfit has been developed by the General Electric Company.

As will be seen in the accompanying illustration of a 30-amp. rectifier outfit, the arrangement consists of a mercury-arc rectifier tube mounted on a black enameled slate panel with switches, instruments, etc., and the necessary reactance coils. This panel stands 76 in. high and is 24 in. wide, and, as it need stand but 24 in. from the wall, is compact and self-contained. In the center of the panel, the rectifier is mounted in a substantial holder in such a manner that the shake necessary to start the tube in action can be easily given.

Grouped about the rectifier are the switches and instruments. The former include starting, alternating and direct-current line switches and load switches. A circuit-breaker is also included in the direct-current line. The ammeter has its zero at the center of the scale so as to read in either direction. There is also provided an external shunt with 30-ft. leads so that the current may be measured at a convenient point. A small selective switch shown at the left center of the panel is so connected that the direct-current voltage may be conveniently taken across the battery terminals, rectifier terminals, etc.

On the floor beneath the panel proper is located the reactance coil for adjusting the alternating-current supply, thereby controlling the direct current. In addition a suitable reactance is so connected as to reduce the humming on the telephone circuits to a minimum. Tests of this rectifier, made by the American Telephone & Telegraph Company, indicate that there is no noise on the line when the batteries are being charged. This is a point of great importance in the satisfactory operation of any charging device for telephone service.



TELEPHONE CHARGING PANEL OUTFIT.

The space required for an installation of these rectifiers is but one-third of that necessary with the ordinary equipment and the efficiency, as is well known, is much higher than any other method of transforming alternating to direct current.

Electrical Extensions in Savannah, Ga.

Extensive improvements are being made on the properties of the Savannah, Ga., Electric Company. Mr. L. R. Nash, manager, informs us that some new underground work will include the installation of additional feeder to take care of increased load on the Edison three-wire system He adds: "We have on hand, however, other improvements connected with our railway department. Heretofore we have been operating two separate stations, the railway station located near the center of the railway load, the lighting station on the other side of the city near the business district, the two stations being about two miles apart. We are planning to discontinue operation of the railway station and are installing in our lighting station a new 800 kw, direct-connected railway unit, consisting of a General Electric generator and a cross-compound condensing Cooper Corliss engine, running at 100 r.p.m. In connection with this unit there will be installed about 1,000 hp capacity of boilers, and a central condensing plant of the Weiss type will take care of our entire station capacity, with the exception of a recently installed Westinghouse-Parsons turbine which has an independent system for very high vacuum. The new apparatus will be installed in an extension of the present station, to be about 50x125 ft. in size. This extension will also contain some belted railway apparatus for reserve capacity. The change in distributing point requires a considerable addition to as well as rearrangement of the feeder system, requiring about 100,000 lbs. of copper. This work is now in progress and will be completed by May 1, in time for summer business, which in this section of the country is heavier than winter."

High-Potential Insulating Material.

The Electrical Testing Laboratories has conducted a series of tests with Voltax, a recently developed high-potential insulating material. This material is a plastic compound, which is stated to possess numerous mechanical and electrical properties which render it especially advantageous for high-potential insulation. Three kinds of tests were made in order to determine its dielectric strength, its insulation resistance and its heat resisting qualities, respectively.

The high-potential tests were made on alternating current using one or more 5-kw. 10,000-volt transformers according to the e.m.f. required. In testing three samples of wire, each wrapped with a different number of layers of cotton tape impregnated with the compound, a low pressure was applied between the wire and tin foil wrapped tightly around the outside of the insulation, and the voltage was gradually increased until puncture occurred. The compound itself was tested by melting it and testing between 1-in. circular discs, which were placed so as just to touch the opposite surfaces of the sheet. The single-layer punctured at a pressure which, for eight samples, varied from 2,500 to 7,000 effective volts. Nine samples of the two-layer wrapping punctured at from 4,000 to 10,500 effective volts. Six samples of the four-layer wrapping punctured at from 11,400 to 19,000 effective volts, while a seventh sample withstood 21,000 volts without puncturing. To test the heat resisting qualities of the material, as indicated by the current carrying capacity of wire insulated with the compound, a current of 50 amperes was forced through four samples of No. 6 B & S. wires connected in series. The current was gradually increased. At 180 amperes, and after 16 minutes, the samples showed the first signs of moisture, and the first drop fell from sample No. 4. When the current was increased to 200 amperes, and after 64 minutes, this sample dripped freely, but the other three samples remained intact.

When the compound was tested in sheets, it was found that a pressure of from 267 to 286 effective volts per mil thickness was required to puncture the sheets. The insulation resistance of the compound in sheets was too high to be measured.

It is stated that the compound is water, acid and alkali proof, and will not drip under 200° F., that it may be subjected to severe tension and bent at short angles without in any way affecting the insulation, and that it retains its elasticity and insulating properties for an indefinite period. This interesting material is manufactured by the Electric Cable Company, 42 Broadway, New York.

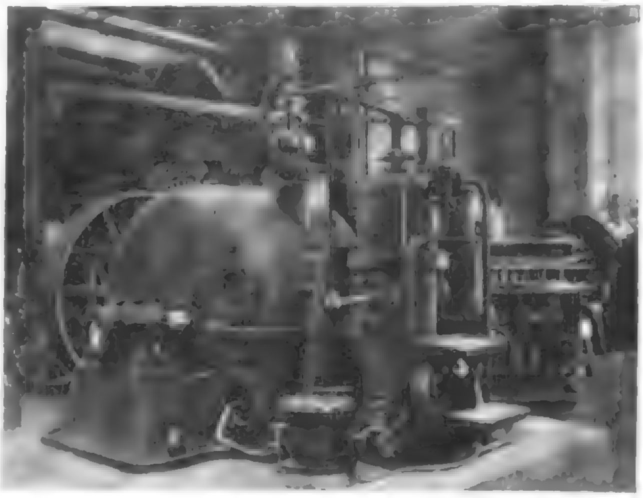
Electric Power in Canada.

Some important developments that are based largely upon the use of electric power are planned in Canada. The Toronto correspondent of the *Iron Age* says: "A preliminary agreement has been entered into between the town of Port Arthur and two men from Boston, Messrs. Hedges and Burleigh, for the establishment in the town of works for the manufacture of tubes, and also works for the manufacture of wire nails. The agreement is of the same character as that into which the town entered with the Atikokan Iron Company. The town will furnish a site of 100 acres, which it has yet to purchase; it will take $100,000 of the company's bonds at par; it will have three representatives on the Board of Directors; and it will appoint the company's treasurer. On their part the promoters contract to erect boiler, tube and pipe mills costing $750,000; to begin work on the mills three months after the agreement is ratified by the rate payers; to make the works of 1,000 tons monthly capacity, and to employ 250 men from the beginning. The plant is to be operated by electricity, requiring from 1,500 to 2,000 hp.

"Great works for the development of electric power at the Kakebeka Falls on the Kaministiquia are being constructed by a power company which expects to dispose of its entire current in Port Arthur and Fort William. William Mackenzie, of the Mackenzie & Mann Company, chief proprietor of the Canadian Northern Railway Company, and party to the agreement concerning the Atikokan Iron Company, was in Port Arthur when the Boston men were there. He expressed the hope that Port Arthur would get such an industry, as at present all the tubes required here came from the United States. Mr. Hedges stated that the tube and wire plant would take up the output of the works of the Atikokan Iron Company, evidently meaning that he understood this company would add steel furnaces and rolling mills and supply the material for tubes and wire.

New Water Development for the Piedmont Region.

The Southern Power Company, of Charlotte, N. C., through the acquisition of the stock of the Catawba Power Company, now controls a water power which is delivering about 10,000 hp to Charlotte and other towns in the vicinity. One of the latest of this company's developments is that near Fort Lawn, S. C., one of a series of proposed improvements, in which six Allis-Chalmers 5,200-hp twin hydraulic turbines recently ordered will be installed to operate at a speed of 225 r.p.m., from a 72-ft. head; also two 700-hp. twin horizontal exciter turbines to operate at a speed of 450 r.p.m. The power produced will be distributed with that from other plants of the series to the cotton mills throughout the Piedmont region of North and South Carolina.



TWIN HYDRAULIC TURBINES.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of a very favorable character are made of spring jobbing trade, and in some lines of retail trade there has been greater activity as a result of the more seasonable weather. Shipments of finished products of manufacture are of enormous volume, and mills are pushed for the filling of previous orders. The month of January was the most active ever experienced by the railroad companies, gross receipts showing a gain of 20 per cent over last year. Money is easy and collections range from fair to good. Easier conditions are noted along the leading staples. The pig-iron market was quiet and showed a tendency to recede. On the other hand, the demand for structural material continues heavy, and there is a marked pressure for delivery. Mills find it easier in making deliveries than they did a few months ago. Steel rails are in active demand and new orders are of good volume. It is estimated that rail makers have booked for 1906 delivery 2,400,000 to 2,500,000 tons, the figures being exclusive of export sales. Copper is weak under pressure to sell and the market was inactive. Material for Eastern refining works is coming forward in good volume, but the demand is far ahead of the supply of copper for electrical apparatus makers and wire drawers. Selling agencies which represent producers of 85 per cent of the country's output of copper are asking 18⅝c. for May delivery of Lake and electrolytic. Casting copper of best sorts is held at 18¼c. It is said by the leading buyers and sellers of copper that the agencies which are quoting from 17¾c. to 18c. for Lake and electrolytic have no metal for sale. Buyers for the principal copper and brass working plants of New York and New England report sufficient stock to carry them on till the May deliveries arrive. It is estimated that the exports of copper during the month will be 15,000 tons. In Europe electrolytic copper is scare, especially in England. Winter weather has interrupted the long spell of activity in building and caused a quieter demand for lumber, paints, glass and building supplies generally. The business failures during the week ending February 8, as reported by *Bradstreet's*, numbered 204, against 228 the week previous and 207 in the corresponding week last year.

ALLIS-CHALMERS HYDRAULIC WORK.—The Allis-Chalmers Company has produced a line of hydraulic power machinery suitable for operation under every conceivable condition by means of impulse or tangential wheel and the central discharge type. Following are a few installations recently completed or in process of building, which will indicate the scale on which this branch or production has been undertaken: California Gas & Electric Corporation, San Francisco, Cal., 1 single horizontal scroll case turbine, 9,700 hp; Milford Construction Company, Milford, Me., 8 twin vertical turbines, 7,000 hp; Southern Power Company, Charlotte, N. C., 6 twin horizontal turbines, 31,200 hp; Edison Electric Company, Los Angeles, Cal., 4 twin horizontal impulse wheels with deflecting nozzles, 43,000 hp; Great Northern Power Company, Duluth, Minn., 3 vertical single scroll case turbines, 30,000 hp; Guanajuato Power & Electric Company, Guanajuato, Mex., 1 single horizontal scroll case turbine, 5,000 hp; Niagara Falls Power Company, Niagara Falls, N. Y., replace parts for the reconstruction of five vertical single turbines, 27,500 hp. In the last two years the company has installed 181,400 hp of hydraulic turbines.

INDUCTION MOTORS FOR THE ANACONDA.—Four of the largest induction motors ever installed in the West and some of the largest in the country, with the exception of those installed at Niagara, will be used to furnish power at the $9,000,000 reduction plant of the Anaconda Copper Mining Company, Anaconda, Montana. The Allis-Chalmers Company, of Milwaukee, will furnish this electrical equipment for the mammoth 8,000-ton concentrator and the Street Railway Company at Anaconda. The concentrator equipment will consist of four 1,200-hp induction motors, three 300-kw motor generator sets, together with the usual auxiliary accessories. This order is only one of many which will follow the determination of the Anaconda Company to substitute Missouri River power, transmitted 60 miles at 70,000 volts, in place of the present power system installed in the largest smelter in the world. Each of the big induction motors will weigh over forty tons.

IMPROVING WORCESTER WIRE PLANT.—The United States Steel Corporation has appropriated $450,000 for additions and improvements at the Quinsigamond works of the American Steel & Wire Company. Inside of two weeks construction will begin on a new electric cable factory for the manufacture of wire cables, a factory for the manufacture of weather-proof cables, a new rope factory, a central pumping station and a big addition to the power house. The main cable factory will be three stories high, and will have a floor area of 72,000 square feet. The smaller factory, to be used for the manufacture of weather-proof cables, will contain two stories and will have a floor area of 12,480 square feet.

THE STANDARD ELECTRIC WORKS, San Francisco, Cal., have lately received two orders for supplying the Palma Mining Company, of Guatimape, Mexico, and the Sonora Bonanza Mining Company of Imuris, State of Sonora, Mexico, with switchboards, motors, generating sets, and all necessary electrical supplies for same, including incandescent electric lamps for lighting the mills, tramways and mines of the two companies. The Palma Mining Company has also ordered in connection with its electrical supplies a two-stage turbine pump manufactured by the Platt Iron Works of Dayton, O., and electrically driven, the motor for which is supplied by the Standard Electric Works.

THE INTERMOUNTAIN ELECTRIC COMPANY, of Salt Lake City, is completing plans for the construction of four hydro-electric power stations, with a total capacity of 5,555 kw in the Big Cotonwood canon about 16 miles southeast. The power is to be delivered at four points at Park City and Alta, two mining camps at the Utah Copper Company's new smelter, near Garfield Beach, and 900 hp at Salt Lake City. The total length of the transmission line will be about 65 miles and the line pressure 22,000 volts. The company expects to begin operations before next winter. The total cost is $600,000. Willard Young and Frank L. Kelsey are the engineers in charge.

WESTERN ELECTRIC FACTORY.—The Western Electric Company, New York City, recently purchased a new Allis-Chalmers, vertical, cross-compound engine, cylinders, 22x44 inches in diameter and 36-inch stroke, for direct connection to a direct-current Western Electric generator 600 kw. The new unit will be installed in the big factory of the Western Electric Company on the Hudson River front, New York City. The company is said to be doing a business of over $4,500,000 a month.

W. H. SCHOTT, CHICAGO, recently secured a contract from the Huntington Light & Fuel Company, of Huntington, Ind., for the rebuilding of that company's plant and installation of an exhaust heating system. The Huntington Light & Fuel Company has the electric lighting and natural and artificial gas plants in Huntington. The Michigan Power Company is about to develop water powers at several points on the Grand River. Contracts have been awarded to Mr. Schott.

THE ROBINS CONVEYING BELT COMPANY, of New York, has recently secured an order for three belt conveyors for the Depue plant of the New Jersey Zinc Company. Among other orders the company now has on hand is one from F. G. Boas, of Philadelphia, Pa., for a 14-inch belt conveyor, and an order for a picking belt conveyor from Fraser & Chalmers, of South Africa.

BOSTON ELEVATED.—The Boston Elevated Railway has awarded a contract to the General Electric Company for 45 new car equipments with the Sprague-General Electric multiple unit control. The Boston Elevated Company is about to equip its system with over 175 electrically operated circuit-breakers, purchased from the General Electric Company.

ORDER FOR RAILWAY CABLES.—The Interborough Rapid Transit Company, of New York, has just placed an order with the Electric Cable Company of New York for fifteen miles of cables insulated with Voltax, the new high-potential insulating compound which has just been placed on the market.

APPARATUS IN SPAIN.—Narciso Cot, Gerona 51, Barcelona, Spain, writes us that he would like to represent some electrical manufacturers in that country. He states that he is engaged in the business of selling electrical supplies, and can guarantee satisfaction to such parties.

ALLIS-CHALMERS ORDERS.—Spranley & Reed, Ltd., New Orleans, are recent purchasers of electrical machinery, consisting of two 42½-kw Bullock belted generators and two 6-kw equalizer sets, together with a number of Bullock type B motors from 5 to 25 hp, 500 volts. The new equipment will be used for lighting and power purposes and will be furnished by the Allis-Chalmers Company. The Journal Printing Company, Minneapolis, will install a new 40-hp Bullock teaser press equipment complete for 220 volts. The new equipment consisting of a 40-hp motor, a booster-teaser, drum controller and resistance, switchboard, etc. The City Light & Water Works, Union Springs, Ala., which recently experienced a breakdown in its electrical equipment, has ordered new machinery, consisting of an 80 kw, 2,200 volt Bullock alternator with exciter, direct-connected, and a number of induction motors of small horse-power. The Mosler Safe Company, Hamilton, O., whose works have been undergoing extensive improvement, due to increased volume of business, have purchased additional electrical equipment, consisting of eighteen Bullock induction motors, a 17½-kw multiple voltage balancing set and switchboard. The motors will be used to drive planers, lathes and Fosdick Radial drills. The controllers to be used will give a speed range of 5 to 1 on a multiple voltage system of 90, 160 and 250 volts, allowing twelve speeds in the forward direction and nine in the reverse direction. John W. Shaw, receiver of the Harrisburg, Ill., Water, Light & Power Company, has undertaken an addition to the company's present electrical plant, consisting of a 110-kw single-phase, 1,100 volt belted alternator with exciter. This will be used to carry the lighting load of the city and will have a capacity up to three thousand lamps.

PUMPING ENGINES FOR SUGAR REFINERY.—The American Sugar Refining Company has completed arrangements for the mechanical equipment for their Chalmette plant, New Orleans, La. Orders have been placed recently for six horizontal, Reynolds-Corliss driving engines, 500 hp each, and two horizontal, double-acting plunger pumping engines each having a capacity of 12,000,000 gallons daily against a head of 125 feet. The power engines which are of the heavy-duty type will be arranged in two groups of three each, one for direct connection to 350-kw, alternating-current generators, and the other for belt transmission. The Chalmette Refinery power plant will be equalled by few for the size of its units, and for economy in operation. The pumping engines are particularly noteworthy on account of their capacity for installation in an industrial establishment. The Allis-Chalmers Co., Milwaukee, will furnish the entire equipment.

INDUCTION MOTORS IN GLASS WORKS.—The application of electrically driven grinders and polishers in the process of manufacturing plate glass will be used on a large scale at the new Crystal City plant of the Pittsburgh Plate Glass Company, Crystal City, Mo. Sixteen hundred horse-power in Allis-Chalmers induction motors, driven by Allis-Chalmers gas engine and steam units, will be installed for the purpose. Arrangements have been completed for the installation of two 500-hp and two 300-hp induction motors to be ready for operation by June.

Financial Intelligence.

THE WEEK IN WALL STREET.—Trading on the stock market was quiet and prices were irregular. The outside public is holding aloof, growing somewhat skeptical about the various important deals and developments which are freely predicted, but which so far fail to materialize. Various unfavorable factors also received attention, chief among them being the unsettled coal-mining labor situation, the passage of the Hepburn railway rate bill by the House of Representatives at Washington, and the indications that the boom in the iron and steel industries is making no further progress, if, indeed, it is not beginning to wane. The reports of a complete pacification between the Heinze and Amalgamated interests were again used in connection with the manipulation of the copper stocks, and more or less irregularity prevailed in both the bituminous and anthracite coal stocks, attributable to the uncertainty in connection with the labor situation in the mining districts. The traction group was somewhat heavy in view of the threatened legislative interference with the Interborough-Metropolitan merger plan; and in the minor industrial stocks activity and interest were considerably smaller. There were no features in the electric stocks, the list being somewhat neglected in sympathy with the general market. Allis-Chalmers common is unchanged at 24, but preferred is ⅛ higher, the closing quotation being 63⅛. General Electric lost ¼-point net, closing at 175, and Westinghouse preferred 2⅝, the last quotation being 185. Westinghouse rights are quoted at ¼. Among the tractions, Brooklyn Rapid Transit lost 1⅜ points net, the closing price being 85. Metropolitan Street Railway is down ¼-point, closing at 120¼, and Interborough Rapid Transit 1⅛, the last quotation being 232¾. Western Union closed at 93¼; American Telephone & Telegraph, 142½, a net advance of 3½, and American Telegraph & Cable at 92, a decline of 1 point. American Locomotive common closed at 75¾ and preferred at 116½, being, in the former, a net gain of ⅞, and in the later a loss of ½ point. Following are the closing quotations of Feb. 13:

NEW YORK

	Feb. 6	Feb 13		Feb. 6	Feb.
Allis-Chalmers Co	24¼	23¾	General Electric	175	174⅝
Allis-Chalmers Co. pfd	63⅜	63	Hudson River Tel	...	..
American Dist. Tel	37	37	Interborough Rap. Tran	233	232
American Locomotive	78	75	Mackay Cos	60⅝	61⅝
American Locomotive pfd	118⅝	118⅝	Mackay Cos. pfd	74⅝	74
American Tel. & Cable	91	91	Marconi Tel	..	..
American Tel. & Tel.	138⅜	141⅞	Metropolitan St. Ry	121⅝	120⅝
Brooklyn Rapid Transit	86	85⅝	N. Y. & N. J. Tel	...	..
Electric Boat	25	26	Western Union Tel	93⅝	93
Electric Boat pfd	60	60	Westinghouse com.	166	165
Electric Vehicle	16	16	Westinghouse pfd	...	..
Electric Vehicle pfd	18	19			

BOSTON

	Feb. 6	Feb. 13		Feb. 6	Feb. 13
American Tel. & Tel	139⅝	142¼	Mass. Elec. Ry. pfd	67	68
Cumberland Telephone	...	117⅝	Mexican Telephone	..	4
Edison Elec. Illum	..	..	New England Telephone	137	..
General Electric	...	...	Western Tel. & Tel	14	.
Mass. Elec. Ry	18⅝	20	Western Tel. & Tel. pfd	.	..

PHILADELPHIA

	Feb. 6	Feb. 13		Feb. 6	Feb. 13
American Railways	53	53	Phila. Electric	7⅞	8
Elec. Co. of America	11⅝	11⅝	Phila. Rapid Trans	32⅝	32⅝
Elec. Storage Battery	81	80	Phila. Traction	...	...
Elec. Storage Battery pfd	...	...			

CHICAGO

	Feb. 6	Feb. 13		Feb 6	Feb. 12
Chicago City Ry	200	185	National Carbon	81⅛	83¼
Chicago Edison	...	...	National Carbon pfd	117⅜	120
Chicago Subway	...	...	Union Traction	...	...
Chicago Tel. Co	..	...	Union Traction pfd	...	...
Metropolitan Elev. com	26	23⅝			

* Asked.

SAN FRANCISCO LIGHTING.—In accordance with a recent order of the Board of Supervisors the companies engaged in furnishing light, power or heat in San Francisco have filed statements covering their earnings and expenses for 1905. The San Francisco Gas & Electric Company reports as follows: Revenues from the sale of gas, $2,528,905.81; from the sale of electric current, $2,055,925.48, and from other sources, $72,638.90, making a total of $4,657,468.19. The cost of producing the current and the gas is estimated at $3,677,790.13, leaving a profit of $979,678.06. Dividends have been paid to the amount of $792,421.68, and the surplus is $187,256.38. The cost of the gas plant the company figures at $16,803,639.88, and that of the electric plant at $6,535,216.85. The present value of the two plants is reckoned at $26,342,105.79. The Central Light & Power Company reports: Revenue derived from the sale of electric current and steam, $106,317.75; expenditures for the same, $65,888.36; expense in construction, $17,446.20; original cost of plant, $238,600; outstanding shares, 70,000; floating indebtedness, $3,000. The Martel Power Company puts its receipts from rent, power and steam, $33,234.19; expenses for the same, $19,181.04; expenses in construction, $1,600.21; cost of plant, $50,000; shares outstanding, 37,500; indebtedness, $9,000. The Mutual Electric Light Company gives its revenue for the twelve months ending December 31 at $132,144.71, and its expenditures at $100,423.50. The original cost of the plant was $869,212.85. Capital stock to the amount of $500,000 has been issued.

LIGHT COMPANY TO DISSOLVE.—A petition has been presented by the Reading Illuminating Company, Reading, Pa., asking that the company be dissolved. The company was chartered July 27, 1905, to furnish electric light, heat and power to the city, but at a recent meeting of the stockholders it was decided to dissolve. The company has no debts. Ralph W. Gifford is president. The application will be heard March 12.

ELECTRIC COMPANIES COMBINE.—A merger is practically completed which will give the Detroit Edison Company, of Detroit, Mich., control of the electric power interests in that part of the State. The plants of the Detroit Edison Company and the Central Heating Company, of Detroit, and the power plants in Port Huron, Pontiac, Grosse Pointe, Ypsilanti, Ann Arbor, Jackson and Kalamazoo are to be consolidated. The plan is to beautify Huron River landscapes as well as to use the river's power. An engineer's report showed that the Huron has a fall of 150 feet almost within a mile. An immense power dam will be built across the river near Ann Arbor, which will form a lake at least five miles in extent. The merger, financed and controlled by the North American Company, of New York, will make possible the transmission of electricity between the cities named.

CHICAGO PNEUMATIC TOOL annual report shows a net of $852,612 and a total surplus of $536,292 for 1905. President J. W. Duntley, in his report to the stockholders, says that the sales in 1905 were the largest since the organization of the corporation, and profits realized in 1905 amounted to 9.15 per cent available for dividends, of which 4 per cent were paid in dividends during the year. He adds: "Your company during the year acquired the business of the Philadelphia Pneumatic Tool Company. In connection with this transaction it was found desirable to borrow temporarily the sum of $125,000. Your company also acquired the business and plant of the Canadian Pneumatic Tool Company. During the year the Consolidated Pneumatic Tool Company, Ltd., of London, has been developing the organization of the Fraserburg plant, Scotland, and extending its operations until at the present time it is running to full capacity. Our foreign operations have been further enlarged during the past year by the organization of the International Compressed Air & Electric Company, of Berlin, which company acquired the business of Isaac G. Eckstein, and is now conducting continental operations. Your attention is called to the fact that of the authorized issue of $2,500,000 bonds, $200,000 are in the treasury and $208,000 have been retired for sinking fund purposes, leaving the outstanding issue $2,092,000. In addition to the assets acquired through the foreign organizations, approximately $350,000 has been spent in permanent betterments to plants, all of which has added to the securities underlying the outstanding issue of bonds."

PUBLIC SERVICE CORPORATION, N. J.—It is announced that change of ownership is proposed in the Public Service Corporation of New Jersey. As outlined the plan is to place the management of the railroad lines under the direction of the Pennsylvania Railroad Company, and lighting properties under the United Gas Improvement Company. The Prudential Insurance Company and the Fidelity Trust Company, it is said, will not part entirely with their holdings, but will retain something like a third interest. Of the company's $25,000,000 stock there remains half in the treasury and this, it is said, will be turned over to a leading New York banking house. The treasury stock, together with other stock at present held by parties interested in the transaction, is to be listed on the New York Stock Exchange. Newark parties will either pay for or guarantee the sale of a third, the Philadelphia parties of another third and the Prudential the remainder.

BELL TELEPHONE BONDS.—It is announced that the issue of $150,000,000 4 per cent convertible bonds of the American Telephone & Telegraph Company have been taken up by the firms of J. Pierpont Morgan & Company, Kuhn, Loeb & Company, Baring, Magoun & Company and Kidder, Peabody & Company, of Boston. These bonds were authorized at a special meeting of the stockholders on December 21, 1905, and are convertible into stock after two years and not more than twelve years from date of issue. The issue is made necessary to provide the company's treasury with funds to continue the policy of expanding and developing the telephone business. The company has been expending at the rate of about $25,000,000 a year for the extension of its service, and the development of its business, and this capital has been raised by increasing the capital stock, which, at the present rate, amounts to $155,661,800, upon which is paid a dividend of 7½ per cent a year.

AN ELECTRIC HOLDING COMPANY.—The Traction, Gas & Electric Finance Company, of New York City, was incorporated with the Secretary of the State at Albany last week. It is formed as a holding company and the capital stock is $500,000. The directors are John E. Borne, Cord Meyer, Stephen Peabody, Joseph B. Mayer and William F. Sheehan, of New York City. The corporation has the power to hold the stocks of gas, electric light and transit companies, and, it is said, has power to operate in every State of the Union. The Colonial Trust Company, of which Mr. Borne is president, has been associated with interests allied with the traction companies of Anthony N. Brady. Cord Meyer is chairman of the Democratic State Committee in addition to his banking affiliations.

MINNEAPOLIS GENERAL ELECTRIC, one of the properties under Stone & Webster management, showed for December, 1905, a gross of $77,804 and net profit of $25,360, while the twelve months gross was $724,581 and the net, $229,070. The construction charges during the year were no less than $1,367,359. This is due to the expenditure on the Taylor's Falls power that is now being developed at a total cost of about $3,000,000. The water power at Taylor's Falls which the company is developing will cost approximately $3,000,000. To provide money for this purpose the old five per cent first mortgage bonds were called under date of May 1, and a contract made for the sale of new five per cent bonds sufficient in amount to take up the old bonds and pay for the water power development.

DIVIDENDS.—The Rochester Railway & Light Company's directors have declared the regular quarterly dividend of 1 per cent on the preferred stock, payable March 1. The directors of the Niles-Bement-Pond Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable February 15, and a dividend of 1½ per cent on the common stock, payable March 20, and a dividend of 1½ per cent on the common, payable June 20. The directors of the Pratt & Whitney Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable February 15.

CUYAHOGA TELEPHONE ANNUAL.—The Cuyahoga Telephone Company, of Cleveland, O., has issued its annual report for the year ended December 31, 1905. The income account compares as follows:

	1905.	1904.	1903.	1902.
Gross	$587,487	$435,274	$396,490	$385,852
Net	255,354	195,533	182,530	156,143
Charges, depreciation, etc.	159,459	128,400	129,259	155,600
Surplus	95,895	67,133	52,571	546
Preferred dividends and other deductions, etc.	64,880	55,977	8,027	......
Net surplus	31,932	10,991	44,544	543

THE NORTH AMERICAN COMPANY has come to take a prominent position of late years, through the steady appreciation of its properties in value. The Milwaukee Electric stock owns the Laclede Gas, Union Light, Heat & Power, United Railways, Detroit Edison and miscellaneous securities and have a book value of $29,916,744 and a market value of $36,273,944. There is outstanding $29,635,500 of North American stock, which gives a book value per share of $109.47 and a liquidating value of $130.93. The rate of dividends is now 6 per cent.

AMERICAN LIGHT & TRACTION.—All of the new issue of stock, aggregating 55,000 shares, of the American Light & Traction Company has been subscribed for by stockholders of record as of January 26. The right to subscribe expired February 6. The $5,500,000 derived from the sale of the stock is to be used as payment for the newly acquired property of the Detroit City Gas Company.

PITTSBURG BELL TELEPHONE.—The income account of the Central District Printing & Telegraph Company of Pittsburg for the year ended December 31, 1905, compares as follows:

	1905.	1904.	1903.
Gross	$3,372,292	$3,055,433	$2,733,926
Expenses	2,469,821	2,154,889	1,991,843
Net	902,471	900,544	742,083
Dividends	800,000	800,000	700,000
Surplus	102,471	100,544	42,083

WILKESBARRE FIGURES.—At the annual meeting of the Wilkesbarre Gas & Electric Company, held in Wilkesbarre, the old board of directors were re-elected. The financial statement for the year ending December 31 shows a gratifying growth, as follows:

	1905.	1904.
Gross	$297,595	$260,755
Net	156,152	118,832

PENNSYLVANIA TRACTION FINANCE.—Newburger Bros. & Henderson, E. C. Miller & Company and Bioren & Company have jointly purchased from the American Railway Company $1,100,000 Altoona & Logans Valley Electric Railway Company first mortgage tax free guaranteed 4½ per cent bonds, and have underwritten the issue to the stockholders at par, $1,174,650, of American Railways Company stock.

EDISON ELECTRIC OF BROCKTON.—The Edison Electric Illuminating Company, of Brockton, Mass., shows for 1905 gross earnings of $145,979 and a final net profit after interest charges, etc., of $34,158. This was an increase in the gross of $24,237 during the year and a decrease of $6,347 in the net. There was spent in construction in 1905 the sum of $27,331.

LOWELL ELECTRIC LIGHT CORPORATION, of Lowell, Mass., shows a total for 1905 of $254,935, operating expenses of $155,305 and a final net of $90,209. The gross had a gain over 1905 of $15,565 and the net of $5,069.

GALVESTON ELECTRIC shows for December a gross of $22,602, a gain of $2,380, and net, $8,541. The gross for eight months is $194,598, and increase of $12,692; net, $77,215, and a surplus over charges of $43,882.

GENERAL NEWS.

Construction Notes.

MONTGOMERY, ALA.—The Citizens' Light, Heat & Power Company will within the next 60 days let contracts for improvements, at a cost of $50,000.

GADSDEN, ALA.—The Alabama City, Gadsden & Attalia Railway Company is arranging for the construction of a mile of railway line. John D. Gaboury, manager.

HUNTSVILLE, ALA.—It is reported from Fayetteville and Shelbyville that, failing to get the Nashville & Huntsville Railroad, the people of these towns will undertake to raise the money for building an electric railway to Huntsville.

MOBILE, ALA.—Harry Pillans has deposited with the City Clerk a certified check for $5,000 as a token on the part of himself and associates to construct electric car lines over certain streets of Mobile, for which they have been voted a franchise.

HUNTSVILLE, ALA.—J. H. Conner, president of the Nashville & Huntsville Railway, has been in the city recently closing up a contract with T. W. Pratt and the Huntsville stockholders to build the line through this city and eventually to Birmingham and the coast.

BIRMINGHAM, ALA.—For some months J. M. Dewberry and associates have been securing franchises to build an electric railway for freight and passenger traffic from Gadsden, through the Birmingham district to the Warrior River at Tuskaloosa, there to connect with a line of boats and barges to Mobile. Many of the important franchises are in hand, including the cities of Birmingham, Pratt City, Ensley, Bessemer and Tuskaloosa. The line will consist of three divisions, viz.: the railroad division from Gadsden to Birmingham, the railroad division from Birmingham to Tuskaloosa, and the boat division from Tuskaloosa to Mobile.

GREEN FOREST, ARK.—John Odell has made application for an electric light and power franchise.

OZARK, ARK.—W. G. Bill and Whit. Martin have petitioned the Council for a franchise for an electric light plant.

YELLVILLE, ARK.—H. G. Umversagt, of Omaha, Neb., has secured the contract for constructing water works and an electric light plant at Yellville.

MENA, ARK.—The Mena Electric Light plant, Tomlinson Bros., proprietors, will install at once a new alternator and engine. R. A. Tomlinson is manager.

WYNNE, ARK.—The Wynne Light & Water Works contemplate installing an alternating-current dynamo and a Corliss engine. E. H. Demsey, superintendent.

SILOAM SPRINGS, ARK.—The City Council of Siloam Springs is considering the advisability of leasing its electric light and water works plants to a private individual for a term of years.

ROGERS, ARK.—The Rogers Electric Light Company is making arrangements to build an addition to its plant. Considerable new machinery will be installed, including a 200-hp boiler, a 75-kw generator, a 200-hp heater, alternating-current motors, etc.

STOCKTON, CAL.—An election will probably soon be held to vote on issuing $700,000 bonds for municipal improvements, including an electric light plant.

ALAMEDA, CAL.—At a recent meeting of the City Trustees, a petition was received from F. M. Greenwood, president of the Century Electric Company, of San Francisco, for a 50-year franchise to operate a steam road through the streets of Alameda. The information is given out, however, that the motive power to be used will in all probability be changed to electricity.

BISHOP, CAL.—Work is in progress on Owens River on behalf of the Mono Power Company and the Owens River Power Company. The Mono Company's object is to generate electricity for power and light in California, Nevada and adjacent States. The mining region east of the White Mountains is understood to be the objective territory of the power lines. W. H. Leffingwell, a civil engineer from Berkeley, is at present in charge of engineering parties for both companies. The company will divert water through a mile-long tunnel which will have a fall of about 450 feet, and impulse wheels will be used to generate 30,000 hp. Below this point will be the intake of the Owens River Company, the water being carried through a 250-foot tunnel and then across the river channel through another mile-and-a-half tunnel. The several tunnels will be 6 feet wide by 7 feet high, lined with concrete.

SAN FRANCISCO, CAL.—The Stanislaus Electric Power Company, through its California representatives, Beach Thompson and H. P. Veeder, has secured control by purchase of the Tuolumne County Water & Electric Power Company, and will incorporate the extensive system of this latter concern, it is understood, with the new $10,000,000 plant for which the entire bond issue was underwritten in the East during last December. It is stated that the consideration for this latest deal was something in excess of $500,000. The Tuolumne Company owned very extensive interests on the South Fork of the Stanislaus River and on the North Fork of the Tuolumne River, together with more than 180 miles of ditches which convey the water from the streams and after its utilization in generating power, distribute it throughout Tuolumne County for irrigation purposes. The Tuolumne County Water & Electric Power Company also owned six large and a number of small reservoirs, supplying the towns of Carters and Jamestown with water. It owned a 2,500-hp hydro-electric plant near Phoenix Lake, about six miles from Sonora, together with an extensive transmission system, which supplies the mines throughout Tuolumne County with power as well as with water. It is stated that during the approaching summer the new owners intend to make extensive additions and repairs to the existing system, especially in the line of building additional reservoirs and in a general improvement and perfection of the system. The company will be operated as an adjunct of the Stanislaus Electric Power Company, which has already commenced work on its 20,000-kw plant on the middle fork of the Stanislaus River. The Union Construction Company, controlled by Sanderson & Porter, the Stanislaus Electric Power Company's engineers, will construct the entire plant. This concern is establishing headquarters at Vallecito, Calaveras County, about eight miles from the power site. Engineer Wm. R. King will be resident manager at Vallecito. The construction of about 60 miles of roads will be commenced at once to facilitate work on the project. A saw-mill with a daily capacity of 50,000 feet is being installed near the headworks in Tuolumne County.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Lighting Company expects to change to a 60-cycle three-phase system this spring.

BRIDGEPORT, CONN.—It is reported that the Bryant Electrical Company will soon start work on another extension to its factory on State Street. The proposed building is to be erected on Hancock Avenue, and will be about 150 feet long and four stories high.

BRIDGEPORT, CONN.—Architect Warren R. Briggs has prepared plans for the proposed addition to be built on to the plant of the United Illuminating Company, on Congress Street, where the piles are now being driven for the foundations. It will be 30 x 40 feet, of brick, one story high, with tin roof. The contract has not been let as yet.

HARTFORD, CONN.—The Hartford Street Railway Company will build within two months a large addition to its present power plant. It will be constructed of iron and red brick, 70 x 23 ft. The roof will be corrugated iron. The plans for this structure were drawn by Norman McD. Crawford, former manager of the company. The contract has been given to the Berlin Construction Company.

NORWICH, CONN.—The National Construction Equipment Company, of 42 Broadway, New York, has the contract for the construction and equipment of the Norwich & Westerly Railway and is awarding orders for the apparatus. The power station will contain three 400-kw units and will be located about 4½ miles from the Norwich terminus. The line is 22 miles in length and about 10 miles have already been graded. It will be completed, it is thought, by July 1, 1906.

WILMINGTON, DEL.—Plans for the new building of the Atlantic Telegraph & Telephone Company have been submitted to the building department.

COCHRAN, GA.—The date of opening of bids for water tower, fire pump, boiler, generator, and engine, for water and light plant, has been extended from February 6 to February 20. W. B. Denham is city clerk. Arthur Pew, of Atlanta, is engineer.

MILLEDGEVILLE, GA.—The Oconee Electric Light & Power Company hopes to commence construction this spring of a 6,000-kw plant driven by four 42-in. water wheels. The plant will be located four miles north of this city. The company has no machinery whatever as yet. Charles F. Howe is manager.

COLUMBUS, GA.—The Southern Bell Telephone Company is preparing to do a good deal of important and expensive work in this city. It will in the near future begin the erection of a new exchange on the lot on Second Avenue and 12th Street, purchased some time ago. In the meantime the work of laying new conduits in the streets for underground wires is being pushed.

MARENGO, ILL.—The city electric light and water works may be overhauled this spring. T. T. Parkhurst, superintendent.

HIGHLAND, ILL.—A new boiler of large capacity will be installed in the municipal lighting plant before long. Fred Wiess, manager.

PERU, ILL.—The city expects to install larger engines and dynamos in the city electric light plant very soon. John J. Mueller, superintendent.

ODELL, ILL.—The Odell Electric Company expects to install another large boiler this season. Theo. Trecker, manager.

WINDSOR, ILL.—The City Council has granted to Thomas Lefforge, of this city, a franchise for an electric light plant.

MORRISONVILLE, ILL.—The Morrisonville Electric Company is considering building a new station complete. Charles E. Kester, Hillsboro, Ill., is superintendent.

TRENTON, ILL.—A 40-kw direct-connected unit will be installed in the spring in the city electric light plant, and a water works system may be put in also. J. L. Wilson, manager.

MOUND CITY, ILL.—The Mound City Water, Light, Power, Heat & Mfg. Company expects to install a new boiler plant and also a new engine in a year or so. A. J. Dougherty, manager.

CHICAGO, ILL.—The Rockford, Beloit & Janesville (Wis.) Electric Interurban Line has been sold by John Farson, of Chicago, to the Rockford Street & Interurban Railway Company.

ATLANTA, ILL.—The Atlanta Electric Light & Power Company is making arrangements to install six new 1200-cp enclosed arc lamps and will probably use 300 pounds of copper wire this spring. J. C. Robinson, manager.

SPRINGFIELD, ILL.—The Springfield Consolidated Railway Company has filed a certificate of increase of capital stock from $750,000 to $900,000 to provide for improvements.

CHICAGO, ILL.—Bids will be received until April 4 by the Board of Trustees, Sanitary District, Chicago, for furnishing transmission line poles along the right of way of the said district to the city of Chicago.

LOVINGTON, ILL.—The Lovington Electric Light & Power Company expects to extend its main lines several blocks in different parts of the city and also contemplates lighting the city with enclosed arc lamps. G. W. Bryant, superintendent.

MONMOUTH, ILL.—O. G. F. Marcus, representative of the Mainland syndicate which owns the Monmouth Gas & Electric Company's plants and franchises, is here arranging the details relative to the beginning of work on the new electric plant.

FULTON, ILL.—The Fulton Electric Light & Power Company expects to change its lighting system from open arcs to enclosed arcs and will substitute alternating current for direct current. The old arc machines will be discarded and alternators installed. D. Gallagher is manager of the company.

DUQUOIN, ILL.—The City Council has granted a franchise for an electric light and power plant to Dr. T. B. Reagin and James Forester, who will construct an independent system here. Work on the plant will begin at once. It is thought that St. Louis capitalists are interested in the project, it being spoken of in connection with a proposed electric railway to connect this city with surrounding towns and carry coal from the mines.

JOLIET, ILL.—Included in the plans of the Joliet & Southern Traction Company for building a system of electric railways to radiate from Joliet as a center, is an interurban terminal station to be located at Joliet. The company is now before the City Council asking for a franchise granting independent entrance to the center of the city from all directions which embraces about six miles of tracks on prominent unoccupied streets. Active work all along the line will be commenced as soon as the weather will permit in the spring and pushed to completion as rapidly as possible. The Joliet, Plainfield & Aurora Railroad is owned by those promoting the new company and may become a part of the system. In any event, it will be operated in harmony with the Joliet & Southern.

CHICKASHA, I. T.—The electric light franchise held by Judge Holmes and associates has been extended for a period of 10 years. It is reported that extensive improvements will be made to the plant.

VINITA, I. T.—The Vinita Electric Light, Ice & Power Company expects shortly to install 31 alternating-current series arc lamps for lighting the streets. C. E. Lahman, manager and superintendent.

CONNERSVILLE, IND.—The Bell Telephone Company, of this city, has arranged to rebuild its local plant and will increase its capacity to 1,000 telephones.

EAST CHICAGO, IND.—C. S. Kirk, agent for the receiver of the East Chicago Water & Light Company, writes that the entire plant may be rebuilt the coming season.

SPENCER, IND.—The Spencer Electric Light Company is making arrangements for a renewal of its poles and will change from open to enclosed arc lamps. William S. Mead, manager.

MONTICELLO, IND.—Monticello has been surveyed for a street car line connecting the public square with both depots and extending to the suburbs, including East Monticello, Tioga and Norway.

ROCKVILLE, IND.—In the fall the town expects to install a larger alternator in the electric light plant, and will change the street lighting system from direct-current to alternating current. E. G. Lanning, superintendent.

INDIANAPOLIS, IND.—The Indianapolis Light & Power Company has decided to change its conduits on Kentucky Avenue in order to accommodate the track elevation west of the Union Station; the work will probably cost $23,547.

FORT WAYNE, IND.—An extension of the Wabash Valley Traction Company's line will be made along the old Wabash & Erie Canal towpath, agents having secured the right-of-way from this city to Toledo. The route will connect at Toledo with a number of Ohio systems, opening up a direct line from Detroit to Indianapolis.

CRESTON, IA.—Fire destroyed the electric light plant of Jones & Hovey. The loss is estimated at $12,000.

INDIANOLA, IA.—The citizens have voted to grant a 25-year franchise for the railway projected from Des Moines to Indianola.

LOGAN, IA.—The Logan Electric Light Company has transferred its electric light plant and the milling property on the banks of the Boyer to J. A. Felthouse, of St. Paul.

SEYMOUR, IA.—The circuits of the town lighting plant will be increased in the near future by the addition of 15 Nernst lamps. Frank Kellogg is manager and superintendent.

DECORAH, IA.—The Decorah Electric Light Company has in contemplation a water power development with which to operate its Decorah and Waukon (Ia.) plants. W. H. Bertis, manager and superintendent.

CHARLES CITY, IA.—E. S. Marrenner is reported to have purchased the water power plant here, and will construct a new concrete dam and install an electric plant which will supply both day and night service.

DAVENPORT, IA.—The People's Light Company is reported to have voted additional stock to the amount of $100,000, most of which, it is said, will be used for improvements during the coming year. Fred. W. Kelley is manager.

DES MOINES, IA.—The promoters of the new interurban road to connect Valley Junction with this city are now at work with the railway committee of the City Council of Des Moines, framing a franchise to be submitted to the voters of the city at the spring election to be held March 27.

WINTERSET, IA.—The promoters of the Des Moines, Winterset & Creston Railway Company secured the signatures of the requisite number of property owners to a petition asking the City Council to submit the proposition of voting a franchise at an election to be held some time in March. There is considerable opposition to granting the franchise asked because it is an exclusive one for a period of 25 years and will give the company the right to use any and all of the streets of Winterset during said period, when in fact they will only need a few. The franchise may be defeated on account of those two features.

HIGHLAND, KAN.—L. Bender has asked for a franchise for an electric light plant here.

SALINA, KAN.—E. S. Alnut, of Pueblo, Col., has been granted a franchise for an interurban street railway here, to be completed within one year.

WELLINGTON, KAN.—M. H. Kirk, superintendent of the city electric light plant, writes that it will soon be necessary to increase the capacity of the plant.

COTTONWOOD FALLS, KAN.—The City Council of Cottonwood Falls has granted a franchise to the Consolidated Company to build a street railway system.

ALMA, KAN.—The Alma Light & Power Company will extend its lines in the spring and will install incandescent street lamps for the town. W. B. Wilson, manager.

BAXTER SPRINGS, KAN.—Various improvements will be made in the near future in the plant of the Baxter Electric Company. C. A. Childs has again resumed the management of the plant.

HUTCHINSON, KAN.—The Hutchinson City Council has called an election to vote $20,000 bonds to the Hutchinson Interurban Railway Company, to build 8 miles of track in that city.

HORTON, KAN.—The Horton Water & Light Company is contemplating an all-night service; will add another generator and establish a meter system. A. Westeen is manager and superintendent.

BELLEVILLE, KAN.—John B. Peach, city clerk, writes that an election will be held April 3 to vote on issuing bonds for an electric light plant, to cost from $18,000 to $20,000. W. K. Palmer, of Kansas City, Mo., is the engineer.

COUNCIL GROVE, KAN.—The Council Grove Electric Light & Power Company may change its city lighting schedule to an all-night moonlight basis, in which case the street lighting system will be changed from direct-current series to series alternating, and a 90-kw, 60-cycle alternator will take the place of the present 125-cycle machine. An extra 90-kw alternator and one 100-hp engine will also be installed. John H. Packer, Council Grove, Kan., is general manager.

COFFEYVILLE, KAN.—We are informed by Mr. E. L. Rossiter, municipal light commissioner of Coffeyville, Kan., that the plant has been completely changed. It now comprises two Hamilton-Corliss engines and two Westinghouse alternators, two phase, 60 cycle, 2,300 volts, 200 kw each; three high-pressure Kewanee boilers. As soon as weather permits about ten miles of new line will be built in the suburbs of the city. The change to the new system was made by Mr. Rossiter and his assistant, Mr. P. G. Walker, without a shut down, except one day while changing the transformers from 1,100 to 2,300 volts on the primary.

PITTSBURGH, KAN.—W. T. Osborn & Co., of Kansas City, Mo., are installing the plant for the Home Light, Heat & Power Company, of Pittsburgh. The installation is as follows: one 300-kw, three-phase, 60-cycle, revolving-field, 2,300-volt, 100-revolution alternating-current generator, connected to simple Corliss engine, also one 150-kw belted unit, three-phase, 60-cycle, 600-revolution revolving field, one 50-hp motor-generator set; arc system of 150 arc light capacity of the Hartford system for street lighting, switchboard, etc. The generating plant as specified is manufactured by the General Electric Company.

HOPKINSVILLE, KY.—The State Senate is reported to have passed a bill, appropriating $35,000 for a new laundry, lighting plant and other improvements for the Western Asylum in Hopkinsville.

PIKEVILLE, KY.—The Pikeville Electric Light Company will extend its lines and reinforce the present circuit by dividing it and using heavier copper. It will also operate a direct-current day circuit this summer. Address A. S. Reese, superintendent.

CENTRAL CITY, KY.—The Central City Light & Power Company expects to double the capacity of its plant this spring. Efforts are being made to secure franchises to light other towns, which will necessitate a still further increase in equipment in case the franchises are granted. R. B. Culbertson is manager and superintendent.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company, Inc., will install some time after March either a direct-current or an alternating-current dynamo and engine to operate the same, and a new 100 or 150-hp high-pressure boiler. The wiring sets will also be changed. H. B. McElroy, superintendent and manager.

OPELOUSAS, LA.—A. C. Jones, superintendent of the municipal electric light and water works, writes that it will probably be necessary next fall to install a 300-kw alternator, engine and boilers, although it is possible that it may be decided to install a 300-kw turbine and change the plant to a 60-cycle plant.

LAFAYETTE, LA.—Mr. C. J. Miller, superintendent of the city waterworks and electric light plant, informs us that the city is to vote on a $100,000 bond issue. If it goes through, the following improvements will probably be made: a series arc alternating-current system will be installed, including engine and generator, a 150-hp boiler, and the electric light mains extended. About 75 direct-current motors will also be installed.

BANGOR, ME.—The Bangor Railway & Electric Company contemplates building a new concrete dam at the Veazie power station. J. W. Cartwright is purchasing agent.

FREYBURG, ME.—The Freyburg Electric Light Company is considering the development of a new water power of from 200 to 600 hp, and will make extensions to its lines. C. E. Harris, purchasing agent.

MILO, ME.—At the annual meeting of the stockholders of the Milo Electric Light & Power Company it was decided to build a large brick power station on the site now occupied by C. W. Pierce's saw mill early next spring. Water power will be used to run the generator, but steam will also be installed to be used during periods of low water.

ELKTON, MD.—Bids will be received until March 1 by the Town Commissioners for lighting the streets of the town.

SALISBURY, MD.—The Salisbury Light, Heat & Power Company contemplates increasing its equipment by the addition of two 75-kw, 125-volt, direct-connected dynamos. Address R. B. Rhodes, manager and superintendent.

HAVRE DE GRACE, MD.—The Havre de Grace Electric Company contemplates installing another unit shortly, consisting of a 150-kw generator, direct-connected to a 225-hp engine. Wesley W. Reynolds, purchasing agent.

TOWSON, MD.—The Chesapeake & Potomac Telephone Company has obtained permits from the Highway Commissioners at Towson, to extend the telephone lines to Freeland and Maryland Line, and along the North Road, west from Reisterstown turnpike, in the Fourth district, near Owings Mills.

QUEEN ANNE, MD.—E. W. Maloney, a representative of a Philadelphia company, is said to be here with a view to constructing an electric light plant to furnish light and power to Queen Anne, Hillsboro, Denton, Greensboro, Ridgely, Centreville and possibly Easton. The power for the system will be generated at Tuckahoe River, it is said.

YARMOUTH, MASS.—The Electric Light Company have made a proposition to install a plant.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company contemplates increasing its engine capacity. G. W. Lawrence is superintendent.

HUNTINGTON, MASS.—The Huntington Electric Light Company expects shortly to make provision for supplying electricity, as more street lamps will be installed by the town in the spring. E. E. Stanton, superintendent.

MIDDLEBORO, MASS.—The power equipment of the Middleboro gas and electric plant will be increased for the addition of another generator for the supply of a day circuit. Geo. A. Philbrook is manager and superintendent.

WALTHAM, MASS.—The Waltham Gas Light Company is erecting a new power house in which will be installed two 500-kw Parsons turbo-generators and one 400-kw direct-connected engine and generator of Crocker-Wheeler make. C. F. Spaulding, superintendent.

ROBINSONVILLE, MASS.—J. F. Sturdy's Sons, owners of the factories at Robinsonville, have decided to install an electric plant to operate the machinery in the three buildings before April 1. They will also install about a dozen motors in various parts of the buildings.

LEOMINSTER, MASS.—Leominster Electric Light & Power Company contemplates a complete overhauling of its outside lines and the station piping system. A new unit will be installed in the station and new arc and incandescent lamps will be put in throughout the town. L. W. Collins, superintendent.

STOW, MASS.—At the special town meeting it was voted to adopt chapter 143 of the Acts of 1898, which gives the town of Hudson the right to furnish the town of Stow with electricity for light, heating and power, and it was voted that the town appropriate the sum of $800 for contingent expenses.

NORTH ATTLEBORO, MASS.—There is a movement on foot among several of the local manufacturers of the town to have an article inserted in the annual town warrant this spring asking for a permit to allow the Attleboro Electric Company to run wires to this town and furnish power between the hours of 6 A. M. and 7 P. M., or later, if they so desire, for the factories.

NORTH ADAMS, MASS.—The petition of the North Adams Gas & Electric Light Company, to make and sell electricity for heat, light and power for towns including Monroe, Florida and Savoy, has been favorably considered by the Legislature. The bill provides that the consent of the selectmen of the towns in question shall be obtained and the company is subject to all duties and liabilities of the statutes.

HART, MICH.—The Pere Marquette Light & Power Company contemplates rebuilding its plant in order to furnish light to Hart, Shelby and Pentwater. M. D. Girard, Pentwater, Mich., is manager.

YPSILANTI, MICH.—The Council has requested the Board of Public Works to investigate the cost and feasibility of the city's going into the business of commercial lighting. The city owns its lighting plant, which is very economically conducted.

ORION, MICH.—The Lake Orion Power & Improvement Company, which succeeded the Orion Light & Power Company, is preparing to increase its power in order to supply electricity for lighting other villages. J. G. Krieg, Detroit, Mich., manager.

HOLLY, MICH.—Because of the announcement that the Ionia-Owosso line will be continued through to Pontiac, an effort is now being made to induce the company to locate its power house at Holly, a central location into which are operated two railroads.

BENTON HARBOR, MICH.—Benton Harbor will soon be equipped with underground conduits. The company is preparing estimates of the cost and of the material needed and will be ready in a short time to complete its arrangements for beginning the work.

OWOSSO, MICH.—The city has been asked for a franchise by the Saginaw Bay & Southwestern Electric Company. The line is to be in operation within two years, from Bay City to Owosso. George Emerick, of Saginaw, is the chief promoter of the enterprise.

DETROIT, MICH.—The Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company has recently issued $600,000 bonds to cover the cost of building a two-mile branch to the village of Dexter, and other improvements to be made on the main line. Work will be commenced on the Dexter branch as soon as spring opens.

ALMA, MICH.—A delegation of forty citizens of Crystal met the citizens of Alma for the exchange of ideas on the electric railway project. A committee was appointed to confer with the officers of the Detroit United Railway Company and ascertain what requirements were expected of the citizens along the line.

LANSING, MICH.—The Michigan Power Company has been organized with a capital of $2,500,000, to develop water power along Grand River. It will also take over the property of the Piatt Heating Company, of Lansing. It is reported that a central heating plant will be constructed during the coming year to replace the present one. F. B. Piatt and C. C. Carnahan are among the directors.

BENTON HARBOR, MICH.—Besides the lines already under construction, the Benton Harbor & St. Joseph Electric Railroad & Light Company, the recently consolidated concern, has in contemplation a road to Kalamazoo, the construction of which will probably be undertaken later in the season. Power is expected to be delivered from Buchanan this month. With its installation the rates for light and power will be reduced and better service will be given.

KALAMAZOO, MICH.—The City Council has been asked by the Kalamazoo, Elkhart & South Bend Traction Company for a franchise in the city. The proposed railroad is being promoted by Chicago, South Bend and Elkhart people, of whom John M. Caulfield, of South Bend, is the representative. The right of way through the country districts has been nearly all secured and franchises have been granted in several towns. The company asks the right to use the tracks of the Michigan Traction Company. It is agreed to have the road in operation in three years. A later dispatch states that the franchise has been granted.

NILES, MICH.—Condemnation proceedings have been brought by the South Bend & Southern Michigan Interurban Railway Company against farmers who are not willing to sell right of way at a reasonable figure. The company expects to have the line completed to St. Joseph by May 1. A sub-station is in course of construction here for the transmission of power to either the South Bend or Harrison Springs lines, and within a few days the company's 4000-hp engine at Scotdale will be started, high-tension wires having been just completed from that point to Niles for the transmission of the power.

APPLETON, MINN.—A 24-hour service may be established in the spring at the Appleton electric light and water works municipal plant. John Grady is superintendent.

MADISON, MINN.—It is possible that storage batteries will be installed in the city electric light plant for furnishing day service. J. C. Bang, manager and superintendent.

EVELETH, MINN.—The Eveleth Electric Company expects to construct about two miles of street lines this spring, also additional lines for residence service, etc. S. S. Hough, purchasing agent.

BUTTE, MONT.—The Phoenix Electric Company expects shortly to add 400 hp to its boiler equipment during the coming summer. J. E. Davidson, superintendent.

HELENA, MONT.—Contracts have been let by the Washoe Company, at Helena, for four of the largest induction motors ever installed in the West, and by July 15 of this year, the mammoth 10,000-ton concentrator of the Washoe Smelter, at Anaconda, will be running with power supplied by the two plants of the Helena Power Transmission Company on the Missouri

River near Helena, a distance of nearly 100 miles from Anaconda. The placing of the order for this electrical equipment marks the beginning of the completion of improvements involving about $750,000. A second dam is being built across the Missouri River, near Helena. The waters will be backed up by the dam and form a lake near the capital city, several miles in width. The waters of the lake will approach within eight miles of the city proper, whereas they are now more than 12 miles distant. Power will be transmitted to Anaconda, nearly 100 miles away, at 70,000 volts.

UNIVERSITY, MISS.—It is expected to install new machinery throughout in the University light plant. E. Campbell is superintendent of the plant.

SARDIS, MISS.—The Panola Electric Light & Power Company expects soon to secure the contract for lighting the streets of Sardis. The company also supplies light to Batesville and Como. Odie Owen is manager.

CLARKSDALE, MISS.—The Department of Light & Water expects within the next six months to extend the lines of the Clarksdale water and light plant to Riverton, Miss., about half a mile distant. Within a year it expects to furnish light to Lyons, 3 miles east. It is likely that another 150-hp boiler will be installed before next winter. Jos. E. Craig is superintendent.

HATTIESBURG, MISS.—The charter of the Hattiesburg & Rawls Springs Railroad Company has been forwarded to Jackson for the approval of the governor. The purpose of the company is to build an electric railway from this city to Rawls Springs and Mammoth Springs, two health resorts situated north of here, a distance of six miles. Among the incorporators are J. R. S. Pitts, J. P. Featherbee and B. F. Ballard.

OKOLONA, MISS.—The city electric light plant (municipal) expects to install a 45 kw, 60-cycle, single-phase alternating-current dynamo of Bullock make, a 11 x 12 Lycoming engine, a new switchboard and a new series alternating-current arc system of Jandus make. The plant will furnish all-night service and possibly a day fan circuit, and the establishment of a meter system is under consideration. The multiple alternating-current arcs will be discarded. Address A. Ortgier, manager and superintendent.

PINEVILLE, MO.—O. O. Hargrove will install an electric light plant in connection with his flour mill.

PIERCE CITY, MO.—A new engine and dynamo will be installed in the city electric light plant in the spring.

NEOSHO, MO.—The Neosho Electric Light Company contemplates duplicating its present equipment in the spring. R. B. Rudy, manager.

HOLDEN, MO.—The municipal electric light plant will probably be thoroughly overhauled and enlarged in the spring. S. P. Piper, superintendent.

JEFFERSON CITY, MO.—Plans are being prepared for a new central light, heat and power plant for the Penitentiary. The new plant, if constructed, will cost about $200,000, but will have to be authorized by an act of the State Legislature.

SEDALIA, MO.—A consolidation is said to be pending, which will merge the Sedalia Electric Light & Power Company, the electric traction company and the water works company. G. M. Moran is manager and superintendent of the Sedalia Electric Light & Power Company.

WYMORE, NEB.—Frank M. Smith has been granted a franchise for an independent telephone system.

SUPERIOR, NEB.—The Superior Electric Light Company expects soon to add a power circuit to its service and will install a new dynamo to provide for the same. Walter M. Lee manager.

GRAND ISLAND, NEB.—It is stated that an election will be held March 6 to vote on an issue of $35,000 bonds for the construction of an electric light plant. W. K. Palmer, of Kansas City, Mo., is engineer in charge of the work.

KEARNEY, NEB.—The Northwestern Electric Heat & Power Company contemplates installing considerable new equipment, including new boilers, an additional Corliss engine and an alternating-current dynamo. S. J. Duncan is superintendent of the plant.

NEW BOSTON, N. H.—Allen P. Wilson, proprietor of the electric light plant here, expects to change from water to steam power shortly.

NASHUA, N. H.—It is reported that the Nashua Manufacturing Company proposes to use the power at Runnell's bridge to generate electricity for operating part of the machinery in its plant in the city proper. At Runnell's bridge is the third dam on the Nashua River proceeding up from the mouth of that stream.

WEST ORANGE, N. J.—Press reports state that bids will be received by the Town Council until March 6 for lighting the city by electricity on a 1 and 5 year contract.

TRENTON, N. J.—Ordinances have been introduced in the Council by the Trenton, Hamilton & Ewing Traction Company, asking for authority to extend the tracks of the Trenton Street Railway from West State Street to the Ewing Township boundary.

TRENTON, N. J.—The lowest bid opened on February 6 for lighting the streets and public places by electricity was submitted by the Public Service Corporation of Trenton. It bid for 400 arc lamps of 2,000 cp, on a 3-year contract, $92.77 per lamp per year, and for 5 years, $85 per lamp.

CORINTH, N. Y.—The Corinth Electric Light Company expects to install a 300-kw, 60-cycle, three-phase alternator in the spring. J. Merit Smith, superintendent.

SHERMAN, N. Y.—The Sherman Electric Light Company will install at once 20 additional 16-cp incandescent street lights. Address E. E. Penke, superintendent.

SYRACUSE, N. Y.—The Syracuse Lighting Company will install another 1,500-kw turbine by August 1, 1906, with necessary boilers, etc. E. B. Doen, superintendent.

GENESEO, N. Y.—The Geneseo Gas Light Company expects to increase its equipment by the addition of a new alternator of larger capacity. Alex. Wynes, Jr., manager and superintendent.

GLOVERSVILLE, N. Y.—Bryce E. Morrow, of Albany, representing the Hudson River Electric Power Company, has petitioned for a franchise to furnish light and power in Gloversville.

ALBANY, N. Y.—The Union Traction Company has changed its name to that of Batavia, Medina & Ontario Railway Company. It will construct an electric street railway from Batavia north through Genesee County.

HOOSICK FALLS, N. Y.—The Hoosick Falls Illuminating Company expects to increase the size of its steam plant in the near future and will add 200 kilowatts to the generator capacity. E. E. Larrabee, manager and purchasing agent.

SYRACUSE, N. Y.—Attorney E. Nottingham, representing the capitalists who own the Rochester, Syracuse & Eastern, the Auburn & Syracuse and the Lake Shore & Northern Railways, has bought the Fulton & Oswego Falls Railway for $3,000.

ALBANY, N. Y.—The Board of Contract and Supply is reported to have awarded the contract for lighting the city by electricity for a term of 5 years, beginning June 21, to the Municipal Gas Company, at 27 cents per lamp per day or $98.55 per lamp per year, which includes repairs, cleaning and replacing broken globes.

OXFORD, N. C.—The Oxford Motor & Electric Company states that its business is rapidly increasing and the prospects are good for a much greater motor service. J. A. Niles, superintendent.

LILESVILLE, N. C.—Hugh McRae and associates have purchased the Bluitt Falls, located 12 miles from Lilesville on Pee Dee River, and will develop the same for electrical purposes, the power to be transmitted to Rockingham, Laurinburg, Florence, McColls, Darlington, and other places. Lockwood, Greene & Co., of Boston, Mass., are the engineers.

MINOT, N. D.—The Minot Roller Mills will install an electric light plant.

WILLISTON, N. D.—The citizens have voted to issue $27,000 water and lighting bonds.

FAIRMOUNT, N. D.—Mr. Dennstedt is reported to have decided to construct an electric light plant.

ELYRIA, OHIO.—The Dean Electric Company is contemplating installing another large gas engine unit. A. E. Barker, manager.

PAINESVILLE, OHIO.—J. R. Curtiss has petitioned the Council for a franchise to furnish the city with electric light, heat and power.

CALEDONIA, OHIO.—The C. D. Resler Electric Light & Power Company is talking of doubling its plant equipment. G. W. Thuro, manager.

McCONNELLSVILLE, OHIO.—The McConnellsville-Malta Electric Company contemplates a general reconstruction of its arc system. A. Durbin, secretary.

CLEVELAND, OHIO.—The municipal electric light plant will install 200 arc lamps within the next thirty days. C. V. Smith, 317 City Hall, superintendent.

BUCYRUS, OHIO.—The Columbus, Delaware & Marion Railway is making preparations to commence work on its Bucyrus extension as soon as the weather permits.

FOSTORIA, OHIO.—The City Heat & Light Company is considering making the necessary changes in its plant to enable it to establish a day circuit. J. J. Cramer is manager.

GEORGETOWN, OHIO.—An election held in this city for issuing $15,000 bonds for a municipal electric lighting plant resulted in a majority of 245 in favor of the issue.

COLUMBUS, OHIO.—The Columbus & Miami Valley Railway Company, which was recently incorporated, proposes to build an electric railway from Columbus to Xenia, with a branch to Oregonia.

BARBERTON, OHIO.—The Barberton, Wadsworth & Western Traction Company has applied for a franchise in Barberton. Some time ago a franchise was refused and now a new proposition is being made.

JEFFERSON, OHIO.—G. H. Bacon and Henry Orth, of Rock Creek, who are promoting an electric railway from Jefferson to Chardon by way of Rock Creek, are making arrangements with Pittsburg capitalists to finance the project.

COLUMBUS, OHIO.—The Columbus Railway & Light Company is planning to double-track its line to the State Hospital and may build a single-track line to a point two miles beyond. Property owners are anxious to have the extensions made.

DELTA, OHIO.—The Delta Electric Light Company expects to add either hot water heating or exhaust steam and a water works system, possibly both; also extend its lighting service to a town of about 1,000 people, 6 miles distant. J. T. Hamilton, superintendent.

OBERLIN, OHIO.—The Council has repealed the franchise granted to the Oberlin-Lorain Traction Company, a projected road, as it was claimed that the grant was made illegally. A new franchise will be asked for and the promoters claim that the road will be built.

TOLEDO, OHIO. The Toledo & Columbus Traction Company is securing right of way and making surveys for its proposed line from Bucyrus to Tiffin and Fremont. D. H. James, D. T. Davies, Jr., G. D. Everett and others of Toledo are at the head of the company.

CLEVELAND, OHIO. Sealed proposals will be received at the office of the secretary of the Board of Public Service, 105 City Hall, until February 21, 1906, for an electric light and power plant for the City Hall Building, and for arc lamps, wire and accessories needed for the extension of the Cleveland municipal lighting plant.

STEUBENVILLE, OHIO.—The Belmont County Commissioners have granted a franchise to the Steubenville & Wheeling Traction Company for an extension of its line south from Brilliant to connect a line to Wheeling, thus making a through line on the Ohio side from Steubenville to Wheeling. The line will be built this year.

CLEVELAND, OHIO.—The recent failure of Dennison, Prior & Co., local bankers, will probably put a quietus on the building, for the present at least, of the Missouri Valley line, from Kansas City to St. Joseph. This company was the chief promoter of the project and had arranged for the financing of the scheme with Cleveland bankers.

COLUMBUS, OHIO.—The dates for the sales of the Appleyard properties have been changed and are now as follows: February 19, for the Dayton, Springfield & Urbana Railway and the Columbus, London & Springfield Railway; February 20, for the Central Market Street Railway and the Columbus, Grove City & Southwestern; and on or about February 24 for the Urbana, Bellefontaine & Northern Railway.

FOSTORIA, OHIO.—The Toledo, Fostoria & Findlay Railway, which recently completed an extension from Fostoria to Pemberville, is now rebuilding its old line from Findlay to Fostoria in order to quicken the schedules. This year a line is to be built from Fostoria to Fremont and this portion and the main line will then be in the direct route for through high-speed service between Cleveland, Dayton and Indianapolis.

SPRINGFIELD, OHIO.—E. W. Christy, of Cleveland, who, with associates, recently purchased the Springfield, Charleston, Washington C. H. & Chillicothe Traction Company has made arrangements with the Springfield, Troy & Piqua Traction Company to supply the road with power until it can build its own station. A power house and car shops will probably be erected at Washington C. H., to which point the road will be extended the coming summer.

CANAL DOVER, OHIO.—The local sub-station and car house of the Canton & New Philadelphia Railway were destroyed by fire February 5. Several cars and most of the sub-station machinery were destroyed. The loss will exceed $75,000, and is fully covered by insurance. It is probable that the barns will be rebuilt at New Philadelphia. The schedule was restored in a short time, part of the power being supplied by the station of the Tuscarawas Traction Company, near New Philadelphia.

CLEVELAND, OHIO.—The Youngstown & Ohio River Railway Company, which is being promoted by well-known Cleveland people, has organized with the following officers: George Stanley, president; Warren Bicknell, vice-president; Max P. Goodwin, secretary; Charles Thrasher, general manager, all of Cleveland. The line will extend from Youngstown to East Liverpool, a distance of 55 miles, and the investment will amount to about $1,500,000. The Cleveland Construction Company is contracting engineer for the work, which involves some interesting engineering problems.

TOLEDO, OHIO.—The Ottawa Beach & Southern Railway, a new interurban company which is backed by the Toledo Railways & Light Company, has just secured considerable right of way by condemnation proceedings which will enable it to start work in the spring. The road will be an extension of the Toledo & Point Place line and will reach a number of summer resorts on the lake shore north of Toledo. There is talk that the line may eventually be extended to connect with the Detroit United Railway's line at Trenton, thus forming a new line from Toledo to Detroit, owned by the Everett-Moore syndicate.

CLEVELAND, OHIO.—President E. W. Moore, of the Lake Shore Electric Railway, announces that steps will be taken immediately to double track the main line between Cleveland and Avon, at which point the Avon Beach & Southern division branches off to Elyria. Late in the year it is possible that the double track may be extended to Lorain. The company is installing a 2,000-kw unit in its Avon power station. It is quite probable that the company will decide to build a line from Sandusky to connect with its main line at Clyde, thus forming a short route between Sandusky and Toledo and opening up a new undeveloped territory.

CLEVELAND, OHIO.—The Northern Ohio Traction & Light Company has placed a contract with the Cleveland Construction Company, of this city, for the building of an extension of its Barberton division to Wadsworth and Seville, a distance of about 18 miles. The line will connect with the southern division of the Cleveland & Southwestern, giving Akron a new outlet to the South, and it will open up several small villages which have been comparatively isolated. Engineering work for the line is now in progress and construction work will start in the spring. One or two sub-stations will be erected and power will be supplied from the main station at Akron. The extension will cost about $400,000.

PERRY, OKLA.—The citizens have voted to issue $25,000 bonds, for water works and an electric light plant.

ENID, OKLA.—Guy Morrison Walker, of New York, who is interested in the Pittsburg, Kan., utilities, is said to have written the Mayor of Enid stating that he will visit the city soon and make a proposition for building an electric railway here.

PORTLAND, ORE.—The Pacific States Telephone & Telegraph Company plans to spend about half a million dollars in the improvement and betterment of its system in Portland. The improvements will include three new stations on the East Side, the installation of a block system of wiring and a central-energy system.

NEW CASTLE, PA.—This city is preparing to place all municipal wires underground.

PATTON, PA.—The George S. Good Electric Light Company is contemplating an extension of its motor business. Cecil Mitchel, manager.

MEADVILLE, PA.—The electric light plant of the city will be entirely overhauled the coming season. Harry Ellsworth is superintendent of the plant.

QUAKERTOWN, PA.—Two 200-hp water-tube boilers will be installed shortly in the municipal electric light plant, of which G. Frey is superintendent.

CORRY, PA.—The Corry City Electric Light Company contemplates remodelling its power house. E. W. Jordan is secretary and treasurer of the company.

NEW HOLLAND, PA.—At a meeting of the Enterprise Telephone & Telegraph Company it was decided to increase the capital stock from $25,000 to $50,000.

PITTSBURG, PA.—Mayor Hays has signed the ordinance granting the South Side Electric Manufacturing Company permission to extend its lines over the entire South Side.

LIGONIER, PA. The Ligonier Electric Light Company is contemplating the installation of an incandescent street lighting system for the town. John Andrews, Jr., manager.

MEDIA, PA.—W. Roger Fronefeld, of Media, president of the Media Electric Light, Heat & Power Company, writes that this company has in contemplation extensive improvements.

HANOVER, PA. The Hanover Light, Heat & Power Company will increase the capacity of its plant in order to supply power for railway purposes. Address Robert E. Manley, manager.

LEHIGHTON, PA.—The Borough electric light and power plant will probably install two 150-kw, three-phase, alternating-current power generators in a short time. E. W. Moser, superintendent.

BRADDOCK, PA.—The Pittsburg & Allegheny Telephone Company will have an ordinance presented in the Braddock Council asking for a franchise for an underground conduit system in Braddock Avenue.

NORTH YORK, PA.—The Merchants' Electric Light, Heat & Power Company, of York, is reported to have secured the contract for lighting the borough streets for the ensuing year at 11 cents per lamp per night.

GREENSBURG, PA.—At the annual meeting of the stockholders of the Pittsburg & Westmoreland Railway Company at Irwin an appropriation to build a line from Herminie to Irwin, through Rilton and Madison, was made.

PITTSBURG, PA. H. T. Douglas, Jr., chief engineer Wabash-Pittsburg Terminal Company, writes that the proposed electric power plant for the terminal building and freight station will cost $100,000. The engineers are Westinghouse, Church, Kerr & Co.

PITTSBURG, PA.—The Pittsburg & Greensburg Street Railway Company, which is operated by the Pittsburg, McKeesport & Connellsville Railway, is extending its line from Irwin to Trafford City. When this link is finished cars will be operated between Pittsburg and Greensburg. Cars will run through Braddock, East Pittsburg, Wilmerding, Irwin and Greensburg to Scottdale, and through Uniontown to Fairchance, a distance of 75 miles. The line will take in all the important mining towns east and northeast of Pittsburg.

PITTSBURG, PA.—The Pittsburg Railways Company is engaged in building important extensions. The company will extend its lines by way of California Avenue, Allegheny, Bellevue and Avalon to Dixmont, and cars will be running to the latter place within the present year. The company also operates the line to Coraopolis, and the building of the proposed bridge across the Ohio River connecting with the north Ohio shore at Leetsdale will enable the company to operate cars from Pittsburg to Beaver Falls. The south side of the river is also to be connected up in a similar manner. Eventually the company expects to get through Sewickley, which will give it connection with Beaver Falls by way of the North Side lines. The Beaver Valley companies are planning connection with East Liverpool, Ohio, and there is talk of connecting with the New Castle lines.

PROVIDENCE, R. I.—Senator Arnold, of Westerly, has introduced in the Senate an act incorporating the Westerly & Connecticut Railway Company, and it was referred to the Committee on Corporations of the Senate. This act practically provides for an extension of the tracks of the Norwich & Westerly Railway Company into the town of Westerly, R. I. In accordance with a notice given to the Westerly & Hopkinton Railway Company, of Rhode Island, and after granting a hearing to said company, the Town Council of Westerly issued an order to the railroad company requiring the company to build, complete and put in operation such portions of its projected railway, or railways, as may extend into the highways of the town on or before July, 1906.

KINGSTREE, S. C.—There is some talk of constructing an electric light plant here.

UNION, S. C.—The municipal electric light and water works will be enlarged during the coming year. E. M. Anderson, superintendent.

GREENVILLE, S. C.—Mr. J. E. Sirrine, mill architect and engineer, of Greenville, informs us that the Savannah River Power Company, already noted in these columns, will build a dam 12 feet high and about 1,000 feet long at Greggs Shoals. The power house equipment will consist of four 500-kw generators, with the necessary exciters, etc.; and everything has been purchased except the electrical machinery.

GARRETSON, S. D.—The Globe Milling Company contemplates installing an electric light plant.

BRIDGEWATER, S. D.—It is rumored that an electric railway will be constructed between this city and Sioux Falls.

SPARTA, TENN.—Sparta Electric Light & Power Company has increased its capital stock from $5,000 to $10,000.

PARIS, TENN.—The city water and light plant is contemplating some extension of lines. M. W. Youngkin is manager.

CLARKSVILLE, TENN.—Mr. W. M. Case, the superintendent of the electric lighting and power department of the Clarksville Railway & Light Company, informs us that additions to the plant comprise the following: from the General Electric Co.: a Curtis turbo-generator, 3 phase, 2,300 volts, 500 kw.; a 200-kw, 3-phase, belted generator; a turbine exciter set; a motor generator set; another motor generator set of 200 kw for street railway use, and 65 alternating current series arc lamps to replace as many old multiple arcs. The additions include also two Sterling water-tube boilers of 350 hp each, and two duplex pumps and heater.

EL PASO, TEX.—Plans are under consideration by officers of the Phœnix Railway Company for the construction of a line from the Maricopa and Phœnix depot up Center Street to Washington, to connect with the Washington line, and another to run north on Second or Third Avenue.

SPRING CITY, UTAH.—The Spring City Light & Milling Company is planning to extend its line about four miles this next season. Martin Walker is manager.

SALT LAKE CITY, UTAH.—A new company has been incorporated here by M. M. Miller, of Murray, and others, to construct an electric light and power plant on Mill Creek.

HARDWICK, VT.—The village authorities are considering installing meters and will make general extensions to its system during the coming year. C. L. French, manager.

BURLINGTON, VT.—Additional generating apparatus will probably be installed in the Burlington electric light plant. Address Charles W. Taggart, manager and superintendent.

ESSEX JUNCTION, VT.—The People's Electric Light & Power Company will install a 400-kw, 6,600-volt, three-phase, 60-cycle generator. Contracts will be placed this month for a pair of turbine generators, switchboard apparatus, and three 50-kw 6,600-2,200-volt transformers. The company is establishing a 24-hour service, except on Sunday, for both power and light. S. A. Brownell, manager.

MANASSAS, VA.—An election is to be held soon to vote on issuing bonds for water works and an electric light plant.

SOUTH BOSTON, VA.—The South Boston Electric Light & Power Company expects to install a new boiler and engine shortly. J. A. Mebane, superintendent.

FREDERICKSBURG, VA.—The city expects to add incandescent light equipment to its plant during the summer of 1906, which will be operated on alternating current at 60 cycles. E. M. Greene is manager and superintendent.

MARTINSVILLE, VA.—The Martinsville Electric Light & Power Plant, owned by the city, will cost when complete about $80,000, including the amount paid for site, riparian rights, etc. The apparatus will include two General Electric generators of 150-kw each; two exciters; two Morgan-Smith horizontal turbines of 225 hp each; 50 arc lamps and 1,400 incandescents. The plant will be under the supervision of the town council.

RADFORD, VA.—The town of Christiansburg is now lighted by electricity, the power being supplied from a power house at Grayson, on Little River, 12 miles distant. The Radford Water Power Company has just closed a deal with the Westinghouse Electric Company for a big, up-to-date, new generator for its plant on Little River, and will install another within the next 12 months, which will greatly enlarge the capacity of the plant.

KENNEWICK, WASH.—C. E. Wood, of Genesee, Idaho, writes that he proposes constructing water works and electric light plant at Kennewick, at a cost of from $15,000 to $20,000. Wood & Cochran, of Kennewick, are the engineers.

PALOUSE, WASH.—Surveyors of the Washington Water Power Company are at work making a definite location for a power line to Palouse. A sub-station will probably be constructed here by D. C. Klinefelter, manager of the Palouse Light & Power Company.

EVERETT, WASH.—The Farmers' Independent Telephone Company has purchased a site and will soon commence the erection of a substantial brick building for offices and central exchange. Up-to-date service will be obtained as soon as the building is finished.

HUNTINGTON, W. VA.—The Camden Interstate Railway Company expects to build 3½ miles of new track in Huntington. Thomas McK. Hays, superintendent.

RONCEVERTE, W. VA.—The Ronceverte Electric Company contemplates installing in the spring two generators of 40 or 45-kw capacity and a new switchboard. F. M. Weber, manager.

BEAVER DAM, WIS.—The Beaver Dam Illuminating Company expects to install a 150-hp boiler next summer.

HUDSON, WIS.—The St. Croix Power Company has filed an amendment to its charter, increasing its capital to $25,000.

STURGEON BAY, WIS.—The city expects soon to install a new 150-hp boiler in its electric light plant. James E. Johnson, manager.

BANGOR, WIS.—Hussa Bros., proprietors of the electric light plant, expect shortly to install a new engine-generator unit. Emil Hussa, purchasing agent.

MILWAUKEE, WIS.—The Common Council on February 5 passed the ordinance providing for an issue of $250,000 bonds for the construction of a municipal electric light plant.

WHITEHALL, WIS.—The authorities are considering establishing a meter system during the coming year for the supply of electricity for lighting. Wm. H. Selck is manager and superintendent.

CUMBERLAND, WIS.—At the first meeting of the Cumberland Commercial Club it was unanimously voted to have the city issue $10,000 bonds for the installation of a new electric light plant to supplant the old one.

CHILTON, WIS.—The Wisconsin Storage, Electric & Water Company, which owns the plant at Chilton, is contemplating building a line to Charleston this coming spring. Charles D. Smith, Fond du Lac, Wis., is manager.

MADISON, WIS.—F. W. Montgomery, president of the Madison Interurban Company, states that the company will build a $100,000 power house in the spring, spend $50,000 for a new line to South Madison and the county fair grounds and rebuild all city lines not completed.

OCONTO, WIS.—Joseph Pocquette, chairman of the Lighting Committee, of Oconto, Wis., writes that the contract for furnishing the city with electric lights for a period of three years has been awarded to the People's Land Manufacturing Company, of that city, at $45 per lamp per year.

BASIN, WYO.—A company has been formed here to construct an electric light plant. F. H. Standard, of Cody, Wyo., is the engineer.

MILLBROOK, ONT.—J. G. DeLong & Son, proprietors of the electric light plant, intend putting in a 100-hp low speed engine soon.

WEST LORNE, ONT.—The West Lorne Electric Light Company, Ltd., expects to build a new power house and put in a new engine and boiler within the next eighteen months. D. F. Webster, manager.

PICTON, ONT.—The Board of Commissioners expects to add a 175-kw, two-phase alternator and install an enclosed arc system for lighting the streets within the next four months. Address J. A. Cranbell, manager.

GRAVENHURST, ONT.—The town authorities are considering installing a new boiler at the electric light and power plant and may also make arrangements to operate the plant by water power and install a water system. E. Smith, manager.

CAMPBELLFORD, ONT.—The city authorities are contemplating installing a new water-power plant with an output of 2,000 kilowatts, which will necessitate the construction of a dam and the purchase of new hydraulic and electric machinery. F. J. Smith is manager of the plant.

PARRY SOUND, ONT., CAN.—We are informed that the proposed improvements to the electric light plant will cost about $20,000, and will consist of one 425-kw alternator, with switchboard and exciter, which has already been purchased; also water wheels and improvements to the flume and dam, contracts for which have not yet been let. G. Groves, Parry Sound, is the engineer.

Company Elections.

DETROIT, MICH.—At the annual meeting of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company, held in Dearborn, the following directors were elected for the ensuing year: James D. Hawks, S. F. Angus, Henry A. Haigh, W. A. Comstock and A. L. C. Henry. The report of the president was to the effect that the last year's business was the best in the history of the company.

GRAND RAPIDS, MICH.—The following changes in the personnel of the board of directors of the Interurban Railroad, now being built between this city and Ionia, are said to have been made: C. H. Pomroy has retired as treasurer and has been succeeded by former Governor Rich, who was vice-president of the road. Maj. H. P. Lloyd, of New York, president of the International Construction Company, which is building the road, has been elected vice-president of the interurban company. E. M. Hopkins, of Detroit, is still president, and Frank Wescott, of Detroit, continues as secretary.

GRAND RAPIDS, MICH.—At the annual meeting of the Grand Rapids Railway Company, held recently in this city, the following directors were re-elected: C. M. Clark, of Philadelphia; Anton G. Hodenpyl, of New York, L. J. Rindge, Benjamin S. Hanchett, W. H. Anderson, William Judson, J. Boyd Pantlind, Thomas F. Carroll and John A. Covode. The board of directors elected the following officers: C. M. Clark, president; L. J. Rindge, vice-president, Benjamin S. Hanchett, general manager, secretary and treasurer; C. Lord Stevens, of Philadelphia, assistant secretary.

New Incorporations.

STAMFORD, CONN.—The West Branch Light & Power Company has been incorporated with a capital of $50,000, and the following directors: J. P. Grant, Carrie E. Grant and L. P. Grant.

FLORAVILLE, ILL.—The Floraville Telephone Company, with a capital of $1,000, has been incorporated by L. I. Zimmerman, P. Wirth and L. Eckert.

WATERLOO, ILL.—Farmers' Fountain Telephone Company has incorporated with a capital of $10,000. The incorporators are H. P. Stumpf and Fred Schrader.

BURRITT, ILL.—The Burritt & Winnebago Telephone Company has been incorporated with a capital of $2,450, and will establish a telephone service in Burritt and Winnebago. The incorporators are James McNair, W. H. Keith and Frank Colahan.

WATERLOO, IND.—The Waterloo Electric Light & Water Works Company has filed articles of incorporation with the Secretary of State. The company will construct and operate a combined electric light and water works plant in Waterloo. Charles A. Welding, W. J. Vesey and John Dreibelbiss are named as directors.

WILLIAMSPORT, IND.—The Lafayette & State Line Traction Company is the name of a new company which has filed articles of incorporation with the Secretary of State. The initial capital is placed at $10,000. The company proposes to build street and interurban lines in and to connect the following cities and towns: Lafayette, Attica, Williamsport, West Lebanon, Marshfield, Johnsfield and State Line City. The company's headquarters will be in Williamsport. Freemont Goodwine, W. S. Nail and John Hoover are the incorporators.

SOUTH BEND, IND.—By virtue of the consolidation of the Niles & Buchanan Railway Company and the South Bend & Michigan Southern Railway Company under the name of the Southern Michigan Railway Company, the latter has filed articles of incorporation with the Secretary of State, the capital stock being placed at $2,000,000. The properties, lines, power houses, etc., of the two companies will be operated jointly by the new company, and construction work now in progress and projected will be under the control of the new company. Mortimer Reed, Jas. B. McCance, W. B. Babcock and E. F. Gaffrey are the principal managers of the new company.

DOBBS FERRY, N. Y.—The Dobbs Ferry Traction Company has filed articles of incorporation and will operate an electric street railway from Hastings to Dobbs Ferry. The company is capitalized at $30,000, and the following comprise the board of directors: Mark J. Katz, Isaac A. Levy, Harry A. Mendelson and Thomas J. Snee, of New York.

LINCOLN, NEB.—The Hickman Telephone Company has filed articles of incorporation. It has a paid-up capital of $6,000. Directors: A. Brendile, C. H. Hempel and A. Schmitte.

LINCOLN, NEB.—The State Telephone Company of Iowa has filed articles of incorporation with the Secretary of State. The lines of the new company will connect with the Nebraska independent systems.

EVANSVILLE, OHIO.—The Citizens' Telephone Company has been incorporated, to operate a telephone system in Evansville and Vanderburg Counties. The capital stock is $10,000. A. T. Karger, A. P. Lahr and J. P. Bush are the incorporators.

WOODWARD, OKLA.—The Home Enterprise Telephone Company, with a capital stock of $10,000, has been incorporated.

FEDORA, S. D.—The Citizens' Economic Telephone Company has been incorporated with $2,500 capital.

PIERRE, S. D.—Articles of incorporation have been filed for the Farmers' Mutual Telephone Company of Faulk County, at Cresbard. The company has a capital of $15,000, and the incorporators are John J. Pierce, R. M. Griffith, Frank Currier, H. W. Reinecke, O. A. Swift and William A. Lehman.

New Industrial Companies.

THE ELECTRIC MARINE MANUFACTURING COMPANY is the name of a concern recently incorporated, with the following directors: F. G. Hall, Jr., of Brooklyn; W. P. Passenger, of New York, and Thomas Aldcorn, Union Hill, N. J. The company has a capital stock of $25,000 and its principal place of business will be in New York City.

THE WROUGHT METAL & LIGHTING COMPANY, of Meriden, Conn., has filed a certificate of incorporation. It has a capital stock of $20,000, and the incorporators are Julius L. Kipp, Gustave E. Kaschub and Gottlieb A. Bauer, all of Meriden. The concern will manufacture architectural metal goods, especially chandeliers and lighting fixtures. It has already leased a factory in Meriden and will immediately fit it up.

THE AMERICAN AUTOMATIC TELEPHONE COMPANY has recently filed its papers of incorporation at Albany, N. Y. The corporation is capitalized for $1,500,000. The company will manufacture automatic switchboards and telephones. The officers and directors of the company are as follows: President, Senator John Raines, of Canandaigua; vice-president and general manager, J. W. Lattig; secretary and treasurer, B. J. Williams, Shelby, Ohio; Alvaro L. Thompson, Rochester, N. Y.; Henry H. Stebbins, Jr. The new company is now actively engaged in making arrangements for its manufacturing plant and is at the present time purchasing machinery, having its dies and punches made.

Legal.

TURBINE LITIGATION.—The Westinghouse Machine Company has brought suit in the U. S. Circuit Court for the district of New Jersey against the Allis-Chalmers Company for alleged infringement of patents in its new steam turbine. Referring to the filing of this suit an officer of the Allis-Chalmers Company has made this statement: "The Allis-Chalmers Company acquired some time ago from the Parsons interests the rights to all their turbine patents in this country, except those granted prior to September 11, 1900, which constitute the only Parsons rights purchased by the Westinghouse Company, none of which the Allis-Chalmers Company has included nor desires to use in its turbines. The Allis-Chalmers Company thus has the benefit of all the Parsons patent rights and experience since 1900, under agreements also covering all future improvements and experiences." It is said that more than one million horse-power of turbines are in use made under the Parsons patents. We learn from the Westinghouse Company that the contention is that the Allis-Chalmers Company in the manufacture and sale of its turbine, is infringing Patent No. 655,414, issued to Mr. Chas. A. Parsons, August 7, 1900. This invention was made jointly by Parsons, Stoney and Fullagar, and is for steam turbine ring of blades covering, it is claimed, the method of construction used by the Allis-Chalmers Company for securing the blades and vanes in place in their respective holding elements. An assignment of the entire rights under this patent was secured by the machine company from Chas. A. Parsons on January 10, 1905, both Stoney and Fullagar having assigned their interest in the same to Parsons prior to the assignment of the patent.

Personal.

JAMES A. MILNE.

JAMES A. MILNE, who has for a number of years been comptroller of the Allis-Chalmers Company, Milwaukee, has accepted the position of general manager of Allis-Chalmers-Bullock, Limited, Montreal, Canada, to become effective on or before May 1, 1906. Mr. Milne is a native of Canada, having been born at Watertown, Ontario, in 1872. After completing a public school and collegiate course, he began his business career at Toronto in 1888. In 1892 he removed to Chicago, and through Jones, Caesar & Company, chartered accountants, of Chicago and New York, he came in touch with the Allis-Chalmers Company. In August, 1901, he entered its employ as chief cost clerk, and one month later was appointed acting comptroller, being formally elected to that position at the meeting of the board of directors, in May, 1902. Since the early part of last autumn, Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Limited, and the fact that he still retains Canadian citizenship, and is deeply attached to his early associations, has been an important factor in influencing him to heed a recall to the Dominion. The Allis-Chalmers-Bullock, Limited, of Montreal, is an allied interest of the Allis-Chalmers Company, and owns a large manufacturing plant located at Montreal, the direct management of which will now be assumed by Mr. Milne. The Canadian company is conducted as an entirely separate organization, but, in addition to its own production, sells the products of Allis-Chalmers Company in the Dominion of Canada.

MR. J. A. BRETT, of Chicago, has been appointed district manager for the Westinghouse Electric & Manufacturing Company, with headquarters in the Traction Building, Cincinnati, Ohio.

MR. LELIO BORNO.—We are advised that Mr. L. Cameau, having resigned the direction of the telephonic service of Port au Prince, the capital of the Island of Hayti, West Indies, it remains under the management of Mr. Lelio Borno.

MR. E. H. GIMPER is understood to have resigned his position as the superintendent of the Eastern Wisconsin Railway & Light Company's plant at Fond du Lac, Wis., to become general manager of the system at Spokane, Wash.

MR. LOUIS J. MAGEE contributed recently to the *Engineering Magazine* some very interesting and instructive articles on "The American and the German Peril," dealing with industrial rivalry and competition. The articles have been reprinted in an attractive pamphlet, and may be heartily commended for study by all who have to deal with political and economic questions.

MR. R. C. NEWHOUSE, who for the past year has been connected with the crushing and cement machinery selling organization of the Allis-Chalmers Company, with headquarters at the general offices, Milwaukee, has been transferred to the Cincinnati sales office, where he will continue to promote the sale of Allis-Chalmers rock crushing and cement making machinery. Electric operation is being given special attention.

MR. W. A. GIBBS, general manager of the Zanesville Railway, Light & Power Company, of Zanesville, Ohio, has been appointed general manager also of the Columbus, Newark & Zanesville and the Columbus, Buckeye Lake & Newark roads, succeeding Mr. J. R. Harrigan, who has become general manager of the Canton-Akron System. A few evenings ago his Zanesville employes presented Mr. Gibbs with a fine gold watch.

MR. A. A. CARY, the well-known mechanical engineer, read a most interesting paper recently before the American Society of Heating and Ventilating Engineers, on the work of Benjamin Franklin as the first of that kind of expert. Particular attention was drawn to the famous Pennsylvania fireplace, out of which the later so-called "Franklin stove" has been evolved.

MR. J. G. WHITE is the subject of a biographical sketch in the recently issued *Sibley Journal of Engineering* for January; and the frontispiece to the number is an excellent portrait. Mr. White attended other seats of learning, but graduated from Cornell University in 1885 with a Ph.D. degree and a fellowship. Always devoted to electrical engineering his success in that sphere and in the world-wide development of engineering enterprises is well known.

MR. JULES NEHER, engineer director of the French Westinghouse Company, who succeeded Mr. Maurice Coster in charge of affairs at Paris, has been on a visit of several weeks to this country, which he had not visited in some years. He sailed for Europe on Thursday, having renewed many old friendships and made numerous new acquaintances. He describes business as extremely active in Europe, not less than here, and has a great deal of important work awaiting him.

MR. L. F. BOWER, heretofore manager of the Allis-Chalmers electrical works at Cincinnati, will succeed Mr. Milne as comptroller of the Allis-Chalmers Company, who has accepted the position of manager of Allis-Chalmers-Bullock, Ltd. Mr. Bower graduated from Wesleyan University in 1879. For some years previous to 1901 he was secretary and treasurer of the Dickson Manufacturing Company at Scranton, Pa., which was absorbed by the Allis-Chalmers Company, and on April 1, 1904, he was transferred to the electrical department at Cincinnati.

MR. C. K. JEFFRIES, superintendent of the Indianapolis & Northwestern Traction Company, has been transferred to the superintendency of the Indianapolis & Eastern Railway to succeed Mr. W. R. McKown and Mr. Raymond Reynolds has become superintendent of the Indianapolis & Northwestern Company. Mr. C. E. Morgan, purchasing agent of the Indianapolis & Eastern Company, has been made superintendent of the Indianapolis & Martinsville Company and also of the Indianapolis & Plainfield Company.

DODGE & DAY.—On March 1, Dodge & Day will remove to their new offices in the Drexel Building, Fifth and Chestnut Streets, Philadelphia, in order to be nearer to the financial centre as well as to obtain more commodious quarters. This step is the natural result of the rapid growth of their business. Most of our readers are familiar with their pioneer work in the industrial field and its subsequent development along broader lines, taking in architectural as well as mechanical and electrical engineering.

MR. CHAS. H. MERZ, the well-known English consulting electrical engineer, who has been prominently connected with the enterprise for the unified production of current for London, and with electric railway and power developments in the northern counties, sailed for Liverpool on the "Carmania." Accompanied by his younger brother, Mr. Merz spent about five weeks in the country on this trip, going out to the Pacific Coast. Most of the time was given to sight seeing, but the recent developments in electrical work received their due share of attention. Mr. Merz remains hopeful as to the London power project under the new political régime, believing that it must win by its merit and the necessities of the situation.

MR. F. J. PARSONS.—Cable advices from Paris state that Mr. Frederick J. Parsons, chief engineer of the French Thomson-Houston Company, and electrical engineer of the Thomson-Houston International Company since 1888, has been made a chevalier of the Legion of Honor. Mr. Parsons was born of American parents at Vicomedia, Turkey, December 3, 1860, and graduated from Williams College in 1881. He took a post graduate course at Williamstown in 1881-2, and became instructor in French and mathematics at his alma mater 1882-4. He then traveled in Europe for two years and became professor of physics at the Northwestern University 1886-7. He returned to Europe for the Thomson-Houston interests to take up the work of which he has made so great a success and which has brought him this well-deserved honor.

MR. H. M. BRINCKERHOFF, formerly general manager of the Metropolitan West Side Elevated Railway Company of Chicago, has become associated with the firm of William Barclay Parsons, consulting engineers, 60 Wall Street, New York. He will have charge of the electrical and mechanical engineering which comes up in that firm's work. Mr. Brinckerhoff was connected with the Metropolitan Elevated in Chicago from the time it was electrically equipped in 1894 until recently, being first electrical engineer and later general manager. He has had abundant technical and operating experience, therefore, to fit him for his new work. Mr. Brinckerhoff's biography appeared in the ELECTRICAL WORLD AND ENGINEER of February 8, 1902, as one of a series on prominent electrical engineers of the day.

Trade Publications.

PNEUMATIC CLAMSHELL DREDGING BUCKET.—William H. Arnold & Co., 165 Prospect Park West, Brooklyn, N. Y., have issued an illustrated description of the Arnold pneumatic clamshell dredging bucket for digging hard material.

THE NEW YORK EDISON COMPANY has just issued a very handsome and useful weekly slip calendar for the year, February 1906-7. It is printed in green, white and buff on sheets 24 inches long and 5½ inches wide, so that the figures can be seen very clearly from a distance. The outside cover of the calendar, which it seems simple to detach, has three of the clever archaic Cooper figures of the Colonial time with the legend: "The Edison man at your service." Each weekly slip also has a clever pictorial suggestion of what electricity can do for the public.

ALLIS-CHALMERS ENGINES.—"At Home and Abroad" is the title of a bulletin issued by the Milwaukee company, which is unique in that it contains 68 pages without a vestige of reading matter except brief descriptions underneath the cuts and a list of the company's products at the end. The title page illustration represents four huge engines, capable of furnishing 35,000 hp, installed in the power house of the Twin City Rapid Transit Company, Minneapolis. Other plants shown include those of the N. Y. Interborough Rapid Transit Company, "Subway" and "Manhattan" stations; New York City Railway Company; Brooklyn Rapid Transit Company; Chicago Metropolitan West Side Elevated Railway Company; Chicago Union Traction Company; Central London, England (Underground) Railway; London United Tramways, Ltd.; Dublin, Ireland, Tramways; Cincinnati Gas & Electric Company; St. Louis Union Electric Light & Power Company; St. Louis & Suburban Street Railway Company; Glasgow United Tramways; Detroit United Railway; Bristol, England, United Tramways; Kansas City Metropolitan Street Railway; Kansas City, Kan.; Consolidated Electric Light & Power Company; Middlesboro, England, Power Station; Cleveland Electric Railway Company; Toledo Railway & Light Company; Barcelona, Spain, Tramway Company, Ltd.; Grand Rapids Electric Railway Company; Isle of Thanet, England, Tramways; Sydney, New South Wales, Government Tramways; Buenos Aires, Argentina, Compania Alemana Transatlantica de Electricidad; Havana, Cuba, Electric Railway Company; Louisville Railway Company, and other well-known companies. Pumping engines, a number of which hold world's records for economy and efficiency in their respective fields of operation, are shown installed in the plants of the Boston Metropolitan Water & Sewerage Board, Chestnut Hill, Ward St., Charlestown & Deer Island stations; Chicago Water Works, 39th St. and Chicago Ave. stations; Pittsburg Water Works, Brilliant station; St. Louis Water Works, Baden station, and large industrial plants.. Blowing engines are represented by impressive lines at furnaces of the Carnegie Steel Company and American Steel & Wire Company; air compressors by machines in operation for the Anaconda Copper Mining Company and Atlas Portland Cement Company, and hoisting engines by numerous mining installations, prominent among which is that of the famous LeRoi mine at Rossland, B. C.

News of the Trade.

THE FORD ELECTRIC & MANUFACTURING COMPANY, St. Louis, Mo., has changed its name to the Ford-Oliver Electric & Manufacturing Company.

THE HARRISON SAFETY BOILER WORKS, Philadelphia, Pa., report recent sales of its heaters in the South to 25 different concerns, the heaters aggregating 27,050 hp in capacity.

CATALOGUES WANTED.—The Philadelphia Fire Inspection and Protection Bureau, 137 South Fifth Street, that city, desires to receive catalogues and descriptive matter for its office files, from the manufacturers of electrical equipment, fire protection apparatus, hydrants, etc.

MR. G. M. GEST, the electrical subway contractor of New York, has recently sold to the Dayton Electric Light Company, 1,000 of his patented cable hangers. This device has met with great success. Thousands of them have recently been sold to electrical firms throughout the country.

THE WESTINGHOUSE MACHINE COMPANY has opened a Philadelphia sales office in Room 1003 North American Building. The establishment of this office was necessitated by its rapidly expanding business in the territory, particularly in gas engines and Westinghouse-Parsons steam turbines, and is in line with the progressive policy of the company to establish headquarters in all large industrial cities.

ASBESTOS MEN MEET.—For several years past it has been the custom of the H. W. Johns-Manville Company to gather its various branch managers and salesmen in an annual convention. This convention, at which about 150 men were present, met in New York City recently for the purpose of discussing the general business of the company and to enable the various representatives to get acquainted with each other. After an interesting session lasting four days, the convention wound up with a farewell dinner at the New York Athletic Club, on Friday evening, February 2. The H. W. Johns-Manville Company has branch houses in all the principal cities, and representatives from the following branches were present at the convention: Milwaukee, Chicago, Boston, Philadelphia, St. Louis, Pittsburg, Cleveland, San Francisco, Los Angeles, Seattle, Kansas City, Minneapolis, Little Rock and New Orleans.

THE CENTRAL ELECTRIC COMPANY has sent out a circular calling attention to the fact that it is now settled in its new quarters at 264-270 Fifth Ave., Chicago, Ill. In the new building the floor space approximates 60,000 square feet. The equipment includes every modern appliance to facilitate the proper and prompt handling of business, and the stock of goods is complete in every detail. It will be recalled that the offices and warehouse of this company were entirely destroyed by fire on February 11, 1905, and that the company was established in its temportary quarters at 207 East Jackson Blvd., and all arrangements for installing a new equipment and resuming business were made within one hour after the usual time for opening.

R. M. CORNWELL CO., Syracuse, N. Y., maker of the Wonder gasoline engines, dynamos and motors and jobber in electrical supplies, has recently opened an office at 1132 Park Row Building, New York, with Mr. J. P. Williams, as manager, to attend to a rapidly growing business. It is only about a year ago that it started in the manufacture of small dynamos and motors, gasoline engines for marine and stationary purposes and small lighting outfits for country homes, etc. These equipments have all met with approval, to such an extent that the new office has become a necessity with the States of Rhode Island and New Jersey and part of Pennsylvania as territory. The company is now shipping all over the world, and in the past two weeks has filled orders in Holland, Siam, India and Australia. The simplicity of the apparatus, no less than the small price, commends it everywhere. The concern is now going to drop its automobile business and is putting up a four-story building on Clinton Street, Syracuse, 50 feet by 120. It will thus be able to manufacture in large quantities the present apparatus, and, in addition, small connected pumping outfits for domestic, factory and mine purposes. It has also added four or five new sizes of marine engines, and is manufacturing them from 1½ to 24 hp; the stationary engines being from 1½ to 6 hp. The new catalogue issued by the firm is one of 50 pages.

BROOKLYN ELECTRICAL SUPPLY.—The ownership of the Brooklyn Electrical Supply Company, the oldest house in the line in Brooklyn, N. Y., has passed into the hands of Mr. Herman T. Hochausen, who has already assumed active management. He has resigned as president and general manager of the Metropolitan Engineering Company, of Brooklyn, and has disposed of his interest and participation in all other electrical enterprises which he so successfully developed, in order that he may devote his entire time to the advancement of the Brooklyn Electrical Supply Company. A manufacturing branch to produce the electrical machinery and numerous devices invented by Mr. Hochausen will shortly be added. The name of Hochausen is familiar to all those conversant with early electrical development. His father, Wm. Hochausen, being the inventor of the Excelsior system of arc lighting. Mr. H. T. Hochausen, after receiving a thorough technical education at the Polytechnic Institute of Brooklyn, obtained a minor position with the Excelsior Company, and was promoted frequently until he became superintendent of construction and traveling expert. The principal work accomplished by him in this capacity was important experimental work on rotary converters, single phase and synchronous motors and straightening out the intricacies involved in the novel system of lighting adopted by the West Side City Lighting Plant in Chicago, Ill. When the Excelsior Company was taken over by the General Electric Company, Mr. Hochausen spent two years in the practice of marine electrical engineering. He then started manufacturing signs under the firm name of H. T. Hochausen. Mr. Hochausen manufactured, erected and placed in service the first wholly metallic sign. He afterwards merged his sign business with the Metropolitan Engineering Company, becoming president and general manager.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED FEB. 6, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

811,533. CONTROL OF AUTOMOBILE MOTORS; Edward H. Anderson, Schenectady, N. Y. App. filed June 29, 1905. In order to avoid the shock and jar due to the interruption of the motor circuit when the controller is shifted, the patentee provides a special controller by which the field windings are placed in various successive relations with a resistance without at any time interrupting the circuit continuity.

811,538. ELECTROLYTIC ELECTRICITY METER; Charles O. Bastian, London, Eng. App. filed Mar. 10, 1904. A glass tube closed at its lower end contains water and a pair of concentrically arranged electrodes between which the current to be measured passes. A scale is supported by the electrode terminals to indicate the amount of water consumed.

811,539. ELECTRICAL CONTROL SYSTEM; Ralph E. Bates, Wilkinsburg, Pa. App. filed Feb. 1, 1905. The pilot wheel has an arm moving over spaced segments each in a separate circuit with a corresponding arm attached to the steering gear. The arrangement is such that the steering motor is slowed down as it approaches the desired steering position, and arrested when it arrives thereat.

811,552. PROCESS OF MAKING HYDRATED OXIDE OF LEAD; Jas. H. Bridge, New York, N. Y., and Carleton Ellis, Boston, Mass. App. filed Mar. 14, 1904. A process for making hydrated oxide of lead which consists in first electrolizing with lead anodes a hot aqueous solution of purified brine, then mixing the products of said electrolysis, and finally separating the so-formed hydrated oxide of lead.

811,644. SINGLE-PHASE ALTERNATING-CURRENT MOTOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed Feb. 27, 1904. A single-phase induction motor having a main primary winding comprising two portions, means for connecting portions in series for starting and in parallel for running and at the same time changing the number of magnetic poles produced by said winding, and an auxiliary winding having a different time constant from that of the main winding.

811,645. ELECTRICAL MEASURING INSTRUMENT; Edwin E. Lehr, Wilkinsburg, Pa. App. filed Nov. 21, 1903. A coil carried by the movable arm is connected to constitute the secondary winding of a series transformer of which the primary coil is stationary and included in the circuit to be measured. The movable coil swings between diverging pole faces of such shape as to give a constant or uniformly graduated scale.

811,654. ELECTRIC WAVE DETECTOR; Thomas J. Murphy, New York, N. Y. App. filed December 17, 1904. The coherer tube contains electrodes with immediate iron filings in the usual way, but is mounted to rotate axially under the influence of a spring motor, and in a constant magnetic field from a permanent magnet.

811,656. SPARK COIL; Charles P. L. Noxon, Syracuse, N. Y. App. filed Sept. 26, 1904. In order to economize the battery current, mechanism is provided by which only a single spark passes for each ignition. For this purpose an electro-magnet is arranged to prevent the vibrator from making more than one excursion at each actuation.

811,673. ELECTRICAL BRUSH HOLDER; Moffat St. Clair, Fort Wayne, Ind. App. filed Mar. 27, 1905. The carbon is bolted to a metallic clip or terminal to which is also attached a spring which serves to keep the carbon pressed against a flat surface on the brush holder. An additional spring serves to press the carbon longitudinally against the commutator.

811,691. PARTY TELEPHONE LINE; Edward A. Buell, Dekalb, Ill. App. filed Mar. 17, 1905. Party line subscriber's station having selecting switching mechanism including a releasing magnet for restoring the selecting mechanism to normal condition and a switching device operated by the releasing magnet for opening the signal receiving circuit.

811,692. PARTY TELEPHONE LINE; Edward A. Buell, Pittsburg, Pa. App. filed May 1, 1905. A subscriber's station equipment including a signal receiver, a signaling generator normally in operative relation with the signal receiver, and switching mechanism operated by the signal receiver and serving to control the association of the telephone signal receiver and generator with the line.

811,702. INITIATING APPARATUS; Lewis D. Cook, Mt. Holly Springs, Pa. App. filed Apr. 10, 1905. An initiating device having a revoluble member, means to revolve the same, means to lock and predetermine the extent of rotation thereof, electric lamps on opposite sides of said revoluble member successively displayed by the rotation thereof, a source of energy, and connections including the same with said lamp.

811,758. INDUCTION MOTOR CONTROL; Albert H. Armstrong, Schenectady, N. Y. App. filed June 28, 1905. In combination with a vehicle, a plurality of induction motors mechanically connected to the driving wheels of said vehicle, means under the control of the motorman for controlling said motors simultaneously and means for adjusting the relative torques of said motors.

811,759. ELECTRODEPOSITION; William C. Arsem, Schenectady, N. Y. App. filed July 25, 1904. The process of electroplating, which consists in passing an alternating current through an aqueous solution of platinum by means of suitable elctrodes, thereby deposing platinum from the solution.

811,766. SYSTEM OF MOTOR CONTROL; Fred B. Corey, Schenectady, N. Y. App. filed Oct. 1, 1904. The controller arm on each car is operated by a segment gear having a small arc of movement. Two train pipes control separate cylinders having link connections with said gear whereby the arm can be moved to any position by establishing a proper relation of pressures in the two train pipes.

811,772. UNIVERSAL MOLDING BOX; John L. Gleason, Boston, Mass. App. filed Feb. 25, 1905. Detail features of a molding box, particularly adapted for locating a bracket at the intersection of two transverse molding strips.

811,773. SYSTEM OF DISTANT ELECTRICAL CONTROL; Joel Gomnorrow, Lynn, Mass. App. filed Sept. 14, 1904. A motor at the distant point has differential field windings with a common connection through the armature leading to a fixed source of potential. The field terminals can be connected to one or another circuit by a relay so as to control the direction of the motor and move a strip over contacts in one direction or the other. The amount of movement is controlled by additional pilot circuits.

811,792. DYNAMO ELECTRIC MACHINE; Henry G. Reist, Schenectady, N. Y. App. filed May 7, 1904. The pole piece laminations are stamped with lugs having one straight and one inclined side so that the laminations may be assembled with their inclined sides in alternate directions, within the containing dovetail groove of the field frame.

811,795. WALL RECEPTACLE; Howard R. Sargent, Schenectady, N. Y. App. filed Nov. 19, 1902. A rectangular porcelain block is channeled to receive the various terminals and plates and has a central threaded shell for the reception of a lamp or connection. The block has an ornamental brass cover with a small hinged door opposite the threaded shell.

811,796. SNAP SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed July 5, 1904. Four circularly spaced contact plates are respectively bridged by radially movable arms which are projected by cam means concentric with the casing. The cam means is adapted to give a quick return movement.

811,819. THERMO-ELECTRIC COUPLE; William H. Bristol, New York, N. Y. App. filed June 30, 1905. The hot terminals of a thermo pile are especially connected to be detachable from their respective circuits so that they may be conveniently replaced in case they burn out or are damaged in any way.

811,822. AUTOMATIC CIRCUIT BREAKING SAFETY APPLIANCE FOR USE IN TROLLEY WIRE SYSTEMS FOR ELECTRIC TRACTION; James Carter, Stalybridge; George Hall, Manchester, and Arthur Parsons, Leeds, England. App. filed Oct. 29, 1904. The trolley wire is divided into sections and the various sections are connected to a special form of hanger having a hinge so that in case a section breaks and falls, the hinge becomes effective to move a switch arm and break the circuit.

811,836. ELECTRICAL HOSE SIGNALING APPARATUS; William Fowler, Colorado Springs, Col. App. filed June 14, 1904. In order to permit electric signals being transmitted along a fire hose, the latter has a pair of conducting wires woven into it and plates at the hose couplings are effective to establish a complete circuit through such wires so that firemen may telegraph signals to the engine.

811,837. SUPPORT FOR INCANDESCENT LAMPS; Edwin R. Gill, Yonkers, N. Y. App. filed Jan. 17, 1905. A special form of wall socket comprising a porcelain plate with lateral ears or lugs which receive the usual circuit wires so that bared portions thereof may be directly clamped to the metallic fixtures of the socket. The connection is afterward covered up by a porcelain cover plate.

811,852. METHOD OF ASCERTAINING THE COMPASS DIRECTION OF MOVING OBJECTS; Isidor Kitsee, Philadelphia, Pa. App. filed Jan. 15, 1903. An apparatus for determining the direction of a torpedo, having a pair of compass needles on the torpedo, the movements of which vary resistances in the two arms of a Wheatstone bridge, from which data the direction can be calculated. The patentee arranges the resistance balances to show the direction directly without calculation.

811,859. ELECTRIC RESISTANCE ELEMENT; Albert L. Marsh, Lake Bluff, Ill. App. filed Mar. 15, 1905. An electrical resistance element composed of a metal alloy consisting of one of the metals of the chromium group in the proportion of less than 50 per cent. of the element, the balance being formed by an alloy of nickel and cobalt.

811,906. ELECTRIC COUPLING; John J. Dossert, New York, N. Y. App. filed Aug. 17, 1904. A pair of split rings having oppositely coned ends are placed over the terminal ends of the conductors and engaged thereon by a screw coupling.

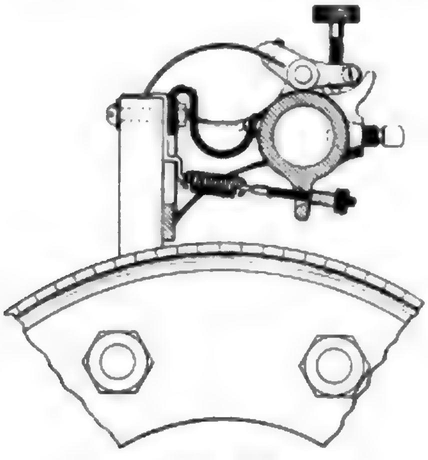
811,907. BRANCH COUPLING FOR ELECTRIC CONDUCTORS; John J. Dossert, New York, N. .Y. App. filed Feb. 9, 1905. The conductors are bared for a short distance and a hook having a pair of curved engaging surfaces is clamped over the bared portion so as to make electrical connection therewith.

811,908. SPLIT SLEEVE CONNECTOR; John J. Dossert, New York, N. Y. App. filed Feb. 9, 1905. Relates to modifications of the coupling covered in number 811,906, having but a single split sleeve, instead of two separate sleeves as in the previous patent.

811,979. TROLLEY REPLACER; Robert Barney Higgins, St. Louis, Mo. App. filed Aug. 14, 1905. An inverted trough and chute is hung above the trolley wire and just beyond the usual guy wire, so that the wheel runs into the chute and is replaced thereby in case it leaves the wire.

811,950. DIAL TRANSMITTER; Charles F. Pearce, New York, N. Y. App. filed Sept. 9, 1905. Details of an apparatus for fire alarm stations with a plurality of dials which can be separately connected to gear trains by which they are rotated, having specially interconnected fans by which their rotation takes place at a certain speed and in a certain way.

811,956. ELECTRICAL MEASURING INSTRUMENT; Maurice C. Rypinski, New York, N. Y. App. filed Mar. 15, 1905. A magnet coil has an axially supported pointer moving over a dial thereon and having a small permanent magnet within the coil and acted upon thereby. The magnet moves in a viscous fluid and can be immersed to a varying degree so as to regulate the throw of the pointer.



811,673.—Electrical Brush Holder.

811,967. ELECTRIC CAR; Lewis B. Stillwell, Lakewood, N. J. App. filed July 29, 1904. In order to cool the motors, resistances, etc., of a train, and at the same time warm the cars in winter, the patentee provides an air circulating system through the various resistance and motor casings, and leading through the train.

811,972. TELEPHONE SYSTEM; Elmer A. Terpening, Geneseo, Ill. App. filed Sept. 3, 1903. A telephone set comprising a transmitter, a receiver and a switch hook, and means including circuit connections, whereby the switch hook when in one position connects said receiver and transmitter in closed local circuits, and when in another position operatively connects said transmitter and receiver to transmit and receive over the line.

811,994. TELEGRAPH TRANSMITTER; John C. Barclay, New York, N. Y. App. filed Feb. 27, 1905. A telegraph transmitter comprising a revolubly mounted drum, a longitudinally movable stop carried thereby, radially arranged adjusting arms, push pins operated thereby for moving the said stops longitudinally, means for operating said arms, means guiding said push pins, and means for resetting the stops.

811,995. PRINTING MECHANISM; John C. Barclay, New York, N. Y. App. filed Mar. 24, 1905. An electric typewriter of essentially Blickensderfer type, except that the usual bails which actuate the type wheel are controlled by power magnets, and the selector finger is likewise controlled by selecter magnets.

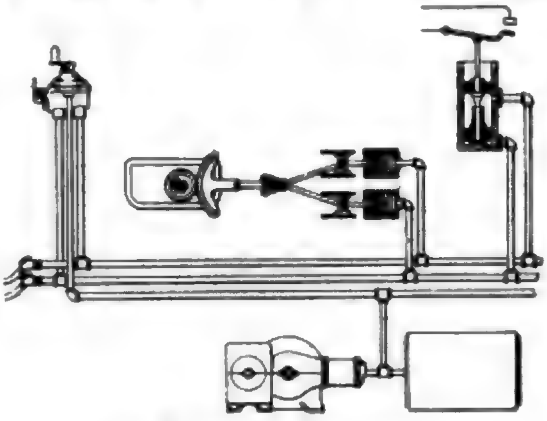
811,996. RELAY; John C. Barclay, New York, N. Y. App. filed July 11, 1905. A contact is swiveled to rock into engagement with two brushes and such swiveling movement is produced by a lever vibrating between two electro-magnets.

812,025. SIGNAL; Charles R. Dowler, Lamar, Colo. App. filed Dec. 18, 1905. In order to indicate when the water at a bridge or river crossing is dangerously high, the patentee provides a chamber having a float which establishes an electric alarm circuit when raised by the water level.

812,038. REGULATION OF ELECTRIC CURRENTS WHICH FEED ELECTRIC ARCS; Johannes Hessberger, Ludwigshafen-on-the-Rhine, Germany. App. filed Nov. 22, 1904. In order to obtain the advantages of a choke coil as a steadying resistance for arc lamps, and at the same time avoid the losses and inefficiency caused by a choke coil, the patentee has some of his lamps in the primary, and some in the secondary circuit of a transformer.

812,040. RAIL BOND FOR STEAM AND ELECTRIC RAILWAYS; Frank C. Hoffman, Somerville, N. J. App. filed Nov. 12, 1904. The bond terminal is passed through a conical bushing, one side of which is slotted tangentially, so that the bushing may collapse upon the conductor end when it is driven into place within the rail.

812,089. ELECTRIC TRANSFORMER AND CONNECTIONS; Herbert F. Provandie, Melrose, Mass. App. filed Nov. 11, 1904. Relates to miscellaneous details of the mechanical features of an induction coil having sectional primary windings.



811,766.—System of Motor Control.

812,117. ELECTRICALLY ACTUATED AND CONTROLLED SELF-PLAYING MUSICAL INSTRUMENT; George H. Davis, West Orange, N. J. App. filed Mar. 29, 1904. A friction roll is continuously driven by an electric motor and selecter magnets are effective to depress segment levers into contact with the roll so that they are moved to depress the various keys of the instrument.

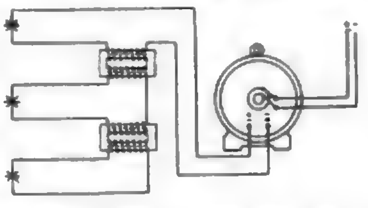
812,125. TELEPHONE TRANSMITTER ARM; William D. Gharky, Philadelphia, Pa. App. filed Mar. 7, 1901. Construction of a telephone arm having two identical castings with concave faces which are assembled together and riveted in such relation. The arm has conical recesses for engagement with the usual journal cones.

812,126. LIGHTNING ARRESTER; William Gifford, Thompsonville, Mich. App. filed May 25, 1905. A lightning arrester having a plurality of spaced conducting balls or knobs each in a separate circuit with a glass tube containing powdered graphite through which the lightning discharge may take place.

812,142. FACSIMILE TELEGRAPH; Edward E. Kleinschmidt, New York, N. Y. App. filed Jan. 18, 1901. A facsimile printing telegraph in which drums at the transmitting and receiving station are synchronously rotated. The transmitting drum has the usual tin foil with the characters thereon in insulating paint. The drums rotate freely except they are synchronized after every fourth letter.

812,164. CONTACT BOX FOR ELECTRIC RAILWAY SYSTEMS; Geo. L. Campbell, Williamsport, Pa. App. filed Dec. 30, 1904. The contract box has a pair of soft iron rods projecting therein which complete a magnetic circuit from an electro-magnet on the car. The circuit is effective to raise a hemispherical iron shell which energizes the contact plate.

812,170. APPARATUS FOR MAGNETIC SEPARATION OF IRON ORE; Gustaf Grondal, Djurshold, Sweden. App. filed Nov. 12, 1903. The liquid carrying the ore particles is made to flow over a narrow ledge in intimate proximity to a powerful magnet. The result is to deflect the magnetic particles into the upper portion of the stream, where they are carried into a separate channel, the upper part of the stream being diverted for this purpose.



812,038.—Regulation of Electric Currents which Feed Electric Arcs.

812,171. MAGNETIC ORE SEPARATOR; Gustaf Grondal, Djursholm, Sweden. App. filed Nov. 3, 1904. A device for separating ore particles upon the same principle as the above, except that the arrangement is in the form of a valve having an electro-magnet with annular pole faces organized therein.

812,172. MAGNETIC SEPARATION OF IRON ORE; Gustaf Grondal, Djursholm, Sweden. App. filed Dec. 3, 1904. The process in the performance of which the machine covered by 812,170 operates.

812,173. MAGNETIC ORE SEPARATOR; Gustaf Grondal, Djursholm, Sweden. App. filed Apr. 7, 1905. The process in the performance of which patent No. 812,171 operates.

812,440. ELECTRICALLY PROPELLED VEHICLE; Russell Thayer, Philadelphia, Pa. App. filed July 29, 1905. A vehicle having rubber tires and built on motor car lines except that it has a trolley pole and may be run on track rails when desired. A pair of depressible track wheels are provided for assisting the vehicle on to and off of the rails.

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The Gas "Arc."

From all over the country come reports of the successful meeting by Nernst lamps of the stiff competition put up by so-called gas "arcs" for commercial lighting. That the competition of this type of gas burner with electric illuminants is severe in the majority of places cannot be denied, and it has perhaps been most keenly felt where the gas "arc" has come into direct competition with alternating-current arcs. As is well known, both of these sources are deficient with respect to the proportion of total light thrown downward at angles below 60 degs. from the vertical. It is just at this point that the Nernst lamp comes in with its large percentage of downward illumination. That the burner does make a good showing when comparisons are made on the basis of mean spherical candle-power cannot be denied, but the defect noted has been its undoing, except where electric rates are very high and gas rates very low, when brought into competition with Nernst or high-efficiency incandescent lighting units properly placed and equipped with reflectors. It appears to be the general experience that one 3-glower Nernst lamp taking 264 watts is able in commercial practice to replace the ordinary four-burner gas "arc" lamp; and this is confirmed by some recent tests which show that the useful light from a three-glower Nernst is about the same as that from a four-burner gas "arc." Assuming the Nernst lamp to be supplied with electrical energy at 10 cents per kw-hour, the cost of operating the three-glower, 264-watt Nernst lamp would be 2.6 cents per hour. Four-burner gas lamps when burning at an efficiency making them comparable with three-glower Nernst lamps, consume in the neighborhood of 20 cu. ft. of gas per hour, making a cost of 2.5 cents per lamp-hour, with gas at $1.25 per thousand cu. ft. With the cost to the user approximately the same, the electric light naturally has always the preference.

◆

The Distribution of Magnetic Flux in Induction Motors.

The article by Messrs. H. F. and H. W. Connell appearing on page 408 of this issue emphasizes and supports the now generally accepted belief that the flux distribution in an induction motor is sinusoidal, both as to electrical time value and as to electrical space distribution, unless the impressed e.m.f. differs appreciably from a sine wave in form. From the earliest days of the construction and theoretical analysis of the induction motor there have been some who maintained that the magnetic flux in the motor could not be sinusoidal, even when the impressed e.m.f. was sinusoidal and the windings of the motor were completely distributed. But experimental investigation has, we believe, always negatived this proposition. That is to say, the numerous experiments that have been made during the last fifteen years on induction motors indicate that the flux tends to have a sine-wave form of space distribution, unless the magnetic surfaces are very polar, or the impressed e.m.f. is kinky. Of course, this is a fortunate condition of affairs from all standpoints, because it simplifies everything connected with the analysis of actions in the induction motor. If we accept the doctrine supported by the experiments described in the article, we find that the conclusion is in line with the great generalization that Nature loves simplicity; or, that although the complex organism or organization may survive in competition with the simpler, yet the unnecessarily complex organism or organization tends to be suppressed. One form of this generalization in dynamics is called the principle of least action, enunciated by Hamilton.

Multitudes of examples of the tendency of waves to the sinusoidal form are presented to our view. A storm on the ocean raises within its sphere of influence waves of every imaginable degree of complexity in outline, which spread out and radiate for hundreds of miles in all directions. In the end, these waves, as ocean swell, follow a simple sinusoidal form, or lose all their original complexity. Similarly, sound waves in air which may be very complex near their source, become smoother at increasing distances and approximate simple sinusoidal fundamental tones, especially if transmitted through solids. We impress upon a telephone transmitter, vocal sounds of great complexity, and the outgoing electric waves along the circuit leaving the transmitter have a like degree of complexity; but, on a long circuit, as the waves advance, the overtones die off, and the wave form tends to the simply sinusoidal. We impress upon the sending end of a long submarine cable a rectangular alternating-current wave form from a battery and vibrating reverser. At the distant end, the arriving alternating current is a simple sinusoidal current. Again, we impress a complex alternating e.m.f. upon a circuit containing considerable reactance, and the current in the circuit tends to become a simple sinusoid. Possibly the simplest explanation for the large group of phenomena, of which only a few examples have above been given, is that of all forms of continuous oscillatory disturbance, the simple sinusoidal disturbance is the smoothest, and if as generally happens, the disturbance meets with opposing reactions, the reactions will be a minimum when the disturbance is sinusoidal. If, for instance, we advance along a road with hills of the same height at uniform intervals, the average rate of continuous ascent or descent will be a minimum when the hills are simply sinusoidal in outline. If the hills are simply pyramidal, with a uniform slope on both sides, the gradient will then be uniformly the same up or down, as the average gradient when sinusoidal, but there will be a sudden discontinuity of motion on the top of the pyramidal hill, a sudden reversal from ascending to descending; whereas there is no such discontinuity, or sudden reversal, on the top of the sinusoidal hill. The effect of reactions on all kinds of transmitted cylic disturbances is thus to reduce them to the sinusoidal form.

The magnetic flux in the induction motor appears to be a case in point. The high frequency secondary currents produced by any distortion in the flux tend to suppress the kinkiness in the wave form of the rotating magnetic field and hence to shear away upper harmonics. Not only for long-distance transmission lines, but also for alternating-current motors generally, the simple sine wave of e.m.f. shows itself the simplest, the most economical and the best. Design of alternators in recent years has tended more and more towards the sinusoidal e.m.f. wave. The only exception to the rule is found in the transformers, which prefer a peaked e.m.f. wave, because the magnetic density they are then called upon to develop in their cores is somewhat less than when the e.m.f. is of the same magnitude by voltmeter but is of sinusoidal form. In most cases, however, the preference of transformers in this matter is overweighted by the preference of lines and motors for smooth sine wave.

THE UNITED STATES BUREAU OF STANDARDS.

The Bureau of Standards has recently issued its annual report. The importance of this institution as a national asset can scarcely be overestimated. It is the repository of the National Lares and Penates, so far as relates to weights, measures, mechanical, physical and chemical units. It is not too much to say that all of the surveys, measures and measuring instruments of the country depend, either directly or indirectly, upon the standards kept at the Bureau, and upon the faithful comparison at the Bureau between those standards and secondary standards or commercial copies in general distribution. Taking, for example, electrical engineering applications, the many thousands of electric meters on customers' premises in the various cities of the country are standardized and calibrated by comparison with secondary standard instruments in the makers' factories. These secondary standards have always been brought into comparison with the standards kept at the Bureau, either directly, or by indirect succession. Not only are disputes avoided and litigation minimized by reference to the arbitration of the Bureau in the matter of weights and measures, but there is a very great national economy in having the final standards and their comparison entrusted to a single national Bureau, instead of leaving the labor of primary calibration to each individual manufacturer, or each individual seller.

If the Bureau had not been created, it would be necessary either for each individual manufacturer or group of manufacturers to maintain a separate series of primary standards of measure; or to depend upon foreign National Laboratories for this work. Although it is manifestly desirable that all fundamental measures should be conformed to those issued at a single international Bureau, such as the International Bureau of Weights and Measures at Sèvres in France, yet there is a marked advantage and economy in retaining a National Bureau in each country, the duty of which is to keep in conformity with the international Bureau on the one hand, and also to serve the commercial interests of that particular country on the other. Otherwise, delicate instruments would be constantly passing to and fro across the ocean, with much unnecessary delay between manufacturer and standardizer. Not only in its immediate service is the Bureau a national asset and support of industrial precision, but it has also great value from an educational standpoint. Just as a completely untutored savage cannot be accurate in any act or statement, save by chance, so accuracy and precision is the most characteristic quality of the most advanced type of man, be his industry or occupation what it may. That a country maintains a Bureau whose duty is accuracy in industrial service, necessarily means a strong educational and civilizing influence on the community.

THE RADIOACTIVITY OF URANIUM COMPOUNDS.

The hypothesis most generally entertained at present concerning the origin of the enormous power of the emanations of radium is that the power is ultimately derived from the breaking up and death of uranium atoms. Uranium is the most massive element known to chemists, its atom having nearly 240 times the mass of a hydrogen atom. It is supposed that the dynamic equilibrium of these massive atoms is unstable and that occasionally an atom disrupts or explodes. The event is of extremely rare occurrence, as regards any small group of atoms; but since any appreciable mass of the substance, say a gramme of it, has such an enormous number of atoms, the event of an explo sion is of common occurrence. This may be likened to the condition of railroad accidents in the world at large. The event of a fatal railroad accident is extremely rare, and the probability of its occurrence among a given small group of passengers is very small. Nevertheless, taking the aggregate vast numbers of railroad passengers in the course of a year, the total annual number of fatal railroad accidents is relatively large.

It was observed by experimentalists that a substance which contains radium also contains uranium, and a certain degree of proportionality appeared to exist between them. According to the present provisional hypothesis, uranium will, in the course of millions of years, all be lost by decay into radium, or into substances that in their turn give rise to radium. Radium itself has but a limited lifetime, and breaks up into other substances, of which helium is said to be one. The original stock of energy contained in a massive atom of uranium is thus gradually dissipated in the series of explosions or disruptions ending in relatively inert substances like helium. According to this hypothesis uranium, and possibly also other substances of massive atoms, are very slowly undergoing disaggregation or disruption with attendant loss of energy; whereas, according to the Laplacian view of the universe, the process of consolidation or aggregation of mass is everywhere in progress, attended by loss of radiant energy. The *Philosophical Magazine* for January, 1906, contains a paper by Prof. H. N. McCoy on the relation between the radioactivity and composition of uranium compounds, as determined experimentally from five samples of uranium compounds found in different parts of the world. The result of these measurements is that the radioactivity of these ores is, within 1 per cent, proportional to the quantity of uranium they contain. In pure uranium compounds the specific radioactivity is about four times less than in these ores. The results, however, go to support the provisional theory that uranium is the parent or ancestor of radium.

STUDIES IN STEAM ECONOMY.

The valuable paper of Messrs. Stevens and Hobart, which we print this week, may be considered as supplementary to their previous consideration of engine economies. In the present research they take up the operation of the steam turbine under various conditions, and its comparative qualities as related to the reciprocating engine. The results are somewhat at variance with the preconceived notions generally current upon the subject, but they have a direct practical value as being based on actual working conditions. The data for such a comparison at the present time are necessarily somewhat fragmentary and require careful consideration to make them useful. The authors have given them, however, a remarkable analysis, bringing out from them some generalizations that are most instructive. One of the points very clearly brought out is the fallacy in the often repeated statement that the reciprocating engine suffers severely in economy at light loads. A careful inspection of Figs. 31 and 32 in the present paper should go far toward demonstrating the facts in the case. We are sorry that the authors have confined themselves to the Parsons turbines in these comparisons, since other turbines designed along rather different lines would show slightly different characteristics, although perhaps not different enough to change the general conclusions. These figures show clearly what we have often stated, that assuming engines to be designed with reference to light-load efficiency, their economy suffers very little or not at all, within the range of loads which they would in practice carry. The trouble is that most engine builders have not yet bestirred themselves to produce machines of the highest economy, but have adhered to the standard lines popular before the introduction of turbines.

Another most important matter here brought out is the relatively excellent performance of turbines at moderate steam pressures and low superheat. High steam pressure and superheat are of course always valuable, since they increase the available working range of temperature. Turbines, however, appear from the data here assembled to have a better thermal efficiency under somewhat adverse conditions than do the reciprocating engines, provided that these conditions do not include a poor vacuum. On the other hand, an engine designed for high economy seems to gain only in a moderate degree from extremely high vacua, the proportioning of the low pressure cylinder to utilize them entailing somewhat serious general losses. On the other hand, increased working temperature is especially advantageous to the reciprocating engine, which can in this way be pushed to efficiency as yet untouched by turbines. No superheat over 180° F. is considered in the present discussion, so that no extreme figures for economy appear. In spite of this, a figure of about 15 lb. of steam per kw-hour is reached at a little over 200 lb. pressure and 180° superheat in engines of several thousand kilowatts capacity. Recent turbine guarantees indicate that under favorable conditions this economy can perhaps be closely approximated. If one can judge anything from guarantees, always rather uncertain guides, the turbine seems to be a close second under all ordinary circumstances. The data available in this country for checking Stevens and Hobart's values are very meagre indeed, so that their actual figures must be taken with some caution so far as absolute values are concerned. We know of no American tests in actual commercial work anywhere near 15 lb. of steam per kw-hour for either piston engines or turbines. There are almost no turbine tests available, made in regular commercial work save a few with apologies tied to their tails; and the rare tests made on very large piston engines in regular service have shown nearer 17 lb. than 15.

In tests intended as guides to commercial practice, rigorous account should be taken of all the steam used for the auxiliaries, and of the energy required for superheating. This latter quantity is extremely difficult to ascertain save in the case of an independent fixed superheater. In point of fact, when all the auxiliaries, steam and electric, are taken into account, we very much doubt whether in any kind of direct-connected unit 20 lb. of steam per kw-hour at the switchboard is bettered save under very unusual circumstances. That it can be materially bettered admits of no doubt, and we have great hopes that the competition between turbines and piston engines will prove an active agent in improvement. If Stevens and Hobart's data are trustworthy it appears, as we have been disposed to think, that the steam turbine is particularly in its most advantageous field in units of moderate size, with first-class vacuum and moderate conditions of pressure and superheat. When the direct-current turbo-generator takes its proper place in the art it should be able to give, for instance, highly valuable results in plants of moderate size. Some of the best published results from turbines have been in the smaller sizes. It would consequently seem that it would be worth while to push these machines most actively in this field where these good qualities count for most, although such use is less striking than their adoption in the great power stations in which they have been chiefly exploited up to the present.

The Institute Nominations.

Much interest is shown in the nominations for the vice-presidencies and managerships in the American Institute of Electrical Engineers. Several excellent names have already been proposed from different parts of the country and the several branches of the profession, and while the list is doubtless incomplete, the following may be noted: For vice-president, Dr. Louis Bell, F. G. Baum, H. L. Doherty, W. C. L. Eglin, A. M. Hunt, H. H. Humphrey, Dr. F. A. C. Perrine, P. N. Nunn, J. G. White. For manager: C. B. Burleigh, J. J. Carty, G. A. Damon, P. M. Lincoln, C. O. Poole, F. W. Roller, Paul Spencer, P. Torchio, P. H. Thomas. Some of these gentlemen have already served the Institute; others represent the younger public-spirited element from which the strength of such a body must always be recruited.

In connection with the campaign, no little excitement and indignation appears to have been aroused in Philadelphia by the anonymous circulation of a full ballot, headed by the name of Dr. Sheldon, and issued by a "Local Organization Campaign Committee." The officers of the local chapter have no knowledge of the matter, as a body, and the extraordinary thing is that the circular mailed with the ticket has a "fake" address, there being no such street number in the city, it is said, as that given on the circular. It is stated from Philadelphia that some formal action is to be taken by the local membership condemning this curious proceeding. One of the alleged candidates on this ballot has telegraphed us as follows: "Use of my name unauthorized by me; I know nothing of the source from which the circular emanated."

A circular to the membership at large has been issued, advocating the candidacy of Mr. E. W. Rice, Jr., for president, signed by Messrs. T. A. Edison, Elihu Thomson and F. P. Fish. A further circular endorsing the same candidacy has been issued by Mr. John J. Carty, who refuses to allow the use of his name as a candidate for the office. The nomination blanks have to be returned before March 1.

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International Electrical Congress of St. Louis.

The affairs of the International Electrical Congress of St. Louis, 1904, have been finally closed and a statement of the Treasurer, audited by the Audit Company of New York, is being forwarded to members of the Congress, which statement shows a balance on hand of $2,046.37. The Executive Committee has directed that this sum shall be offered to the Library of the American Institute of Electrical Engineers as a fund in perpetuity, the annual proceeds to be devoted to the purchase of international electrical literature. This condition was made in view of the large foreign membership in the Congress—almost 25 per cent.

The statement says that a deficit was warded off by the sale of *Transactions* at $10 per set, the membership fees received not being sufficient to meet all the expenses of the Congress, including printing and distributing the *Transactions*. When the probability of a deficit became evident a systematic canvass was instituted for the sale of *Transactions*, which produced $2,678.82. Part of the balance on hand—about $500—is due to a binding arrangement whereby the Congress was saved the cost of delivery of the *Transactions* of those members who desired to have their copies bound. The arrangement gave members the advantage of edition cost of binding which, with the cost of delivery added, was somewhat less than the usual cost of job binding.

The total membership in the Congress was 2,068. The cost of the stenographic report at St. Louis was $1,000.35; $518.60 was expended for postage, and $721.50 for distributing *Transactions* to members. The total cost of delivery to members in the United States was about 70 cents per set; to members in Europe 55 cents, and to members in Japan, 35 cents. The three volumes of *Transactions* contain 159 papers, 2,844 pages, 698 illustrations in the text, 124 half-tones on inserted coated sheets and three photogravure frontispieces. The copies printed for sale were exhausted several months ago, and the demand which continues for the *Transactions* may justify the Library of the American Institute of Electrical Engineers, as the legatee of the Congress, to arrange for the printing of a small edition from the plates.

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Chicago Drainage Canal Power Offered for Sale.

The Sanitary District of Chicago, which is developing a large water power plant on the Chicago Drainage Canal at Lockport, Ill., according to an announcement recently issued by Robert R. McCormick, president of the drainage board, expects to be prepared to deliver power from its new plant by January 1, 1907, and the trustees are prepared to enter into contracts with Chicago or any of the other municipalities within the limits of the sanitary district for such electrical energy as may be required for municipal purposes. The estimates upon the cost of generating and delivering this power have been made by the engineers of the sanitary district, of which Mr. Isham Randolph is chief engineer and Edward B. Ellicott assistant engineer, in charge of electrical work. The power is offered to the city of Chicago for municipal purposes at a price of $26.40 per horse-power per year on a basis of 24-hour service per day. Anticipating that a municipality may not be able to use power 24 hours a day, another alternative price of $20 per horse-power per year has been made on a basis of 12 hours' service per day, the trustees of the sanitary district endeavoring to dispose of the power for the remaining 12 hours. President McCormick states that the price of $26.40 per horse-power per year for 24-hour service represents the true cost to the sanitary district and gives the following itemized estimate:

Total cost of development and transmission		$3,500,000.00
Estimate of Cost		
Interest on investment at 4%	$140,000.00	
Taxes on real estate, building, etc.	7,020.00	
Depreciation on buildings, at 1%	3,650.00	
Depreciation on water wheels, at 2%	2,027.32	
Depreciation on generators, at 2%	1,824.60	
Depreciation on pole line, at 3%	2,020.50	
Depreciation on other electrical apparatus at 3%	3,995.52	
Total fixed charges		161,137.94
Operating Expenses.		
For power and sub-station labor	$63,240.00	
For repairs to machinery and buildings	3,700.00	
For incidental expenses	1,200.00	
Operating Lawrence Avenue Pumping Station	43,060.00	
Operating 39th Street Pumping Station	120,380.00	
Interest on investment, 39th St. Station, at 4%	15,599.76	
Total operating expenses		246,079.76
Total cost per year to Sanitary District		$400,217.70

With 15,500 horse-power delivered at the sub-station the cost per hp-year will, therefore, be $26.40. To avoid delays in considering the application of electrical power the following data is given: Power will be delivered to purchasers at the sub-station located at West 48th Avenue and the Canal. The responsibility and cost of transmission from that point must be assumed by purchasers. Power will be measured at the sub-station switchboard, assuming 746 watts as a horse-power. Alternating-current of 60 cycles at either 6,600, 9,000 or 11,000 volts will be furnished.

When the full flow of water is available in the Canal, which will probably be within six or seven years, the power can be increased to 31,000 horse-power with an additional outlay of $450,000. The true cost will then be reduced to $14.07, and it is the intention of making a provisional reduction to this figure in all contracts made at this time, to the effect that all municipalities entitled thereto may secure the benefit of the power at cost to the Sanitary District.

No action has been taken by any of the officials of the city of Chicago toward accepting this offer, although the general sentiment seems to be favorable to it. Mr. William Carroll, city electrician, has asked for an appropriation of $500,000 to make the necessary changes to put the city in a position to utilize this power. No definite plans, however, have been worked out.

A large part of the municipal street lighting system of Chicago consists of direct-current open arcs. Some of the newer circuits are alternating current. If the city uses the drainage canal power, it will be necessary either to change the direct-current series arc system to alternating-current enclosed arcs or to install alternating-current motors at the present power plants to drive the present direct-current arc machines. The latter change, although the cheapest one to make, is not favored by Mr. Carroll because of its inefficiency, and the fact that it would continue in operation a lot of obsolete apparatus which might better be changed at the start. Mr. Carroll estimates that the street lighting of Chicago will be sufficient to take the entire output of the Lockport plant even after the full flow of water is available in the canal and the output increased to 31,000-hp.

Inasmuch as Chicago newspapers have laid considerable emphasis on the exceeding cheapness of this power as compared to that supplied by the Chicago Edison Company to private consumers, it is interesting to note that $20 per horse-power per year, 12 hours each day, amounts to 6 cents per kw-hour. As the load factor in commercial lighting and power, that is, the ratio of the average to the maximum power required in a day, is seldom better than 50 per cent and frequently falls as low as 10 or 20 per cent of the maximum, it is evident that this cost of 6 cents per kw-hour would be from 1.2 to 6 cents if it were applied to commercial work. To this must be added the cost of operation, interest and depreciation on sub-stations and distributing systems so that by the time the drainage canal power would get to the consumer if used for ordinary commercial purposes, it would cost fully as much as the prevailing central station rates in Chicago. There are plenty of motors connected to central station service in Chicago that do not pay more than $20 to $25 per year per rated horse-power.

A Successful Apprentice School in an Electrical Factory.

A recent issue of the *National Civic Federation Review* gives a full account of an address delivered by Mr. M. W. Alexander before the National Civic Federation dealing with the theoretical and practical training of boys in the West Lynn shops of the General Electric Company. We present below a brief abstract of the address.

The apprenticeship system was organized in February, 1902, for boys of at least 16 years of age, who had obtained a grammar school training and were desirous of learning a trade. The period of apprenticeship lasts four years, during which time the boys are taught the trades which are practiced in the factory. The aim is not only to make of these boys efficient machinists and tool makers, pattern makers and carpenters, iron, steel and brass moulders, instrument makers and electrical workers, but to develop a class of artisans from whom can be chosen men for the leading positions in the factory, for assistant foremen, foremen and master mechanics. It was found desirable to incorporate with the apprenticeship system a school especially fitted for the needs of the apprentices.

Each boy receives three years of instruction. He enters school after he has been an apprentice for about six months and he graduates from the school several months before he graduates from his apprenticeship. Each school year consists of forty weeks with two sessions of two and one-half hours each per week. A large part of the teaching is merely a review of some of the grammar school work, but applied to practical factory conditions. Experience has shown that it is desirable to devote a good share of the time to this review and to carry it back to the elementary stage of the subjects.

The rest of the time is devoted to subjects which either have not been taught in the grammar school at all or have been touched upon only in a general way.

In commenting upon the training obtained in grammar schools, Mr. Alexander said: "The question will arise: Why should we, who have had no pedagogical training, attempt to review what has already been taught in the public schools by pedagogically trained teachers? With all due respect to our public schools, excellent as they are in the main—and nobody has a higher regard than I for a teacher and his efforts—I find from my years of experience that the public schools fail to teach the boy to think for himself and to think clearly and logically. The school has taught the boy a great amount of knowledge and has committed to his memory many formulas, but when it comes to the application of this knowledge and of these formulas to practical uses, many a boy finds himself blocked, because he has not acquired the faculty of independent thinking. Our review, then, aims to instill in the boy the habit of independent thinking."

During the first year English and mathematics are taught, one-third of the time being devoted to the former and two-thirds to the latter. In English, the spelling of technical terms is first taken up and then followed by short dictations explaining technical processes, describing materials and their properties and various kinds of apparatus. The boy, therefore, becomes acquainted in a general way with all the practical work. In the instruction in mathematics only concrete examples are given by the teachers, who aim to lead the boy on to independent thinking and to make him acquainted with the very technical arithmetic which he may have to use as a shop foreman. It is only a test of the boy's memory when he is asked to solve '3 × 420 × 12,' but it is an entirely different test if the same problem is put in the following manner: 'A factory consists of three rooms; each room is lighted with twelve arc lamps, each of which requires 420 watts of power. How much horse-power will have to be provided for the lighting of the whole factory if 746 watts equal one horse-power?' In stating such a problem an explanation is given in the very briefest manner of the meaning of 'watt' as a unit of power, and also the nature of an arc lamp, showing the outside appearance of the same and the inside mechanism.

An examination is held at the end of each term, and only those apprentices who obtain a percentage of 60 or more are allowed to advance to the next school term. Some have been left behind. The knowledge of their failure, however, became quickly known among their shopmates and had a most stimulating effect on the mental machinery of these boys. The final examination after three years of schooling is a competitive one, wherein everyone who obtains a percentage of 95 or more is presented by the company with a technical book or a useful working tool. The standing obtained in the school is also stated in the "certificate of apprenticeship," which is given to the boy at the successful termination of his apprenticeship, together with a cash bonus of $100.

In an apprentice training room, the equipment has cost about $5,000, and an additional $3,000 will be spent within the next half year for the purchase of new machines. These machines are a good investment and can be used anywhere in the factory. "The General Electric Company," Mr. Alexander said, "does not believe in letting anything go to waste. No money is spent in a purely sentimental way; there is always a straight business proposition at the bottom of things. If that were not the case I would not care to help in the work."

Printing Telegraph.

Three patents were issued on February 6 to Mr. John C. Barclay, assistant general manager and electrical engineer of the Western Union Telegraph Company, on separate features of his printing telegraph system, which has already been referred to in these columns. One covers a keyboard telegraph transmitter; another relates to the printing mechanism of the receiving apparatus and the third has for its subject a relay used in connection with the transmitting apparatus. The keyboard transmitter is intended primarily for use in connection with Mr. Barclay's page-printing telegraph printer, although it is not limited to this particular application.

The essential parts in combination consist of several adjustable stops or circuit-controlling devices, adjustably mounted on a movable drum, and arranged to be adjusted in position according to the character to be transmitted. The stops are arranged and set into position by the manipulation of the keys on the keyboard, which is practically similar to that of the ordinary typewriter. The stops so set represent the dots, dashes and spaces comprising the characters of the alphabet or code, the next stop in the sequence of operations being the actual transmission of the characters to the line. One of the problems in developing instruments of this class has been to devise means to secure uniform spacing between characters. The letter "E," for instance, in the Morse code is represented by one dot, while the character for a paragraph is four dashes, and that for the numeral 6 is six dots. If unit time were allotted per character it is obvious that the spacing between characters would vary inversely as their length. It is necessary in instruments of this kind to keep the space between characters uniform.

Mr. Barclay accomplishes this result in a very ingenious manner, and this is one of the objects of the present invention, others being, certain and rapid operation, ease of operation, ease of inspection and keeping in order, and relative economy. The stops may be set either by electro-mechanical means or by mechanical means. The drawings show the apparatus operated by electromagnets, these being controlled by the depression of the key levers by hand. For the protection of the instrument the transmitter is not connected directly to the line, but operates a relay which repeats the signals into the main circuit. The second patent covers an improvement in the printing mechanism of the page-printing receiving apparatus used by Mr. Barclay in the printing system. The type characters are arranged on the surface of a wheel, like a ticker type wheel, which is revolved until the desired character is brought into printing position; the wheel is then moved forward into contact with the paper, thus printing the characters in sequence.

It was found that when such printing mechanism was operated at high speed some characters missed position. The object of Mr. Barclay's invention is to prevent this missing of characters and secure certainty and reliability of action. The relay described in the third patent is designed to control a large number of electrical circuits and is particularly intended for use in Mr. Barclay's printing telegraph system. It may be either of the polar or the neutral type. The instrument represented in the drawing has an extension of the armature lever, at the outer end of which is a recess which engages a pin on a rocker or drum placed vertically upon the base of the instrument. The body of the drum is of insulating material, but through it, longitudinally, are arranged contact pins which close the various circuits by coming into contact with contact fingers on one side or the other as the armature lever vibrates. The contact fingers, representing circuit terminals, are arranged in two vertical rows parallel to the axis of the drum, so that when the armature lever is on one side one row of contact fingers is connected in circuit and with the armature on the other side the other row is in service. The pins project through the rocker from back to front. The back contacts constitute the other terminals of the circuits. In a general way the drum and its functions are similar to those of the electric railway car controller on a small scale.

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Induction Motors for Traction.

A patent issued February 6 to Mr. A. H. Armstrong discloses means for maintaining an equal distribution of load between several polyphase induction motors used for railway work.

An efficient induction motor is substantially a synchronous machine; that is, it operates normally with a small slip. Consequently if the driving wheels of a vehicle are of unequal size, due to unequal wear, or if two cars or locomotives with wheels of different size are coupled together in a train, the synchronous characteristic of the motors produces an unequal distribution of load. Thus, for instance, if the motors operate at full load with a five per cent slip and if one driving wheel is five per cent smaller than another the motor geared to the larger wheel may be operating at full load with five per cent slip, while the motor geared to the smaller wheel may be running at synchronism, and consequently doing no work whatever. If the inequality between the wheels is greater than the slip, the motor geared to the smaller wheel may even be operating as a generator, returning power to the line, and thereby acting as a brake to overload further the other motors. The inventor connects independent adjustable resistances in series with the secondary windings of the several motors, respectively, as indicated in the accompanying illustration.

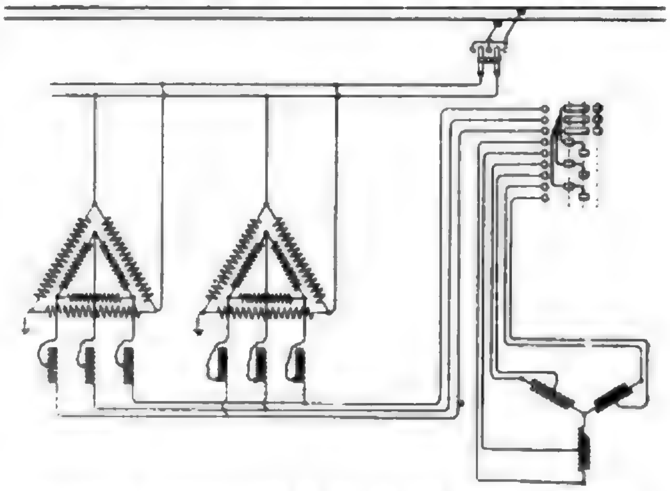

DIAGRAM OF CONNECTIONS OF POLYPHASE RAILWAY MOTORS.

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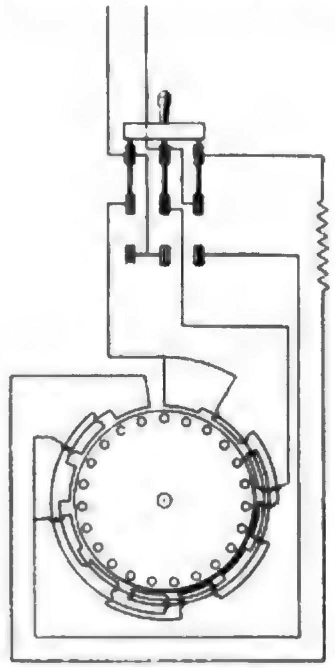
Single-Phase Induction Motor.

As is well known, at or near half-speed a single-phase induction motor has considerable torque. The accompanying illustration shows a scheme proposed by Mr. B. G. Lamme in a patent issued February 27, for bringing the rotor up to half speed in order that the machine may then be switched to the simple single-phase connection. The main primary winding is divided into two groups of coils, which are connected in series in starting the motor and in parallel for running, the current being reversed in one portion of the winding. The number of the poles induced in the primary member with the two portions of the windings in series is double the number corresponding to parallel connection of the two portions of the windings. The number of the poles produced by the current in the auxiliary winding is equal to the number of poles due to the current in the main winding when its two portions are connected in series. The usual "phase-splitting" resistance is connected in the auxiliary starting circuit.



SINGLE-PHASE INDUCTION MOTORS.

CURRENT NEWS AND NOTES.

HONORS FROM GOTTINGEN.—Prof. J. J. Thomson, of Cambridge; Mr. Oliver Heaviside, of London; M. Henri Becquerel, of Paris, and Prof. P. Zeeman, of Amsterdam, were made honorary doctors of the University of Göttingen, on the occasion of the dedication of the new physical laboratory.

LECTURE ON TELAUTOGRAPH.—Mr. James Dixon, electrical engineer of the Gray National Telautograph Company, will lecture on the improved telautograph before the Electrical Engineering Society of Columbia University, in room 301 of the Engineering Building, at 8.15 p.m., on March 7. An invitation to attend is extended by the society to those who are interested in the subject.

ELECTRICITY VS. GAS.—Gasoline or vapor lamps now in use in Memphis, Tenn., will give way to electric arc lamps in a short time. The lights have not given satisfaction and electricity will be substituted in all cases where it is possible. The city now uses 440 electric arc lamps, paying $85 a year for each lamp. It is stated that in case a number of additional lamps are used a rate of $75 a year can be secured. The city has 825 gas lamps at $25.60 a year and 430 gasoline lamps at $24.60 a year.

RADIO-TELEGRAPH RATES.—Mr. David J. Hill, U. S. minister at The Hague, reports that the Netherlands Government has issued an order respecting the exchange of radiotelegraphic messages, and fixing a provisional tariff in regard thereto. The rate will be 10 Dutch cents per word, with a minimum of 1 florin, which is equal to 40 cents per message, and in addition a ship's tax may be allowed of ten Dutch cents per word.

FOR PURE SCIENCE.—The cause of pure science has been benefited by the recent action of Mrs. Elizabeth Milbank Anderson, of New York City, who has added to a sum approximating $2,900,000 already donated by her to the institution, another gift of $100,000 to Barnard College. Her latest donation is to be used for the establishment of a pure science course to lead to the degree of bachelor of science. Two members of the Board of Trustees, whose names are withheld, have offered to guarantee any deficit arising by reason of expenditures for the new course during the next ten years to the amount of $20,000.

WIRELESS IN MEXICO.—U. S. Consul Kaiser, of Mazatlan, writes: "Wireless telegraphy was put in public service on January 1, 1906, and messages are now being sent and received for Guayamas and Santa Rosalia, Lower California, the latter place having been, up to said date, without telegraphic communication. The tariff rate for a message is $1 American currency for each ten words, and 10 cents American for each additional word. It is too early to give an opinion as to the success of the system, which consists of two plants, called the "Slaby Arco" and Telefunken," both of which have been imported from Germany.

COST OF POWER IN BUFFALO.—Mayor Adam transmitted to the Board of Aldermen recently two communications which he had received from prominent manufacturers relating to the cost of power in Buffalo. It was stated in one letter that a large Chicago establishment which desired to locate in the city had found upon inquiry that it could get an electric hp-year for from $6 to $8 less outside the city than in Buffalo, and that one small city outside of Buffalo will in a short time be in position to supply energy at $9 less than the minimum price in Buffalo. C. H Kellogg wrote that his firm after a trial of electricity, substituted gas engines, electric energy having cost it $68 yer horse-power per year.

WIRELESS STATION STARTS.—The American De Forest wireless telegraph station in Springfield, Mass., was formally opened on February 13 and is now ready for commercial work. A number of congratulatory messages were forwarded at 1 o'clock, the first one being from Mayor Dickinson to Governor Guild, as follows: "On the whispering winds I send you hearty congratulations upon the auspicious outlook for your administration." The mast from which the messages are sent is 210 ft. high. Current for operating the station is secured from the United Electric Light Company. The company has secured downtown offices in the Whitney Building, from which messages will be communicated by telephone to the sending station on the Hill.

WIRELESS DEPOTS ON CANADIAN COAST.—Commander Spain, of Ottawa, Ont., has submitted a report on the operation of the Government wireless stations on the coasts of the eastern provinces. There are thirteen stations in all, ten of high power and three of low power. The initial cost of each high-power station is $8,500, and of each low-power station $5,000. The annual cost of maintenance is about $1,800 in each case. Several Government vessels are also equipped with Marconi apparatus, the cost being $1,550 for each ship. The adoption of this system enables constant communication to be maintained all round the eastern coasts from Anticosti to Belle Isle, then to Cape May, Cape Race, Sable Island, Halifax, around the western coast of Nova Scotia and up the Bay of Fundy to St. John. On the occasion of the recent visit to Canada of the battleship Dominion, the Government stations were enabled to communicate with her at a distance from Halifax of 950 miles.

OWNERSHIP AGITATION EFFECTS.—Anxious interest has been aroused by the decline in the value of New York City bonds, since the municipal ownership campaign began. Accountants in the Finance Department have been making a careful examination of the records of municipal bond sales in the last ten years for the purpose of analyzing the results of last week's sale, when the city secured an average price of only $108.052 for $20,000,000 worth of 4 per cent bonds. These were the first 4 per cent bonds that the city has issued in a quarter of a century. The investigation has shown that in the years 1898, 1899, 1900, and 1901 the city repeatedly and almost continually sold 3½ per cent bonds at prices materially higher than was received last week for 4 per cents. The investigation also showed that on averages the city is paying to investors a higher rate for money than it ever has been obliged to pay since consolidation, and that the rate is likely to increase, for, although the city is prohibited by law from paying more than 4 per cent on its bonds, the price at which these bonds will sell is prospectively dropping. The investigators say that this is due in part at least to the municipal ownership agitation and to the likelihood of many large issues being thrown on the market, and therefore the city will be receiving less and less premium on its issues.

ELEPHANT POWER.—A correspondent in the East Indies addresses the following inquiry to London *Engineering*: "We have a number of elephants in the State. I propose to utilize them in working dynamos for six hours every day and generating electricity to store it in batteries and use it at night for lighting streets. I shall feel obliged if you will please give me the information required in the statement accompanying: 1. How many electrical units will an elephant of ordinary strength, working six hours, produce? 2. Cost of dynamos required. 3. Cost of gear required to work it by elephants. 4. Cost of battery to store the electricity." The journal remarks: The mechanical equivalent of the power of an elephant is probably known in India, but we have not been able to find it in textbooks published here. Probably, as compared with that of a horse, it varies as their respective weights. A central station containing a score of elephants walking round like mill horses, or climbing ramps that slipped away under their feet, would be rather a painful spectacle. Apart from this, however, we see no way in which the enterprising department in question could utilize the source of power at their disposal. We do not suppose elephants could be trained to raise water in their trunks and spurt it on a Pelton wheel; and as we have no means of calculating the force of a jet of this kind, we are not able to recommend this means.

THEFT OF COPPER WIRE.—The extent to which the stealing of copper telegraph and telephone wire has developed in this country is indicated by the fact that more than 40 wire thieves are now serving terms in the penitentiary.

PROPOSED MILWAUKEE LIGHTING COMMISSION.—Alderman F. J. Stiglbauer, of Milwaukee, Wis., is in favor of the creation of a lighting commission patterned after the one in Detroit, Mich., and is preparing to introduce a resolution providing for the appointment by the Mayor of five commissioners to be confirmed by the Council, who are to be given power to construct and operate the proposed city plant.

ILLUMINATING ENGINEERING SOCIETY.—In our report of the recent meeting of the Illuminating Engineering Society, through a typographical error the membership was stated to be 50, instead of 150. Since the meeting the enrollment has reached 180, with a number of applications yet to be acted upon. Many of the recent comers are from the South and West, with one from Havana and another from Winnipeg, Canada.

STOCK FOR EMPLOYEES.—The Michigan State Telephone Company has established co-operative relations between itself and its employees by issuing stock to the latter upon advantageous terms. The company obtained an option on a block of preferred stock at 90, which is 7 points under the market price. Circulars were sent out to the employees, offering from one share up, and $60,000 worth of the stock was subscribed for. The stock is held by the company until paid for by the employee, who receives the dividends, and who is credited with interest on the money he pays at the rate of 6 per cent a year.

ELECTRICITY FOR SOUTHERN INDUSTRIES.—A number of large industrial developments are under way in North Carolina, which it is expected will greatly increase the demand for electric energy for motors. Among the consumers is a new cotton mill to be erected at Dallas, Gaston County, which will have 5,000 spindles for the manufacture of yarns. The mill was operated by electricity to be secured from either W. T. Love, of Spencer Mountain, or the Catawba Power Company. The Brown Manufacturing Company is also installing a textile mill, operating 7,860 spindles and 300 looms, the motive power for which will be electricity. The Southern Power Company has secured a number of contracts for power from mills in and around Gastonia, which will probably be supplied from its new station at Great Falls as soon as it can be completed.

GASOLINE MOTOR CARS.—Southern Pacific R. R. officials have recently tested a gasoline motor car on one of the company's interurban lines out of Los Angeles, and it is stated that another motor car has been ordered. It is reported that Salt Lake City railway officials are considering the use of gasoline motor cars for use on their suburban lines. The Pennsylvania R. R. has been running an experimental gasoline-electric car over its main line and branches in the vicinity of West Chester, Pa. Two trips were recently made over the Pomeroy & Newark Railroad, where the present train service is poor, and a trip was made over the Downington & Lancaster Railroad. The J. G. Brill Company is building several Strang gasoline-electric cars, for the Missouri-Kansas Interurban Railway Company.

BRIDGES FOR POWER WIRES.—An agreement has been reached before the Board of Railway Commissioners, of Ottawa, Ont., between the representatives of the Ontario Power Company, of Niagara Falls, and the Grand Trunk Railway Company with reference to the carrying of the company's high-voltage wires over the railway company's tracks. The power company undertakes to use light steel bridges for supporting the wires, with a span of 56 ft. over single tracks and 76 ft. over double tracks. Where telegraph wires are outside the ends of the bridge, they are to be protected by guard wires with a 24½-ft. clearance from the rail of the bridge. The Grand Trunk Railway Company waives its objections to the turning on of the current immediately, the power company to assume all responsibility for accidents. The steel bridges are to be constructed within 90 days.

LABORATORY WORK IN PENNSYLVANIA STATE COLLEGE.—In the course which is offered in electrical engineering at the Pennsylvania State College much emphasis is placed upon the importance of laboratory work as an invaluable aid in causing the student to appreciate the significance of the theory which is obtained from textbooks. For four hours per week during two and one-half semesters, the work includes electrical measurements, study of instruments, testing of direct-current machinery, and the first part of the course in alternating-current laboratory work. During the remainder of the course, which extends over a total of four semesters, four hours per week are devoted to the testing of alternating-current machinery. The students are required to submit, at stated times, reports of the experiments performed in the laboratory, in the preparation of which they display an exceptional amount of interest. Accompanying the report of each experiment are well-executed diagrams showing the machine or instrument being tested and its position in the testing circuits. In connection with these diagrams is a complete description of the object of the test and the method of performing the experiment. The experimental observations are recorded in neatly arranged tables and plotted in the form of curves, which are then analyzed and discussed by the student. The results obtained show that the labor and care which are devoted to the experiments and the reports form one of the most useful parts of the training in engineering which it is possible for the student to acquire in college. The laboratory course is given under the direction of Prof. H. P. Wood, who is assisted by Dr. R. E. Myers, Mr A. R. Dennington and Mr. E. E. Godard. The department of electrical engineering is in charge of Prof. J. Price Jackson.

ELECTRIC POWER FOR CANADIAN CITIES.—An interesting address on Ontario's water powers and their possibilities was recently delivered at a meeting of the Borden Club, of Toronto, Ont., by Hon. Adam Beck, of London, a member of the Provincial Cabinet. While refraining from giving any inkling of the possible trend of the reports to be submitted to the Government shortly by the Hydro-Electric Power Commission and the Municipal Power Commission, of both of which bodies he is a member, Mr. Beck's address was, nevertheless, considered as encouraging by those who favor action on part of the Ontario Government toward control of the great natural sources of power as Ontario possesses. Mr. Beck said the Government had not yet formulated its policy in regard to the question, but taking as his authority statistics and facts which have been made public, he did not hesitate to say that electric energy at $17 per hp-year should and would be ultimately available in Toronto, provided the municipal authorities were alive to their privileges and opportunities. Manitoba, he said, had already gone far in developing its water powers, and the City of Winnipeg had recently not only secured control of 100,000 horse-power, but had taken the drastic action of shutting out a private power company. Dealing with the question of rates and the possibilities of municipal transmission and distribution of power, Mr. Beck cited the case of Guelph, which last year had a revenue of $25,000 from its water works, electric light plant and street railway, which might be doubled if the city could purchase power to run these utilities at half the present cost. A Montreal company, Mr. Beck stated, is supplied with energy from Shawinigan Falls, 91 miles distant, for $15, which is resold to consumers for about $75. Hamilton, which has had water power for years, is paying more than Toronto or London for its lighting, although the electricity in those cities is generated by steam. Toronto, he said, will reap no advantage from Niagara energy at $35, since it can be generated as cheaply with coal.

ANOTHER ELECTRIC TUNNEL.—A dispatch from Providence says that the New Haven Railroad has practically decided to expend $2,000,000 in the construction of a tunnel, two miles long, from the Union Passenger Station to East Providence, where it will connect with the Boston, Worcester & Fall River tracks. The motive power will be electrical.

GOVERNMENT OWNERSHIP OF TELEPHONES.—The Legislation Committee of the Toronto, Ont., City Council has recommended that the council petition the Dominion Parliament for permission to take over the telephone business of the province and operate the same. It is said that the City of Toronto has already lost a quarter of a million dollars in the past ten years by not accepting an offer that was made at that time by the Bell Company, and the opinion seems to prevail that the city should either go into government ownership or make a contract with the existing company.

N. E. L. A.—President Blood, of the National Electric Light Association, spent several days in New York last week in consultation with other officers of the association regarding the development of plans for the Atlantic City convention to be held in June. Although the programme of the meeting is not complete as yet, sufficient papers and reports have been promised to assure ample compensation to all who are in attendance. A large number of applications for associate membership have been received in the past week or two owing to the desire of manufacturers to supply companies to secure good locations for their exhibits.

BUYING LAND BY WIRELESS.—Ex-Congressman Jefferson M. Levy, who has just arrived in London, bought property in New York City by wireless from his cabin on the *Kaiser Wilhelm der Grosse* in midocean. Mr. Levy had the Maiden Lane property submitted to him by a broker as he was sailing. He thought well of it, particularly as he already owned the adjoining buildings, but there was not time enough to arrange the terms of the deal before the next morning. Negotiations with Mr. Levy were kept up, however, through the Marconi station at Nantucket, and later through that at Sable Island. The last exchange of messages was effected in midocean through another liner, between the big *Kaiser* and the shore, until all the details of the transaction had been arranged.

GREAT FALLS PLANT NEARLY COMPLETED.—The first of the three plants being installed by the Southern Power Company at Great Falls on the Catawba River in South Carolina is nearing completion, and the 45,000 hp which will be developed at this plant will soon be available for transmission. The initial installation will include six 5,200-hp twin water turbines operating at 225 r.p.m. under a 72-ft. head, to which will be added two 700-hp horizontal turbines for driving the exciter generators. The water from the tail race after leaving the turbines is to be turned back into the river bed. The current will be distributed over a section about 160 miles long by 60 miles wide. One line will run up the river to the Catawba power plant, whence it will be transmitted to Charlotte, Gastonia, Rock Hill and other points. Other main lines will be run to Columbia, Spartanburg and other principal manufacturing points in South Carolina.

DRAINAGE CANAL ELECTRIC POWER.—The Board of Trustees of the Chicago Drainage Canal has fixed the price for electricity to municipalities and park boards within the sanitary district at $26.40 per hp-year, which represents the actual cost of the power according to an itemized statement prepared by the chairman of the committee. The total cost of development and the transmission of power is placed at $409,217.70. The board can deliver 15,500 hp at the sub-station at West Forty-eighth Avenue and the canal, and the purchasers will have to convey the power from the sub-station. The report of the committee further says that when the full flow of water is available in the canal, which probably will be in six or seven years, the power can be increased to 31,000 hp with an additional outlay of $450,000. This would reduce the cost to $14.97. The drainage board will make provision for such reduction in all its contracts.

HONORING FULTON'S MEMORY.—The Robert Fulton Memorial Association, which was organized recently to erect a suitable monument to the inventor of the steamboat, and possibly a tomb for him, in the centennial year of the first sailing of the *Claremont*, the pioneer steamer, has been incorporated at Albany. The incorporators are Samuel L. Clemens (Mark Twain), R. Fulton Cutting, Andrew F. Burleigh, Gen. Frederick D. Grant, Col. H. O. S. Heistand, United States Army; Hugh Gordon Miller and others. Gen. Grant has consented to serve as temporary president of the association, but as he feels that his military duties would prevent him from devoting as much of his time to the work as he would wish he has asked that some one else be selected permanent president. The incorporators are now considering three men of national reputation for the office. It is intended to have the monument erected on some suitable spot overlooking the Hudson. Among those appointed to serve on the general and executive committees of the association are John Jacob Astor, William Bayard Cutting, Austen G. Fox, W. H. Fletcher, Bishop Coadjutor David H. Greer, Gov. Higgins, Admiral George W. Melville, John E. Parsons, E. E. Olcott, George L. Rives, James Stillman, Horace White and George Foster Peabody.

MUNICIPAL LIGHTING IN VERMONT.—The village of Northfield, Vt., buys from private company the electricity required for lighting the streets and private houses. The current from the plant on Mad River is delivered at the transformer house in the village and there the responsibility of the electric company ends. The village owns the poles and the street lamps, it wires the stores and residences, makes all repairs, fixes the price and collects the bills. The town originally owned its plant, which was built twelve years ago, and which with the three water powers purchased imposed a bonded debt of $30,000 on the village. In October, 1904, the municipal plant was burned, and Messrs. Moody & Almon, the owners of the Mad River plant, were then asked to supply energy temporarily for lighting purposes. After a trial of a few weeks a contract was made for a year. The question of rebuilding the old plant remained under consideration, but at a special meeting recently called to act on the matter it was voted to renew the contract with Moody & Almon for ten years at $4,500 a year, the company to receive in addition a percentage on all new business added. The village leases its water power to the Rabidou Lumber Company. A steam plant has been erected for use in case of emergency, but has only been needed once for a few hours.

METRIC IN NEW JERSEY.—In the New Jersey Legislature on February 14, the body without a dissenting vote placed itself on record as favoring the passage by Congress of the Littauer bill providing that the metric system shall be employed in the transaction of the business of the United States government. The action of the Legislature consisted of the adoption of the following Senate concurrent resolution introduced by Mr. Hutchinson, of Mercer County: Whereas it is represented that the business transacted through the Custom House of the United States is greatly hampered and made expensive by reason of the necessity of the reduction to the basis of the federal system of invoices made under the metric systems of other countries; and Whereas it is deemed advisable that a common and scientific system should be used for such transaction the world over; and Whereas the Littauer bill now pending before the Committee on Coinage, Weights and Measures of the House of Representatives provides for a moderate and conservative advance towards the adoption of the metric system in this country by providing that it shall be employed in the transaction of the government business; therefore, be it hereby Resolved, the House of Assembly concurring, That it is the sense of the New Jersey Legislature that the Littauer bill should be passed by Congress, and that the Senators and Representatives from this State be and are hereby respectfully requested to support that measure; and, further, be it Resolved, That a copy of this concurrent resolution be sent to each of the United States Senators and Representatives in Congress from New Jersey.

CABLE TO PANAMA.—A bill has been introduced providing for an appropriation of $1,000,000 for the construction of a cable from Key West, Fla., to Guantanamo, Cuba, and thence to the canal zone on the Isthmus of Panama.

MEXICAN POWER PROJECTS.—Writing from Durango, United States Consul Le Roy says: "It is reported that a large company has been formed to exploit the extensive water power near Guanecevi, using it to supply with power the camps at the latter place and at Parral, as well as to operate an electric railroad between these two camps. The details of this organization are not known at this point, except that it is an American enterprise."

SALE OF FRANCHISES.—The Newark, N. J., Board of Trade has received a report from the legislative committee of the organization, which recommended the adoption of a resolution calling upon the Legislature to pass a law limiting all public utilities franchises to twenty-five years. The resolution also provides that such a law should be brief and set forth specifically that at the expiration of the franchise period the property ownership shall revert to the municipality, and that it shall then be sold at auction to the highest bidder. The resolution was adopted by an almost unanimous vote.

PRIVATE TROLLEY LINE.—It is stated from Paterson, N. J., that Mr. Edward H. Harriman, the railroad man, has completed arrangements for the construction of a ten-mile private trolley line to his new million-dollar residence at Forest Lake, N. Y. The line will run from the Newburg Junction on the Erie Railroad through Tuxedo, and thence to Arden and the mountains above Greenwood Lake, where Mr. Harriman's summer home is to be located. The rolling stock will consist of two passenger cars, one of which will be a parlor car. It is expected that work on the road will begin in the spring.

CALCIUM STEEL.—United States Consul-General Mason, of Paris, reports that the so-called "calcium steel" is not any form of steel or any other metal, but a ceramic product, made by baking in an oven a paste made of finely pulverized feldspar, sand and lime in certain specified proportions. These materials, being mixed with water and worked into a plastic paste resembling sculptor's clay, and then baked, produce a porcelain or earthenware of great hardness and durability, which resists corrosion by acids, or alteration by atmospheric influence, is a poor conductor of heat or electricity, has a specific gravity of 3.3, and is in color a yellowish white, which may be varied to any desired tint by the addition of metallic oxides. By reason of its hardness and a certain toughness it can be bored, cut, planed or polished—qualities which generally belong to metals rather than ceramics. So far as can be ascertained, it has not yet become an industrial product of any great importance, although cheap, easy of manufacture, tough and exceeding resistance to acids, moisture and other deteriorating influences.

LIGHTING IN NEW YORK.—At a meeting of the New York Board of Aldermen on February 14, the finance committee submitted a report rejecting a resolution passed by the Board of Estimate and Apportionment appropriating $10,000 in addition to the $600,000 appropriated last year for the purchase of land for municipal electric lighting plants. The committee stated in its report that it was unable to obtain information showing that the land was worth as much as it was proposed to pay for it. The committee of engineers appointed to select sites and arrange for the construction of the plants, purchased sites for all the boroughs except Richmond, and needed $10,000 more to complete their work. Chief Engineer Lewis said at the time that, with this additional appropriation, the committee's work would soon be completed and the city could go ahead with the construction of the plants. The report of the finance committee against the appropriation was adopted by a vote of 51 to 10, involving a virtual abandonment of the municipal lighting plan, as the $600,000 appropriation is entirely exhausted and the engineers cannot continue the work for which they were appointed.

Electrical Engineers of the Times.—XLVII.

MR. W. H. MERRILL, JR.

William Henry Merrill, Jr., was born January 10, 1868, at Warsaw, N. Y., and educated in Holderness School, Plymouth, N. H., and the Massachusetts Institute of Technology, Boston, from which latter he was graduated with the class of '89. Upon graduation he became connected with underwriters' electrical inspection work in Boston, and in 1893 went to Chicago, where the following year he started in a very small way what has, under his supervision, now grown to be the Underwriters' Laboratories of the National Board of Fire Underwriters, where all the testing of electrical and other apparatus for the benefit of fire underwriters of the United States is carried on. The history of Mr. Merrill's engineering work is practically identical with the history of underwriters' inspection and testing since that time.

The Underwriters' Laboratories soon outgrew the cramped quarters in the down-town district of Chicago and were moved to a location on East Twenty-first Street. In 1905 a large model fireproof building was erected at East Ohio Street on the lake shore. The Underwriters' Laboratories, Inc., of which Mr. Merrill is the secretary, is the testing station of the National Board of Fire Underwriters. Its purpose is to examine and test all devices and materials affecting the fire hazard. The principal work of this institution is the testing of fire extinguishing and retarding devices, but an important department is devoted to the testing of electrical fittings. It is the best equipped laboratory plant of the kind in the world and is constantly extending its work through affiliation with important insurance organizations, manufacturers' associations, municipal departments and manufacturing companies. Mr. Merrill is also secretary of the National Fire Protection Association, which includes in its membership all of the insurance boards and organizations in the United States and Canada, as well as the American Institute of Architects, American Society of Mechanical Engineers, American Water Works Association and other national societies. It compiles all of the rules of the National Board of Fire Underwriters covering fire protection subjects and is the most important organization engaged in engineering work affecting the insurance interests. He is also secretary of the committee of consulting engineers of the National Board of Fire Underwriters, having in charge for that body the engineering work covering gas, oil and all hazards except electricity. He is chief electrician of the Electrical Bureau of the National Board of Fire Underwriters, supervising the electrical inspection service in twenty central western states and territories and having in charge the compilation and publication of the quarterly reports of electrical fires for the United States. Mr. Merrill is also a member of the electrical committee of the Underwriters' National Electric Association and of the National Conference on standard wiring rules, which organizations have in charge the compilation of the National Electrical Code.

W. H. MERRILL, JR.

The District Supply System of the North Shore Electric Company, Near Chicago.

In the summer of 1902 Mr. Samuel Insull, president of the Chicago Edison Company, began the acquisition of the various electrical plants operating in the suburbs of Chicago, having in mind their consolidation under one management and the generating of the necessary current in stations of sufficient size to operate economically.

The company organized to carry on this work is known as the North Shore Electric Company and has the following officers: Mr. Frank J. Baker, vice-president and general manager; Mr. F. W. Insull, secretary and treasurer, and Mr. George H. Lukes, general superintendent.

Originally controlling a small part of the north shore suburban territory, the company has extended until now it owns the largest system of district, or village to village, electrical distribution in the Middle West. It controls practically all the suburban lighting around Chicago, and by so doing has made it possible to supply electric light and power to a number of small suburban towns where a purely local plant would not have been able to operate profitably.

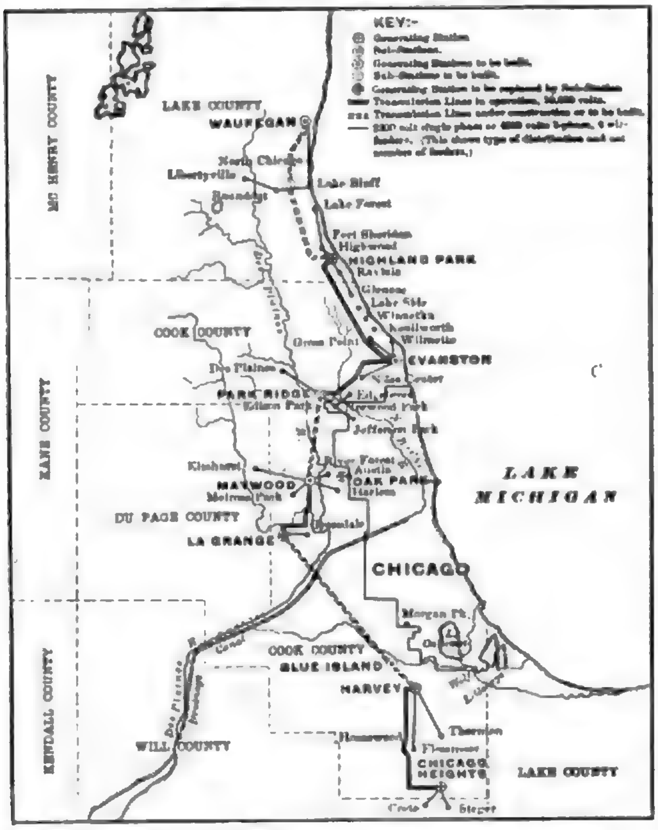


FIG. 1.—MAP OF NORTH SHORE ELECTRIC COMPANY'S SYSTEM.

As the suburban territory around Chicago is certain to have a large and rapid growth, high standards of construction have been adhered to; much higher, in fact, than would be justified in rural communities where no such rapid growth is sure to take place. The general engineering methods are naturally those of the Chicago Edison and the Commonwealth Electric Companies operating in Chicago, of which Mr. Insull is president, but of course many modifications have been introduced in these methods to suit them to suburban work where the load is more scattered than in the city.

The extent of the company's system can be seen by the map, Fig. 1, which shows in diagram the location of this company's generating stations, sub-stations and transmission lines. It will be seen that the company's distributing systems extend from Waukegan, 37 miles north of the business district of Chicago, to Chicago Heights and Crete, about 30 miles south. The general plan adopted has been to transmit from the generating stations to sub-stations over three-phase, 60-cycle, 10,000-volt, high-tension lines. These high-tension lines have been constructed with the intention of raising the voltage to 20,000 when the load increases enough to necessitate it. At the various sub-stations static transformers are placed, which step-down from 10,000 to 2,300 volts. The local distribution from each sub-station is by means of a 2,300-volt, four-wire, three-phase, 60-cycle system. By this system the secondaries of the sub-station transformers are Y-connected. Between the neutral point and the outer wires 2,300 volts is obtained, and between any two outer wires 4,000 volts. This gives a three-phase circuit at 4,000 volts for power purposes and 2,300-volt, single-phase circuits for lighting distribution.

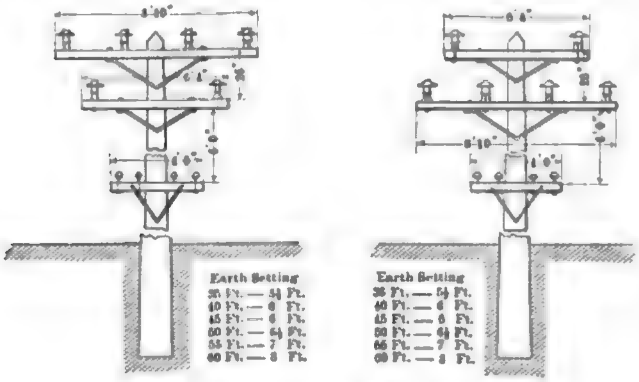
Referring again to the map, Fig. 1, and beginning at the extreme north, it is seen that a generating station is located at Waukegan. The Waukegan station supplies by ordinary 2,300-volt distribution the towns of North Chicago, Lake Bluff, Rondout and Libertyville, taking a maximum or peak load of about 400 kw. At Highland Park is another generating station, the peak load upon which is about 475 kw. This supplies Highland Park, Lake Forest, Fort Sheridan, Highwood, Ravinia and Glencoe. This station is connected by a transmission line to a generating station at Evanston. The Highland Park station is operated only during part of the day, and it is the intenton to do away with the operation of the steam plant there and make it purely a sub-station as soon as possible. The company finds that stations operated to carry a peak load only are expensive luxuries and to be avoided as far as possible, although it is well to keep the steam machinery as a reserve for use in case of breakdown. At Evanston the company has two plants, from one of which hot water heating is supplied. These two plants carry a peak load of 800 kw and supply Evanston, Wilmette, Gross Point and Niles Center by a 2,300-volt distribution. The Evanston stations carry all of the load at Highland Park except during the peak. It is proposed to build a transmission line from Highland Park to Waukegan and to erect a large economical generating station on the lake shore at Waukegan. Thus the Waukegan and Evanston plants will be connected by transmission lines and it will be possible to carry much of the load of the north shore suburbs from the Waukegan plant, although on account of the hot water heating business in Evanston and the large load there, the generating stations in Evanston cannot be abandoned.

From Evanston a transmission line runs to a sub-station at Park Ridge, upon which there is a maximum load of 150 kw. From this sub-station the suburbs of Des Plaines, Park Ridge, Edison Park, Norwood Park, Jefferson Park and Edgebrook are supplied.

The next generating station is at Maywood, where a new plant is being erected, as it is in the center of the important suburban district directly west of Chicago. The transmission line will soon be completed between Maywood and the Park Ridge sub-station, thus connecting Maywood with Evanston. The Maywood station supplies Maywood, River Forest, Harlem, Melrose Park and Elmhurst, all by 2,300-volt distribution except the line to Elmhurst, which is operated at 5,000 volts with step-down transformers at Elmhurst, reducing to 2,300 volts. The street lighting at Elmhurst is by 32-cp incandescent lamps supplied from a low-tension, multiple distribution, the street lighting transmission line being switched on and off at the power station at Maywood. The peak load on Maywood is about 250 kw, but this does not include the power to be supplied from there over the transmission line to La Grange.

From Maywood to La Grange is a 10,000-volt transmission line, recently constructed for the purpose of making it possible to shut down the steam plant of the La Grange Service Company and operate it as a sub-station. This is another combined water and lighting plant. Centrifugal pumps with vertical shafts built by the Byron-Jackson Machine Works in San Francisco will be used for this pumping. These pumps have been extensively used for the pumping of irrigation water and in mines, operating against very high heads, in California. The peak load at La Grange is about 250 kw. From this sub-station La Grange, La Grange Park, Grossdale and West Grossdale are supplied by 2,300-volt lines. From La Grange to Blue Island there is a long stretch of country containing no suburban towns of much consequence. Probably some day a transmission line will be built connecting the southern suburbs with La Grange.

At the present time there is a combined electric light and water pumping plant at Harvey and an electric light plant at Chicago Heights. These two towns are connected by a transmission line and one or both stations operated as suits the company's convenience. The heaviest load is at Chicago Heights, but it is necessary to operate the Harvey steam plant continuously at present on account of the water pumping. It is now proposed to build a steam plant at Blue Island on the Calumet River. This will be a steam turbine condensing plant of good size, for supplying Chicago Heights and Harvey, and also furnishing energy to the Chicago & Southern Traction Company, which now controls the electric railway line from Harvey to Sixty-third Street, Chicago, and is constructing south from Harvey through Chicago Heights to Kankakee. From Harvey the towns of Thornton, Homewood and Flossmoor are supplied at 2,300 volts, and from Chicago Heights 2,300-volt lines are run to Steger and Crete. The peak load at Harvey is 150 kw, and that at Chicago Heights 400 kw. From this map and description it is seen that the company supplies a very large territory, and that when the transmission lines which it is proposed to construct immediately are completed, the generating stations will be so interconnected that the load can be distributed between them in an economical manner, and the possibilities of interruption to service reduced to a minimum.



FIGS. 2 AND 3.—DIAGRAMS OF POLES.

Fig. 2 shows the standard pole line construction used for the high-tension lines connecting generating and sub-stations. As before explained, these lines are now operated at 10,000 volts with the idea of increasing this voltage ultimately to 20,000 volts. As all the details of construction are specified on the drawing, very little explanation is necessary. The insulators are porcelain, Locke No. 408A, on the line which is now being constructed. These are larger than many that are commonly used on 20,000-volt lines, so that there is a good factor of safety. The lower cross arm carries four telephone wires. Although these pole lines are constructed for two transmission circuits, only one circuit has been placed on any of them so far. The ordinary length of pole in the country is 40 ft. This length is, of course, varied to suit conditions. Thirty-five-ft. poles would do ordinarily in the country but for the fact that most of the company's transmission lines have also 2,300-volt distributing circuits on lower cross arms. The smallest wire that will be used on transmission lines in the future is No. 3 hard-drawn copper, this minimum size being used to secure mechanical strength. The telephone lines are No. 12 hard-drawn copper.

Fig. 3 shows the standard transmission line construction at a transposition. The telephone line is transposed every five poles on Locke No. 7 insulators.

Fig. 4 shows the standard construction at corners for the transmission and telephone lines.

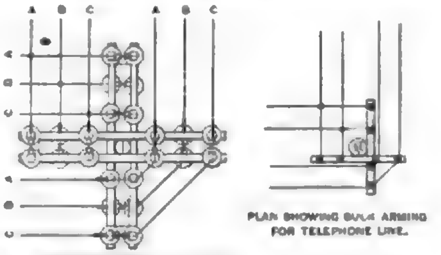
The present lines are mainly located on highways for which franchises had to be secured as well as the consent of the property owners along the route. In a few places the company has purchased consent to set poles on private property. After considerable experience with the right-of-way question, the company has come to the conclusion that in general it is better to secure private right-of-way, rather than build on the highway.

The general plan of operation is to keep the 2,300-volt bus-bar voltage constant at the sub-stations and to regulate the various single-phase lighting feeders with C. R. regulators, by which the voltage can be raised or lowered 10 per cent.

No fuses are used in the 2,300-volt distributing circuits save at the transformer terminals. Automatic circuit-breakers are provided on feeders at sub-stations. No time limits are placed on automatic circuit-breakers at sub-stations, but a time limit device is used on those at generating stations so as to give the circuit-breaker on any feeder time to act before that at the generating station will open and so prevent opening the station circuit-breaker in case of a heavy short-circuit on one feeder. The switch used on all 4,000-2,300-volt circuits is the type K3 oil switch of the General Electric Company.

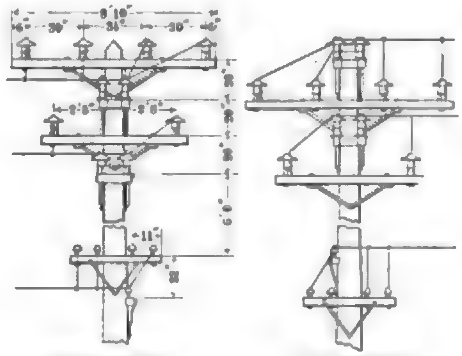
The 10,000-volt transmission lines outgoing from power stations have General Electric type H3 switches and the incoming 10,000-volt lines at sub-stations have General Electric K6 switches.

Most of the sub-stations are of sufficient importance to justify the keeping of men on duty there twenty-four hours per day. The Park Ridge sub-station, however, which supplies a number of very small suburban towns, has an attendant only during the night when current is on. At present the company gives twenty-four-hour service in most of its territory. As soon as plans are complete, it will do so throughout all of it. The company maintains district offices at or near its stations and sub-stations. In small villages where there is no sub-station, arrangements for lamp renewals, etc., are made with some village store. Free lamp renewals are given. In Evanston and Waukegan, the two largest towns in the company's territory, a delivery service for lamps is maintained, although in some places an extra charge is made for the delivery of lamps. As indicated by Mr. Baker, the vice-president, in a discussion at the last Illinois State Electric Association, the company finds that the policy of furnishing free lamp renewals is desirable in order to make sure that the customer's sockets are not filled with low-efficiency lamps purchased at Chicago department stores, and that the customer's do not neglect to renew burned-out lamps and so cause a loss of revenue to the company.



PLAN SHOWING DOUBLE AND BUCK ARMING FOR TRANS. LINES.

PLAN SHOWING BUCK ARMING FOR TELEPHONE LINE.



FRONT ELEVATION. SIDE ELEVATION.

FIG. 4.—DIAGRAMS OF CORNER POLES.

The company has its own telephone lines, carried on the transmission lines as indicated. Special attention has been given to the protection of telephone instruments, and a special cut-out with a very long enclosed fuse of No. 40 wire is used in each telephone circuit where it enters a building.

The Reincarnation of an Electrical Idea.

By Frank J. Sprague.

It has been only a few weeks since, in order to emphasize the fact that not only had we by no means reached the limit of direct current operation, but that we were within striking distance of working potentials which at first sight might seem startling, I venture to express myself as ready in case circumstances warranted to undertake heavy electric operation under a motor potential of not less than 1,500 volts. No sooner was this announcement made than all sorts of inquiries appeared as to how I proposed to do it, what was the meaning of this assertion, and, after all, were not the difficulties inherent to any such radical change greater than those to be anticipated in other departments of electric advance? I reserved to myself the privilege of explaining methods until the time of my own selection, and as to these details I hold myself still privileged, but perhaps I may as well call attention to a recent movement which has some bearing on the matter.

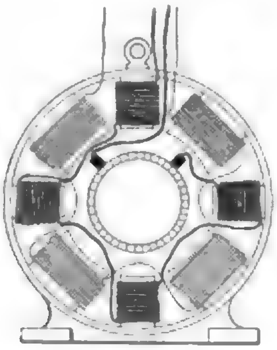


FIG. 1.—INTER-POLE MOTOR.

It is a curious circumstance that there should have been recently resuscitated and put into a practical working form, a method originally developed for the same purpose, and then, like many other good things, for the time being laid aside in the march of development along other lines. This particular instance is one of the most curious with which I am acquainted, and illustrates the fact that no thoroughly good idea is likely to remain forever buried, for the same reason which originally called it forth will again in the march of improvement demand its resurrection. And the particular idea which now bids fair to be of vital consequence, and utility in the further development of continuous current apparatus is that illustrated by the use of what are commonly known as commutating or inter-poles, but which in a broader sense may be termed the method of neutralizing armature reaction and eliminating sparking by automatically varying the polar resultant, or correcting the distortion due to varying relations between armature and field strengths in dynamo-electric machinery.

In this specific form the commercial application of the inter-pole has been comparatively recent, but since this general method is one which is fundamental to the larger devlopment of non-sparking continuous-current machines operated at increased potentials, I derive more than ordinary satisfaction from the fact that both the idea and practice originated with me a good many years ago.

Among recent advertisements of one of the best-known American constructions the following paragraphs occur:

"What do you do when a motor begins to spark as the load comes on? You rock back the brushes because the point of best commutation has rocked backward. If this point of best commutation could be kept stationary and other conditions were right, the motor could be kept running without sparking and without shifting the brushes. Now that is exactly what occurs in the inter-pole motor. The inter-pole, midway between the main poles, being excited with series coils, weaken and strengthen with the load. Therefore, the resultant pole of the motor approaches the inter-pole when this is strengthened under heavy load and approaches the main pole under light loads. In other words, the field is automatically rocked back and forth, and, all other conditions being right, the brushes are always at the point of best commutation."

"When an inter-pole motor is speeded by the device of weakening the main fields, the motor calls for more current to maintain its increased speed and the armature tends to react strongly on the weakened main poles and twist the field backwards just as it does in the ordinary motor.

"It doesn't succeed in doing this because the strengthened inter-pole exerts its influence and brings the field and the non-sparking commutation point of the brushes forward where it belongs. What is the result?

"The inter-pole motor can be speeded 600 per cent over its slowest speed by field control and wth absolutely no sparking at the commutator.

"Reversing? That is simple. The armature circuit is reversed and with it the inter-pole, which simply reverses its function and helps out its left instead of its right-hand neighbor."

It is some years since there appeared in my United States patents, Nos. 428,732, May 27, 1890; 324,891, August 25, 1885, and 335,781, February 9, 1886, filed July 19, 1884, March 12, 1885, and September 26, 1885, respectively; also in a paper on "Electric Motors," read before the Naval Institute at Annapolis, Md., May 6, 1887, and in Chapter 13 of Martin and Wetzler's work, "The Electric Motor," published in 1886 and 1888, a complete description of the method of correcting sparking in direct-current machines by an automatically variable shifting of the field poles to offset the distortion set up by the armature. From the last-mentioned work the following is quoted:

"The winding of the field magnets of the motors is peculiar. One of the great difficulties which has invariably been met with in working with motors is the change of lead necessary to get the brushes at the point of non-sparking. It is considered necessary when dealing with large powers, if there is going to be continuous and successful running, to maintain the brushes at such a point. This change of the lead, caused by a distortion which is set up by the armature, varies with every change of load, with every change of the armature current, and with every change in the field magnet strength. It has furthermore been the habit where any considerable power has been developed to use two sets of brushes, one for forward and the other for backward motion. Mr. Sprague has entirely obviated the necessity for doing this by an arrangement which is as simple as it is efficient. This consists in the method of constructing, winding and connecting up the field magnets. The latter are wound with two sets of coils. One of these is a fine shunt coil which is in series with an independent regulating resistance and produces the normal poles; the other is a coarse coil in series with the armature, which tends to produce poles at right angles to the normal poles, and this circuit is included in the reversing switch so that when the armature circuit is reversed the current in the coarse coil is also reversed. There are then four poles set up in this machine, two being normal and variable at will, the other two being abnormal variable poles dependent upon the current flowing through the armature.

"In the normal arrangement of circuits the two sets of field coils, fine and coarse, combine to set up a resultant polar line which is distorted or rotated in the plane of rotation of the armature. Since any increase in the armature current causes the same increase in the series field coils, the tendency to distortion by these two elements will always vary to the same extent, and the resultant position will be always the same no matter what is the extent of variation of current. If the strength of the field magnet is varied independently of the armature, by changing the resistance in the shunt field circuit or by a variation of potential on the line, while there is a tendency to change the armature distortion, there is an equal and opposite tendency to change the distortion due to the series field coils, and so this, also, has no effect. If the direction of the armature current is changed so also is that of the current in the series field, and hence the direction of each distortion is changed; but they still oppose each other and vary equally and oppositely as before, and there is still no change in the non-sparking points. It is immaterial whether the change in direction of armature current is due to a change of terminals in changing the direction of rotation of the motor, or is caused in changing the motor into a generator by strengthening the field. Hence the motor will run in either direction on a circuit of constant or varying potential, with a single or double set of tangential or end-contact brushes, with no necessity for changing the position of the brushes. The position of the brushes having been once properly adjusted, it is made independent of the amount of work the machine is doing, or the speed at which it runs, or whether it is acting as a dynamo or as a motor. It is likewise independent of the strength of field and of the armature current so long as the magnetic moment of the field sufficiently exceeds that of the armature."

Two claims from patent No. 335,781 are sufficiently illustrative:

"12. An electro-dynamic motor having series and shunt field coils arranged to produce polar lines at right angles to each other in combination with an adjustable resistance and a circuit reverser in the armature circuit, and an adjustable resistance in the shunt field circuit, substantially as set forth.

"13. An electro-dynamic motor having series and shunt field coils wound so that the series coils distort the poles set up by the shunt coils, in combination with means for reversing the direction of distortion, substantially as set forth."

These claims define the poles as being at "right angles" to each other, because bipolar machines were used with consequent pole windings, but the meaning of course is that the poles set up by the series coil are intermediate between and equidistant from those determined by the shunt winding.

In the stationary motors which I for some time constructed with double coils the series winding was a distorted one, and intended to shift the field in one direction only, but on motors installed and operated for some months in the year 1886 on the Thirty-fourth Street branch of the elevated railroad the series armature coil was equally distributed so as to tend to produce the supplemental poles equally midway between the normal ones. No actual polar projections at these points were used, but this is a physical not a fundamental difference; and, as stated, consequent not salient poles were used in these early constructions.

The actual construction of the fields and the winding of the series field coil, as well as its connection to the armature and reverser, are illustrated in the accompanying sketch.

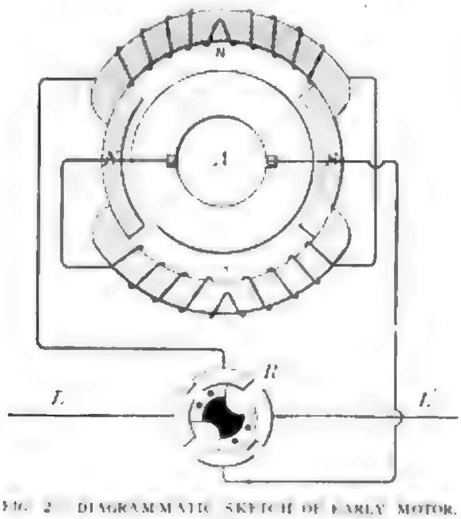


FIG. 2.—DIAGRAMMATIC SKETCH OF EARLY MOTOR.

The shunt winding, making the poles N and S is omitted for clearness. The variable supplemental poles are n and s.

The late Prof. Henry Rowland, in reporting upon the features distinguishing the early practice of the old Sprague Electric Railway & Motor Company, pronounced this a most important and valuable advance.

This general idea, since quite independently, I assume, conceived and applied to salient pole machines, bids fair to revolutionize much of the continuous-current practice, and is one of the principal features which I unhesitatingly assert is going to make possible very much higher potentials in direct-current machines. Those who have experimented with this development have been astonished with the results, and the freedom of design which it leaves in the hands of the constructor. Not only American but English and German manufacturers are rapidly becoming interested in it, and some of the possibilities are indicated in an interesting paper by Dettmar in a late article in the *Elek. Zeit.*, from which I quote the following brief extract:

"On account of the necessity for obtaining good commutation, direct-current dynamos have been built in the past mainly for electromotive forces not over 700 volts, for large generating sets not over 1,100 volts, and in extraordinary cases 2,000 volts have been employed. With the use of interpoles it will be easy to at least double the voltage. This should have an important effect on direct-current traction and simple power transmissions. * * * It may, therefore, be assumed that there will be a tendency in the future to make interpole construction the rule."

Of course this is but one element of the problem so far as railroad practice is concerned, and there are other important essentials. But the possible increase of potentials directly used on invidual motors to 1,500 volts, to say nothing of what may be used in combinations of motors, promises important developments in direct-current work. And when to this is added the fact that by special methods of regulation not only can there be a range of at least six or eight to one in economic speed under load with the utmost refinement of variation, but that in addition where there are down grades the locomotives can be used to restore energy to the line through a complete range of like character, if the gain warrants the increased size and cost of apparatus common to all proposals for return of energy, some idea may be had of possible future developments.

Turning now to other types of machines, it is interesting to note somewhat further to what extent double fields are used. For example, in the normal commutatorless polyphase motor an essential element is the use of two equally displaced windings to create by alternating currents of differing phase two variable and reversible fields which combine into a resultant rotating field.

Again, the compensating coils used on some commutating types of alternating-current motors are really coils wound to create magnetic fluxes intermediate as to polar resultant between the normal poles, as illustrated by the Lamme motor described in the ELECTRICAL WORLD of February 10, and in the diagram of the single-phase motors of the General Electric and other companies.

Referring again to direct-current practice, the development of this general method of neutralizing armature reaction is but one element of the problem so far as railroad practice is concerned, and there are other important essentials. But the possible increase of potentials directly used on individual motors to 1,500 volts, to say nothing of what may be used in combinations of motors, promises important developments in direct-current work. And when to this is added the fact that by special methods of regulaton not only can there be a range of at least six or eight to one in economic speed under load, with the utmost refinement of variation, but that in addition where there are down grades the locomotives can be used to restore energy to the line through a complete range of like character; if the gain warrants the increased size and cost of apparatus common to all proposals for return of energy, some idea may be had of possible future developments on direct-current lines, irrespective of whatever excellent results may be attained by direct alternating-current methods; all making to a common end, the greater development of heavy electric traction.

The Magnetism in Induction Motors.

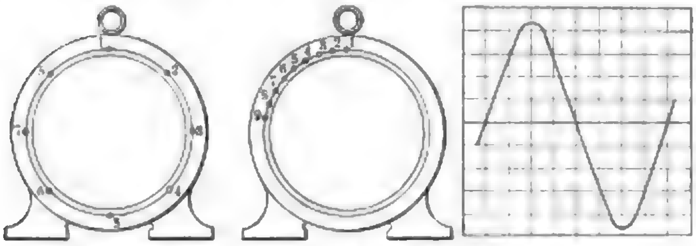
By H. F. and H. W. Connell

THE investigation which is outlined below was undertaken for the purpose of ascertaining how nearly the commercial induction motor of to-day follows the theoretical laws regarding the impressed e.m.f. wave form and its relation to the resultant wave form of the flux, both as to time value and space distribution. Although the results here obtained may have no commercial value, they will nevertheless be of interest to the student and the designer in showing how nearly theory and practice agree.

Kapp, Blondell and others have shown theoretically that if the induction motor is subjected to sinusoidal e.m.f's the resultant time value of the flux in the air-gap will likewise be sinusoidal. It was with the object of observing if this condition held true in practice, and of ascertaining the space distribution of the flux in commercial machines running under actual working conditions, that the investigation was made.

The value of the flux was ascertained by the use of test coils placed on the induction motor, both around large arcs of the stator and also around single teeth of the stator, these coils being connected to a Rosa curve tracer. Therefore, the curves obtained are not entirely accurate as regards the form and the actual values of variation of flux, but they show the general form both as to its time value and space distribution. One of the principal causes of variation in the curves was the inability to keep the impressed e.m.f. at a constant value, due to poor governing of the engine.

The machines used in making the investigation were a four-pole, two-phase, 3-hp, 200-volt induction motor and a four-pole, single-phase, 1-hp, 100-volt induction motor.

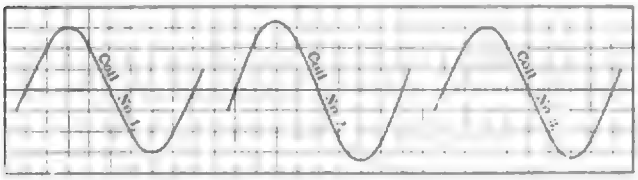


FIGS. 1, 2 AND 3.—ARRANGEMENT OF TEST COILS, AND WAVE OF E.M.F.

The impressed e.m.f. curve (Fig. 3) was observed by connecting a high non-inductive resistance to the source of supply of alternating current. A shunt was run from this resistance to the curve tracer, while the contact maker was driven by a synchronous motor connected to the same alternating-current mains. This curve it will be seen is approximately sinusoidal.

In order to ascertain the time value of the flux in various positions over the pole faces eight test coils were placed at equal distances, 45 mechanical degrees apart, around the circumference of the stator of the four-pole, single-phase motor, as shown in Fig. 1.

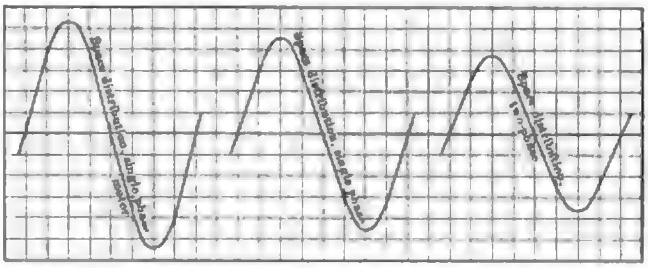
Observations were made of the time value of the flux in each of the eight test coils, the contact maker being revolved through a complete three hundred and sixty degrees for each set of observations. Three of the curves of the flux when the induction motor was running light for coils 1, 2 and 3, respectively, are shown in Figs. 4, 5 and 6. Curves were also obtained when the machine was running under 9 per cent slip. These latter differed inappreciably from the former as to general form.



FIGS. 4, 5 AND 6.—TIME VALUE OF MAGNETIC FLUX OF SINGLE-PHASE MOTOR.

It will be seen from Figs. 4, 5 and 6 that there is a small variation in the maximum value of the flux in the different curves shown; also a smaller variation in the maximum value of the flux of the different legs of the same curve. As stated before, this is due almost entirely to poor governing of the engine. This variation does not, however, materially affect the worth of the curves, since it is the wave form in these curves that is desired, and not the numerical value of the flux.

In order to observe the space distribution of the flux over the pole faces of the stator, nine test coils were placed, equal distances apart, over one pole face, as shown in Fig. 2. The contact maker was then set at zero, and points of the curve were obtained by successively connecting the curve tracer to test coils 1, 2, 3, etc. Fig. 7 shows one of the curves which were obtained with the contact maker set at different positions throughout the 360° This curve shows the instantaneous value of the space distribution of the magnetism when the machine was running light.



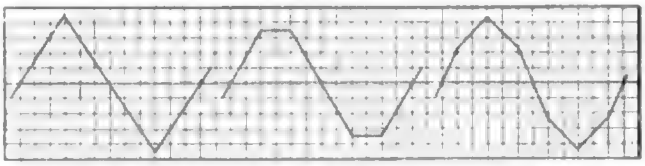
FIGS. 7, 8 AND 9.—OBSERVED SPACE DISTRIBUTION OF FLUX IN SINGLE-PHASE AND TWO-PHASE MOTORS.,

Fig. 8 shows the space distribution of the magnetism when under load at 9 per cent slip. It will be noticed that these curves are sinusoidal.

The space distribution of the flux for the two-phase motor was found by using seven test coils, placed at equal distances over one pole face of the stator of the motor in a manner similar to that employed in obtaining the curves of space distribution for the single-phase motor. Fig. 9 shows one of the curves thus obtained. It was considered unnecessary to plot curves of the time value of the magnetism for the two-phase motor, since the curves of the single-phase motor showed what form of curve would have been obtained.

Figs. 10, 11 and 12 show theoretical space distribution curves as assumed by several well-known writers. Fig. 10 refers to a single-phase motor in which the winding covers the whole pole pitch, while Fig. 11 is for a single-phase motor when the winding covers two-thirds of the pole pitch. Fig. 12 refers to a three-phase motor. It will be seen that these assumed theoretical curves are not sine curves. An investigation of the flux distribution in the three-phase motor was not made. It was considered unnecessary, as the two-phase and three-phase motors are so nearly allied that the sine distribution of flux which obtained in the single-phase motor and in the two-phase motor would certainly hold in the three-phase motor.

It is frequently assumed that the space distribution of the flux is affected by the distribution of the winding over the pole pitch.



FIGS. 10, 11 AND 12—ASSUMED SPACE DISTRIBUTION OF FLUX IN SINGLE-PHASE AND THREE-PHASE MOTORS.

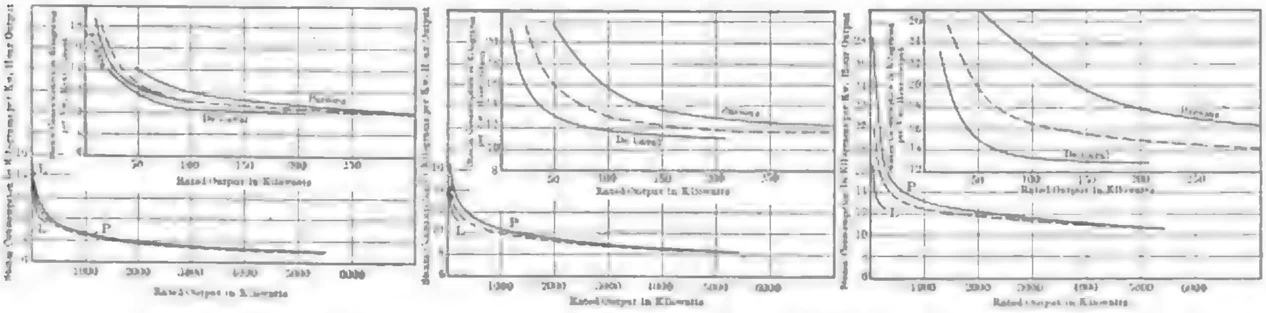
In this investigation such was not found to be the case. Neither was the form of the slot found to have any effect on the wave form.

The curves obtained from the investigation show that in the commercial induction motor there is a sinusoidal space distribution of the flux in the air-gap, when a sinusoidal e.m.f. is impressed upon the primary. It is apparent that in the induction motor the currents in the windings of the different phases, and in the rotor combine their magnetomotive forces so as to produce a sinusoidal flux in the air-gap, or, in other words, the different fluxes combine according to the ordinary laws of harmonic variation. It is evident also that the field is practically uniform except for small variations, due to the non-uniform reluctance of the iron.

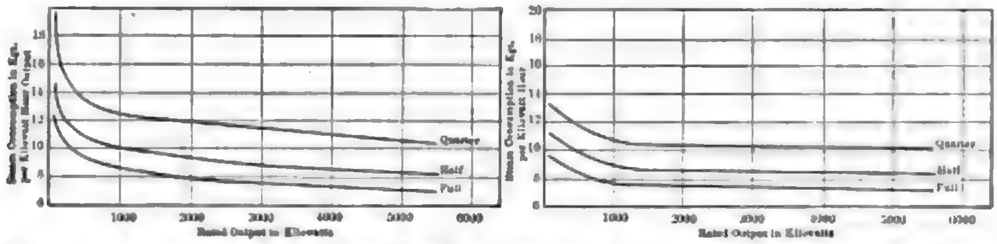
The Economy of Steam Turbines Compared With that of Reciprocating Engines.

By T. Stevens and H. M. Hobart.

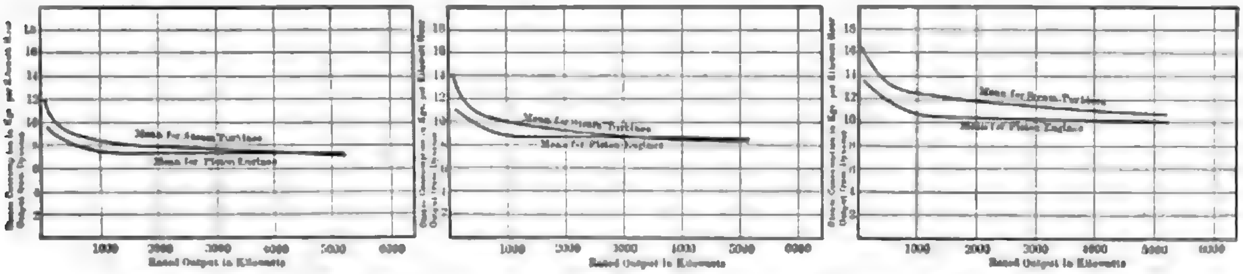
THE comparative economy of reciprocating engines and steam turbines is a question of considerable interest at the present time. In instituting comparisons it is generally attempted to arrive at a broad conclusion in favor of one or the other type. The writers find, however, that the result depends very greatly upon the conditions of admission pressure, superheat and vacuum employed. The greater the first two of these quantities, the better showing does the reciprocating engine make in the comparison, while at high vacua and moderate or low pressures and superheats, the steam turbine excels over the reciprocating engine. This fact becomes evident from an analytical investigation of the published data of the two types. In an article which appeared in the issue of Electrical World for February 17, 1906, information was given concerning the steam consumption of modern reciprocating engines and curves were drawn to show the effect of changes in admission pressure, degrees of superheat and in the value of the vacuum. In the present article similar information is given concerning steam turbines, and comparisons are made between the relative behavior of reciprocating engines, and steam turbines with reference to the effect on the economy of varying the conditions of operation.



Figs. 1, 2 and 3.—Consumption of Parsons, De Laval and Elektra Steam Turbines.



Figs. 4 and 5.—Consumption of Steam Turbines and Reciprocating Engines Under Standard Conditions.



Figs. 6, 7 and 8.—Steam Consumptions for Steam Turbines and Engines of Various Outputs.

The results of such a large number of tests of steam turbines of the Parsons and the de Laval types have been published from time to time, that it is practicable to embody the conclusions in curves.* When these results are reduced to the standards of reference which has been chosen for this purpose, viz., an admission pressure of 13 absolute metric atmospheres, 50 degs. Cent. of superheat and 86.6 per cent vacuum, for full, half, and quarter loads respectively, the curves shown in Figs. 1, 2 and 3 are obtained.

In each of these three illustrations there has been drawn a dotted curve, which is considered to give, for practical purposes, a fair representation of the entire set of results. These dotted curves are reproduced in the three curves of Fig. 4, and are to be taken as representative, at full, half and quarter load respectively, of the steam consumption of steam turbines in general, for the present state of development. The corresponding results for good reciprocating engine practice are given in the three curves of Fig. 5. In Figs. 6, 7 and 8, relating respectively to full load, half load, and quarter load, there have been brought together the curves for steam turbines and reciprocating engines, corresponding to the standard pressure, temperature, and vacuum adopted in this article.

It is exceedingly difficult to make such a comparison, owing to the individual characteristics of the various types, not only of the reciprocating engines, but also of the steam turbines. Nevertheless, the conclusions given have been deduced only after a very thorough investigation, and it is believed that they indicate as good a general comparison between the two great classes of steam engines as can at present be arrived at.

Before developing for steam turbines a series of curves similar to those of Figs. 18 to 29, of the previous article, representing reciprocating engines, it is necessary to consider the influence of admission pressure, superheat, and vacuum on the steam consumption of turbines.

For the purpose of comparison between piston engines and turbines, as regards their respective steam economies, the treatment below is confined chiefly to the Parsons steam turbine, since the data and test results on this type are far more exhaustive than those on any other; and the range of capacity over which tests have been made is greater. From these and other considerations, this type of steam turbine has been chosen as most suitable for the purpose of comparison with piston engines.

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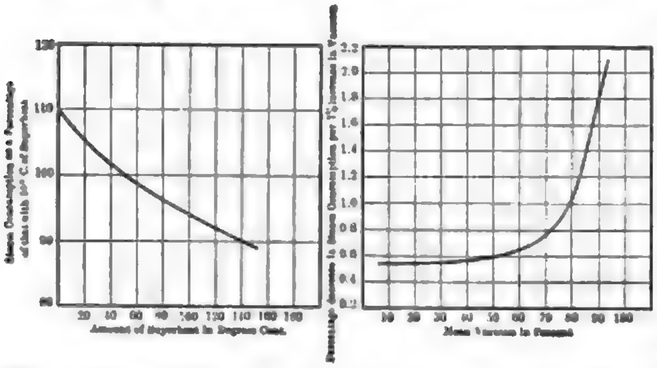
* A curve has also been added setting forth the values guaranteed for the Elektra type.

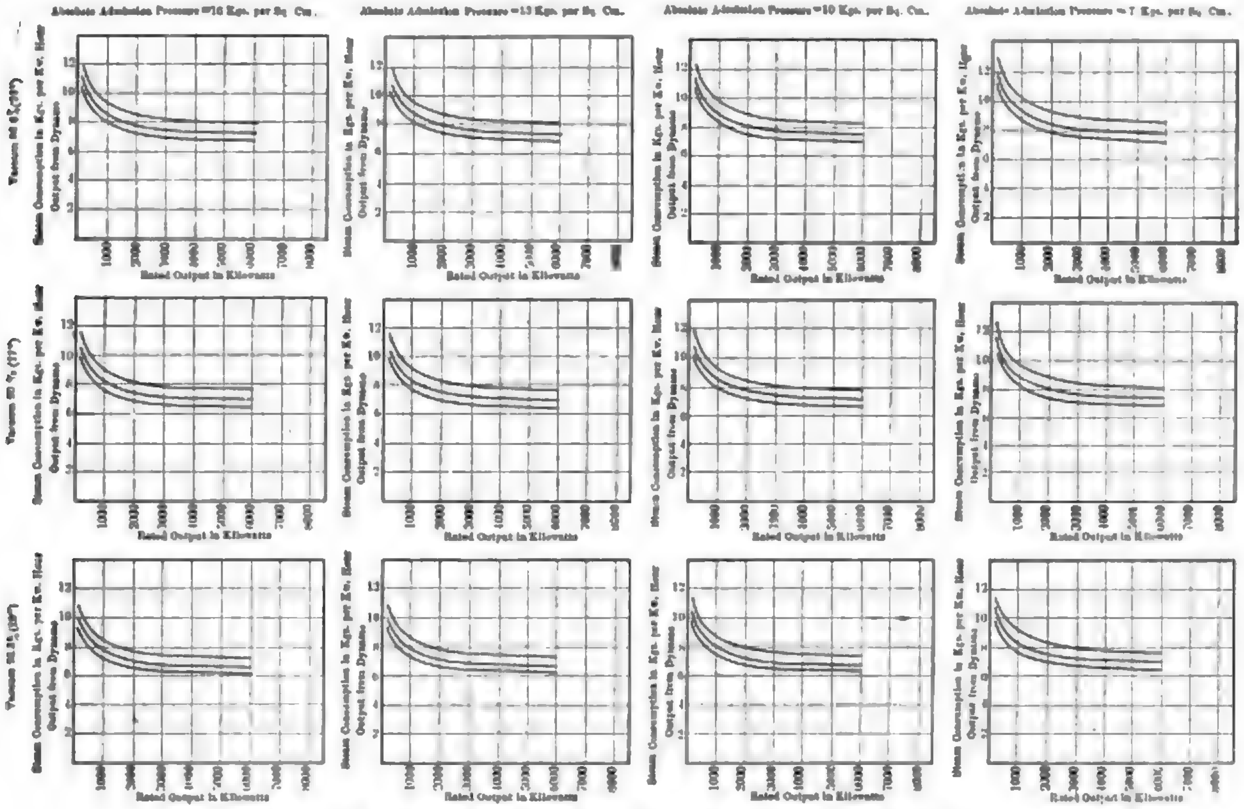
The economy of the Parsons type of turbine is influenced very slightly by variations in steam admission pressure; so slightly, in fact, as to render a diagram representing this influence of very little value.



FIGS. 9 AND 10.—EFFECT OF CHANGES IN SUPERHEAT AND VACUUM.

In deriving curves of steam consumption for other than the assumed standard conditions of pressure, superheat and vacuum, the procedure will be as follows:

The effect of varying the admission pressure is taken in accordance with conclusions arrived at as the result of an exhaustive study of the published test data on the Parsons type of steam turbine. From these values the following rate of variation was estimated:



FIGS. 11 TO 22.—STEAM CONSUMPTION CURVES FOR STEAM TURBINES.

Decreasing the absolute admission pressure from 16 kgs. to 13 kgs. per sq. cm. increases the steam consumption by 1 per cent.

Decreasing the absolute admission pressure from 13 kgs. to 10 kgs. per sq. cm. increases the consumption by 2 per cent.

Decreasing the absolute admission pressure from 10 kgs. to 7 kgs. per sq. cm. increases the steam consumption by 4 per cent.

The influence of change in superheat on the steam consumption of the Parsons type of turbine is shown in Fig. 9. Fig. 10 shows the effect of change in the vacuum on steam consumption of the Parsons turbine.

From these results have been derived the sets of curves in Figs. 11 to 22 inclusive.

In Figs. 23 to 30 have been brought together, for the purpose of comparison the full-load steam-consumption curves for piston engines and steam turbines, derived from the sets of curves in Figs. 18 to 29 of the former article and Figs. 11 to 22, given above. In the set of curves in Figs. 23 to 30, the steam consumptions have been considered only under the extreme conditions, namely, absolute admission pressures of 16 kgs. and 7 kgs. per sq. cm., vacuum of 93.3 per cent and 86.6 per cent, with superheats of 50° C. (Figs. 23 to 26) and of 100° C. (Figs. 27 to 30).

It will be well to describe briefly the curves represented in Figs. 31, 32 and 33. Throughout, the comparisons have been drawn exclusively between the full-load steam consumptions of piston engines and steam turbines. In Figs. 31, 32 and 33, however, an attempt has been made to represent in diagrammatic form the increase in steam consumption with the decrease of load. The abscissae indicate the load, the ordinates representing the steam consumption as a percentage of that at full-rated load.

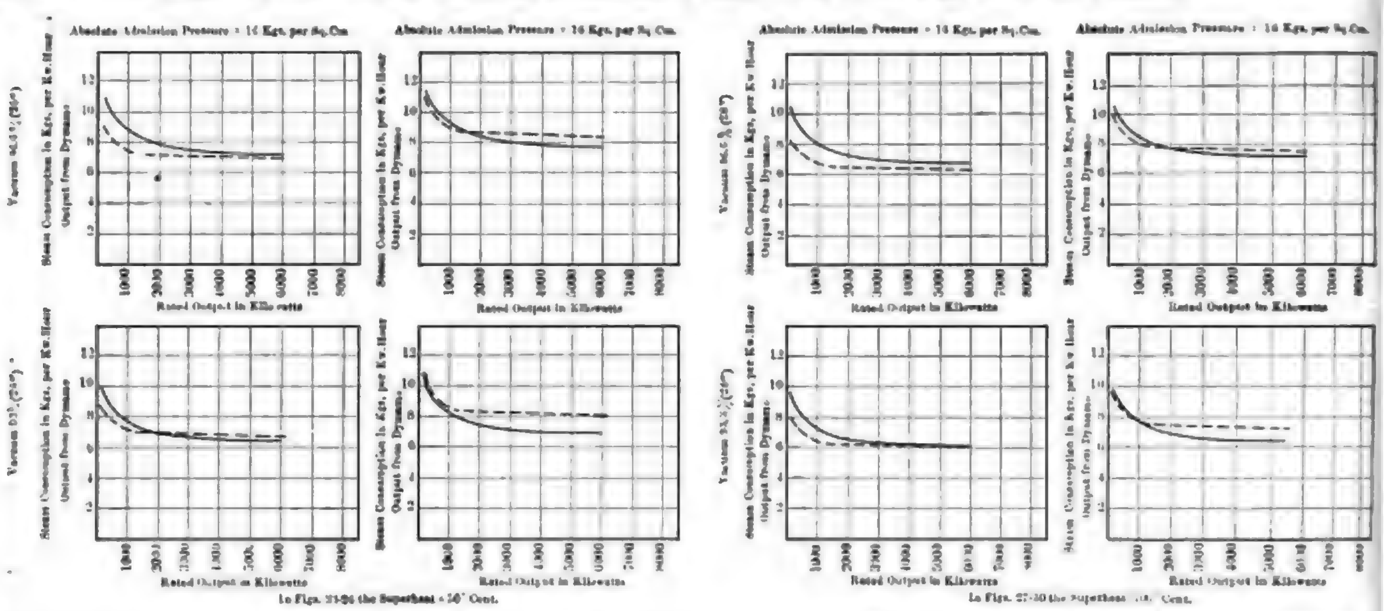
Fig. 31 is confined to modern reciprocating engines. There are eight curves in all, representing the consumptions of nine different engines, ranging in capacity from 30 kw to 1600 kw. In addition to the actual consumption curves, two limit-curves have been drawn, fairly representing what may generally be considered as the highest and lowest consumptions at various loads.

Curve *IX* is for a 1,600-kw engine, and it will be noticed from the shape of the curve that the minimum steam consumption occurs when the engine is running at about ⅝ of rated load. This is a desirable arrangement for engines whose average load is not over ¾ of the rated full load.

Fig. 32 contains similar curves for steam consumptions of steam turbines ranging from 250-kw to 4,000-kw output. For reasons previously mentioned, only the Parsons type has been considered. In this figure, as in Fig. 31, upper and lower-limit curves have been drawn.

In Fig. 33 the limit-curves of Figs. 31 and 32 have been replotted, the dotted line representing reciprocating engines, the full line steam turbines. The areas enclosed have been shaded with vertical and horizontal lines respectively.

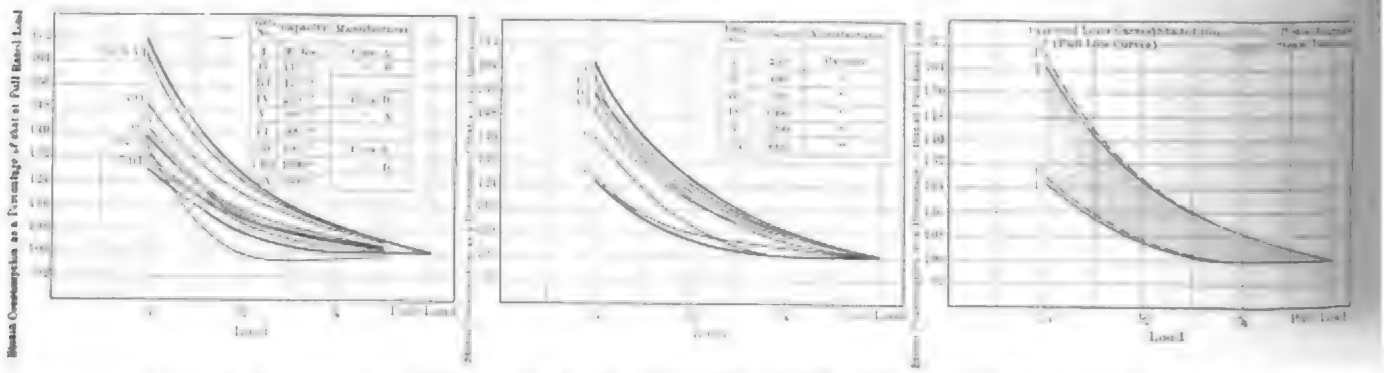
From this diagram it is obvious that there is practically no difference, so far as relates to these sets of tests, as regards the percentage of steam consumption at full load between the two types of steam engines. This diagram is instructive, inasmuch as it indicates graphically within what limits the steam consumption at various loads, expressed as a percentage of the full-load consumption, can be expected to lie.



Figs. 23 to 30.—Full-Load Steam Consumptions of Reciprocating Engines and Steam Turbines Under Extreme Conditions.

Returning now to Figs. 23 to 30, it should be noticed that under the conditions of a good vacuum, and a low admission pressure, the steam turbine has certainly an advantage over the reciprocating engine. Generally speaking, the highest steam economies have been obtained with reciprocating engines, though, at the same time, a point very little inferior has been reached by turbines when working under favorable conditions. As can be seen from Figs. 23 to 30, it is a notable fact that the employment of superheat has a considerably greater influence on the steam consumption in the case of reciprocating engines than in that of turbines. With vacuum, however, the reverse is the case, the economy of the turbine being more beneficially affected by a high vacuum than is the economy of the piston engine.

The forecasting of the future as regards the steam engine, whether of the turbine or reciprocating type, is by no means an easy matter; but one thing is certain, that the relative positions of the two types, so far as concerns steam consumption, will in the future depend to a very large extent upon the amount to which these especial characteristics are developed and utilized.



Figs. 31 to 33.—Steam Consumption of Reciprocating Engines and Turbines at Various Loads.

The characteristic of the steam turbine, in being but slightly dependent upon the admission pressure, undoubtedly opens a path for the future, deviating from that along which the development of the piston engine will advance. The probable tendency in future designs of steam turbines, for large sizes at a rate, will be to reduce the admission pressure, and therefore th saturation temperature, thus permitting of a greater range o superheat, and removing to some extent the difficulties now encountered when dealing with high temperatures. In the cas of the reciprocating engine, whose steam economy is so great affected by the admission pressure, the amount of superheat use is limited, on account of the very high temperatures to be dea with, owing to the high admission pressure.

There are certain obstacles in the way of the development of the steam turbine, consequent on the necessity of more perfect condensing plant. The initial outlay would thus be considerably increased, though there doubtless will follow a considerable advancement in the design of condensers, both as regards efficiency and cost.

So far, these remarks have related only to steam economy, though for an absolute comparison there are, of course, many other points which call for consideration. An exhaustive investigation from this point of view will not be attempted, bu there is the question of oil economy, which affects the case both of reciprocating engines and steam turbines, and is worthy of mention. In districts where the cost of coal is $3 (12 s.) per ton, the cost of oil will generally amount to some 8 per cent of the cost of coal in the case of good modern reciprocating engines. It is claimed that for the operation of steam turbines the outlay for oil will be reduced to an almost negligible amount (0.5 per cent to 2 per cent). If the value be taken at 3 per cent for a district where coal costs $3 per ton, there remains a 5 per cent advantage for the steam turbine as far as relates to the combined outlay for coal and oil. Hence the turbine can afford to have an inferiority of 5 per cent in steam consumption.

It is too early as yet to attempt to arrive at any useful conclusions as to the relative rates of depreciation of the two types of engine.

The Testing Room of the Worcester Electric Light Company.

AN interesting example of testing room practice in central station work is found in the plant of the Worcester, Mass., Electric Light Company. Many of our readers are familiar with the Faraday Street station of this company, which was one of the first large urban lighting plants to be placed in service in New England, and which has always been operated with a close regard to first-class maintenance methods. In visiting the station to-day it is difficult to believe that it has been in constant operation for something like twenty years, so well kept is the equipment. During this time the apparatus has undergone various changes to enable the company to meet the altered requirements of recent years.

The original equipment was all belt-driven through countershafts, consisting of Thomson-Houston arc machines, 500-volt, direct-current generators and high-frequency composite-wound alternators. The idea of belt driving is still used at the plant in connection with the direct-current power and the Brush arc machines which have replaced the old T.-H. outfits, but the alternating-current service of the company is now provided by direct-connected, revolving-field units. New engines, boilers and a new stack have been added, all of these changes having been recorded in our columns at the time of their occurrence. The company has also invested heavily in underground construction, having a larger amount of duct than any other company in the State outside of Boston, and the voltage on the incandescent primaries has been raised from 1,100 to 2,200, the frequency of 60 cycles being adopted in place of the old high frequency of 133 periods.

In connection with the regular maintenance work of the company the daily testing of the circuits is an important duty. To facilitate this as much as possible, the tests are made in a special room 14 ft. long, 9 ft. wide and 16 ft. high, the room being closed in and set apart in one corner of the dynamo room. The test room was equipped according to the designs of Mr. Fred H. Smith, electrical engineer of the company, and its regular work is carried out under his immediate oversight. The switchboards at the Faraday Street plant are mounted in the center of the dynamo room and the test room is connected with the switchboard rear so that any circuit of the company can be brought in for testing.

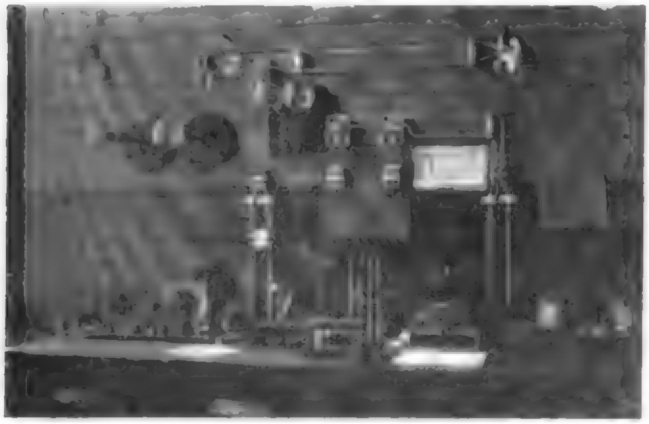


FIG. 1.—TESTING ROOM.

The accompanying illustration (Fig. 1) is a view of the principal apparatus in the test room. An addition to this room contains a Queen cable testing set with D'Arsonval reflecting galvanometer and Wheatstone bridge, and six Bristol recording voltmeters. The Queen set is mounted upon a large marble table, wired up for immediate service. Auxiliary lighting is furnished by the company's regular 104-volt, 60-cycle circuit. The Queen set has proved most useful in testing the insulation resistance, capacity, leakage and general integrity of newly-installed underground cables. The recording voltmeters are connected with the company's incandescent and alternating power bus-bars, one meter being connected across each phase, there being two sets of three-phase copper bus-bars on the alternating switchboard. The work done with the Queen set embraces the usual range of delicate measurements familiar to telegraph and cable companies, when the situation arises which calls for work of this character. In the main, the testing is done with the apparatus illustrated in Figs. 1 and 2, Fig. 2 being a special motor-generator set which is located in the dynamo room just without the testing room. Fig. 3 is a diagram of the connections of the apparatus, excluding the Queen cable testing set and the recording voltmeters.

In laying out the apparatus the idea constantly kept in mind was to provide a large number of testing combinations with the maximum simplicity of arrangement. The complication of connections is only apparent, and the actual work of making the daily tests is small, on account of the convenience of the layout. Referring to Fig. 3, and to the photograph, Fig. 1, *L L* are 16-cp, 104-volt incandescent lamps used for lighting purposes only, and operated from the leads cut in or out by switch *R*. On the bench at the left is a revolving reversing switch driven by a single-phase motor through gearing which reduces the speed from the vicinity of 1,800 r.p.m. to 4 r.p.m. The motor is operated from the 104-volt lighting circuit through a plug and socket connection as shown in the photograph.

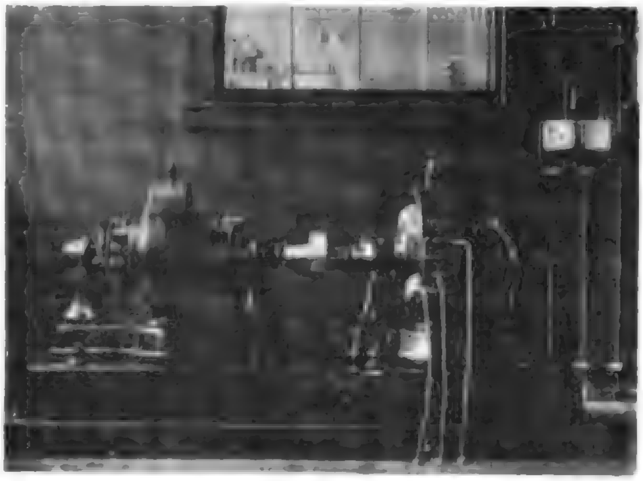


FIG. 2.—MOTOR-GENERATOR TESTING SET.

Current for testing is drawn from the special motor-generator set, *X Y*. This set delivers from 50 to 500 volts direct current, the voltage control being effected through a separately excited field winding on the generator end of the machine. When the switch, *M* (Fig. 3), is thrown upward, the armatures are placed in multiple, the downward position throwing the armatures in series. The set was made by the Holtzer-Cabot Company and it runs at 1,170 r.p.m. The motor is a 550-volt, direct-current, shunt machine, rated at 3 hp. The switch, *M*, is located on a further wall of the test room and is not visible in the photograph. In Fig. 3, *N* is a 150 alternating-current-direct-current voltmeter, *O* and *Q* are 150-volt, direct-current instruments, and *P* is a 600-voltmeter for direct current. The testing room set also contains a 150-volt, 20-amp., Thomson indicating wattmeter, shown disconnected in Fig. 1; another 600-voltmeter, lamp bank, etc.

The apparatus on the wall consists of four 25-cp, series incandescent lamps, *A*, *B*, *C* and *D*, a terminal board carrying eight binding posts and two double-pole, single-throw switches, *E* and *F*, a double-pole, double-throw switch, *H*, and a single-throw, double-pole switch, *K*. Lamps *A* and *B* are mounted on a panel with a plug switch having four positions. In position 1 of the plug, lamps *A* and *B* are in series; at 2, *A* is cut in with *B* out; at 3, *A* and *B* are short-circuited, and at 4 *B* is in and *A* out of circuit. These lamps are used chiefly as direct indicators. Switch *E* throws direct current of from 50 to 500 volts upon the binding posts, 1 and 2, and thence upon the reversing switch through lamps *A* and *B* to binding post 3 and by direct wire to post 5. From posts 3, 4 and 6 three leads are run to the rear of the main switchboard in the dynamo room. Post 5 is grounded and posts 7 and 8 are connected to voltmeter, *O*. Voltmeter *Q* is cut in across 6 and 8; voltmeter *P* is connected across 4 and 5 through the reversing switch, *H*, and a special tap is run between 5 and 7. From Fig. 1 it will be seen that these connections are in no sense arbitrary, but they can be altered to meet almost any conditions arising. A push button circuit, not shown, notifies the switchboard attendant what circuits to bring into the testing room according to a prearranged code of signals. The tests are made daily at 8 a.m.; arc circuits are tested for open condition hourly from the main switchboard.

The morning ground test on the arc circuits is made as follows: On receiving the bell signal the switchboard attendant touches plug 6 to the positive side of arc circuit No. 1. Switches *M*, *K* and *F* are closed meanwhile, throwing the potential of *X Y* upon the arc circuit through the voltmeter, *Q*. One side of the motor-generator set is always grounded, as shown in Fig. 3. The insulation of the arc circuit is, therefore, shown by the indication of the voltmeter needle, and a record of the reading is transcribed upon a test pad, which enables the condition of the feeder to be followed from day to day. As soon as the reading is taken the attendant at the switchboard is signalled to apply plug 6 to circuit No. 2, and so on. It is a great advantage to be able to apply such a wide range of potentials to the circuits, and with e.m.f's of one or two hundred volts, exceedingly definite results are at once apparent.

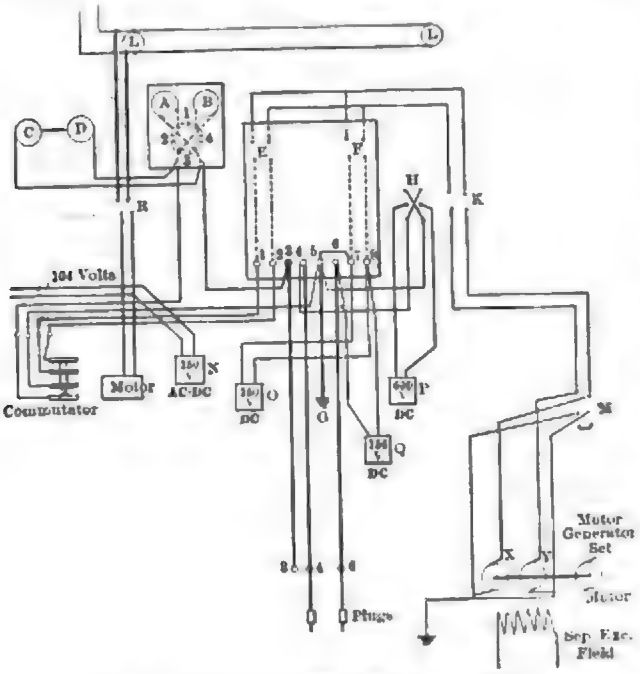


FIG. 3.—DIAGRAM OF CONNECTIONS, TEST ROOM.

In case an arc circuit is found to be grounded, say in the underground system between manholes somewhere on the line, the No. 3 load is connected permanently with one side of the arc circuit at the switchboard. This throws, when switches *E*, *K* and *M* are closed, the external arc circuit through lamps *A* and *B* upon the motor-generator potential, and as long as the ground exists the lamps will burn with a degree of brilliancy depending upon the applied voltage, circuit and ground resistance. Linemen now proceed to pass over the circuit with a horse and wagon, stopping every few manholes to apply a compass in the manhole just over the cable which is affected. The compass needle will deflect until the ground is passed, when it is located between two definite manholes, requiring but one cut in the cable. As soon as the ground is removed, or the cable cut, lamps *A* and *B* cease to burn, notifying the observer in the test room that the trouble is at an end.

In locating an open circuit in an arc circuit the lead No. 4 is grounded in the terminal room and No. 3 lead is touched to the unconnected side of the arc circuit, No. 4 being connected previously to the one side of the arc circuit. If a flash occurs it proves that the circuit is closed without the station. If there is no flash, the No. 3 lead is left connected, No. 4 is disconnected and linemen proceed to "cover" the circuit, stopping at intervals to ground the positive side. Throughout the city the right-hand side of the arc circuit, proceeding from the station, is positive. Each time the positive side is grounded momentarily by the lineman, a flash occurs at the point of contact, until the open circuit is passed, when no further flash occurs. Lamps *A* and *B* indicate the grounding at each point by glowing as the contact is made.

To determine the condition of a wire on a 500-volt power circuit without shutting off current, it is only necessary to apply the 600-voltmeter, *P*, to the circuit, one side at a time, the other side of the voltmeter being grounded. This is done by applying No. 4 lead to the power wire and reading, *P*.

The ground test on a dead power circuit is made by closing switches *M*, *K* and *F* and applying No. 6 lead to each side of the power circuit. This puts about 200 volts on the line to ground and the voltmeter, *Q*, is in series with the arrangement.

Ground tests on a dead alternating or power circuit are made by connecting the circuit at the station with the No. 3 lead, closing switches *E*, *K* and *M*. This enables current to flow continuously through the otherwise dead power circuit to ground and back to the generators, *X Y*. Linemen follow the cables with two compasses, applying each compass to one lead of the circuit. The deflections of the needles will be in the same direction until the ground is passed, when one of the needles reverses. Here also but one cut in the cable is necessary, between the various manholes. Short-circuits in power lines and connections are tested in much the same way, both sides of the line being connected with the special generator at the test room. When the short-circuit is approached the compass needle deflects; when it is passed there is no deflection.

The importance of regular tests in a central station of this character is not easily overestimated. Continuous service depends in a marked degree upon the watch which is kept upon the condition of the feeder system. The Worcester Electric Light Company now serves a population of about 130,000 people, operating some 1,200 hp in motors, 776 open arcs, 564 enclosed arcs and 68,100 incandescents. The officers of the company are: President, A. B. R. Sprague; treasurer, H. H. Fairbanks; superintendent and chief electrician, W. H. Coughlin.

* * *

The Lighting Problem in Residence Streets.

By H. S. Knowlton.

THE proper lighting of residence streets is one of the most difficult problems in modern central station practice. Except in the most thickly settled portions of the larger cities, it is not too much to say that the residential street lighting situation is to-day more unsatisfactory than that obtaining in any other application of electricity. The point is, not that electricity is unequal to the demands upon it, but that the communities served are rarely willing to pay for thoroughly good practice in the illumination of their residential streets.

From the standpoint of the municipality the lighting of scores or even hundreds of miles of residential streets is usually regarded as a heavy expense, whether the quality of illumination be good or bad. The per capita cost frequently reaches $1 per annum, but in comparison with the money expended per inhabitant for other public utilities the cost of street lighting is generally far from excessive. It is almost impossible to reduce to figures the decreased legal and punitive expenses which are brought about by the maintenance of a high standard of street illumination in any large town or city, but there is no doubt that crime is greatly lessened with well lighted thoroughfares.

It is out of the question to expect any residential street to be brilliantly lighted under the municipal appropriations common at the present time, but this does not mean that the problem should be let alone by the central station manager who is anxious to extend his business by educating the public to a fuller appreciation of the possibilities of electricity in every phase of human activity. Doubtless every progressive manager would be only too glad to install additional lamps in the residence streets of his city if the necessary appropriation were forthcoming, but unless an organized effort to improve the situation is made, little can be accomplished. At the present time central stations are working hard to gain new business in many quarters, but very little has been done in the direction of street lighting expansion. An enormous field lies open to the manager who can convince the public that better street lighting and more of it is worth securing in the residence districts of nearly every American city. It is hopeless to expect much real assistance from the politicians, in this direction; the solution of the problem lies in creating a public demand for more extensive facilities.

In suggesting how this can be done it is realized that any increase in municipal expenses which the individual taxpayer feels is certain to produce great opposition unless it can be definitely shown that the increased expense results in vastly better service than the previous quality rendered. But two factors bear upon the matter which give good grounds for hope that some improvement may reasonably be expected. The first of these is the distinctly American characteristic of being willing to pay a fair price for good service of any kind, rather than a low price for inferior service; the second is the aroused public sentiment against municipal graft which manifested itself so emphatically in 1905. If, in any specific case, the public can be convinced that it will be getting its money's worth in a more extended and better distributed illumination of residential streets, it is more than probable that the entering wedge can be driven. Why should not some of the money which in previous years has been mulcted from the municipal treasury by the grafters be devoted under the improved conditions of to-day to securing the real public betterment of more extended street lighting?

Within the last two or three years great progress has been made in the production of higher illuminating efficiencies in low candle power units. The size of these units is admirably suited to the requirements of the average residential street, and in localities where the foliage is dense it would seem that the experimental equipment of a few representative streets with improved incandescents spaced sufficiently near together to give reasonably good lighting might be a valuable object lesson to the public. The magnetite arc lamp also offers much to the central station manager in the way of a more efficient and better distributed light for street service which is not hampered by too much foliage. It will not do to conclude that the public cannot be induced to buy more current for the lighting of residential districts simply because it has in the past failed to appropriate enough money to secure the results which a more liberal policy and the advance of electrical science would now make possible. In some cogent, forceful way there must be created a public demand for more lighting units in the residence streets. Many cities and towns are provided with progressive Boards of Trade, Improvement Associations, etc., which can readily be interested in so great a public benefit as the proper lighting of residence districts, and the co-operation of the newspapers ought not to be a difficult thing to secure, in starting the movement. There is no need to disguise the fact that the company intends to make a reasonable profit out of all new business which it secures, for no sane citizen will deny any square-dealing public service corporation a just return for its commodity.

It ought to be a simple matter to convince the public that the inadequate lighting of residential streets now conditioned by scanty appropriations is entirely out-of-date in the twentieth century scheme of living. The public demands, receives and pays for, in its urban transportation systems to-day, a service which is as far superior to that given by the horse cars of twenty years ago as the present precarious darkness of the average residence street in our cities and towns is inferior to the illumination of the business districts. The equipment of a single street along modern lines and comparative photographs of the old and the new street lighting arrangements, coupled with succinct statements as to costs, would be an object lesson worth having, and the time is certainly ripe for the new business departments of our modern central stations to see what can be done toward capturing this attractive and profitable field.

LETTER TO THE EDITORS.

Weight of Single-Phase Motors.

To the Editors of Electrical World:

SIRS:—I find that in the table accompanying the article entitled "Heavy Railroading," which appeared under my name in your issue of November 18, 1905, page 860, an error occurs concerning the single-phase motor of the General Electric Company. The data referring to the 75-hp single-phase motor of this company were partly taken from a publication in the *Street Railway Journal*, in which it was stated that the motor weighs 4,900 lb. (2,200 kg.), which I assumed to be the weight without gears. I am now informed that the motor without gears weighs 1,900 kg.

Similarly, I figured out from the gear ratio, wheel diameter and speed, the number of revolutions per minute, as 1,500, but I am now informed that this motor makes 700 r.p.m. at normal rated load. Accordingly the weight factor for this motor is about 180.

I note also that the article as printed might lead to the inference that I admit that the single-phase traction system is cheaper in first cost than the three-phase system owing to the use by the former of only a single contact conductor. In point of fact I showed by figures that this is not the case owing to the additional cost of the primary line, geenrating plant and especially the cost of the electrical equipment for the single-phase system. Again, in the part of the article treating of the superior economy of the three-phase system for lines requiring frequent stops, this claim is supported with reference to the single cascade connection, whereas my argument was based upon the multiple cascade connection.

BUDAPEST, HUNGARY. BELA VALATIN,
Electrical Engineer, Ganz & Co.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Design of Alternators.—WITTEK.—A paper illustrated by diagrams, discussing the design of alternators solely from the point of view of the voltage regulation without regard for the size of the machine. Formulas are developed and applied to numerical examples.—*Elek. und Masch.*, February 4.

Armature Reaction in Three-Phase Generators.—SUMEC.—The conclusion of his long mathematical paper, illustrated by diagrams, on the armature reaction in three-phase generators, with an account of the discussion which followed.—*Elek. und Masch.*, January 28.

Alternating-Current Commutator Motors.—NIETHAMMER.—The conclusion of his mathematical article giving the vector diagrams of different types of alternating-current commutator motors.—*Elek. und Masch.*, January 7.

Single-Phase Series Motor.—DICK.—A paper on the design of single-phase series motor for traction purposes. The author first explains why it is preferable to use a high speed in order to get small dimensions. Various formulas are given which should prove helpful to the designer and the use and design of special commutation poles is discussed at some length.—*Elek. und Masch.*, January 7, 14.

Armature Soldering Outfit.—POTTER.—An illustrated description of a soldering outfit for soldering armatures and a pneumatic press for pressing armature coils into shape, both of which devices have been developed at the Detroit United Railway repair shops.—*St. R'y Jour.*, February 3.

Lamps and Lighting.

Street Lighting.—Bloch.—An account of comparative tests made on street lighting in Berlin, partly with electric arc lamps, and partly with compressed gas (millennium light). The illumination in Friedrich Strasse (corresponding somewhat to Broadway in New York), is 6.8 lux, that of Alexander Strasse 5.2 lux. The exact measurements show that for a surface of street of 100 square meters (1,076 sq. ft.) each lux of mean horizontal illumination requires 8.4 watts with electric arc lamps, while with millennium light 50 litres of gas per hour are required for the same purpose. (To make the comparison complete it must be stated that in the tests the illumination by arc lamps was more uniform than with millennium light, so that the result would become more favorable to the arc lighting if by suspending the arc lamps at a lower level the character of the illumination would be made more similar to the illumination by gas. At special places in Berlin a much higher illumination is obtained, and in such places "intensive flame-arc lamps" are used. This is, for instance, the case on the Potsdam Square where two poles carry each four flame-arc lamps, each consuming 20 amperes. The lamps are provided with ordinary (not frosted) glass globes and are suspended at a height of 18 meters above the ground. The maximum illumination in this case is 82 lux and the mean illumination is 18.8 lux, the surface of the square being 3,640 square meters. This corresponds to a consumption of 6.5 watts for one lux and 100 square meters surface. This power consumption is much smaller than the value given above for ordinary arc lamps, but on the other hand the cost of maintenance is considerably higher with flame-arcs.—*Jour. f. Gasbel.*, Febrvary 3.

Negative Crater.—Reich.—An account of an experimental investigation of the size and the temperature of the negative crater of the electric arc.—*Phys. Zeit.*, February 1.

Lighting in Mines.—Anders.—A fully illustrated article on electric lighting in mines with descriptions of methods of wiring and accessories, etc.—*Glueckauf*, February 3.

New Metallic Filament Volume Lamp.—Kremsenezky.—An account of results of tests of the new metallic filament lamp of Hans Kuzel. A long abstract of this paper was published in our last issue.—*Elek. und Masch.*, February 4.

Power.

British Power Plant.—A description of the system of the Durham Collieries Electric Power Company. Cheap coal is available at the power plant and steam turbo-generators are used. Each turbo-generator has its own boilers, condensing plant and switch gear, which can be worked independently of any of the others. The engine room at present contains five main sets, all of the same size, three driven by Parsons turbines and the remaining two by Willans-Robinson turbines. The latter turbines are bolted down to their foundations and are rigidly coupled to their condensers, the latter being mounted on springs and provided with pipes, which are to a certain extent flexible, leading to the pumps. The Parsons machines are without holding-down bolts, and are connected with their condensers by flexible joints, the condensers themselves being rigidly bolted to their foundations. The alternators coupled to each turbine are of the high-speed, revolving-field type, running at 1,500 revolutions per minute. The normal output is 1,000 kw each. Three-phase currents are generated at 6,600 volts, the frequency being 50. Two auxiliary sets are provided, each consisting of one 180-kw direct-current generator, working at 550 to 600 volts for driving the various motors in the station and a 40-kw exciter on the same shaft. It is intended to put down two 400-kw, 550-volt Bruce-Peebles-Lacour "motor-converters," to supply power for traction. The load consists mainly of collieries, besides traction. Electric driving is applied for pumping, cutting, underground haulage, etc.—Lond. *Elec.*, January 26.

British Power Companies.—A table giving the maps of the areas of 23 British power companies which supply whole districts. For 10 of these companies, statistical data are given in a table concerning the history, system, equipment, tariff, etc.—Supplement to Lond. *Elec.*, January 26.

Gas Power.—Hoffman.—An illustrated article of a general nature on gas producers and gas engines and their use in electric stations.—*Elek. und Masch.*, February 4.

Elevators.—Klein.—A fully illustrated description of an electric elevator system used by a German company.—*Elek. Bahnen.*, January 4.

Coal Handling.—An illustrated description of the coal handling plant at the Willesden station of the Metropolitan Electric Supply Co.—Lond. *Elec.*, January 26.

Traction.

Electrification of Trunk Railways.—Leonard.—A note in which the author emphasizes his conviction that the replacement of steam locomotives by electric locomotives would be a paying proposition to-day upon a large percentage of our trunk line railways. The cost of electrification of steam railways will, of course, vary considerably, but it is probable that with the best systems of electrification the average cost will not exceed $60 per horse-power in the locomotive. On horse-power in the locomotive produces an output of about 13,000 ton-miles per annum on the existing railways. Based upon the average revenue per ton-mile in the United States, the earning power of the average United States locomotive is about $100 per hp-year. The total railway capital at present employed in the United States railways is about $600 per horse-power. The electrification of an average existing railway means an increase of its total capital by about 10 per cent, to provide the same total power as it now uses. If it be assumed than the ton-miles per annum on United States railways will increase, in the future, at the same rate as during the past ten years, and that the railways will be comprehensively electrified by 1925, it is estimated by the writer that not less than $1,200,000,000 of electrical apparatus will be required for this purpose alone during the next twenty years. When the construction of a new trunk line railway is considered, there is an enormous advantage in favor of electric traction over steam traction which is not properly appreciated. This is due to an inherent defect of the steam locomotive in that its power, when hauling a certain train, falls off rapidly as the grade is increased. Also, simultaneously, the cost per horse-power rapidly increases. Enormous expenditures of capital are made in railway construction in order to escape the inefficiency of operation which would result from operating the steam locomotive on grades heavier than a certain limiting grade. The electric locomotive is one in which a voltage control of the speed is employed, and in which, as a consequence, the total power and the cost per hp-hour can be maintained constant over the range of tractive effort desired in practice. Other features of important superiority possessed by the electric locomotive are its ability to regenerate useful energy in going down grades and for breaking generally.—*St. R'y Jour.*, January 27.

Automatic Boosting.—Tilmey.—A paper read before the Birmingham section of the (Brit.) Inst. Elec. Eng. The author describes a system of automatic regulation of the shunt field circuit, the regulation being automatic both when the booster is charging and discharging; the apparatus is so arranged as to

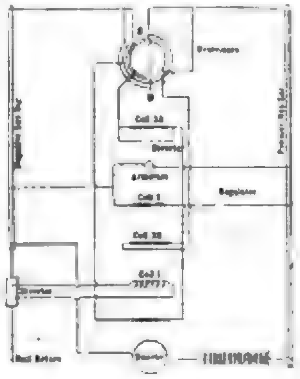


FIG. 1.—AUTOMATIC BOOSTING.

provide for reversal of the shunt excitation. The complete diagram of the arrangement showing booster and battery is given in Fig. 1, while the two diagrams in Fig. 2 show the multiple-way regulating and reversing switch and details of the same. This switch is mounted on a kind of table having all the resistances fixed underneath it. The switch-contact blocks are directly connected to the spindle of a small motor armature, which is caused to turn one way or the other from its neutral position by the interaction of the four field coils 1, 2, *3A* and *3B*. There are two pairs of contact blocks, one pair making contact on rings 1 and 2 and the other pair on rings 3 and 4. The reversal of the booster excitation and the discharge before reversal is effected by the two contacts marked *SS*, the switches, as they pass on to and over these contacts, short-circuiting the booster field windings. In practice, no sign of any inductive spark is visible, even with very rapid reversal. As the full boost is never required on discharge, there is a permanent resistance, as shown in the diagram, in series with the regulating resistance on the discharge side. The armature has a small current always passing through it. The field coils are in four different circuits: No. 1 carries a definite proportion of the outside load diverted through it by the main diverter. No. 2 is set to give a certain number of ampere-turns depending on the output of the machines running in the station, and this value of No. 2 coil has to be altered only when a machine is shut down or put on the bus-bars. Coil *3A* is in the circuit of the booster field when the latter is charging the battery and coil *3B* when it is discharging, the change from one to the other being effected by dividing the inside ring of the switch at the point where the booster field is short-circuited before reversal. Coil *3A* has connected in parallel with it a small diverter which is to compensate for the rise in volts of the battery. The author gives some notes on the dimensioning of the coils with numerical examples. There was considerable discussion, an account of which is given. The author also gives some information on the results obtained with the regulator in actual practice at a British tramway station.—Lond. *Elec.*, January 26.

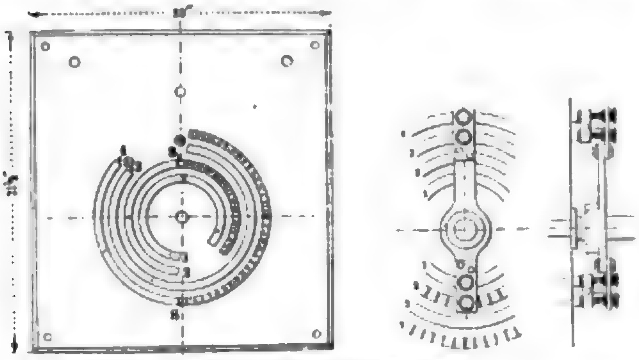


FIG. 2.—AUTOMATIC BOOSTING.

Traction in Great Britain.—Statistical tables giving a great many details on electric tramways and railways in the United Kingdom. There are three different tables, the first relating to the 114 tramways which are supplied from combined lighting and traction stations (11 more than last year); the second relating to 47 tramways which have their own power houses (2 more than last year); and the third referring to electric railways, of which there are now ten in operation and five more under construction. The 114 "combined" stations supply 1,190 miles of route (1,860 miles of single track), and the 47 tramways with their own power houses have a mileage of 780 miles of route, equivalent to 1,180 miles of single track. The former tramways possess 5,060 cars and the latter 4,360. On January 1, 1905 there were 1,770 route-miles of tramways in the United Kingdom, equivalent to 2,740 miles of single track. On January 1, 1906, there were 1,970 route-miles, equivalent to 3,040 miles of single-track—an increase of about 11 per cent in each case. Last year there were 106 route-miles of electrically-equipped railway, equivalent to 212 miles of track; this year 150 route-miles, or 285 miles of single track, an increase of 41 and 33 per cent respectively.—Lond. *Elec.*, February 2.

Tokio.—Baldwin.—An illustrated description of the street railways of Tokio, Japan. The machinery was furnished by the General Electric Company, but the installation and operation were, and are, in the hands of Japanese engineers. The power plant contains three 1,200-kw alternators, generating three-phase currents, 6,600 volts at a frequency of 25, for transmission to two converter sub-stations. The use of the rails for the return current is forbidden by the government. It was, therefore, necessary to use two trolley wires.—*Elek. ahnen*, February 3.

London Subway.—The first part of an illustrated description of the Kingsway shallow-tunnel tramway. The conduit system is used, but the construction of the conduit is simpler and cheaper than on the surface roads.—Lond. *Elec.*, January 2.

Canal Haulage.—Perkins.—An illustrated description of systems of electric canal haulage in use in Germany and in the United States.—*Iron Age*, February 15.

Lightning Protection.—Titus.—A paper read before the Ohio Interurban Railway Assoc. giving a review of the present status of lightning protection on electric railways.—*St. R'y Jour.*, February 3.

Installation, Systems and Appliances.

Tariff Reform.—Roberts.—To introduce electric light to greater extent for private residence lighting a sound tariff must be applied. The writer thinks that for supplying small consumers both the flat rate and the maximum demand system are wrong. "Instead of lamenting their disadvantage as compared with the gas companies, who can equitably and, indeed, must measure their product by a meter, the central station engineers should be pleased that the business of electric supply does not require such a piece of apparatus. The argument in favor of charging solely by the amount of the maximum demand is growing stronger day by day as supply is getting into the hands of large companies whose variable costs are forming even smaller proportion of their total costs than before." The author recommends to let the consumer say what is the maximum number of lamps he wants to light altogether and make a charge at such per week, month or quarter as desired without installing any meter. In order to prevent the declared maximum being exceeded, a simple instrument can be used which will either cut off the current altogether or reduce it as desired.—Lond. *Elec. Times*, January 25.

Electrophysics and Magnetism.

Dielectric Strength of Air.—Russell.—A long account of an experimental investigation in which the problems connected with the dielectric strength of air are discussed from all possible points of view. The author concludes that the dielectric strength of air at ordinary atmospheric pressure lies between 38,000 and 39,000 volts per centimeter, which is about 30 per cent greater than the value ordinarily given. J. J. Thompson gives the value as approximately 30 volts per cm. and M. O'Gorman as 27,000 per centimeter. "The confidence of electricians who are responsible for the working of high-pressure networks for the distribution of electric power on the working of their spark-gap safety-valves at the moment the pressure attains a definite value and the extensive use they make of micrometer spark-gaps for measuring high voltages, prove that under ordinary working conditions they find that the dielectric strength of air is approximately constant. In ordinary work we may take its value as 38 kilovolts per centimeter."—*Phil. Mag.*, February.

Inductance and Capacity.—Hilpert.—The first parts of a mathematical article. The author points out that the effects of inductance and capacity are analogous to the inertia effect of mass action in mechanical problems. Various electrical problems may, therefore, be discussed by the analogy with mechanical problems. The author deals with the increase in time of the current in circuits having self-induction and resistance or capacity and resistance and then describes graphical methods for determining heat effects in electrical processes.—*Elek. Bahnen*, January 24 and February 3.

Radiation.—A note stating that the Roentgen Society of London on a suggestion of Mr. Phillips considers the possibility of formulating a unit of radiant energy "which, while applying more strictly to radioactive bodies and other ionizing agents, may be widened so as to include all known radiations." It is thought that presumably the intention is not to formulate a unit but rather a method of measurement. The general method of measuring radiant energy is to absorb the rays completely and to observe the rise of temperature of the absorbing matter. In the case of radio-active bodies and other ionizing agents, the difficulty is that there is no substance which will absorb the highly-penetrating rays in question. If, on the other hand, the intention is to solve the problem by comparing ionizing powers, it is still necessary to establish a law for every variety of radiation, connecting the radiant energy and the ionization it produces. This relation is not the same for alpha-rays as for gamma-rays, and is very different when, for instance, ultra-violet light and rays from radiant matter are in question.—Lond. *Elec.*, January 26.

Canal Rays.—Stark and Hermann.—An account of an experimental investigation of the spectrum of the light of the canal rays in nitrogen and hydrogen.—*Phys. Zeit.*, February 1.

Magnetic Hysteresis.—Duhem.—A second paper on magnetic hysteresis. The author discusses magnetization in a field which rapidly changes. In order to obtain the laws for this case, it is sufficient to consider the laws which govern the infinitely slow variations of the same magnetization and to substitute for the total magnetic field, the sum of this real magnetic field and of an imaginary magnetic field which is called the field of magnetic viscosity. The properties of the latter are derived from a consideration of viscosity in general.—*Revue Gen. des Sciences*, January 30.

Electrochemistry and Batteries.

Ore Dressing by Flotation.—An article giving abstracts of two recent Faraday Society papers. The joint authors of one are Swinburne and Rudorf. The author of the second paper is Huntington. The practice of the flotation process in the Broken Hill district is first discussed. The question then comes up as to the nature and origin of the gas causing flotation. The gas is carbon dioxide. According to Swinburne and Rudorf the phenomenon of flotation is one of capillarity. In a general way Huntington seems to hold the same opinion, although he criticises special points in Swinburne and Rudorf's theory. Electrification occurs during the process but Huntington was unable to obtain any evidence that it plays any direct part in the flotation.—*Electrochem. and Met. Ind.*, February.

Specific Resistance of Molten Steel.—Hering.—A communication correcting a mistake in a paper by Gin. Cast iron containing about 93 per cent iron and about 3 per cent each of carbon and manganese has a resistivity of 0.00016 ohm-centimeters at temperatures between 1,280° C. and 1,340° C.—*Electrochem. and Met. Ind.*, February.

Edison-Lalande Cell.—Arendt.—An article on a new type of the copper oxide-zinc primary cell, made by Wedekind. The special feature appears to be the preparation of the copper oxide.—*Elek. Zeit.*, January 11.

Units, Measurements and Instruments.

Devices Indicating Whether a Conductor Carries Current.—The Assoc. of French Mfgrs. against Accidents had offered prizes for the most suitable devices to indicate whether a line wire carries current. Eight devices were tested by Roux and Alliamet. The first prize was not granted to anyone. The second prize was given to Miet, his instrument being essentially an electroscope. A small glass tube, like a test tube in chemical laboratories, is closed with a rubber stopper through which a copper rod enters the tube. The outside terminal of the tube is a small copper sphere, while inside the tube the copper wire terminates in two thin aluminum leaves. If the copper sphere is held at a distance of two or three cm. from a 2,500-volt conductor, the aluminum leaves repel each other strongly. If the line carries 10,000 volts the instruments shows this at a distance of 10 cm. If the copper sphere is brought into contact with the line the instrument indicates a voltage of 100. The third prize was given to Taylor for an electric wheel. A glass globe of seven or eight cm diameter contains an S-formed wire which rests on the point of a metallic rod. This metallic rod passed through a rubber support which closes the globe and the outside terminal of the rod is a sphere. If the sphere is brought into contact with the conductor-carrying current, the wire in the globe is charged and begins to rotate. This device indicates voltages above 7,000, and is well suitable for switchboards with bare metallic portions, while it is unsuitable for cables. For lower voltages Taylor has devised another instrument. This consists of a closed cylindrical glass tube which is filled with gasoline, a bronze powder being finely distributed throughout the liquid. A piece of metal is suspended in the liquid and is connected to a wire fused in the glass and terminating on the outside in a metallic bottom. If contact is made between the bottom and the conductor-carrying current, the metallic powder collects instantaneously at one place. The effectiveness of the device, which is less suitable for direct current than for alternating current, depends on the nature of the liquid and on the fineness of the metallic powder. Below 200 volts the indications are not certain. At 6,000 volts it is sufficient to bring the instrument near the conductor in order to produce at once the prescribed effect. An indicator by Thornton was recommended; It consists of a glass tube, closed on both sides with metallic caps and filled with petroleum in which are distributed carburized woolen threads. Metallic electrodes pass through the metal caps at the two ends into the tube. If the electrodes are connected between the conductors carrying the current the woolen threads assume a distinct direction and strong sparks occur between them, which are even visible in sunlight. An indicator by Knobloch consists essentially of an induction coil with iron fastened at the end of a rod. A telephone is connected with the coil. If by means of the rod the coil is brought near the conductor carrying alternating current one hears a sound in the telephone. The instrument is suitable only for alternating current of considerable intensity. Another proposition of Knobloch is to connect a voltmeter with adjustable rheostat between the conductor and earth. Schrottke of the Siemens-Schuckert Company proposes to insert a spark induction coil between an overhead conductor and earth. If the line carries current, sparks are produced and electric waves are emitted, by which coherers with relays are brought into operation. It is necessary to have a whole set of such oscillators and to choose the proper instrument according to the voltage.—*Elek. und Masch.*, January 28.

Street Photometer.—As a supplement to the paper by Harrison on street lighting which was recently abstracted in the Digest, the Harrison photometer is described by means of which an illumination measurement is taken in one direction only, and the screen is set at an angle of 45 deg. The construction is shown in Fig. 3. *S L* is the standard lamp, which can be moved vertically up and down the case until a balance is obtained. The mirror, *M*, reflects the light from this lamp on to the rotating screen, *F*, of the photometer proper. This is of the "Flicker" pattern, which facilitates measurements with illuminants of different colors. The screen which receives the illumination to be measured is inclined, at an angle of 45 deg., and the two illuminated surfaces are alternately presented to the eye of the observer through an eye-piece in the usual way. The battery feeding the standard lamp consists of four accumulator cells in non-spillable cases, contained in two compartments of the box, and permanently connected through a small press key to the lamp. When required the range of the instrument can be increased by the employment of two standard glow lamps of different candle-powers. A leveling arrangement enables the photometer screen to be set at an angle of exactly 4 deg. with the horizontal, and a lens and scale show at a glance the angle at which the rays from the source of light fall upon the screen. From a read-

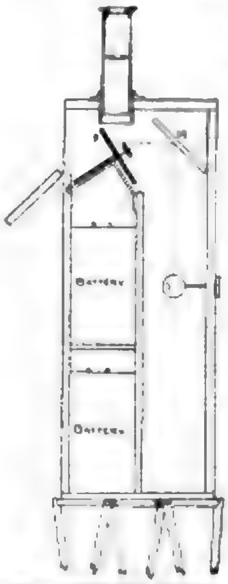


FIG. 3 STREET PHOTOMETER.

ing taken in this way, representing the illumination on a surface inclined at 45 deg., either the horizontal or vertical illumination can be at once calculated, or, if required, the actual candle-power of the lamp in question.—Lond. *Elec.*, February 2.

High-Frequency Currents and Electric Waves.—FLEMING.—The first part of a full reprint of his second Cantor lecture on the measurement of high-frequency voltage.—Lond. *Elec.*, February 2.

Electrometer.—BENNDORF.—An illustrated description of a registering electrometer for measurements of air electricity.—*Phys. Zeit.*, February 1.

Telegraphy, Telephony and Signals.

Telephone Exchange.—A profusely illustrated description of the City Exchange of the British Post Office telephone system in London. It represents some new departures from modern British telephone practice. The subscribers' multiple has been abandoned on the answering positions of the exchange, and the 20 per cent of the incoming calls that are "local" are dealt with in a similar way to calls for subscribers in other exchanges. The reason for this is, not in order to unify the system of operating, but chiefly to render it possible to deal with a greater number of subscribers than hitherto in a single switchroom, and, secondly, to save a considerable item in the cost of wiring the switchboard. The practical limit of a subscriber's multiple has hitherto been 14,400 subscribers, and proposals to introduce a divided multiple with a selective calling key on the subscriber's instrument have not met with favor, nor has it been deemed advisable to reduce the size of the multiple jacks which are already reduced to ¼-in. centers. Thus the method of confining the multiple to junction and transfer positions was adopted, and it is evident that further extensions can be dealt with almost to an unlimited extent by making suitable arrangements for dividing the multiple. An iron skeleton construction is used for the switchboards, and an independent connection is provided for each cord circuit to a main fuse board, a new pattern of cord having been adopted.—Lond. *Elec.* and Lond. *Elec. Rev.*, January 26.

BOOK REVIEW.

HANDBUCH DER ANGEWANDTEN PHYSIKALISCHEN CHEMIE. Vol. I. Electrochemie Wasseriger Losungen. By Dr. Fritz Foerster, Vol. II. Physikalisch-Chemische. By Dr. C. Doelter. Leipzig; Johann Ambrosius Barth. Vol. I, 507 pages, 121 illus. Price, 20 marks. Vol. II, 272 pages, 66 illus. Price, 12 marks.

Everybody who reads German admires the thoroughness of German treatises—the orderly presentation of the subject, the clearness of type, cleanness of appearance, and generally fresh and pleasing impression, which connotes the pleasure found in perusing the volume. Dr. Foerster's book is a model treatise; we wish there were anything half so good in English. After five short chapters on general principles, three on electrolytic theory, and one on galvanic cells, follows the special treatment in a chapter of 14 pages on the separation of oxygen and hydrogen, one of 38 pages on the behavior of electrodes, and secondary reactions, 63 pages on the applications to different metals, 43 pages on electrolytic reduction, 100 pages on the halgen elements, and 47 pages on electrolytic oxidation (perduction). The treatise is most admirably suited for use as a textbook in colleges, for self-instruction, and for reference. A translation into English would be "a consummation devoutly to be wished."

Dr. Doelter's book is a similarly thorough and painstaking compilation of work in an entirely different line, and work which is almost all very recent, because of the great advances made within the last decade. Mineralogy is sometimes regarded as a cut-and-dried finished science, to which is added from time to time the description of a few new and curious minerals found in some out-of-the-way corner; but anyone who merely glances through this treatise will quickly, yes, immediately, see that the very opposite is the case. Here we have nearly three hundred pages of applications of physical and chemical principles to the study of the formation and nature of minerals. Applications of the theory of solutions, entectic mixtures, phase rule, thermodynamic formulæ, decomposition tensions, lowering of the freezing point, raising of the boiling point, relations between chemical composition and physical properties—are only a few of the many absorbing topics discussed. This is the new mineralogy, the illuminating mineralogy, having about the same relation to the old descriptive mineralogy as a play of Shakespeare has to a dictionary of the English language. The publisher has done his part faultlessly.

Electrical Equipment of the Louisville & Nashville R. R. Shops.

An up-to-date example of the electrical equipment of railroad shops and in the application of the electric motor to all manner of power purposes is furnished by the new shops of the Louisville & Nashville R R. at South Louisville, Ky.

The generating plant consists of three 350-kw, 250-volt, Bullock generators (Fig. 1), direct-connected to cross-compound Buckeye engines running at 175 r.p.m. Steam at 125 lbs. pressure is supplied by a battery of Sterling boilers and equipped with mechanical stokers. The coal elevator is motor driven.

A transfer table having a bridge 100 ft. long and a transverse travel of 1,050 ft. is the center about which the buildings are grouped and serves as the connecting link to bind the various departments together. The bridge is operated by a railway motor capable of driving it at a speed of 12 miles per hour. By means of sliding clutches the motor may be disconnected from the bridge drive and connected to a drum to pull coaches and locomotives on to and off of the bridge.

Along the north side of the transfer table lies the largest building of the group, having a length of one thousand feet and including under one roof the boiler shop, the general machine shop, and the erecting shop. The south bay of this building is divided into 40 sections and every section has a track connecting with the transfer table. Eleven of these sections are in the boiler shop, which is separated from the erecting shop by a brick

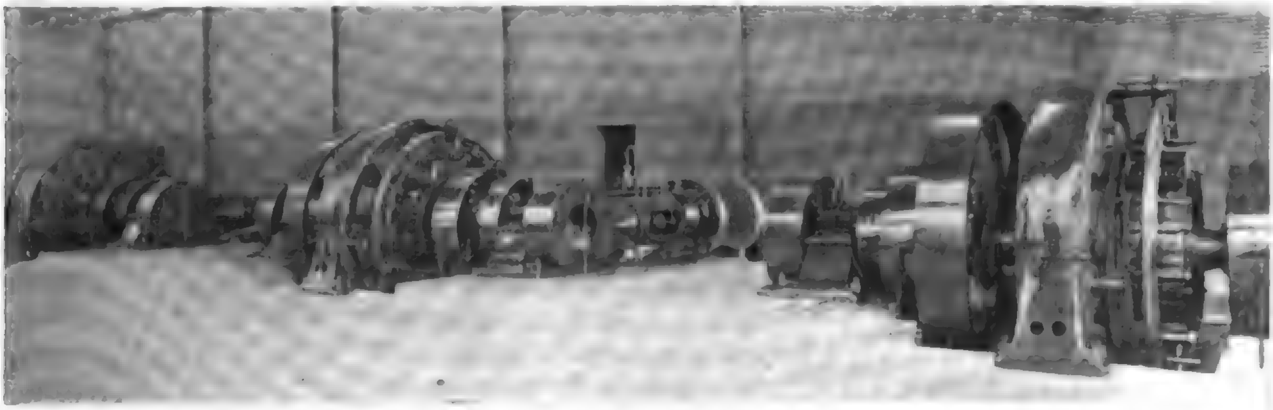


FIG. 1.—VIEW OF GENERATING PLANT.

wall 12 ft. high. The erecting floor is covered by a 100-ton crane provided with two trolleys and capable of carrying the largest sized locomotives from any part of the erecting shop over the wall into the boiler shop. A 10-ton crane on a lower runway serves to carry small parts, and these traveling cranes, of which there are eleven, are motor driven, the cranes being of the Niles Company's make.

In the machine shop the most extensive applications of electric drive are found. Near the middle of the shop is a switchboard controlling the various local feeders and connecting them to the mains running to the power house. Near the switchboard is located a Bullock three-wire, multiple-voltage balancer, shown in Fig. 2, which divides the 240 volts supplied by the mains into 100 and 140-volt circuits. A third wire, in addition to the generator mains, serves to supply three different voltages, viz., 100, 140 and 240 volts, to the motor's driving tools, which it is desired to operate at variable speeds. These different voltages are applied successively to the motor armatures by means of Bullock controllers, and intermediate speeds, and speeds above the normal at 240 volts, are obtained by the use of shunt-field resistance. The larger tools requiring variable speed are driven by individual Bullock three-wire, variable-speed motors, mostly direct-connected to the machines by gearing. Fig 3 shows a group of three-head frame slotters thus driven; such tools as are operated at constant speed are belted to a line shaft driven by a belted motor.

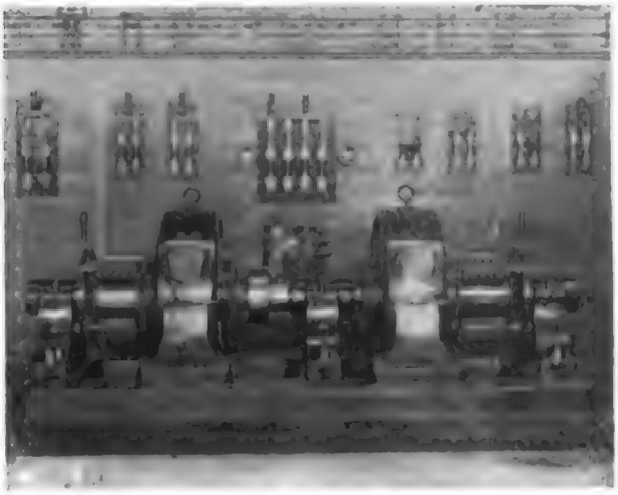


FIG. 2.—THREE-WIRE BALANCER.

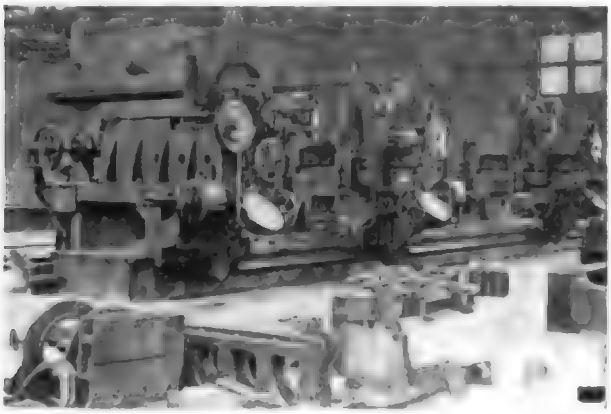


FIG. 3.—GROUP OF SLOTTERS.

In the boiler shop the large punches and shears are driven by individual compound-wound motors, which are belted to the tools. The slipping of the belt in starting, due to the unusually large inertia of this class of tools, allows the motor to start with much less current than would be required if the motors were geared, and the compounding of the fields has the same effect, as it increases the torque of the motor.

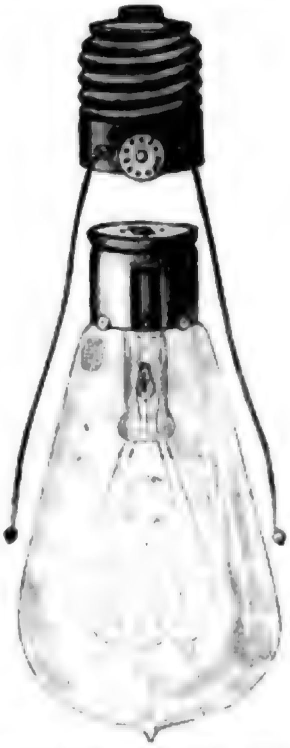
To the north of the machine shop lie the forge shop and the wheel shop. In the forge shop, motors are used where possible, but as nothing has been found thus far to displace steam hammers, the number of motors is not very large. In the wheel shop, the machine tools are all of a constant speed type and are belted to countershafting. The whole shop is driven by a Bullock 60-hp motor. To the north of the wheel shop lies the foundry, and electricity is used for all purposes to which it is applicable. The drop for breaking the scrap, the blowers for the cupolas, and the ventilating fans as well as the cranes, are all motor-driven. The distance from the power house to the foundry is so great that no other method of transmission could be considered.

Placed along the east side of the foundry is a traveling runway which passes along the side of the wheel shop, the end of the machine shop, and extends as far as the transfer table. The crane bridge is 40 ft. long, thus giving excellent yard service to the various shops and affording a very satisfactory method of transporting material from one department to another. In the wood shop the tools are operated at constant speed, and most of them are driven by belts from line shafts which are motor driven. The power house is located at the south of the group of buildings where the handling of fuel and ashes can be done most conveniently.

The generating and motor equipment was furnished by the Allis-Chalmers Co. and the switchboard by the Western Electric Co. Mr. Theo. E. Curtis, superintendent of machinery, designed the shops and supervised the installation of the machinery.

Turn-Down Incandescent Lamp.

The accompanying cut illustrates a new type of turn-down lamp recently placed on the market by the Rooney Electric Lamp Co., of New York. As shown, the lamp and the base, upon which the switching device is located, are separable. This construction allows the base to be removed from an old or broken lamp, by loosening the milled screw at the top. It can then be attached to a new lamp at a saving in price to the consumer, as it is practically indestructible. The switching device is made of hard copper, which prevents any arcing, and the entire base is finished in nickel. In the form shown, the switch is operated by two strings, at the ends of which are a black and white glass bead. By pulling on the black bead, the lamp is turned low, and



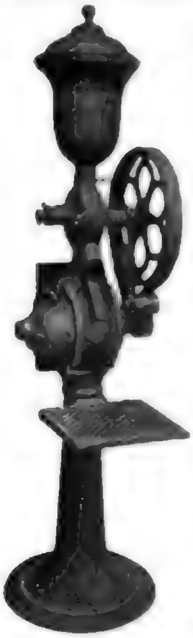
SUN-STAR TURN-DOWN LAMP.

on the white bead, the full candle-power will be obtained.

The turn-down scheme of the lamp is extremely simple. The main filament is joined directly in series with the "baby" filament, the two being connected permanently across the terminals of the lamp. From the junction point between the two filaments is brought out an insulated tap which passes to the switch which serves to short-circuit the "baby" filament when it is desired to operate the lamp at its full brilliancy. The short-circuiting switch consists of a miniature nut which travels along a small bolt as it is turned by the strings. A defect at the switch could produce no result more disastrous than the continuous operation of the main filament, the "baby" filament being shunted out of circuit. These lamps are designed for all the standard voltages and candle powers.

Applications of Jenney Electric Motors.

The Jenney Electric Manufacturing Company, of Indianapolis, Ind., is turning out a complete electrically-operated coffee grinder (Fig. 1) which has certain desirable mechanical features. It is built to stand on the floor, instead of on the counter, as is the case with most mills, and being entirely self-contained, can be easily moved from place to place. One of the strongest features of this mill, however, is the advantage given by the belt drive over the gear drive frequently employed. As will be seen from Fig. 1, the motor is belted to the grinder and there is a spring tension idler pulley for maintaining the tension on the belt. This gives an elasticity and element of safety in the drive that frequently saves the mill from serious damage on account of nails or other foreign substances getting into the coffee.



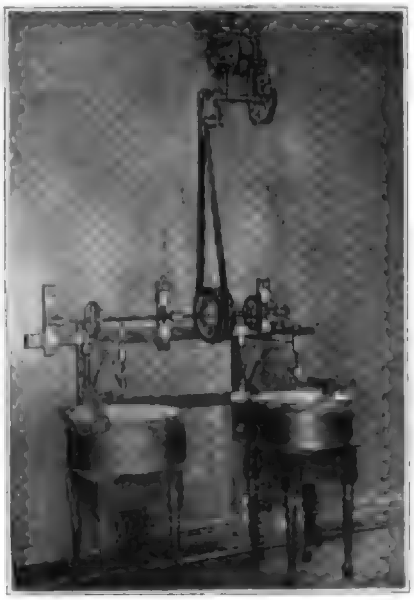


FIG. 1.—COFFEE MILL. FIG. 2.—APPLICATION OF BACK-BELTED MOTOR.

The Jenney Company furnishes with some of its motors a useful attachment for obtaining very slow speed. This consists (Fig. 3) of a countershaft mounted on the motor frame to which the armature shaft is belted. An idler pulley with spring tension completes the combination. This placing of the countershaft on the motor frequently does away with expensive and unsightly countershafting which must be erected by a millwright, causing delay and extra expense in the installation. On the other hand, the belt is more noiseless than the gears frequently employed on back-geared motors. The idler overcomes most of the objections to the employment of a very short belt, as it maintains the proper tension and brings the belt in contact with a greater amount of the pulley surface. Fig. 2 shows an application of a back-belted motor to medicine mixers in the plant of the Eli Lilly Company, Indianapolis.

High Pressure Fire Pumping in New York City.

As a result of the recent ordinance authorizing the building of two new fresh and salt water pumping stations for the Borough of Manhattan, bids were recently closed and contracts awarded to the Allis-Chalmers Company, of Milwaukee, by the Commission of the Water Supply, Gas and Electricity. The equipment to be furnished consists of ten multi-stage, electrically-driven, centrifugal pumps, identical in design to those built by the Escher, Nyss Company, engineers of Zurich, Switzerland, and whose rights for this country are owned by the Allis-Chalmers Company. This equipment will be installed in two stations now in course of construction, one at the northeast corner of Gansevoort and West Streets, called the Gansevoort Station, and the other located at the northwest corner of Oliver and South Streets, called the Oliver Street Station. The two stations are identical in every way even to the arrangement of the interiors. These plants will be laid out to accommodate eight pumping units, the piping being so arranged that when the three future pumps are installed it will only be necessary to remove the blank flanges from the toes to make the present arrangement of piping suitable for the operation of eight pumping units.

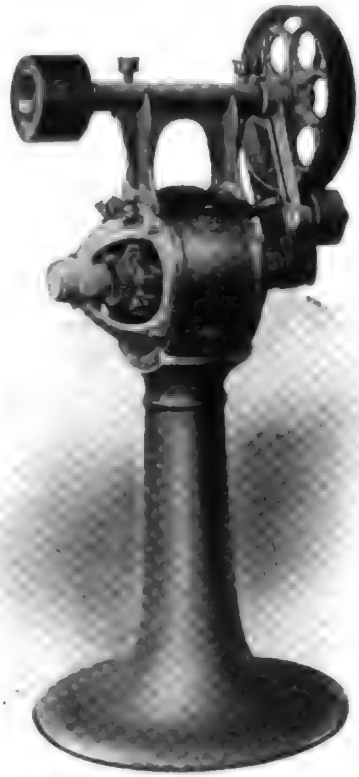


FIG. 3.—BACK-BELTED MOTOR ON PEDESTAL.

The pumps will be of the horizontal shaft, multi-stage, centrifugal type, connected to 800-hp induction motors. Each pump will be constructed with six runners: i. e., the water will be handled in six stages, each stage raising the total required amount of water through one-sixth of the total required head. The pumps are designed to give their maximum efficiency when delivering 3,000 gal. of sea water each per minute, at a speed of approximately 735 r.p.m., and delivering against a discharge pressure of 300 lbs. per square inch.

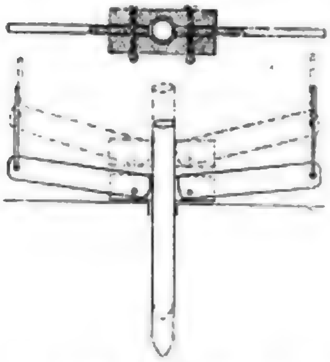
The induction motors are the type in which resistance can be inserted at starting to limit the current taken from the supply lines. These motors are built in accordance with the specifications of the Department of Water Supply, Gas and Electricity. It is expected that these stations will be in operation by the first of October.

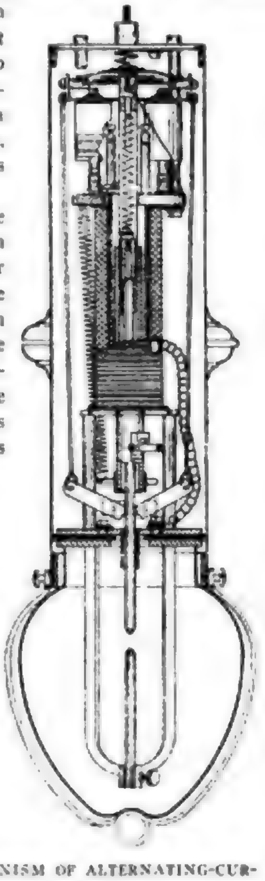
"Liliput" and "Economy" Arc Lamps.

The "Liliput" arc lamps, which have recently been developed by the Siemens-Schuckert Company, are intended to occupy the field between the ordinary incandescent lamps and the more familiar forms of arc lamps. On account of their liliputian dimensions, economical burning and simplicity of handling they can be employed equally well for indoor as for outdoor purposes. They are built for either direct or alternating-current circuits.

The direct-current lamp has a restricted supply of air and is generally built for a single globe. For the regulation of the carbons it contains a movable clamping arrangement. The lamps are constructed for a consumption of about two or three amperes, at about 80 volts. The two-ampere lamp with an alabaster globe gives a hemispherical light of about 130 cp at a consumption of 1.2 watts per candle, while the three-ampere lamp gives 280 cp at .85 watts per candle.

The special cored carbons of these lamps are about one-fifth of an inch in diameter, the length of the upper carbon being about 7.5 in. and of the lower 2½ in.; when the upper carbon has burned down to 2.5 in., it can be used to replace the lower. The outer dimensions of the "Liliput" are very small; the cylindrical cover has a diameter of 2.5 in., and measures 12.3 in. in length, while the globe has a diameter of 3.25 in.





FIGS. 1 AND 2.—REGULATING MECHANISM OF ALTERNATING-CURRENT LAMP.

The alternating-current lamp is similar to the direct-current one with reference to its dimensions, but differs somewhat in mechanical construction. The construction and operation of the regulating mechanism are indicated in the accompanying illustrations. The upper carbon is moved in a vertical direction by means of two levers which are caused to clamp the carbon when a pull is exerted by the series-wound electromagnet upon the two wires shown. When the pull of the magnet becomes weakened the levers are allowed to drop against a plate which causes the levers to release the carbon, which then descends due to the action of gravity. Two dash-pots at the top of the mechanism serve to prevent too rapid movement of the regulating mechanism. When the upper carbon is lowered sufficiently the current through the arc increases and the electromagnet tends again to separate the carbons until the current reaches its normal value. The operation of the regulating mechanism is such that the illumination remains approximately constant, even when the carbon is being lowered.

The fittings of the "Liliput" lamp for alternating current are the same as those of the direct-current lamp, but since with the alternating-current arc a large part of the light is thrown to the upper hemisphere, a reflector must be used with this type of lamp. They are designed for a circuit e.m.f. of about 100 volts, about 70 volts of which are used at the arc, the remainder being used up in an impedance. Each lamp consumes about three amperes.

The Siemens-Schuckert Company has recently introduced another type of arc lamp known as the "Economy," which occupies a place between the "Liliput" lamp and the usual form of arc lamp. This lamp can be used on a 100-volt, direct-current circuit, or two of them may be connected in series on 200 or 220 volts. Each lamp operates at an active pressure of 80 volts, and according to its design consumes 3, 4 or 5 amperes, giving an average hemispherical illumination of 355, 500 or 760 cp, respectively. The upper carbon is 10.5 in. long, while the lower is 3.5 in. The two carbons burn in an almost air-tight space for about 25 hours at one trimming. The carbon consumption is stated to be about one-twentieth of that found with open arcs.

The mechanism is extremely simple and contains only a grip feeder. It permits the lamp to assume normal condition rapidly after the circuit is completed without undue hunting. It is expected that these lamps will prove successful competitors against the gas arc lamps. These lamps are being placed on the American market by Felix Hamburger, 90 William Street, New York.

Barriett Direct-Current Motors.

The Barriett Electric Manufacturing Company, Cincinnati, O., recently placed on the market two new types of direct-current motors of the semi-enclosed and fully-enclosed types, respectively. These motors are extremely simple and rigid in construction. Owing to the special design of the oil chambers they may be operated on the floor, wall or ceiling without the necessity of changing the end brackets.

The frame is of cast iron, and to it are bolted cast-steel pole pieces. The armature is of the standard slotted-drum type with form-wound coils. Two carbons are used in each brush holder so that carbons may be changed if necessary while the machine is running. These motors are designed for either constant-speed or variable-speed service.

MOTOR-DRIVEN EMERY GRINDER.

In the accompanying illustration is shown a motor of the fully-enclosed type mounted for use with two emery wheels. As will be noted, the outfit is neat and compact. The motor differs from the standard enclosed motors only with respect to the bearings which are made somewhat longer; it is equipped with doors which permit inspection of the brushes and commutator.

The Wire and Telephone Company of America.

The Wire & Telephone Company of America in order better to meet the demand for its present products and also to enter extensively into the manufacture of telephone apparatus and supplies, has just completed a large addition to its plant at Rome, N. Y. The company was organized for the purpose of manufacturing bare copper wire, magnet wire, rubber-covered wire, telephone apparatus, telephone supplies, etc. Shortly after its incorporation the company acquired the Electric Wire Works and the Empire Wire Company, both of Rome, N. Y., and the machinery of the latter was moved to the site of the Electric Wire Works where better facilities were afforded and room for development and growth was available.

Since purchasing these plants the company has expended considerable money in improved machinery and equipment. The concentration of the two plants on one site necessitated an entire rearrangement and remodeling of the works, and additions were made to the old buildings whereby the floor space was increased by a third.

The building for the manufacture of insulated wire and telephone supplies is of brick and steel construction. The first section of this building is 270 ft. in length and 75 ft. in depth, and the addition of sections contemplated will so enlarge the building that ultimately it will have a depth of 600 ft. Across the front of the building is a two-story section, the upper story of which is used for offices, draughting rooms and engineering and developing work. The main building in general is a one-story structure with the excellent provisions for light and ventilation that is possible.

The manufacture of bare copper wire is now carried on and completed in the enlarged and remodeled wire mill buildings. The machinery is arranged so that from the copper rod to the finished wire the manufacturing processes are progressive. The rods are taken directly from the cars on a siding, weighed and stored. After leaving the storeroom the drawing, annealing, pickling and cleaning operations follow each other in rapid sequence. To guard against possible shut down the machinery is in duplicate.

The insulating departments are housed in the new building, and wire to be insulated passes direct from the mills to this building. The winding machinery is arranged so that additional units may be installed at any time without interfering in the least with the operation of the rest of the machinery. The wire is wound with single, double or triple cotton or with single or double silk covering.

The rubber insulating department is situated at one end of the building, where the heavy machinery required for this work is to be concentrated. This department is in charge of men having years of experience with the best manufacturers of rubber-covered wire, and the company has secured the services of two of the most expert rubber compounders in the country to supervise this branch of the work.

The general offices of the company are on the second floor of the new building, but the greater part of this floor is set aside for the development of a special form of telephone instrument and for the manufacture of a new type of binding post. The company controls the fundamental Houghton-Potter telephone patents, and telephone engineering and contracting departments have been established for the purpose of designing and installing telephone systems in factories, office buildings, apartment houses, hotels, towns, cities, etc. The company makes a careful study of local conditions in each case and prepares plans and specifications to insure the installation of a system best suited to the requirements, and upon it rests the entire responsibility of the installation.

The buildings are well lighted and the machinery is driven by induction motors, power being purchased from the Rome Gas, Electric Light & Power Company, the transmission line from Trenton Falls passing the works. A large brick and steel vault extending through to the second floor has been built in the new building for the purpose of keeping the large stock of diamond wire dies, special tools, silk, etc., carried by the company. A railroad siding from the New York Central tracks runs between the old and new buildings, and a track also runs along the front of the works for their entire length. Bare wire is shipped direct from the wire mills and insulated wire is shipped from both ends of the new building. The company manufactures copper wire from No. 0000 to No. 40, cotton and silk-covered magnet wire, rubber-covered wire, switchboard cord and cables, German silver wire, piano wire, etc. Only copper of 98 per cent conductivity is used and the product is subjected to rigid tests at every step. Every piece of magnet wire is tested by hand for imperfections and rewound on spools before shipment. The company owns a plot of ground 600 ft. deep in the rear of the works upon which it purposes to build in the spring. The rear wall of the new building is false and this will be moved back bodily 70 ft. so as to double the floor space of the insulating department.

The directorate of the company is as follows: J. S. Dyett, president; Oliver Shiras, vice-president; F. M. Potter, Jr., vice-president; H. T. Dyett, secretary-treasurer; T. H. Stryker, W. C. White, R. A. Downey, S. H. P. Pell and S. C. Houghton. Mr. Potter was formerly manager of the Syracuse Telephone Company. Mr. Shiras was connected with the board of managers of the British Westinghouse Company. Mr. Stryker is president of the First National Bank of Rome. Mr. White is vice-president of the White Sewing Machine Company, of Cleveland. Mr. Downey is president of the First National Bank of Oswego, and Mr. Pell is connected with the New York banking firm of S. H. Pell & Co. The company is managed by an executive committee consisting of Messrs. Shiras, J. S. Dyett, H. T. Dyett, F. M. Potter and S. C. Houghton, in whom is vested all power in the conduct of the business.

Current Indicator for Spark Coils.

In the operation of a gas engine, trouble is frequently experienced with the sparking equipment due to improper adjustment. A coil will cause the firing of a charge perfectly with a certain amount of current, and all in excess of this amount is more than a loss, as the greater the amount of current passing through the coil the more rapidly the battery becomes exhausted, and the sparking and timing contacts deteriorates, thus introducing unnecessary wear and improper timing. In adjusting the coil, increasing the tension on the vibrator increases the current passing through the coil, and in the majority of cases the coils are adjusted to consume more current than is actually required to do the work.

CURRENT INDICATOR FOR SPARK COIL.

The device shown in the accompanying illustration, which is intended to allow the sparking apparatus to be properly adjusted, has recently been placed upon the market by the Connecticut Telephone & Electric Company, Meriden, Conn. It consists of a special form of indicating meter, attached to which is a double conducting cord and metallic circuit plug. When the device is being used, the metallic circuit plug is substituted for the running plug, thus placing the instrument in circuit, so that it indicates the value of the current passing through the coil.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The present winter conditions have apparently had no effect upon spring trade in dry goods, clothing, etc., expansion being reported generally. Retail trade was appreciably benefited by the weather, but, it is stated, considerable stocks will be unquestionably carried over. Generally favorable conditions are reported in other lines. Collections are fair to good, except at the South, where the holding of cotton is a drawback. The market for iron and steel was weaker, the general tendency being for premiums to disappear. Structural material continues active, though new business in the East is not so heavy: A despatch from Pittsburg states that orders have accumulated so rapidly on the books of the United States Steel Corporation that it has been found necessary to decline new business, representing thousands of tons, because it could not agree to make deliveries at a specified time. The orders now on the books are nearly 8,000,000 tons, which is within 2,000,000 tons of the entire capacity, and the corporation has found it necessary to close its order books to certain classes of material. Steel rails and plates are in good demand, railways having placed additional orders for track material. The machinery trade is in good conditions, and much new business is pending. Copper is steady in price with a waiting market. The majority of the greater domestic producers are quoting Lake and electrolytic at 18¾ and 18½c. for future delivery. Casting copper is in fair demand, but the stocks are inadequate. For round lots for May delivery it is quoted at 18@18¼c. January exports of domestic products make the best showing ever recorded in that month. Breadstuffs, especially corn, show large increases over a year ago, as do also cotton, provisions and oils. Exports of five leading products exceed January a year ago by 47 per cent, though 22 per cent less than in December. Seven months' exports of these products likewise break all records. *Bradstreet's* reports 208 business failures during the week ending Feb. 15 against 204 the previous week and 243 in the corresponding week last year.

A LARGE COPPER PLANT.—The Nevada Consolidated Copper Company, San Francisco, whose properties are located near Ely, Nevada, where a new 1,000-ton concentrating, roasting and smelting plant is in process of construction, has recently let the contracts for the entire equipment, including power and electrical apparatus, to the Allis-Chalmers Company, of Milwaukee. The main shafting for the entire group of six furnaces will be driven from a 20-hp Bullock induction motor, running at a speed of 850 r.p.m. The operator will be enabled to control the operation of each furnace from any one of three floors or stages about them. The engine equipment consists of two 22 and 48 x 48-inch compound condensing, heavy duty type; a blowing engine with cylinders 16 x 32-in., to deliver 6,000 cubic feet of free air per minute, and electrical machinery as follows: two 800-kw Allis-Chalmers Bullock engine type alternators, two exciters and seven motors, ranging from 20 to 100 hp, for the operation of the various ore reducing devices, furnaces, etc.

AIR-BRAKE EQUIPMENT FOR PITTSBURG RAILWAY.—The Pittsburg Railway Company will install 20 emergency straight air-brake equipments for motor cars and 10 emergency straight air-brake equipments for trail cars, furnished by the General Electric Company, of Schenectady, N. Y. The cars upon which these equipments will be mounted are to be run singly and in two-car trains, consisting of one motor car and one trailer. The type of air-brake equipment above mentioned, sometimes called "semi-automatic," is essentially a straight air-brake system, having in addition an emergency valve on each car, which in case the train breaks apart, disconnects the brake cylinder from the train line and connects it directly to the main reservoir, thus applying the brakes on all cars, just as in the automatic system. In ordinary service, the operation is exactly the same as with a standard straight air-brake system. This method therefore combines the simplicity, reliability and easy manipulation of the straight air-brake system with the emergency protection of the "automatic" system

THE ABNER DOBLE COMPANY, of San Francisco, has recently taken a contract for a Doble tangential water wheel unit which will have a capacity of 13,000 horse-power, thus surpassing in power any tangential wheel now built or contracted for. The unit has been ordered by the California Gas & Electric Corporation, for installation in its noted Colgate plant, where it will form a valuable addition to that company's extensive hydro-electric system. It will be of the double-wheel two-bearing type of construction, and when first installed will operate under an effective head of 660 feet, delivering 8,500 horse-power. It is planned eventually to increase the pressure on one of the wheels by delivering the water through a new pipe line under an effective head of 1,050 feet. This will bring the output of the unit up to 13,000 horse-power. The unit will operate at a speed of 300 r.p.m. and will drive a 5,500-kw Westinghouse generator. It will be equipped with a Bethlehem nickel-steel hollow forged shaft, and Doble ring-oiling revolvable-shell bearings, needle regulating and deflecting nozzles, ellipsoidal buckets, and centrifugal water guards.

LARGE POWER HOUSE ECONOMIZERS.—In the new power house of the Interborough Rapid Transit Co., New York City, the 26,000-hp of boilers now installed are soon to be equipped with economizers built by the B. F. Sturtevant Co., of Boston, Mass. The 28 economizers will contain 7,840 pipes, having an aggregate length of nearly 15 miles. They will increase the heating surface of the plant about 25 per cent and store 265 tons of hot water or 18 per cent of the volumetric capacity of the boilers. It is estimated that the saving due to the utilization of heat in the waste gases will average more than 10 per cent for the whole 24 hours. This figure will be greatly exceeded while the load is at a maximum, at which time the heat will be utilized which was previously stored while the fires were banked.

STURTEVANT ORDERS.—Among recent orders for generating sets received by the B. F. Sturtevant Company, of Boston, Mass., may be mentioned those for the Garlock Packing Company, Palmyra, N. Y.; New York State Reformatory for Women, Bedford, N. Y.; Union Drop Forge Co., Chicago, Ill.; Tennessee Bag Company, Memphis, Tenn., and the Wildman Mfg. Company, Norristown, Pa. The Thomas Devlin Mfg. Co., Burlington, N. J., is installing a complete system of Sturtevant electric propeller fans for exhausting smoke from its foundry building. Marine generating sets are to be furnished for the turbine steamer "Governor Cobb," of the Eastern S. S. Co., Boston, Mass., and the police boat, "Samuel G. King," Philadelphia, Pa.

HEAVY JANUARY TRADE is noted by the government, in exports and imports. In fact the month's foreign trade was the largest on record for any January. The increase in merchandise exports over a year ago was $47,036,779 and in imports $8,218,574. In other words the merchandise exports were $170,634,162 and the imports were $106,561,450, showing an export excess of $64,072,712; while the total exports for the seven months are already $1,056,656,764. Another striking fact is that out of the month's export of $170,000,000 over $74,000,000 were non-agricultural.

NEW TELEPHONE EXCHANGE.—Plans have been filed with Building Superintendent Murphy for a new 3-story and basement structure to be built for the New York Telephone Company at the northwest corner of Convent Avenue and 146th Street. It is to be of colonial design, with facades of ornamental brick with terra cotta trimmings, is to be called the Audubon central station and is to cost $110,000.

PENNSYLVANIA POWER PLANT.—The Pennsylvania Railroad Company has filed plans with the building department for an electrical power station on the south side of 31st Street, facing the new terminal. The building is to be 99x161 ft. and four stories high, in the same architectural style as the terminal. The estimated cost is $500,000.

THE SPRAGUE ELECTRIC COMPANY has recently sold 16 motors to Edwards, Deutsch & Heitmann, Chicago, for driving printing presses and allied machines. Among other well-known firms that have placed orders with the Sprague Company are Styles & Cash, New York City, 37 motors; G. Schirmer, music publisher, New York City, 25 motors, and Perley & Company, Pittsburg, 22 motors.

ELECTRICAL EQUIPMENT FOR WORSTED MILL.—The General Electric Company has secured the contract for installing the electrical equipment in one of the largest and best equipped factories for the manufacture of worsted yarn in the world, now in course of construction at South Lawrence, Mass., for the Wood Worsted Company. In the power house will be located two main generating units, consisting of a double non-condensing 1,800-hp engine, direct-connected to a 1,500-kw generator and a compound condensing engine with two vertical and two horizontal cylinders, of 5,000-hp capacity, direct-connected to a 4,000-kw generator. There will also be a 100-kw generator for light loads and emergency work; besides a 65-kw, 125-volt motor-driven exciter generator and a small direct-connected steam unit of the same capacity as a reverse. The generating units will supply current at 40 cycles and 680 volts to a complete and modern switchboard, from which distribution will be made to the various buildings. The switchboard will consist of 33 panels. About 500 hp of induction motors will be required for driving the various groups of machinery. The motors are of the latest G. E. type, wound for 550 volts and range in size from 8 to 175 hp. The general lighting will be done by 200 direct-current arc lamps, the transformation from alternating to direct current being accomplished by means of constant-current transformers and mercury arc rectifiers. Six 25-kw and 10-kw transformers will furnish current for the incandescent lamps.

ALLIS-CHALMERS CONTRACTS.—The Dempsey Lumber Co., of Manistee, Mich., which will furnish its new Tacoma, Wash., mill with one of the largest and most complete outfits ever installed in that section, will use Allis-Chalmers engines, generators and electric motors for power, lighting and machine-drive. The Sutton Lumber & Trading Co., which has started the erection of a large mill at Clayoquot Sound, on the west coast of Vancouver Island—the first in that section—will install a Reynolds-Corliss twin engine and complete electric lighting and power plant, in addition to the full equipment of saw mill machinery purchased from Allis-Chalmers Company. The Ancortes Lumber & Box Company, Ancortes, Wash., has added to the full line of saw-mill machinery recently supplied by Allis-Chalmers Company a Bullock generator for direct connection to its engine. The Foster Lumber Company, Clinesburg, Texas, will install a Bullock generator for furnishing electric current with which to drive its saw mill and elevating machinery. The Pratt Mill & Elevator Company, of Pratt, Kan., and the Kramer Milling Company, of Wellington, Kan., have ordered Allis-Chalmers power equipments for their new mills, which are to be furnished throughout with machinery made by the same company, and new mills to be constructed in the Canadian Northwest have ordered, through Allis-Chalmers-Bullock, Ltd., of Montreal, motors aggregating 5,250 hp to be furnished at once.

FACTORY POWER PLANTS.—Some of the recent factory plants installed by the Triumph Electric Company, of Cincinnati, are a 200-kw generator, switchboard and 30 motors for the Yellow poplar Lumber Company, Coal Grove, Ohio; a 150-kw. direct-connected generator, switchboard and motors for Helmers, Bettman & Co., shoe manufacturers; a 150-kw belted generator, switchboard and motors for the John Van Range Company; 56 motors for the A. H. Pugh Printing Company, and 25 motors for the U. S. Printing Company, which had previously purchased a Triumph generator and a quantity of Triumph motors. All of these plants are equipped according to the latest engineering practice, the machinery being operated either by group or individual motor drive.

ELECTRICALLY DRIVEN PUMPS.—The City of New York, Borough of Manhattan, has ordered ten electrically-driven, multi-stage centrifugal pumps, each having a capacity of 3,000 gallons per minute against a head of 300 pounds per square inch, together with all the station appurtenances for high-pressure service from the Allis-Chalmers Company, Milwaukee, Wis. The Delaware, Lackawanna & Western Railroad Company has also ordered from the Allis-Chalmers Company four centrifugal electrically-operated pumps, three each having a capacity of 250 gallons per minute against a head of 100 feet, and one having a capacity of 700 gallons per minute against a head of 100 feet for mine service in the Lackawanna County, Pa., coal region.

THE ELECTRIC CABLE COMPANY, of 42 Broadway, New York, has just received an order from the New York & Long Island Railroad Company for 15 miles of cables insulated with Voltax, the new high potential insulating compound. This order follows with a week that of the Interborough Rapid Transit Company, who recently ordered from the same company the same amount of material.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was quiet with a heavy tone, and declines of a moderate character were general throughout the list. The anthracite coal labor situation and higher money rates exercised a restrictive influence. The Steel stocks attracted no particular attention despite the reports of a deal between the corporation and the Great Northern concerning the latter's ore lands, and the continuance of the good reports about the steel industry. Allis-Chalmers closed at 22⅛ for common and 62 for preferred, these quotations representing net declines of 1⅝ and 1⅛ respectively. General Electric closed with a net loss of 5 points at 170, and Westinghouse dropped 4⅝ points, the last quotation being 161. Westinghouse rights are quoted at ⅛. American Locomotive common closed at 71¾, a loss of 3¾, and preferred at 116, a loss of ½ point. Brooklyn Rapid Transit fluctuated between 86½ and 78½, but regained some of the loss and closed at 79⅝, which is a net decline of 5⅛ points. Metropolitan Street Railway closed at the lowest quotation of the week—116¾, being a decline of 3½ points. The final quotation of Interborough Rapid Transit was 227½, a loss of 5¼ points. Interborough-Metropolitan common is quoted on the curb at 53½ and 4½s at 93¼. Mackay Companies reached 62, but declined to 58⅛, which was the closing price and a net decline of 3 points. Western Union Telegraph closed at 93 and American Telephone & Telegraph at 141½, the former being a net loss of ¼ and the latter 1 point. Following are the closing quotations on Feb. 26:

NEW YORK

	Feb. 13	Feb 20		Feb. 13	Feb. 20
Allis-Chalmers Co.	23¾	22⅛	General Electric	174½	171¾
Allis-Chalmers Co. pfd.	63	61⅞	Hudson River Tel.	...	...
American Dist. Tel.	37	37	Interborough Rap. Tran.	223	220¾
American Locomotive	75	71¾	Mackay Cos.	61¼	58
American Locomotive pfd.	116½	116	Mackay Cos. pfd.	74	74
American Tel. & Cable	81	80	Marconi Tel.	...	...
American Tel. & Tel.	141¾	140¾	Metropolitan St. Ry.	120⅛	117¾
Brooklyn Rapid Transit	86⅛	82	N. Y. & N. J. Tel.	...	...
Electric Boat	25	25	Western Union Tel.	93	93¾
Electric Boat pfd.	60	60	Westinghouse com.	166	161½
Electric Vehicle	16	17	Westinghouse pfd.	...	...
Electric Vehicle pfd.	19	19			

BOSTON

	Feb. 13	Feb. 20		Feb. 13	Feb. 20
American Tel. & Tel	143¼	140¾	Mass. Elec. Ry. pfd.	69	66
Cumberland Telephone	117¾	117¾	Mexican Telephone	4	...
Edison Elec. Illum.	...	...	New England Telephone	..	...
General Electric	...	...	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	20	Western Tel. & Tel. pfd.	...	83

PHILADELPHIA

	Feb. 13	Feb. 20		Feb. 13	Feb. 2
American Railways	53	..	Phila. Electric	9	...
Elec. Co. of America	11⅝	...	Phila. Rapid Trans.	33⅝	...
Elec. Storage Battery	60	...	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Feb. 13	Feb. 20		Feb 13	Feb. 20
Chicago City Ry.	185	190	National Carbon	63⅛	58
Chicago Edison	...	...	National Carbon pfd.	120	117
Chicago Subway	...	...	Union Traction	...	...
Chicago Tel. Co	...	...	Union Traction pfd.	...	...
Metropolitan Elev. com.	20⅛	20			

* Asked.

N. Y. & N. J. TELEPHONE.—President Bethell has presented his annual report to the stockholders of the New York & New Jersey Telephone Company. The income account of the company for the year ended Dec. 31, 1905, compares as follows:

	1905.	1904.	1903.	1902.
Gross	$6,217,288	$5,393,709	$4,741,344	$3,962,597
Expenses	4,575,845	3,729,335	3,269,996	2,823,458
Net	$1,641,443	$1,664,374	$1,471,348	$1,139,139
Charges and taxes	195,428	187,422	181,214	166,350
Surplus	$1,446,015	$1,476,952	$1,290,134	$972,789
Dividends	1,034,149	962,089	852,216	707,627
Surplus	$411,866	$514,863	$437,918	$265,162

The reduction in rates in Brooklyn, Queens and Richmond, Jersey City, Newark and other places during the year rendered the surplus smaller proportionally than in previous years. The gain in stations during the year was 31,725, or nearly 40 per cent. The authorized capital stock of the company is now $17,360,000, an increase of 25 per cent during 1905. Expenditures for construction last year amounted to $3,027,000. Total number of stations on Jan. 1 was 112,049.

NORTH AMERICAN STOCK.—The additional $73,700 capital stock of the North American Company, which has been listed on the New York Stock Exchange, is to be used for the purpose of acquiring 737 additional shares of par value of $100 each, of the capital stock of the Union Electric Light & Power Company; the remaining authorized capital stock of the North American Company, $226,300, is to be issued to purchase capital stock of the Union Electric Light & Power Company and the common stock of the Laclede Gas Light Company.

THE MACKAY COMPANIES published its annual report last week showing the steady growth of this great telegraphic corporation. During the year the preferred stock was increased by $4,676,900, which was issued in exchange for stock in other corporations. Among the securities acquired was stock representing a controlling interest in the North American Telegraph Company, which operates in Minnesota, Wisconsin, Iowa and Illinois. The Mackay Companies, besides controlling the Commercial Cable Company and the Postal Telegraph lines, is one of the largest stockholders in the American Telephone & Telegraph Company. In regard to the dividend policy of the company the trustees in their report to the stockholders say: "The income of the subordinate companies of the Mackay Companies is largely in excess of the amount required to pay these dividends, but its policy is to obtain from its subordinate companies only enough money to meet the dividends on the Mackay Companies shares. All surplus earnings are left in the treasuries of the subordinate companies for extensions and the development of the business and the increase of reserves." Dealing with the Commercial Cable Company the report refers to the new Pacific cables, and says that the lines to Japan from Guam and to China from Manila will be put in operation by April 1. The report shows that the income from subsidiary companies during the period from February 23, 1905, to February 1, 1906, was $2,719,595 The Mackay Companies distributed $2,332,492 in dividends, paid out $23,186 for various expenses, and carried forward $363,917. The issued capital stock consists of $40,645,600 preferred and $41,380,400 common.

BALTIMORE UNITED BONDS.—The United Electric Light & Power Company of Baltimore, Md., is offering $1,000,000 first consolidated mortgage 4½ per cent bonds—an underlying bond of the Consolidated Gas, Electric Light & Power Company of that city, through N. W. Harris & Co. The business of the company shows earnings of 8.6 per cent on $2,000,000 common stock, over and above bond interest and preferred dividends. The total bonds authorized are $4,500,000. The United Electric Light & Power Company was on Feb. 14, 1905, merged into the Consolidated Gas, Electric Light & Power Company of Baltimore. This latter company, in addition to its large electric lighting and power interests, owns $6,563,400 par value, out of $10,770,968 outstanding capital stock of the Consolidated Gas Company of Baltimore, thereby controlling the entire gas business of the city. This Consolidated Gas Company stock is deposited with trustees as additional collateral security under the mortgage securing the general mortgage bonds of the Consolidated Gas, Electric Light & Power Company. The above bonds, in addition to being an underlying security of the Consolidated Gas, Electric Light & Power Company ($12,700,000 outstanding capital stock and $7,288,000 outstanding general mortgage bonds), are secured, in opinion of counsel, by a first mortgage on the entire property, including franchises unlimited in time of the former United Electric Light & Power Company, subject only to $257,000 underlying bonds.

NATIONAL ELECTRIC OFFER.—The Standard Trust Company of New York has made an offer of 30 per cent of the face value of all proved and undisputed claims against the bankrupt National Electric Company of Milwaukee. Bloodgood, Kemper & Bloodgood, representing a majority of the creditors of the bankrupt concern, have sent a letter to clients advising the acceptance of the offer It is said that creditors having claims of more than $400,000 have already signified their willingness to accept it While the exact amount of the offer is undeterminable, it is said that it is equal to $750,000 if all disputed claims are thrown out, and is equal to more than $850,000 if all disputed claims are sustained. The offer of the Standard Trust Company is made only to those creditors having undisputed claims against the estate, and it is expressly stated that the offer will not hold good if a majority of the creditors do not accept within two weeks from the date of the letter, February 17. The National Electric Company went into bankruptcy following the defalcation of Frank G. Bigelow, formerly president of the First National Bank of this city. Bigelow was one of the chief promoters of the concern. Mr. John I. Beggs, as receiver, then took hold and by hard and intelligent work brought the affairs of the concern into a condition where it again had a large value.

POWER DEAL IN VERMONT.—The consolidation and merger of the Rutland (Vt.) Street Railway Company, the Crittenden Power Company, the People's Gas Light Company and the Vermont Internal Improvement Company has been completed The Vermont Improvement Company was chartered by the Legislature of 1902 with a capital stock of $100,000, for the purpose of acquiring electric railways and lighting and heating plants anywhere in the State of Vermont and to establish an electric trunk through Rutland County and southern Vermont. The combined capital of the consolidated companies was $2,400,000. The officers of the company are: President, G T. Rogers, Binghamton, N. Y.; vice-president, L. H. Wise, of New York City; secretary and treasurer, C. H. West, Rutland, and these gentlemen with J. H. Powers, of Troy, N. Y., and George T. Chaffee, of Rutland, constitute the board of directors. The property will be known under the name of the Rutland Railway, Light & Power Company. Messrs. Rogers and Powers are well known in the lighting and traction field of the Empire State.

NEBRASKA TELEPHONE STOCK.—The Nebraska Telephone Company, a sub-company of the American Telephone & Telegraph Company, is offering 10,000 shares of new stock to stockholders at par in the ratio of one share of new stock for every three shares held as of Feb. 15, 1906. The stock will be paid for in four instalments ending Sept. 30, 1906. The new issue is made necesary by the rapidly expanding business and is the first substantial increase since 1893. The outstanding stock at present is $2,635,000 and there is no bonded debt. The proceeds from the sale of the new stock will be used to pay off floating indebtedness incurred to meet the rapidly growing business. The company had on Dec. 31, 1905, a total of 35,855 stations, an increase of 8,501 during the year, equal to a gain of 31 per cent. It also has had 21,593 sub-license stations and 18,713 miles of toll line wire. During the year $420,000 was charged off to maintenance, as was the case in 1904 and 1903. Expenditures for new construction amounted to $957,171. The total income for 1905 was $1,361,456.

SAN FRANCISCO GAS & ELECTRIC COMPANY has made the following report to the Supervisors: Revenues—From sales of gas, $2,528,905.81; from sales of electric current, $2,055,923.48; from all other sources, $72,630.19; total, $4,657,469.19. Cost—Gas, $2,039,122.72; electric current, $1,638,667.41; total, $3,677,790.13; net profits, $979,678.06; dividends paid, $792,421.68; surplus for the year, $187,256.38. Original cost of plant—Gas, $16,803,630.88; electric, $6,535,216.85; total, $23,338,856.73 Present cost of plant—Gas, plant, $9,345,038.65; pipes, $7,196,633.94; meters, $904,717.58; lamps, $81,114.88; total, $17,527,505.05; electric, plant, $6,562,957.17; conduits, $2,018,197.96; meters, $233,445.61; total, $8,814,600.74; present value of plant, $26,342,105.79; capital stock outstanding, $15,794,284.36; amount of bonds outstanding, $9,813,813; amount of floating debt, $237,400.28.

UNITED GAS IMPROVEMENT.—The United Gas Improvement Company, of Philadelphia, will increase its capital stock by $9,181,250, making the total $45,006,250, the new stock being offered to stockholders at par. The chief purpose of the increase is to purchase a third interest in the Public Service Corporation of New Jersey, control of which will be shared with the Prudential Life Insurance Company interests and the Pennsylvania Railroad The Public Service Corporation is to issue $12,500,000 treasury stock.

NORTH AMERICAN STOCK INCREASE.—The North American Company has applied to list $300,000 additional capital stock. Of the increase of $15,000,000 authorized by the stockholders a year ago $14,700,000 were listed. Of the amount all but $60,000 was issued. It is now proposed to issue the $60,000 and the balance of the increase, a total of 3,600 shares. The stock will be used to acquire some of the outstanding stock in one of the subsidiary companies.

ROCKY MOUNTAIN BELL.—The annual meeting of the stockholders of the Rocky Mountain Bell Telephone Company will be held in Salt Lake City on February 26. A special meeting of the stockholders will also be held on the same day for the purpose of voting on an increase in the capital stock of the company to $10,000,000. The present outstanding capital stock is $2,304,800.

BELL TELEPHONE BONDS.—Applications for participation in the American Telephone & Telegraph Company's $100,000 issue of 4 per cent convertible bonds are said to have been more than could be accommodated. Allotments were made as follows: Twenty per cent to Europe, 30 per cent to New England, and the remainder to New York and the country at large.

DIVIDENDS.—The directors of the American Telegraph & Cable Company have declared the regular quarterly dividend of 1¼ per cent, payable March 1. The directors of the Manila Electric Railroad & Lighting Corporation have declared a dividend of 1 per cent on the capital stock of the company, payable April 2.

GENERAL NEWS.

Construction Notes.

MONTGOMERY, ALA.—The Montgomery Light & Water Power Company is contemplatinng the installation of a storage battery outfit.

ALBERTVILLE, ALA.—The Mayor and Board of Aldermen have accepted the proposition of Prof. Edward Kay, of the State University, to install water works and an electric light plant.

BIRMINGHAM, ALA.—Ford, Bacon & Davis, 24 Broad Street, New York, N. Y., are the engineers for the proposed improvements contemplated by the Birmingham Railway, Light & Power Company. J. A. Emery, Birmingham, General Manager

MOBILE, ALA.—In the condemnation proceedings of the Home Telephone Company against R. Moore, for right of way through certain property on Blakely Island, a decision favorable to the telephone company was had in the Probate Court. A commission is to be named to assess the damages. This decision will enable construction work to be begun.

SILOAM SPRINGS, ARK.—The City Council is considering the advisability of leasing its electric light and water works plants to a private individual for a term of years.

FORREST CITY, ARK.—The Forrest City Electric Company contemplates installing a new generator and boilers in its lighting plant. J. W. McCarty is manager and superintendent.

ESCONDIDO, CAL.—Hugh T. Duff, of Los Angeles, has petitioned the Board of Trustees for a franchise for an electric power plant.

VACAVILLE, CAL.—The Vacaville Water & Light Company is contemplating the construction of 8 miles of line during the summer. W. Z. McBride is manager.

ONTARIO, CAL.—The directors of the San Antonio Water Company have decided to install at a cost of $30,000 a steam or other power plant. This is intended to supplement the present water power.

OAKLAND, CAL.—It is reported that in the near future the San Francisco, Oakland & San Jose Railway (Key Route) will be extended up the bay shore from Berkeley, not only to Port Richmond, but also to Martinez.

LOS ANGELES, CAL. The Los Angeles-Pacific Company has recently awarded a contract to Hunt, Mirk & Co., of San Francisco, to furnish a 2750-kw, three-phase, 50-cycle Westinghouse-Parsons turbo-generator. The contract also included a condenser with 9000 sq. ft. of surface, together with other auxiliary apparatus.

SAN FRANCISCO, CAL.—The Battle Creek Power Company has mortgaged its property to the Mercantile Trust Company, which has guaranteed its recent $1,000,000 bonds issue. The mortgage covers the capital stock, real estate, water rights and franchises of the power company. The bonds bear 5 per cent interest and are to run 30 years, being issued to provide for future expansion and improvements.

SANTA CRUZ, CAL.—Extensive improvements are contemplated by the Big Creek Power Company in the near future, which include the addition of considerable equipment, consisting of one 1,000-hp engine, direct-connected to one 780-kw, three-phase, 11,000-volt Westinghouse generator, one 450 kw, two-phase, 1,100-volt generator, direct-connected to a Pelton water wheel, two 180-kw, two-phase, 1,100-volt generators direct-connected to a Pelton wheel operating under 900 ft. head; 800 kw in transformers, 75 hp in small motors for operation on 200 and 400-volt circuits, and four 75-hp motors to furnish power to the Union Traction Company. C. E. Lilly is manager.

SAN FRANCISCO, CAL.—The Westinghouse Electric & Manufacturing Company has been given the contract to supply the Fort Bragg Electric Power Company, which is controlled by the Union Lumber Company, of San Francisco, an additional 300-kw engine-type alternator and a direct-connected engine. The new machines will be installed in the power plant at Fort Bragg. The plant will be enlarged to accommodate the new equipment, which is being provided to increase the capacity of the plant and enable the company to furnish electric current for lighting at Mendocino, ten miles distant down the coast. This has been contracted for by the Mendocino Electric Light & Power Company, and the necessary extension of the Fort Bragg line will be made at once.

SAN FRANCISCO, CAL.—What will be probably the northernmost hydro-electric plant in the world will be installed by the Yukon Consolidated Goldfields Company in the Yukon Territory, close to the Arctic Circle. The contract, which has been given to the Westinghouse Electric & Manufacturing Company, calls for a complete electric power transmission and gold dredging equipment and includes two 625-kw, three-phase, 60-cycle, 2,200-volt generators, which will be direct-connected to two Pelton impulse wheels; also three dredge outfits, each aggregating 250 hp in motors ranging from 100 hp down. There will be four Westinghouse 250-kw transformers at the power house and four 200-kw transformers at the sub-station. Power will be transmitted 30 miles at 30,000 volts for dredging purposes only. The electrical equipment will be shipped within the next five months via Hamilton, Ont., and Vancouver. O. B. Perry, whose headquarters are with the Western Engineering & Construction Company, Rialto Building, San Francisco, Cal., is manager of the Yukon Consolidated Goldfields Company.

DURANGO, COL.—The Animas Power & Water Company expects to add this year two 2,250-kw machines and several miles of transmission line. H. T. Henderson, general superintendent.

SILVERTON, COL.—A new switchboard will probably be installed in the municipal lighting plant and the system changed to three-phase alternating current. H. S. Sherman is city electrician.

BUENA VISTA, COL.—W. P. Eyre, lessee of the Buena Vista Electric light and power plant, owned by the Buena Vista Smelting & Refining Company, is contemplating improving the water power and will replace the present Heisler system with an alternating-current multiple system of incandescent lighting.

LITCHFIELD, CONN.—The Litchfield Electric Light & Power Company is making arrangements to extend its lighting and power circuits to Morris and Bethlehem, Conn. Guion Thompson is superintendent.

NEW HAVEN, CONN.—The Strouse-Adler Company proposes generating its own electricity and will put in a plant of sufficient capacity to supply 1,000 lamps and furnish about 100 hp for the operation of motors.

NORWICH, CONN.—The officials of the Norwich & Westerly Railway Company have placed the contract for the boiler and engines for the power house of the road. The engines will be 1500 hp and the boiler 1600 hp. Besides the main power house, there will be a sub-station in North Stonington. The location of the power house and the transformer station has not been definitely settled as yet.

WASHINGTON, D. C.—The Potomac Electric Power Company, of Washington, has contracted with J. G. White & Co., of New York, for the erection and equipment of a new power house for both lighting and power purposes in the city of Washington. This company is one of the sub-companies of the Washington Railway & Electric Company which divides with the Capital Traction Company the control of the electric traction business of the Capital City. The power house will cost in all about $1,500,000. The building is to be approximately 166x183x67 ft., and will have a steel frame with curtain walls, which will probably be constructed of moulded concrete blocks. The boiler room will contain four rows of boilers with three chimneys, located between the second and third rows. Thus, there will be two divisions of the firing floor, each serving two rows of boilers. The first installation will consist of two 2,000-kw and one 5,000-kw Curtis turbines with boilers and superheaters, and the building is designed for future installation of two additional 5,000-kw Curtis turbines with their steam generators, making a power house of 19,000-kw ultimate capacity. All of the turbines will generate 25-cycle, three-phase current at 6,600 volts for distribution directly to the sub-stations. Two of the 2,000-kw units are already installed, one of them being equipped with an ordinary type of surface condenser. All of the remaining units, however, will have the latest type condensers, self-contained in the base of the turbine. A storage battery will be installed, having capacity enough to furnish excitation current for the entire station for one hour.

PUNTA GORDA, FLA.—This city is considering issuing $18,000 bonds for constructing an electric light plant and water works system.

DALLAS, GA. The citizens have voted $20,000 bonds for lights, water and schools.

JACKSON, GA.—The citizens have voted to issue bonds for water works and an electric light plant.

ADEL, GA. The Adel Electric Light & Power Company has been organized with William Scandrett president. The preliminary work will be started at once and it is hoped to have the town lighted within a few months.

BLACKFOOT, IDAHO.—The Blackfoot Light & Water Company, which is controlled by the American Falls Power, Light & Water Company, of Pocatello, Idaho, is making arrangements for the reconstruction of the sub-station which was recently destroyed by fire. Power is purchased from the Pocatello Company. F. U. Bliss, of Pocatello, is general superintendent.

COFFEEN, ILL.—The Town Council has granted Frank C. Edwards a franchise for an electric light plant.

FREEPORT, ILL.—The contract for lighting the streets of Freeport for a term of five years from April 6, 1906, has been awarded to the Freeport Railway, Light & Power Company.

FISHER, ILL.—The Wardlow Electric Lighting Company is contemplating installing water works and a heating plant. A. L. Wardlow is manager and superintendent.

ROCK ISLAND, ILL. The Central Union Telephone Company has proposed an ordinance to the City Council providing for the laying underground of all of its wires, except those used for distribution within the district known as the fire limits. This change means an expenditure of many thousands of dollars.

MOWEAQUA, ILL.—The Moweaqua Electric Company states that its plant is for sale. The town has a population of 1,478, and the lighting contract comprises twenty 2,000-cp arc lamps at $75 per lamp per year, operated on a moonlight schedule. The plant also supplies eight commercial arcs of 2,000 cp and furnishes electricity for about 3,000 incandescent lamps. W. F. Covington is manager and superintendent of the plant.

EAST ST. LOUIS, ILL.—At a meeting of the stockholders in St. Louis, Mo., on February 14, the Illinois Illuminating Company, which holds a franchise in East St. Louis to supply current for lighting and power, was practically reorganized and new officers elected. R. V. Scudder was chosen president; H. H. Humphrey, vice-president; Charles Scudder, Jr., secretary and treasurer. The company has purchased a lot 100 x 140 ft., on which will be erected a $100,000 plant, the construction work to begin immediately. All the machinery, boilers and equipment have been contracted for and will be installed as fast as the building is ready for them.

HENDERSON, IND.—The local telephone company is contemplating a number of improvements in its system here.

SOUTH BEND, IND.—Plans have been completed for a new $200,000 Y. M. C. A. building in this city which call for an unusual amount of electrical equipment for a building of the kind.

ATTICA, IND.—The City Council has granted a franchise to the Crawfordsville & Northwestern Interurban Railway to enter this city with a trolley line to be constructed from this place to Crawfordsville.

GOODLAND, IND.—The Board of Trustees expects to put in a new lead to the center of distribution and will overhaul the entire system of the municipal lighting plant. John Carpenter, Town Clerk, is purchasing agent.

BLOOMFIELD, IND.—The Home Light & Water Company is making arrangements to install a 150-kw generator and a 250-volt dynamo for the purpose of supplying a power circuit to be established shortly. Robert B. Dugger is manager of the plant.

KOKOMO, IND.—George J. Marott, president, and T. C. McReynolds, general manager, of the Kokomo Electric Light & Interurban Company, announce that they will enlarge and greatly increase the capacity of the plant and install some modern machinery.

CONNERSVILLE, IND.—The Central Manufacturing Company of this city has just completed the installation of its new building and is now ready for operation. The new building is a one-story structure, 540 feet long and equipped with modern machinery, driven by electric power. Seventeen electric motors, ranging from 3 to 30 hp and aggregating 195 hp have been installed. The officials say three additional motors will be installed in the spring.

CRAWFORDSVILLE, IND.—W. H. Smith, a wealthy farmer east of this city, is the first to experiment with the use of the electric current from a traction wire for heating and lighting his house and barn and for power. Mr. Smith has erected a power house and tapped the wires of the Indianapolis & Northwestern Traction Company. Motors of various sizes and kinds have been placed for the purpose of supplying light and heat, pumping water, operating the various farm appliances. Mr. Smith expects soon to add the necessary equipment to operate his plows, threshers and other farming implements.

RAVIA, I. T.—Franchises have been granted for a telephone system and an electric light plant.

FT. GIBSON, I. T.—Messrs. Brown and Rosecrans, of Joplin, Mo., are interested in the construction of an electric light and power plant at Ft. Gibson.

OCHELATA, I. T.—The Town Council, at a recent meeting, granted a franchise to a company of capitalists from Chicago, who declare their intention to connect the towns in the oil field of Indian Territory by an interurban electric railway. It is proposed to have the headquarters in Ochelata, with lines running north to Tulsa and Bartlesville and east to Chelsea and Cleveland, Okla.

ALBIA, IA.—T. J. Baird, city clerk, writes that the citizens voted February 14 to grant A. R. Jackson a franchise to construct and maintain an electric light, heat and power plant.

AFTON, IA.—The Commercial Electrical Supply Company, of St, Louis, Mo., has secured the contract for constructing municipal electric light plant for $3,233. E. A. Lee, chairman of the Lighting Committee.

CRESTON, IA.—The City Council has passed an ordinance granting to the Des Moines, Winterset & Creston Electric Railway Company, subject to a vote of the people at the spring election on March 26.

CLAY CENTER, KAN.—It has been voted to grant a franchise to F. L. Williamson for an electric lighting plant.

OSAGE CITY, KAN.—Preliminary steps toward establishing an electric light plant have been taken by the city authorities.

HOLTON, KAN.—It is reported that estimates have been completed for water works and sewerage systems and an electric light plant, which place the cost at $89,000.

ARKANSAS CITY, KAN.—The rails for the Kansas Oklahoma Interurban Railway have been contracted for. The road will be under construction by April 1.

LEAVENWORTH, KAN.—The present franchise of the Leavenworth Light & Heating Company will expire March 25, 1907, and the question of municipal ownership is now being agitated.

CHEROKEE, KAN.—An electric light and power plant is to be installed here shortly by private parties. It will furnish an all-night lighting service and will operate a day circuit for power purposes.

ANTHONY, KAN.—The Anthony Electric Company is installing an additional circuit and is considering other improvements in its plant, which will enable it to meet the increased demands for street lighting.

CHERRYVALE, KAN.—W. R. Murrow and A. E. Eads, of Peru, Kan., are installing an electric light and power plant in Cherryvale. The company will be known as the Murrow Electric Light & Power Company.

PAINTSVILLE, KY.—E. E. Maggard, of Morehead, writes that it is proposed to construct an electric light plant at Paintsville, at a cost of $30,000.

RUMFORD FALLS, ME.—The Rumford Falls Light Company is enlarging its plant and putting in new machinery. Chas. A. Mixer, the resident engineer, has the matter in charge.

PORT FAIRFIELD, ME.—A new electric light company is being organized here. The new company will either buy power from the Presque Isle Electric Light Company or establish a steam plant at some convenient point in the village.

WOBURN, MASS.—In order to ascertain why electric lighting rates have increased in Woburn, Alderman J. H. Connolly is drafting an order asking for an inquiry into the matter. He proposes to recommend that a municipal plant be established, if possible, in conjunction with Wakefield and Winchester. The Woburn Board of Public Works is also interested in securing cheap lighting rates.

PITTSFIELD, MASS.—The plans of the Pittsfield Street Railroad Company's new power house are completed, and the specifications will be offered within a few days to the local contractors for bids by Messrs. P. J. & P. C. Dolan, through Engineer C. K. Stearns. The whole plant will cost not less than $125,000. Two vertical engines made by the Brown-Corliss Engine Company of Corliss, Wis., of 825 hp each, have been bought for $10,000 cash. These will be installed in addition to those already in use and will make a total of four power units.

DETROIT, MICH.—The power plant of the Detroit United Railways Company at Riopelle and Atwater Streets was slightly damaged by fire a few days ago. The loss is placed at not more than $5,000, but the damage was such as to compel the company temporarily to draw on its other plants for power.

WYANDOTTE, MICH.—The Pennsylvania Salt Manufacturing Company, Wyandotte, Mich., with head offices in Philadelphia, is one of the large salt producers. This company recently purchased a new power equipment to supplement the one already in use in order to meet the demands of increased business. The new units are a 36 x 48-in. simple, heavy-duty, Reynolds Corliss engine, direct coupled to an 800-kw, direct current Bullock generator. The engine will run in parallel with other units, and the load from the generator, which is of the engine type, will be used in part for light and power, but for the most part for electrolytic purposes. The entire unit, steam and electrical, will be furnished by the Allis-Chalmers Company, Milwaukee, and is expected to be ready for service early in June.

GIBBON, MINN.—It is reported that the Council is considering the issue of bonds for a lighting plant.

BRAINERD, MINN.—Ambrose Tighe, owner of the water works, has decided to construct a power plant on Crow Wing River.

SHAKOPEE, MINN.—A. K. Adams, superintendent of the city electric light plant, writes that the city may install a small generator direct-connected to engine.

LITCHFIELD, MINN.—Emil Aveldson, superintendent of the village electric light plant, writes that it is intended to rebuild the street lighting system and install a new switchboard.

DULUTH, MINN.—The Mesaba Traction Company, which was recently incorporated, is making arrangements for the issue of $800,000 bonds with which to begin work. The preliminary survey for the line has been made and applications for franchises are pending before the councils of several of the towns. It is announced that if no delay is experienced construction work will begin in the spring.

AMORY, MISS.—The Amory Light & Power Company is making arrangements to duplicate its present plant next fall. Russell Miller is superintendent.

PLAINS, MONT.—M. H. Pierce and P. B. Jackson propose installing an electric light plant.

LIVINGSTON, MONT.—An election will probably soon be held to vote on granting a 35-year franchise to the Livingston Water Power Company to furnish electric light and power to the city.

CLINTON, MO.—The citizens are reported to have voted February 15 to issue $30,000 bonds for an electric light plant, and $70,000 for water works.

HIGGINSVILLE, MO.—The Higginsville water and light plant (municipal) will rebuild its lines this spring and will be in the market for a 60-kw, 60-cycle, alternating-current dynamo and also for fans and motors. Frank Monser is manager and superintendent.

DEXTER, MO.—The City Electric Light & Power Company, which is leased by the city to Arthur Sprinkle, is planning to erect new cedar poles to take the places of the old cypress ones. A new engine will also be installed in the plant during the summer.

MORRISTOWN, N. J.—The Morris County Traction Company has applied for a franchise for an electric railway over Morristown streets.

TRENTON, N. J.—The Trenton, Hamilton & Ewing Traction Company has secured franchises for its Trenton Junction and Hamilton Square extensions.

FT. WOOD, N. Y.—Bids will be received by G. C. Burnell, Constr Q. M., U. S. A., until April 16, for constructing an electric light and power system here.

UTICA, N. Y.—The Utica Gas & Electric Company has decided to increase the capacity of its electric generating plant on West Canada Creek at Trenton Falls and Prospect. M. Jesse Brayton is secretary.

HUNTINGTON, N. Y.—Supervisor Ireland and Charles E. Shepherd, of this place, are busy securing consents for the proposed electric railway between Huntington Station and Amityville by way of Melville and Farmingdale. This road is to be built by the Long Island Railroad Company.

NEW YORK, N. Y.—Plans have been filed for the great electric power station for the $4,000,000 terminal station of the Pennsylvania, New York & Long Island Railroad tunnel to be built opposite the passenger terminal on the south side of 31st Street, extending from Seventh to Eighth Aves. It is to be of granite ornamented with pilasters, and will be three and four stories high, with a basement cellar and sub-cellar. It will front 161.4 feet on the street and will have a depth of 98 feet. There will be an office floor, a floor for the electric fans and storage batteries, a floor for the economizer and coal bins, and a switch-board gallery. The designers of the power station are Westinghouse, Church, Kerr & Co., who estimate the cost at $300,000.

CHARLOTTE, N. C.—The Simons-Myrant Company of Charleston, S. C., has secured the contract for constructing a canal from the dam across Catawba River to the power house, about 1½ miles in length; probable cost, $75,000.

LILESVILLE, N. C.—Engineers Lockwood, Greene & Co., of Boston, Mass., write that the probable cost of the proposed development of Bluett Falls will be about $2,000,000. Bids for construction will probably be called for in two or three months.

CHARLOTTE, N. C.—The Southern Power Company is arranging to furnish the mills in and around Gastonia with electric power from its new station at Great Falls. The line will be built via the Old Catawba station, near Rock Hill, and Clover through Gastonia and on to the mills at Lowell and Belmont, the latter only eleven miles west of Charlotte. The main transmission line will be built of steel towers. Power will be transmitted at 44,000 volts, which will be stepped down in transformer sub-stations to working voltage. Contracts which warrant the construction of this line have already been made.

KENMARE, N. D.—The Kenmare Light & Power Company will install some new machinery.

WALHALLA, N. D.—J. F. Mager, proprietor of the Walhalla electric light plant, is contemplating increasing the boiler and generator capacity of the plant in the near future.

WILMINGTON, OHIO.—The Wilmington Water & Light Company is contemplating the purchase of a larger generator and will make extensions to its system during the summer. J. C. Martin is manager.

DAYTON, OHIO.—Cyrus E. Mead, general manager of the Citizens' Electric Co., writes that bids will be received about March 15 for the construction of an electric light, heat and power plant, to cost about $1,500,000.

ALLIANCE, OHIO.—The promoters of the Sandy Valley Traction Company, which proposes to build from Alliance to Canal Dover, has been obliged to change portions of its route because of the opposition of farmers who are asking exorbitant prices for right of way. The headquarters of the company are in Alliance.

CLEVELAND, OHIO.—The promoters of the Cleveland, Ravenna & Alliance Traction Company, which proposes to build from Alliance to Cleveland, announce that construction work will start in the spring. Locations for a power station and four sub-stations will be decided upon within a few days, the average distance between sub-stations being 12 miles. C. R. Morley and J. W. Holcomb, of Cleveland, are the chief promoters of the project.

RAINIER, ORE.—The City Council has granted W. P. Ely a franchise for an electric light plant.

ASTORIA, ORE.—The residents of Uniontown, Ore., are contemplating the erection of an electric lighting plant to be operated on the co-operative plan.

UNION, ORE.—The Central Railway of Oregon, which has made arrangements for an electric belt line throughout the Grande Ronde Valley, which has begun its permanent and final survey in Union.

FOREST GROVE, ORE.—The Haines Power Company expects during the year to treble the output of its plant, in which case considerable new machinery will be required. E. W. Haines is manager of the company.

PORTLAND, ORE.—The farmers of Eastern Multnomah and Clackamas Counties have organized for the purpose of introducing the rural telephone system. At the recent meeting of delegates W. H. Snasball, of Pleasant Valley, was elected chairman, and Theodore Bruegger, who lives near Gresham, was elected secretary.

BAKER CITY, ORE.—The Sumpter Electric Railway to the mining camp of Bourne is to be built this spring. W. E. Hurd, of Portland, and Anthony Mohr, of Sumpter, are in the east in the interest of the new road. It will be an electric line about ten miles long, serving one of the richest mining camps in the Northwest.

PORTLAND, ORE.—H. H. Newhall and Joseph M. Healy have filed a notice of their intention to apply for a franchise for an electric railway in this city. The franchise will also provide for the construction of bridges over Sullivan's Gulch. Mr. Newhall and Mr. Healy are respectively presidents of the East Side Bank and the Healy Investment Company.

BEDFORD, PA.—The Bedford Electric Light, Heat & Power Company expects to install a 200-hp boiler soon. William Brice, Jr., is manager.

WILKESBARRE, PA.—Scranton and Wilkesbarre interests have applied to the City Council for a franchise here for a proposed electric railway to be built between Wilkesbarre and Nanticoke, a distance of 8 miles.

PITTSBURG, PA.—The directors of the Pittsburg & Alleghany Telephone Company have appropriated $750,000 for new construction and extensions during the coming fiscal year. President Splane submitted his annual report in which he showed a substantial gain in the number of new telephones installed and in the gross and net earnings. During the year about 55,000,000 messages were handled. The increase in long distance business was more than 200 per cent, as compared with the preceding year.

EDGEFIELD, S. C.—A movement is on foot at Edgefield to establish a water and electric lighting plant, and a mass meeting was recently held to consider the matter. The total estimated cost by experts is given at $51,000 for the water and lights. C. C. Wilson, of Columbia, has been appointed engineer.

ANDERSON, S. C.—The preliminary survey of the proposed electric railway between Anderson and Belton has been completed and it is announced that the work of construction will begin in the spring. The contract for steel rails has already been let.

WALHALLA, S. C.—The Oconee Water, Light & Power Company, of Walhalla, would like to correspond with parties for the financing of its project, or with a contractor to finance and construct. The company will supply water to Walhalla and West Union, and light and power to Walhalla, West Union, Seneca, Earley, Liberty and Central. The water plant is a gravity system, and there will be required piping, electric machinery, four 100,000-gal. tanks, etc.; a dam will also be built. The whole will involve an expenditure of about $200,000. The franchises for water and light are exclusive, and plants are exempt from municipal taxation during the life of the franchise, 50 years. All the power is already contracted for. James Thompson is secretary.

DEADWOOD, S. D.—The Consolidated Power & Light Company of South Dakota is contemplating the construction of 70 miles of power line. J. W. Springer is manager.

HURON, S. D.—A power plant for heating and lighting will be constructed at Huron College; it will contain one 50-kw generator and a 80-hp engine; also two 66x16-ft. boilers with accessories. J. J. Flather, consulting engineer, Minneapolis, Minn.

NASHVILLE, TENN.—The Nashville Railway & Light Company is discussing plans for a number of improvements in its system, which will probably be made during the present year.

BOLIVAR, TENN.—Bolivar is now prepared to test the advantages of municipal ownership, the electric light and water plant which has been in course of construction for some time, having been completed and turned over to the city.

STAMFORD, TEX.—J. H. Gintar is interested in the construction of an electric light plant.

YORKTOWN, TEX.—Franz Koenig, of Moulton, has decided to construct an electric light and ice plant.

MINEOLA, TEX.—The Mineola Light & Ice Company states that it will be in the market soon for a 75-hp producer-gas outfit. J. P. Kittrell is superintendent.

FORT WORTH, TEX.—Major J. D. Beardsley states that he has obtained a franchise from the City of Mineral Wells for the construction of six miles of electric railway.

AMARILLO, TEX.—The Amarillo Water, Light & Power Company is planning to install new machinery in its plant, consisting of a 225-hp engine, a 175-kw alternating-current dynamo and a 30-kw rotary converter. H. B. Jones, superintendent.

CLEBURNE, TEX.—B. F. Bond, of Jacksonville, Ill., and associates, have been granted a 50-year franchise for building an electric street railway over the residence and business streets of the city. The work is to begin within thirty days.

COALVILLE, UTAH.—The Council has decided to issue bonds for improving the electric light plant.

SALT LAKE CITY, UTAH.—O. C. Bluemel of Logan, Utah, has made an application for water from the Logan River for power purposes. His plant is to be of 150 hp. and the power to be generated will be used for driving machinery and for electric lighting about Logan.

WINCHESTER, VA.—The Winchester & Washington City Railway Company of Virginia has virtually closed a deal, it is said, for the purchase of the plant of the Winchester Gas & Electric Company. The purchasing company is developing a large water power on the Shenandoah River in the State of Virginia, and, it is announced, will supply lights to Winchester and other towns beginning June 1.

GREENACRES, WASH.—The Spokane & Pend o'Reille Rapid Transit Company has a corps of engineers in the field locating the right of way for its proposed line from Spokane through the valley and on to the lake.

PORT ANGELES, WASH.—The city is at present considering a plan to use water power instead of steam for the operation of the municipal lighting plant, the capacity of which will probably be increased three fold. John Hallahan, manager.

SEATTLE, WASH.—In March the citizens will vote on the matter of issuing $600,000 for improvements in the municipal lighting plant, which will include an additional 1,200-kw machine, construction of a duplicate pole line, 5,000 cut-ins for commercial work, 500 arc lamps and 2,500 additional 6.6-amp. lamps. J. D. Ross, constructing electrician.

SPOKANE, WASH.—The Fremont Power Company is making arrangements to complete its power plant at the Red Boy mine near Olive Lake, which is expected to be ready for operation by next September or October. When the plant is completed it will be of sufficient capacity to furnish power for electric machinery and lighting at a number of mines in the upper camps as well as the Red Boy, and will be an important factor in the development of that section.

CLARKSBURG, W. VA.—The Bell Telephone Company is preparing for big improvements at once, which, when made, will place the company in a position to do a more extensive business and afford its patrons far better service. It is planned to install a new and larger exchange. These improvements are estimated to cost at least $20,000.

MARTINSBURG, W. VA.—The Martinsburg Power Company has applied to the County Court of Jefferson County for a franchise permitting it to erect poles and wires from dam No. 4 to Shepherdstown and Kearneysville for the purpose of transmitting electric power. The company expects to establish a large electric power plant at dam No. 4, which will furnish light and power to Shepherdstown and Martinsburg and will also provide power for the extensive stone quarries at Kearneysville.

ONALASKA, WIS.—The Wisconsin Light & Power Company is reported to have secured a franchise.

NEW LONDON, WIS.—It is expected that a 60-kw alternator and a high-speed engine will be installed in the city electric light plant next fall. H. C. Sterling is superintendent.

PLYMOUTH, WIS.—The Water & Light Board is planning to install in the city lighting plant this coming summer a new 72 x 18 horizontal tubular boiler. P. J. Douglas is superintendent of the plant.

SUPERIOR, WIS.—The Superior Water & Light Company is expecting to completely overhaul its plant this year and will purchase power from the hydro-electric plant of the Great Northern Power Company, of Duluth, Minn. B. F. Ellison is general manager.

VANCOUVER, B. C.—Pacific Coast capitalists are planning to build an electric road from here to Portland, Ore., approximately 250 miles.

NEW WESTMINSTER, B. C.—The City Council and board of trade have combined forces to secure an electric railway to Millside, a distance of about 2 miles. Address Mayor Keary.

VICTORIA, B. C.—The British Columbia Telephone Company will shortly call for bids for the erection of a new central exchange here. The company will also install a new switchboard, with a capacity for 10,000 pairs of direct lines, at a cost of $100,000.

VANCOUVER, B. C.—A power company is being formed to generate 5000 electrical horse-power to supply the city with light and power. The aldermen are said to be in favor of commencing a civic lighting plant immediately. Address Mayor Buscombe or Alderman Odlum.

WINNIPEG, MAN., CAN.—The Winnipeg Electric Company has plans for a number of extensions around this city which will total over 20 miles. Wilford Phillips is general superintendent.

EDMONTON, CAN.—Members of the City Council have left for American cities to inspect various automatic telephone systems in use, and if their report is deemed satisfactory the Council will install an automatic system here. Address Mayor May or City Electrician Ormsby.

TORONTO, CAN.—The Allis-Chalmers-Bullock, Ltd., Montreal, has received an order from the Canadian Forty-Mile Gold Dredging Company, of Toronto, Can., for a special gold dredge equipped complete. The contract covers the electric light plant, two boilers, 100 hp each, engines, pumps, etc. The dredge will be ready for use early in May.

LETHBRIDGE, CAN.—A. J. Arnold, an attorney of Windsor, Ont., has applied for incorporation for the Alberta Northern Railway & Coal Company. The charter includes the power to build and operate a telephone line alongside the railway which will be built from this town to Edmonton, via Clagary and High River, a distance of approximately 500 miles. The charter also includes the power to make connections whereever desired en route.

CARBERRY, MAN.—The Council has applied for permission to issue bonds to the amount of $150,000 for the construction of an electric light plant. Mayor Eaton is chairman of the committee.

PORTAGE LA PRAIRIE, MAN.—It has been decided to issue $50,000 bonds for the purchase of the electric light plant, in which a number of improvements will be made. F. A. Whittaker is city clerk.

WINNIPEG, MAN.—The Bell Telephone Company will spend $750,000 in the Canadian Northwest this year on extensions and improvements to its local and long distance lines. Frank Patterson, Winnipeg, is district manager.

WINNIPEG, MAN.—The Winnipeg, Selkirk & Lake Winnipeg Railroad, now operated by steam, has been taken over by the Winnipeg Electric Company. The line will be electrified at once and many other improvements made. For further particulars address Wilford Phillips, Winnipeg, Man.

WINNIPEG, MAN.—The Canadian Pacific Railroad Company is making arrangements to connect its hotel in the Rocky Mountains by a copper telephone circuit, involving the stringing of 126 miles of wire. Work will be commenced in the spring. F. F. Busteen is assistant engineer.

WINNIPEG, MAN.—Surveys and plans are being rushed for the civic power plant which will be erected at Lac du Bonnet, and an effort will be made to have the plant completed to deliver power before the end of the year. Active construction will be commenced as soon as the weather permits in the spring. The power will be brought into this city by a 60-mile transmission line. H. N. Ruttan, city engineer.

WINNIPEG, MAN.—The Legislature recently appointed a committee to visit American cities for the purpose of inspecting various automatic telephone systems. The committee, after visiting Chicago, Ill., and Grand Rapids, Mich., rendered a very satisfactory report of its inspection, and it is probable that the automatic system will be adopted throughout the province and operated under the control of the government. Hon. Robert Rogers is minister of public works.

MAZATLAN, MEX.—An electric power plant to cost $500,000 is to be installed at the Guadalupe de los Reyes mines in this state. The order for the machinery for the proposed plant will be placed in the United States.

GUADALAJARA, MEX.—It is reported that negotiations are in progress for the consolidation of the electric light and power and street railway properties of La Electra, S. A., and the Compania Industrial de Guadalajara, of this city. Each company is offering to sell its holdings to the other, the price fixed by the Compania Industrial de Guadalajara for its interests being in excess of $2,000,000 gold. The two concerns control valuable water-power rights.

PORT ARTHUR, ONT.—Architect Aylesworth has completed plans for a $12,000 telephone exchange which the town will erect this year. City Clerk, J. McTeigue.

TEESWATER, ONT.—The Teeswater Electric Light Company intends to entirely reconstruct its lines and will install more arc lamps. W. H. Green, of Wingham, is manager.

KENORA, ONT.—The Board of Trade is endeavoring to interest capitalists in the construction of a street railway from here to Keewatin, a distance of about 17 miles. Address Mayor Horswill, Kenora, Ont.

OTTAWA, ONT.—The Canadian Pacific Railroad is planning to make experiments towards electrifying its branch lines in Eastern Canada. Address W. T. Tye, chief engineer, Montreal, Que.

HAMILTON, ONT.—The Hamilton Electric Terminal Company has made application to the City Council for permission to build a terminal station here for all electric lines running into the city. The cost is estimated at $250,000.

FORT WILLIAM, ONT.—A by-law has been passed by the taxpayers providing for a sum of $12,000 to be expended in improvements and extensions to the municipal telephone service. The sum of $15,000 has also been voted to be expended on the municipal electric lighting plant. Address Mayor Whalen.

BRANTFORD, ONT.—Brantford has scored a distinct point in the light and power deal with the Western Counties Power Company, which is seeking a 25-year franchise here. The company has agreed to waive the provisions of the Conmee Act, and hence the city will at any time be able to go into municipal lighting without purchasing the plant of the company.

MONTREAL, QUE.—The Montreal & Southern Counties Railway Company is seeking an entrance to Montreal by means of an electric railway, after having crossed the Victoria Bridge.

MONTREAL, QUE.—The Montreal Electric Street Railroad Company has decided to lay an additional 171 miles of track during the year, which will make its mileage 300 miles. The company estimates the total expenditure at about $15,500,000, including the cost of rails, power, rolling stock, real estate and equipment.

SASKATOON, SASK.—A. R. Campbell, Moosejaw, Sask., has been instructed by the City Council to prepare an estimate of the cost of installing an electric lighting plant.

DAWSON, Y. T.—Thomas O'Brien states that the Alaska Mines Railroad Company will build an electric line from here to Sulphur Springs, a distance of 30 miles.

Company Elections.

SAN FRANCISCO, CAL.—At the annual meeting of the Petaluma & Santa Rosa Railway Company on Feb. 6, the stockholders re-elected the present board of directors and they in turn re-elected the officers as follows: John A. McNear, president; J. W. Kelley, vice-president; Thomas Archer, secretary; Burke Corbet, treasurer and attorney.

CHICAGO, ILL.—At the annual meeting of the Chicago City Railway Company, held Feb. 16, a number of changes were made in the personnel of the company. The directors were re-elected as follows: John A. Spoor, chairman; A. J. Earling, Robert M. Fair, T. E. Mitten, Edward Morris, P. A. Valentine and Lawrence A. Young. The officers elected are T. E. Mitten, president; Mason B. Starring, vice-president and general manager; J. B. ..ogarth, secretary and auditor; J. P. Burke, treasurer.

LONG ISLAND CITY, N. Y.—At the annual meeting of the Long Island Consolidated Electrical Companies, held Feb. 15, Messrs. Joseph F. Keany and W. G. Oakman were elected directors to succeed S. M. Prevost and W. F. Potter, both deceased. The other directors were re-elected.

LORAIN, OHIO.—At the annual meeting of the Black River Telephone Company the following named officers were elected: E. M. Pierce, president; William Honecker, vice-president; L. A. Fauver, secretary; H. E. Hageman, assistant secretary, and J. P. Preble, superintendent.

COLUMBUS, OHIO.—At the recent annual meeting of the Columbus Citizens' Telephone Company, the board of directors organized by electing Henry A. Lanman, president; John Joyce, vice-president; Edwin R. Sharp, secretary and treasurer; Frank A. Davis, general counsel; Gansey R. Johnson, general manager.

WAYNESBORO, PA.—The following officers were elected at the recent meeting of the Waynesboro Electric Light & Power Company; George B. Beaver, president; D. M. Wertz, treasurer, and H. B. McNulty, secretary.

PHILADELPHIA, PA.—The new board of directors of the United Telephone & Telegraph Company have elected the following officers: Richard G. Park, president; Edward Davis, vice-president, and S. R. Caldwell, secretary and treasurer.

PHILADELPHIA, PA.—At a meeting of the Board of Directors of the Atlantic Coast Electric Light Company, held in this city Feb. 13, the following officers were elected: S. F. Hazelrigg, president; George B. Cade, treasurer. J. G. Campbell will continue as superintendent.

PITTSBURG, PA.—At the annual meeting of the Pittsburg & Allegheny Telephone Company, the following directors were elected: J. G. Splane, John S. Weller, R. C. Hall, D. P. Reighard, J. M. Clapp, R. R. Binns, G. B. Beatty, George R. Webb, Ralph E. Flinn. The organization of the board resulted as follows: president, J. G. Splane; vice-president and general counsel, John S. Weller; treasurer, R. C. Hall; secretary and assistant treasurer, T. G. Davis.

NASHVILLE, TENN.—At the annual meeting of the stockholders of the Nashville Railway & Light Company, held in Nashville a few days ago, the following directors were elected: Percy Warner, J. H. Fall, F. O. Watts, Joseph H. Thompson, A. M. Shook, of Nashville, and A. H. Ford, J. K. Newman, S. H. March and George H. Davis, of New York. The directors met and elected the following officers: Percy Warner, president and general manager; J. H. Fall, vice-president, and N. P. Yeatman, secretary and treasurer.

WHEELING, W. VA.—The Ohio Valley Electric Light & Power Company has elected the following officers for the ensuing year: W. C. Handlan, president; John F. Frasher, general manager; William H. Snyder, secretary and treasurer.

LARAMIE, WYO.—At the annual meeting of the Laramie Electric, Gas Light & Fuel Company, R. H. Homer was re-elected president, Eli Cumrine, treasurer, and John H. Symons, secretary.

TORONTO, ONT.—The Electrical Development Company has elected the following officers: President, Sir H. M. Pellatt; vice-president, Fred Nichols; treasurer, D. H. McDougall; secretary, H. G. Nichols.

New Incorporations.

OAKLAND, CAL.—Articles of incorporation of the Coast Electric Company have been filed with the County Clerk. The directors are H. N. Turrell, George Turrell and Hugh Kimball. The capital stock is $10,000.

EATON, COL.—The Eaton Water & Light Company has been incorporated with a capital of $30,000, by William Atchison, C. D. Eggleston and others.

COLUMBUS, GA.—The Columbus Electric Company has been formed here to take over the following properties: the power plant and riparian right of the Columbus Power Company, the property of the Chattahoochee Falls Company, and that of the Coweta Power Company. The company will build immediately a 3,000-hp steam electric plant. G. Gunby Jordan and W. E. Bradley are named as directors of the company.

SPRING GROVE, ILL.—The Spring Grove Telephone Company has been incorporated with a capital of $10,000.

MATTOON, ILL.—The Coles County Telephone Company & Telegraph Company, with a capital of $100,000, has filed articles of incorporation. L. L. Lumpkin, W. G. Lumpkin and John McNutt, Jr., are the incorporators.

GREENVILLE, ILL.—The Bond County Telephone Company has been incorporated with a capital of $6,000. The incorporators are J. S. Bradford, E. E. Wise and George V. Weise.

COLFAX, ILL.—The Colfax Telephone Company has filed articles of incorporation stating its capital stock to be $15,000. The incorporators are William Gaddis, J. P. Arnold and F. J. Harris.

WATERLOO, ILL.—The Waterloo Electric Light & Water Works Company has filed articles of incorporation, with a capital stock of $25,000, for the purpose of constructing a combined water works and electric light plant. The directors are C. A. Wilding, W. J. Vesey and others.

CARBONDALE, ILL.—The Ohio & Mississippi Valley Telephone Company has filed articles of incorporation. The company is capitalized at $100,000 and will engage in the telephone, lighting and power business. J. B. Bundy, F. W. Willard and William H. Wardner are named as directors.

EAST ST. LOUIS, ILL.—The Southern Traction Company of Illinois has filed articles of incorporation. The line is to be constructed from East St. Louis to Millstadt, via Centerville, and from Centerville Station to Belleville, also from Millstadt to Belleville and easterly and southeasterly through St. Clair, Washington, Clinton, Randolph and Perry Counties. The principal offices will be located at East St. Louis. The capital stock is $2,500 and the incorporators and first board of directors are John Fouchette, Centerville Station; Henry C. Bogole, Belleville; W. E. Trautman, East St. Louis; F. P. Ernst and R. Vennon Clark, of East St. Louis.

SHIPSHEWANA, IND.—The Mutual Telephone Company has filed articles of incorporation. The company will receive bids for the construction of a telephone exchange, lines and equipment. David A. Plantz, M. S. Yoder and W. H. Weaver are directors.

INDIANAPOLIS, IND.—Articles of incorporation have been filed by the Columbus & Seymour Traction Company, which proposes to build an interurban road from Columbus to Seymour. The initial capital stock is $20,000, and the directors are F. P. Smith, C. S. Baker, R. O. Boyer, H. P. Hughes and H. M. Campbell. It is the understanding that the work of building the road will actually be done by the Indianapolis, Columbus & Southern Traction Company, and that the new company will be taken over as soon as the road is ready to operate. The Seymour City Council has granted the Columbus & Seymour Traction Company a franchise, but this will in time be transferred to the Indianapolis, Columbus & Seymour Traction Company.

LACONA, IA.—The Lacona Telephone Company has filed articles of incorporation with a capital stock of $4,000.

DES MOINES, IA.—The St. Lucas Farmers' Telephone Company of Fayette County has filed articles of incorporation with the Secretary of State.

INDIANOLA, IA.—The Stony Point Telephone Company has been organized by some of the farmers in this vicinity. P. A. Millslagle is president of the company and J. W. Barnett, vice-president.

HUTCHINSON, KAN.—The People's Water, Light & Power Company has been organized with a capital of $50,000. It purposes constructing an electric light and gas plant, and later on, water works.

HUTCHINSON, KAN.—The People's Water, Light & Power Company has been incorporated and has applied for a charter. The capital stock is $50,000. It is proposed at first to build an electric light and gas plant and later ask the city for a franchise to build a water plant, in order to furnish the city and surrounding towns with water, light and power. The incorporators are also the directors of the Hutchinson Interurban Railway Company, the concern which will soon start the construction of an electric railway here.

PORTLAND, ME.—The De Forest Occidental & Oriental Wireless Company, a subsidiary concern of the American De Forest Wireless Telegraph Company has filed its certificate of incorporation. The authorized capitalization is $2,000,000.

CORINNA, ME.—The West Penobscot Telephone & Telegraph Company has been incorporated for the purpose of constructing and operating telephone and telegraph lines between Corinna and other villages in that section of Penobscot County. The company has a capital of $10,000 and the following officers: C. L. Jones, president, and J. T. Grey, treasurer, both of this city.

BALTIMORE, MD.—The Baltimore Electric Light & Power Company has been incorporated by Thomas J. Shryock, Summerfield B. Medairy, Alfred F. Booth, Robert M. Spedden and Peter E. Tome, all of this city. The capital stock of the company is said to be fixed at $250,000, but may be increased to $2,500,000. The company has heretofore been operated as a private concern.

BALTIMORE, MD.—William B. Turner, Joseph E. Henderson, Edward McIntyre, Charles R. Durling and Emory A. Craig have filed articles of incorporation for the Durling Electric Company, having a capital stock of $10,000. The corporation will manufacture, sell and install electrical machinery and devices.

JACKSON, MICH.—Articles of incorporation have been filed for the Cambridge & Woodstock Telephone Company, having a capital stock of $500.

LANSING, MICH.—The Michigan Power Company has been incorporated with a capital of $2,500,000, to operate the dams owned by the Platt Heat & Power Company, at Lansing, Dimondale, Grand Ledge and Eagle, and further develop the water power at those places. A. A. and F. B. Pratt and Robert Ingersoll, of New York, are the promoters of the enterprise.

STARBUCK, MINN. The White Bear Lake Telephone Company has been incorporated with a capital of $8,000.

DULUTH, MINN. Articles of incorporation have been filed by the Mesaba Traction Company. The capital stock of the company is fixed at $50,000, and its officers are F. B Myers, president; H. G. Seeley, vice-president; J. S. Hopkins, secretary-treasurer. All are residents of Biwabik.

CORINTH, MISS.—The Alcorn Electric Company has filed articles of incorporation, with a capital of $25,000. Among the incorporators are J. H. Jones and J. M. Boone.

BEATRICE, NEB.—The New Home Telephone Company has been incorporated and will erect a $20,000 exchange building.

CLATONIA, NEB.—The Farmers' Mutual Telephone Company, of this city, has filed articles of incorporation with the Secretary of State. The capital stock is $1,200, and B. C. Albert is named as one of the incorporators.

TRENTON, N. J.—The United Missouri River Power Company filed a certificate of incorporation in the office of the Secretary of State. The authorized capital stock is $5,000,000. The incorporators are B. R. Higgons, Samuel Hartman and E. G. Graves.

TRENTON, N. J.—The Mercer Electrical Company has filed articles of incorporation. The authorized capital stock is $100,000 and the incorporators are Francis C. Lawthrop, Robert R. Volk and Margaret T. Simpson. The object of the company is to generate and distribute electricity for heat, light and power.

RED HOOK, N. Y.—J. H. Sharpe, F. W. L. Fullerton, F. B. Sharpe and others have filed articles of incorporation for the Red Hook Light & Power Company, with a capital stock of $25,000.

EVANS MILLS, N. Y. The North Country Telephone & Telegraph Company has been incorporated by Newton S. Beebe, Charles E. Paul and Emory E. Ward. The company has a capital of $15,000.

BROOKLYN, N. Y.—The Suttepec Electric Light & Power Company has filed articles of incorporation, with a capital of $200,000. A. F. Cole, Alexander Keogh and R. J. Heisler, of New York, are the incorporators.

TROY, N. Y.—A certificate of incorporation of the East Springfield Telephone Company has been filed. The capital stock is $10,000, and the directors include Henry Rathbon, S. A. Young, H. W. Young and O. R. Young.

ROCHESTER, N. Y.—The Rochester, Scottsville & Caledonia Railroad Company has been incorporated with a capital of $500,000 to operate an electric street surface railroad from Rochester to Caledonia. The directors are Henry C. Brewster, John N. Beckley, Merton E. Lewis, George C. Buell, Edmund Lyon and Charles T. Chapin, of Rochester, and others.

TOLEDO, OHIO.—The Forest Incandescent Lighting Company has been incorporated with a capital stock of $10,000, by A. L. Betz and E. A. Green.

FISHER, OHIO. The Farmers' Telephone Company, with a capital of $2,500, has been incorporated by M. Dalton, R. M. Patterson, H. D. Hooper, Julian Gift and J. C. Harner.

NEW LEXINGTON, OHIO.—The Citizens' Independent Telephone Company has been incorporated with a capital stock of $50,000. J. H. Rhodes and T. J. Smith are among the incorporators.

LYONS, OHIO.—Articles of incorporation have been filed for the Lyons Mutual Telephone Company by Frank Denson, D. S. Knight, Eugene Carpenter, Charles W. Cassall, B. E. Pater and John Crow.

EDMOND, OKLA. The Farmers' Mutual Telephone Company has been incorporated, with a capital of $5,000, by E. W. Wood, J. F. Paul, John McMullen, William Beresford and E. W. Childers.

PORTLAND, ORE.—The Forest Grove Transportation Company has been incorporated, with a capital of $10,000, by E. W. Haines, George G. Hancock, F. A. Watrous, George F. Naylor, J. E. Loomis and W. H. Hollis.

WAGNER, S. D.—The Farm & Home Telephone Company has been incorporated with a capital of $5,000.

ARMOUR, S. D.—Special articles of incorporation have been filed for the Chester Telephone Company, having a capital of $1,000. G. Fuhlendorf, Frank Groesbeck and Henry Bussell are the incorporators.

SAN MARCOS, TEX.—Articles of incorporation of the San Marcos-Luling Traction Company have been filed in the State Department. The company is capitalized at $500,000, and J. H. Jennings, R. C. Neighbors and C. R. Smith are named as directors.

SPOKANE, WASH.—With a capital of $1,000,000, the Inland Power & Electric Company has been incorporated for the purpose of developing water powers. The incorporators are Arthur Phillips, F. P. Walters and C. A. Lundford.

OLYMPIA, WASH.—The Northwestern Long Distance Telephone Company, a California corporation, which has already filed articles of incorporation in Sacramento, has filed articles of incorporation under the laws of the State of Washington. Its principal office is at Los Angeles, Cal. The company has a capital stock of $1,500,000, and announces its intention to construct lines from Ashland, Ore., to Vancouver, B. C.

LADYSMITH, WIS. The Ladysmith Light Company has been incorporated with a capital of $25,000 by C. A. Huffman, G. E. Newman and L. E. McGill.

BELOIT, WIS.—A consolidation of the gas, electric light and water companies have been completed. The name of the new company is the Beloit Water, Gas & Electric Company. Joseph L. Hendley, of Beloit, has been elected president, W. H. Wheeler, of Beloit, vice-president, and C. H. Wooley, of Cincinnati, secretary and treasurer. The new company is capitalized at $1,300,000.

MONTREAL, QUE.—The Central Light, Heat & Power Company, with a capital of $500,000, has been incorporated and will construct and operate a light, heat and power plant. The directors are Samuel Carsley, W. F. Carsley and Charles Morton.

MONTREAL, QUE.—The Grosvenor Electric Light & Heat Company has been organized here with a capital of $125,000, and will do a general lighting, heating and power business. The directors include J. W. A. Hickson, H. B. Picken and T. P. Howard.

THE RAILWAY ELECTRIC SIGNAL COMPANY, of Jersey City, has been incorporated by George Lande, Jr., L. B. Elkins, Jr., and Edward P. Coyne.

THE TELEPHONE SIGNAL COMPANY, of Alliance, has been incorporated by Binford T., William H., Arthur J. and Orlin Shreeve and Morris Taylor. The company is capitalized at $15,000.

TURBO-ELECTRIC CONSTRUCTION COMPANY, of New York, has been incorporated with a capital stock of $75,000, and the following directors: G. F. Archer, G. E. Hesse and W. D. Vanderbilt.

AMERICAN ELECTRIC WELDING COMPANY, New York City, with a capital of $500,000, has filed articles of incorporation. Maurice Lachman, Reginald Hawley and Joseph Solomon are named as directors.

UNITED STATES ELECTRIC PROTECTION & CONSTRUCTION COMPANY, New York, has been incorporated with a capital of $30,000 and the following directors: G. M. Treiber, R. C. Bennett and F. C. Bruckner.

H. C. K. COMPANY, of New York, has been incorporated and will manufacture electrical apparatus. The company is capitalized at $5000 and the following are named as directors: J. W. Holberg, P. H. Klein, Jr., and H. B. Coles.

THE BIDWELL ELECTRICAL COMPANY, of El Reno, Okla., and Chicago, Ill., has been chartered with a capital stock of $2,000,000. The incorporators are Benson Bidwell and C. W. Johnson, of Chicago, and H. L. Fogg, of El Reno.

THE AMERICAN ELECTRICAL NOVELTY MANUFACTURING COMPANY, of Jersey City, N. J., has filed articles of incorporation with a capital stock of $30,000. The incorporators are H. O. Coughlan, John R. Turner and H. Stafford Mantz.

THE CHEROKEE ELECTRIC & MANUFACTURING COMPANY, of Cherokee, Okla., has been incorporated with a capital stock of $25,000. J. W. Howard, A. J. Henderson, W. R. Ross, E. J. Dixon and L. G. Carpenter are named as the directors.

AUTOMATIC HEAT REGULATING & VENTILATING COMPANY, Newburg, N. Y., has filed articles of incorporation. It has a capital stock of $500,000, and the following are named as directors: F. C. C. Hadborn, M. J. Keogh and M. M. Keogh.

THE JAMES McNAUGHTON COMPANY, of Buffalo, N. Y., has been incorporated and will engage in the motor manufacturing business. The company is capitalized at $100,000, and James R. McNaughton, Charles S. Chamberlain and M. D. Ashford are named as directors.

INTERNATIONAL CLARK WIRELESS TELEGRAPH COMPANY, Augusta, Me., has filed its articles of incorporation. The authorized capitalization is $2,000,000. The stockholders are F. W. Parsons, Thomas E. Clark, W. E. Rogers, W. H. Gowan, M. A. Lafond, Frank Ford and Charles W. Thompson, of Detroit, Mich.

THE AUTOMOBILE COMPANY OF PATERSON, N. J., has filed articles of incorporation with the County Clerk. The authorized capital stock is $15,000, and the stockholders are Alfred B. Watson, Samuel J. Watson and Edwin M. Squires. The company's office is located at 217 Paterson Street. The building is to be renovated and enlarged, and a large amount of machinery and equipment for the manufacture and repair of all kinds of motor vehicles will be installed.

Legal.

TUNNEL STATIONS.—Chancellor Magie, sitting at Jersey City, has made permanent a temporary injunction restraining the Hoboken and Manhattan Tunnel Company from constructing a subway station under the trolley terminal station of the Public Service Corporation at Hoboken. The fight between the two companies has been going on since early in December. When the tunnel company's employes invaded the Public Service Corporation's property to begin operations they were arrested. Then the tunnel company, of which William G. McAdoo is president, secured an injunction restraining the Public Service Corporation from interfering with the tunnel company's employes, on the ground that the tunnel company held a lease of the disputed property. At this point the Fidelity Trust Company of Newark came into the fight. This company secured a temporary injunction restraining the tunnel company from continuing operations, on the ground that the company is trustee for the bonds of the Jersey City, Hoboken & Paterson Street Railway Company, whose lines are now leased to the Public Service Corporation. The Fidelity Trust Company alleged that the construction of a tunnel station under the Public Service Corporation's terminal at Hoboken would damage the property and jeopardize the security of the bonds for which the company is trustee.

TRESPASS BY TELEPHONE.—At Boston, recently, the question whether a person may trespass by telephone was up for discussion before Judge Richardson in the Superior Court. A bill was brought by the Derby Desk Company and the Superintendent of its Somerville factory, George L. Holton, against his wife, Jennie H. P. Holton of Cambridge, who is living apart from him and who is said to have called him by telephone frequently. A demurrer by Mrs. Holton was sustained because Judge Richardson expressed the opinion that a husband could not maintain a bill against his wife, having taken chances on the things complained of in this case when he married the woman. The court thought, however, that the company could maintain an action for itself, and the husband's name was stricken out of the complaint. "I think one having a telephone in his house," said Judge Richardson, "could enjoin a person from continuously ringing him up day and night upon unimportant matters which he had no right to do, to the loss of sleep and rest to the occupant and to his great annoyance."

WISCONSIN TELEPHONE LITIGATION.—Attorney-General Sturdevant has started action against the Bell telephone interests in Wisconsin for the recovery of $500 provided for by Chapter 389 of the laws of 1905, to prevent one telephone company from charging a greater rental in one city than of like service in another city of the same class. The Wisconsin Telephone Company operates in some 30 cities of the State. The independents lobbied persistently during the last three sessions of the legislature for the passage of a bill to prevent discrimination. They charged that the Bell company would use unfair and ruinous competitive methods to drive out an independent company from a field, and then, after destroying the independent company, would make up the loss sustained on the competition by greatly raising the price for telephone service. The Bell people resisted the movement. Finally, in the session of 1905, a law was enacted classifying cities of Wisconsin according to size, and providing that any company maintaining exchanges in more than one place should charge the same price for like service in cities of the same class. It is for alleged violation of this law that the Attorney-General, upon the instigation of the independent companies, is proceeding. The offense alleged is the charging of higher rates in Beloit than in Janesville.

CHICAGO TELEPHONE RATES.—The U. S. Supreme Court of Illinois has handed down a decision against the Chicago Telephone Company in its refusal to meet the claims made on it by the city. The court has decided that the company has no right to charge more than $125 a year for a telephone or collect tolls within the city limits. The company has 6,000 telephones, it is estimated, for which it has been charging $175 a year, besides receiving large sums for telephone tolls. The decision will entail a loss of $50 on each of the 6,000 telephones for a period of three years, which makes an item of $900,000. The city claims the company owes it from $350,000 to $500,000 for compensation. The loss of tolls for connections with outlying stations, the payment of compensation to the city and the reduced telephone rate, it is believed, will cost the company $500,000 a year. Within a few years after receiving its franchise from the city the company began to install its "improved metallic circuit service" and make other improvements. On the ground that this improved service was not contemplated by the ordinance, the company added $50 a year for the use of telephones equipped for this service. The court holds that all territory annexed since the ordinance was passed is entitled to the same service and to the same rates as that portion of Chicago included within the city limits at the time of the passage of the ordinance. The decision says the improved service does not warrant an increase in the rate beyond the maximum fixed by the ordinance. It declares the provisions of the ordinance are general and apply to every kind of service. Nearly two years ago Comptroller McGann made a demand on the company to pay 3 per cent compensation on its business done outside the old city limits. The company made the same claim it urged in the quo warranto suit—that the ordinance of 1889 applied only to the territory within the city limits at that time. A suit for an accounting is now pending.

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Educational.

TELEPHONY AT PURDUE.—The department of telephone engineering at Purdue University is now in the hands of Prof. Arthur Bessey Smith, who has been in charge since last September. The department is being enlarged and new apparatus installed. More new apparatus is in view, which, together with changes in the arrangement of the laboratories, will give better results than ever in teaching thoroughly the principles and practices of modern telephony. Special stress is laid on the necessity for a perfect understanding of fundamental principles, not the mere mastery of special cases. In addition to those specializing in telephony, every electrical engineering student is required to complete a typical experiment, which reveals to him a few of the features of the telephone.

Personal.

MR. CHARLES L. CORNELL has been elected secretary of the Niles-Bement-Pond Company in place of the late E. M. C. Davis. Mr. Cornell also fills the office of treasurer.

MR. THOMAS A. WAY, who has disposed of his interests in the Western Electric Telephone Company, of Mason City, Ia., has gone to Watertown, S. D., where he will be interested in the construction of railroads.

MR. M. NYMAN, formerly connected with the sales department of the Electric Appliance Company, Chicago, has been appointed manager of the Chicago office of the Buffalo Forge Company and the Buffalo Steam Pump Company.

BARSTOW & CHAMBERS.—The firm of Barstow & Chambers of Portland, Ore., and New York, has recently taken enlarged quarters, formerly occupied by the University Club, in the Failing Building, Portland. This firm has recently closed some important contracts for railways and power plants in the west.

MR. C. W. GEARHART, manager of the Syracuse office of the Crocker-Wheeler Company, has resigned recently, to the regret of the company and his colleagues, and has been succeeded by Mr. H. B. Hussey, formerly of the Stanley Company.

MR. W. H. WHITEHEAD, who has been manager of the New Heat, Light & Power Company, of Newark, N. J., since last spring, has resigned his position to take effect March 1. Mr. Whitehead will continue as manager of the city water works.

DR. LEE DE FOREST, inventor of the system of wireless telegraphy that bears his name, was married last week to Miss Lucile Sheardown, daughter of Mrs. M. T. Sheardown, of New York City. He and his wife sailed on the "Lucania" on Saturday for Europe.

MR. GEORGE F. BROCKMAN has resigned as superintendent of the Jackson, Ala., electric light plant, in order to go to Ensenada, Lower California, where he will superintend the building of a power plant and water works. Mr. Brockman superintended the building of the Jackson plant, and was its superintendent since it went in operation in 1904.

MR. R. D. SMITH, general superintendent of the St. Louis & Northern Railway Company, which is a part of the McKinley interurban system, has been appointed general manager of the Edwardsville Electric Light Company, the plant recently acquired from the local company. W. E. Owens, auditor of the railroad company has been appointed superintendent of the plant.

MR. G. A. NISBET, for several years with the General Incandescent Arc Light Co. and lately General Manager at the Chas. A. Thompson Co., New York, has taken charge of the New York branch of the Munder Electric Co., Springfield, Mass., manufacturers of incandescent lamps. The Munder Electric Co. is fortunate in securing the services of Mr. Nisbet, whose acquaintance in the electrical field is a very extensive one.

MR. J. E. FRIES has recently joined the selling organization of the Allis-Chalmers Company. He graduated from the Royal Technical College, Stockholm, Sweden, in 1898, and became connected with the General Telephone Company of that city. Later he engaged in electrical contracting in that city and during a period of four years carried out some large installations. On coming to this country he became connected with Westinghouse, Church, Kerr & Co., and worked on the Long Island Railroad electrification. He is now engaged with the Allis-Chalmers Company as a commercial engineer, located at present at the Cincinnati works, where he is familiarizing himself with the Bullock apparatus and manufacturing standards before joining the central headquarters at Milwaukee.

MR. B. S. JOSSELYN was recently elected president of the Maryland Telephone Company in place of Mr. D. E. Evans. Up to the time that Mr. Josselyn went to Baltimore he was general manager of the Union Terminal Railway Company at Sioux City, Iowa, and in the West has an enviable reputation as a successful manager. He was born on February 7, 1858, at Heyworth, Ill., and entered railway service in 1873 as ticket clerk. He served in a clerical capacity on various lines until 1893, when he became general manager of the Kansas City, Osceola & Southern Railway. This road was owned by Hon. John I. Blair, and while managing it Mr. Josselyn also operated various coal mines and looked after numerous farms and real estate holdings belonging to Mr. Blair. He constructed 40 miles of railroad through the brakes of the Ozark Mountains in Missouri, forming a connection with the St. Louis and San Francisco Railway, and was instrumental in the sale of the Kansas City, Osceola and Southern Railway to the 'Frisco Line. In January, 1899, Mr. Josselyn became general superintendent of the Omaha and St. Louis and Omaha and Kansas City and Eastern lines, and later was employed by Eastern capitalists as a railway expert to make reports on various properties. In February, 1900, he was appointed manager of the Kentucky and Indiana Bridge Railroad Company. A little over two years after taking the position he was selected to manage the Hudson Valley Railroad.

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Obituary.

MR. GEORGE D. MACMILLAN, president of the La Crosse Gas & Electric Company, of La Crosse, Wis., died at his home in that city Feb. 12 of uraemic poisoning. Mr. MacMillan was 61 years of age at the time of his death.

Trade Publications.

HEATING APPARATUS.—The American Blower Company, Detroit, Mich., has issued illustrated sectional catalogue No. 186 describing "A B C" heating apparatus for the heating and ventilating of factory and public buildings and the drying of materials of all kinds.

HEATING PLANTS.—W. H. Schott, Marquette Building, Chicago, Ill., has issued an artistic poster directing attention to the Schott systems for central station heating plants, including the balanced column, hot-water system and the regulated vacuum steam system.

RAILWAY LINE MATERIAL.—The February blotter of the General Electric Co. is illustrated with a view of catenary construction, and is intended for directing attention to this company's line material Leaflet No. 3420 is devoted to steel cutters for use on trolley wheels.

LIGHTING SPECIALTIES.—Flyer No. 2171 of the General Electric Company, Schenectady, N. Y., shows a complete line of fused ceiling rosettes for both 125 and 250 volts. Flyer No. 2173 of the same company deals with seamless outlet boxes for flush pocket switches and wall receptacles.

SWITCHBOARD INSTRUMENTS.—Bulletin No. 4429, of the General Electric Company, describes type R voltmeters and ammeters for use on switchboards. These instruments are constructed on the Thomson inclined-coil principle and are placed in heavy cast-iron cases to protect them from mechanical and magnetic disturbances.

ELECTRIC FANS.—Catalogue No. 17, of the Diehl Manufacturing Company, Elizabethport, N. J., is a neat publication dealing with ventilating fans for direct-current circuits. Illustrations and descriptions are given ceiling fans, electrolier fans, column fans, electrolier column fans, universal desk fans, telephone booth fans and counter column fans.

ELECTRIC HEATING DEVICES.—Booklet No. 3368, recently received from the General Electric Company, Schenectady, N. Y., gives a well-prepared description of household electric devices, including water heaters, milk warmers, cereal cookers, coffee percolators, chafing dishes, electric stoves, frying pans, flat irons, electric cigar lighters and luminous radiators.

DIRECT-CURRENT GENERATORS.—Bulletin No. 63 of the Crocker Wheeler Company Ampere, N. J., gives a complete and detailed list of direct-current engine type generators now in use or on order. The bulletin gives the name of the company now operating the generator, the place where the generator is being used and states the rating of the machine.

GAS ENGINE-DRIVEN ALTERNATORS. The Crocker-Wheeler Company, Ampere, N. J., uses as an illustration for its first quarterly calendar for 1906 a view of a 4,000-kw C-W alternating-current generator Three of these machines, which are stated to be the largest gas-engine-driven alternators ever built, will supply electricity for all of the trolley lines in San Francisco and vicinity.

THE AITON MACHINE COMPANY 126 Liberty Street, New York City, has just issued its bulletin No. 2 describing its 8-drum stranding machine, which carries spools 12x8 in. at a speed of 200 r.p.m. The entire machine is mounted on a stiff bed plate, and is equipped throughout without gearing. Further details will be cheerfully given upon request at the company's office.

FAN MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued as catalogue No. 4220 an illustrated description of the 1906 Trojan fan for alternating-current motors. The motors operate on the induction principle, without brushes or commutators. Each motor is provided with a two-speed switch which allows the breeze from the fan to be adjusted to varying requirements.

ELECTRIC MINING MACHINERY.—Bulletin No. 11 of the Jeffrey Manufacturing Company, Columbus, Ohio, contains a well-prepared article by Mr. F. L. Sessions, on "The Application of Electricity to Mining." The article is profusely illustrated, numerous views being given of electric locomotives in service, electric coal cutting machines, electric pumps, electric hoists, electric drills, electric generating equipments and switchboards.

HIGH-PRESSURE BLOWERS is the title of Bulletin No. 127 of the Sturtevant Co., of Boston, Mass In condensed form it presents the essential features of this type of rotary or so-called positive blower, tabulates the proper sizes required for different capacities of foundry cupolas, gives the principal dimensions of horizontal and vertical types and illustrates methods of driving by direct-connected Sturtevant motors and engines.

ELECTRICAL SPECIALTIES. Catalogue No. 16 of Pass & Seymour, Solvay, N. Y., clearly and comprehensively illustrates a complete line of electrical specialties in which the major insulating material is porcelain. All unnecessary descriptive matter has been eliminated, but the devices are well illustrated and much information is given concerning them. Price list No. 83, of the same company, shows the rates at which the specialties may be purchased

COAL HANDLING MACHINERY Pamphlet No. 061 of the C. W. Hunt Company, West New Brighton, New York, is issued as an introduction to the general line of machinery manufactured by this company. Although the pamphlet is of vest pocket size and consists of only 24 pages it contains illustrative and descriptive matter relating to almost all types of coal handling machinery and auxiliary devices in addition to industrial railways and electric locomotives.

TELEGRAPH CODE.—F. B. Badt & Co., 1504 Monadnock Block, Chicago, have issued a concise pocket telegraph code which will doubtless be welcome to the electrical profession and trade in general, as most of the codes now in existence are either too bulky or do not meet necessary requirements. Each code word contains at least five words, and are so selected that an error in one letter will usually not make the word unintelligible.

CURVE-DRAWING INSTRUMENTS.—An illustrated blotter recently received from the General Electric Company, Schenectady, N. Y., shows a record made by a curve-drawing voltmeter in addition to view of the instrument itself. This line of curve-drawing instrument includes ammeters, voltmeters, single-phase and polyphase wattmeters. These instruments have high torque with minimum friction and are unaffected by stray magnetic fields.

TRANSFORMERS.—The February bulletin of the Pittsburg Transformer Company, Pittsburg, Pa., gives an illustrated description of furnaces used for annealing the sheet steel cores of Pittsburg transformers. The furnaces are fired with natural gas through high-power Bunsen burners. The February calendar of this company is one of the prettiest of an exceedingly beautiful line of monthly reminders which the company sends to its friends.

OIL SWITCHES AND CIRCUIT BREAKERS.—Bulletin No. 7 of the Hartman Circuit Breaker Company, Ohio, describes and illustrates oil switches and circuit breakers for high potential circuits. These switches are designed for single phase, two phase and three-phase systems and for any voltage or capacity. Views are given of single-throw and double-throw, three-pole switches and of remote controlled oil circuit breakers for potential of 45,000 volts.

INCANDESCENT LAMPS.—The Buckeye Electric Company, Cleveland, Ohio, has issued a striking folder entitled "Under the Gates of Babylon." The folder contains a well-executed illustration of ancient Babylon, beneath which is a cut of a modern "Buckeye" lamp. After giving a word picture of the siege of Babylon, the description concludes as follows: "And, the weird, mysterious hand-writing appeared on the walls—and there arose the words which have been echoed through time, 'Better Buy Buckeye.'"

FEED-WATER HEATERS.—Catalogue No. 6 of the Alberger Condenser Company, 95 Liberty Street, New York, is devoted to Wainwright feed-water heaters, expansion joints, heat extractors and air coolers. The Wainwright "Evenflow" heater is provided with corrugated tubes which disturb the feed water and give to it a tumbling motion, constantly bringing fresh particles into contact with the walls of the tube and thereby increasing the conduction of heat through the metal to the water.

VENTILATING FANS.—The American Blower Company, Detroit, Mich., has issued an illustrated circular designated as "miniature No. 67," which deals with disc ventilating fans. Among the views are several showing compact equipment, each consisting of an electric motor direct connected to the shaft of the fan. One of the illustrations shows the motor placed upon a substantial base, the guard of the fan being mounted on the frame of the motor, resulting in a combination of exceptional rigidity and compactness.

THE SPLICING OF WIRE ROPE.—The John A. Roebling's Sons Company, Trenton, N. J., has issued an extremely well-prepared pamphlet, presenting a description of the method of wire-rope splicing as employed in its shops. The instructions are accompanied with illustrations from photographs taken during the splicing of a one-inch diameter regular lay rope, with six strands and a hemp center. This pamphlet, which may be obtained upon request, should prove of much value to any having to deal with the splicing of wire rope.

HYDRAULIC JACKS.—Catalogue No. 68 of the Watson-Stillman Company, 46 Dey Street, New York, is a 91-page publication relating to hydraulic jacks. The head and interior tube or ram of the jack form a reservoir from which the filling flows to the pumps, and to which it is returned in lowering. From the pump it is forced, by the downward stroke of the piston, past the lower valve into the cylinder, and this being closed at the bottom, the ram rises to allow space for the water The catalogue is well illustrated throughout.

HEAVY DUTY ENGINE.—The heavy duty horizontal engines manufactured by Allis-Chalmers Company may be seen in operation in so many public and private power plants that few who desire to investigate their construction need have recourse to a descriptive bulletin. One, however, is shortly to be issued for the convenience of prospective customers, and this will naturally embody the latest features of design. The bulletin will appeal not only to engineers in charge of power plants, but also to the owners who may not have much information concerning technical details of operation, yet can understand "results."

OIL AS FUEL. Chas. C. Moore & Co., 64 First Street, San Francisco, Ca., has issued as a treatise "On the Economy of Steam Power Plants Using Oil Fuel," reprints of articles which appeared in the *Journal of Electricity, Power and Gas* The descriptive matter is accompanied by twenty tables dealing with such factors as cost of labor per kw-hour, cost of plant per kilowatt, etc. The publication should prove extremely valuable as a convenient reference for any one interested in oil as fuel. The possibilities which lie in the use of oil for this purpose will be appreciated when it is known that a barrel of oil which contains 6,216,000 B.t.u. may be purchased for from 40 cents to $1.50.

PRICES OF COPPER.—An interesting little folder has just been issued by the Wire & Telephone Company of America, Rome, N. Y., giving the monthly average price of copper from 1883 to 1906. The highest price reached was 19 cents per pound in 1905, while the lowest price was 9¼ cents per pound in 1894.

ALTERNATING CURRENT GENERATORS.—While direct-connected alternators have largely displaced belted machines in modern power stations, there are many places, particularly in comparatively small installations, where belted units are called for. Belted machines are easily connected to the existing source of power, as for example, a line shaft used for driving other machinery; and for these installations of lesser size they are lower in first cost than direct connected apparatus. The Bullock machines described in a bulletin just issued by the Allis-Chalmers Company, of Milwaukee, are adapted to a wide range of output.

THE VEHICLE EQUIPMENT CO., Long Island City, N. Y., manufacturer of automobiles for all purposes, has just issued a very handsome oblong catalogue devoted to its specialty—electric vehicles. Of these for industrial uses alone it has made not far short of a thousand in the last four or five years, and the demand grows all the time. The industry deserves to be fostered by the central stations as a new field of current supply, and this is seen by some of them already, notably the New York Edison Company, which employs 50 in its own service. The Vehicle Equipment Company in this catalogue illustrates a great many types, and quotes a number of testimonials, showing how efficient, enduring and economical the electric vehicle really is when properly built.

VARIABLE SPEED MOTORS.—In bulletin No. 4430 of the General Electric Co., are shown two curves illustrating the cutting speeds used and the time required to face a 72-in. cast-iron disc when the lathe was driven by an electric motor with field control and when driven by belt from a counter shaft, respectively. The electrically-driven tool accomplished the work in 53 per cent. of the time required for the other tool. These tests indicate that one man operating a lathe driven by an electric motor of the variable-speed type can do almost the same amount of work in the same time as two men operating two lathes driven through stepped-cone pulleys. This bulletin describes a complete line of variable-speed motors for use with machine tools, and shows numerous illustrations of the motors and their controllers. Flyer No. 2172 of the same company is devoted to speed-controlling rheostats for use with variable-speed shunt or compound wound motors, particularly adapted for use with motors driving machine tools.

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News of the Trade.

THE CANADIAN GENERAL ELECTRIC COMPANY, of Toronto, is planning to build a plant at Rossland, B. C., for manufacturing electrical supplies.

THE EWING-MERKLE ELECTRIC COMPANY, of St. Louis, Mo., has filed a statement increasing its capital stock from $50,000 to $150,000. One-half of the increase has been paid in.

THE BAY STATE LAMP COMPANY, of Danvers, Mass., very naturally is satisfied with its business during 1905, since the increase over 1904 was nearly 70 per cent, while the present outlook is equally encouraging.

NATIONAL-ACME MFG. CO. has taken new quarters for its offices and warehouses in the Edgcomb Building, Clinton, and West Washington Streets, Chicago, and with offices at 56 West Washington Street. A large stock will be carried.

DOSSERT & CO., manufacturers of wire and other connections, etc., have moved to their new factory and offices at 242 West Forty-first Street, New York City, where they will enjoy larger facilities, and will increase their production, being thus enabled to make prompt deliveries of all such apparatus.

MOORE TUBES.—The Moore Electrical Company has issued a new and revised edition of its booklet on vacuum tube lighting by the system of Mr. D. M. Moore. This inventor has been slowly and steadily pushing his way and now has over a thousand feet or more of tubes in commercial use "and miles in immediate prospect."

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., now has its commodious and modern factory in full operation. The growth of the concern, which necessitated a larger and better equipped plant, has been rapid and substantial.

THE BRYANT ELECTRIC COMPANY, of Bridgeport, Conn., has awarded the contract for the erection of a $25,000 addition to its plant. The structure will be of brick, three stories high, with basement, 60 x 122 ft., and will be electrically equipped.

THE DIEHL MANUFACTURING COMPANY has recently leased the entire building at 1305 Race Street, Philadelphia, Pa., for use as a warehouse, and a much more complete stock of apparatus of all kinds will be carried. The large increase of the business of the Philadelphia office of the company has made this action necessary. The office still remains at 1217 Filbert Street.

ELECTRIC STORAGE BATTERY CO.—We are advised by the Electric Storage Battery Company of Philadelphia, with regard to the recent elaborate description in our pages of the equipment of the Public Service Corporation of New Jersey, that the 600-amp. battery at Orange for railroad feed is of its construction, as well as the 700-amp. battery at Paterson for incandescent lighting service; and the 1,000-amp. 500-volt power battery at Mechanics Street. These were all made and installed by the company.

GENERATING SETS are now manufactured by the B. F. Sturtevant Co., Boston, Mass., in a line of 30 sizes ranging from 3 to 100,000 kw, direct connected. The vertical cross-compound engines were designed to meet the rigid specifications of the U. S. Navy Department, which in the case of the 100-kw demand a consumption of 31 pounds per kw hour. These engines, as well as the vertical and horizontal simple engines, are entirely enclosed, provided with forced lubrication and watershed partitions. The generators are multi-polar, capable of carrying 50 per cent momentary overload and 25 per cent excess for two hours without sparking or undue heating. The smaller sizes of these sets are adapted to service as boosters.

THE UNDER-FEED STOKER COMPANY of America, general offices, Chicago, announces the opening the first of the present month of its New York office, Mr. B. S. Lachlan, manager, at 930 Bowling Green Building, 11 Broadway. As the purchasing departments of so many large concerns controlling plants in various parts of the country have their headquarters in New York City, and because of the large number of consulting or advising engineers practicing in New York, it is absolutely necessary that inquiries from this section should have the personal attention of a representative. Previous to coming with the company, Mr. Lachlan was connected with the purchasing department of the American Can Company, and enjoys a large acquaintance among purchasing officials generally, as well as the engineering profession. It is expected that Mr. Lachlan will receive the same consideration upon re-entry to his former field, as when looking after the Under-Feed Stoker Company's interests as manager of its former office in Boston.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED FEBRUARY 13, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N.Y.]

812,183. TELEGRAPH KEY; William O. Coffe, Cleveland, O. App. filed Jan. 11, 1904. In order to facilitate the transmission of Morse code messages the patentee makes use of a short pendulum vibrating between contacts. The movements of the pendulum are controlled by a lever whereby it may vibrate to transmit dots, or be held to produce dashes as required.

812,184. THERMAL PROTECTOR AND ALARM; Frank B. Cook, Chicago, Ill. App. filed Dec. 18, 1902. A combined thermal protector and lightning arrester having the usual spaced carbon blocks, and having spring fixtures organized therewith which tend to separate and break the circuit, but which are normally held together by the usual thermal cartridges.

812,196. APPARATUS FOR MEASURING ELECTRIC RESISTANCES; Sydney Evershed, Streatley, Eng. App. filed Feb. 27, 1904. A resistance box, including a generator and a particular form of voltmeter which is not influenced by the stray field of the generator. For this purpose the voltmeter includes two specially arranged movable coils both of which vibrate in a very strong permanent field.

812,236. JACK CORD DISTRIBUTER; Benno Salemann, Berlin, Germany. App. filed Nov. 16, 1905. Details of a distribution switchboard of a telephone exchange.

812,279. AUTOMATIC ENGINE STOP; Nathaniel C. Locke, Salem, Mass. App. filed Apr. 10, 1905. An arrangement for closing an engine throttle by an electrically-operated trip. A form of needle valve is spring-tensioned to open a passage behind a piston which effects the closing of the engine valve, but the needle valve is normally constrained against such movement by an electro-magnet.

812,287. TEST CLAMP; Theodore Bagel, Chicago, Ill. App. filed Dec. 19, 1904. A clamp for temporarily connecting a number of wires of different sizes. Includes a series of loosely mounted plates which are pressed together by a screw, and serve to engage the wires between their parallel faces.

812,433. ELECTRIC RAILWAY SIGNALING SYSTEM; Charles Mitchell and Harry Millinger, East St. Louis, Ill. App. filed Aug. 8, 1903. Details of a signal system including semaphores provided with a special form of eccentric and catch. Includes a train stop for setting the air brakes on the train in case the signal is disregarded.

812,436. SYSTEM OF CALIBRATING RECORDING WATT-HOUR METERS; Douglas P. Morrison, Newark, N. J. App. filed June 17, 1905. A system of calibrating a watt-hour meter which consists in providing a standard meter whose field coils are in circuit with each other and in circuit with the mains leading from the source to the load, a potential circuit for the standard meter and the meter to be tested leading to the mains, and a switch interposed in the potential circuit of the standard meter.

812,445. MULTIPOLAR ELECTROMAGNET; Hermann G. Pape, New York, N. Y. App. filed May 17, 1904. A U-shaped magnet, the intensity of which can be regulated. Each leg consists of an ironclad magnet, the central pole of which can be advanced or retracted with respect to the outside rim or casing.

812,491. TELEPHONE SWITCH PLUG MECHANISM; Adolph C. Gilgen, Passaic, N. J. App. filed Nov. 25, 1904. A switch plug mechanism having a plug at its conical end and a contact spring having a portion disposed in the path of and constructed to engage said plug frictionally when the same is moved in one direction, and to act upon the conical end of said plug to complete its return movement.

812,504. PRIMARY BATTERY; Charles E. Lockwood and George A. Lutz, New York, N. Y. App. filed July 18, 1904. A battery element comprising a perforated retainer containing a depolarizer and having a binder soluble in battery liquid for preventing such depolarizer from passing through the perforations in the retainer.

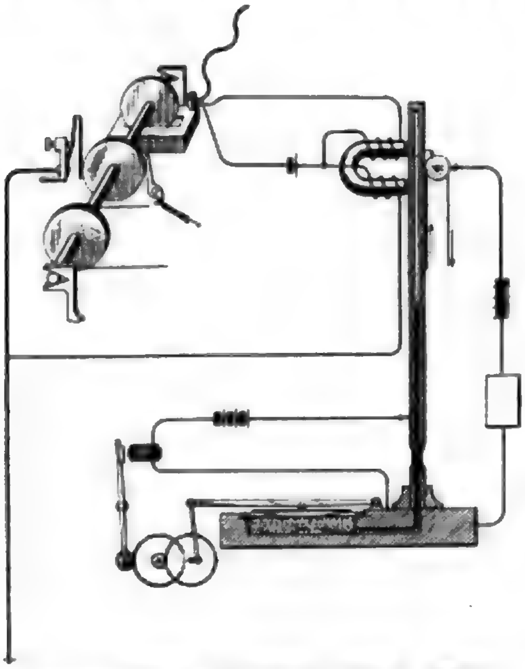
812,505. PRIMARY BATTERY; Charles E. Lockwood and George A. Lutz, New York, N. Y. App. filed July 16, 1904. A battery comprising a liquid holding jar, a perforated retainer therein, a depolarizer in the retainer, a zinc between the retainer and the wall of the jar, a caustic solution in the jar and a binder applied to the wall of the retainer, closing the perforations therein, said binder being soluble in said solution and of a character to not materially effect the electrical efficiency of the battery.

812,557. METHOD OF RECEIVING TELEGRAPHIC SIGNALS; Stephen D. Field, Stockbridge, Mass. App. filed June 10, 1905. A universally tuned receiver for syntonic wireless messages. In order to be able to pick up wireless messages which are tuned to any particular frequency, whatever that frequency may be, patentee provides a mechanical vibrator which receives the impulses from the detector circuit. The mechanical vibrator as means by which its periodicity is constantly changing so that it is bound to pass through the frequency of any messages during some portion of the cycle of its change. When resonance occurs in this way, the vibrator is made to continue in the particular resonating relation.

812,561. OVERHEAD LINE; Emile Giraud, Paris, France. App. filed Oct. 31, 1903. In order to avoid destructive effects by the breakage of a high potential wire, the latter is supported by a hinged arm, the movement of which when the wire breaks is effective to harmlessly ground the conductor or connect it to another circuit.

812,573. AUTOMOBILE; Hermann Lemp, Lynn, Mass. App. filed June 9, 1904. A tricycle as a single motive wheel with a special arrangement of differential gearing for driving the same, including two sprocket chains respectively connected to an engine and motor and to a generator. The relation is such that the generator absorbs the energy on down grades, and a storage battery assists by driving the motor on hills, etc.

812,507. RAILWAY TRAFFIC CONTROL SYSTEM; William Rowe, Marrickville, N. S. W., Australia. App. filed Feb. 23, 1905. A block signal system, including contact plates along the track by means of which the various semaphore signals are operated, and telegraphic communication had with the various stations along the route under certain circumstances.



812,557.—Method of Receiving Telegraphic Signals.

812,607. INDUCTION COIL; John Splitdorf, New York, N. Y. App. filed Nov. 15, 1904. The core of the induction coil is provided with longitudinal ducts or passages for the purpose of ventilation and an external air space or jacket is provided around the core to further promote the cooling and ventilation thereof.

812,609. ELECTRIC HEATER FOR LIQUIDS; George E. Stevens, Lynn, Mass. App. filed July 19, 1904. Details of a portable heater for liquids comprising a vessel having a central chamber containing a heat coil, the wires of which pass outward through the handle of the device.

812,611. RHEOSTAT; Fred L. Stone, Schenectady, N. Y. App. filed July 25, 1904. The resistance element is disposed in a series of concentric rings having their extremities alternately joined so as to form one continuous conductor. The regulating arm has blocks moving in the annular spaces between the rings so as to short circuit portions of the elements.

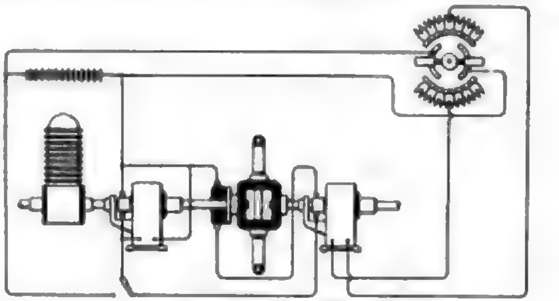
812,657. ELECTRIC COIL; Isidor Kitsee, Philadelphia, Pa. App. filed Sept. 10, 1904. A method of making magnet coils and similar bobbins the essential feature of which is to wind bare wire with insulating layers of unvulcanized rubber, and then vulcanize the whole into a compact spool.

812,700. RHEOSTAT; George E. Stevens, Lynn, Mass. App filed Oct 12, 1904. A pair of resistance coils are disposed in parallel relation and the regulator arm has blades which swing over the bare resistance wire so as to cut in or out portions thereof.

812,710. PORTABLE ELECTRIC LAMP OUTFIT; Arthur Wilson, Berlin, Wis. App. filed Mar. 28, 1905. Includes a box casing having a number of battery cells therein, and a supplemental housing including a lamp and a coil of flexible cord

812,718. TELEPHONIC REPEATING SYSTEM; Adolpr J. P. Bertschy, Woodstock, Ill. A repeating system comprising an electro-magnet connected in a receiving circuit, a transmitter for controlling currents in the sending circuit, a vibratory diaphragm common to said electro-magnet and said transmitter and an auxiliary switching device controlled by said diaphragm to cause the closure of a break in the sending circuit.

812,725. SURFACE CONTACT SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed July 22, 1904. Separate generator is located on a train and driven by the air pressure system. This generator serves to furnish current for operating the connection of distributing circuits along the track to energize sections or plates as the train passes along. The separate generator is also used for supplying light and heat to the train.



812,573.—Automobile.

812,726. LOCKING DEVICE FOR AUTOMOBILES; Alexander Churchward, New York, N. Y. App. filed June 30, 1904. Relates to an automobile driving mechanism of the form set forth in patent No. 812,573. In this case the patentee provides a mechanical arrangement for locking the generator armature to its field frame as an emergency device in case of the differential clutch arrangement should fail.

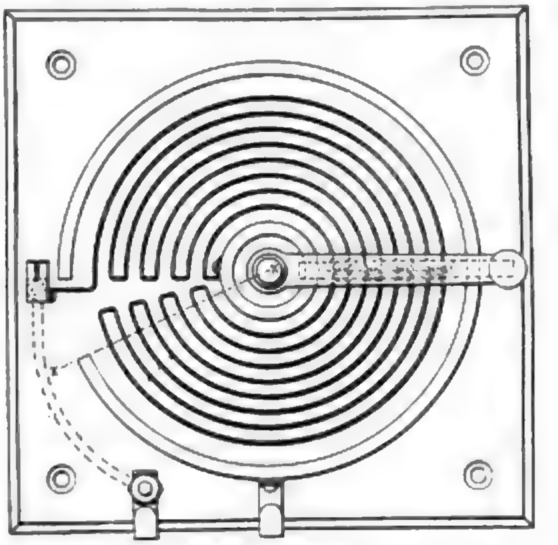
812,733. POLICE SIGNALING APPARATUS; Charles L. Foster and Peter K. Higgfins, Los Angeles, Cal. App. filed July 14, 1904. Details of a police signaling apparatus having circuits including the various police boxes operated by the opening of the doors and the insertion of keys therein.

812,766. ELECTRICAL ROSETTE; James A. Mabane, South Boston, Va. App. filed Apr. 30, 1904. Relates particularly to the wire attaching means which comprise metallic clips having their ends bent into an S shape so as to embrace the wire between the convulutions thereof.

812,773. TELEGRAPH INSTRUMENT; Carl J. Schwarze, Adrian, Mich. App. filed May 31, 1904. The relays are wound with a separate coil or winding forming a closed circuit, the purpose of which is to take the extra current due to the fall of magnetization, and prevent sparking at the contact points.

812,776. AUTOMATIC FIRE ALARM; Alfred Taylor, Victoria, Canada. App. filed May 13, 1905. The push buttons of a call bell system are constructed with a pair of flexible diaphragms forming an air chamber. In case of fire the expansion of the air closes the circuit independently of the button.

812,781. ELECTRICALLY CONDUCTIVE RAIL JOINT AND BOND THEREFOR; Bancroft G. Braine, New York, N. Y. App. filed Apr. 11, 1904. The fish-plates have V recesses therein to engage the rail bases. The engaging surfaces have strips of copper inset therein which are pressed together when the fish-plates are clamped into place and constitute bonds.



812,611.—Rheostat.

812,790. ELECTRIC RAILWAY SYSTEM; William N. Haring, Nyack, N. Y. App. filed Oct. 31, 1903. Relates to an underground conduit system having a sectional conductor, the sections of which are spring pressed upward. When the car passes they are depressed by the collector shoe, and temporarily charged by contact with the potential source.

812,791. MOTOR CONTROLLER; Wiley E. Houston, Santa Ana, Cal. App. filed June 14, 1905. In order to avoid a burn-out of motors employed for driving pumps due to temporary failures of the line current, the patentee provides a circuit breaker operated by a check valve in the water pipe so that in case of stoppage the circuit cannot be again completed without proper manipulation.

812,797. INSULATING ATTACHMENT FOR ELECTRIC FIXTURES; Adolphus A. Knudson, New York, N. Y. App. filed Mar. 8, 1905. A flexible jacket for electric lamp fixtures to guard against shocks in case the fixtures become grounded

812,801. ELECTRIC FURNACE; Julius E. Ober, Schenectady, N. Y. App. filed July 25, 1904. An electric furnace comprising a tubular heating member, a sheath therefor of titanium carbid and a packing of finely divided, heat-resisting material surrounding said sheath.

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REGULATION OF WIRELESS.

The cruise of the *Dewey* floating dock across the Atlantic gave opportunity for some very valuable practice in long-distance wireless telegraphy, messages from the guardians of that huge but not speedy craft having been received over something like 1,800 miles. These records were made, of course, under the favoring shelter of night, like practically all the other long-distance records. This is very encouraging, albeit it chances to be coupled with home news of a somewhat amusing character, when some high school boys of an experimental turn of mind threw the Newport naval wireless station into a succession of fits with an old Morse key, a broken incandescent lamp and a few dry batteries. These youngsters had the commendable Yankee spirit and no desire to make trouble for their country's defenders. They gave incidentally a valuable demonstration of the need of improvement, to which we trust the Navy Department will give due heed. If such rudimentary equipment accomplished so considerable a disturbance, what would happen if a hostile fleet went deliberately to work with powerful and skilfully devised apparatus? Of course, in working disturbance at a distance, much more power is needed than when working nearby. Still it appears safe to conclude that the navy system as now used could be hopelessly tangled up, without going to much trouble. And the same so far as has yet transpired is true of every other wireless system in use for practical purposes. Where is the syntonic wireless of which we have heard so often enthusiastic reports?

Of course, for long-distance work everybody likes to use as long waves as practicable, and there being limits on the feasible lengths of vertical antennæ, the natural tendency is for all hands to use waves of about the same order of magnitude. The work of these Newport boys, however, signifies that with the apparatus now commonly used one can get interference with almost any sort of sending wave provided it carries a reasonable amount of energy. If there is any such thing as a syntonic system, it is high time Uncle Sam hunted it up with a view to adoption. There have been many very ingenious schemes of syntonism proposed, and if any one of them is really effective his owner should pack up his kit and head for Newport. His welcome is already guaranteed. Meanwhile, it is time something were done in the way of preventing malicious or improper use of private wireless stations. There is no need of interfering with legitimate experimenting. These boys with extemporized outfits may some day help the Government out of a scrape, but means should be provided to confine their efforts within definite bounds, just as it would be proper to check indiscriminate trials of searchlights in the neighborhood of lighthouses. The rights of the Government in the regulation of commerce would seem to be sufficient to cover the case, if judiciously exercised. Perhaps as good a way as any would be to require the registration of wireless stations, without expense, and their operation under permits revocable for persistent misuse or other sufficient cause. It would be an excellent thing for the Government thus to keep in touch with all the available experts on the subject, so as the more readily to utilize their services in case of need. State authority is not sufficient in this case, as all wireless stations are willy-nilly engaging in impromptu interstate commerce. One of the serious dangers is that various enterprising newspapers may undertake to install private wireless plants for perfectly legitimate ends, but in such wise as to cause very serious trouble.

Suppose, for example, one of our metropolitan dailies were to arrange with its Washington correspondent for a regular wireless service reporting every evening the proceedings of Congress, and were imitated by one or two others. Things would be lively all along the coast, and officers anxiously awaiting reports from incoming vessels would not be particularly edified by an hour-long speech of the member from Buncombe. The international aspects of the case are not very serious in the United States, but rise to vital importance in Europe where distances are smaller. Altogether the new art presents some rather startling problems, quite aside from the technical ones, and it looks very much as if something rather sweeping would have to be done, not in repression, but in friendly and thorough regulation. Meanwhile the inventors who are working on the subject ought to contrive some effective means of preventing interference. At least half a dozen such have been announced, of which none to our knowledge has as yet amounted to much. The difficulties in syntonism are, of course, great. The sending apparatus must be able to deliver waves of one or several very definite wave lengths, and the receiver must respond to these and to these alone irrespective, within wide limits, of the strength of the impulses. Here seems to be the major part of the difficulty. If directed waves could be sent out, the questions of interference would be simplified, and some experimenters have been striving to accomplish this end, with some hopes, at least, of success. The whole situation has become very complicated and unless something is done about it soon the effect will be like a telephone exchange with all the subscribers on the same line and all trying to talk at once. We believe strongly in the potency of individual effort, and look with distrust upon too intimate Governmental control of private enterprise. Nevertheless, the time has now come when in wireless telegraphy it is either regulation or chaos, and of the two the former is certainly to be preferred. Its proper form is not altogether clear, considering the various interests involved. Surely, however, sufficient regulation to prevent frequent and serious interference with service can be applied wtihout material injury to any one disposed to fair dealing.

THE BUSINESS MANAGER AND THE ENGINEER.

The paper read last week by Mr. J. J. Carty on "Telephone Engineering" before the American Institute of Electrical Engineers, clearly brings to notice the wide range covered by the duties of the modern telephone engineer. It shows that in order to maintain the existing, and to inaugurate the prospective, business of a telephone system with the most efficient and economical service, the engineer has to be consulted upon a great variety of questions that ordinarily are regarded as exclusively in the province of the business manager. Thus, such questions as to where and when a new parcel of real estate should be purchased for installing an additional telephone exchange, whether flat-rates or message-rates should be adopted in contracts with subscribers, or whether the "particular-party method of calling or the "two-number" method should be used at toll-boards, seem at first sight to be matters to be determined entirely by the executive head of the business management, without reference to the engineers. Nevertheless, it is shown in the paper that while such questions might, of course, be dealt with solely by the business manager of the telephone system, yet they necessarily involve large and variable expenditures on the engineering accounts, so that any progressive and economical business policy requires that the engineers must be consulted on all such questions in order to maintain an effective co-operation between all departments, and to keep the responsibility for actions and expenditures upon the individuals to whom it properly belongs.

A similar condition is presented in every engineering enterprise to a greater or less extent. Any operation or public service performed upon a large scale necessarily involves engineering, and the highest development of engineering is so closely associated with business management that it is hard to say where the dividing line should be drawn between them. Nevertheless the distinction between the business manager of an enterprise and its engineer is definite and inevitable. The former is responsible directly to the stockholders and investors, while the engineer is responsible to the business manager. It is possible to find the engineer and the business manager in one and the same individual; but the combination of qualities and experience necessary for the efficient performance of the dual relation is rare. The training needed for the development of the one ability, ordinarily precludes opportunity for the other. Nevertheless, the successful engineer must possess business ability, and the successful manager, of an enterprise involving engineering, must either possess engineering ability, or must have it within call.

The paper expresses decided opinions in several directions, and possesses on this account special technical interest. One such question is the relative advantage of the flat-rate and the message-rate in telephone contracts. The paper favors the message-rate in large cities on engineering grounds, and considers that it is better to charge for service by the telephone-call, and then to stimulate the demand, rather than to charge for service by the year and then to limit the demand. This decision is similar to that which has been universal in the business of electric lighting, where the flat-rate was the original basis of charging the consumer but where the meter-rate is now in full possession of the field. Another mooted question passed upon, is in relation to the advantage of the automatic telephone exchange as compared with the girl-operator telephone exchange. The paper pronounces distinctly in favor of the latter, both as to annual economy of operation, and as to efficiency of service. This is still, of course, a question upon which there has not yet been sufficient time and experience to gain a full consensus of opinion among engineers.

THE PASSING OF THE ARC-LIGHT GENERATOR.

Time brings many changes, and the old order giveth place to new. A significant change is noticeable in central-station arc-lighting machinery. The series arc-light generator was the pioneer dynamo, and the first to make its appearance in commercial service in this country. Now it is ceasing to be built. Many such machines are in excellent service all over the country, but their ranks are not being filled with new members of the same order. The real difficulty with such machines is their incapacity for consolidation. If ever there was a type of dynamo that stood for individualism and for independent service on a small scale, it has been the series-arc generator, either for alternating or direct current. At first, it met its requirements completely. In many small pioneer stations the arc generators and the incandescent generators were about equally numerous, of about the same size and capacity. They were all belted to countershafts run by main engines, and a visit to some of these stations suggested that after all there was nothing like leather.

But the cost of such machines in floor-space, in attendance, and in frictional losses was heavy. As stations enlarged, efforts were made by the station managers, and by the manufacturers, to build larger machines. The incandescent lighting generators responded nobly, adding pound to pound of material, and kilowatt to kilowatt of output. The arc-generator was rebellious, and held aloof. He insisted at first on keeping to within ten amperes of current delivery, and only permitted his volts to go up. The manufacturer built him up to ten thousand volts, and up to 100 kw capacity, but the station manager disliked so high a voltage, and sought for a larger machine. The belts began to disappear from the lighting, power, and traction stations, but they lingered in the arc stations. Then the builders found means to construct multi-circuit arc generators; whereby the volts could be reduced, but the ampere output could be increased. In spite of every attempt, however, the arc generators did not grow above 100 kw capacity, whereas the other types of dynamo grew into sizes of thousands of kilowatts. Then the big alternators appeared among the host of lesser arc-machines and apparently disliking their company, offered to supply power to series alternating-current arcs through constant-current transformers, commonly called "tub" transformers. This was a hint to the arc-machines to get together, but there was no response. They contented themselves with decrying the poor luminous efficiency of the series alternating-current arcs. Finally, an arc lamp was developed and pressed into the service of series-arc circuits fed by the big alternators. The mercury-arc rectifier was also developed. With the aid of a little device of this kind, the "tub" transformers could supply direct current to series-arc circuits, just as well as the direct-current arc-generator, and at a greatly increased economy. So now the doom of the arc-dynamo for large central station service seems to be sealed.

CENTRAL STATIONS GONE TO SEED.

It must be admitted, even though we regret much to do so, that there are a large number of central station properties in this country which have, in the parlance of the street, "gone to seed," or perhaps, to express it more exactly, the management of which has gone to sleep. This lack of alertness to the possibilities of central station business on the part of the management may be due to a number of causes. Sometimes the principal owners of the property are those having other lines of business in the town, and the electric lighting is a side issue to which they give little attention. In other cases it is due to failure of the owners or managers to read electrical journals, attend conventions, or visit progressive companies in other cities in order to keep informed of the possibilities in the business. In some cases coming under our notice where the electric light-business of a city is controlled by gas men of the old school, there has been a decided tendency on the part of the management to sit back and let the business take care of itself on the theory that since the company controls both gas and electric light, every one wishing lighting service other than that obtained from kerosene lamps or private gasoline plants must come to the company. The electric lighting end of the business is looked upon by these as a necessary evil to be put up with only to keep it out of competitive hands. This is by no means universally true, however, because some of the most progressive and pushing central stations are coupled in ownership with gas plants. The consolidation of the gas and electric companies in a city is detrimental only when it puts the management under the illusion that after such a consolidation there is no longer any need to push for business. A case which recently came under our notice is probably typical of conditions in many other cities. The gas and electric light interests in a certain city had been under one managementt for a number of years, this management being of a kind that believed in sitting around and letting the business come. A new company purchased the plant, and after puting up a new station, began to push actively for business, with the result that both the connected electric lighting load and the power load were approximately doubled within the first year, while the gas output was also greatly increased by the pushing of the gas range business. Cases of this kind thoroughly upset any idea that the consolidation of gas and electric companies eliminates the necessity of pushing the business.

It must not be thought, however, that the getting of new business is dependent on soliciting or advertising entirely. As a basis for all this work there must be good and reliable service. The service must be, first of all, free from interruption; second, free from great variations in voltage; and third, the details of the customers' installations must be sufficiently looked after by the central station to insure their being maintained in good condition. This does not inecessarily mean that a company must do a lot of free repair work for customers, but it should keep watch of the "little things" so far as possible, and above all, see that circuits are not loaded up with a lot of inefficient incandescent lamps. There are several ways of getting out of this latter difficulty, and the sooner central station companies give heed to this matter the better. Besides good service, it is essential to have a system of rates that will attract customers and especially power users which will help give a steady day load. Now, all this means that the owners and managers of a central station company must be fully awake to the situation, not only in providing a generating station which can give reliable service at a low generating cost, but in adopting a business policy which will enable it profitably to dispose of its output and bring before possible customers the advantages of its service. We have in mind some central stations which at this season of the year are simply overwhelmed with new business—so much so, in fact, that no soliciting is being done. This, of course, is not true after the heavy winter load is over, but it simply shows what first-class service can do in the way of attracting business, and that in spite of gas competition in the same town. There is much more in the central station business than a large number of the central station companies now in a state of somnambulance can realize. As time goes on more progressive and better posted men will take hold of these poorly paying properties and make them, not only better servants for their communities, but better financial investments.

Residence Versus Store Lighting.

We have recently printed the opinions of a number of central station managers that small residence lighting when secured in sufficient amount gives a character of load which is preferable on the whole to commercial lighting in towns where the stores close at 6 o'clock four or five nights in the week. This applies, of course, to smaller cities and villages where the stores are not of a sufficient size to demand much artificial light during daylight hours. Any idea that residence lighting could possibly be a more desirable kind of load and a better revenue producer for a central station than store lighting would have been considered heresy a few years ago. Under conditions then existing, undoubtedly residence lighting was comparatively unprofitable. It has gradually been dawning upon central station men, however, that the trouble with their residence lighting load has been simply that there was not enough of it per block, and that they have not secured a sufficiently large proportion of the possible customers. Residence lighting with but one or two customers in a block, or so scattered that a large number of transformers have to be installed in proportion to the number of customers connected, undoubtedly calls for large investment and large transformer losses per customer, but with a reasonably large proportion of the residences in a block using electric light the case is entirely different. The load curve of residence lighting taken the year around is much better from a central station company's standpoint than the load curve of commercial lighting when stores close at 6 o'clock, leaving out of account the sign and display lighting done by merchants in the down-town district, which really comes in a separate class. The load curve of 6 o'clock store lighting rises to a towering peak at 6 o'clock part of the year, after which it drops to zero, and during the summer months amounts to nothing at all. The residence load curve has its peak extended over a period of about three hours in the winter and one hour in the summer, and calls for a more reasonable investment than the store load in generating apparatus in proportion to the kw-hour output. As far as the form of the load curve is concerned, therefore, residence lighting is far the more desirable of the two.

This brings us to the question of transformer and meter losses, the cost of meters and transformers, and the cost of bookkeeping for a large number of small consumers. Here is where the importance of a large number of consumers on one transformer comes in. The average residence, be it large or small, seldom has anywhere near the full number of connected lamps turned on at once. Where there are a lot of residences on one transformer, the transformer investment can be kept very low, for the reason that the average current taken during the evening by a small residence is a much larger proportion of its maximum possible load than in the case of a large residence with an individual transformer. That the cost of maintaining and reading the meter and keeping the customer's account is a large percentage of the cost of service in the case of small customers cannot be denied. On the other hand, it must be remembered that the prevailing residence rates are frequently higher per kw-hour than those obtained for commercial lighting in the business district. Then, too, there is the certain advent of the electric flat-iron in the next few years to increase residence use of current during the day. In not a few cases this will double the income from residences. The whole question would seem to settle down to one of geting a large enough proportion of the small residences. Not a few managers are realizing the importance of this branch of the business and will not rest content as long as kerosene lamps and gas are still doing business in the residence districts of their cities. Electric lighting men have been entirely too willing to admit the cheapness of gas and kerosene. While it is true that gas bills usually average lower than electric light bills and the cost of kerosene oil lower still, this tells so small a part of the story of cost that no manager or employee of a central station electric lighting company should allow remarks by customers as to the cheapness of gas or kerosene to go unchallenged, as is too frequently done. Central stations should get some of the money that is now going to paper hangers and decorators. The point of the whole matter is that central station managers must get away from the old idea that electric light is for the comparatively well-to-do only, and should not rest content until they see it in the majority of the residences within the district which they serve. This field is one which is capable of more development in the majority of cities than any other branch of the electric lighting business, with the possible exception of display and sign lighting.

Electric Lighting as Advertising.

In the issue of February 3, we gave some account of the efforts of the central station company at St. Paul in pushing for sign and decorative lighting. In that city, electric signs, building outline lights and the like are urged upon merchants and manufacturers as so much additional advertising to be fairly compared with other means of advertising used by merchants. The same policy is being followed in the new business campaigns of a number of other central-station companies, and it is undoubtedly the proper basis upon which to push for new business of this kind. One might go further still and include the improvement of the interior lighting of stores as something to be considered in the nature of advertising. When the matter is urged in this way, as it should be legitimately, it is likely to be looked upon with much more favor by any progressive merchant than if simply considered as so much increase in his lighting expense. This field of sign and decorative lighting is one which electric light has all to itself, nor is any serious competition likely to arise in the immediate future. A large gas-lighted sign is not to be thought of, and gas even for window lighting when skillfully installed at the top of windows with good reflectors, has hard work to make any headway. When it comes to outline lighting, the incandescent lamp is without any attempted competition.

The kinds of lighting which can be classed as used for advertising purposes entirely are, therefore, not only the ones which are desirable from a central station standpoint, because they are of all the least likely to be even in part supplanted by competing illuminants. It is quite true that advertising to be effective must have a certain element of novelty in it, and that advertising methods by electric light to-day will not serve a few years from now. The tendency, however, will be not to abandon advertising by means of electric light, but rather to evolve new schemes calling for even greater consumption of energy. In fact, this has been the history of electric sign and decorative advertising up to date, and it will simply repeat itself during the next few years to the benefit of the central station company.

February Meeting of the American Institute of Electrical Engineers.

At the meeting of the American Institute of Electrical Engineers, which was held on February 23, a paper was presented by Mr. J. J. Carty on the subject of "Telephone Engineering." A considerable portion of the paper was devoted to a description of the proper scope of telephone engineering in its relation to the telephone industry.

Ordinarily, engineering has to do principally, if not exclusively, with physical factors, but telephone engineering has not only to deal with physical factors of the utmost complexity, but it has also to deal with commercial questions which, of themselves, would seem to be only remotely connected with the work of the telephone engineer, but which really vitally affect it. The author expressed the opinion that telephone engineering presents more factors of this nature than are to be found in many other branches. The case of a civil engineer who has before him the problem of constructing a masonry dam is an instance involving solely physical factors. The stability of the dam or its capabilities of impounding the necessary amount of water are in no way affected by any action which the board of directors of the water works company may take with reference to its dealings with its customers. It is not so with telephone engineering, for a telephone toll line and switchboard system might be designed in accordance with the highest state of the art and constructed so as to give the best efficiency and yet by the action of the business management, causing the adoption of what might seem to be a reasonable commercial practice, the operativeness of the switchboard system might be totally destroyed. This statement will be appreciated when one considers the effect of changing from a flat-rate to a message-rate of charging.

Under the flat-rate method, the more times the customer uses the telephone the greater is the expense to the company, and there is a tendency for the customer to make excessive use of the telephone. The consequence of this excessive use is that the busy calls attain such serious proportions that it is difficult, if not absolutely impossible, to give satisfactory service. This difficulty having been caused by commercial methods could not be overcome by the engineer employing physical methods. The solution of this difficulty lay with the business management and consisted in the adoption of a proper system of message rates. As soon as the message-rate system was adopted all of these difficulties disappeared, and many positive advantages not even suspected as residing in the message-rate plan developed. Under the flat-rate system there was every temptation for the subscriber to send as many calls as possible over one line. This resulted in overcrowding the line and was attended by bad reactions of every kind. Only those having a large number of calls installed a telephone, and those having small use for the telephone made it a practice to use the telephones of their neighbors or did not employ the telephone at all.

By introducing into the large cities the message-rate system, and by placing proper limits on the load which should be carried upon one line, and by providing a graduated system whereby additional lines could be obtained on a basis proportionate to the amount of their use, relief from this overloading was afforded. More than this, under the message-rate system it is obviously for the interest of the telephone company to encourage the use of the telephone in every manner. For this reason it became feasible and desirable to install as many auxiliary instruments as possible. This development not only reacted upon the central office engineering and the general engineering of the plant, but also completely changed the state of affairs with reference to speaking-tube telephones, practically limiting the former speaking-tube system to special and peculiar conditions.

During the ten years just passed, a revolution has taken place in the design and construction of telephone switchboards, the magneto switchboard, so-called, having given way to the common-battery switchboard. This change has resulted in the creation of a power plant at each central office, upon which the operation of the telephone switchboard and apparatus is wholly dependent. The requirements of the telephone are such that storage battery practice from the telephone point of view presents problems which are different from those encountered elsewhere. Even almost infinitesimal changes in the voltage of the battery might result in disturbances at the telephone receivers.

In discussing automatic telephone switchboards, the author stated that taking into account all of the factors involved, and which go to make up the total annual charges which could properly be placed against the automatic switchboard system, on the one hand, and the manual system on the other hand, leaving out of account switchboards suitable for use only in small villages and making comparison up to switchboards of 10,000 lines capacity, the annual charges upon the automatic system are substantially greater than the annual charges upon a manual system operated on the common-battery multiple plan. He said that from the standpoint of costs the automatic system fails when placed in competition with the common-battery multiple-board operated manually, and that no plan thus far employed, which requires that the subscriber should operate a machine and send his call automatically to the central office, can successfully compete with the plan which requires that the subscriber should remove the telephone from the hook and send the call orally.

The discussion was opened by Mr. Thomas D. Lockwood, who outlined the history of the invention of the telephone and the development of the telephone industry. He stated that the only sensible method of charging for telephone service is by the message rate, which is even more preferable to the flat rate than the European plan is to the American plan with reference to hotel charges.

Prof. M. I. Pupin remarked that telephone engineering is extremely exact and elaborate because with it one is working to the limit. A loose contact in ordinary electrical engineering will do no harm, as the voltage is high, but in telephone engigineering, where the voltage is excessively low, the slightest loss of contact may cause a great deal of trouble because it will produce at low voltages much higher resistance than at high voltages. Moreover, in telephone engineering there is wave transmission, and when the wave gets to a loose joint it may be reflected, and reflection is a serious matter. The power transmission engineer desires as high permeability in iron as possible, but the telephone engineer wishes to obtain as low a permeability as possible. If it were impossible to obtain a permeability lower than 1,000, telephony would in all probability be out of the question. The Creator, however, has provided a microscopic lower limit within which the permeability of the iron is 200 or less. It is this limit which the telephone engineer had to discover, and he must be constantly on his guard not to extend his operations outside of this limit.

Mr. Bancroft Gherardi outlined the duties of the various executive departments of a telephone organization.

Dr. C. P. Steinmetz showed that although both the transmission of power and the transmission of speech are essentially electrical transmissions of power, the purposes involved in the two are quite different and, therefore, different methods must be employed. In electric power transmission the problem is to deliver at the end of the line as large a percentage as possible of the power which has been sent into the line; that is, high efficiency is a prime requisite. In electric speech transmission the problem is to retain as far as possible the relative proportions of the different components of the complex current wave which the microphone sends into the line, and the percentage of power delivered need not be considered. The telephone is so sensitive that we could transmit from San Francisco to New York and even include a transatlantic cable, and could still get enough power to operate a telephone, that is, to hear a sound, but not to understand. The higher harmonics of the current wave which constitute the difference between the letters would be wiped out. To transmit the electric power so as to destroy the articulation as little as possible is the problem of telephony, but the question of the power delivered is immaterial, because the amount needed is negligible.

Investigation of Automobile Gasoline Ignitors.

In the August 12, 1905, issue of the Electrical World and Engineer an editorial called attention to the real need of some experimental knowledge of the requirements for igniting gasoline in the cylinders of automobile engines. Prof. J. W. Esterline of the Department of Electrical Engineering, Purdue University, La Fayette, Ind., has decided to undertake an investigation along the lines suggested in the editorial mentioned. Plans are already being laid for beginning experimental work. Two series of investigations are to be started. A comprehensive study is to be made of the apparatus now on the market for igniting gasoline in engines. This will comprise a study of magnetos, spark coils, batteries and the sparking or igniting appliances. Parallel with this there will be conducted another series of tests for the purpose of determining the limitations of, and, if possible, the ideal conditions for, the igniting of gasoline. Variations of capacity, inductance, current, electromotive force, compression, and quality of the mixture will be made, and the effect of these variables studied. It is hoped that a comparison of the ideal requirements with the tests of the commercial apparatus will be possible

The hearty co-operation of the manufacturers of gasoline engines and igniting apparatus is all that is now required to make this series of experiments comprehensive and of a nature which would be of value to the manufacturers and operators of such apparatus. It is to be hoped that this co-operation will be freely accorded.

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Underwriters' Position on Gasoline Vapor Lamps.

Several years ago, the active work done by salesmen of so-called gasoline "arc" lamps caused some alarm among the owners of smaller central companies, as a good many merchants in smaller villages were induced to put in these dangerous appliances as a substitute for electric light. Recently not much has been heard about this form of competition, although occasionally their adoption is reported in towns where agents have been unusually active. In the type here referred to the gasoline is contained in the lamp itself. Hence the lamps must be filled each day, a process involving not only time, but danger The fact is, the inconvenience and danger of the gasoline lamp have been sufficient to drive it out of the field on account of its own inherent qualities wherever central station service is reasonably good and cheap and central station managers are wide awake. Such managers have seen to it that the people of the town have been made acquainted with the numerous accidents which have occurred in the use of these lamps. In the long run every town where they are used is likely to furnish one or more examples for the casualty list, as it is usually only a question of time until an accident occurs where a number of these lamps are in use.

A number of central station managers have recently made inquiries as to the position taken by the Fire Underwriters as to these gasoline vapor lamps. The latest bulletins on this subject, by the consulting engineers of the National Board of Fire Underwriters, can be obtained at any time by application to William H. Merrill, Jr., Secretary, 382 Ohio Street, Chicago. It contains a list of 32 vapor lamps which have been examined under the rules and requirements of the National Board of Fire Underwriters by its committee of consulting engineers and which, to use the language of the bulletin, "may be permitted for use when installed according to requirements at such higher rates as may be fixed by the local or state board of Underwriters having jurisdiction, if the company insuring the property consents to the same in writing on its policy" The bulletin then continues in language which is certainly not very cheering or encouraging to the users of such appliances as follows:

"The use of storage of gasoline even with all known precautions is a danger which should always be recognized by Underwriters in higher rates of premiums. Where permitted it should be surrounded with the most rigid safeguards. Attention is called to the fact that the laws of some States prohibit the use of gasoline for lighting purposes. It should be further noted that the installation of gasoline lamps inside buildings is prohibited in certain districts by local authorities and local boards."

"A list is given of gasoline vapor lamps which have been examined and tested from samples secured in the market from time to time and which are stated to be safeguarded to as great extent as it is possible to safeguard dangerous devices of this character. The list covers pendant and bracket lamps only. No portable hand or table lamp is permitted. It is noted particularly that gasoline lamps should be hung at a safe distance from ignitible material, woodwork, etc., the following caution is given:

"The principal danger from these gasoline devices is in having the gasoline about. At ordinary temperature gasoline continually gives off inflammable vapor, and a light some distance from the material will ignite it through the medium of this vapor. The vapor from one pint of gasoline will make 200 cu. ft. of air explosive. It depends upon the proportion of air and vapor whether it becomes a burning gas or destructive explosive. Beware of any leaks in cans, and never forget how dangerous a material you are handling."

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Ward Leonard System in a German Colliery.

In a paper read before the Manchester section of the (British) Institute of Electrical Engineers Mr. W. C. Mountain gave an interesting description of the hoisting installation at the Zollern II colliery in Germany, where use is made of an electric equipment involving the Ward Leonard system of voltage control, and of an extremely heavy fly-wheel. The armatures of the hoisting motors are connected directly without switches to the armature of a generator, the voltage of which can be varied at will, the field strength of the hoisting motors being maintained at a constant value.

The winding drum is driven by two direct-current motors, each of which is rated at 750 hp at 500 volts. These motors receive their power from a motor-generator, a description of which is given below. The whole of the starting, stopping, speed regulation and reversing is done by one switch, which operates a resistance placed in the shunt field circuit of the generator of the motor-generator. By this means only currents of small magnitude are dealt with, the burning of contacts is avoided, and heavy and expensive resistances are not necessary. Practically no power is wasted in resistance when the winding drum is run at reduced speeds. A small amount of energy is returned to the motor-generator from the winding motors during retardation, and this is usefully applied in accelerating the enormous fly-wheel used with the motor-generator, instead of being consumed by friction in braking.

The main generating equipment consists of two engine-driven, 525-volt, 1,100-kw, direct-current generators, which supply power to the whole of the machinery at the colliery. A single generator is sufficient to supply power to the electric hoisting equipment, the washery, fans, air compressors, work shops and pumps.

The most interesting part of the electrical installation is the motor-generator which was referred to above. This machine is used to prevent abnormal fluctuations in the demand for power from the main generators. The starting of the winding drum would have necessitated a tremendous rush of current from the generators if the usual type of equipment had been employed. The motor-generator consists of a shunt-wound generator direct-connected to a 15-ton fly-wheel and a special variable-voltage generator The fly-wheel is of steel and runs at a peripheral speed of 14,000 ft. per minute. It is placed between the two bearings of the set, the armature of the motor being mounted outside of the bearing, and that of the other outside of the other bearing. Although the motor is rated at only 300 effective horsepower, the generator is a 1,000-kw machine when excited to full e.m.f. of 550 volts. The latter machine is specially designed. It is provided with a double commutator and a special field magnet system, having auxiliary poles with series windings to prevent sparking. The main field coils are shunt wound and are supplied with current from the main generators. By this means any desired e.m.f. is obtained for operating the hoisting motors.

The effectiveness of the motor-generator set in preventing fluctuations is shown from a series of tests reported by the author. Although the current taken by the hoisting motors during starting was 1,500 amperes, decreased to 1,000 amperes as the hoisting motors reached full speed, and became 500 amperes when the drum was brought to rest, the current taken from the main generators by the motor of the motor-generator set varied from 100 while the drum was being started, to 450 when the drum reached full speed and decreased to 0 when the drum was being brought to rest.

Prof. Elihu Thomson on Alcohol Engines.

In connection with the recent agitation for free industrial alcohol the Ways and Means Committee of the House of Representatives has had hearings on the subject in Washington, when an interesting memorandum on the subject was presented by Prof. Elihu Thomson. We quote as follows, some portions of it:

"Gasoline as well as kerosene has the great disadvantage that it floats upon water and is distributed by water. It is a well known fact that it is commercially useless to attempt to extinguish burning gasoline or kerosene by water alone. The use of water may, in fact, be a positive disadvantage in floating the burning material over considerable places in spreading fire. Not so with alcohol, which mixes with water in all portions, and which is at once diluted and prevented from remaining combustible.

"We have recently tested at the Lynn works of the General Electric Company a Deutz alcohol engine, a type of engine made in Germany especially for use with alcohol, and the results have been such as to prove without doubt the entire suitability of alcohol, if cheap enough, as a fuel for internal combustion engines. This particular engine is to be sent to the island of Cuba and coupled to a dynamo for lighting. It will be operated with the cheap Cuban alcohol, which is, I am informed, sold there at about 12 to 15 cents per gallon. A few gallons of this alcohol were obtained and used in our tests here, and it was found to be a high grade spirit, containing 94 per cent alcohol by volume and 6 per cent of water, or about 91 per cent alcohol by weight.

"While it is not methylated or denaturalized, there is no question that the behavior in the engine of denaturalized or methylated spirit would be identically the same as with the pure grain alcohol. To obtain this sample of Cuban alcohol it was necessary that we pay an import duty of $4 per gallon, with other charges, which made the cost of the material used in testing enormous as compared with its actual value in Cuba, and I may here remark that, as in testing an engine of this kind a considerable quantity of alcohol will be used, manufacturers here in the United States would suffer a considerable disadvantage in building such engines as compared with those in a country where methylated spirit, untaxed, is obtainable. In fact, the cost of the material for testing the engines is probably a sufficiently strong deterrent just now to prevent the manufacture being taken up in the United States. The island of Cuba is, however, an excellent field for the use of such machinery, on account of the low cost of alcohol

"It may be mentioned here that our experiments developed the fact that alcohol is suitable as a motor fuel even when it contains as high a percentage as 15 per cent of water. Notwithstanding the fact that the heating value of alcohol, or the number of heat units contained, is much less than in gasoline, it is found by actual experiment that a gallon of alcohol will develop substantially the same power in an internal combustion engine as a gallon of gasoline. This is owing to the superior efficiency of operation when alcohol is used. Less of the heat is thrown away in waste gases and in the water jacket. The mixture of alcohol vapor with air stands a much higher compression than does a mixture of gasoline and air without premature explosion, and this is one of the main factors in giving a greater efficiency.

"The exhaust gases from the alcohol engine carry off less heat. They are cooler gases. It is well known that the exhaust gases from a gasoline or kerosene engine are liable to be very objectionable on account of the odor. In our tests of the Deutz alcohol engine there was absolutely no such objection with alcohol fuel, the exhaust gases being but slightly odorous, or nearly inodorous, but what odor there was was not of a disagreeable character.

"There is just now the beginning of a large development in the application of the internal combustion engine to the propulsion of railroad cars on short lines as feeders to the main lines. In this case an ordinary passenger car is equipped with a power compartment at one end, in which there will be installed an engine of, say, 200 horse-power of the internal combustion or explosion type. The growth of such a system is liable to be hampered in the near future by the cost of gasoline as a fuel, and the difficulties of using kerosene are still quite considerable. Especially is the exhaust likely to be offensive. In this case alcohol, which could be produced in unlimited amount, could be substituted.

"It may be mentioned in conclusion that the efficiency—that is, the ratio ot the conversion of the heat units contained in the fuel into power—is probably higher in the alcohol engine than in engines operated with any other combustible, and doubtless, on account of the comparative newness of the alcohol engines, there is still room for improvement in this respect."

A copy of the bill introduced in the House by Mr. Calderwood making ethyl alcohol free, if rendered undrinkable, has now been circulated with a petition for signature. Accompanying the bill is a very interesting pamphlet going over the whole field of arts and industries, pointing out the manufacturing and other purposes for which untaxed denaturized alcohol would be used, and arguing that the development of many important industries is hampered by an excessive alcohol tax. Reference is made, for example, to use in lacquer work, where the solvent is the principal item of cost. Special note is also made of the use of shellac and alcohol in binding together the coils or layers of wires in motors and generators. The use of this alcohol-shellac solution is also noted in regard to the manufacture of mica and other insulting material used in electrical machinery.

Technical Education in Great Britain.

The present status of technical education in Great Britain is illustrated in a report on the subject by Prof. W. Ripper, of the Technical Department of Sheffield University, recently made at the annual meeting of the Association of Technical Institutions. It appears that British employers, as a rule, have no use for the technical graduate, and Prof. Ripper states that he knows of students who, when applying for an appointment, have feared to mention that they had been trained in a technical institution. Formerly a similar condition existed in this country, but fortunately was uprooted half a generation ago. Doubtless the inchoate condition of technical educational methods in Great Britain is largely responsible for the position of employers. While technical schools, so-called, are not lacking, their number being more than 100, it is astonishing to find that the faculty in the majority of these schools consists of only four members or less.

The clue to the present unsatisfactory condition appears to be given in the report of Prof. Ripper, the title of which is "On the Best Method of Arranging the Period of College and Workshop Training for Technical Day Students." This discusses the question whether the student should enter the workshop first, and afterwards proceed to the technical college; whether he should enter the technical college direct from school, and after his college course proceed to the works; or whether he should follow the works training and college training concurrently, by alternating attendance of six summer months in the works and six winter months at the college. It would thus appear that the methods of technical training which were discarded a score or more years ago in this country and in Germany still hold full sway in Great Britain.

In support of its conclusions, the report lays down the principle that the principal qualities required of a successful engineer are the qualities acquired in the workshop, the qualities acquired as a student being of secondary importance to the practical. In striking contrast is the broad American and German view, that the function of the technical school is to train the mental faculties and impart the great body of scientific and technical principles upon which a given branch of engineering reposes; and that the educational period should precede the period of application, and not be curtailed by an intermixture of practical work apt to be of little or no value to the graduate starting on his work-a-day career. Early experience in technical education in this country taught that whether a graduate had a maximum or minimum of practical instruction during his college career, he had to begin at the bottom of the ladder upon graduation; that but a small fraction of his school-day practical training applied directly to any particular line of work in which he might after graduation enter, and even this fraction would partly or wholly have to be unlearned as not in accordance with the practice of his employer; in short, that under any educational circumstances the graduate was accepted only as raw material and that a period of apprenticeship of several years in direct contact with practical work was necessary for his adjustment to the particular industrial conditions of his field of work, and for the attainment of the balanced judgment which is the most essential qualification of the engineer.

The report does not discuss technical education in any of its broader aspects, and concludes that each of the three systems above noted has its advantages, as follows:

1. The student who has been in a works first brings to his college work a knowledge of practical facts which enable him to appreciate to the full the value of his technical lectures. Many of the points raised in the technical lectures are of little meaning or interest to the student who has never previously been in a works.

2. The youth is generally much more certain of his college training if he takes it before entering the works, than if he postpones the college training till he has been through the works, as there are often many inducements held out to him not to break away from his connection with the works. The student who enters the workshop first finds on returning to the college that he has lost much of the information acquired during his school training, particularly his skill in mathematics, and also the habit of study, and has to spend much time in regaining lost ground.

3. Prof. Ripper says he has had some experience with the system whereby there is attendance at the works and college concurrently, and is satisfied that it is a very good one. The opinion of his best students who have passed under this system is of strong approval and high appreciation of it, as a means of preparation, both practical and theoretical, for their future career.

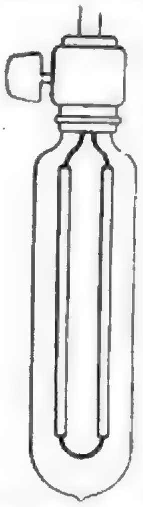
What Great Britain appears to lack is a militant educator who will have the courage to expose the pitiful inadequacy of British technical educational methods for the needs of the present age, and who will, day in and day out, advocate before the public the modern methods which have been such a large factor in transferring to the United States and Germany the industrial ascendency formerly held by Great Britain.

Business-Getting Instruction in Brooklyn.

The Edison Electric Illuminating Company, of Brooklyn, has arranged for a course in "business-getting" instruction for its employes, of whom about 60, mostly in the canvassing department, have taken advantage of the opportunity. The price of the course is $40 per student; the greater part of this is assumed initially by the Edison Company, and a weekly charge of 50 cents per student made during the course will be refunded to each student when he successfully completes the course, thus making the instruction finally free. The course, which is by correspondence, supplemented by lectures in Brooklyn, is given by Arthur Frederick Sheldon, of Chicago.

Composite Incandescent Lamps.

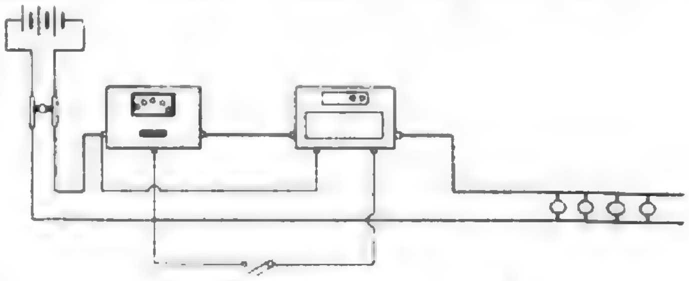
The accompanying illustration shows an incandescent electric lamp for which a patent was granted to Prof. H. C. Parker on February 20, 1906. A tube of quartz is coated on its inner surface with a thin film of iridium. The middle portion of the tube is tightly packed with powdered quartz. The leading-in wires are embedded in graphite which fills the ends of the tube and forms an electrical connection between the leading-in wires and the iridium film. The ends of the tube are sealed tightly. When the current is turned on, the film of iridium is heated to incandescence and the light from it passes readily through the thin quartz tube. A very high temperature is maintained in the conductive part of the lamp, and therefore the efficiency is relatively large. The inventor states that the lamp is mechanically very durable, and its useful life is very long.



COMPOSITE INCANDESCENT LAMP.

Calibrating Watt-Hour Meters

A patent issued recently to D. P. Morrison discloses a convenient method by which only one person is needed in calibrating a watt-hour meter by comparison with a standard meter. The standard meter is subjected to the same load as the unknown meter by connecting the field-coils of the standard meter with the mains of the work-circuit, as indicated in the drawing, but in such a manner that the recording mechanism of the standard meter is not operated. This is conveniently done by introducing any suitable switch in the potential-circuit leading from the brush-holders of the standard meter to the mains. The position of the hand on the dial or dials of the standard meter is noted, and at a certain point of the revolution of the unknown meter the switch in the shunt circuit of the standard meter is closed, thereby making the recording mechanism of this meter operative. A revolution or a certain number of revolutions of the unknown meter is then observed, and the switch is then thrown out again, thereby causing the recording mechanism of the standard meter to cease operation. The observed result of the unknown meter is then compared with the recorded results of the standard meter, and the variance, if any, can be determined thereby.



CALIBRATING WATT-HOUR METER.

CURRENT NEWS AND NOTES.

BAD FIRE IN 'FRISCO.—A fire occurring on Washington's Birthday at the central station of the San Francisco Gas & Electric Company, is reported by telegraph to have caused a loss estimated at nearly $1,000,000 and, in spite of the many outside sources of power controlled by the corporation, to have caused a shut down of the service for many hours.

NEW YORK ELECTRICAL SOCIETY.—Word has just been received from Mr. Marconi that he will make a special trip to this country to lecture before the New York Electrical Society on Wednesday, March 28, at the Teachers' College, Columbia University. It will be remembered that this lecture was fixed for January 16, but had to be postponed owing to Mr. Marconi's being detained in England by a severe attack of grippe.

ELECTRICITY IN HAZING.—It is reported from the Winona Technical Institute, Indianapolis, that several of the students there have been hazed or "initiated" with severe electrical treatment, and the matter is now under investigation. The practice is said to have attained considerable proportions in the electrical and mechanical departments, and that the hazing has consisted in keeping the victims forcibly in the circuit until they lost consciousness under the effect of the shock.

NEW YORK WATER is always the subject of complaint. The service is under municipal ownership and control and the newspapers are making charges as to corruption in regard to the meters. The *New York World* says that $10,000,000 worth of water has been stolen or given away to political grafters and others by water department officials of New York city in the last few years, and that the water stolen and wasted out of the present supply is more than sufficient to answer all the needs of the city for years to come.

N. E. L. A. QUESTION BOX.—Mr. Paul Lupke, of Trenton, N. J., editor of the Question Box of the National Electric Light Association, issued last week his first set of questions for the Atlantic City convention, June 5, 6, 7 and 8. It embraces 34 closely printed pages, with questions ranging over the entire art, divided into 27 different classes. Answers are invited from the membership, and if furnished in any number should be valuable. Some of the questions indicate a desire to secure professional services without cost to the inquirer.

FORTY STORIES.—The new Singer Building to be erected on Liberty Street, New York, is to have forty stories, and an altitude above Broadway level of 593 ft.—higher than the Washington Monument or the Federal Building in Philadelphia. Electricity renders easy the lighting and power service of such a structure, and the elevators in the Washington Monument have also shown than electrical equipment for that work is also adequate. The building is to be devoted to offices right up to the dome of its tower-like shaft.

ILLUMINATING ENGINEERING SOCIETY.—Mr. E. L. Elliott, secretary, announces that the Illuminating Engineering Society will hold its next regular meeting in the Edison Auditorium, 44 West 27th Street, New York City on Friday, March 9 at 8 p. m. Papers will be presented on the following subjects: "The Luminous Arc," by E. L. Elliott; "The Inverted Incandescent Gas Burner," by Victor Rettich; "Illuminating Engineering from the Architect's Standpoint," by W. S. Kellogg. The papers will be open to general discussion and all interested in the subjects treated are invited to attend.

GERMAN ENGINEERING SOCIETY.—American engineers of all professions are extending their congratulations to the "Verein Deutscher Ingenieure" (German Engineering Society), which with more than 20,000 members, represents the largest technical society in the world, and celebrates its fiftieth anniversary this year. This will take place in connection with the annual meeting of the Society to be held this year on behalf of an invitation of the Berlin Section of the Society at Berlin from June 10 to 14. A very large attendance is expected, including many Americans.

FERRETS TO CONDUITS.—At Terre Haute, Ind., on the new Bell telephone conduit system, the old tradition of using ferrets to pull in wires has actually been tried, and is reported by the superintendent of construction to be a successful plan. "We thought the ferret idea was only a good newspaper story," he said, "but on a test we found the little animals did the work perfectly. A harness was made for them, to which is attached a light fishing line. At the next manhole a piece of meat was hung and the ferret made for it at once. We will use rats as the attraction for the ferret. A ferret will displace three men."

EIGHTY-CENT GAS.—The New York State Commission of Gas and Electricity has issued an order fixing the maximum price of gas in the Borough of Manhattan after May 1, at 80 cents per thousand cubic feet. The commission in justification of its edict says that this will allow 8 per cent return upon the actual capital invested. This seems a debatable point. The Consolidated Gas Company has stocks and bonds of $101,000,000 and the Commission puts the value of the property at $30,000,000. With electricity at 10 cents per kilowatt-hour maximum and gas at 80 cents, New York City is highly favored as to economical light, heat and power.

DAMMING THE COLORADO.—According to advices from Los Angeles, Cal., the energy of the Colorado River is to be transmitted to that city, on plans now being matured by local and Philadelphia capitalists. At first the power is to be distributed among the mining camps on the Nevada and Arizona border. It is claimed that between the Grand Cañon of the Colorado and the Black Cañon it is possible to take advantage of certain sites and develop 500,000 horse-power. Plans are being prepared for a concrete dam 200 ft. high to be constructed at the lower end of the Black Cañon, and with the fall thus obtained it is calculated that 110,000 horse-power will be developed at the minimum of flow.

PETROLEUM REFINING.—As bearing upon the question of illumination, the United States Census Office figures just issued as to petroleum production are of special interest. There were 98 establishments in 1905 with a capital of $136,280,541, with 1,974 salaried employes paid $2,724,065 and 16,711 wage earners paid $9,989,367. The total value of the product was $175,005,320, of which illuminating oil amounting to 27,588,654 barrels was worth $92,272,186. There were 5,811,289 barrels of naphtha and gasoline valued at $21,314,837, leaving $61,418,297 for all other products. Of course a large part of this is shipped abroad. President Marks, of the Illuminating Engineering Society, in his recent address, states that the oil used in lighting in this country per annum is now worth about $60,000,000.

COST OF COPPER PRODUCTION.—It is always of interest to those engaged in the electrical industries to know what is the real cost of copper production, and at the present moment when the price of the metal is so high, the report of the treasurer of the Tennessee Copper Company is particularly timely. The production for the year from ores out of the company's mines amounted to 7,977,982 pounds of fine copper. This entire product was marketed in the form of pig copper, the comparatively high price received for the crude material making it unprofitable to refine the copper at the company's works. The cost of producing and marketing per pound of fine copper was as follows: Cost at works, 8.08 cents; freight, insurance and other selling expenses, .68 cent; taxes, legal and administration expenses, .52 cent, making per pound a total of 9.28 cents. Thus this corporation has been getting for its copper just about double the total cost of production and of selling expenses.

A REPETITION.—We are in receipt of the following correction from Mr. Frank J. Sprague, as to a recent proofreading error: "I beg to call your attention to an oversight on the part of your office proof correction in the matter of my communication on 'The Reincarnation of an Electrical Idea' in your issue of February 24, which makes me apparently guilty of repetition. The second paragraph in the second column on page 408, beginning 'Of course' and ending with 'development' was cut out and should have been omitted."

ELECTRICITY IN SOUTH AMERICA.—There is promise of electrical development at several South American points. The Compania General de Electricidad Industrial has secured concessions in Chili for supplying the cities of Linares, Los Angeles and Providencia with electric heat, light and motive power; the concessions running for ten years. The city of Rosario in the Argentine Republic is inviting bids for the installation of an electric light plant, the tenders being received up to April 16, 1906. The Compania Carris de Ferro Porto Alegreuse has called for tenders for the installation of electric power for the street railways of Porto Alegre, but the tenders, it is said, are to be sent in by March 1.

OSTWALD ON ATHLETICS.—Prof. W. Ostwald, the distinguished German chemist whose return home we noted recently, is not favorably impressed with the manner in which college sports in America are hurtful to the intellectual life. In a statement made last week at Leipzig he said: "The personal interest of the students next to their studies is concentrated alone on sport, which draws their attention altogether from intellectual or æsthetic pursuits. Football before all is loved uncommonly, and it is practiced in such a fashion that academic and state authority are near to forbidding it altogether. In the course of a single semester nineteen students fell victims of enraged, brutal handling. At every American university is a sort of open amphitheatre in which many thousands of spectators view the periodic football battles." Prof. Ostwald is preparing a report of what he observed for the Prussian Ministry of Education.

ANOTHER CHICAGO SHOW.—The electrical show will be held in Chicago next year, January 14 to 26. This was decided at a meeting of the executive committee of the Electrical Trades Exposition Company, held February 16. At this time the organization for the coming year was completed. The executive committee will consist of Messrs. E. B. Overshiner, chairman; Charles E. Gregory and Stewart Spalding. Mr. Homer E. Niesz, assistant to second vice-president of the Chicago Edison Company, was made managing director, which is the title carrying with it the usual duties of a general manager. Mr. Niesz will accordingly have general charge of next year's show, and announces that over one-half of the floor space has already been applied for for next year. Applications will be received for the remaining space at once. The allotment will be made at a date to be announced later. For the present, the management will be carried on by Mr. Niesz at his offices with the Chicago Edison Company, 139 Adams Street, Chicago.

IMPORTANT TROLLEY ENTERPRISE.—The spectacular copper warfare out in Montana ended recently, as our readers are probably aware, with the retirement of the Heinzes from the field with $25,000,000 in cash and securities. It is now stated that quite a large part of this money will be invested in a new trolley system in New York state. The new railway, which will operate a high-speed electric service between Elmira and Rochester, will be called the Rochester & Elmira Electric Railway Company, and will be capitalized at $4,000,000. Franchises have already been procured in all the townships through which the road will run, and for a good part of its length private right of way across country has been contracted for. No construction or grading has been attempted, but surveys have been made of the entire route. The enterprise is in such shape that work may be started as soon as the formal approval of the State Railroad Commissioners has been obtained. The incorporators are men who have been associated with the Heinzes in their copper enterprises.

PITTSBURG MEETING A. I. E. E.—A very successful meeting of the Pittsburg branch of the American Institute of Electrical Engineers was held on February 13, about 200 being present. Mr. W. E. Moore read an excellent paper in which he brought out the economies effected in the new plant of the West Penn Railways at Connellsville, with 1,500-kw, engine-type alternators and turbo-generators, transmission at 22,000 volts, three-phase, 60-cycle current being used for lighting and 25-cycle for railway purposes, over a large district. The recent Stott paper was the originating cause of the Moore paper and of several other kindred discussions by Messrs. W. C. Clarke, P. M. Lincoln, A. Kingsbury, F. Hodgkinson, W. P. Flint, R. Wintzer, W. Bradshaw, S. Q. Hayes, E. Lunn and J. R. Bibbins. At the close of the meeting, which was held at the Carnegie Technical Schools, the members inspected the new isolated power plant of the institution, wherein is installed one of the new type of 500-hp horizontal high-speed Westinghouse gas engines.

POWER IN THE HOME.—An interesting argument for the use of electricity in domestic heating is presented by Mrs. Ellen H. Richards, instructor in sanitary chemistry at the Massachusetts institute of Technology, Boston, in her recently published book, "The Cost of Shelter." The point is brought out that this age of machinery has set free the human laborer, if only he will qualify himself to use the power at hand. The house will become the first lesson in the use of mechanical appliances in control of the harnessed forces of nature, and of that spirit of co-operation which alone can bring the benefits of modern science to the doors of all. To manage the machine-driven house will require delicate handling, but let women once overcome their fear of machinery, and they will use it with skill. The undue influence of sentiment retards all domestic progress. "Heating might now be accomplished," says Mrs. Richards, "without dust and ashes, without the destructive effects of steam, if enough houses would take electricity to enable a company to supply it in the form of a sort of dado of carrying wires safely imbedded in a non-conducting substance, or in the form of a carpet threaded with conducting wire. Both heating and cooling apparatus could be installed in the shape of a motor to replace the punkah man and the present buzz-wheel fan, and to give fresh air without the opening of windows which leads to half our housekeeping miseries."

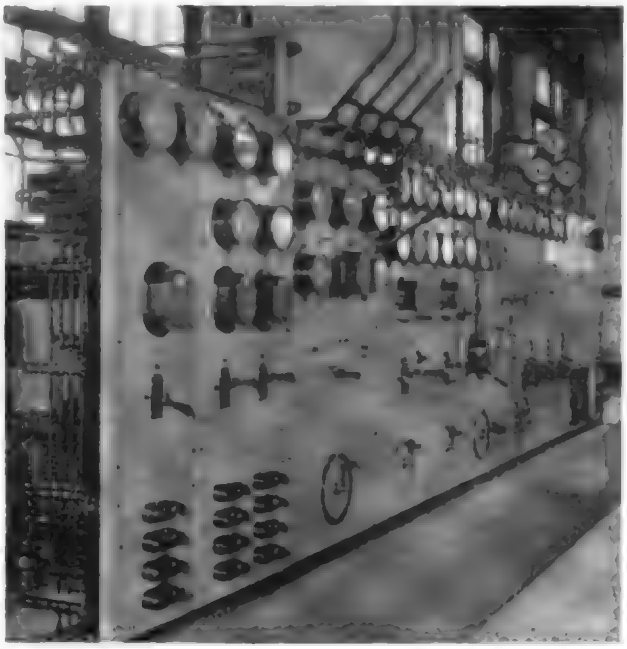
RECESSION OF NIAGARA FALLS.—There has been a good deal of discussion as to the effect on Niagara of withdrawing so much water from it for power, it being held by some authorities that the great cataract is breaking down under the volume of water and is becoming a long series of rapids. As bearing upon this point it is perhaps interesting to note that Dr. J. M. Clark, New York State geologist, of the State Museum, says: "The heavy bed of tough dolomite limestone at the crest of the Falls, which is the occasion of their existence, lies above a thick mass of soft shale which easily caves in under the rebound of the falling waters, and by so doing becomes the chief cause of the breaking down of the crest and of the cataract's retreat. This bed of shale runs down into the earth in the direction from which the water comes, the south. It will be out of the reach of the cataract after a while, leaving an escarpment wholly composed of the tough limestone, which will make the problem of retreat thenceforward quite a different one from what it is to-day. There are, moreover, 57 ft. of hard dolomites above the crest of the Falls over whose edges the water now descends in rapids. As the cataract moves southward by the falling away of its rock face it will grow higher instead of lower, until after it has passed the parting of the waters above Goat Island. Indeed, it may become fifty feet higher than it now is and so firmly upheld by the heavy masonry of limestones that caving in must cease and further retreat will be reduced to its slowest terms."

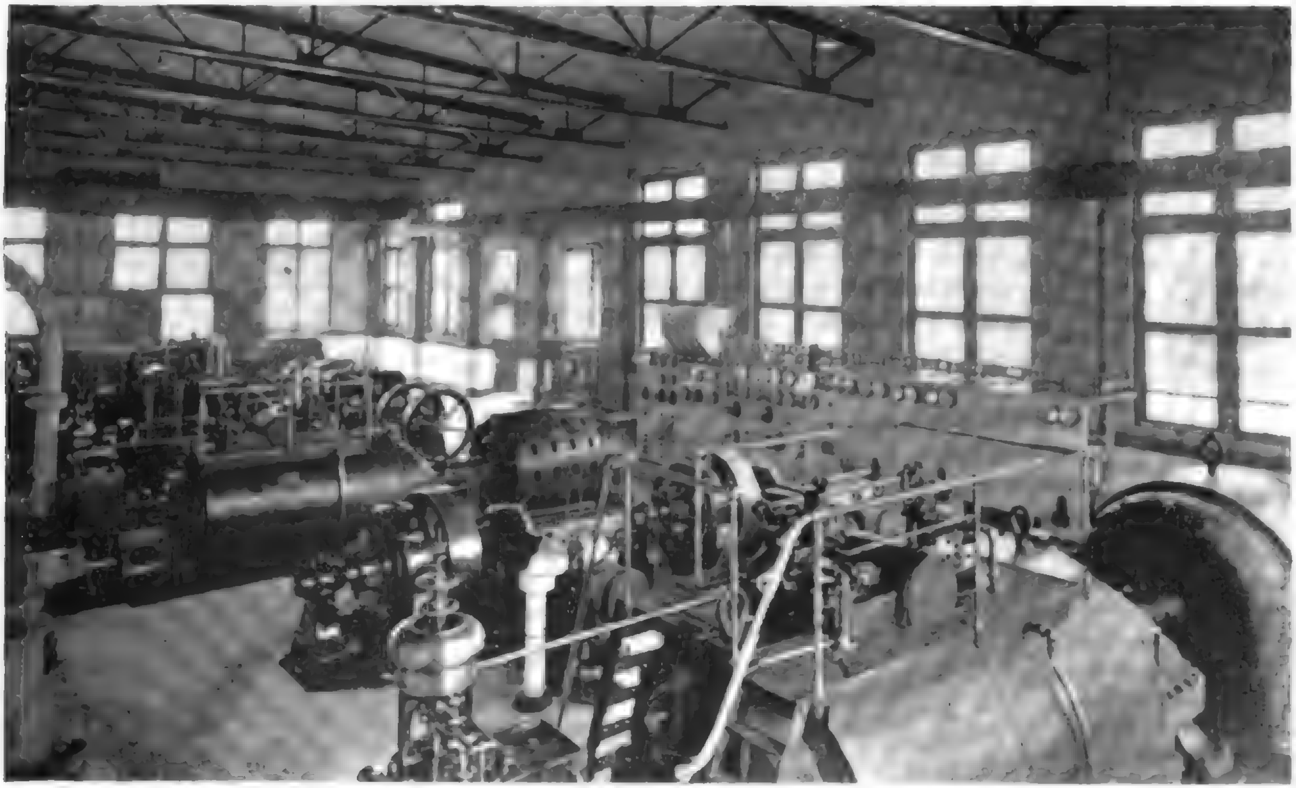
The Dutch Point Station of the Hartford Electric Light Company.

As is probably well known, almost all the power used by the Hartford Electric Light Company, of Hartford, Conn., to generate electrical energy is supplied by the waters of the Farmington River; the company having stations at Poquonock and Tariffville. So great, however, became the demand for service on the company's system that the output of these stations was insufficient; and to augment the supply and also to provide sufficient reserve capacity in case of seasons of severe drought, the company has erected a new steam-turbine-driven station at Dutch Point on the Connecticut River, within the city of Hartford. The site is advantageous in that abundant water supply is assured and the facilities for receiving coal are excellent, coal being brought to the wharf by boat or to the rear of the boiler room by cars on a siding from a branch line of the New York, New Haven & Hartford Railroad hard by.

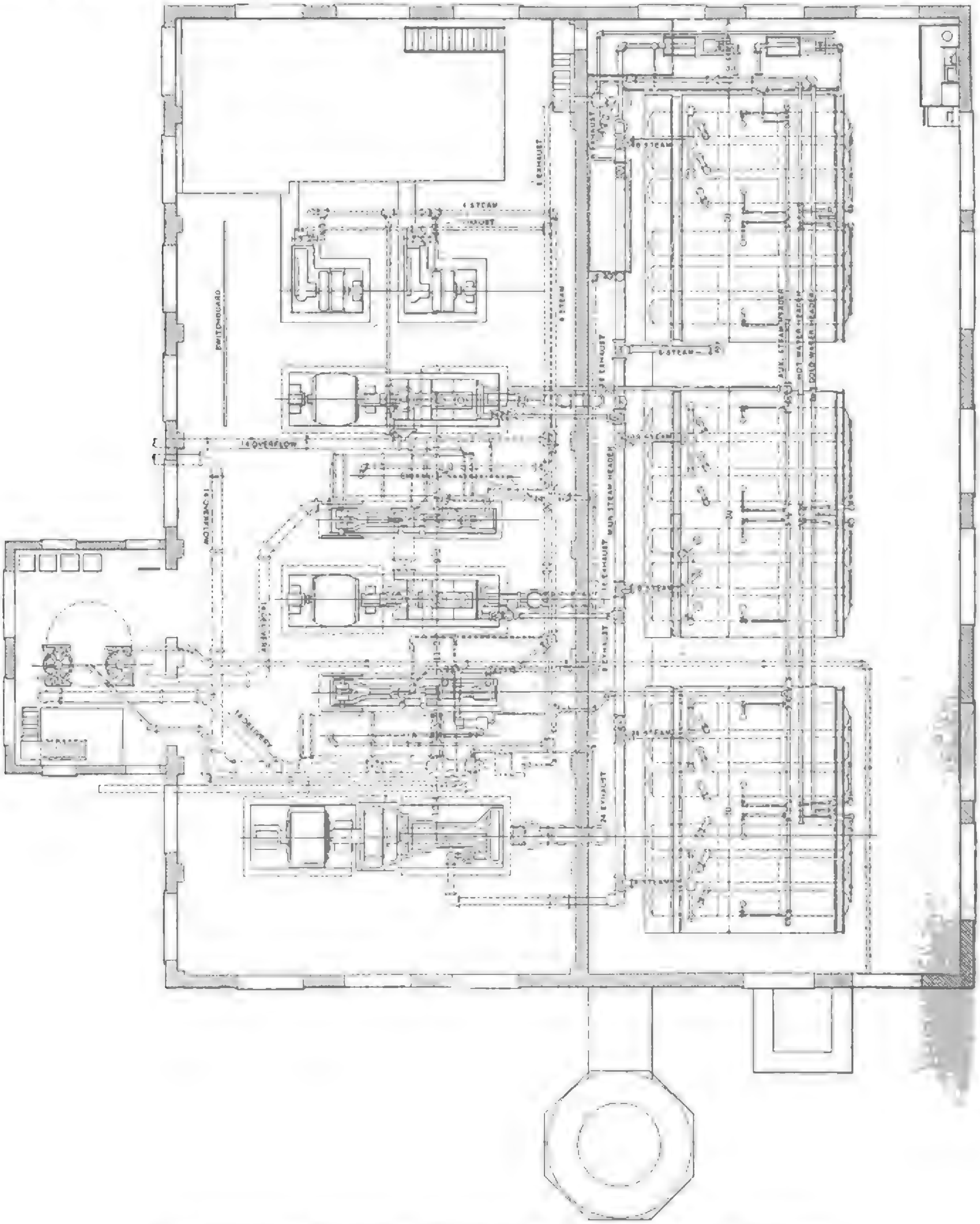
The station is built of brick and steel, concrete also entering largely into its construction. It is 119 ft. long by 92 ft. wide, and is divided by a brick wall into a boiler and an engine room, the former being 45 ft. wide and the latter 47. An extension 24½ ft. by about 17 ft. is built on the river side of the station over the intake well and contains the pumps and auxiliaries for the circulating water. The boiler room has a clear height to the bottom of the roof girders of about 23½ ft. and below the floor is a basement 16½ ft. high. The engine room floor is somewhat above the level of the boiler room, leaving a basement beneath almost 20 ft. high. Ample light is afforded by large windows on all sides of the building and by monitors in the roof over the boiler room.

Steam is supplied by six water-tube boilers in batteries of two, built by The Aultman & Taylor Machinery Co., of Mansfield, O. These have each a capacity of 550 horse-power and generate steam at a pressure of 150 lbs., which is superheated 100° Fahr. by Foster superheaters installed in the boilers. Each boiler is, in addition, equipped with the Parsons automatic system of forced draft which operates by blowing steam under the grates when the pressure drops below a predetermined limit. The boilers are hand fired with buckwheat coal. An industrial railway runs from the wharf on the Connecticut River to the rear of the power house, by means of which coal brought to the dock by boat is removed to the storage bins, where ample storage facilities are provided for a six months' supply. During the winter months when the river is not navigable owing to the ice, coal is brought by rail over the New York, New Haven & Hartford Railroad. A coal hoist elevates the coal into a hopper, from which


SWITCHBOARD, DUTCH POINT STATION.


GENERAL VIEW OF GENERATOR ROOM, DUTCH POINT STATION OF THE HARTFORD ELECTRIC LIGHT COMPANY.

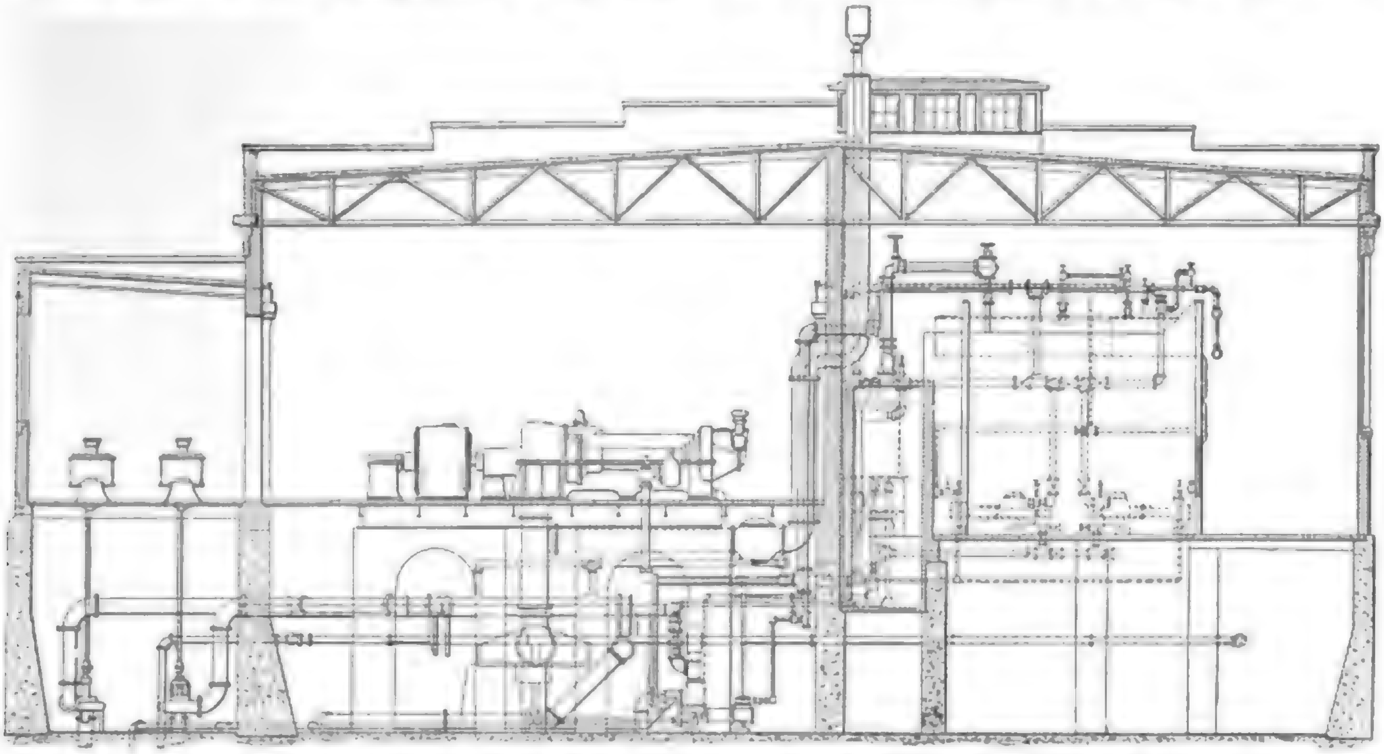
it slides by gravity through chutes to the boiler room. Hand barrows are used to convey the coal from the chutes to convenient points in front of the furnace doors. A brick flue built between the partition wall and the back of the boilers connects the boilers with a 135-ft. steel stack. This stack which is provided with an 18-ft. square brick base is located to the north of the power house and is 10 ft. in diameter.



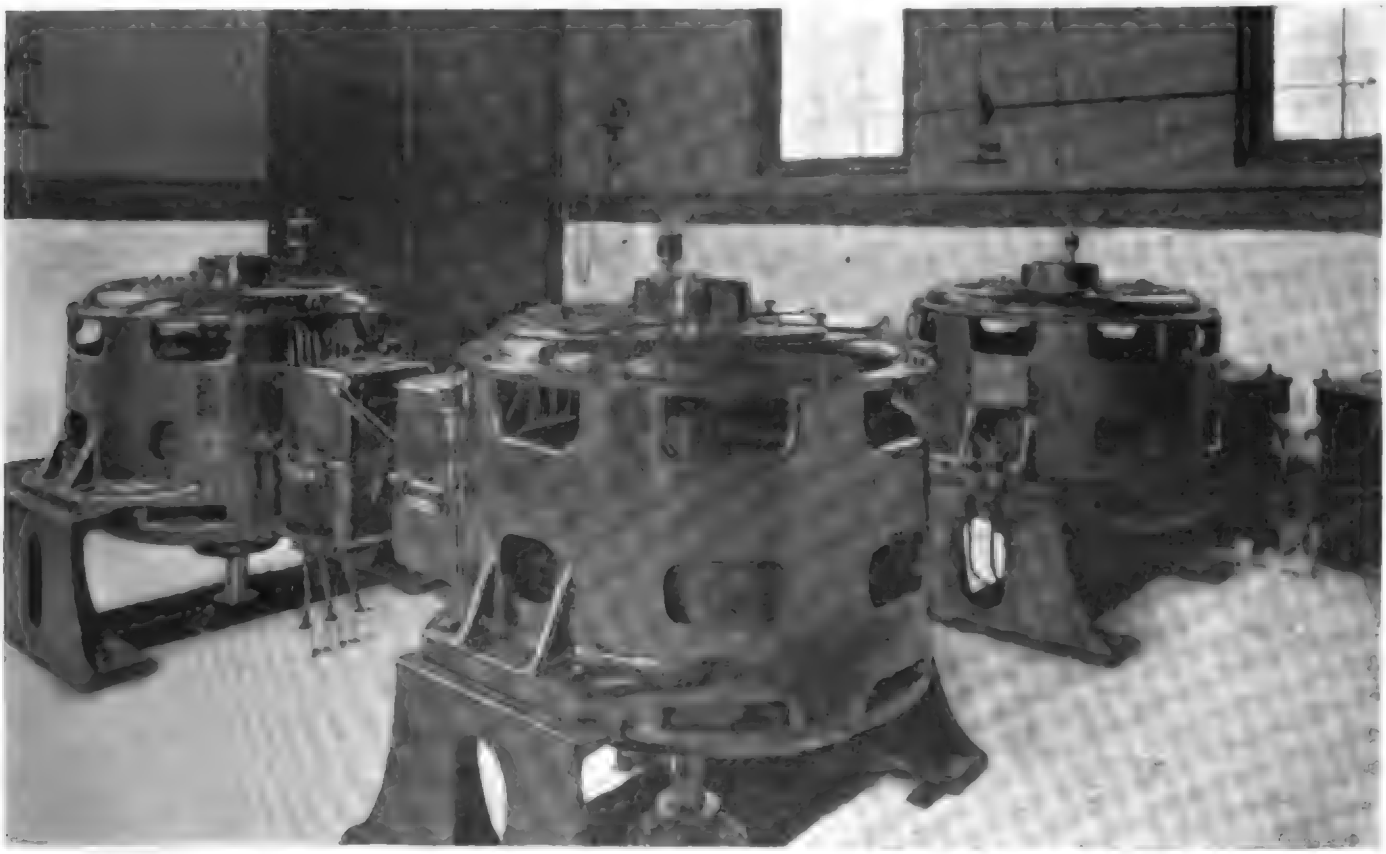
Plan View of the Dutch Point Station of the Hartford Electric Light Company.

In the basement below the boiler room is a railway for removing the ashes. These are dropped from the ash pits into the cars through chutes controlled by a chain-operated gate. The ashes are then elevated and carried to the rear or side of the plant where they are used for filling-in purposes.

The main units in the engine room are supplied with steam from a 12-in. header running parallel to the partition wall and above the boiler flue. The auxiliaries are supplied by a small auxiliary header running along the top of the boilers near the front. This header carries saturated steam fed directly from the drums through small lengths of pipe. The turbines being run condensing, water for boiler-feed purposes is taken directly from the hot well into which the surface condensers empty. Any loss is made up with water from the intake or from the city mains. A feed-water heater is installed at one end of the boiler room through which the feed-water passes; this heater is supplied with exhaust steam from the auxiliaries.



Sectional Elevation of the Dutch Point Station of the Hartford Electric Light Company.



Vertical Induction Motors for Centrifugal Pumps.

The water is pumped from the hot well by a Deane pump to a storage tank on the roof of the boiler room from which it is pumped by two Deane 7x10x12-in. feed pumps through the feed-water heater to the boilers. The pump for the hot well is provided with an automatic governor and the water is controlled by a float valve. This float acts on the city supply main leading to the tank, so that if for any reason the pump should be shut down the float will open the city water pipe. In case of an excess of water in the tank the supply to the steam pump is throttled.

The main units in the engine room consist of four Westinghouse-Parsons steam turbines driving 2,400-volt, two-phase, 60-

cycle generators. Two of these units are of 1,000-kw capacity, one of 1,500-kw capacity, and the other of 2,000-kw capacity. The alternator attached to the latter turbine is entirely enclosed and kept cool by forced draft. The 1,500-kw unit is the historic turbine first installed in the Pearl Street stations and about which so much has been written. This unit, which was started early in 1902, was dismantled and set up in the Dutch Point station where it is running in conjunction with more improved turbines of the same make. Steam is supplied to the largest turbine by a 10-in. pipe which after passing through the partition wall from the header in the boiler room drops to the basement beneath the engine room and up again to the steam chest of the turbines, as shown. The exhaust pipe from this turbine is 24 ins. in diameter. The 1,500-kw unit is also fed by a 10-in. steam pipe and is fitted with a 24-in. exhaust pipe. The 1,000-kw units are each fitted with 6-in. steam and 18-in. exhaust pipes. The air pump discharge pipes are 6 ins. in diameter.

The steam from the turbines discharges directly into surface condensers of which there are three, all of Alberger make. The 1,500-kw unit is supplied with a condenser, having 6,000 sq. ft. of cooling surface; both the 1,000-kw units exhaust to a condenser of the same size, and the 2,000-kw unit is supplied with a condenser having 8,000 sq. ft. of cooling surface. Two 8x18x18x24 Alberger air pumps situated in the engine room, one between the 1,000-kw units and the other between the 1,000-kw and the 1,500-kw unit, and a Worthington pump heretofore used on the old 1,500-kw unit and situated beyond the 2,000-kw unit, maintain the vacuum in the condensers. The connections are such that any air pump may be run on any unit desired. The condensers are provided with 14-in. overflows.

Circulating water is taken from an intake well 10 ft. in diameter, which is supplied by a 4-ft. intake pipe running out to the river. The usual precautions are taken to exclude refuse, etc., from the intake. Centrifugal pumps force the water from the intake well through 14-in. pipes to the condensers. These pumps are located in the basement of the extension built on the river side and are driven by vertical two-phase induction motors through shafts from the engine room floor above. The pump feeding the large condenser is driven by a 65-hp induction motor and the other pumps are each driven by a 50-hp induction motor. Power for the motors is supplied through transformers which step down the voltage from 2,400 to 220. Each motor is fitted with an auto starter which is mounted on the motor frame.

In connection with these turbines, it may be interesting to give the results of tests made on one of the 1,000-kw units by a committee of the National Electric Light Association on April 6, 1905. This machine at the time of the test had not yet been covered with non-conducting material, although the middle lagging was in place about the turbine. There were also at that time but two boilers installed in the plant, and the superheaters were so connected that they could not be by-passed in order to mix the saturated steam with the superheated steam. The exhaust from the turbine is taken out of the bottom of the low-pressure and run vertically downwards to a lead which brings the exhaust horizontally into the bottom of the condenser. The dry air pump is situated directly above the condenser with as short a connection as possible to the bottom. No air cooler is provided on the dry air suction since the air is taken out of the coldest part of the condenser. The wet vacuum pump is situated alongside of the condenser immediately below and connected to the hot well with a short run of pipe.

Throughout the time of the test the turbine operated very quietly and without any appreciable vibration, through all the loads from no-load to 50 per cent overload. The auxiliaries for the turbine required the principal atention of the one attendant, the wet vacuum requiring attention when starting up in order that it would not become air bound. Some trouble was experienced by the carbonization of the oil in the second stage cylinder of the dry air pump, which partially closed the air ports into the cylinder and caused the air-relief valves to stick open. The loads on the turbine at all times were purely commercial in the respect that the current generated was used for lighting and motor driving. The condenser was found to be absolutely tight. Electrical testing apparatus was brought from New York and after the test sent to the Electrical Testing Laboratories for calibration. The steam apparatus consisted of carefully standardized thermometers placed in the steam chest in front of the admission valve and in the exhaust pipe on the horizontal leg leading to the condenser. There were also steam gauges on the steam pipe close to the turbine and on the first stage of the turbine, and a mercury column on the exhaust nozzle close to the turbine casing. The readings of the mercury column were corrected from barometric readings furnished by the Weather Bureau at Hartford. The water was carefully weighed on standard scales. The results of the tests are tabulated in the accompanying table. Each test was of an hour's duration with the exception of the no-load test, which was half an hour.

Situated between the 1,000-kw and 2,000-kw units are two 10x12 Chandler & Taylor horizontal engines direct-connected to 70-kw, 125-volt, direct-current generators of Westinghouse make. These receive steam from the auxiliary steam header in the boiler room through a 4-in. main running in the basement below, and exhaust through the feed-water heater; the exhaust pipe connecting with an 8-in. exhaust main from the air pumps, etc. The current is used for exciting the fields of the alternators and for lighting. One unit is sufficient to supply the exciting current.

Two 11-in. Westinghouse air brake pumps are fastened to the partition wall in the engine room and these supply compressed air for cleaning purposes and for operating the boiler tube cleaners. The engine room is provided with a 25-ton hand-operated traveling crane and the small room containing the pumps, motors and transformers is provided with a 5-ton crane. The switchboard is made up of 13 panels, and is situated along the river wall of the station. The first two panels are devoted to the three centrifugal motor-driven pumps, and the four panels next to these are generator panels, one for each turbo-generator set. The two exciter units are controlled from one panel and the remaining six panels are devoted to feeder circuits, two panels being blank. The panel on the south end of the board controls a feeder circuit which goes around the east side of the city to the Pearl Street station. Feeders from the other three panels pass from the four copper-rod bus-bars back of the switchboard under the floor to a manhole outside the station and thence by underground lines to the Pearl Street station for distribution. The engine room floor is finished in white tile, and the room is brilliantly lighted at night by Nernst and Edison lamps.

TEST OF A 1,000-KW WESTINGHOUSE-PARSONS STEAM TURBINE AT HARTFORD, CONN.

Time	Kilowatts Corrected	Superheat.	Absolute Pressure, Inches.	Lbs. Water per Hour, Gross.	Water Seal of End Bearing.	Steam By Pass Valve Chest.	Net Water Lbs. per Hour.	Water per kw Hour.	Steam Pressure, Throttle, Corrected.
8:05 to 9:05 P. M.	1546.4	108.0	2.19	30172	939.	114.5	29347.5	18.98	135.0
6:55 to 7:55 P. M.	1219.3	92.4	1.70	23933	852.	106.5	23187.5	19.02	137.1
8:30 to 9:30 A. M.	1047.6	76.0	1.57	20900	796.5	68.	20171.5	19.26	137.2
2:50 to 3:50 P. M.	1071.5	77.7	1.70	21281	705.	75.	20501.	19.22	137.7
10:40 to 11:40 A. M.	735.8	72.9	1.21	16000	820.5	43.5	15224.	20.68	138.6
12:00 to 1:00	463.	62.1	1.01	11550	911.	23.	10671.	23.04	140.7
1:30 to 2:30	271.8	49.2	0.88	8968	951.	19.	8036.	29.50	140.3
9:20 to 9:50		24.5	1.43	3596	912.		2684.		144.7

The Lighting of Miscellaneous Rooms in Residences.

By J. R. Cravath and V. R. Lansingh.

The present article is intended to supplement two previous articles on residence lighting by the authors,[*] by taking up the lighting of rooms not before dealt with.

LIGHTING OF LARGE PARLORS.

The parlors here illustrated are mainly those of the larger class where expense is a secondary consideration. Smaller parlors and living rooms were taken up in the January 6 issue.

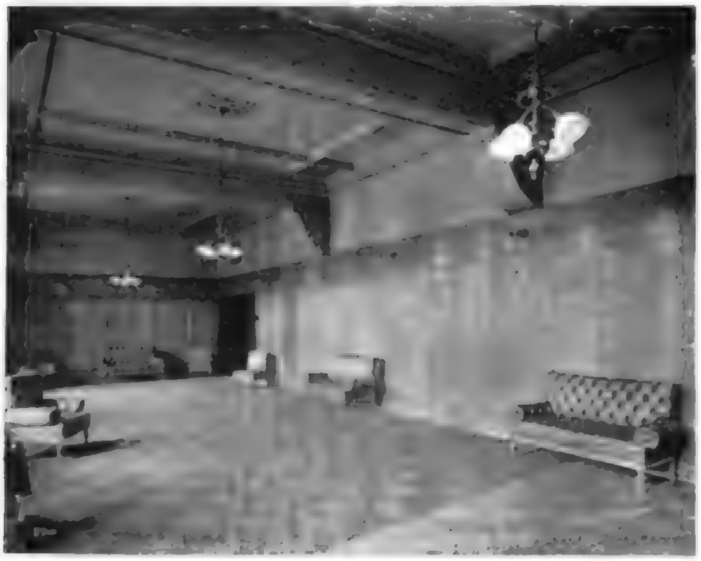


FIG. 1.—PARLOR LIGHT WITH TOO MUCH GLARE.

Fig. 1 is an example of the lighting of a large parlor which could be considerably improved. The first objection to be urged against the arrangement shown in this figure is the great amount of glare from the lamp filaments which any one sitting in the room receives. The opaline shades are of little value as reflectors and are not of a shape to act as diffusers and softeners of the light. An opal or ground glass reflector of this shape, used with frosted bulb lamps, would give much better results. The location of the fixtures in this case is very good for a parlor of this kind. Both the chandeliers and the brackets along the wall are placed high. In general, it can be said that the results, as far as the amount of light obtained below the horizontal is concerned, would be much better in this case if any good reflector giving a large amount of light below the horizontal was selected in place of those on the chandeliers at present.

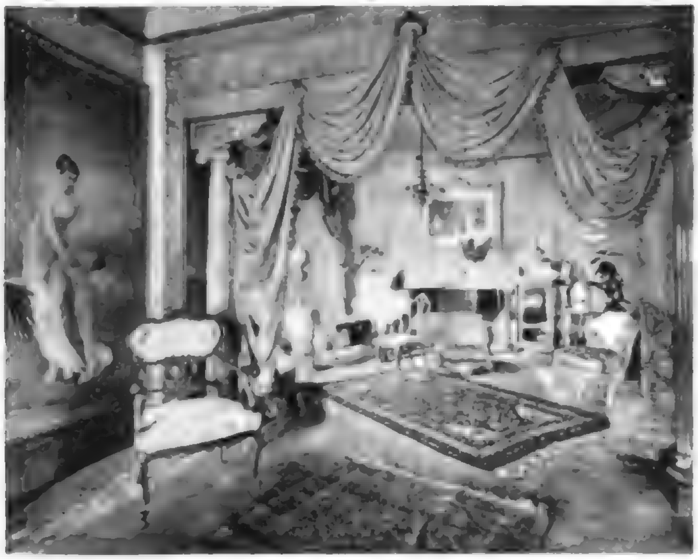


FIG. 3.—POORLY DIFFUSED LIGHT.

Fig. 2 is an example of lighting in a living room where expense is a secondary consideration. The ground glass globes in which all the lamps are enclosed diffuse the light so that the arrangement is very good from a hygienic standpoint. With the arrangement shown, an unnecessary amount of light is being spent on the ceiling. Prismatic glass reflectors over the large, spherical bulbs seen on the ceiling fixtures in the center of the room would add to rather than detract from the appearance of the fixture and would greatly increase the amount of light secured around the table and at the piano where the light is most needed. In a dark finished room of this kind it is seldom that there is any too much light thrown down in the lower part of the room for useful purposes.

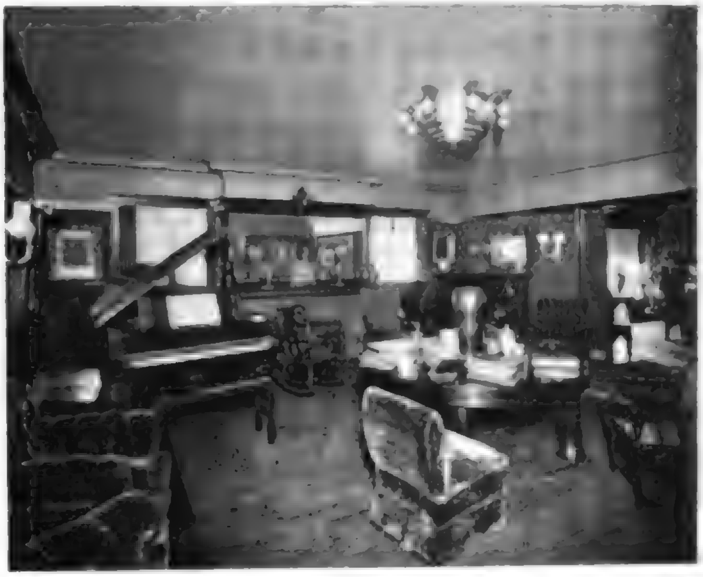


FIG. 2.—PARLOR WELL LIGHTED—GROUND GLASS BALLS.

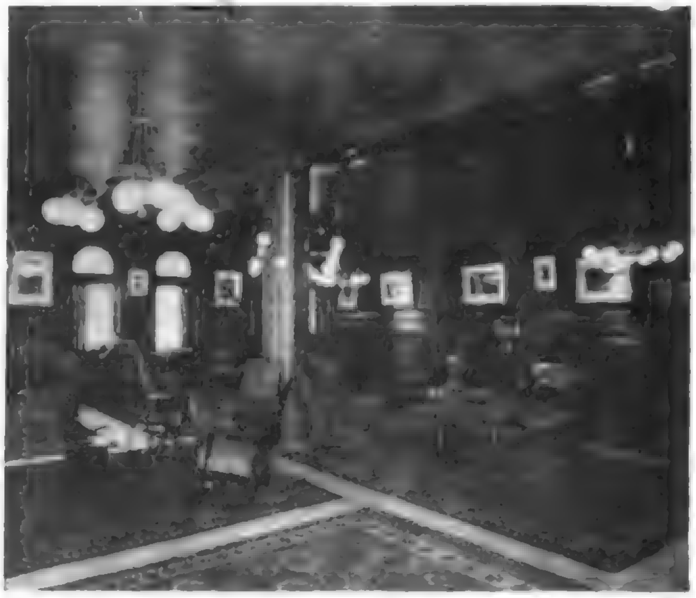


FIG. 4.—WELL DIFFUSED LIGHT.

Fig. 3 is an example of lighting in a parlor where expense is no object but where there is much room for improvement. The lamps on the central chandelier are covered with etched glass shades having a large amount of clear glass and are hence very poor diffusers of light. They, furthermore, have clear glass bulbs. In such a location, reflectors are not necessary for the sake of economy, but some means should always be taken to diffuse and soften the light by the use of frosted bulbs or diffusing globes. Almost any kind of ornamental etched glass shades desired by the owner can be used if frosted bulbs are used inside of them. The piano is in an excellent location with respect to the wall bracket, as the light from the wall bracket is thrown on the music from the left of the player. This bracket light could with advantage be equipped with a frosted bulb and some kind of reflector for increasing the light on the music. The other bracket happens to be in a very inconvenient position. The brackets in this room well illustrate the fact that in the lighting of parlors and living rooms it is easy to place brackets where they will be a nuisance rather than a convenience. In general, the use of such brackets is not advisable for this reason, unless they are to be used for reading purposes and are placed with this in view. It is generally better to put flush receptacles in the base board at various places where they may be useful around the room for portable fixtures, piano or other lighting, fans, etc.

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[*] "The Lighting of Living Rooms," Electrical World, Jan. 6, 1906, and "The Lighting of Dining and Bed Rooms," Electrical World, Feb. 3, 1906.

Fig. 4, the parlor of the Windemere Hotel, Chicago, is lighted with lamps in Holophane ball globes, the principal purpose of which is to diffuse and soften the light so as to avoid glare. Ground glass balls could be used for the same purpose but would not give quite as good a diffusion. More downward distribution of light could be obtained by certain other types of Holophane globes which modify the distribution of light from the bare lamp more than do these balls. Aside from this the design of the lighting of this parlor is good.

KITCHEN LIGHTING.

The kitchen requires the best general illumination of any room in the house because it is a room in which work requiring good light is done in a number of places. In most of the rooms in the house a concentrated light at one or two places in a room is sufficient for ordinary uses. In the kitchen there is usually a sink, a table, and a stove, upon all of which work is done which requires a good light. It is too frequently the case that the kitchen is the last room in the house to be considered in planning the lighting.

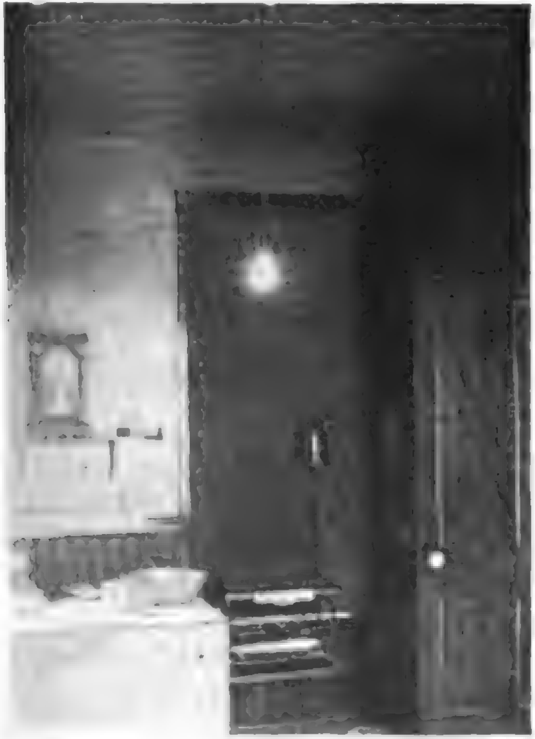


FIG. 5.—COMMON FAULTY KITCHEN LIGHTING.

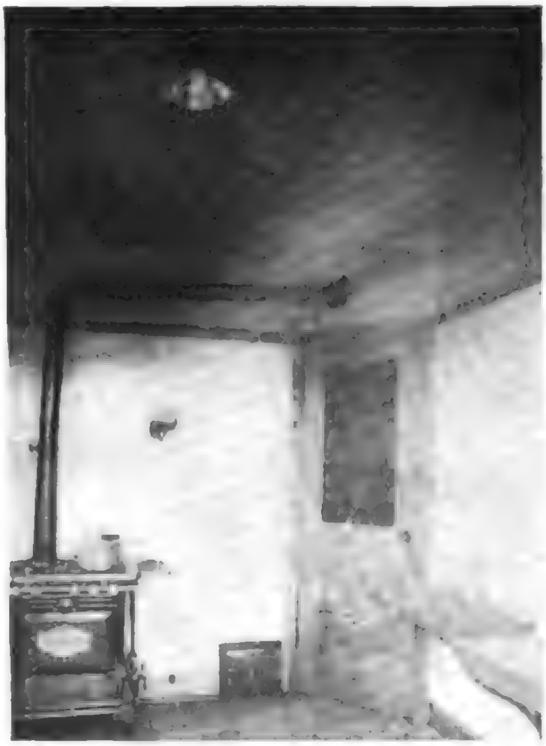


FIG. 6.—GOOD POSITION FOR KITCHEN LIGHT.

Fig. 5 shows a common, faulty method of kitchen lighting, which consists simply of hanging a bare lamp on a drop cord about six feet from the floor. Now, we know from the photometric curves that a bare lamp will give an unnecessary amount of light to the side walls and ceiling and not enough down on the stove, sink and table with such an arrangement. We know further from what has gone before that a bare lamp like this, hung in the middle of the kitchen, has a certain blinding effect on persons attempting to see across the room, and hence detracts from the efficiency of the illumination. Further than this, it is objectionable because, with table, stove and sink located around the sides of the room, the users must always stand in their own light or else stand very much to one side.

Where a single lamp must serve for the lighting of the whole kitchen, the best plan is to put it at the ceiling in the center as in Fig. 6, with a reflector which will throw light over all of the lower part of the room. A reflector giving the maximum light at an angle of about 40 to 45 deg. below the horizontal is the one to choose for such a location. The reflector shown in Fig. 6 concentrates too much light below the lamp, or in other words does not give a wide enough distribution to be best suited to such a location. Better ones would be the shade shown on page 1034 of the December 16 issue of this paper in an article by the authors, an opal cone or an opal dome.

Another better arrangement for kitchen lighting would be to place bracket lights well up over sink, table and stove, using them with downwardly pointed sockets and reflectors of opal or prismatic glass. With three 4-cp bracket lamps of this kind, the consumption of current will be about the same as with one 16-cp lamp, and the concentrated light on the three points where the most work is done will give a better light for working, although the general illumination of the room will not be as good. It sometimes happens that cupboard doors and windows interfere with such bracket arrangements in kitchens. A bracket light over a stove will require frequent cleaning on account of the steam and grease rising from the cooking. For this reason, a globe with outer prisms should never be used in such places; either an opal or prismatic reflector with a smooth inside surface being preferable.

In a small pantry the best thing that can be selected is a lamp in the middle in a diffusing globe hung about six feet from the floor, because what is needed here mainly is good light on the shelves. In a large or butler's pantry, the conditions are similar to those in the kitchen.

PORCH LIGHTING.

This, as a rule, is a simple problem, poorly done more often than not. The requirements for porch lighting are evidently to light the floor of the porch and the steps to it as well as to throw light on a person standing on the porch. This means, of course, a strong downward light. The ordinary incandescent lamp throws less than one-half its rated candle-power directly downward so that if this type of lamp is to be used, some means should be adopted to increase the downward light. For artistic reasons a closed form of globe is usually chosen, as in Fig. 7, instead of a reflector, although a reflector is by far the most economical thing that can be used. If a good prismatic reflector is employed, a 4-cp lamp is usually sufficient, although an 8-cp is better. Another plan sometimes adopted is to use a turn-down lamp having the 1-cp filament turned on for the ordinary everyday requirements of lighting the porch and steps and using the 16-cp filament on special occasions.

One of the best forms of porch lighting is a hemisphere placed on the ceiling. The light inside should be a single lamp mounted in the center pointing straight downward and provided with a reflector inside of the hemisphere. When used with a reflector almost any kind of diffusing hemisphere can be used, ground glass being preferable to opal and opaline because of its higher efficiency and more artistic appearance. If no reflector is used in the hemisphere, a Holophane hemisphere is preferable because of its power of directing the horizontal rays of light downward. When a ball effect is desired, one should avoid the typical example shown in Fig. 7 where most of the light is thrown sideways and on the ceiling and the minimum downward where it is wanted. By the use of a ground glass ball with a 4-in. holder permitting the use of an 8 or 16-cp lamp with a small prismatic reflector hanging directly on the lamp inside the globe a pleasing and efficient arrangement can be obtained. It is also possible to use in such cases one of the new type of balls with prismatic reflector on top and ground glass on the bottom. It is not possible to obtain as great efficiency using an enclosing globe even with a reflector inside of it as can be obtained with a lamp in a larger reflector without the enclosing globe. An effective and practical arrangement for porch lighting when using hemispheres is to place one lamp in the center for common use and others surrounding it for special occasions controlled by a separate switch. Brackets are often effectively and artistically employed in porch lighting. Such cases present practically the same problems as come up in bracket lighting elsewhere.

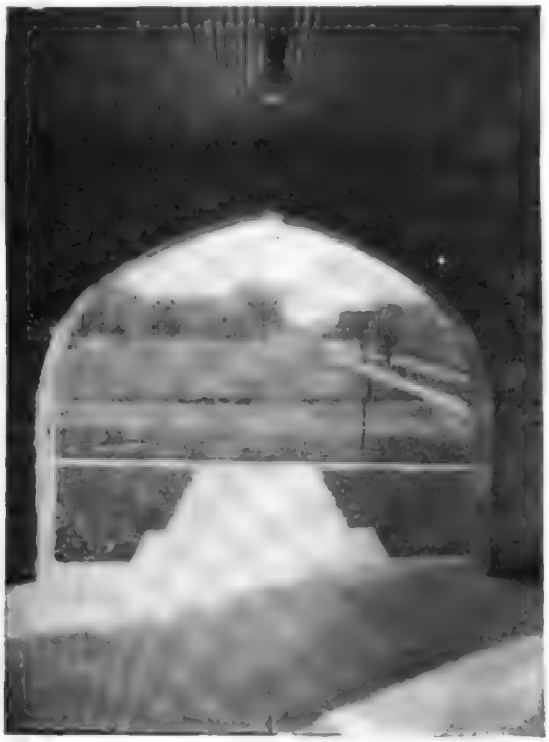


FIG. 7.—INEFFICIENT PORCH LIGHT.

BATH ROOM LIGHTING.

The lighting of the bath room depends somewhat on the amount of use that is to be made of the bath room mirror. In a small bath room where the mirror is not used much, a light in the center on a pendant about 6½ ft. above the floor, equipped with a reflector which gives good general distribution below the horizontal, will answer very well. A preferable arrangement is to place it at the ceiling and control it with a wall switch. Where mirror lighting is important, the arrangement shown in Fig. 8 is good. In this figure, the upright lamps on brackets at each side of the mirror are equipped with a Class B Holophane globe, which diffuse the light and also direct most of it below the horizontal. Because of the fact that bath rooms have usually light walls and ceilings, reflectors do not play as important a part here is in dark finished rooms, although, in the example given in Fig. 8, there is so much dark wood work in the vicinity of the brackets that the per cent of reflection is very low.

BASEMENT LIGHTING.

In the basement in the average residence but a limited amount of light is needed at night, but what few lights there are must illuminate a large area. It is best not to provide anything which will collect an unnoticed amount of dirt, and for this reason flat, opal reflectors and lamps, placed near the ceiling, usually make the best combination. If a more concentrated light is wanted than is afforded by a flat, opal reflector, some conical reflector can be used. A very useful suggestion offered by Mr. J. Kermode, of Cleveland, in a paper on wiring of residences, before the Ohio Electric Light Association in 1905, is to the effect that where several lamps are used in a basement they should all be connected to one switch at the top of the basement stairs and all sockets should be equipped with a "turn-down" lamp, which has one filament of 1-cp and another filament of 16-cp. The 1-cp filaments will be kept turned on, so that they will light whenever the switch controlling the basement is thrown on. After the switch is thrown on, the user has a dim light from the 1-cp filament with which to find his way around, and whenever he desires more light at one lamp, can immediately turn on the 16-cp filament. When he leaves the basement all lights are turned off at the one switch.

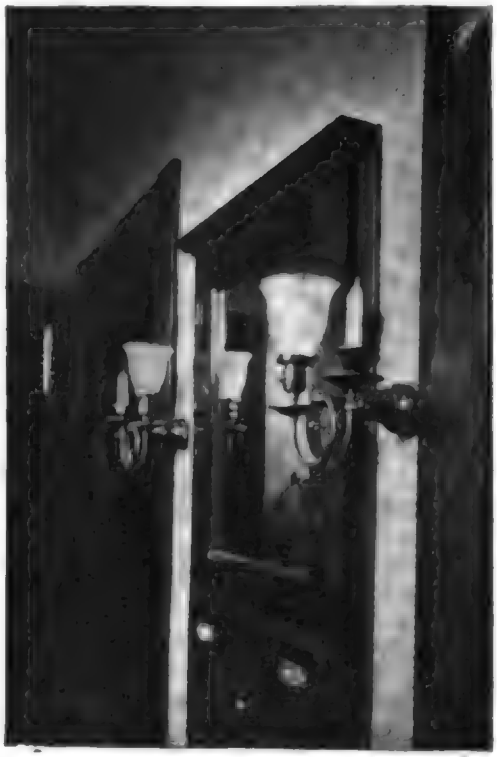


FIG. 8.—WELL-LIGHTED BATH ROOM MIRROR.

HALL LIGHTING.

The lighting of a long hall in a residence can best be accomplished by placing a two-light fixture with lamps near the ceiling at the middle, placing frosted tip lamps in concentrating reflectors and pointing them so that the maximum intensity of light is in the direction of the floor at the ends of the hall as in Fig. 9. This accomplishes the lighting with one outlet. For longer halls two or more outlets are advisable. The lamps may be placed on pendants in diffusing globes of sand blasted or opal glass, or in reflectors giving a general distribution of light below the horizontal.

The use of a turn-down lamp in a hall is frequently desirable, in which case the cords for turning up and down must be within reach of an ordinary adult from the floor. The use of side brackets for hall lighting is also artistic and permissible. Lamps in side brackets should be always enclosed in diffusing globes. The main thing in hall lighting is a general moderate illumination without concentration at any one point, and without any blinding glare from bare lamps placed in the ordinary line of vision.

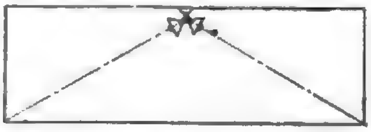


FIG. 9.—DIAGRAM OF LONG HALL LIGHTING.

Boiler Efficiency Tests.

By GEO. T. HANCHETT.

THE efficiency of a boiler is so dependent alike upon the coal, conditions of draught, and more particularly the fireman, that it does not have the definite significance which many engineers attach to it. A first-class fireman can get an efficiency well above 50 per cent with an old-fashioned cylindrical boiler without tubes. The poor fireman will get the same figure with a modern water tube type.

Considering the modern type as a whole, there is so little difference in the efficiencies of the various forms when properly handled, that a boiler test is really a fireman and coal test. The real factors of the merit of the boiler are those of convenience in keeping the boiler clean, the life of its tubes, surfaces and brick work, the dryness of steam that it produces, its quick steaming capacities, and the number of cubic feet of water that the boiler contains, the last being a measure of its steam holding powers.

Nevertheless, efficiency tests are and probably always will be made and required, and owing to the fact that isolated plants may wish to test their firemen and boilers, it is not to be denied that efficiency tests are useful. Therefore convenient methods for making these tests, which are troublesome at best, may be appreciated, and it is the purpose of this article to devote a few columns to the description of methods which the writer has found convenient.

The quantities to be measured in a boiler test are the following:

1. The weight of fuel consumed.
2. The weight of incombustible material rejected.
3. The temperature of the flue gases.
4. Thermal units of the combustible elements.
5. The weight of water evaporated.
6. Pressure of steam at which it is delivered to the line.
7. Temperature of the incoming feed water.
8. The quality of the steam delivered.
9. Draught.

The boiler test for efficiency should continue for at least eight hours. Any shorter test is likely to be accomplished with gross errors in the weight of coal and water, and is valueless. It is commonly preferred to test a boiler at full working load, and means must be provided to dispose of the steam which the boiler generates at such load. If the boiler is tested under a normal varying load, the test should continue for a much longer period of time.

The weighing of the coal in a short-time boiler test, such as will be described in this article, should be done before the test is begun. The amount of coal that will be consumed during the eight hours should be computed on the basis of about 5 lbs. to the hp-hour, and this amount of coal carefully weighed and dumped in one corner of the boiler room. After the test is completed, any unused coal must be weighed and credited.

The weighing of the water for very accurate work is preferably accomplished by two barrels mounted on scales. These barrels are alternately filled and emptied and allowed to drain to a suction reservoir of the boiler feed pump, and should be weighed both empty and full, the weight of the full barrels being placed in one column of a log, and the weight of the empty barrels in another, the difference of the totals being the amount of water consumed. It is not often that two platform scales are available, and the piping to two barrels is more or less inconvenient; a very close approximation, however, can be reached in the following way:

Two barrels should be selected and weighed empty and wet, the top should be carefully leveled, and they should be filled to the overflow point and again weighed, the difference representing the capacities of the barrels in pounds. These two barrels should then be mounted in a position whereby they can drain completely to a suction tank, and the system should be equipped with water taps, preferably quick opening valves, with drainage and filling connections and a pump suction tank. The tops should be carefully leveled, and the water allowed in every case to overflow the top of the barrel. As this entails considerable slopping of water, the weighing station, as it may now be called, should be located in some part of the boiler room where the overflow water can be conveniently taken care of, preferably by some catch basin.

It will be found convenient so to arrange each barrel that it will contain a quantity of water corresponding to an even convenient figure. The barrels can be brought to the required capacity by inserting in them heavy material displacing the required amount of water, the most convenient material being bricks, the cubic content of which is readily computed.

In lieu of weighing or measuring, and more convenient than either, is metering, and especially is this true if the water is hot. A meter should be selected of the piston type, as being the most accurate, and if there is any doubt about the accuracy of the meter, it may be calibrated by weighing or measuring. It may be said in passing that the error of the water meter is always negative; that is to say, it always registers when in error less water than actually passes through it, thus causing the boiler to show a lower efficiency.

The temperature of the feed water should be taken by means of a chemical thermometer. This thermometer should be placed in a pocket in the feed pipe. A convenient form of pocket may be made by equipping the feed pipe with a tee, the side outlet of which is equipped with a short nipple and cap; the latter is drilled to accommodate a ⅛-in. nipple and cap, which is screwed into the larger cap so that it projects directly in the path of the feed water. This thermometer pocket should be filled with oil, and should preferably be of such length that the mercury column in the stem will always be visible and the thermometer will not be required to be lifted out. Thermometers for this purpose which require only to be tapped into the feed pipe, preferably at some elbow, are made and are accurate.

The boiler pressure is of course obtained by means of a gauge, and if there is any doubt about the accuracy of the gauge, it should be tested. If the gauge is new, the chances are that it is quite accurate.

The temperature of the flue gases should be taken by means of a pyrometer. This may be an electrical instrument used in connection with an ohmmeter, or it may be a direct reading mercurial pyrometer which is less conveniently handled, but reads directly.

The weighing of the ashes should be accomplished by having a perfectly clean ash pit on the start of the test, and at the close the ashes weighed that it contains, together with a certain amount of the quenched fire at the close of the test. The quality of the steam is most conveniently observed by means of a Peabody throttling calorimeter. A weighed amount of wood should be provided sufficient to start the fire.

If the water is metered, one man will find it easy to take all the measurements necessary in making the test, and he will also be able to direct the fireman. If the water is to be weighed or measured, two men will be necessary, a man to attend the water tanks and keep the water log, and another to read the other instruments and exercise general supervision.

Before the test is begun the boiler should be under load and steaming well. At the time of starting the test the fires should be quickly drawn, wood thrown in where it will immediately ignite in the hot furnace, and a new fire built up from the weighed coal. The test should proceed through the allotted time, and at the time of closing the test the fire should be drawn, and if necessary that the plant should be run, it should be immediately rebuilt with fuel ready at hand for the purpose. The drawn fire contains a certain percentage of coal and ash, which should be estimated and accounted for as described below. The various measurements during the test should be taken in the following way:

If the water is to be weighed, a log should be provided, as shown below:

Water Log No. 1.

Time.	Wt. full.	Wt. empty.
7.00 A.M.	257	52
7.10	264	68
7.20	230	57
etc.	etc	etc.
Totals, ...	....	....

Gross weight, ...
Tare, ...
Difference or net evaporation, ...

This should be kept by the man who weighs the water, and has two columns, one of which contains the weight of the empty barrel and the other the weight of the full barrel. A third column is provided for the time, from which an idea of the rate of evaporation can be had.

If the water is measured by means of the barrels, the tally sheet is somewhat simpler, as shown in the water log below:

Water Log No. 2.

Time.	Bbl. 1.	Bbl. 2.
7.00 A.M.	1	
7.10		1
7.20	1	
etc.	etc.	etc.

Weight of barrel No. 1 empty 52 lbs.
Weight of barrel No. 2 empty 61 lbs.
Weight of barrel No. 1 full 265 lbs.
Weight of barrel No. 2 full 278 lbs.
No. of barrels No. 1. ....
No. of barrels No. 2. ....
Total. ....
Tare No. 1. ....
Tare No. 2. ....
Total tare. ....
Difference or water used. ....

The test should be so conducted that an exact even number of barrels can be used, and the log can consist of but three columns, two of which are simply tally columns, and the third a time column. The method of estimating the actual weight of water consumed is apparent from the form of the tally sheet. The temperature of the feed water, the boiler pressure, and the temperature of the flue gases should be kept on one sheet, and should be taken every ten minutes. The results can then be reduced to curves with reference to time, if such data are desired. The form of such a tally sheet is shown below, which also contains a water column, for use in case the water is measured by meter.

General Tally Sheet.

Time.	Water meter.	Feed temp.	Pyrometer.	Boiler press.	Cal. temp.	Cal. press.	% moisture.	Barometer.	Draft.
7.00 A.M.	018275	175	625	110	..	..	..	..	
7.15	295	185	600	112	..	..	..	..	
7.30	325	165	650	115	.	..	..	..	
7.45	360	195	580	112	.	..	..	.	
8.00	395	200	525	111	..	..	..	.	
etc.	etc	etc.	etc.	etc.	..	..	..	..	
Elapsed time.	Difference from start.	Av. temp.	Av. temp.	Av. press	Av. temp.	Av. press.	Av. moist	Av. barom.	Av. drft.

Measurements of the throttling calorimeter should also be taken every hour, and their results computed as described below. The water level of the gauge glass of boiler should be carefully noted and the test should be finished on the same water level as on the start.

RESULTS OF TEST.

BOILER DATA.

Type and make
Rated horse-power
Grate area
No. of tubes
Diameter of tubes
Water capacity
Total heating surface
Ratio grate area to heating surface

FURNACE DATA.

Type of grate bar
Cubic content of combustion chamber
Area of britching
Area of stack
Width of space between bars

FUEL DATA.

Coal burned, lbs.
Kind of coal
B.t.u. per pound as given by dealers
B.t.u. per pound as given by analysis
Percentage of noncombustible

TEMPERATURES.

Average feed water temperature
Average flue temperature
Average calorimeter superheat temperature

ASH DATA.

Ashes in ash pit.................... lbs.
Ashes in drawn fire................ lbs.
Total non-combustible............. lbs.

TIME DATA.

Time of beginning
Time of ending
Elapsed time

PRESSURES.

Average boiler pressure............. lbs.
Average barometric pressure....... lbs.
Average calorimeter pressure....... lbs.
Average absolute pressure.......... lbs.
Average draught.................... water

EVAPORATIVE DATA.

Observed water evaporated......... lbs.
Average moisture in steam......... lbs.

COMPUTED RESULTS.

Heat units in 1 lb. of steam at boiler pressure
Heat units in 1 lb. of feed water.
Net heat units given to 1 lb. of water
Heat units in 1 lb. of steam from and at 212°
Factor of evaporation
Lbs. of water evaporated from and at 212°
Lbs. of water evaporated per hour from and at 212°
Horse-power of boiler at 34.5 lbs. per horse-power per hour
Lbs. of water per lb. of coal
Lbs. of water per lb. of coal from and at 212°
Lbs. of water per pound of combustible
Lbs. of water per lb. of combustible from and at 212°
Lbs. of water per square foot of heating surface per hour
Lbs. of coal burned per square foot of grate surface per hour
Total heat units given to boiler in coal
Total heat units appearing in evaporated steam
Ratio or percentage of efficiency.

A sample of the coal should be selected in the following way: A number of shovelsful should be taken from different parts of the pile of weighed coal and piled together on the boiler room floor and thoroughly mixed. This pile should be quartered, and one quarter selected, mixed, and requartered, the process continuing until a sample weighing about 2 lb. is had. This can be analyzed at leisure, most conveniently by a calorimeter method, which was described by the writer in the *American Electrician* of April, 1905

The wood used in the test can be charged at one-half its weight in coal. It is usually a miscellaneous collection of scrap and cannot be more closely evaluated, and if the test is of long duration and much fuel is used, serious error is not entailed by this procedure.

The ashes in the ash pit should be considered as incombustible material unless the grate bars are very wide and the coal very fine anthracite, when they should be given the same treatment as the drawn fire.

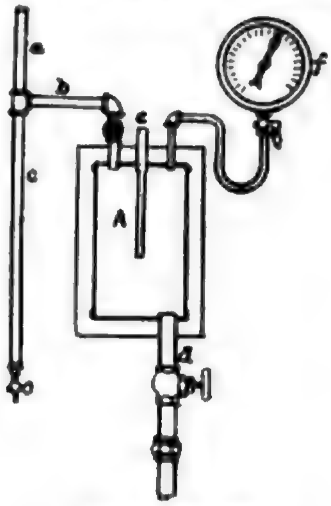
The drawn fire should be quenched and examined by taking a small sample; usually visual examination of this sample will enable an estimate to be made sufficiently close to determine what percentage of the drawn fire is combustible material, which should be credited back with the unused coal, and the proportion of ash, added to the ashes found in the ash pit. The error is not large, especially in a boiler test of long duration, in which case it would make a difference of less than one-tenth of one per cent in the total fuel consumed.

The finished report of the boiler test should contain the data shown above, most items of which are obvious, and others are readily arrived at by computation by the methods shown below. In discussing this computation the obvious figures will of course be omitted.

The average absolute pressure is the sum of the average barometric pressure and the average boiler pressure. There are two varieties of steam tables, one of which quotes gauge pressures and is approximate. The other quotes absolute pressures and is accurate. If the table employing absolute pressures is available and barometric pressures have not been taken in the test, a close approximation can be had by considering the barometric pressure to be 14.7 lb.

The average draught is the average readings of a draught gauge, which can consist of a U-tube containing water, one leg of which is piped to the britching of the boiler. This figure cannot be used in the computation of any result, and is only of information to those who are experienced in boilers, grates, and furnaces. With a knowledge of what draught is, an experienced boiler man, knowing the kind of coal used, can tell whether or not the maximum number of pounds possible to obtain per square foot of grate was burned during the test, or in other words, whether the boiler was forced to its ultimate capacity.

The average moisture in the steam is obtained by means of the readings of a Peabody calorimeter. This calorimeter is one known as the throttling type and is illustrated in principle below. Steam is admitted at *a*, the pocket *c* being simply a condensation pocket which can be drained by the pet cock. The steam passes through the pipe *b* and through the valve, which is opened very slightly so as to allow the steam to wire-draw, and enters the chamber, *A*, from which it escapes through the pipe and valve, *d*. The temperature of this steam, which is superheated by the process of wire-drawing, is taken at the thermometer pocket, *c*, and its pressure is noted by the gauge, *f*. The following formula now obtains



STEAM CALORIMETER.

$$x = \frac{\lambda + C_p\ (t_s - t_1) - q}{r}$$

The letters have the following significance:

r = The latent heat of vaporization.

q = The heat of the liquid.

λ = The total heat in the steam.

t_1 = The temperature of saturated steam at that pressure.

t_s = Temperature of superheated steam in the calorimeter.

c_p = Specific heat of steam at constant pressure, and may be taken as .48.

x = That portion of the steam which is genuine steam, and the difference between that figure and *l*, is the portion that is water, or the per cent of priming.

The formula can best be illustrated by the example given below:

Pressure of the atmosphere..............14.8 pounds
Steam pressure by gauge................69.8 pounds
Pressure in the calorimeter gauge........12.0 pounds
Temperature in the calorimeter............268° .2 F.

$$x = \frac{1156.4 + 0.48\ (280.2 - 243.9) - 286.3}{892.7} = 0.988$$

The priming is thus 0.012 or 1.2 per cent.

Duscussing this example it may be stated that the absolute pressure of the entering steam is, of course, the sum of the first two figures, gauge and atmospheric pressure, or 84.6. From the steam tables the heat of liquid at 84.6 pounds will be found to be 286.3, the value of *q*. The gauge pressure in the calorimeter is 12 pounds, the absolute pressure is 26.8. At 26.8 pounds from the steam table the temperature of saturated steam is found to be 243.9, and the total heat λ is found to be 1156.4. The figure 268.2 is observed from the calorimeter thermometer, and the constant .48 is already understood. The figure 892.7 is, of course, the latent heat of vaporation at the absolute pressure of steam at 84.6 pounds, and from the steam tables will be found to be as stated.

Solving the arithmetical problem shows that 98.8 per cent of the mixture is steam and the remainder is water. A consideration of the formula will show that unless the steam is superheated by the action of the calorimeter, it will fail of its action. Therefore, the observed temperature in the calorimeter must exceed the temperature given for saturated steam at the absolute pressure in the calorimeter.

In the computed results the heat units in one pound of steam at boiler pressure are obtained from total heat columns in a steam table. The heat units in one pound of feed water is equal to its temperature in F. degrees minus 32. The difference between the heat units in the feed water and the heat units in the steam is necessarily the heat units given to one pound of water by the boiler itself.

The heat units required to evaporate one pound of steam from and at 212 is a very familiar figure, 965.8; and if we divide the net heat units given to one pound of water, by this figure, we will obtain the number of pounds from and at 212° that this heat would evaporate. This factor is called the factor of evaporation, and if the actual water evaporated is multiplied by the factor of evaporation, the result will be the number of pounds evaporated from and at 212°. From this figure the number of pounds of evaporation per hour can be easily computed, and dividing this figure by 34.5, the average horsepower of the boiler during the test can be determined.

An analysis of the heat units contained in one pound of coal multiplied by the coal burned, will give the total heat units given to the boiler. Multiplying the heat units given to one pound of steam by the total water evaporated, will give the total heat units appearing in the evaporated steam; the ratio of the two will give the efficiency of the boiler in per cent. Anything exceeding 70 is a very good figure indeed.

The Design of a Small Electric Power Station.—I.

By James F. Hobart.

Upon being commissioned to design and erect a power plant, say of 125 to 150 hp, the engineer will first proceed to collect the data necessary for properly laying down and selecting the machines and material necessary to meet the conditions as they exist. Possibly, when completed, the engineer's data sheet may look something like the following:

> Location, in the South, plenty of land, all the room necessary. Shipping facilities good. Railroad siding at door. Sewage matters may give trouble. Water level near ground surface. Water supply for boilers, driven wells. Surface water best. Too much lime in deeply driven wells. Fuel, yellow pine wood four feet long—cordwood, $2.00 per cord. Load, steady, engine, during day, boiler only at night. Pressure during day, to suit engine. Pressure at night, 125 to 150 pounds, for chemical purposes. Steam required, 125 hp during day, steady load. At night, 140 to 150 pounds pressure. About 75 hp required from 6 p. m. to 7.30 p. m. About 40 hp required from 7.30 to 5 or 6 o'clock a. m. The pressure and time of application noted above, must be continued until the product of steam pressure in pounds and the time in hours, equals 1,250. The count to begin after the fall in quantity of steam required which takes place when the apparatus is fully heated to steam temperature. Labor and attendance all negro with exception of white engineer and white superintendent. Repair facilities very poor, necessary to send 30 to 40 miles for machine shop work or repairs outside of factory. Strong winds frequent with fine sand blowing freely. No frost, but high winds and severe storms. Foundations to be laid in sand. Hard-pan many feet below surface, too far to be counted in arranging foundations, which are to be laid in clean sand free from clay or loam. Building material, nothing but long leaf yellow pine from a country sawmill four miles distance. All lumber green, freshly cut to order and sawed to schedule. No planing machines in mill. Novelty works a mile and a half in opposite direction from sawmill, but they do not know how to do anything well except fix maximum prices and render bills. All dressed boards and lumber must be ordered 40 miles by rail. No stone for concrete. Brick must be ordered by rail and are very poor and soft. Price delivered $10.00 per 1,000. Native magnesia lime, not very strong, can be obtained. Plenty of sharp clean sand everywhere, to be had for the taking. A deposit of "rock-clay" near at hand and available at a cost of $1.00 per cubic yard delivered. This clay rams down exceedingly hard and is used for "paving" roads and sidewalks. It gets dusty when dry and muddy if wet. No skilled mechanics obtainable for erection of factory. All machinery must be erected by ordinary—very ordinary—carpenters who require constant and close watching. All work must be laid out for them and all lines and centers laid down and constantly watched to see that they are worked to. No millwrights or machinists available. The engineer-to-be is a good blacksmith. Superintendent of plant good at erection but not accustomed to machinery drawings. Never saw one before. Blacksmith tools at plant, also grindstone, pipe tools and hand die for cutting bolt threads. No engineer with transit available. All lines and levels must be laid out with 12-ft. pole and carpenter's level with a small iron level for setting the machinery. Even a straightedge must be made of yellow pine and will hardly stay straight from one minute to another. Cost of labor, $1.25 per day from 6 a. m. to 4.30 p. m., with half an hour nooning. Quality fair, above negro average. All skilled (?) labor, $2.00 to $2.50 per day; capacity, "two looks and one move per hour," very slow and poor except at mistakes. Fire protection, absolutely none. Fire danger great. Wood-burning locomotives pass close to plant frequently. Insurance rates almost prohibitive, 4½ per cent to 5 per cent per year. Location, 1½ miles from post-office, bank, stores or hotel.

The above data, taken almost verbatim from a notebook by the writer, will serve as one extreme illustration in engineering, and nothing calling more fully for a self-sustaining steam plant can well be imagined. It is in strong contrast to a plant in town, where real estate is valuable and the best of labor and material can be obtained. In each case, the engineering problems to be solved are as different as are the conditions, and between the two may be found probably the entire range of "condition engineering." From the foregoing, it will at once become apparent that a high grade plant is not to be thought of. Water tube boilers and a condensing engine are not for this plant. Indeed, the specifications for the entire layout must be about like the specifications for a fence which the writer was called upon to witness recently—or, more properly speaking, to witness the contract of which the specifications formed a part. They were for a fence: "Horse high, hog tight, and bull strong." The plant to be laid out in this case must be simple and easily kept in repair without the necessity of a machine shop. There was plenty of room and no necessity for obtaining the highest rate of evaporation, therefore there was selected a plain tubular boiler, 72 in. x 18 ft., built of 9/16-in. steel (firebox)to carry a working presure of 150 pounds to the square inch. To make sure that the boiler was up to the requirements, the contract called for the boiler to be insured either in the Fidelity Company or in the Hartford Steam Boiler Inspection and Insurance Company, which was done.

The engine selected by the writer was a plain, low-priced Corliss type engine, which in paper mills has stood the test of running "28 hours per day and eight days per week," with surprisingly small bills for repairs.

But someone interested evidently "had a pull" and the concern for whom the plant was to be designed, considered it to their interest to purchase the steam plant themselves, and, instead of a 14-in. x 30-in. Corliss engine running at 90 r.p.m., they finally purchased a 14-in. x 18-in. slide-valve engine to run at 130 r.p.m. Upon looking up the engine purchased, it was found that it was built to work under only 90 pounds of pressure per square inch, thus making it necessary to put a reducing valve in the steam pipe between boiler and engine—a piece of engineering not to be recommended!

A considerable portion of the material consumed in the plant, and all its output, was necessarily handled by rail; therefore the factory was laid down on the plans beside a side-track which swept in an easy curve away from the main line of railroad, thus giving plenty of room on either side of the siding in question. But someone—perhaps the man who selected the engine—took a finger in the location, and jammed the factory close alongside the main line in such a manner that the turnout was only a parallel siding, only one side of which could be used, the other side being within 10 ft. of the main line. This action added immensely to the fire risk, as the sides of the factory (the roof was so-called fireproof) was exposed, together with 200 cords or so of wood before the boiler house, to the sparks from wood-burning locomotives on the main line of railroad.

A water tank having a capacity of 15,000 gal. was erected on a tower near the factory building, the bottom of the tower being placed just above the ridge of the highest roof, which was about 30 ft. from the ground. Hose connection for ⅝-in. nozzles in various parts of the factory afforded a certain fire protection, and the intention is to place automatic sprinklers throughout the building and to connect them with the water tank in a "wet" system. The hose connections are so arranged that the water tank can be cut off by closing a valve, and the boiler feed pump be worked directly into the hose connection lines.

Sewage bids fair to give considerable trouble, but as it was possible to place closets at a distance of 100 ft. from the factory, and as the sand would readily absorb any surface discharge of water, all drips and blowoffs were simply carried out of the building on the surface level just at the floor line and discharged at the rear, where there chanced to be a slight depression in the ground.

It was impossible to excavate more than three or four feet without coming to water, therefore it was necessary that the foundation excavations be very shallow. For all building foundations, excavations were made about 13 inches below the floor line and the soft "sand clay bricks" available, were laid down to form a pavement about 28 in. wide. Upon each layer of brick, very thin grout was poured, thus making sure that all the joints were well filled. Layer after layer of bricks were thus laid, the two lower ones being "flush" courses and about 20 in. apart. Each succeeding course was stepped back about 2 in., making the top of the foundation wall about 13 in. wide, upon which sills were to be laid, each 8 in. x 8 in. The extra width of foundation was provided for the purpose of afterward giving the entire factory a veneer of brick 4 in. thick outside of posts, and 13 in. thick between them, the weatherboarding and all smaller timbers being torn out as the bricking-in process proceeded.

All piers were laid up in the same manner, five courses of bricks high, laid flatwise, and the inside bricks well grouted, course by course, after the outer bricks had been laid and the joints closed to prevent the cement grout from running out. All important piers were finished 12 in. square, the bottom being started 29 in. x 29 in. Some of the lesser piers were finished 8 in. x 8 in., the lower courses being laid only 25 in. x 25 in. The engine foundation was constructed in the same manner, the base being made as wide as possible and the 2-in. stepping allowed to reach the above ground limits of the foundation.

The outboard bearing of the engine shaft was made of sufficient mass to require double the pull of the belt to overturn it. The ground friction on sides of pier was not taken into account, thus allowing that resistance, whatever it may be, to increase the factor of safety of 2, provided for above.

In laying out all walls, piers and machinery foundations, for which there were no templets, the method followed was to erect stout stakes well braced, and to nail on batter boards, the upper edges of which were 6 ft. above the top of the proposed wall, foundation or pier, provided that the proposed finish line was anywhere above the surface of the ground. This method was adopted in order that the batter boards might be up out of the way of the workmen, particularly the wheelers of brick and mortar. The batter boards were accurately leveled and the piers and walls could be worked directly to measurements from the batters, or from lines stretched tightly across them. Indeed, it is the custom of the masons in this part of the country to work levels altogether from lines very tightly stretched.

The writer heretofore has always had a prejudice against the working of levels in this manner, but from the results obtained, there certainly is something in the method worth getting acquainted with. The masons would stretch lines tightly over the high batters provided for them, and, saw cuts having been made for the lines to be drawn into, both for the finished walls or piers and for the footings of them as well, the stretched lines showed both the lines and the levels as well. With a stick cut to the proper length, the masons would measure from the line to the bottom of the excavation. The lower end of the stick was laid off with the number of courses of brickwork to be laid, so it was only necessary to level up to the lower end of the stick and then place the first layer of bricks ready for the grouting. As masons invariably lay bricks to a line, there is no reason why a line should not be used for arriving at the grade of several small piers between the ends of the line. With a little care in keeping up where the line sags, satisfactory work can be done with great ease and speed. It is not equal to transit and Y-level work, but it can be done in a manner entirely satisfactory and adequate to the requirements.

In laying out the work, all measurements were taken with wooden poles "rods" they are called in some places—made of ½-in. x 1-in. yellow pine planed on four sides and smoothed up, the corners being removed so as to show a face about 1/16 in. wide. A master rod 20 feet long was made up and kept in the engineer's headquarters. This rod was never allowed to be taken out and all rods used in the work were made from the master rod by clamping another rod along the master rod, and then squaring across at each footmark with a sharp penknife. In this manner, the use of rods too long or too short was entirely avoided. A considerable number of rods were made in order that no time should ever be lost in looking for a measuring stick.

One rod 12 ft. long was kept in the engineer's office for his personal use, as it is not conducive to morality to be obliged to chase around five or ten minutes for a measuring rod when a measurement is needed in a hurry. Two rods were kept at the lumber piles and not allowed to be taken away. One of these rods was 20 ft. long, the other one 12 ft., and each of these had the feet marked with paint, each alternate foot being painted white, the remaining number of feet being left the natural color of the wood, thus making it easy to determine the length of a 16 or 18-ft. board of timber without having to walk to the far end of it in order to read the rod. One of the worst things there is to contend with in this class of building—the short or the long rod, or both—was done away with, and accurate and speedy measurements provided for at all times.

As soon as the batter-boards above described had been erected and leveled, two main lines were drawn or stretched, one the central line of the main building, the other, the center line of the engine shaft. Or, two lines, one the center line of the engine, the other, the center line of the engine shaft, may be used if desired, but in this case, it was most convenient to use the center line of th building and run the shaft line at right angles thereto. In laying out these lines, great care was taken with the "squaring" of the two lines, which was done as follows:

Three boards were arranged just flush with the top edges of the batter boards, one of the boards being 12 ft., another 16 and the third 20 ft. long. Three rods were prepared and squared up very carefully as was the case with all rods made and used on the job. The rods were made to the lengths given above, viz.: 12, 16 and 20 ft. The two shorter rods were laid with one corner of each in contact with each other, on the three prepared boards mentioned above, and the 12-ft. rod was brought parallel with the main line to which the other line was to be squared. Thus arranged, the adjusting of the second line was to be done along the 16-ft. rod. The 20-ft. rod was then placed diagonally across from one of the shorter rods to the other, forming a right angled triangle with sides 12, 16 and 20 ft.

After very carefully adjusting the three rods and one of them to the line, the second or cross line was so adjusted that it was exactly parallel with the 16-ft. rod. The principle of this work lies in the fact that the three sides of a triangle made by the distances 6, 8 and 10, must contain a right angle invariably. Multiples of these numbers must also enclose a right angle at one of the rod intersections. By doubling the length of the sides, the possible error in laying out, is halved and the work rendered of sufficient accuracy for any type of factory.

When a line was wanted in any portion of the factory, all that was necessary was to locate one point in the line by its distance from the center line, marking the same on the batters, then measure off the same distance from the center line at the other end of the factory, mark on the batters, and stretch a line between the two marks thus made. Never was there any necessity for squaring another line during the construction of the factory—it was only necessary to measure from one or the other of the center lines in two places—draw a line between marks, and, there you are.

After the building was erected, the lines were both permanently marked on the timbers of the frame at opposite sides of the factory. This was done with both the lines, and it was only necessary to stretch a line between the marks thus made permanent, when it was desired to locate any shaft or machine from the plans of the factory. It proved a very desirable and accurate method of obtaining lines, and, taken in connection with the method of measuring with two graduated rods placed end to end, it proved one of the best ways—in fact the best—that the writer ever worked with.

In other articles the construction of the building, selection and installation of the machinery, operation of the plant, etc., will be taken up.

The Slide Rule as a Substitute for the Wire Table.

By Carl P. Nachod.

THE methods outlined in this article enable resistance calculations to be made with extreme rapidity, and yet each one has the accuracy consistent with the slide rule. They give complete information in the absence of the wire table. The wire sizes correspond to the Brown & Sharpe gauge. The slide rule referred to is a Faber, views of which are shown in the accompanying illustrations.

To find the resistance per 1,000 feet when the diameter in inches is given, and conversely.

The reading on the *C* scale over the end of the *D* scale is the diameter; and that on the *A* scale over the end of *B*, the resistance.

For instance, to find the resistance per 1,000 ft. of copper wire .032 in. in diameter, place 3.2 on *C* over the end of *D*, and read 9.77 ohms on *A* over the end of *B*.

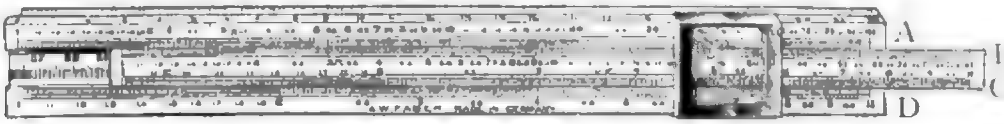


Fig. 1.—Front of Slide Rule.

The resistance so found is that at 11° C.; for other temperatures in place of using the end of *D*, place the diameter on *C* over one of the following constants on *D:*

Temperature C°	0	20	40	60
Constant	.98	1.02	1.055	1.095

If the resistance of some length other than 1,000 ft. is required, that resistance can be read on *A* over the given length on *B*. Thus at a single setting of the rule find the resistance of 438 ft. of .0179-in. wire at 20° C. Place 1.79 on *C* over 1.02 on *D*, and over 438 on *B* read the result on *A*, 14.2 ohms.

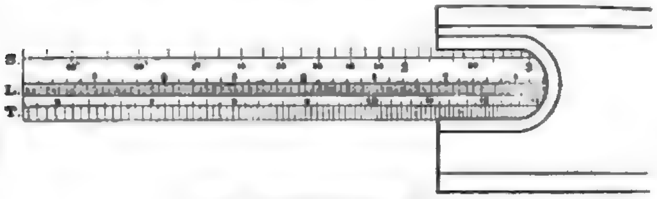


Fig. 2.—Reverse of Slide Rule.

To find the resistance per 1,000 ft. when the area in circular mils is given, and conversely. At 11° C. the fundamental formula reduces to $r = \frac{10,000}{\text{cm.}}$. At other temperatures the constant, instead of being 10,000 will have the following values:

Temperature C°	0	20	40	60
Constant	9,590	10,350	11,150	11,950

This formula, which is very convenient for the slide rule, needs no explanation.

To find the resistance per 1,000 ft. when the B. & S. size number is given, a method proposed by Y. Sakai (*Electric Journal*, Oct. 1905, p. 632) may be used: Divide the size number by 10, calling the integral part the characteristic, and the decimal fraction, the mantissa. Place the mantissa on the *L* scale over the index on the back of the rule. Turn the rule face up, and read the resistance on *D* under the end of *C*, pointing off a number of integral places equal to the characteristic.

For instance to find the resistance per 1,000 ft. of No. 25 wire, divide 25 by 10, which gives 2.5. Place 5 on the *L* scale over the index on the back, and read on the *D* scale, in front, 316. Pointing off two places according to the characteristic, the result is 31.6 ohms.

For No. 3-0, which may be expressed as No. -2 by continuation of the size number series negatively, dividing by 10 gives -.2; and converting this to a positive mantissa, it is equivalent to -1 + .8, or $\bar{1}.8$. Place 8 on the *L* scale, and read 631 on *D*, which is to be pointed off according to the characteristic -1 as .0631 ohms.

Of course if the resistance of, say, 1,250 ft. were required, we should read .079 ohms on *D*, under 1,250 on *C*, without changing the setting.

A peculiarity of the above method is that the value of the resistance so obtained is not at the same temperature for all sizes. For No. 4-0 it is at 27° C., and for No. 36 at 10° C., intermediate sizes being represented by a straight line law, so that a very simple relation connects the resistances so obtained with the size number and temperature, viz:

$$t = (36-n)\ .436 + 10$$

where t is the temperature, and n the size number. Applying this formula to the two cases above, gives 14.8° C. for the temperature coresponding to the resistance of the No. 25; and 26.6° C. for the No. 3-0.

Having the resistance at any known temperature, that at any other may be found from the familiar formula:

$$r_{t_2} = r_{t_1}\ [1 + a\ (t_2 - t_1)].$$

This is, however, not convenient for the slide rule; but an ingenious method by Miles Walker (*Electric Journal*, Nov., 1905, p. 694) is very rapid, and moreover includes the greater exactness of the variation of the temperature coefficient itself. The slide rule must be prepared by marking the *T* (tangent) scale as follows: Beginning at 23° 30′ as 0, and ending at 31° 50′ every fifth division is to be numbered so that the series of 11 of them read 0°, 10°, 20°, 30°......100° C. The remaining marks on the *T* scale are not to be considered. The slide is to be placed in the rule with the *T* scale next the *D;* then if the temperature on scale *T* is brought over the corresponding resistance on *D*, the resistance for any temperature may be read on the *D* scale under that temperature.

In the example above, having given the resistance 31.6 ohms at 14.8° C., that at say 20° is immediately obtained by placing 14.8 on *T* over 31.6 on *D*, and reading 32.2 under 20° on *T*. In the second case where the resistance is .0631 at 26.6° C., to reduce it to 20°, place 26.6 on *T* over .0631 on *D*, and under 20 on *T*, read .0616 ohms.

As an example of the sufficiency of these rules, and of the application of their converse, a calculation of a magnet winding is given without the use of the wire table.

Suppose the winding is to furnish 3,000 ampere-turns ($N\ I$) on a 110-volt (E) circuit, the winding space being 2 in. inside diameter, and 4 in. outside diameter; size of wire and axial length (L) of coil to be determined.

The mean turn (T) is $\frac{3 \times 3.14}{12} = .786$ ft. The resistance per 1,000 feet of the wire in the coil is

$$r = \frac{1{,}000\ E}{N\ I \times T} = \frac{1{,}000 \times 110}{3{,}000 \times .786} = 46.7 \text{ ohms.}$$

Placing the end of the *C* scale over 46.7, and turning the rule, we read on the back index 6.7. Since the number of integral places in the resistance is 2, this means 26.7, or No. 26 wire, for which the resistance is found to be 39.8 ohms at 14.4° C., by the method already described.

Assume 40° C. rise over an air temperature of 20, which gives a working temperature of 60°. Place 14.4 on *T* over 39.8 on *D*, and read 47 ohms on *D* under 60° on *T*. Comparing this with the resistance required, 46.7, shows No. 26 a trifle too small, but near enough for practical purposes.

The axial length of the coil is determined by temperature considerations. Let A_w equal the square inches of cylindrical radiating surface per watt, then

$$\textit{temperature rise} = \frac{100}{A_w}.$$

For 40° rise, $A_w = 2.5$.

To find the bare diameter of No. 26, place the end of *B* under 47, its resistance per 1,000 ft. at 60°, on *A*; and over the constant for 60°, 1.095, on *D*, read .01595 in. diameter on *C*. An allowance of 4.5 mils for the increase in diameter due to single cotton covering gives .02045 in. as the diameter over insulation.

Each linear inch of the winding, which is one inch deep, has $\frac{1}{(.02045)^2} = 2390$ turns. This, at .786 ft. per mean turn, equals 1,880 ft.; and has a resistance of $\frac{1880}{1000} \times 47 = 88.4$ ohms at 60° (r''). The cylindrical radiating surface per linear inch (a'') $= 3.14 \times 4 \times 1 = 12.56$ square inches.

The length of the coil may now be determined from the equation:

$$A_w = \frac{a'' L}{\frac{E^2}{r'' L}} = \frac{a'' r'' L^2}{E^2}$$

$$\text{or } L = \sqrt{\frac{A_w E^2}{a'' r''}} = \sqrt{\frac{2.5 \times 110^2}{12.56 \times 88.4}} = 5.23 \text{ inches.}$$

The total resistance of the coil is 5.23 × 88.4 = 462 ohms at 60° C.

Central Station Operation and District Supply at Hillsboro, Ill.

THE Hillsboro Electric Light & Power Company is one of the most progressive of the smaller central station companies operating in Illinois and enjoys the distinction of having constructed and put in operation the highest voltage, single-phase village-to-village transmission line yet built in that State. The station at Hillsboro now supplies the electric lighting system at Raymond, a distance of 15 miles over a single-phase, 16,000-volt transmission line.

THE CENTRAL STATION AT HILLSBORO.

Before going into the details of the transmission to Raymond, an account of the company's station and operating methods in Hillsboro will be in order. Hillsboro was credited by the census of 1900 with a population of 1937. From present appearances it has a population somewhere between 2,500 and 3,000. The company is fortunate in having a single uniform system of generation and distribution, this being by single-phase, 60-cycle, 1,100-volt current. With this system of distribution it handles all classes of power and lighting service. The power house has two generators, one of which is a 78-amp., 1,100-volt, 60-cycle alternator belted to a high-speed Chuse engine built at Mattoon, Ill. There is also one Westinghouse 45-amp. alternator belted to an Ideal engine. There are three horizontal return flue boilers, two of 80 rated horse-power and one of 150 hp.

The exterior of the power house is shown in Fig. 1. The water tower on the adjoining lot at the left belongs to the city and has no connection with this company's work. The engine room is 40 ft. by 60 ft., the boiler room 23 ft. by 52 ft. A limited amount of exhaust steam heating is done as the station is near the business district of Hillsboro. This exhaust steam heating service will be given to more customers as additional load is put on this station by the supplying of power to surrounding towns over transmission lines. The engine room which formerly contained a store room has now been relieved of this, which reduces the fire hazard and adds greatly to the appearance of the station. The building is of brick as can be seen in Fig. 1. The engine room floor which is now of wood will be replaced with one of concrete when the capacity of the station is enlarged as it will have to be soon to take care of the load. This will make a thoroughly fire-proof station. The arc lighting is done from an 128-kw Western Electric constant-current transformer and regulator. The company has connected thirty-nine 7-amp., 70-volt, alternating-current, series enclosed arcs. There is also one series of 10 incandescent lamps for alley lighting run off the 1,100-volt bus-bars. The maximum peak load in Hillsboro, not including the power transmitted to Raymond, is about 70 amp. The maximum daylight load in Hillsboro is about 25 amp. The average is much below this. Day service has been given for about three years. The operating force in this station consists of two engineers and one fireman. The connected incandescent load in Hillsboro is equivalent to 3,800 16-cp lamps.

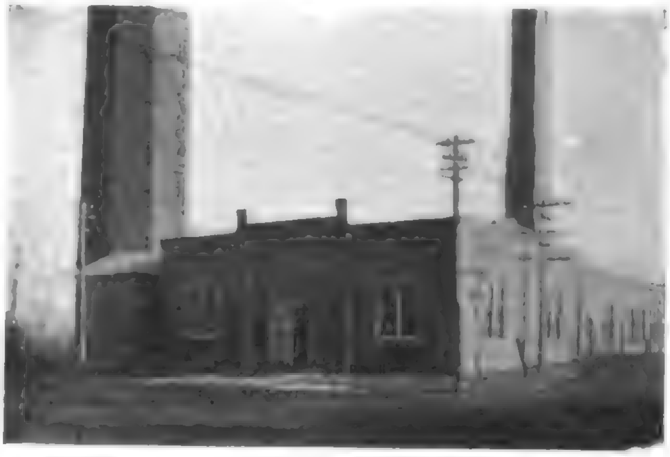


FIG. 1.—POWER STATION AND SUB-STATION AT HILLSBORO.

THE RAYMOND PLANT.

Raymond had a population of 906 in 1900 and is growing slowly. The plant in use at Raymond before the change consisted of one Chuse engine, one boiler and one alternating-current dynamo. The maximum load on the Raymond plant was about 30 amp. Two men were required to operate the plant.

THE HILLSBORO RAYMOND TRANSMISSION.

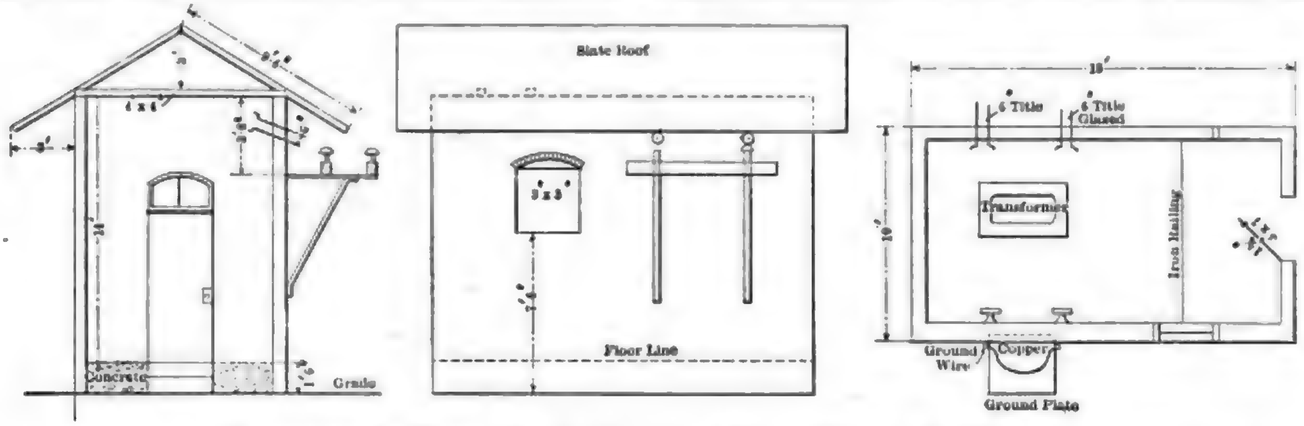
About the first of December, 1905, the Hillsboro Electric Light & Power Company, having completed the 16,500-volt single-phase transmission line between Hillsboro and Raymond, a distance of 15 miles, shut down the steam plant at Raymond and supplied that town entirely with power transmitted from Hillsboro. Figs. 2 and 3 show the transmission line near Raymond. The right of way is along the highway. Since the photographs Figs. 2 and 3 were taken, the telephone poles shown on the same side of the road as the transmission line have been moved by the electric light and power company to the opposite side of the road. There are 37 poles per mile. Cross-arms are shorter than usual, bringing the wires 18 inches apart. These were made short so as to make a substantial line construction without the use of cross arm braces. The wire is No. 8 hard-drawn copper. The insulators are the Lima Insulator Company's porcelain No. 22, 3 ins. high over all and 6 ins. in diameter. This line was built by the company at a remarkably low cost per mile, the cost of the transmission line exclusive of sub-stations and transformers being only $3,184 or $212 per mile of line.

The sub-stations in which are housed the lightning arresters and transformers at each end of this line are very substantial little buildings. The one at Hillsboro is seen adjoining the power house at the left in Fig. 1.—This is built of concrete block. The one at Raymond is of the same design but is built of brick. Figs. 4, 5 and 6 show the plan and elevations of the Raymond sub-station which occupies a ground space 10 x 18 ft. This is a thoroughly fireproof structure with plenty of room for the transformer and lightning arresters. The step-up and step-down transformers are oil-cooled Westinghouse of 50-kw capacity. The lightning arresters are also Westinghouse. Both transformers are designed for 16,500 volts on the high tension coil and 1,100 on the low tension. Each transformer has four different taps by which the ratio of transformation can be slightly varied to compensate for drop in the high tension line. As a matter of fact, the high tension line drop is so small that it has never yet been accurately determined.

FIG. 2.—TRANSMISSION LINE NEAR RAYMOND.

SAVING BY THE TRANSMISSION.

The point of most interest to other companies thinking of shutting down steam operated electric light plants in neighboring towns and supplying them over transmission lines is the economy of the proposition. Previous articles in this paper have given data on some of the other district supply systems in Illinois, but in the cases before described the distance of transmission has not been as great.



FIGS. 4, 5 AND 6.—END AND SIDE ELEVATIONS AND PLAN OF RAYMOND SUB-STATION.

The cost of the transmission line and sub-stations was $4,852 divided as follows:

Transmission line	$3,184
Transformers and lightning arresters	1,268
Sub-station buildings	400
Total	$4,852

The cost of the Raymond steam plant which, of course, was purchased along with the distributing system in Raymond, is estimated at $3,000. Of this about $1,000 is estimated as being lost entirely by the discontinuance of the plant, leaving an estimated value of the equipment in the plant of $1,650 and $350 for the buildings and plant.

In December, 1904, the Raymond plant burned $81 worth of coal at $1.75 per ton and the Hillsboro plant $146 worth of coal at from 70 cents to 85 cents per ton. The first month of operation of the transmission plant the Hillsboro plant burned approximately $152 worth of coal, carrying both the Hillsboro and the Raymond loads. Facilities were not at hand for making accurate determination of the amount of coal burned in a month at the Hillsboro plant on account of the condition of the coal bins. It is believed, however, that it did not take at most over $15 worth more of coal to carry the Raymond load than would have been required had the Raymond system not been connected. There is, therefore, a saving of nearly $67 per month in fuel by supplying the two towns from one station. As to labor, two men were formerly kept at Raymond to run the plant there. Now one man is sufficient at Raymond and, in fact, it would be possible to operate without any man at the Raymond sub-station. One man is being kept there, however, at the present time. As it is, a saving of $40 per month on labor at Raymond is being made. The saving made is, therefore, at least $107 per month which is amply sufficient to justify the investment in the transmission line. The additional load placed upon the Hillsboro power station comes at a most economical point on the engines. All of the fixed engine and boiler room losses were taken care of before the Raymond load was added, hence the low cost of fuel to carry the Raymond load. There are a number of other villages within transmission distance from Hillsboro which may some day be supplied from the Hillsboro plant.

FIG. 3.—TRANSMISSION LINE, HILLSBORO.

MISCELLANEOUS POINTS OF INTEREST.

In order to stimulate the fan business, the company keeps a stock of fans which it rents at $1 per month during the fan season. These are placed in store room during the winter months. The customer of course pays for what current he uses at the regular rates. Electric flat irons are rented at 50 cents per month. Four or five Emerson sewing machine motors are in use in Hillsboro. An interesting installation which offers a steady revenue is the electric lighting of the signal lamps at an interlocking switch plant of the Big Four Railroad at Hillsboro. There are 27 2-cp lamps located on switches and signals scattered over a distance one mile each way from the interlocking tower. The wire is placed in iron pipe conduit with a woven fabric lining. The signal lights are operated off the same transformer as the supervisor's office and depot.

The Westinghouse meter has been adopted by the company as its standard. Meters are checked for accuracy by comparison with a Wagner indicating wattmeter. This wattmeter is sent to St. Louis for calibration four times a year and is also used to check station instruments. This meter has a series transformer for use in checking meters of over 5 amperes capacity.

The rates are as follows:

Fifteen cents per kw-hour until the consumer has used 20 kw-hours; 10 cents per kw-hour for all over and above 20 kw-hours.

A meter rental of 25 cents per month is charged and no bill for current is less than 25 cents. This practically makes the minimum bill 50 cents per month. The meter rental is added to the amount charged for power until this amount reaches $2.50.

The gross income from Hillsboro and Raymond last year was about $23,500. This is remarkably good considering the population served, which is probably less than 4,500 and possibly will not be over 4,000. The total investment which the company has made to date amounts to approximately $48,000. Extensions and improvements since the plant was first built have been paid for out of the earnings rather than by increases in the capital stock, the owners preferring to invest the money in that way rather than take it out in the shape of dividends. The company is owned entirely in Hillsboro by a number of business men there. The management is under Mr. J. J. Frey, and the electrical and mechanical work is under the supervision of Mr. John T. Kester, superintendent. The company appears to have the nucleus for a valuable and substantial property and offers a good example for other companies operating in small towns to follow. It is Mr. Frey's general idea to extend the company's system to other villages and to add to the power house new and more economical apparatus from time to time, thus constantly improving the character of the investment and the economy of production and making it possible to employ the services of specialists in the various departments to a greater extent than is possible in the ordinary small country plant.

A Combined Electric and Gas Plant.

A good example of the beneficial results which follow a thorough reconstruction is furnished by the plant of the Meriden Electric Light Company, of Meriden, Conn. The company was incorporated in 1888 for serving the city of Meriden with arc and incandescent lights. A power plant was completed and placed in service the same year, furnishing direct-current series arc and 1,000-volt, alternating-current incandescent light and power on the independent transformer system. In 1807 the alternating-current incandescent system was changed to a 110-volt, three-wire Edison system, resulting in a reduction of the distribution losses of from 5 to 10 per cent, according to the load. In 1901 the business of the company had assumed such proportions as to necessitate additional power. The old equipment had practically reached the limit of usefulness, and the outlook for new business was so encouraging that it was decided to overhaul the entire system.

The power house is situated on the south bank of Harbor Brook and extends for some distance along the line of the New York, New Haven & Hartford Railroad. The site possesses excellent coal and water facilities, but by reason of the identity of interests between the electric light and gas plants, refuse coke is supplied by the latter plant for fuel. The old equipment consisted of six engines, some simple and some compound, all being run non-condensing. These were belted to Wood and T.-H. arc machines and T.-H. and Eddy generators having capacities of 25 to 40 kw.

In the process of reconstruction the old building was converted into a fire-proof structure and the insurance heretofore carried discontinued. The conversion of the power units was completed at seasons of light load whereby it became possible to shift sufficient incandescent load upon the other machines and make room for a 225-kw, direct-connected unit, consisting of a Westinghouse vertical compound engine and a three-wire generator. By transferring the load to the new unit, a second unit of 125 kw capacity was installed, which completed the incandescent equipment. By similarly transferring the arc load to an idle machine, space was cleared for a direct-connected alternator. The arc circuits were then successively transferred to the new system during the day, and the old series arcs were replaced by new alternating-current enclosed arc lamps.

By reason of the comparatively small size of the generating units, a central condensing system was installed. The common practice of mounting the engine and generator upon a single bed plate has been departed from and an important economy effected in the weight and cost of each unit. The three-wire machines operate in connection with balancing coils whereby the unbalanced current upon the neutral is returned to the armature winding. All the direct current is measured by meters inserted in the various distribution feeders, a voltmeter and multiple-point switch indicating the voltage at each center of distribution. The alternators generate two-phase, 60-cycle currents which are stepped up to 5,000 volts by transformers in the basement. The current then passes through constant-current regulators to the distributing panel.

Prior to the reconstruction of the plant 9.6 and 6.8-amp., open-arc lamps were used, the territory covered from a single station being within a one-mile circle. The line losses averaged about 20 per cent and the losses from the engine cylinder to the switchboard 30 per cent. By replacing the open arcs with 6.6 and 5.5-amp. enclosed arc lamps, the line losses were reduced one-third, and by changing from direct-current series to alternating-current series, the total efficiency was raised to over 75 per cent. This system was installed for street arcs, and commercial arcs were transferred as quickly as possible to the three-wire, direct-current system, so as to be more under the control of the customer and upon a meter rather than upon a flat-rate basis. The three-wire, 220-volt system was retained for the incandescent service; but the losses between the station and the distribution centers were considerably reduced by the addition of more copper. The power service is almost entirely upon the 220-volt system, and where this assumes large proportions special feeders are run from the station in order to prevent fluctuations upon the lighting mains.

Electrical energy is sold at a flat rate of 12½ cents per kw-hour without discount for lamps, and at a rate varying from 10 to 6 cents per kw-hour for motors, depending on the quantity used.

With the reconstruction of the plant with its resultant economies, and the addition of another unit, the management seems to rest content, no effort whatever being made by solicitation or advertising of any kind to push the sale of electrical energy. The union of the gas and electric interests precludes any semblance of rivalry or competition. The gas company advertises gas and employs a solicitor to increase the sale of gas stoves, but does not look with favor on Welsbach mantels or gas arcs. In return for this latter favor the electric light company purchases at a price equivalent to coal the coke which is a by-product of the gas company and which would otherwise have no market.

The electric light company carries a small stock of supplies and does a little wiring, there being no electrical supply store in the city. Lamps are renewed free of charge and meters are tested once in two years. A 24-hour service is maintained. The company has no lines outside the city limits and has a city contract to light the streets with 2,000-cp arcs at $120 per year.

It is significant that in a city of 30,000 inhabitants the number of customers for central station service is 450, and out of these but 12 are for residence lighting. Despite this inactivity the load has increased within the past year about 25 per cent.

The officers of the company are: W. Hubbard, president; S. Dodd, secretary-treasurer; C. A. Learned, manager and superintendent; J. W. Clark, chief engineer, and H. Minkwitz, chief electrician.

A Progressive Central Station.

The Hartford Electric Light Company, of Hartford, Conn., has ever been in the forefront among energetic and progressive electric generating concerns. It was, perhaps, the first central station to adopt modern methods of power transmission from water power; the first to use polyphase transmission apparatus; the first to introduce extensively alternating-current enclosed arc lamps, 60-cycle rotaries, and the constant-current, alternating arc-light system. It has led the way to the adoption of the steam-turbo-generator as a part of regular central-station equipment, and ushered the Nernst lamp into commercial being. The acumen of its officers has resulted in the Hartford company setting the central station pace of this country, and in the whole state of Connecticut there is not another company engaged in electric lighting which even approaches it in aggressiveness of management or stability of growth. "Hartford," said the electrical inspector at a recent meeting of the Board of Fire Underwriters, "Hartford stands far in the lead of any other city in the world in the use of electricity for light and power per capita."

The company operates five stations, each of which is connected to the Pearl Street station. Two of the power plants are operated by water and are located on the Farmington River at points about 3 miles apart, one at Poquonock and the other at Tariffville. The State Street station is a storage-battery plant and the Pearl Street station is now used as a distribution station. All of these stations have been described from time to time in these columns. The fifth station is located at Dutch Point on the Connecticut River and has only recently been completed. The equipment here consists of four steam-turbo-generators having a combined rated capacity of 6,000 kilowatts. A detailed description of this station will be found on page 447 of this issue

The water power stations generate 60-cycle, two-phase currents, at 500 volts which e.m.f. is stepped up to 10,000 volts, three-phase, in oil-cooled transformers for transmision to the Pearl Street station, where it is again transformed to 2,400 volts and lower for the rotaries, which deliver 220 and 110-volt current to an underground three-wire system supplying the main business section of the city. Two-phase, 60-cycle current at a potential of 2,400 volts is distributed to transformer sub-stations and suburbs of the city for lighting and motor service. At the State Street station the 2,400-volt current is transformed by rotaries into 220-volt, direct-current to feed either the storage battery or the underground three-wire system. At the transformer sub-stations devoted to the supply of alternating-current arc lamps on a series circuit, the 2,400-volt current is passed through constant-current transformers. The stations are all tied together so that it is possible to combine the outputs and give any station any desired portion of the total service load. Surplus energy from the water-power stations is absorbed by the storage battery in the State Street station and discharged into the three-wire network in the usual manner. Both alternating and direct-current circuits are maintained, the alternating-current motors being two-phase, 60-cycle machines.

The price of electrical energy for lighting purposes ranges from 13 to 10 cents per kw-hour, subject to a discount of 5 per cent for payment within 10 days from the receipt of bill, the minimum rate being $1 per month. No charge is made for incandescent lamps except for the initial installation and for those mechanically broken. The company requests the return of all lamps that are below rated candle-power, which they willingly exchange for new lamps. The price of electrical energy for motor purposes ranges from 6 cents per kw-hour down, the minimum rate being $1 per month. For its city arc lamps the company receives $70 per year and $18 per year for twin series incandescent lamps. Within the past three years the price of electrical energy for lignting has been reduced from 20 to 16 to 13 cents per kw-hour, and the result of every reduction has been an increase in the demand for service, especially among smaller consumers.

In its relations with its customers and with the general public the company is particularly fortunate, since it possesses the good will of both to an uncommon extent, and not without merit or reason. Complaints, which in almost all companies are looked after by a complaint clerk, are in the Hartford Electric Light Company looked after by an executive officer of the company, usually the secretary. The erstwhile arrogance of the ordinary complaint clerk thus gives place to the diplomacy of the executive officer, who allows no one to go away with a bitter feeling against the company. Before the adoption of this method of treating complaints at Hartford, these usually averaged about 165 monthly. How well the plan has worked may be judged from the fact that from April to September not a single complaint was received by the company. Meters are tested every year, and when a dispute arises touching the accuracy of the company's meter, the company makes a special test of the meter and gives the customer the exact finding in the case. Oftentimes the working of a meter is explained in detail to a customer, a number of lamps of known current consumption being switched into circuit and the record taken. Lights are then switched in or out and the customer convinced of the accuracy of the meter and also enlightened on some hitherto mysterious electrical phenomenon. Suggestions are made to the customer as to the proper use of light, where his lights are too large for the service required, and where lights of smaller candle-power might be installed to advantage. This frankness on the part of the electric light company is a revelation to many customers, and does not lose its reward.

In the matter of meter readings the company has adopted a plan which is worthy of adoption by other stations. The whole territory service is divided into districts, and the meters in a certain district are read on the same date every month. The bills are mailed the next night and in this way the company mails bills every day and not on one day of the month as is usual. The advantages of this plan are many. A customer in a district has his meter read, say, on the 10th of the month. The reading is turned in at the office at night, the computations made, and the next night the bill is mailed. The customer receives his bill on the morning of the 12th, and this is true of every customer in that district. In this way the customer knows exactly when his bill will arrive and in the case under discussion knows that his bill is for electric energy used from the 10th of the previous month to the 10th of the month in which he receives his bill. Meter readers are also kept in ignorance of the name of the customer whose meter they read, the meter being designated by number and location only. Meter readers are also changed about so that each man only goes over a certain district once in so often. By this means any personal feeling between a meter reader and a customer does not find an outlet in a bill. The company realizes that while a wrong reading may be easily rectified, its effect upon a customer is not so easily eradicated, and the plan has worked very well since its inception.

The use of water power and the economical methods of distribution have placed the Hartford Electric Light Company in an excellent position as regards effective competition with the gas company. The rate for gas in Hartford has been moderate for some years, being $1 per thousand cubic feet; nevertheless, the electric light company has fought gas on rates alone and increased its load at an exceptionally rapid rate. During the past year its increase in output was 10,447 incandescent lamps, 576 Nernst lamps, 1,746 "Meridian" lamps, 166 arc lamps and 597 hp in motors. In 1895 the number of arc lamps of all kinds connected was 917 and the number of incandescent lamps 7,070. In 1905 the total record for the year was as follows: 121,333 incandescent lamps 2,876 Nernst lamps, 4,570 "Meridian" lamps, 2,021 arc lamps and 5,556 hp in motors. In connection with this it should be stated that the population of Hartford is about 93,000 and that gas competition has been very keen.

The company finds little difficulty in vanquishing the gas "arc" with the Nernst lamp, the usual method being to place a Nernst lamp among a lot of gas "arc" lamps that have been put up, the service for the Nernst lamp being guaranteed to the user to be as cheap as gas. The result is that the gas arcs gradually disappear. The company has recently ordered a number of flaming arc lamps with which it expects to play havoc among the gas arcs. The company has also conducted a series of experiments on electric cooking and other household utensils, and as a result of these experiments, has suggested improvements to the manufacturers of this apparatus, whereby it is expected to remove this apparatus from the class of expensive luxuries to that of practical utility. The company contemplates in the near future starting an effective electric cooking campaign with apparatus using a minimum amount of current. It expects to build a large office building in the next year or two in which will be maintained a large and comprehensive show room. At present the company has none, nor does it make any pretense at any advertising aside from a satisfied customer and the daily press.

The company lights Hartford, East Hartford, Tariffville, West Hartford, Wethersfield and Windsor. The officers are as follows: A. C. Dunham, president; S. G. Dunham, vice-president; C. C. Cook, secretary; D. N. Barney, treasurer; C. M. Yale, purchasing agent; R. W. Rollins, manager; E. F. Lawton, superintendent; F. M. Wilbraham, chief engineer; F. W. Pruice, chief electrician, and W. L. Robb, consulting engineer.

The Milan, O., Municipal Plant.

The village of Milan, Ohio, the birthplace of Thomas A. Edison, has a municipal lighting plant which, viewed from the standpoint of the village authorities, is considered a profitable investment, although to a private corporation it might be considered the reverse. The village has a population of about 800. Twenty years ago it installed a water works system consisting of half a mile of mains supplied by a million-gallon tandem compound pumping engine, which even at present is about three times the pumping capacity required for the service. The pump runs from 5.30 a.m. to 7.30 p.m. and requires the services of but one man. The town received a small revenue from water customers, but a great benefit is from the fire protection which has cut the insurance rates down considerably. Excellent soft water was obtained from a flowing spring around which a well was built. The original investment was about $10,000.

Several years ago it was decided to install municipal lighting and the pumping station was enlarged somewhat, another boiler installed together with an engine and generator, the outlay being about $6,500 for the entire installation, including wires and lamps. There are two 100-hp Erie boilers, a 85-hp Noye engine and a 60-kw, single-phase, 133-cycle, 1,100-volt Warren generator. There are 28 Adams-Bagnall 110-volt multiple arc lamps in the village, practically every street intersection having a lamp. The lamps are run on a moonlight schedule from dark to 12 midnight, and from 5 a.m. to daylight. There is no day circuit.

One factory, all the stores and about half the houses are illuminated, there being no gas in the town. Residences are metered while for places of business there is a flat rate of 50 cents per month per lamp for five lamps and 40 cents for additional lamps. No power is supplied. The peak of the incandescent load is about 15 amperes. One boiler handles the work nicely and each is operated on alternate months. Fuel costs $2.30 per ton delivered and about 1½ tons per day are used during the winter. It is claimed that the quality of the arc lighting is excellent; an expert who recently made tests in this part of the state read a certain type 124 ft. from the lamp, or 14 ft. farther than in the case of any similar service in this district.

For a time the returns from the lighting plant were not very satisfactory, but the present administration instituted economies that have made a decided improvement. Current for residence and commercial service was raised from 8 to 10 cents per kw-hour, and at the same time the number of customers was increased by solicitation. The charge to the village for arc lighting was increased from $700 to $1,500 or $53.64 per lamp. The practice of selling supplies and wiring houses has been dispensed with. Formerly this was done at cost and there were many leaks. The office of superintendent was dispensed with. The village clerk, Mr. F. A. Roberts, is manager and attends to the business, devoting only part of his time to it. Only two men are employed on the system. One engineer works 14 hours, from 5 a. m., operating the plant and attending to inside repair work, winding coils, etc. The other man goes on at noon and works until 12 midnight, spending the afternoon in outside work, and from 7 p. m. to midnight in the plant. The following financial statement for 1905 was supplied by the manager:

Water rentals	$246
Commercial lighting	1,629
Charge for arcs	1,500
Total receipts	$3,375
Operating expenses	3,255
Surplus	$120

No allowance was made for interest and depreciation, which at 10 per cent on an investment of $16,500 would be $1,650. Adding this to the $1,500 charged to the village for lighting it might be considered that the 28 lamps cost the village an inordinate sum. But the village fathers feeling that they are only paying about 50 per cent more than they formerly paid for the water works service alone, and considering the excellence of the lighting service and the convenience to the people, are well satisfied with the arrangement.

A Lilliput Central Station.

The question has often been asked—what is the minimum size of town that will support a lighting plant? That there are thousands of small villages or hamlets all over the country where an enterprising man could make a fair living by operating a small lighting plant is shown by the history of the Burton, O., central station. Burton is a pretty little village of 700 population located in the hilly district of the Western Reserve, about 30 miles from Cleveland. This is a dairy farming country, the town is an old one, there is little or no manufacturing, and the people are fairly prosperous.

The history of the plant dates back nearly ten years when Mr. Earl C. Bliss left the village to enter the electrical engineering course at Case School in Cleveland. After two years he was obliged to leave school and go to work. He spent about a year in the machine shop of a prominent engineering concern and during that time he saved about $125. With this capital he went back to his home and made a proposition to the village fathers to light the town. With considerable scepticism they gave him a franchise and a contract for one arc lamp in the center of the public square. His first investment was for an old traction combined engine and boiler, a small second-hand generator, some wire and a few lamps. His plant he set up in the basement of an old building in the heart of the town. Gradually he secured new business and improved his plant. At present his outfit consists of a 50-hp Erie boiler, a 50-hp Erie engine, one 20-kw Akron, one 15-kw Peerless and one 7½-kw Westinghouse generator, all belted and generating direct-current at 125 volts.

Mr. Bliss did all his own work of setting up the machinery, wiring the building, built his own switchboard, equipping it with Norton instruments, built a boiler feed-pump, heater, etc. He operates the entire business without assistance, fires the boiler, strings the wires, wires buildings, trims and repairs lamps, keeps the books and collects the bills. Once a year for ten days he hires a substitute to run the plant while he takes a vacation, but the balance of the year he is on duty about 14 hours a day. He now owns the building where the plant is located, has paid for all his outfit and has a home nearly paid for, all out of his earnings of the plant. Of course, with some assistance he might have time to engage in other business, but he prefers to devote his entire time to keeping his system in first-class condition and improving his business.

At present the load consists of two arc lamps at $60 per year, 54 incandescent street lamps at $6 per year and four commercial arcs at $60. All the stores, the town hall, several churches and about 50 residences are illuminated by incandescents. Formerly all lights were on a flat rate, but the first of this year Mr. Bliss adopted a meter rate of 15 cents per kw-hour for residences and 10 cents for churches and places of business. This has cut out considerable waste and increased his income proportionately. The announcement of the change in policy was made on the back of a handsome calendar at the first of the year and circulated to all the townspeople, attracting considerable attention. He uses an electrolytic meter manufactured by the Helios Company, Philadelphia, a simple and inexpensive device which has proven very satisfactory. Meters are installed on payment of $10 which is returned when the meters are returned in good condition. If used less than one year, $1 is deducted from the refund.

Findlay, O., Lighting and Steam Heating Plant.

A number of lighting companies in Ohio are operating hot water or steam heating plants in connection with their stations and in the majority of cases this is proving a considerable source of revenue with but little additional operating expense.

An interesting combination of this character is conducted at Findlay, Ohio, by the Toledo, Bowling Green & Southern Traction Company, which several years ago absorbed the local street railway system and the Hancock Light & Power Company. Up to very recently the railway and lighting systems were supplied from separate plants. A year or so ago the 50-mile interurban portion of the system was extended and it was decided to erect a large central power station to take care of all of the railway system, displacing several small scattered plants, and at the same time take care of the local lighting load. Large units were provided to take care of both classes of service, and provision was made in the plans for a hot water heating system.

The new station is in the heart of the business district of Findlay, a city of 25,000 inhabitants. Boiler feed and condensing water is pumped from the Blanchard River, a distance of 2,000 ft., through a 16-in. main. The main generating units are two 1,000-kw, revolving-field, General Electric alternators, producing 25-cycle, 380-volt, three-phase current, driven by 26x52x48-in. McIntosh-Seymour cross-compound condensing engines. Exciting current is furnished by 50-kw, 125-volt, direct-current generators belted to the fly-wheels of the large engines. There are six 250-hp Aultman-Taylor water-tube boilers designed for 250 lbs. steam pressure, and fired by Jones underfeed stokers. Forced draft is supplied by two 15-ft. fans, which operate in connection with a Green fuel economizer plant. Fuel is delivered into the building by a traveling hoist with clam shell bucket which takes coal from the cars and dumps it into overhead bins.

In the old plant, which immediately adjoins the new one, the engines were non-condensing and the exhaust steam was used to heat the water for the heating system. In the new plant it was desirable to operate condensing and in order to dispense with additional heaters for the heating system it was decided to use the condenser discharge for this purpose. Wheeler surface condensers having 3,200 sq. ft. of surface, considerably larger than would be necessary under ordinary conditions, were placed under each engine. The condensers have two inlets and two outlets and are divided into four sections and the various mains have manifold valves for varying the intake and discharge in the four sections. During cold weather the larger portion of the discharge passes out through one of the upper sections, and after passing through the heating system, returns in a cooled condition and enters at the corresponding lower section and is used over again. Cold water from the river intake enters at the bottom of the other half and is discharged to the sewer at the corresponding upper section. By decreasing the amount of cold water admitted to the condenser from the river intake, the temperature of the hot water system is increased. The maximum temperature which it is possible to obtain from the discharge water is 170°, and the drop in the lines is about 30°. It is, of course, impossible to obtain the highest vacuum with water at this temperature, but it is figured that the loss in efficiency is more than compensated for by the extra revenue derived from the heating system, which is considered to have a great advantage over the old scheme when the exhaust heat was wasted for more than half the year. It also serves to balance the load the year around because the system has the peculiarity of having a lighter load for both lighting and railway service during the winter months than in the summer. This is accounted for by the heavy summer traffic and more frequent service on the interurban lines and by reason of the fact that a great deal of natural gas is used in Findlay. Many people use this for illuminating in winter as it helps heat the houses and in summer they use electric lights, which are cooler.

In regulating the heating system the power house engineer observes the outside atmosphere and brings the vacuum to a certain point by varying the supply of cold water to the condenser. By a table which has been figured out, an outside atmosphere of, say, 20°, calls for a vacuum of 21 in. to give a temperature of 165° to the outgoing condenser discharge. The table is shown herewith:

Temp. of Air.	Temp. of Water.	Ins. Vac.
60	120	26½
50	130	25½
40	140	24
32	150	22
30	155	21½
25	160	21
20	165	19
15	170	18
10	175	16
5	180	14
0	190	8
—5	200	0

When it is necessary to raise the temperature of the water above 170° additional hot water is supplied by firing a boiler in the old plant, which has been retained, and the water is passed directly through this. The circulation of the hot water is taken care of by a pair of 14 by 12 by 18 Laidlaw-Dunn-Gordon pumps in the old boiler room.

The hot water system is known as the Yaryan system, consisting of duplicate pipes ranging from 10 in. to 4 in. in diameter. The system covers something over four square miles with a maximum distance from the station of 1½ miles, and serves all the business section and a considerable part of the residence district. The mains are laid side by side in cypress boxes, the casings being filled with oiled shavings and covered inside and out with tarred paper. Beneath the box is a drain pipe. Houses and buildings are heated at a flat rate based on 15 cents per sq. ft. of radiation; in determining the radiation allowance is made for storm doors, vestibules, weather strips and other protections. Bills are payable as follows: 5 per cent. October 1, 15 per cent November 1, 20 per cent December 1, 20 per cent January 1, 20 per cent February 1, 15 per cent March 1. The contract provides for a temperature of 70°, water to enter the building at 140° when the weather is freezing and to be raised 1° with each 1° drop of temperature. There is a thermostat on each house line arranged to be cut on or off at any temperature. In estimating radiation the company makes a liberal allowance over what is actually required, which is a protection against complaints and enables it to use a lower temperature of water than is called for in the schedule. The original installation cost about $40,000. The receipts from the system during the present season will be about $10,000. It is stated that the scheme used under normal conditions for, say, three months in the year, effects a saving of $20 per day over what would be required to heat the water direct from a boiler. The new scheme is considered very satisfactory and this branch of the business is increasing rapidly. The average electrical daily output is about 20,000 kw-hours, of which about 5,000 kw-hours are used in the lighting service. The current for lighting is passed through two frequency changers consisting of 330-kw, 25-cycle, 370-volt, three-phase synchronous motors direct-connected to 300-kw, 60-cycle, three-phase generators. The voltage of 380 is raised to 1,150 volts for the incandescent circuits and to 5,000 volts for the city lighting, this latter current passing through five 50-light air-cooled "tub" transformers. The company has the city lighting contract and operates 196 street arcs of the General Electric series arc type, using 6.6 amp. at 72 volts, arranged in four circuits. The rate is $69.50 all-night, every-night schedule. In addition there are about 70 arcs in stores and other places. The incandescent lighting is on the three-phase, three-wire, 110-volt system and the company supplies several hundred horse-power of motors, some of them being of the alternating-current type on the lighting circuit and others 550-volt, direct-current motors on the railway circuits. Residences are supplied at 10 cents per kw-hour, business places at 8 cents and power at 7 cents, with discounts of 5 per cent for cash before the 10th of the month, and for quantity up to 30 per cent. All flat rate service has been discontinued and everything is now metered. The grouping of transformers is now being carried out as rapidly as possible. Store and sign lighting has been pushed with success and a number of time switches are in use.

Owing to the presence in this district of an ample supply of a very good quality of natural gas which is sold at 25 cents per thousand cubic feet, it is difficult to develop the house lighting business, but the arguments of superior cleanliness, healthfulness and convenience of the electric light frequently win them recognition, especially among the better class of people. As stated, many people use electricity in summer and gas in winter. The accompanying table shows the earnings of the various branches of the company's business for the past year:

Interurban railway	$212,170
Local railway	36,921
Light and power	50,598
Heating	7,881
	$307,590

Until recently the company did all of its own installation work, both in the lighting and heating lines, but recently it has turned this work over to construction companies formed by former employees.

High Efficiency Small Carbon Arc Lamps in Chicago.

The Chicago Edison Company, as before noted in these columns, has adopted smaller carbons than those commonly in use for its direct-current arc lamps, thereby securing a marked increase in the amount of light obtained with a given consumption of energy as well as a whiter light. The light is also much more steady than with larger carbons because the arc cannot wander. The size carbon adopted is 5/16 in. On a 3.5-amp. lamp the use of 5/16-in. carbons as compared to the usual ½-in. carbons, gives a consumption of 2.2 watts per candle, as against 3.4 watts with the ½-in. carbons or an increase of 50 per cent in light. These 5/16-in. carbons can now be obtained from American manufacturers. It is necessary to change the lamps slightly to use the smaller carbons and this is done in the company's repair department. The G.-I. arc lamp is used. The gain in steadiness and efficiency is found to be of much importance, especially in meeting the competition of gas arc lamps. The company is now obtaining a life of about 100 hours from the 5/16-in. carbons. Smaller carbons do not blacken the inner globes in a given number of hours of burning as much as do the larger carbons. With large carbons in use it was necessary formerly in order to secure good efficiency to clean the inner globes every 70 hours, or once between each trimming. It is now unnecessary to clean between trimmings. The increase of efficiency by the use of smaller carbons as well as the greater steadiness and improved color of the light due to the fact that there is not such a preponderance of violet rays are matter upon which laboratory tests are hardly necessary as they are apparent even to the casual observer. Before 5/16-in. carbons were made the company's standard, the matter was exhaustively tested by Mr. George N. Eastman, of that company's testing department, and the tests have been referred to a number of times in these columns. (See issue of April 8, 1905, page 670, and April 15, 1905, page 722.) Some alternating-current arc lamps have also been equipped and put in service with 5/16-in. carbons with great improvements in the illumination, although no laboratory tests on alternating-current lamps with these carbons have yet been made public.

Cable Splicing.

In a paper describing the underground construction as used in an electric lighting and power system at La Crosse, Wis., which was read by Mr. W. D. Burford before the Northwestern Electrical Association at Chicago, much valuable information was given concerning the splicing of electric cables for supplying power to lamps and motors.

Preparatory to splicing the cable, it is first carefully trained around the wall of the manhole in such a manner as to occupy as little space as possible. The ends of the cable are then sawed off in such a manner that the two ends meet. The sheath is removed for a distance of 15 in., 8 in. from one end and 7 in. from the other. A lead cylinder 18 in. long and 3 in. in diameter with 3/16-in. wall is then slipped over one end of the cable and back out of the way. The diameter of this cylinder, of course, is governed by the size of the cable. The dimensions given above are for a 100,000-c.m. splice. Paper tubes of sufficient diameter to fit closely over the conductors are now slipped over each conductor, on the 8-in. end, and a large paper cylinder of sufficient diameter to contain these three paper tubes is slipped over the whole cable, and back out of the way.

The next operation after slipping these paper tubes over the conductors is the removal of 1½ in. of the paper insulation from the end of each conductor. The conductors are then joined together by slotted copper cylinders 2½ in. in length and of a sufficient diameter to fit snugly over the conductors. These connectors are carefully sweated with melted tin poured from a ladle, all surplus tin is wiped off, particular care being used to prevent the formation of any teats or needles. The joint is then allowed to cool and is painted with a hot solution of No. 1 Minerallac, and is served with sufficient Empire tape to fill up the joints to a level with the adjoining paper insulation. After taping the joints, the paper tubes are slipped over the joints, and the large paper belt is slipped over the entire work binding the three paper tubes firmly together and serving to doubly insulate the connections from the lead sheath and secure the work against accidental slipping of the inner tubes. The large lead cylinder, previously mentioned, is now slipped over the completed splice, the ends are dressed down to a close fit on the lead sheath of the cable and a regular plumber's joint is wiped on either end. Two cuts are now made at right angles to each other on the top side of the lead cylinder and about six inches from one end which allows of turning up a lip of lead. This opens a hole in the sleeve through which the splice is completely filled with No. 2 Minerallac or high grade paraffine. The splice is allowed to cool, then refilled until all air is expelled. The lip is hammered down flush and securely sealed with a soldering iron. This completes the splice which is suspended on the wall of the manhole from suitable cable supports which are driven into holes drilled in the brick wall of the manhole and plugged with wooden plugs.

The making of branch or tap splices is a much more difficult matter requiring greater skill on the part of the splicer. No paper tubes are used in these splices. The insulation being secured by the use of Empire tape. A special copper connector is used, formed in such a manner as to accommodate the three or four conductors as the case may be. These joints are made up in such a manner as to be staggered at intervals of three inches apart along the splice. This prevents the splice becoming too bulky and also insures a higher insulation. Great care must be used in making both kinds of splices not to bend the individual conductors abruptly as there is considerable danger of weakening the paper insulation at the point where the lead sheath is removed. In branch splices the joints are wiped in the same manner as previously described, excepting that the joint wiped at one end is termed a "Y" joint.

The upper end of a lateral cable is equipped with a discharge bell sometimes termed a pot head. The purpose of this discharge bell is to seal the end of the cable hermetically and bring the conductors out in a manner convenient for connections to the primary service boxes. This head is in three parts, the base being of cast brass 4½ in. in diameter with a hole in the lower end threaded in such a manner as to make a tight fit on the cable. After the cable is properly bent into position five inches of the sheath is removed. This brass casting is slipped down over the cable with the large end up. It is then screwed down on the lead sheath, the threads cutting their way into the lead for a distance of about ½ in. along the sheath. This makes an air-tight connection and does away with the necessity of a wiped joint at this point. The three conductors are now bared for a distance of 1½ in. and are spliced to heavy rubber-covered braided wire of sufficient length to reach the primary service boxes.

The joints between these rubber covered wires and the cable conductors are spliced in exactly the same manner as the straight splices, paper sleeves being used of sufficient diameter to slide back over the rubber insulation. When the splice is completed, as described, a brass shell 4½ in. in diameter and 9 in. long threaded at one end to fit a female thread in the top end of the brass casting previously mentioned, is then slipped over the ends of the rubber covered wire and screwed into the brass casting. A copper hood made of 16 gauge sheet copper and formed in the shape of a quarter section of a ball is slipped over the top of the frame, the lower edge of it extending slightly below the horizontal shelf and being tacked in position with iron tacks. This copper hood makes the discharge bell absolutely water, snow and insect proof.

Residence Wiring.

By Louis J. Auerbacher.

THE electrical equipment of a residence presents a number of problems which, if successfully solved, add much to the income of the contractor and to the comfort of the inmates. The method of equipping and wiring a house depends, first, on the cost of the installation, and second, on the construction of the building. Buildings of wood frame construction, especially those in the suburban districts, are often wired by means of the open wire, porcelain knob or tube method. This is the least expensive method of wiring, and though the writer does not recommend it, it is nevertheless largely employed. Other methods of wiring a house in course of construction employ flexible fiber conduits, steel spiral armored conductors, flexible steel tube, and solid iron conduits. In case the building is of fireproof construction, having steel beams and fireproof brick partitions, flexible steel conduits, or solid iron conduits are the only means available.

One of the most important and most profitable branches of residence work is the wiring of old houses which are being remodeled. In houses having wooden partitions flexible steel armored conductors are especially applicable. These can be readily fished from outlet to outlet and in addition to making a neat job make a safe one.

Below are given sample specifications for the electrical equipment of a four-story and basement house having wooden floors and partitions. There is nothing technical about these specifications so that a contractor can submit them to a customer without any danger of their full intent and meaning being misunderstood.

In addition to the ordinary lighting equipment there are given in special paragraphs, specifications for the installation of devices which, though not essential to the equipment, are nevertheless much used. These special devices, if properly installed, are a source of much profit to a contractor. Following the specifications is an analysis of the various paragraphs. In case of special apparatus, drawings, wiring diagrams and detailed description are given.

SAMPLE SPECIFICATIONS.

Scope of Contract.

These specifications and the contract thereunder are intended to cover a complete electric lighting system, and include all the material and labor necessary to put the specified equipment in proper working order, but do not include the supplying or installing of the fixtures.

System.

The system of wiring shall be that known as the three-wire system, having 240 volts between the outside wires and 120 volts between the neutral and outside wires

Main Service Wires.

From a point in the cellar where the illuminating company brings in its service wires to its service cut-outs, will be run a main wire which shall have sufficient capacity to carry the specified equipment with a loss not to exceed 2 per cent at the farthest outlet from the service wire, when all the lights are turned on. This main wire will terminate in a service panel board and shall be run in iron conduits.

Service Panel.

There shall be located in the basement a service panel of marbleized slate, upon which shall be mounted one three-pole single-throw knife switch of 100 amperes capacity, and fitted with enclosed fuses. There shall also be mounted on this board a double-pole single-throw fused switch to control the motor circuit. There shall be space left on this board for the meter which the illuminating company will furnish and install.

Power Panel.

There shall be located in the motor room a power panel which shall be made of marbleized slate, upon which shall be mounted four 50-ampere, double-pole, fused knife switches.

Feeders.

There shall be installed three feeders for electric lighting, as follows:

Feeder No. 1, to run from service board, through flexible steel conduits to the panel located on the first floor. Feeder No. 2 shall run from the service panel through flexibl-steel conduits to the panel located on the second floor. Feeder No. 3 shall run from the service panel, in flexible steel conduits to the panel on the third floor. Feeder No. 4, for power work shall run to the power panel in the elevator room, in flexible steel conduits.

Panelboards.

There shall be installed in the closet under the stairway on the first floor, a panelbox which will control the various circuits on the first and basement floors. There shall be installed on the second floor a panelbox to control the various circuits on the second floor. There shall be installed on the third floor a panelbox to control the various circuits on the third and fourth floors. The banelboards are to consist of marbleized slate upon which shall be mounted the bus-bars, switches and fuses. Each circuit is to be controlled by a separate switch and the fuses are to be of the plug type. There is to be supplied two additional circuits on each panel to provide for future extensions. These panelboards are to be set in boxes which shall be lined with 1/16-in. sheet-iron, which sheet-iron shall be painted with a moisture repellant paint. There shall be a 4-in. gutter surrounding the panelboards and the contractor is to supply an extra set of fuses of the proper capacity.

All switches are to be properly labeled, and there shall be a directory showing which circuit each switch controls.

There shall be furnished hardwood trims having door with tumbler lock and key. These trims are to match the surrounding wood work, and are to be set flush with the wall.

Circuit Wiring.

From the panelboards as specified, shall radiate the various circuits supplying different outlets throughout the house. The circuit wiring shall be done with flexible steel-armored conductors. Each circuit is to feed not more than 10 lights of 16-cp each, excepting where an outlet has 12 such lights. These conductors are to run from outlet to outlet without being spliced or tapped, and shall terminate in an improved iron outlet box. Outlet boxes shall be of cast-iron and neatly and securely mounted so as to be flush with the plaster and hold a fixture of reasonable weight.

Switches.

There shall be installed as indicated on the plans and as enumerated below, flush switches which shall be of the ——, or an equally good type. These switches are to be placed in improved steel outlet boxes, which set in the walls flush with the trim. They are to be furnished with surface plates to match the surrounding hardware.

Receptacles.

There shall be installed in locations described on plans, and as enumerated below, flush wall receptacles which shall be of the —— type. These receptacles shall be set in the surbase or trim, in locations as directed. These receptacles shall be set in steel outlet boxes and have surface plates to match the surrounding hardware. They shall also be supplied with the proper plug connections ready for the extension cords.

Damage Clause.

All wiring specified is to be installed so as not to damage the walls or ceilings except where rooms have side outlets, and where these side outlets are located on brick walls. In this case it is necessary to channel the walls, and the contractor is not to be held responsible for this damage.

SPECIAL EQUIPMENT.

SUMMARY OF OUTLETS.

	Side Outlets.	No. of Lamps.	Center Outlets.	No. of Lamps.	Switches.	Receptacle.
Cellar	2	2	1	1		
Kitchen	2	4	1	2	1	
Laundry	1	1	1	1		
Servant's room..			1	2	1	
Toilet	1	1				
Rear hall	1	1				
Front hall ...	2	2				
1st floor.						
Vestibule			1	3		
Reception hall...	3	6			1	2
Parlor	4	12			2	3
Dining-room ...	4	12	1	8	2	2
Pantry	1	1	1	1		
Rear hall	1	1				
2nd floor						
Library	4	12	1	6	2	2
Music room	2	4	1	4	1	
Owner's bedroom	2	6	1	6	2	1
Bedroom	2	4	1	4	1	
Bedroom	2	2	1	1	1	1
Front hall.......	2	2				
Rear hall.......	1	1				
3rd floor.						
Bedroom	2	6	1	3	1	
Bedroom	2	6	1	3	1	
Bedroom	2	4	1	2		
Bathroom	1	2				
Nursery	2	4	1	3		
Rear hall.......	1	1				
Front hall......	2	2				
4th floor.						
Servant's room..	1	1				
Servant's room..	1	1				
Servant's room .	1	1				
Hall	1	1				
Bathroom	1	1				
Billiard room....	2	4				
Store room.....	1	1				
Summary	57	99	17	54	16	13

Inspection.

All work to be done according to the rules and regulations of the National Board of Fire Underwriters and any local boards having jurisdiction. The contract is not to be considered complete until proper certificates have been furnished.

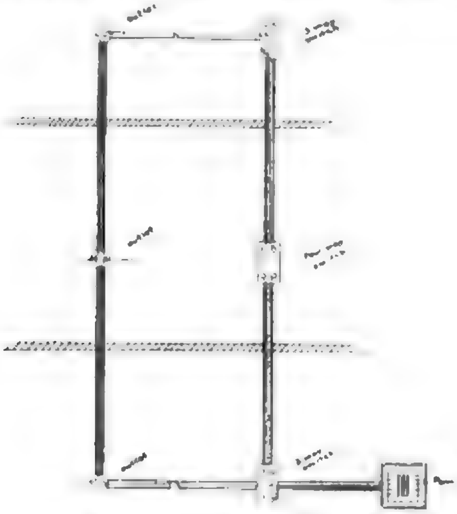


FIG. 1.—ARRANGEMENT OF HALL LIGHTS.

Below are given specifications for a number of special devices which are very frequently used:

Electric Pump.

There shall be furnished and installed in the cellar one electric pump which shall be of sufficient capacity to pump 500 gallons of water per minute. The motor shall be of ½ hp capacity and directly connected to the pump. This motor is to be automatically controlled by a tank switch and float, which should be located on the tank on the roof. The tank switch is to be housed so as to protect it from the elements. There shall be located at a point convenient to the pump, a switch, by means of which the motor can be operated independently of the tank switch. All wires connecting the automatic tank switch with the motor shall be run from the cellar to the roof in flexible steel conduits. There is to be supplied with the pump the usual manufacturer's guarantee, and all necessary fittings. Price does not include the connecting of the pump to the water supply. All piping is to be done by other contractors.

Electric Heating Apparatus.

There shall be furnished and installed in the butler's pantry, a plate warmer of —— inches, having two shelves. These shelves are to contain the necessary apparatus for heating the plate warmer to —— degrees Fahr. in —— minutes. This plate warmer is to be controlled by a switch so that either can be used singly, or both at once. There is to be installed a proper indicating switch, having sufficient capacity to carry the current. There shall be run from the switch controlling this plate warmer, to the power panelboard in the basement floor, wires of sufficient capacity to carry the current necessary to supply the heater. These wires are to run in a flexible steel conduit.

Sad Irons.

There shall be furnished and installed in the laundry a holder which shall take six irons, and which is electrically heated. This holder shall be controlled by an indicating switch and shall be connected to the lighting panel on the first floor. There shall also be furnished a single self-contained electrically-heated iron, having a flexible cord which can be attached by means of a —— plug. This iron shall be 8 in. long and weigh 6 lbs. The handle is to be so arranged that the iron is cut out of circuit when released by the operator.

Hall Lights.

There shall be installed in each hall an outlet for an electric light, as shown by Fig. 1, controlled by "four-way" switches; so that it shall be possible to light the lights in each of the halls by pushing a switch button in any hall, or extinguish all the lights in the halls by pushing the turn-off button of any of the "four-way" switches in the halls. These switches shall be of the —— type, set flush with the wall in iron outlet boxes, and shall be controlled from the first floor panel. All wiring for same is to be done with flexible steel-armored conductors.

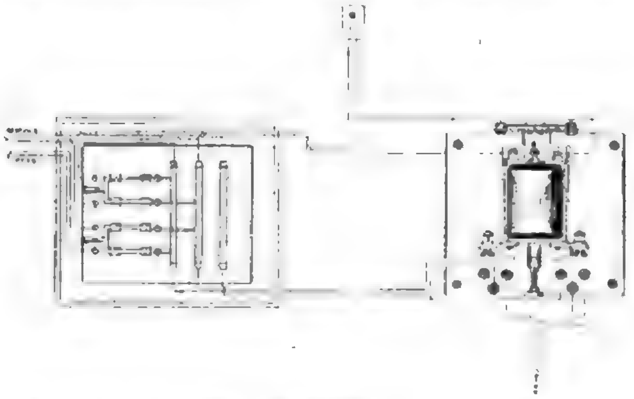


FIG. 2.—SOLENOID SWITCH TO CONTROL ALL LIGHTS OPERATED BY A SINGLE PUSH SWITCH.

Closet Lights.

There shall be installed in the three closets herein specified, closet switches. These switches shall be set in the door-jambs of the closets in iron boxes. They are to be arranged so that upon opening a closet door a switch will light a lamp placed inside the closet. This lamp shall be mounted in a key receptacle, which in turn shall be mounted on an iron outlet box by means of a suitable plate. All wiring to be done with steel-armored conductors.

Automatic Main Switches.

There shall be located on the service panel in the cellar a three-pole automatic solenoid switch which shall be connected in the main circuit so as to control all the lights in the house, except the hall lights. This automatic solenoid switch is to be operated by a switch located in the owner's bedroom, as indicated in Fig. 2, and is to be arranged so that by pressing the "off" button all lights excepting the hall lights will be disconnected from the service. The solenoid switch shall be rigidly mounted on a back board and shall be enclosed in an iron-lined box. There shall be furnished in connection with this switch a special panel so arranged that the hall circuit is supplied whether the switch is on or off. The wires running to the control switch in the owner's bed room are to be of the flexible steel conductor type.

Stained Glass Window Lighting.

There shall be installed to light the stained glass windows on the first floor, eight 16-cp lamps, so arranged that the entire surface of the window will be equally illuminated and so that no blotches of light shall be visible. These lights are to be controlled by a flush switch located in the trim under the window sill, and will be connected to the first floor panel by means of flexible steel conductors.

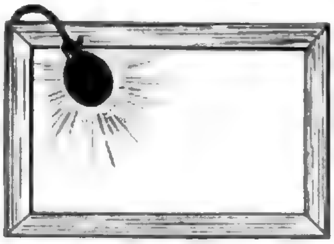


FIG. 3.—PICTURE REFLECTOR.

Picture Lighting.

There shall be furnished and installed ——— reflectors to light pictures located in ——— rooms, as follows: ———. These reflectors are to be finished the same as the picture frame, and are to be adjustably mounted on the frame, as shown in Figs. 3 and 4. They are to be connected by means of flexible cords to flush receptacles behind the picture.

Ceiling Lights.

The parlor ceiling is to be illuminated by lights concealed in a cove or cornice, the lamps to be arranged so that each alternate lamp forms a part of one group controlled by a separate switch. All wiring is to be done by means of flexible steel conduits, and iron outlet box connected to the panelbox on the first floor.

Ventilating.

There is to be installed in the cellar an electric motor direct-connected to a 36-in. fan which is to be placed in a galvanized-iron duct so as to exhaust into the yard. The galvanized-iron duct is to connect with the various rooms from which it is desired to exhaust the vitiated air. This fan motor shall run at 550 r.p.m., and shall be capable of discharging 12,500 ft. of air per minute. The wires for the motor are to be run in iron conduits and to be connected to the power board in the cellar. There is to be located in the butler's pantry, a knife switch and automatic release rheostat for the control of this motor. The wiring for the same is to run in iron conduits.

Polishing Motor.

There shall be located in the basement a ½-hp motor having extended shafts on each end which shall form spindles upon which can be placed polishing buffs. This motor is to be dust-proof and securely mounted on a pedestal 4 ft. high, and having a hood of galvanized iron to collect the particles of dust. The motor to run at a speed of 2,800 r.p.m., and is to be controlled by switch and rheostat conveniently located near the motor. All wires to be run in iron conduits and energy is to be supplied from the power panelboard in the elevator room. An outfit of this kind is shown by Fig. 5.

Electric Dumbwaiter.

There shall be furnished and installed in connection with the present dumbwaiter an electrically controlled dumbwaiter as follows: The dumbwaiter is to run from the basement to the second floor and is to be controlled by means of pushbuttons located on each of the three floors. These pushbuttons shall be so arranged that by pressing the button marked No. 1, the dumbwaiter will automatically start and go to the first floor, and automatically stop. The switches are to be arranged so that if the elevator has once started it shall be impossible to interfere with its operation by pushing any other button. There shall be installed in connection with this dumbwaiter door switches. They shall be connected so that it will be impossible to operate the dumbwaiter while any of the doors are open. The automatic mechanism operating this motor shall be located in the basement and shall be protected by a grating to prevent meddling with the automatic adjustments. The car shall travel at the speed of 60 ft. per minute and shall be capable of lifting 50 lbs. All wiring to be run in iron conduits, with proper outlet boxes for the pushbuttons, and to be supplied with electrical energy from the main feeder in the elevator room.

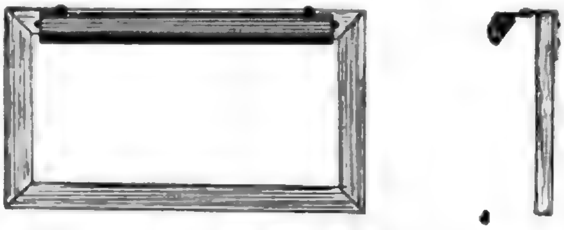


FIG. 4.—PICTURE REFLECTOR.

Special Decoration Lighting.

There shall be installed in the locations specified, flush plug receptacles which shall be controlled by flush switches so that portable lamps or decorative lights for special purposes can be quickly connected without any extra circuit wiring

ANALYSIS OF SPECIFICATIONS.

System.

It is important to specify the system of wiring, as there are sometimes several methods of wiring applicable to an installation. Take, for example, the three-wire system. The three conductors may be of the same size, or the neutral conductor may be twice the size or equal to the combined capacity of the outer conductors. This is called the three-wire convertible system, the advantage of which over a straight three-wire system is that at any future time should the source of supply be changed to a two-wire system the main conductors or feed wires can be changed to a two-wire system by using the neutral wire as one conductor and joining the other two wires and using them as the other conductor. In wiring large buildings which intend to use central station service, it is always advisable to install the convertible system so that at a future time should the rates become such as to make it advisable to install a private

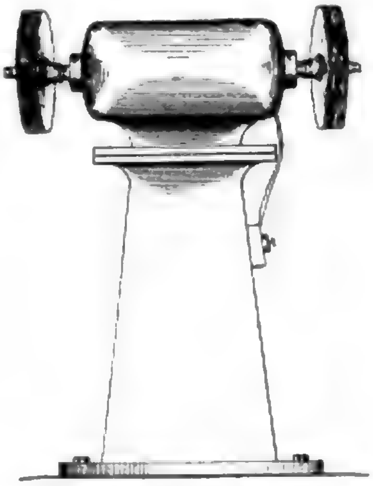


FIG. 5.—POLISHING MOTOR.

plant. It is an easy matter to change from the three-wire system to a two-wire system with a slight additional cost for panelboard and switchboard connections.

Main Service Wires.

Main service wires are usually run inside of iron conduits as either flexible or solid conduit is easily installed on the ceilings of basements on which the main service wires usually run. In small installations where only one distributing center is used the main wires are sometimes omitted and a panelboard, from which all the circuits radiate, is installed where service wires enter. This method of service connection is frequently used in houses of frame construction, where the service wires are brought in through overhead wires to the attic. At the point of entrance a switch is installed, and from the switch, wires to the panel boxes through a meter loop. If the house is a small one this is the best and cheapest method of feeding, but should not be used where the building is large.

Service Panel.

A service panel is a convenience and not used very frequently as it is not a vital part of the installation. It affords a neat and workmanlike way of distributing the current and making meter connections. The panels should be built according to standard switchboard specifications, and the number of feeder switches depends upon the number and size of feeders in the installation.

Power Panel.

In houses using electric elevators and motors the power panel is a convenience though not an essential part of the installation. A power panel should contain the necessary number of switches with fuses, for the installation, and it is also well to have one or two separate switches. These separate switches are convenient for further additions, such as electric motors or electric heating apparatus, which should be put on the power end of the service.

Feeders.

Feeders should be run from the service panels to the panelboards. The best method is to use a separate feeder for each panel, as in case of trouble to one feeder the balance of the installation is not put out of service. When the number of lights in the installation is not large and the expense of separate feeders is too great, one feeder can be run to all panels. In case of a large installation where a great number of lights are taken off at the first or second panel the size of the feeder up to the first panel of course should be large enough for the entire installation. From this panel to the next panel the size of the feeder can be reduced, but in making such reduction it is necessary to provide fuses on the panelboard; as according to the Underwriters' rules it is necessary for a fuse to be put in when reducing the size of a wire in order that smaller wires may be protected. This makes the panels somewhat more expensive, and it is often advisable, unless there is a very material saving in wire, for a contractor to use a uniform feeder on such an installation as the construction of the panel with fuses adds an additional cost which counterbalances the saving on the feeders.

Panels.

Panelboards specified in this installation are designed for plug fuses. For private house wiring the plug fuses are best, as they are easily renewable by unskilled hands, without danger. Link fuses should never be installed in a private house as it is dangerous for anybody but an experienced person to replace them. Blow-outs generally occur in the evening when experienced help is not easily obtainable, and when they cause considerable inconvenience. It is readily seen that the plug fuse with mica front indicating where fuse has blown is the proper one to use. The location of panelboards in private houses is a matter which requires some care. While they should not be put in conspicuous places they should, nevertheless be accessible. Closets are sometimes used, but are very bad places, especially if link fuses are used. Should the door of the panelbox be left open a blow-out would easily cause a fire. Panelboards are sometimes set into cabinets of wainscoting so as to conform to the general decorative scheme of the rooms. Hallways are excellent places for panelboards and the trim or frame if set in woodwork should be made similar to the surroundings so as not to be distinguishable. There should always be one or two spare circuits on a panelboard for future additions, also a directory showing the lights which each circuit feeds.

Circuit Wiring.

These circuits radiate from the panel centers and the flexible cable must be continuous from panel to outlet and from outlet to outlet. Steel armored cables are made in two sizes, Nos. 2 and 12 conductors and Nos. 2 and 14 conductors. Wherever the circuits are 100 ft. long or over it is advisable to use No. 12 cable in order to provide for the extra drop of potential caused in the long run. It is not advisable to put more than ten 16-cp lights to a circuit in a new installation, in order to provide for additions, and as the code restricts circuit wiring to 660 watts or 12 16-cp lamps, if the capacity is used up at the start, any additional lights must be wired up to the panelboard, which is very expensive, especially if the house is finished. In case one outlet is for 12 lights it naturally would be advisable to use up the circuit capacity. Outlet boxes must be used in this work. Fig. 6 shows a good make of outlet box for use in connection with flexible steel cable. Bushings must be provided, as shown in Fig. 7, and bushing for use in connection with the switch outlet box is shown by Fig. 8. Outlet boxes should be set flush with the plaster, and those provided with studs for electric fixtures only, should be securely fastened to a beam or other support so as to sustain any reasonable weight of fixture.

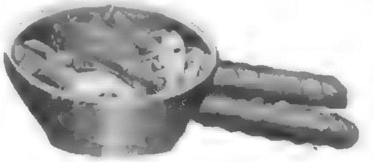
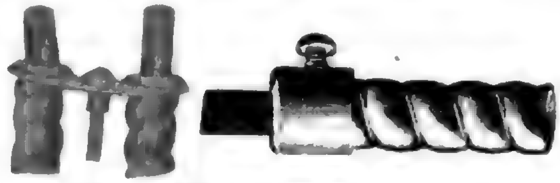


FIG. 6.—OUTLET BOX.



FIGS. 7 AND 8.—BUSHINGS FOR OUTLET BOXES.

Switches.

Flush switches of the push type are the most desirable form of switch to use in private house wiring, as they are indicating to the touch as well as to the eye. They must be mounted in iron or steel outlet boxes, and where more than one switch is mounted at one place, gang boxes are furnished, as shown by Fig. 9. A number of other forms of switches are illustrated in Figs. 10, 11 and 12. Switches should be mounted 4½ ft. from the floor unless the nature of the trim or decoration makes other dimensions necessary. They should be located so that the lights are controlled at the entrance to the room. Hall and cellar lights should be controlled from the stairway leading to the hall, or cellar. Where it is necessary to control a large group of lights, as for instance, a large ball room or hall, from a single flush switch it is necessary to install a solenoid switch operated from a push-button switch.

Receptacles.

In designing the electrical equipment of a house, receptacles are a very important part of the lay-out. They should be installed in all important rooms so as to allow for decorative lighting at banquets, and for connecting piano lamps, and other electrical devices. Fig. 13 illustrates a convenient form of receptacle which is flush when the plug is inserted. These receptacles must be mounted in steel or iron boxes as in the case of switches. Receptacles are usually set in base-boards excepting when desired for picture lighting, when they are sometimes set on top of wainscoting or mantels. Reinforced flexible cord must be used in connection with the plugs. These flexible cords are usually covered with different colored silks so as to harmonize with the prevailing color of the room.

Damage Clause.

When a contract is taken with the understanding that the work is to be done without injuring the decorations the damage clause is important to the owner, and the restrictions named therein equally important to the contractor. In a damage clause of this kind the contractor must carefully ascertain the character of the partitions and construction of the building and must exercise especial care if there are many hardwood floors since hardwood floors are difficult to relay, even by experts. If the house is furred it is easy to fish the conductors from outlet to outlet. The great difficulty is in installing switches and receptacles, as the studding very often interferes with bringing down the cables. It is sometimes necessary to bore from the floor above to the casing of the doors, which are usually hollow, and fish the cable into them. Brick side wall outlets must be excepted in the damage clause as it is impossible to avoid channeling these walls with a cold chisel, in order to install the cables. Where these walls are outside walls, and exposed to dampness it is necessary to use lead encased flexible conductors. Some of the inspection departments require a steel slashing consisting of 1/16-in. steel to be placed over flexible steel conductors where laid in brick walls. This is done as a protection against carelessly driven nails. In estimating on a contract of this kind these points should be kept in mind.

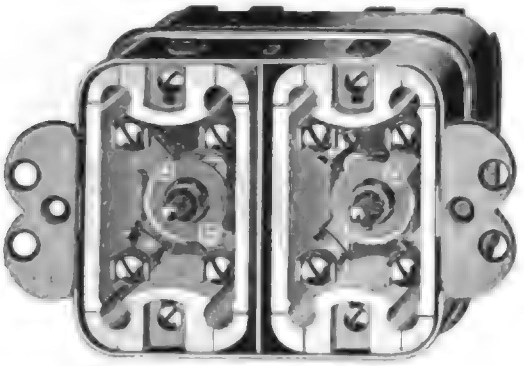
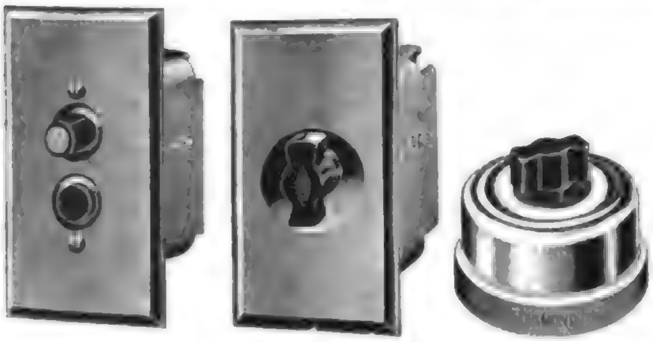


FIG. 9.—GANG SWITCHES.



FIGS. 10, 11 AND 12.—ELECTRIC LIGHT SWITCHES.

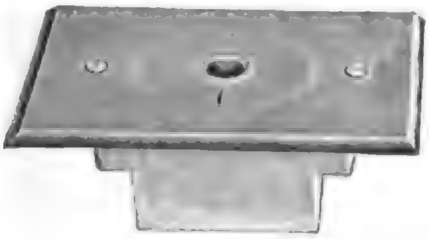


FIG. 13.—FLUSH RECEPTACLE.

Inspection.

The contractor, of course, must agree to comply with the rules of such of the inspection offices as have jurisdiction in his neighborhood, and furnish the proper certificate. The rules of the National Board of Fire Underwriters are those used by practically all the Inspection Bureaus throughout the United States.

Summary of Outlets.

The summary of outlets should contain a complete list of the outlets and their location together with the number of lights, switches and receptacles.

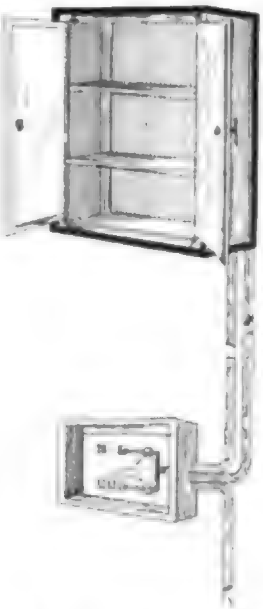


FIG. 14.—PLATE WARMER.

Electric Plate Warmer.

The electric plate warmer, illustrated in Fig. 14, is made of sheet-iron and nickel fittings, and has two heating shelves. These heaters consume one watt of power for every square inch of surface. To control the plate-warmer a special designed double-throw knife switch should be used, as shown in Fig. 15. The clips are cross-connected on the back in such a manner that it is possible to throw the heaters in series, to obtain a medium amount of heat, and in parallel, to obtain the full heating effect. The switch is very often mounted on the side of the plate-warmer, and should be placed in a box lined with 1/16-in. sheet iron. A very good form of switch made for this purpose is shown in Fig. 16.

Electric Pump.

The electric pump shown in Fig. 17 is driven by a ½-hp motor directly connected to the shaft of the pump. The enclosed tank switch, which is single-pole, opens and closes the circuit under the action of a float. An iron-lined box contains two knife switches, one of which closes the circuit of the motor, independent of the tank switch. This is often necessary in order to test the motor and to pump water should the tank switch get out of order. The top jaws of this switch are short-circuited. The tank switch closes the circuit direct to the motor, as a ½-hp motor can be started with a starting resistance. In the case of a large motor, however, it would be necessary to use a starting resistance, and as this would have to be operated automatically the tank switch would be used to close the circuit of an automatic solenoid starter.

FIGS. 15 AND 16.—SPECIAL SWITCHES FOR PLATE WARMERS.

Stained Glass Window Lighting.

Stained glass windows are always a difficult subject for proper illumination. The window should be illuminated equally in every part, and in order to get this effect it is necessary to have a white background. This is easily obtained by using a canvas curtain, which if exposed to the weather should be protected by a metal hood, as shown in Fig. 18. It will be noted that the curtain is hung at an angle. This is done to equalize the illustration and light the bottom of the window as brightly as the top. The lamps and reflectors should be so mounted as to throw the light down, and at the curtain. The reflector should be out of line of vision when standing three or four feet from the window, in other words, the source of light should not be visible at all. If the glass in the window is translucent it is sometimes necessary to mount lights all around the window casing. If the light is projected on the curtain by reflectors a very beautiful effect is obtained. If the window is in the front of the house so that a canvas curtain would be unsightly, a metal shutter, painted white on the inside, may be used. This shutter, at the same time, acts as a protection to the window.

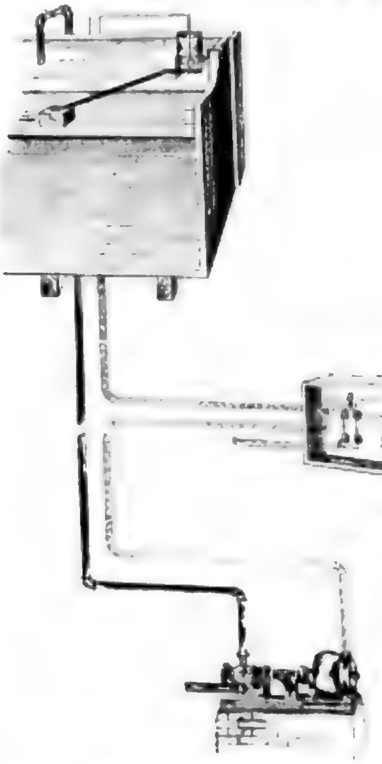


FIG. 17.—CONNECTIONS OF ELECTRIC PUMP.

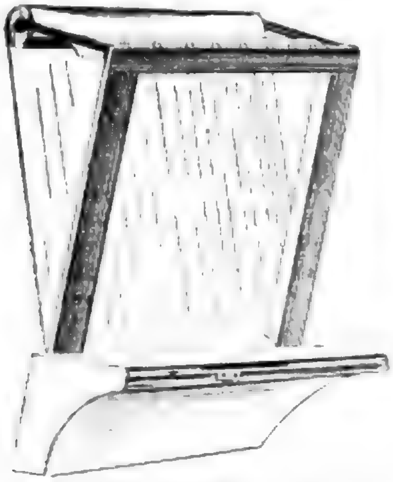


FIG. 18.—STAINED GLASS WINDOW LIGHTING.

Ceiling Lights.

The ideal way of illuminating a room is by concealed lights This, of course, requires a great many more lamps than direct lighting, and is, therefore, much more expensive. The design of the ceiling must be such as to give the right amount of space for the lamps. The contractor should furnish the architect with a print showing just how much space he requires for the reflectors and wiring. The lamps should be hidden from view, and should be wired so that each lamp will be on an alternate circuit so that it is possible to get an equal diffusion of light with half the number of lamps, in case maximum brilliancy is not desired. In connection with ceiling lighting it is important to ventilate the ceiling by means of ducts properly connected to an exhaust fan, as indicated by Fig. 19. The troughs for reflectors, to be used with ceiling lights, may be made very narrow so as to take the socket and a tubular lamp. This trough should have corrugated mirror reflectors, as it is necessary to get the greatest amount of illumination.

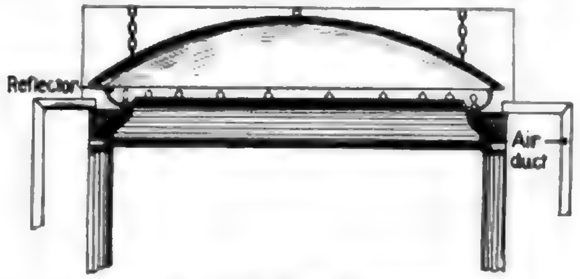


FIG. 19.—"COVE" CEILING LIGHTING.

Electrical Conduit Work in Fireproof Buildings.

By Thomas W. Poppe.

A MOST important requisite of conduit work is that it should be made rigid when installed. If conduit has play and is in places where it will be exposed to knocks and kicks by mechanics working in the vicinity, there may be no visible harm done, but the couplings may be loosened and perhaps stripped, the pipes started and a bad joint, through which to pull wires, made, which will also serve as a gateway for the entrance of water. A water-tight joint is a most important matter as it protects the wire from its most dangerous foe, moisture.

In most every case it is necessary in fire-proof buildings to run conduit on a rough floor, either of concrete or hollow tile. In such cases to fasten conduit so as to have it rigid and safe from danger and injury is not always easy to do cheaply and properly. In this article only the best methods will be considered.

Where one line of conduit only is run on the floor small holes should be drilled in the concrete or in the cement between the joints of the hollow tile, and expansion screws used with ordinary pipe straps the size of the pipe or conduit. The straps should be placed at the conduit couplings and also half way between. Another means of fastening is to slush cement along the sides of the conduit from end to end of the line; to do so only in places is a waste of time and cement, for where the conduit is exposed it will be subject to knocks and the consequent jars, which will crack the cement and loosen the conduit. All conduit should be painted with two coats of some good damp-proof compound and left to dry thoroughly before any covering is placed on it.

Where several lines of conduit run parallel it is best to drill holes into the floor as previously mentioned and firmly secure the conduit with straps of heavy band iron. Nails should not be used as it may be necessary to make some change in the work and nails would probably cause trouble when drawing them from the wood, which would necessarily have to be used. The conduit should be painted as soon as the last connection is made, and where it is run upright in side walls it is best to cement it in as soon as the paint has dried.

For illustration the case will be taken of a floor of a fire-proof building, with a panelboard distributing center. The first thing is to get the location of the distributing center as the basis from which to work, after which the box which will later contain the panel is set. If it be set flush a recess should be cut in the wall as nearly the same size as the box as possible. If the wall is of hard brick (not fire brick) a brick should be cut out on each side near the top location of the box and one on each side near the bottom and blocks of wood firmly wedged in the cavities thus formed as shown in Fig. 1. Dry wood, preferably white pine, should be chosen to avoid shrinkage, and screws used to fasten the box to the blocks. This makes a firm, durable job.

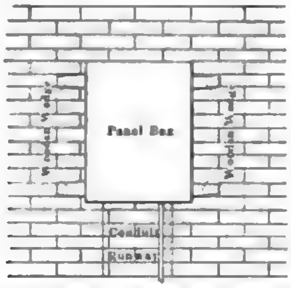


FIG. 1.—PANEL-BOX SETTING FOR BRICK WALLS.

Where the box is to set in hollow tile and the wall or partition is only six inches thick, strips of band iron should be screwed on the rear of the box and allowed to project beyond the sides about twelve inches. The box is then secured to the partition by bolts through the brick, using good-sized washers, as shown in Fig. 2. When this is done all cavities around the box and bolts should be slushed with cement or plaster of paris. The band iron will prevent the box going back or forward and the partition will hold it in all other directions.

When the panel box is finished the circuit feeders should be run to the first outlet. In this way each circuit can be picked up and continued to the end. When the circuit feeders have been run, the locations of the various outlets on that circuit should be determined and the outlet boxes set. The walls at bracket light locations should be so cut as to allow the outside of the pipe or conduit to set flush with the rough brick. The boxes should then be set so as to have the cover flush with the finished work, plaster or wood. To set the boxes firmly in the brick the wall cavity should be filled with plaster of paris and the box pushed into it; every crevice will then be filled and a firm hold taken on the box and brick. If cement is mixed with plaster of paris after a day or two the combination becomes like fine sand compressed and can easily be scraped out of place with a penknife. It is best to use cement or plaster of paris separately. The latter sets quicker and should be used where time is a consideration. Bracket and switch outlet boxes thus set are shown in Fig. 4.

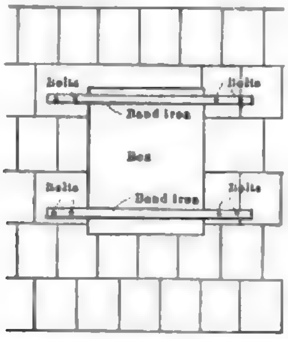


FIG. 2.—PANEL-BOX SETTING FOR FIRE-PROOF WALLS.

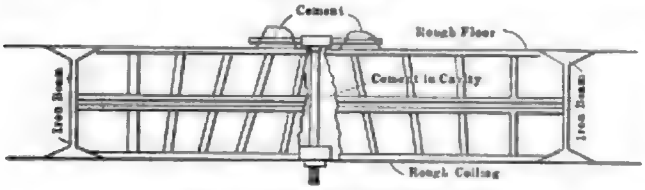


FIG. 3.—ELECTROLIER HANGER.

A hanger to support an electrolier should be supported from the floor above, hang perfectly plumb and be cemented as soon as placed to insure its retaining a proper position. A strong, durable hanger of this kind can be made with a gas tee and length of gas pipe, as shown in Fig. 3. A piece of gas pipe is cut to a length to reach from the rough floor above to one inch below the finished ceiling and both ends threaded. One end is screwed into the top of the tee and a short piece of pipe screwed into each of the remaining outlets of the tee and placed in position on the rough floor. On the end of the pipe that is to hold the electrolier a long thread should be cut so as to allow a lock nut to be placed above and inside the box. This is clearly shown in Fig. 5. The lock nuts will allow the height of the box to be regulated and will hold it firmly in place. A hanger of this kind will answer for an electrolier of any weight when pipe in proportion is used.

Floor outlets should not be used until some of the floor beams are laid in order to allow a definite level to be determined. The top of the box should be flush with the finished floor, which can be ascertained from the sleepers. Having set the box in the proper position, plaster of paris should be used to give it a good foundation and insure its keeping in place. It is good practice to use a box with a cover somewhat flexible, admitting of some "give" in case of a wrong measurement, a change of floor or other cause.

Outlet boxes in unfinished buildings should, when installed, be filled with some substance which will prevent plaster, cement or dirt getting into the conduit. Paper is probably the best material, as it can be packed in quite tight and can be removed easily when the work is ready for the pulling in of conductors.

Where marble is to be set, the outlet boxes should not be fastened in the wall. The conduit should be run to the approximate location and an iron cap screwed on to protect the thread. When the piece of marble containing the outlet hole is at hand measurements should be taken from the stone and the outlet box placed in the exact location. In marble work the holes for the outlets are made when the stone is cut, and if not properly located it will be necessary to move the outlet. The marble location is apt to be correct, since with much rough work to figure from the outlet can easily be misplaced. Frequently a wooden plug is put in an unfinished conduit line to protect it from plaster or other material which would prevent the passage of the wire. This is a bad practice, for the plug is sometimes driven into the conduit and causes loss of time in removing it, while at other times the plug is knocked out and leaves the pipe unprotected. An iron cap screwed on tight is the best precaution.

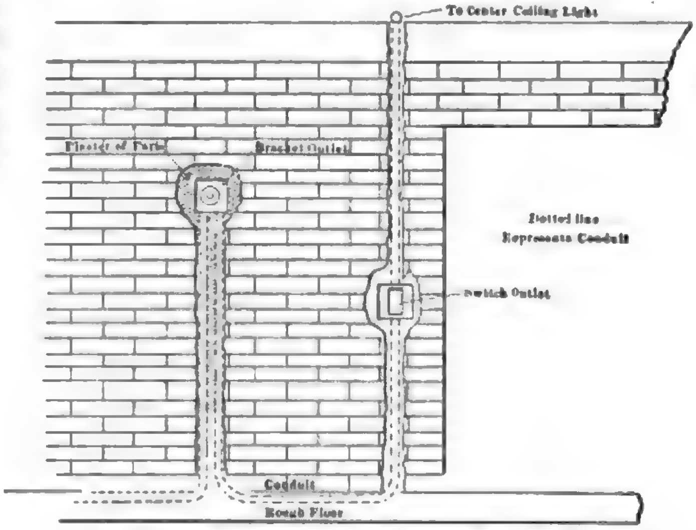


FIG. 4.—SETTING OUTLETS AND CONDUIT IN BRICK WALLS.

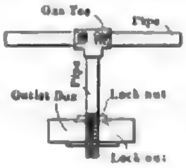


FIG. 5.—ELECTROLIER HANGER.

LETTERS ON PRACTICAL SUBJECTS.

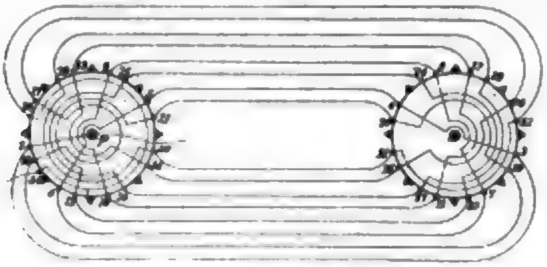
THE SWITCHBOARD OPERATOR.

Of all the men in one of the great modern polyphase power stations, delivering alternating current to sub-stations, none should have a better grasp of his duties than the switchboard operator. He should be a man who has been advanced through minor positions, who understands all the electrical combinations that can be made with the machines, switches and feeders. He should have at least three or four years' experience in the different grades from cleaner to switchboard operator of a high-tension power station. For here experience is the best, practically the only, teacher, for it alone can tell the operator what is going to happen in his generating station, when at some distant point a cable or transformer or converter becomes disabled while in service, or something in his own station goes off with a "bang," and all the alternators in operation begin to emit that almost human-like groan; the lights go out, the sound of escaping steam, the rumble and rattle of rapidly moving machinery without load, a voice giving orders and then finally the death-like stillness when everything is brought to a standstill. (A condition, which the management says should never occur.) Then the rush of two or three men to the place from where the "bang" occurred, the disconnecting of the disabled apparatus, the starting up of machine after machine as rapidly as human hands can open throttle valves and manipulate electrical switches; a burst of light, and men are to be seen at their proper stations doing their allotted work quietly and quickly as if nothing out of the ordinary daily routine had occurred. Ten minutes has barely elapsed from the time of losing the load until everything is again going along as usual. Thanks to good engineering coupled with good careful management, such things rarely happen but sometimes they do, and in all probabilities always will.

New York. H. G. Putt.

REPRESENTING ARMATURE WINDINGS.

I have read with much interest the letter of Mr. Stourbridge in the February number, giving an account of a method of representing armature windings. I hardly think, however, he is warranted in claiming the method described as "entirely new." The accompanying illustration is from a patent issued to me May 5, 1896 (No. 550,497), on a telegraphic relay, and which, it will be seen, employs substantially the same method. This should not, however, detract from Mr. Stourbridge's ingenuity, nor from the value of the illustration as an educational aid.



REPRESENTING ARMATURE WINDINGS.

New York. Charles G. Burke.

PROBLEM IN MOTOR WIRING.

I wish to submit the following problem for solution to the readers of the Electrical World: A 5-hp. three-phase induction motor is to operate an incline rope haulage system. The motor is at the top and must be started, stopped and reversed from both the top and bottom of the incline. The problem is to use a switch at the top and one at the bottom of the incline so that the above conditions may be fulfilled.

Victor, Colo. D. C. McKeehan.

SINGLE-POLE SWITCHES IN THREE-WIRE DYNAMO WORK.

A problem which is becoming more and more a condition to be met with the introduction of the three-wire dynamo, is that of connecting such machines to operate in parallel, either with other machines of like type, or with single voltage machines. The three-wire dynamo to which I have reference is that of the Dobrowolsky type and utilizes in addition to its commutator and brushes, two or more collector rings tapped at equidistant points on the armature by leads from a compensator consisting of coils of wire wound upon a transformer core with a tap taken out at the middle point of the compensator to supply a neutral wire. I employ a method of connecting such machines together, which I have found very convenient, and may be of interest to your readers.

For simplicity sake I will assume the three-wire machine which uses a single-phase compensator, but it will be understood that the device is equally applicable to polyphase compensators. The diagram of such a machine is shown in Fig. 1. It will be noted that in a machine of this kind the series coil is divided into two parts, one on each side of the line. This is necessary in order that the machine may compound, no matter how the machine may be unbalanced; and if the load is badly unbalanced, the machine will require two equalizers instead of one.

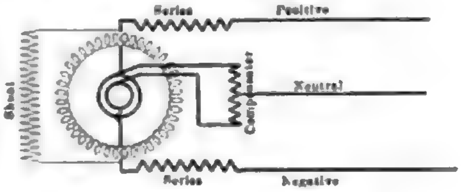


FIG. 1.—THREE-WIRE GENERATOR.

The elementary diagram of connecting two such machines together, and also a third single-voltage machine, is shown in Fig. 2, but its realization in practical switchboard construction is not as simple as it looks, and moreover, the method employed in switching the machines together varies from ordinary practice.

It is possible to use one compensator for all the machines, but if that is done, each machine will have to be synchronized like an ordinary alternator before it can be thrown in parallel with its mate, and all the troubles of unequal division of load that occur with alternators are likely to be encountered. For this reason there should be a separate compensator for each machine, when they can be thrown together regardless of phase relation. It is necessary, furthermore, in case a single-voltage machine is used in connection with the multivoltage machine, to equip it either with two series coils, one on each side of the line, or to divide the series coil in two parts, tapping in the equalizer at the middle point thereof—a procedure that is admissable only when the percentage of over-compounding is very small.

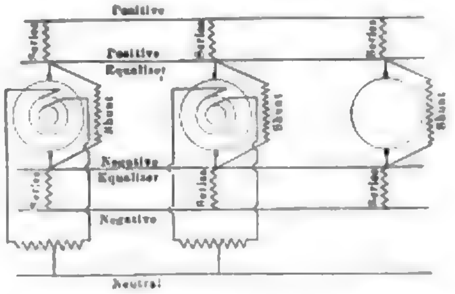


FIG. 2.—THREE-WIRE DYNAMOS IN PARALLEL.

Below is shown what I have found to be the most convenient switchboard diagram in connecting such machines together, and a few words of explanation will suffice to show the reasons for the arrangement.

In the first place, as there are two equalizers, an ammeter installed in either the positive or negative leg of the machine will give erroneous readings, making one machine record too much and the other too little by the difference of current flowing over the equalizer. There is only one place on the system where the ammeter can be installed and give correct indications, and that is the cable leading from the rocker arm of the machine, or in other words, in the armature circuit.

It is furthermore to be appreciated that when both equalizer switches are closed, the machines, even if the main switches are not closed, are in parallel as shunted machines; and if installed in the ordinary way they are without fuse protection in this circuit, and mis-throwing of the equalizer switches will cause a short-circuit of the most formidable character with absolutely no protection between; for this reason the circuit must contain a fuse. It is a well known fact that there should be no fuses in the equalizer for the reason that when the equalizer is carrying current to the extent that it will blow a fuse, that is the time when it is needed most, and its failure at that critical moment would produce more trouble than any possible overheating of the equalizer would entail. For that reason, the fuse protection in this circuit, like the ammeter shunt, must be installed in one of the rocker cables, preferably the opposite cable to that in which that of the ammeter shunt itself is installed.

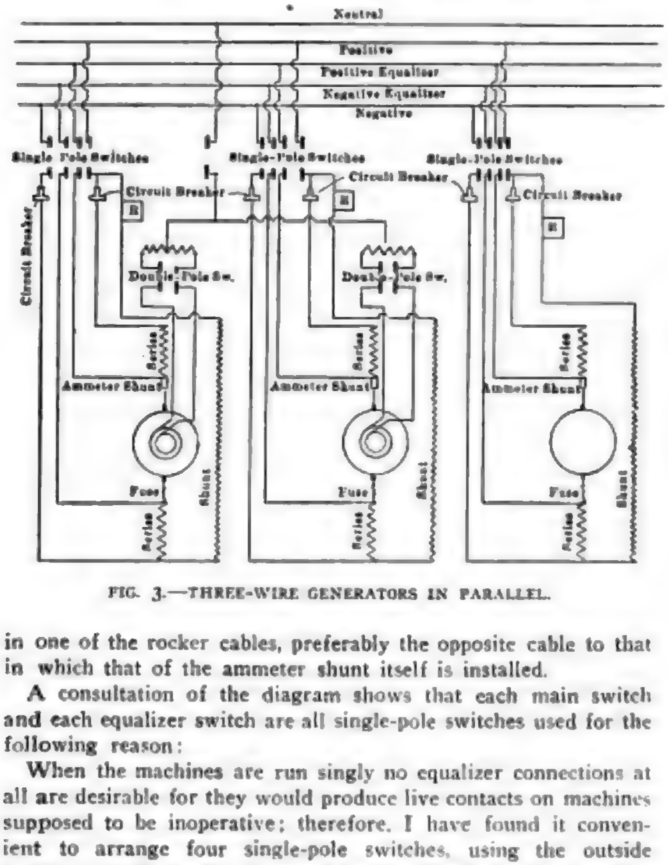


FIG. 3.—THREE-WIRE GENERATORS IN PARALLEL.

A consultation of the diagram shows that each main switch and each equalizer switch are all single-pole switches used for the following reason:

When the machines are run singly no equalizer connections at all are desirable for they would produce live contacts on machines supposed to be inoperative; therefore, I have found it convenient to arrange four single-pole switches, using the outside switches on the main wires and the two inside switches on the positive and negative equalizer wires.

The possibility of unbalanced load requires the installation of two circuit-breakers, one in the positive and one in the negative leg. These should be used in preference to a double-arm circuit-breaker. The reason for this is that it is possible for one side of the line to be overloaded while the other side is well within its load limits. This will blow only one circuit-breaker, leaving the other side still operative provided that the unbalancing is not too much for it, thus disabling the plant less in case of a short-circuit. The procedure in starting up a plant of this kind is as follows:

First, all circuit switches on the board are left open, as are also controlling switches, and the machines to be used are brought up to speed.

Second, all of the controlling switches of one machine are thrown in, the circuit breakers being previously closed, and the neutral switch is closed. After the machine has built up, load within its limits may be applied.

The second machine is now thrown in in the following way: First, the positive and main and positive equalizer are thrown. This throws in the series coil of the machine to be put in circuit, and causes it to rapidly build up in the right direction. The voltages of the machines are then equalized, and at the moment of equalization the second equalizer switch is thrown. This puts the two machines in parallel with one series coil cut-out. Lastly, the negative switch is closed and the incoming machine takes its proportion of the load.

When it is desired to disconnect a machine, it must not be forgotten that two switches must be thrown, either a positive switch and a positive equalizer, or a similar combination of negative switches. It is also well to put a double, or three or four-pole switch, as the phase of the system may require, in the compensating circuit of each machine. Under those circumstances, if one compensator is sufficient to take care of the unbalancing, the others can be thrown out and will save a certain percentage of idle current. This is also convenient in case it is desired at any time to break the compensator circuit to renew the compensator brushes.

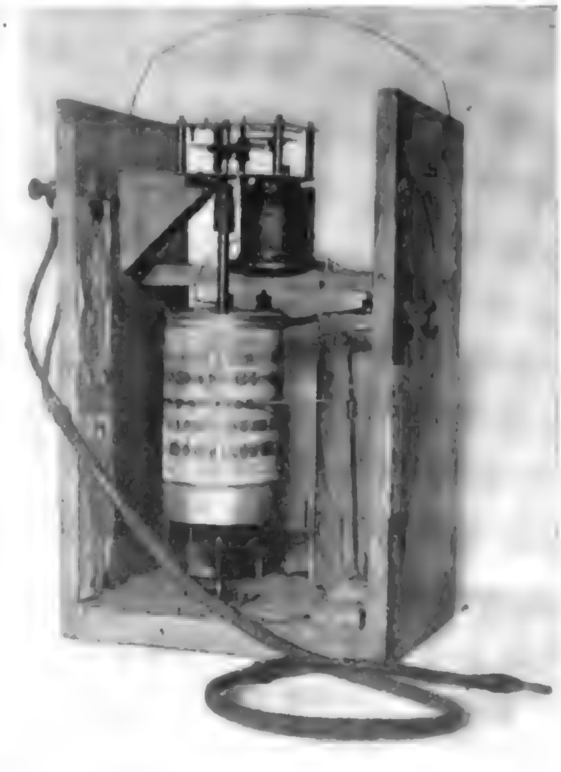
Lastly, the arrangement is convenient because in many cases it will be found that only one equalizer is needed when the load is not badly unbalanced or likely to become so. In such cases this equalizer can be disconnected by means of its single-pole switches, and if any sudden cause arises for disconnecting one of the machines quickly, the opening of a single single-pole switch will answer every purpose.

Finally, the use of single-pole switches in this way enables the various circuits of the machine to be quickly separated for purpose of testing, and it is found very convenient when adjusting the compounding of the machines.

New York City. George T. Hanchett.

MORSE MECHANICAL CALLER.

There is always a peculiar fascination in constructing for one's self some particular apparatus, the object of which is to perform mechanically certain work previously done by hand, thus allowing the operator an opportunity to carry along two independent lines of work at the same time. The apparatus shown in the accompanying cut and appropriately christened "Gabriel" was designed and constructed for the purpose of "raising" telegraph offices that require calling anywhere from ten minutes to one-



MORSE MECHANICAL CALLER.

half hour—such conditions, strange as it may seem, are not at all unusual on railroad telegraph lines.

The extreme simplicity of the apparatus, the fact that it was put together during spare moments, made from "odds and ends"—the thoroughly satisfactory manner in which it does its work, coupled with the knowledge that is acquired in its construction, are matters that will appeal strongly to the amateur electrician, without being devoid of interest to those that are seniors in the school of electrical science.

The general construction of the apparatus will be apparent upon inspection of the cut, although many modifications and improvements which may be added at a slightly increased cost will be readily suggested. The vertical drum is a cylindrical tin box mounted on a shaft and revolving clock-wise in direction. The shaft used in the construction is a steel spindle about 10 in. long. The lower end of the shaft terminates in a point and runs in a concavity in an iron base piece, which is a piece of ⅛-in. iron fastened to the wooden base with ¼-in. brass screws, and receiving one wire that runs to a binding post. The upper end of shaft is connected to the driving gear by a piece of heavy walled rubber tube with an internal diameter suitable to slip firmly on the end of the vertical shaft, at the same time receiving the shaft that forms a part of the driving gear, and which will be described later.

The revolving drum, which turns similar to a phonograph cylinder, carries on its periphery, attached firmly by means of a good quality of mucilage, and with ends lapped with reference to direction of rotation, a sheet of thin, hard, best quality linen type-writer paper, perforated in Morse characters in such a way as to make up the various calls desired, each call being repeated two or three times and the home office signaled.

The prime mover which appears in the background consists of an electrical top, and in its ordinary capacity it figures as an interesting toy, affording no end of amusement to the urchin. As the top makes about 3,000 r.p.m., and a comparatively slow rotary motion was imperatively necessary for the Morse drum, the matter of speed reduction presented itself for solution, and was effected in the following manner:

The movement of a small clock no longer useful as a timepiece was dissected, the superfluous parts discarded and a train of three gears with their pinions reserved for reduction purposes. A ¼-in. dog from the clock was soldered in place after being mounted on the vertical shaft of the motor, the train of gearing being so disposed that the slowest turning shaft in the train was united to the shaft of the Morse drum by a sleeve coupling (the piece of rubber previously referred to), while the first driven wheel in the train was in mesh with the cog on the armature shaft, the reduction in speed being such that the armature made 200 revolutions to 1 revolution of the Morse drum. This was found to give about what was desired in practice, and to obtain a variation in speed about 2 ft. of No. 28 steel piano wire was introduced into the motor circuit, sub-divisions of this resistance being properly connected up to a segment rheostat, the segments being nothing more than five flat-head brass screws arranged on the arc of a circle on the outside of the containing box, the screws protruding on the inside of the box about ⅛ in. to receive the convolutions of the fine resistance wire. The convolutions of the resistance wire are held at the lower end by being passed over metal brads, which are simply inserted in the inside of the containing box.

The rheostat lever can be conveniently made of a piece of unannealed brass wire about No. 18 in size, an eye being formed at one end to admit the passage of a round-head brass screw which fastens it to the box and forms the pivot about which it turns, and also receives one terminal of the battery and motor circuit on the inside.

On the right (inside of box) will be seen a vertical standard of No. 12 hard brass wire on which the drum trailer is arranged to slide up and down; in this way the trailer can be shifted to different calls on the revolving drum. One wire from the binding post runs to the bottom of the standard and brings the telegraph circuit through the drum, the dots, dashes and spaces being formed in accordance with the perforations in the Morse paper. The trailer is wound in a spiral of a half dozen turns about the standard and its free end passes through the box, a vertical slit permitting it to be raised or lowered; some slight recesses are cut in so that when the lower lever is brought up against it, it will hold it in place. By tightening the screw in this lever it will work stiff and remain in any position.

Two cells of good dry battery will operate the motor in first-class shape. A telephone cord is used to connect to line, one pair of terminals being hammered down flat with a piece of sheet mica placed between them for insulation; the two are bound together in any way to preserve their insulation and the pair should have a gentle wedge like taper so it can be pushed under the clip when the circuit closer is thrown out.

North Adams, Mass. T. H. Reardon.

SOLUTIONS TO VARIOUS PROBLEMS.

Enclosed are diagrams which I submit as solutions to various problems published in the January number. Fig. 1 is a solution to Mr. Black's motor problem. The number of switches required to obtain the results asked for is three—two double-pole, double-throw and one single-pole, single-throw; the upper jaws of the double pole switches being connected together permanently by

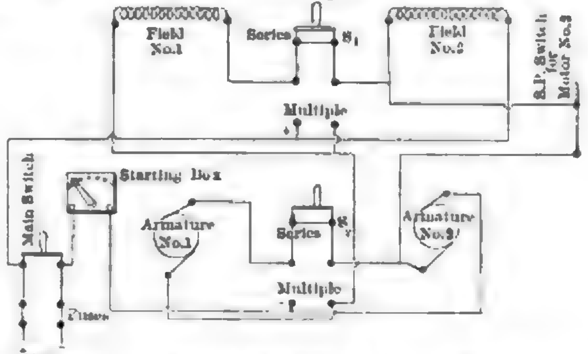


FIG. 1.—MR. MARSHALL'S SOLUTION TO MR. BLACK'S PROBLEM.

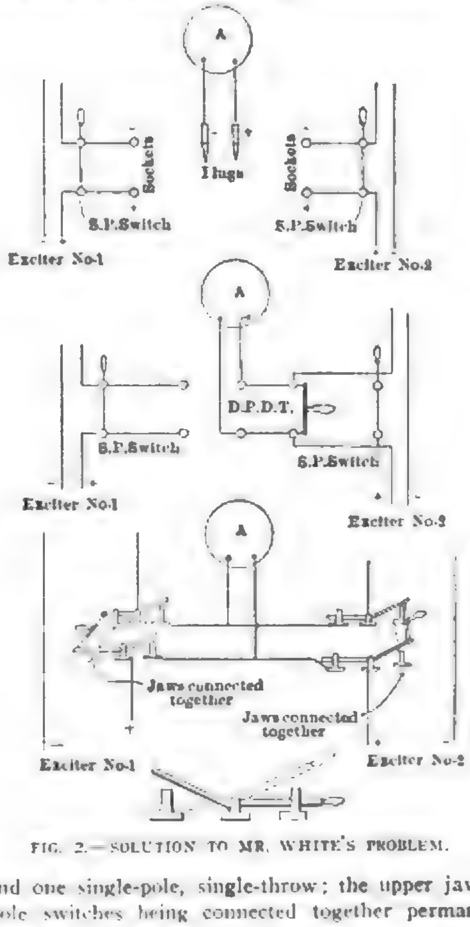
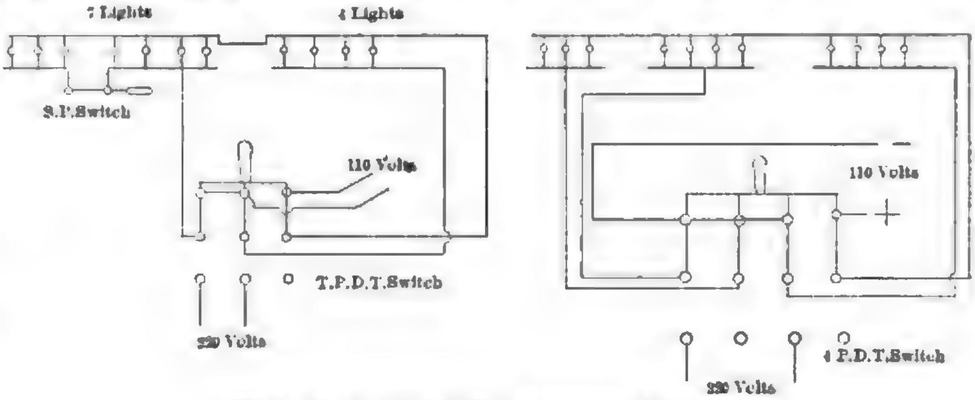


FIG. 2.—SOLUTION TO MR. WHITE'S PROBLEM.

means of a strap. Supposing all switches to be out, the operation is as follows: The main switch and the single-pole switch are both thrown in, and the lever of the starting box is thrown over. This starts and brings motor No. 2 up to speed. To connect the motors in series pull the single-pole switch and throw both double-pole switches up, starting the motors in the usual manner. To connect the motors in multiple place the double-pole switches on the lower jaws. To connect the fields in parallel and the armatures in series, place switch S_1 down and switch S_2 up. To place the armatures in parallel and the fields in series, reverse the switches, i. e., place S_2 across the lower jaws and S_1 across the upper jaws.



FIGS. 3 AND 4.—SOLUTIONS TO MR. WHITE'S PROBLEM.

Fig. 2 gives solutions to Mr. White's instrument problem. The upper engraving shows a simple arrangement using sockets and plugs with short-circuiting switches. To take readings, the plugs are placed in their respective sockets and the single-pole switch opened which corresponds to the set of sockets. Care must be taken to close the switch before withdrawing the plugs since this would open the circuit. In the engraving in the center a double-pole, double-throw switch takes the place of the plugs and sockets in the engraving at the top. The operation is the same as before. In the lower engraving double-pole rocker switches are employed, the jaws of which are of such length that the blades are firmly locked in one set of jaws before the connection is broken on the other jaws. With this arrangement it is impossible to open the circuit.

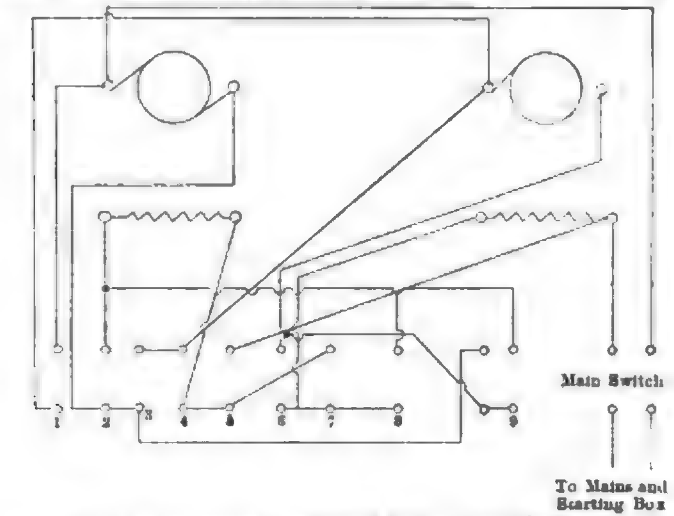


FIG. 5.—MR. BRODE'S SOLUTION TO MR. BLACK'S PROBLEM.

Fig. 3 is a solution to Mr. White's lighting problem, the number of lights designated being only for purposes of illustration. When the triple-pole, double-throw switch is in the position shown all lights are burning on the 110-volt circuit. To place the lights on the 220-volt circuit, the single-pole switch is used to cut out the necessary number of lamps to balance up the system, and the triple-pole switch is thrown on the lower jaws. If it is desired to use only one switch the arrangement shown in Fig. 4 will suffice, the four-pole, double-throw switch being connected as shown.

San Francisco, Cal. J. J. Marshall.

I enclose herewith a diagram of connections for the two-motor problem published in the January number. All but the last switch are single-pole, single-throw; the former is double-pole. To place one motor in circuit switches No. 2 and No. 5 are closed. To place both motors in series, switches No. 2, No. 4 and No. 6 are closed. Both motors may be operated in parallel by closing switches No. 1, No. 2, No. 5 and No. 6. To place the fields in parallel and the armatures in series, switches No. 3, No. 5, No. 6 and No. 8 are thrown in. To place the armatures in parallel and the fields in series switches No. 1, No. 7 and No. 9 are closed. In order to verify my solution I connected up two small motors according to the diagram and found it would work. There are several other speed possibilities, but no risk of reversing, although it is very easy to short-circuit the line or throw full voltage on an armature.

Los Angeles, Cal. L. P. Brode.

Enclosed please find a solution to Mr. R. A. Black's problem in motor control. I used bus wires, not knowing whether the motors were at some distance from the point of control or not. In mill work where the motor leads are usually run to the motor in iron conduit, it would be cheaper to use the bus wires. If the motors are at the point of control, busses are unnecessary. Special three-pole, double-throw switches are employed; but these can be easily made from the ordinary three-pole, double-throw switch by putting in the two extra studs. The handle of each switch, except the main switch, is swung in a horizontal

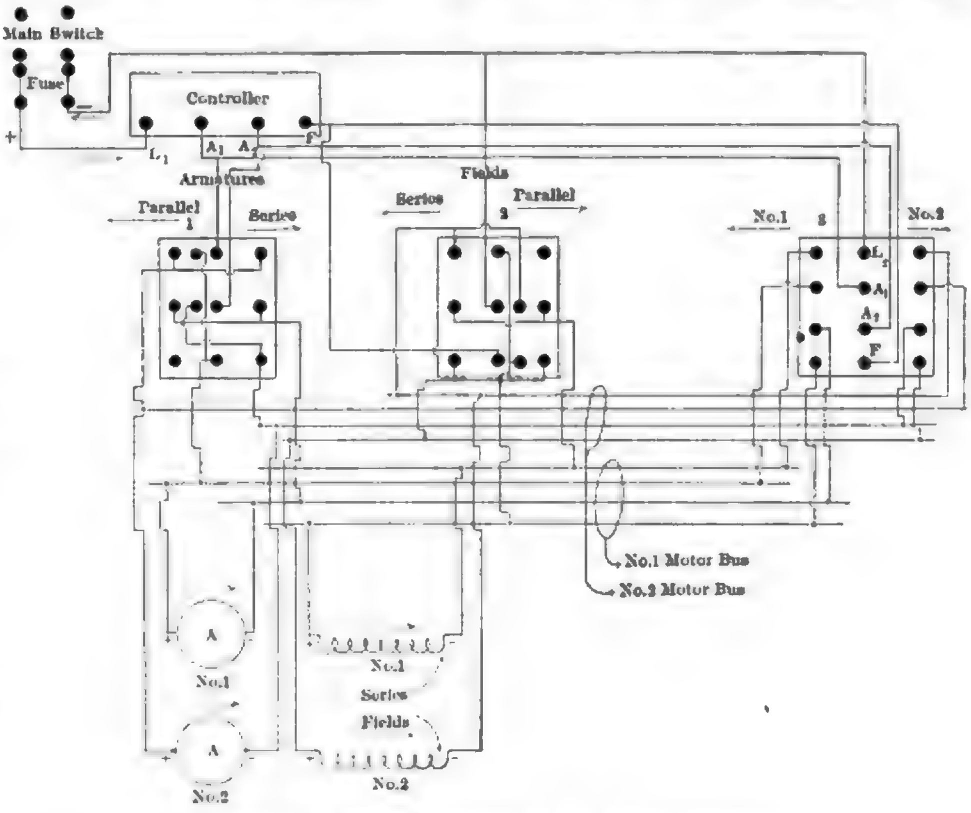
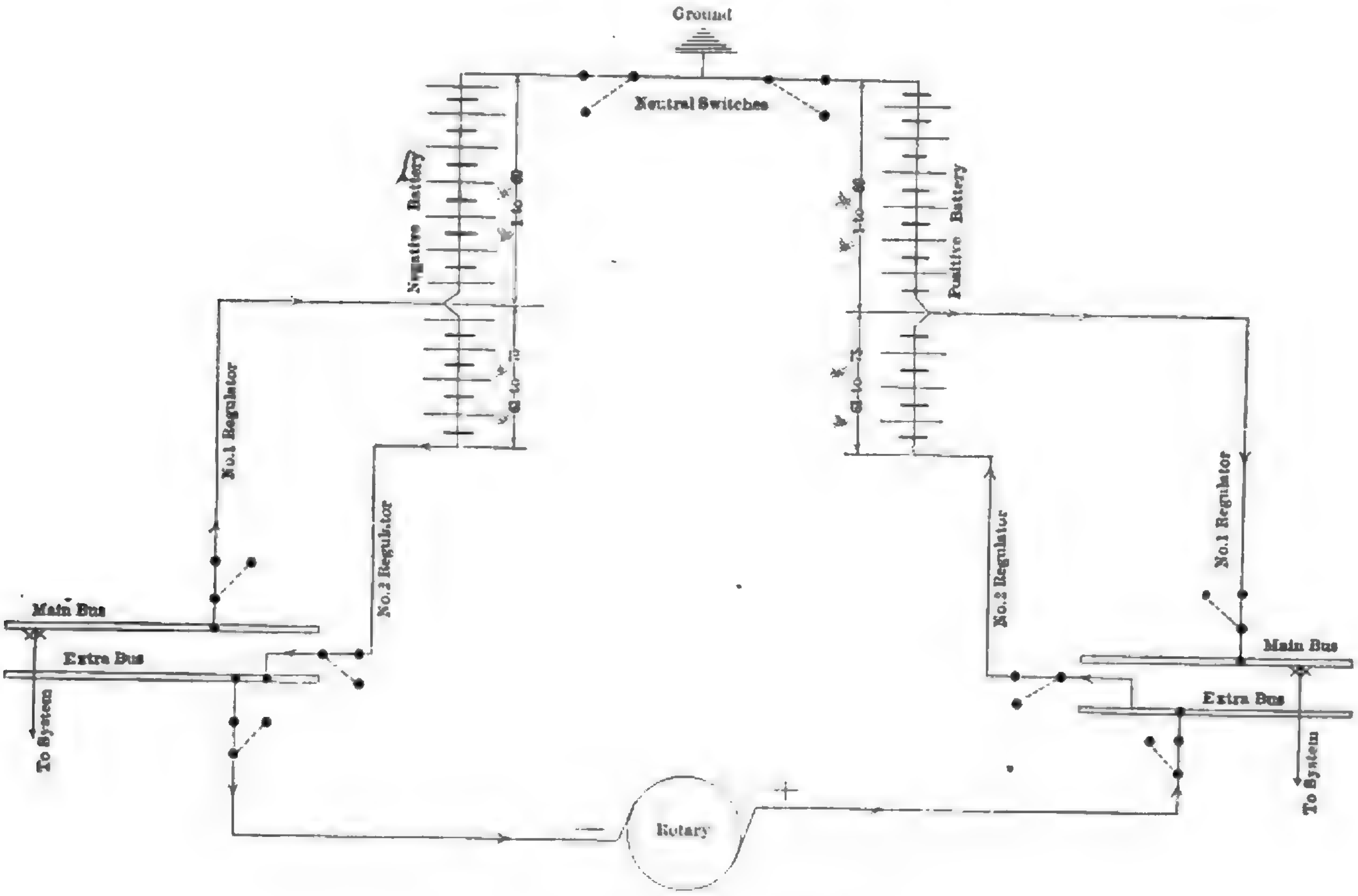


FIG. 6.—MR. STURGESS' SOLUTION TO MR. BLACK'S PROBLEM.

plane. I think that all three switches could be in at starting without any serious results; but in order to obtain the desired combinations only those switches should be in which are specified. In order to put either motor in circuit, switches No. 1 and No. 2 should be open and switch No. 3 thrown to the right for motor No. 2 or to the left for motor No. 1. To put both motors in series switch No. 3 should be open, switch No. 1 thrown to the right and switch No. 2 thrown to the left. When it is desired to operate both motors in parallel switch No. 3 is left open and switch No. 1 is thrown to the left and switch No. 2 to the right. To place the armatures in parallel and the fields in series switch No. 3 is open and switches No. 1 and No. 2 thrown to the left. To place the armatures in series and the fields in parallel both switches No. 1 and No. 2 are thrown to the right and switch No. 3 is left open.

CHICAGO, ILL. F. M. STURGESS.



END CELL CHARGING FROM ROTARY CONVERTERS.

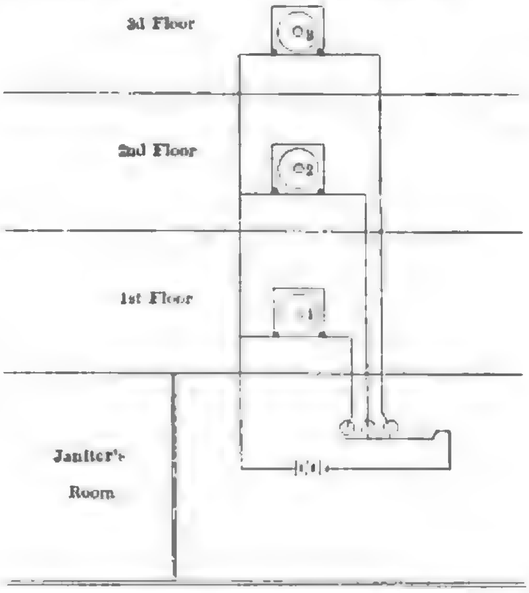
PROBLEM IN END CELL CHARGING FROM ROTARIES.

Herewith is a diagram showing a rotary converter set charging 30 end cells on each side of an Edison three-wire system, the other cells floating on the system. This diagram caused considerable discussion among my fellow employes, and thinking it would be interesting to other readers, I send it to you for publication. The discussion arose from a difference of opinion as to whether the rotary would charge the entire battery or not. I should be pleased to have the opinions of your readers.

NEW YORK CITY. A. J. DUNLOP.

PROBLEM IN APARTMENT HOUSE WIRING.

While making some changes in the electric wiring of an apartment house, I was called upon to overhaul the bell system, and since the alterations were somewhat unusual I felt that it would make interesting reading for your readers, at the same time forming the basis of an interesting problem. The bell in each apartment rang from its respective push button in the basement and it was required to change the wiring so that each push would ring its respective bell and also operate a separate bell and an annunciator in the janitor's room simultaneously. In addition to this a switch was to be placed in the janitor's room to ring all bells at once and at the same time throw two or more batteries on the circuit in multiple in case of fire or general alarm. A switch was also provided to change from one battery to the other should the battery in use give out. All these changes were to be made in the janitor's room, the push buttons remaining in their original position.



PROBLEM IN APARTMENT WIRING.

BROOKLYN, N. Y. W. K. DIMOCK.

QUESTIONS AND ANSWERS.

I have a model motor car run by two dry cells. Would it not be possible for me to use lamps to cut down the voltage and current of my 110-volt lighting circuit, and operate the motor in this way? The dry cells do not last very long and it is expensive to be continually replacing them. J. S. S.

It is possible to cut down your voltage and current by using lamps as you suggest; but this will not be nearly so cheap as the dry cells.

Kindly inform me why with two transformers operated in multiple, if the secondary of one be grounded an accidental ground from the opposite side of the secondary of the other transformer would not result in current flowing from that side of the secondary of one transformer to the opposite side of the secondary of the other transformer? H. H. P.

The secondary circuit of each transformer with its group of lamps is a system in itself and is not affected by grounds on other transformers in circuit with it.

What size of wire should be used to wind a whip spark coil having a core ⅞ in. by 10½ in., and how many cells of battery would it take to operate such a coil? The coil is used for gas-lighting purposes. W. D. L.

Wind the core with No. 16 wire to a depth of eight or ten layers. Two cells of battery should give fairly good results, although more might be added. Excessive current will eat up the contacts on the gas lighting outfit.

I have two compound-wound, direct-current dynamos running in multiple, each being driven by a 44-in. belt. One dynamo makes seven more revolutions a minute than the other, and as the load increases the slow machine takes the greater part of the load, gaining 300 amperes on a load. What change is necessary in order to make both machines share the load equally? I have tried shifting the brushes without success. J. K. G.

Add a resistance externally to and in series with the series coil of the machine which has a tendency to take more than its share of the load.

Can you inform me where I can obtain charcoal plates about six or eight inches square and about one inch thick? I have tried all the local dealers in chemicals, etc., and can only obtain blocks about 1 inch square, such as are used for blow-pipe work. D. C. R.

The largest size of imported charcoal plate of which we have knowledge is three inches by one. You may make a plate of larger dimensions by mixing powdered charcoal with a flux of molasses and subjecting this to hydraulic pressure. The block should then be burned in a kiln to carbonize the sugar. This block will not be so hard as the smaller imported blocks, however.

I have rewound a 52-volt, 133-cycle fan motor for 110 volts and 60 cycles, and obtain a speed of approximately 900 r.p.m. when the stator coils are connected in series, so that there are four pairs of poles. When I connect the coils in multiple series so as to cut down the number of pairs of poles to two, the speed is halved, whereas it should be doubled. Why should this be? C. M. H.

The change does not seem to result in sufficient torque for your motor, and this may be due to the action of the shading coils. There should be four instead of eight of these, and each should almost cover a working coil. We doubt, however, if the motor will operate satisfactorily in any event.

In decorative lighting work, I often have occasion to make up red, white and blue lamps so as to resemble the national emblem, and being anxious to have this as nearly right as possible, I would be obliged if you would inform me what are the dimensions of the standard American flag.

There is no one size of American flag considered as standard. The War and Navy Departments each have a number of standard size flags. The dimensions of some of the flags used by the War Department are as follows: Infantry parade, 4⅓ by 5½; post, 10 by 20; storm, 4 by 8; garrison, 24 by 36. The field occupies about one-third of the fly, and 7/13 of the hoist, or exactly seven of the thirteen bars. The number of stars in the field is equal to the number of States, which at the present time is 45.

(1) Which is the best conducting oil and which the best insulating oil? (2) Which oil is mostly used in high-tension, oil-break switches? (3) How may I prevent collector rings from cutting? C. A. M.

Oil is not a conducting, but an insulating medium. (2) The oil used in oil-break switches is known as transil oil and is obtained from crude petroleum by fractional distillation after chemical treatment. Oil for switch purposes should have a flashing point not below 180° C. and should not burn steadily under 200° C. It should be free from alkali, moisture and acid and should be as fluid as possible. (3) The cutting of collector rings may be prevented by occasionally lubricating them with a small amount of vaseline.

Is it possible to measure the voltage across an arc of a 3000-volt series system with a common 300-volt instrument, the lamps consuming 6.6 amperes at 72 volts? E. J. B.

Yes. In performing this operation, however, it is absolutely necessary that all the lamps be lighted and remain so, and also that the person making the measurement should be insulated from the ground. Unless these conditions obtain, there is an attendant danger. Should the arc across which the measurement is being taken fail, the full potential of the system will be thrown on the instrument, and unless caution is used and the operator insulated from the earth, current at this potential might pass through him to earth with serious results.

Kindly inform me of the best method of making mortar for the walls of stationary boilers. I had a boiler bricked up a month ago, using common mortar and the brickwork is loose and cracked already. 2. Can fire clay be made of Portland cement? 3. In sending a cylinder to a machine shop to be rebored what precautions should be taken to have the work properly done? 4. Will an engine with a throttle governor be good enough to drive a dynamo carrying a lighting load? J. G. G.

The best method of building walls for stationary boilers is to set the brick in cement; common mortar is not suitable for this purpose. 2. We have never heard of fire clay being made from cement. If cement mortar is subjected to a high temperature, the cement loses its water of crystallization and becomes friable. 3. Directions should be given to rebore the cylinder central with the counter bore and not central with the present bore of the worn cylinder. 4. An engine with a good throttling governor ought to give close enough speed regulation to drive a generator on a lighting load.

Kindly explain how a 60-cycle transformer will work on a 125-cycle circuit or a 125-cycle transformer on a 60-cycle circuit? L. G.

The counter e.m.f. of the primary, which almost equals the impressed e.m.f., is numerically proportional to the product of the magnetic lines of force in the core, the number of cycles and the turns in the primary winding. When a 120-cycle transformer is operated on a 60-cycle circuit of the same voltage, this counter e.m.f. is nearly the same as on a 120-cycle circuit. The magnetic flux however is nearly doubled and the magnetizing primary current is almost three times as great as that required on the 120-cycle circuit. The result of the change in frequency from 125 cycles to 60 cycles would be to double the magnetic density in the core and increase the no-load primary current about 200 per cent. The increase in power loss as distinguished from the increase in primary current will be approximately one-third in the core and very little in the primary winding at full load; so that if a transformer showed losses of 3 per cent on 125 cycles, the losses at 60 cycles would be about 4 per cent.

I am operating an electric pumping plant in Texas and I have in use a 110-hp generator and five 20-hp motors which are belted to centrifugal pumps. The pumping season begins about June 1 and ends about September 30 and during that time the generator and motors are in constant use. After four years of service I have discovered that the motors are weakening and will not deliver as much power as at first. Do copper and iron deteriote with age, or what is the reason for this condition of affairs? G. McL.

We know of no reason why with proper care a motor should not continue to deliver the same power after years of operation as it did at first, provided, of course, that proper insulation has been employed in building the machine. It may be that your motors have become damp or dirty, and these two conditions are not conducive to the successful operation of any kind of electrical machinery. An electric motor like any other piece of mechanism is subject to a great many ills which might account for your trouble; and as an aid to the location and remedy of these we would suggest that you read the series of articles entitled "Diseases of Electrical Machinery," by F. B. Crocker and S. S. Wheeler, which was published in the *American Electrician* for March, April, May, June and July, 1905.

CENTRAL STATION SALE OF CURRENT

ELECTRIC SIGNS AS "LEADERS."

THE subject of electric signs as a good leader needs special emphasis. A member of the firm of one of the most successful supply houses in this country recently stated in discussing his own success in building up one of the largest mercantile businesses in this country that in securing the business of many of his customers he had used a leader as an entering wedge—his especial favorite being incandescent lamps. By handling a good incandescent lamp he had often used it as a prime factor in getting the attention of isolated plants and central station men.

In the same manner electric light stations may gain many customers for interior lighting and for power purposes, by first eliciting favorable attention by advertising strongly and soliciting hard for an electric sign.

The Denver Gas & Electric Company has a special salesman out on signs, and the moment he comes in with a contract the contract department starts the regular man in that district right after the same people, showing them what folly it would be to have back-numbered methods for their interior lighting when they are going to have a nice, new, attractive electric sign over their front door. This plan in Denver very seldom fails to secure a second contract, and this in many cases where it had been impossible to get arc lights and incandescent lighting into the store prior to the closing of the sign contract, which, by the way, is done upon a flat rate basis. The merchants like to have good signs and they simply just can't get away from the fact, if they take the time to consider it, that it is unbusiness-like, so long as a sign is a good thing in the day time, not to have it likewise attract the attention of every passerby after twilight.

IS ADVERTISING ENCLOSED WITH BILLS BENEFICIAL?

Some electric light companies, following the lead of the gas companies, have put advertising matter in their bills sent to customers.

It would appear to us that the very time when you do not want to make any suggestions to a man about spending more money is the exact moment when you are reminding him that he owes you probably more than he should like to pay.

Would it not be a good investment to send the advertisement separately from the bill, and not have it reach him at a time when the bill has just been received?

Very few manufacturers reduce the efficiency of their salesmen by having them collect bills, nor is the collector a desirable salesman. A little common sense salesmanship applies equally as well in the advertising business, for, perforce, advertising should always be considered as salesmanship if you want the direct results.

If you must save postage and try to sell your goods while you are dunning a man for a bill, then let a timely hint or suggestion suffice. Don't go into prices, for the bill will furnish him all the figures that he cares to digest at one time, be it for $1 or $100.

As to direct mail solicitation, it has doubtless occurred to many to make the mental inquiry, what about house to house distribution of printed matter?

This is, of course, a much cheaper form of distributing printed advertisements than sending by mail, but advertising experts who have been for many years trying to devise the most economical and forceful methods of publicity, are unanimous in condemning the house to house method of distributing booklets or card advertisements. The cheaper method is, unfortunately, looked upon as "cheap" by the merchant or housekeeper.

SELLING CURRENT IN DENVER.

For several years the Denver Gas & Electric Company has employed most modern methods of business-getting, and since the presidency of this company was assumed by Henry L. Doherty the gas and electric earnings per capita in the city have been approximately doubled.

The secret of this success lies in the wonderfully systematic method in which solicitation has been carried on and combined with advertising. The further interlocking of these two factors, which have contributed so essentially in getting new business, is the aim of President Doherty and Vice-President Frueauff, his able lieutenant, upon whom the general managership has devolved.

The results obtained in Denver are especially interesting since advertising, soliciting and the promotion of new business aggregate $140,000 in cost annually at the present time. This very large sum has caused criticism among some other prominent central station managers, but we note that this criticism is rapidly becoming a thing of the past, since upon careful analysis of the actual earnings obtained the management has been justified, and even fortified for greater efforts, by the magnificent returns upon the money expended.

Many of those attending the last National Electric Light Association, who journeyed to Denver in doubtful mood returned to applaud the magnificent returns that have been achieved.

The number of customers obtained through the efforts put forth in Denver, and likewise in Lincoln, where there is another company of which Mr. Doherty is president, if considered as though they formed a separate electric light company to be purchased, would be worth 8.5 times what they have cost the Denver Company to acquire by its advertising, promotional and business-getting methods. These facts are true after eliminating the natural increase which would have come without the extraordinary efforts that have been put forth. The advertising department has received a great deal of attention from both the president and vice-president of the company, and has been consistently improved from year to year, by any change in the service which would result in increasing its value.

The new business department has been under the general charge of Phillip Cross, and immediately in the charge of C. N. Stannard.

The city is divided into fourteen distinct districts, each district being in charge of one solicitor and one assistant. The territory assigned to this pair of business-getting includes, in order to be fair to each solicitor, a business district and a residence district. The chief solicitor for each district devotes his personal time between the two districts, according to his own discretion, but he makes careful daily returns, as does his assistant, upon blank forms provided for every call that has been made.

Every morning at 8.15 there is a meeting between the contract agent and the solicitors and their assistants, and this meeting lasts until 8.45. A discussion of the contracts closed is taken up as an incentive to others, and criticism and praises are distributed generously, according to whether the contracts that have been secured are thorough enough or not—that is, whether they provide for all the possible use of gas and electricity that they might have done.

Each representative routes himself, but the contract agent compares the route outlined each morning with the actual results turned in at night, and thus the solicitor feels that the contract agent never loses direct interest in his work.

Once a week, on every Thursday evening, from 5 to 6, there is a general meeting in which the different points of salesmanship are discussed and viewed from the standpoint of different men. Perhaps one of the main secrets of the success in securing new business arises from the loyalty and devotion which is seemingly a part of the every-day life of each one of the solicitors, and anyone who has examined into the conditions must note the tremendous enthusiasm of the entire force—literally, they walk about upon their toes.

Another factor largely contributing to the results in this particular instance, is the system by which the solicitors depend upon their returns for their own earnings. Each man is given a drawing account, or salary, but the results are judged by the income and not by the number of contracts secured.

This is a much better method than of judging results from the standpoint of increase in units, since there is continual pressure and incentive on the salesmen to exert themselves towards bringing out good paying business. A salesman who secures a church contract with 600 lights can do no posing, either before his brethren or before the officers of the company, for he knows that that church, viewed from the standpoint of income, is a mighty poor factor and entitles him to little consideration, and what is more to the point will not permit him to handle at the end of the year any of the real dollars of premium, which his wiser brother will have secured through making a contract with a factory for all its electric power.

It is a matter of more than passing interest to note that although the interests identified with the Denver Gas & Electric Company, were first successful in the gas industry, yet the returns from the company show that the electric department is making even a better showing than the gas department, and this notwithstanding the fact that no gas company in the country has more energetically pushed the sale of gas, cooking appliances and industrial fuel promotion than has the Denver company.

In addition to the 28 general salesmen we have indicated there are eight special men, namely, two for electric power, one sign expert, one industrial fuel gas solicitor, one specialist on new buildings and electric light extensions (part of his business being also to confer with architects) and three specials who are domestic fuel experts. It is the business of these men to canvas carefully the residence sections of the city, suggesting new uses for gas and electric household appliances, and also to keep in use gas ranges, hot water heaters, etc.

DENVER BUSINESS-GETTING DEPARTMENT.

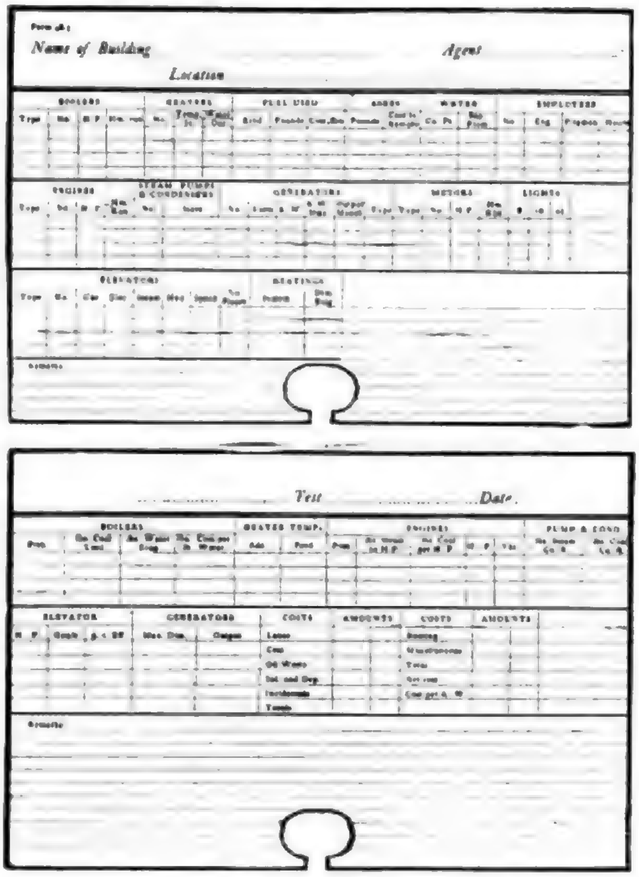
One of the salesmen recently related that he called upon a family to find the gas range discarded, standing out on the porch and being used as a refrigerator. Within one hour he had convinced the woman of the house to allow him to put it back, connect it up and finishing his demonstration by cooking her such a toothsome luncheon, as she admitted, she had never been able to get from her coal range.

The main streets of Denver and many of the side streets, which heretofore have been very uninviting, are flooded with light at night from numerous electric signs of all kinds and descriptions. Many thoroughfares are now popular which heretofore were unfrequented after nightfall, and this has been brought about by reason of the active industry of the company in showing and proving to the merchant that the people would come through their streets at night in large numbers if the streets were only adequately lighted, as compared with some of the more prominent thoroughfares. The company has consistently kept before its prospective sign customers this fact, coupled with a warning "be sure you have a long lease before you put up an electric sign, for your neighbors will do likewise, and then as your street grows more prominent, your landlord will want to raise your rent." Put forth in various forms, this has been a telling argument, and has thrown new light upon one phase which can be utilized to get the value of electric signs into and through the heads of particularly hard-headed old conservatives who are slow in starting with electric lighting.

The Denver papers have been used in this advertising campaign, and the free advertising they have contributed in talking about Denver, the City of Lights, has been a factor in bringing about present conditions. "Boost for Denver" seems to have been synonymous with "Light Denver Better."

The accompanying photograph of the business-getting corps of the Denver Gas & Electric Company has a personality to it that is only interesting to a few people. We do not publish it by reason of this fact, but because numbers when stated simply as numbers are not as impressive as a graphic illustration of what they stand for. Denver is a city of but 150,000 inhabitants, yet the business-getting force of the Denver Gas & Electric Company embraces, approximately, 50 people, including the office force. This means nothing in itself, but it does mean a good deal when it is remembered that Denver is absolutely in the fore-front as a business-getter for both gas and electricity.

More and more central stations are beginning to realize that money spent in securing new business is a good investment, even though charged as an expense. It is far cheaper than buying the curtains from a competing plant would be under the most advantageous terms of purchase.



Name of Building *Agent*

Location

Test *Date.*

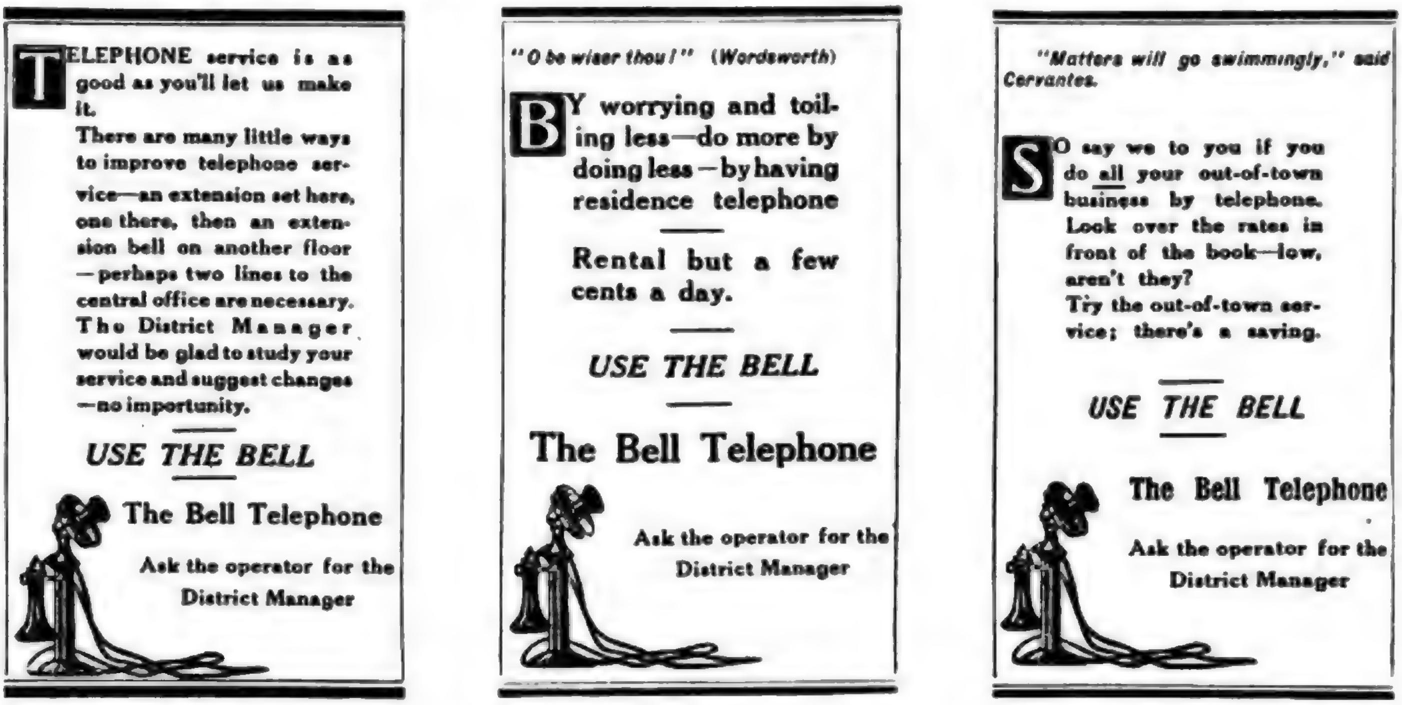
DENVER INDEX CARD.

The accompanying illustrations show two sides of a very complete index card, used by Denver in making tests on isolated plants. It serves as an example of the thorough method used in this city for recording data of all prospective customers for the benefit of the business-getting department.

A Hint From the Telephone Companies.

By Frank B. Rae, Jr.

At a time when so much agitation regarding advertising and new business methods is going forward among electric light and power companies, it is profitable to turn aside and note what is being done in similar channels by other public service corporations. Such investigation not only results in uncovering a wealth of new and adaptable advertising ideas, but gives valuable hints as to the methods employed in a line of work of which too little is known by the central station fraternity.



TELEPHONE service is as good as you'll let us make it.
There are many little ways to improve telephone service—an extension set here, one there, then an extension bell on another floor—perhaps two lines to the central office are necessary. The District Manager would be glad to study your service and suggest changes—no importunity.

USE THE BELL

The Bell Telephone

Ask the operator for the District Manager

"O be wiser thou!" (Wordsworth)

BY worrying and toiling less—do more by doing less—by having residence telephone

Rental but a few cents a day.

USE THE BELL

The Bell Telephone

Ask the operator for the District Manager

"Matters will go swimmingly," said Cervantes.

SO say we to you if you do all your out-of-town business by telephone. Look over the rates in front of the book—low, aren't they?
Try the out-of-town service; there's a saving.

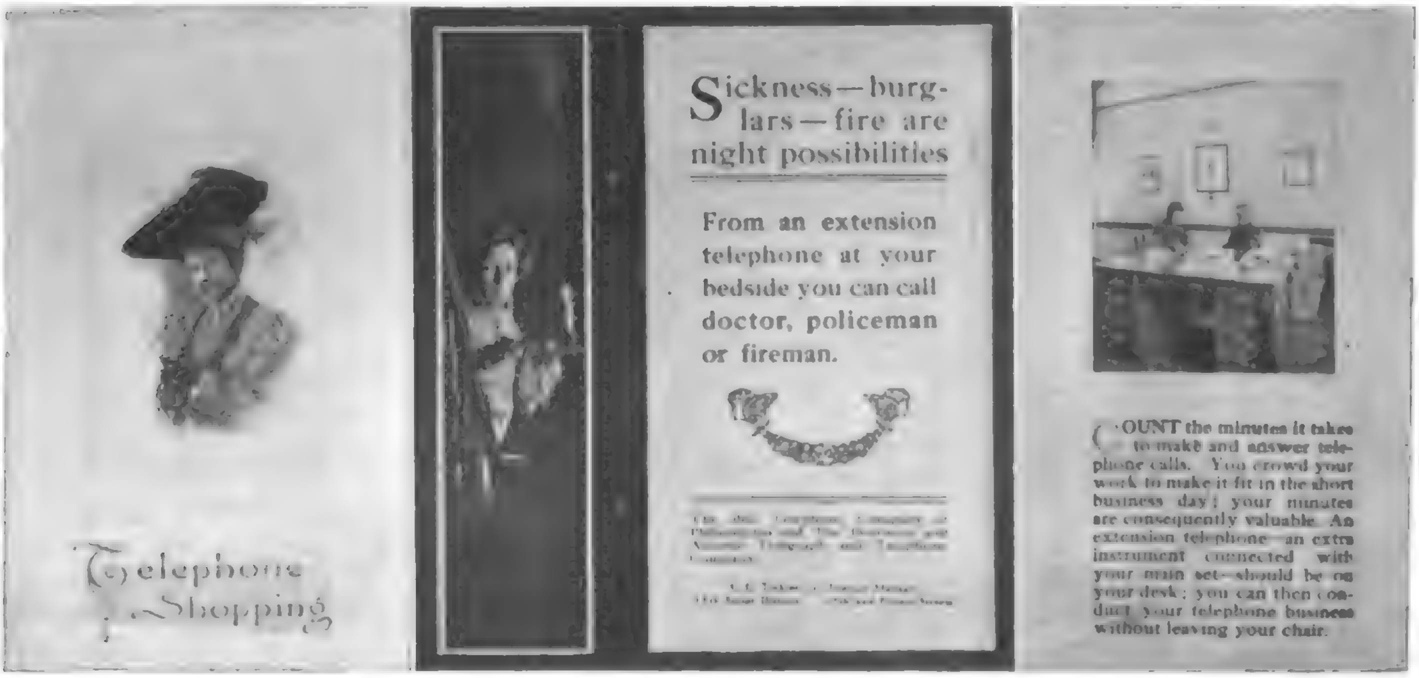
USE THE BELL

The Bell Telephone

Ask the operator for the District Manager

Fig. 1.—Newspaper Advertisements.

The methods of the Bell Telephone Company of Philadelphia constitute a case in point. While these are carried on in a "big" way—from the standpoint of the average central station manager—the *principles* may be practically and successfully applied in getting business for any station serving a population of over 5,000. The Bell advertising under consideration is divisible under two heads: newspapers and direct-by-mail. Each class has its distinctive place in any public service advertising campaign, and both will bear the most careful study.



Telephone Shopping

Sickness—burglars—fire are night possibilities

From an extension telephone at your bedside you can call doctor, policeman or fireman.

COUNT the minutes it takes to make and answer telephone calls. You crowd your work to make it fit in the short business day; your minutes are consequently valuable. An extension telephone—an extra instrument connected with your main set—should be on your desk; you can then conduct your telephone business without leaving your chair.

Fig. 2.—Covers of Booklets.

In the newspapers the Bell Company employs two methods of reaching the public eye. The first and most important of these is a series of single-column display ads, three and one-half inches deep, and set in uniform style. A good-sized initial is of each advertisement, and the phrase, "Use the Bell," is repeat- used at the head of each advertisement, the type being heavy-face, with half inch margins to set it off distinctly from the surrounding matter on the newspaper page. A characteristic cut of the desk 'phone appears in the lower left-hand margin ed throughout the entire series.

As will be seen from the specimens reproduced, "one-idea" copy is used; that is, each advertisement endeavors to bring home in convincing terms only one advantage of the Bell.

The second form of newspaper publicity consists in a series of "readers," tiny two-lined arguments which are tucked in between news items in the paper, and which are read almost unwittingly by even the busiest person scanning the front page for the day's happenings. They are terse, pithy, and have the ring of truth. Their value lies in the suggestive way in which the convenience, speed, and money-saving qualities of the Bell are brought home before the reader realizes that he has stumbled upon an ad. Note that the statements in these "readers" are not glittering generalities, vaguely applicable to anyone, but live, pertinent facts especially addressed to the individual.

Upon both these methods a volume of comment might be penned. We note only the two most salient features—"one-idea" copy, and continuity of effort—as these are the most fundamental principles of public utilities advertising. Say one thing; say it well; then stop. To-morrow say something else; say it equally well; then stop. Such copy requires that the advertising be continuous, not spasmodic.

Don't write that letter—Use the Bell— Quicker and cheaper. Everyone is your neighbor if you USE THE BELL.—Advt.

◆

Are you late Reassure your friends. —USE THE BELL.—Advt.

◆

One firm has 800 Bell Telephones. They pay. You have but one—need more. USE THE BELL.—Advt.

◆

Leaving town in a hurry? The Bell makes it possible. USE THE BELL.—Advt.

◆

Try to think of an emergency out of which the Bell will not help you. USE THE BELL.—Advt.

◆

Of the system used in soliciting business direct-by-mail, we have not the full details, but it is evident from a glance at the material used that these methods are up-to-date and efficient. Booklets are used freely, and are designed to appeal to the class of people to whom the Bell looks for patronage. Also, they are designed, as are many of the newspaper display advertisements and "readers," to increase the number of telephones used by persons who are already subscribers, as well as to persuade new subscribers to fall in line. Thus, a folder, "Count the Minutes," is an appeal for the extension telephone in business, and a booklet, "Inter-Communicating Residence Telephone Service," describes the advantages of this system in homes. "Telephone Shopping" points an easy way out of the often-times vexatious running of errands. "At Night," in twenty words, shows how the Bell offers security in event of sickness, burglars or fires. The title of the pamphlet, "About Business Telephones," explains its contents "How Far Is It?" appeals to the rural subscriber; "The Lombard Central Office," describes and pictures the inner workings of a modern exchange in a way that will be a revelation to the average person.

These booklets are beautifully printed, well illustrated, but their value lies in the "copy." That, unfortunately, we cannot reproduce as fully as is desirable, but the few samples shown will repay study. It is the *copy*—the terse, clear-cut, convincing, business-bringing statements of the superiority and advantages of a product that makes an advertisement good.

A Central Station Bulletin.

The Chicago Edison Company did some very effective exhibiting and advertising during the recent Electrical Show in Chicago. Its special bulletin, the *Daily Electric City*, was issued each day of the show and printed on a No. 4 Miehle press, operated with Edison power, in the power section of the Chicago Edison exhibit. This was one of the leading features of the show and the paper was in great demand, some 100,000 copies being distributed free to exhibitors and visitors in attendance at the show. The paper was folded on a Brown catalogue folding machine, also operated by Edison power in full view of visitors.

The electrical cooking and baking demonstration proved of great interest. One of the features was the free distribution of cookies made from a selected recipe, and cut out in the form of an oval with the Edison trade-mark reproduced thereon.

The text of the bulletin was humorous as well as instructive, while many of the new apparatuses and devices were illustrated and described in a popular but accurate way.

Business-Losing Methods.

A campaign of business-getting methods has recently been developed in these pages, following up on a larger scale the work of the last two years. Some electric lighting companies, however, appear to have peculiarly successful business-losing campaigns of their own. We quote below a letter that has just reached us from a city within a thousand miles of New York from a reader of this journal:

"The company had a circuit running near my property. All they had to do to connect up the current was to put in a transformer and about 50 ft. of wire from one of their poles to my automobile shed and put meters in the shed, as I had an underground conduit running from the shed to the house, and the house wired for about 125 lamps.

"In the first place I had my architect take the matter up with the electric light company, and they promised at once to take the necessary steps to make the connection. About two weeks afterward, as they had done nothing, I called them up over the telephone, asking when they were going to make the connection, and they promised to attend to it within a week. The matter lingered along about two weeks, I calling them up occasionally, when I went down and interviewed the man who looks after the new installations, and he promised he would look after the matter personally and see that I had current at once. It was nearly two weeks after that before the connection was made.

"The gas company treated me in an entirely different manner. When I was ready for the gas I called up over the telephone and asked them to make the connection; they requested me to make a written application, which I immediately did, and they then proceeded to make the connection. I was using the gas for illuminating purposes over a month before I could get the electric current installed.

"The gas company was more alive to obtaining new business. In fact the gas company seemed to consider it a favor to be asked to put in the gas, while the electric light company seemed to consider that they were doing me a favor to make the connection."

Advertising and Gas Competition at Sheboygan, Wis.

The Sheboygan Gas Light Company recently came out with a 4 by 7-in. advertisement in a Sheboygan daily paper worded as follows:

"Cut your store lighting bill in half by using the Indoor Welsbach Gas Arc Lamp. This lamp comes from the factory of the Welsbach Company mechanically perfect with every device that ingenuity can accomplish. Its wonderful popularity is due to the fact that it never disappoints."

Mr. Ernest Gonzenbach, general manager of the Sheboygan Light, Power & Railway Company, somewhat dampened the effect of this advertisement by coming out with a quarter-page advertisement in a following issue.

"Don't cut your store lighting bill in half by using imitation arc lamps. Make it one-fourth by using tallow candles. This is the simplest and cheapest light and it never disappoints. Our grandfathers used them with success. Can be bought at all the best stores. But first-class business houses use electric light. There is a reason why. It pays."

Attractive Central Station Offices.

One of the points emphatically brought out by several speakers at the recent convention of the Northwestern Electrical Association was the importance to central station companies of getting attractive offices or sales rooms. One speaker drew a vivid picture of the conditions as they have existed and still exist in many places where the electric light company's office consists of a dirty desk in one corner of the power plant, surrounded by greasy chairs and covered with a litter of ancient circulars and electrical supply catalogues. In other cases the company maintains no office of its own in the smaller towns, but has headquarters for the payment of bills at the place of business of some officer of the company. As long as the company is contented to lumber along in the old rut of getting only what business is forced upon it, this policy will do very well, but it would seem self-evident that if a company is really out for all the business available and wishes to push actively the use of electric light and other electric service in its town, it must begin by setting an example in its own headquarters. There is an old saying that the "shoemaker's wife goes without shoes," which finds its parallel in a good many other classes of business, including that of some central station companies.

Is it reasonable to expect the merchants of a town to light up brilliantly and attractively when the very company urging them to do this does not? The company's office, even though it be not large, should be in a good location and a model of what can be done in the way of display or artistic lighting. For this reason the management can afford to give considerable thought and money to its office arrangement and equipment. If electric lighting is being urged upon the merchants of a town as a means of advertising, both by the use of electric signs and brilliant interior illumination of stores, the company's offices should be one of the prominent examples in the town of what can be done in this respect. Visits to the offices of some of the more progressive central station companies show that ideas and tastes differ widely as to the kind of display made. The general policy of some of the larger companies is to make their headquarters appear as substantial and artistically lighted as possible. The furniture and fixtures are of the best. Elegance and artistic effect are aimed at rather than mere display. In other companies' headquarters the display feature is more prominent, the aim being to impress the visitor more with the quantity of light than with its artistic application.

It goes without saying that since the company is urging the use of electric signs and decorative lighting for advertising purposes it should make as liberal use of these as will harmonize with the general scheme of the lighting of the company's headquarters. Aside from the questions of the general appearance and illumination of their offices, many companies are weak in the way electrical appliances are displayed, if they are displayed at all. It is too often the case that the goods on display in the windows are not kept in an attractive condition and no use is made of the great opportunities in window display for calling attention to various devices by the use of neat and skillfully worded placards. For example, a company which is pushing the flat iron business may have on hand a large order of irons which it is trying to place, the irons being in the store room and the office window comparatively bare. It would be much better to bring a lot of these irons out of storage and place them attractively in the window. A large quantity of such irons in a window in the average town could not fail to impress passersby with the idea that the electric flat iron must be something worth looking into if a company can afford to purchase such a large quantity and have them on display.

If new devices with which the public is not familiar are put on exhibition, they should always be accompanied with some placard explaining their purpose and, if practicable, stating briefly their advantages. Some companies make it a practice to keep on hand a large stock of chandeliers and fixtures which are kept on display in the company's sales room. These fixtures make an attractive display and prospective customers can make their selections without reference to catalogues.

Compensation for Solicitors.

Considerable interest is being manifested these days in the question of how solicitors for central station companies shall be paid, whether upon a commission basis or on a salary without commission. The same old arguments that have been applied to commission versus salary for agents and solicitors for ages have been revived in this connection. Looking at it from the central station company's side, the company is anxious to have its solicitors put forth their best efforts, to which end it is argued that they will work harder if placed on a commission basis. Against this, from the central station's standpoint, is the fact that a solicitor purely on commission will sometimes sell customers things which they ought not to have and which in the long run will not prove valuable or favorable to the reputation of the central station company. A further objection to the commission basis is that soliciting may be profitable at some seasons of the year and unprofitable at other seasons, so that a solicitor cannot be secured during dull seasons, although it may be to the company's interest to have a solicitor in the field the year around. If commissions are raised so that a solicitor can make a living during the dull seasons they may be entirely too high for the best season of the year.

In a great many places a compromise between the salary and commission schemes has been arranged. Solicitors are paid a fixed salary which is supposed to be about enough barely to cover living expenses. To this is added a commission on the amount of business secured. The method of determining this commission is something upon which a great deal of study may be put. The method adopted by the companies controlled by a certain well-known syndicate, which has studied this out very carefully, is to compare the gross income each year with that of the year previous, crediting each solicitor with a certain percentage of the increase from his territory. The percentage paid depends on the character of the new business secured. Business which increases the revenue without any increase in the company's investment ranks the highest. Consideration is also taken of the fact that purely peak-load business is not as desirable as long-hour business. The making of such a schedule of percentages to be paid solicitors is naturally an elaborate task, involving the consideration of almost every element entering into the cost of power production by central stations. Such schedules may have to be revised and altered from time to time as conditions in the city change. A discussion of this subject by those in charge of such departments should prove of value.

The Spring Flat Iron Campaign.

With the coming of warmer weather, central station companies should prepare to actively push the electric flat iron business. While hot kitchens may not drive housewives to the use of electric flat irons until the latter part of May or June, it is well to be thoroughly prepared in advance and to be continually bringing before them the advantages of the electric flat iron. Some central-station managers have hesitated to push the electric flat iron business for household use because of supposed expense of operation. If some of these managers would spend a half a day in their own kitchens ironing and learn the practical advantages and conveniences of the electric iron as compared to any other, they would radically change their views, as to its possibilities. The electric flat iron is such a decided advance over other irons in convenience and in the rapidity with which work can be done, that few people who have tried the electric iron will go back to coal or gas-heated irons. They will gladly pay the extra cost of operation of the electric iron.

Probably the most successful and least expensive way of advertising and soliciting for electric flat iron business is simply to purchase a lot of irons and put them out on trial in residences. Then the only money involved in the advertising and soliciting part of the work is the few minutes spent by the employee who delivers the iron and sees that the customer is instructed in its use and has arrangements for connecting it in the kitchen. In delivering irons for use on trial, it may frequently happen that some little special arrangement in the way of an extension cord and the like is necessary to its use in the customer's kitchen. The amount of cord ordinarily sent out with an iron is frequently not enough to permit its convenient use and whoever delivers the iron should look after all these details.

It is further desirable that the employee delivering the iron, whether he be a solicitor or not, should call the customer's attention to the numerous advantages the electric iron has over others. For this reason he must be well posted on the subject, and must be able to talk something besides "glittering generalities." In advertising and soliciting an endeavor should be made to cause the advantages of the electric iron to become the talk of the town. An electric iron fad can be created as well as any other, only in this case, the fad is one which is sure to last after the first excitement is over. Many people will go along using ordinary flat irons year after year without thinking of their disadvantages till those points begin to be advertised and talked of; then they will begin to be discontented with the old methods. It is just this discontent with old methods that one should seek to create.

In many cases advertising matter cannot go much into detail about electrical devices, but in the case of the flat iron which is of such universal application and offers such opportunity for steady and desirable load, it is well to go into these details. It is rather surprising that little of the advertising literature which has been printed on electric flat irons for distribution among possible users calls specific attention to the advantages of electric irons compared with others. This is true both of the circulars printed by manufacturers of electric irons for distribution by central station companies and of most of the advertising printed by the central station companies themselves.

SUGGESTIONS FOR CIRCULAR.

The following points are suggested as being among those to be brought out in advertising and soliciting the electric flat iron.

No traveling back and forth to put irons on the stove.

No scraping, cleaning and waxing of irons.

No testing to see whether iron is the right heat.

No starting with an iron hot enough to scorch and finishing with it too cold for good work.

No spoiling of linen with dirt that didn't get wiped off the iron.

No scorched clothes.

No shutting of cooling breezes out of the kitchen on ironing day for fear of blowing out the gas.

The heat is brought to the iron, not the iron to the heat.

Iron always the right heat without any attention to it.

Iron always clean.

Simply go ahead and iron without thinking anything about the iron or its condition.

A great time, patience and labor saver.

As far ahead of the old way as electric light is ahead of other lights.

It will be noticed that the first set of points calls attention to certain well-known shortcomings of ironing by gas and coal stoves. The latter points state the positive advantages of the electric iron. These points might well be arranged in advertising matter in parallel columns, one bringing out the disadvantages of old methods and the other the advantages of the new.

* * *

New Telephone Patents.

SUB-STATION APPARATUS.

In the construction of transmitters it has always been found necessary for best efficiency to make the front wall of the casing very rigid, which has been accomplished by making it thick and therefore difficult and expensive of construction. M. Setter, of Chicago, has endeavored to overcome this expense by building up the casing front of two stamped metal parts. Fig. 1 shows these parts and the manner of securing them together. Mr. Setter has assigned his patent to the American Electric Telephone Mfg. Co.

A. F. Bordman, of Somerville, Mass., has patented a waterproof telephone set. The casing is cylindrical and all working parts are within a sealed compartment which occupies the rear of the casing. Upon the front wall of this rear compartment the stationary receiver hook is mounted, while through it project the horn of the transmitter and a plunger which controls the circuits. This plunger is slightly longer than the depth of the front compartment of the casing. Therefore it becomes depressed when the door provided for this front compartment is closed. The door closes upon a rubber gasket and thus seals the front compartment.

E. P. Garney, of Scranton, Pa., has invented a ventilating system for booths. She provides a fan in the roof of the inner shell and delivers air from the space between the shells through a light valve set in the roof of the outer shell. It is claimed that this arrangement provides ventilation without affecting the quality of the booth.

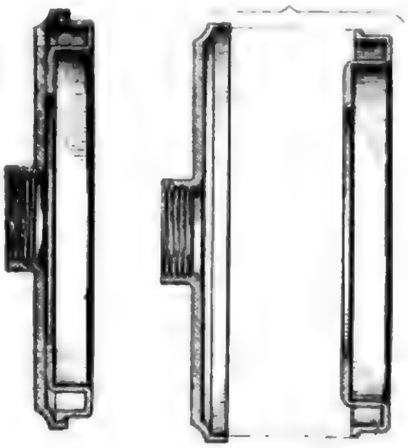


FIG. 1.—SETTER TELEPHONE CASING.

EXCHANGE APPARATUS.

Some small switchboards still have bells as signals, and in order to avoid the confusion arising from the proximity of a number of these bells, W. R. Horning, of Cleveland, O., has patented a drop annunciator attachment. This drop is mounted below the gongs, and it is latched by a bar which is pivoted near its middle and which embraces the bell clapper rod at one end. Whenever this bar is out of mid-position, which it must be with the bell at rest, the clapper being contact with one of the gongs, one of the lower corners of the bar overlaps the shutter of the drop, and thus latches it up. When the bar vibrates, the drop may fall. It might seem that there is a chance for bar and shutter to wedge, but this is overcome by beveling the edges of both. Mr. Horning has assigned his patent to the Williams Telephone and Supply Company.

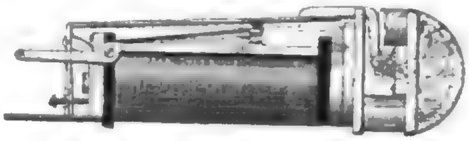


FIG. 2.—OLSON ANNUNCIATOR DROP.

An annunciator of a very different type is shown in Fig. 2, wherein a pivoted shutter is driven from a block attached to the end of the armature of an electromagnet. The electromagnet pole pieces at either end are presented to the sheet metal armature. The action is self-evident. H. M. Olson, of Chicago, is the inventor of this signal, his patent being assigned to the American Electric Telephone Mfg. Co.

F. D. Cook, of Chicago, has brought out another type of self-soldering heat coil, and has obtained a patent for the accompanying protector. The protector comprises the usual collection of ground plate and springs, these especially arranged to take a testing plug, and the special heat coil. This latter has a rotating spindle which carries a toothed wheel. This wheel is normally locked and its teeth hold open the ground connections by engaging the spring. If the solder softens, the spring forces a rotation of the toothed wheel and the auxiliary and ground circuits are closed.

LETTER TO THE EDITORS.

Magnetism of Alloys.

To the Editors of Electrical World:

SIRS:—No satisfactory theory has so far been given for the Heusler magnetic alloy made from non-magnetic metals. It would seem to be possible to get nearer the truth if we would take into consideration that the "optics" of the material plays a part in connection with electric waves, magnetism being nothing but counteraction or displacement pressure of electric waves on a wire through which a current flows. Starting with this point of view, it would probably be possible to find other compositions which have a similar index of refraction as iron.

If we consider an electromagnet as a kind of electric centrifugal machine, we obtain quite a suitable conception of the production of the force on a metallic core in a solenoid.

We then need no molecular currents nor molecular magnets nor lines of force nor other analogies, but we calculate the depression, "the attraction" at the ends of the core from the centrifugal force in the so-called indifferent zone from a speed

$$R_1 = W\,i \times 10^{-1}\left(1 - \frac{a}{90}\right)$$

where the value of a follows from $\tan a = \dfrac{W\,i\,10^{-1}}{a^2\sqrt{g}}$ and a = angular velocity, W = number of turns, i = current in amperes and a = radius of the circle.

This centrifugal force was shown by me experimentally in the revolving electromagnetic field in 1904. I refer to my book on "Elektrische Spektra." The above method of calculating the magnetic force was given in 1889 by W. Fritche, but without an explanation of the real process. The theory of lines of force which does not give any conception, obstructed the evolution of the kinetic theory which is so very simple and completely justified.

"The optical behavior of metals," the refraction and reflection of electric waves on a metal core, is therefore the cause of the increased electromagnetic force of a solenoid supplied with current. The theories and investigations of the last 300 years have so far been unsuccessful in solving the mystery of electromagnetic phenomena. However, as soon as the laws of mechanics and optics are applied to these phenomena—which has been my endeavor for the past 25 years—the phenomena appear to be very simple, as indicated above.

CHARLOTTENBURG, GERMANY. JOH. ZACHARIAS.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Commutator-Motor for Operation Above Synchronism.—LATOUR.—The author first compares the repulsion motor and the series motor and shows why at synchronism the repulsion motor is superior to the series motor with respect to commutation. On the other hand above synchronism the repulsion motor becomes inferior with respect to commutation. If a low frequency is used for traction motors, operation above synchronism may become necessary and the author has, therefore, devised a new type of motor which gives perfect commutation at a speed considerably above synchronism. In Fig. 1 a series motor is shown with compensated armature reaction. The exciting winding, the terminals of which are a and b, are between the compensating winding, C and the rotor, c d. It is assumed that the motor gets the current from the secondary winding, e f, of a transformer, T, which will be the usual method for traction purposes. If now a short-circuit connection is made between a certain point, h, of the secondary of the transformer and a certain point, g, of the exciting winding, and if these points, g and h, are properly chosen, the motor gives perfect commutation for a speed which is the higher above synchronism the nearer the points, g and h, are to the terminals, a and e, respectively. The theory of the motor is given.—*Elek Zeit.*, February 1.

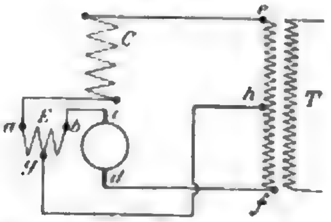
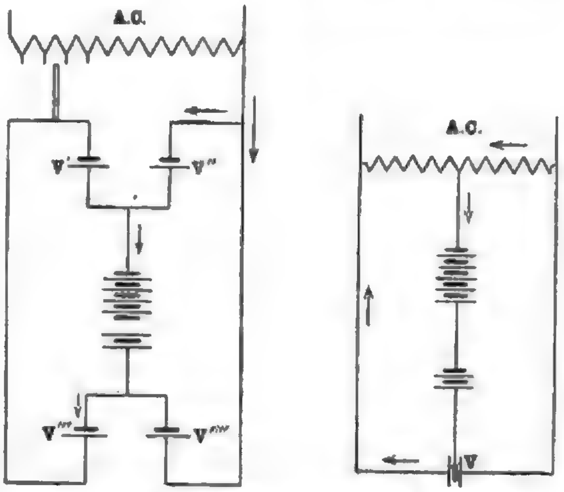


FIG. 1.—SINGLE-PHASE COMMUTATOR MOTOR.

Single-Phase Induction Motor.—FYNN.—The first part of a paper in which the author gives, without complicated mathematics, a simple theory of the single-phase induction motor. His theory is based on the discussion of the following type of motor which the author considers to be the fundamental form of the single-phase motor and more general than either the squirrel-cage rotor type or the rotor type connected with slip rings. His fundamental type comprises a stator and a rotor in the shape of an ordinary direct-current armature, but short-circuited by means of two pairs of brushes along two axes which are stationary in space and in quadrature to each other, while one of them coincides with the stator-field axis.—Lond. *Elec. Rev.*, February 9.

Rectifying Alternating Current.—ROSLING.—A paper read before the Leeds Section of the (British) Inst. Elec. Eng. In the first part the author deals with the electrolytic rectifier and describes two methods of connection for utilizing both half waves of the alternating current. The two methods are indicated in Figs. 2 and 3, where it is assumed that the rectified current is used for charging a battery. Fig. 2 shows the arrangements of Graetz which requires four electrolytic rectifying cells, V. The path of the current during one half-cycle is shown by the arrows. It passes through cell V''', the accumulators and V''. The insulating film forming on V', the aluminum to lead path prevents the cur-



FIGS. 2 AND 3.—RECTIFYING ALTERNATING CURRENTS.

rent from short-circuiting across to the other side of the alternating-current circuit. On the reversal of the polarity the current flows through V'', the accumulators and V''', V'' now forming the "closed door." The current thus passes in the same direction through the accumulator in pulsations of twice the periodicity of the alternating-current circuit. Fig. 3 shows the Churcher arrangement. In it only one rectifying cell, V, is required, but this has one platinum or lead plate and two aluminum plates. The path during one semi-cycle is shown by arrows, from the middle point of the reactance coil the current passes through the accumulators and one-half of the rectifier cell, V. On reversal of polarity, the current flows through the other half of the reactance coil, the accumulators and the other half of the cell, V. In both systems the reactance coil can be arranged with multiple tappings so that the correct e.m.f. for the work to be done can be efficiently obtained, the pressure across the direct-current circuit being approximately 90 per cent of the pressure between the tapping and the terminal end of the reactance coil. In the second part of the article the author deals with the mercury-arc rectifier.—Lond. *Elec.*, February 9.

Lamps and Lighting.

New Metallic Filament Lamp.—A note on an English patent by H. Kuzel; the process is stated to be applicable to refractory metals "such as platinum, chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, etc." (This patent is of interest in view of the remarkable results which were recently reported to have been obtained with lamps of Kuzel as described in ELECTRICAL WORLD February 17, page 354.). The method of manufacture is as follows: The metal is reduced to a colloidal state by a process such as that of Bredig in which an electric arc is produced under water between a pair of rough electrodes of the metal in question. Dr. Kuzel recovers this finely divided metal and forms filaments by forcing it through a die. The filaments are dried at a temperature of 60° C. to 80° C. for 5 or 10 minutes, when they become conductive, but they lose their conductivity again on cooling. To restore the conductivity they are placed in vessels which have either been evacuated or contain only inert gases such as hydrogen, and are first heated to 60° C. or 80° C. to render them conductive and then raised to white heat by an electric current. This, it is stated, restores them to a crystalline state and at the same time diminishes their diameter as well as their specific resistance, and the filaments are then ready for use.—Lond. *Elec.*, February 9.

Zirconium Lamp.—In notes on a lecture by Gaster on recent developments in electric lamps it is stated that the speaker exhibited a zirconium lamp, which, however, is not yet obtainable in the open market. The power consumption is stated to be 1.2 watts per candle with a life of 500 hours; but the lamp needs careful handling and at present is made only for "low voltages."—Lond. *Eng'ing*, February 9.

Power.

Superheated Steam.—LONGRIDGE.—An abstract of a lecture before the Bradford Engineering Soc. The author called attention to the lack of information at present available as to the variations of the specific heat of superheated steam with pressure and temperature, a matter which is now being investigated at the (British) National Physical Laboratory. The application of superheated steam to engines as a means of improving their economy was next considered. The two theories due respectively to Hirn, who atributes the losses to cylinder condensation, and Calender and Nicholson, who ascribe them mainly to a leakage past valves and pistons, were considered, and it was seen that from either point of view superheating could be proved to be conducive to economy. Some interesting reproductions of the late Mr. Donkin's curves, showing the temperature changes in the cylinder walls, were shown, and formulæ were explained for estimating the probable saving with superheated steam. It was pointed out that the saving in triple and quadruple expansion engines could only be fully utilized by employing reheaters between the successive cylinders. Indicator diagrams and results of tests were given to illustrate the gain in actual practice. Steam may be superheated in two ways, either by allowing it to expand without doing work or by supplying it with heat from an outside source. The former method is occasionally employed for moderate degrees of superheat, as in the case of some of the water-tube boilers in the British navy, but the latter method is far more common, a well-known example being the Schmidt superheater. The McPhail and Simpson superheater was also described and Patchell's testimony as to the utility of superheating in electric light stations during the peak of the load was mentioned. After giving some formulas and figures relating to the amount of superheat obtainable with different sizes of superheaters, the lecture concluded with some general notes on the design of engines intended for use with superheated steam.—Lond. *Elec.*, January 26.

Crane Motors.—HILL.—The first part of a paper read before the (British) Inst. Elec. Engs., on crane motors and controllers. In cases where the work of the crane cannot be exactly ascertained beforehand the author considers the following method of specifying and testing to be most convenient both to the purchaser and the maker. The horse-power required to lift or move the load, plus gearing losses, is taken as the brake horse-power of the motor. It is specified to maintain this power on a continuous run of ¼, ½ or 1 hour, as the case may be, with a rise of temperature of 75° F. The author then gives formulas and tables on the rise of temperature in the different parts of a crane motor and discusses the influence of the type of the motor and of its speed on the rise of temperature. He concludes that the ¼-hour motor has a very limited field of application, while the ½-hour motor is suitable for the generality of cranes having low load factors and the one-hour motor is suitable for cranes worked moderately hard. Quite a number of heating and cooling curves are given. The author then begins to discuss motors which work on a known cycle. Lond. *Elec.*, February 9.

Electric Power in North Wales.—An illustrated description of the electric power distribution system in North Wales. Water power is available to the extent of some 6,000 hp or more continuously. There are several big slate quarries in the neighborhood which use power; also a narrow-gauge steam railway is to be electrified. There are four turbines each connected to a 1,500 kilovolt-ampere, three-phase generator with an exciter on the main shaft in each case. The alternator voltage is 10,000.—Lond. *Elec.*, January 26 and Feb. 2.

Traction.

Electric Railway Engineering.—CARTER.—A long paper read before the (Brit.) Inst. Elec. Eng. on technical considerations in electric railway engineering. The bulk of the paper is a thorough discussion of the features of the direct-current system for interurban railways, many diagrams being given. The single-phase system is more briefly discussed. The author says that if earth currents are to be reduced to the same order as in direct-current operation, and if it is desired to place the sub-stations as far apart, the skin effect in the rails will render it necessary to adopt a line pressure of at least 6,000 volts or else to install frequent track boosters to take care of the voltage drop in the earthed conductors. If advantage is to be taken of the high pressure to considerably reduce the number of sub-stations, it becomes necessary either to adopt a completely-insulated line-conductor system, which much increases the difficulty of installation and working at complicated junctions, or to install track boosters, which adds to the expense. The best arrangement of boosters is thought to be that of the Oerlikon Company, in which the track current is transferred by the boosters to a common return conductor running between sub-stations. It is possible, however, to do without the return conductor by connecting the secondaries of the boosters across insulated joints in the track and introducing a small equalizing wire, as shown diagrammatically in Fig. 4. With this arrangement the tracks rails are employed as return conductors. The boosters must, however, be

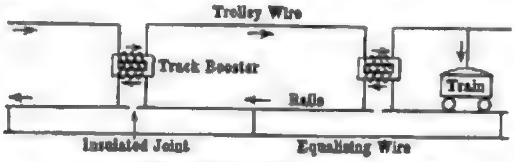


FIG. 4.—ELECTRIC RAILWAY ENGINEERING.

closer together near the sub-stations than in the Oerlikon system and many more are accordingly required. The author points out the limitations of the single-phase system and claims that the equipment of the latter will be considerably heavier than the corresponding direct-current equipment. For suburban conditions, he states that the single-phase system compares very unfavorably with the direct-current system. He says that the torque characteristic of the single-phase motor is more suitable for high-speed service with few stops than for suburban service, but that it would probably be necessary to concentrate the equipment on a locomotive, where the motors may be artificially cooled. Some of the disabilities of the single phase system disappear at low speeds. Again, a service involving infrequent stops, and moderate speeds, where the input per ton is small and the motor losses can accordingly be kept within reasonable limits, may often prove quite suitable for operation by the single-phase system. "In short, this system shows promise of having extensive, but by no means universal, application to railway work." The author finally makes some remarks on the third rail and recommends an efficient wooden protection, which would perhaps add 5 per cent to the total cost of electrification, but would remove the danger to people and prevent short-circuits with track tools. In the discussion which followed, Dawson and Trotter presented some considerations in favor of the single-phase traction system.—Lond. *Elec.*, January 26 and February 2.

Installation, Systems and Appliances.

Development of a German Central Station.—Prenger.—A long article on the rates of charging for electric energy in the city of Cologne, Germany, with statistical data on the development of the central station in that city. The kw-hours sold were 675,962 in 1895 and 12,340,840 in 1905; the cost of generating per kw-hour sold decreased in the same period from 3.01 cents to 1.39 cent, the cost of coal alone from 0.99 to 0.61 cent. The net profits were $45,449 ten years ago and $180,650 last year, while the average price of selling the kw-hour was 15.31 and 3.50 cents respectively. These figures show how good financial results may be obtained even with a small profit per kw-hour. In Cologne the charge for kw-hour was originally 17.5 cents without any consideration of the purpose for which it was used or of the time during the day when it was used. In 1893 the price of electrical energy for power purposes was reduced to 6.25 cents per kw-hour, but those electric motors were excepted which served for the generation of electric light. In 1895 the price per kw-hour for those customers who consumed energy mostly during day time and had their motors in operation for at least 1,000 hours per year was reduced from 6.25 to 5.5 cents. A discount was granted to consumers of large quantities of electrical energy, but the calculation of the discount was rather complicated, being based not only on the total consumption per year but on the number of lamps connected and the hours of burning. When in 1901 the electric tramways contracted for energy from the station, the load factor was very considerably improved, and it then became possible to reduce the rate so as to improve the load factor still more by extending the use of electric energy for many power purposes. A double-tariff system was now introduced with double-tariff meters so as to distinguish the energy consumed during the day ("cheap hours") and during the hours of maximum load in the evening. For the hours in the evening, the price per kw-hour was reduced from 17.50 cents to 12.50 cents, while for the "cheap hours," the price was reduced to 5 cents. Further discount is allowed on these prices, and no distinction is made between energy used for lamps and that used for motors. Consumers of large amounts of energy are permitted to install converter substations for charging storage batteries during day time at a low rate and to discharge them in the evening for producing energy for lighting. Statistical data are given showing the favorable development during recent years, especially the increase of connections of small motors of the station in a great many different trades like baker shops, carpenters, butchers, etc., motors up to 3 hp are mostly used. There were installed in 1903 a total of 516 motors having a combined capacity of 1,075 hp; this increased in 1904 to 598 motors with 2,198 hp, and in 1905 to 820 motors with 3,038 hp.—*Jour. f. Gasbeleucht.*, February 3.

Reversible Booster.—Turnbull.—A paper read before the New Castle Section of the (Brit.) Inst. Elec. Eng., on the "Lancashire" automatic reversible booster invented by the author and McLeod. In external appearance it resembles a four-pole dynamo driven by a four-pole motor; but while the motor is simply a shunt-wound machine, the booster itself has four field windings. One is a shunt winding (referred to as the *A* winding), across the booster terminals; another (*B*) is a shunt winding straight across the bus-bars; the third winding (*C*) carries the generator current and opposes the coil just mentioned; while the fourth winding (D), finally, is in series with the armature of the booster itself. The booster and battery may be worked in the following ways: (1) Booster and battery on bus-bars with generator, keeping the load steady within narrow limits; this is the normal method. (2) Booster and battery on bus-bars with generator, but with coils regulated to make its action comparatively weak. This method is useful when the load on the line is small with occasional jumps. Under these conditions the battery with the aid of the booster meets all the peaks, but maintains a benevolent neutrality during the times when the load is small, when it is not desirable for the battery to charge because it is already full. (3) The battery may be floated on the line without the booster. This method is occasionally suitable when the line load is slack. (4) The booster may be set to mainly charge or mainly discharge the battery, as may be desired; this by regulating coils *B* and *C*. Under this state of matters it will still respond to any excessive outside load. (5) The battery and booster can be put on the bars alone without a generator. The bus-bar volts can then be regulated by adjusting the strength of coil *B* by hand. (6) The battery and booster can be put on the bus-bars with the booster arranged to compound up when the load comes on. (7) The battery can be put on the bus-bars without the booster. The circuit-breaker arrangement used in connection with this booster is shown in Fig. 5.

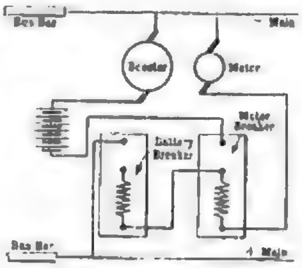


FIG. 5.—REVERSIBLE BOOSTER.

The battery current, as will be seen, goes through the two breakers in series, but it only goes through the solenoid of one breaker, called the battery breaker. An excess current on the battery, which is the usual thing, blows the battery breaker, but leaves the motor running on the battery. An excess current on the motor, which is quite a rare thing, also cuts off the battery, but leaves the motor running on the bus-bars. Thus paralleling is quite easy after a breaker comes out, seeing that it is not necessary to restart the motor. Whichever breaker comes out the motor is still left with a breaker to protect it, so that it would be cut out in the event of a short-circuit occurring in the motor itself. As a general rule, the best efficiency is obtained by making the one-hour rate in amperes of the battery equal to the full-load amperes of the generator, with the two together equal to the ordinary demand of the line. The battery circuit-breaker should be set at about 75 to 100 per cent over the one-hour rate to deal with momentary jumps, and the generator breaker can also be set high.—Lond. *Elec.*, February 9.

British Lighting and Traction Plant.—An illustrated description of the municipal lighting and traction plant of Chesterfield. The power house contains five steam driven generators, two of 100 kw, two of 200 kw and one of 400 kw, also a balancer and a booster and a battery of 280 cells with 600 ampere-hours capacity. The supply connections are at present equivalent to 40,000 lamps of 8 cp, and include some 500 hp of motors in addition to the tramway load. The tramways consist of 3½ miles of single track and ½ mile of double track. In the outlying districts certain power consumers are supplied with current by simply tapping the tramway feeders, while in order to supply certain prospective lighting consumers it is proposed to install a motor generator working in conjunction with a voltage regulator.—Lond. *Elec. Rev.*, February 9.

Combined Meter Tariff and Flat Rate.—Poeschl.—There are cases in which the load curve varies greatly during the year but with distinct regularity, for instance in industries which have distinct seasons of manufacturing. If a combined flat and meter rate is used and if the flat rate per kw-hour is smaller than the meter rate, there is always a distinct value of the energy paid by flat rate, for which the total cost is a minimum. The author shows how to determine this minimum value if the yearly load curve is given.—*Elek. und Masch.*, January 21.

Electrophysics and Magnetism.

Radiation.—Campbell.—An account of an experimental investigation of the radiation from ordinary materials. The author investigated the radiation from lead, copper, aluminum, zinc, iron, platinum, tin, silver, gold. Care was taken to have clean surfaces so as to remove any surface radioactivity. The result of the investigation shows that the emission of ionizing radiation is an inherent property of all the metals investigated, and the author sees no reason why it should not be extended to all substances. "It is not, of course, necessary that this ray-emission should be identified at once with radioactivity—if that word is taken to mean a process of ray-emission accompanied by atomic change. But the constant intensity of the rays, and the probability that the larger portion of them are alpha rays, which is suggested by the investigation of their charge and their penetration, afford considerable support for that hypothesis."—*Phil. Mag.*, February.

Condensation Nuclei.—Barus.—His long presidential address before the Am. Phys. Soc., summarizing our present knowledge of condensation nuclei. In the introduction he describes the prominent methods of observing nucleation, while the following chapters of the address deal with nuclei in general, persistent nuclei, ions, and colloidal nuclei. "If we asked what is the most important outcome of researches of the present character, I should refer to the appearances obtained, indicating that a gas, or at least a moist gas, far from being a uniform system, behaves like an assemblage of nuclei which decrease in size and increase in number as the molecular dimension is approached. Every group of nuclei is none the less a structurally essential part of the gas and (be the number of groups few or many) at once restored if withdrawn; while the molecule itself is distinguished among the many nuclei of its own kind, by the maximum frequency of occurrence."—*Phys. Rev.*, February.

Substitute for Ampere's Rule.—Burch.—Fig. 6 shows a diagram of the end view of an electromagnet with horse-shoe core. It will be seen that the letters S and N themselves indicate directly the direction of the current in the winding.—Lond. *Elec.*, January 20.

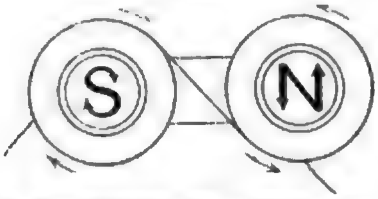


FIG. 6.—SUBSTITUTE FOR AMPERE'S RULE.

Electrochemistry and Batteries.

Electric Production of Ozone.—Ewell.—An abstract of a Phys. Soc'y paper in which the author determined the variation of the yield of ozone by silent discharges between plate electrodes with a dielectric under varying conditions of the experiments. The chief results are as follows: The yield per coulomb was found quite independent of the dielectric, and to be greater the higher the gas velocity. The yield increased with the current to a maximum and then decreased. Narrow, bare electrodes were found to be most efficient. The yield per kw-hour was greatest for a polar distance of a few millimeters. This type of electrode proved far more efficient than the point and plate and than other minor types.—*Phys. Rev.*, February.

Fixation of Atmospheric Nitrogen.—Thompson.—A lecture before the Royal Institution, dealing especially with the Birkeland-Eyde process which is now in use in Europe for the production of fertilizers from atmospheric nitrogen oxidized by electric discharges through air.—Lond. *Elec.*, February 9.

Carbon in Ferro-Alloys.—Offerhaus.—An illustrated article on the determination of carbon in ferrochrome. He compares the indirect method of Woehler with the direct methods of analysis and concludes that the direct method is preferable and that the Eimer carbon combustion crucible may be used here to good advantage.—*Electrochem. and Met. Ind.*, February.

Units, Measurements and Instruments.

Chilled Cast-Iron for Permanent Magnets.—Campbell.—An abstract of a paper before the (Brit.) Phys. Soc. After having reviewed the work of others on the use of chilled cast-iron for permanent magnets for instruments, etc., he gave an account of an investigation of his own which was made on rings in addition to rods of the standard dimensions usual in testing magnet-steels. All the specimens were heated to 1,000° C., and then chilled in cold water, care being taken to support them during the process, as cast-iron is very brittle at such a high temperature. The rods were tested for maximum remanence B and coercivity by Madame Curie's method, the magnetized bar being placed in a long solenoid producing a demagnetizing field which was gradually increased until a search coil slipped along the bar showed that the demagnetization was complete. The results showed the chilled cast-iron to be not very inferior to ordinary magnet-steel. By ballistic tests on the two rings their permeability curves were obtained, and these indicated that the simple process of chilling used was quite satisfactory even for a tolerably massive ring of 6 sq. cm. cross-section. The cheapness and ease of working cast-iron should encourage instrument makers to test its capabilities in various instruments. The cast-iron used was gray commercial cast-iron, but Ashworth has tested several other kinds of cast-iron and found very little difference in their magnetic properties. —Lond. *Elec.*, February 9.

Mica Condensers.—Zeleny.—An account of an experimental investigation which shows that the capacity of a mica condenser as determined by the ordinary direct deflection method is a variable quantity and a function of the period of the galvanometer. It represents neither the unabsorbed free charge nor the total quantity of electricity held by the condenser. The capacity determined from the free charge is independent of the period of the galvanometer and dependent on the condenser only. Standards of precision must be rated, therefore, in terms of the free charge. An interval of several hundredths of a second exists between the time of discharge of the free electricity and before the liberation of a measurable quantity of the absorbed charge. The condenser circuit must be opened during this interval. This is most conveniently accomplished by means of a special key. To avoid a loss of the free charge due to the absorption of the condenser, the discharge should preferably take place immediately after charging, or the time of charging must be continued for several minutes. The ordinary methods employed for comparing the capacities of condensers must also be modified so as to compare the free charges only. The free charge capacity and the temperature coefficient of a condenser being known, it becomes an instrument of precision especially useful for the accurate determination of the constants of ballistic galvanometers. The author recommends to define the capacity of a condenser as the quantity of electricity which it retains unabsorbed while its plates are at a difference of potential of one volt. In such cases in which the condenser is employed in a manner where the time is too short to allow it to become fully charged or discharged or the time is of sufficient length to cause either a part or the whole of the absorbed charge to become effective, the author recommends that the observed capacity value should be called effective capacity.—*Phys. Rev.*, February.

High-Frequency Currents.—Fleming.—The first part of his third lecture on the measurement of high-frequency currents and electric waves. The present installment deals with the measurement of frequency and resonance. Lond. *Elec.*, February 9.

Pyrometers.—Langley.—A description of several new pyrometers by Fery, which are partly of the thermoelectric type and partly of the optical pyrometer type.—*La Revue Elec.*, January 30.

Telegraphy, Telephony and Signals.

German Telephone System.—Some notes on extensions of the German telephone system projected for this year. (It is to be understood that the telephone system in Germany is operated by the Government and is, like the telegraph system, under the supervision of the postal authorities.) Twenty new local telephone exchange systems are to be erected by the German postal authorities during 1906 and connected up to the general long-distance network. Considerable extensions of the trunk lines are also to be carried out, not merely to connect these new exchanges to the trunk system of the country, but also in order to provide new routes and to relieve the congestion on some of the existing trunk lines. The number of new trunk circuits is to be 1,198 (627 overhead and 571 underground), and the total length of new wire will be 40,200 miles. Some 1,450 miles of conductor is to have a diameter of 5 mm. (0.198 in.), about 5,220 miles a diameter of 4.5 mm. (0.177 in.), about 11,700 miles a diameter of 4 mm. (0.157 in.), about 17,120 miles of wire a diameter of 3 mm. (0.118 in.), and some 4,070 miles, finally, a diameter of 2 mm. (0.079). A few of the lines will be of hard-drawn copper, but by far the larger portion is of bronze.—Lond. *Elec.*, February 9.

Call Relay for Wireless Telegraphy.—A description of a new relay devised by Sullivan to be used especially with electrolytic coherers and similar "wireless detectors." The instrument consists essentially of a very sensitive moving-coil galvanometer. A specially strong magnetic field is obtained by permanent magnets, and some idea of the sensibility may be obtained from the fact that with one dry cell working through 8 megohms the limit of working has not been reached. A special alloy is used for the contacts. If both the fixed and moving contacts were mounted on rigid arms, trouble would be experienced in the moving arm rebounding and never making more than a momentary contact, insufficient to ring an ordinary trembler bell. Sullivan gets over that by not only mounting the "fixed" contacts on springs, but by also making the light moving arm of springy material. When the position and strength of the springs is correctly adjusted, both yield slightly when the arm strikes the contact, and this not only diminishes the rebound by softening the blow, but prolongs the contact by following up the return movement. The moving coil is mounted between top and bottom suspensions of phosphor-bronze strip, and is fully damped electromagnetically, and balanced for use on board ship.—Lond. *Elec.*, January 26.

Miscellaneous.

Electric Accidents.—Niethammer.—A note describing precautions to protect electrical engineers against burning by short-circuits, etc. Among other things, he recommends gloves of a refractory texture containing asbestos, etc.—*Elek. und Masch.*, January 28.

BOOK REVIEW.

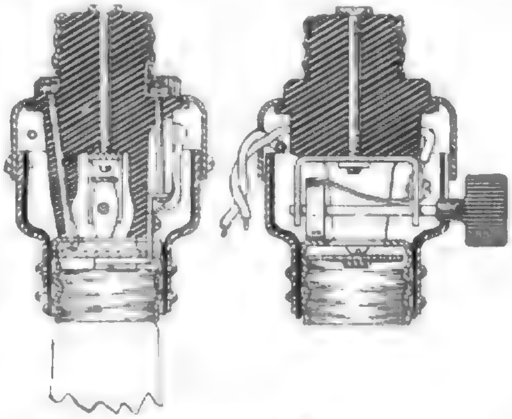
Machine Design. Part II. Form, Strength and Proportion of Parts. By Forrest R. Jones. Third Edition. New York: John Wiley & Sons. 426 pages, 243 ills. Price, $3.00.

This is rather a conventional volume on the proportioning and design of the usual run of machine elements, and could doubtless serve sufficiently well for text-book purposes. Its chief merit, perhaps, consists in its modernness; that is to say, the author has introduced sections on such subjects as ball and roller bearings which are sparingly or not at all referred to in the older standard works on the subject. Even here, however, the matter is more discursive than analytical, and much of it seems made up of catalogue quotations and illustrations. That more or less of this same tendency appears throughout the volume does not, however, necessarily condemn it. In every field there is room for summarizing treatises in which are assembled under one cover the practices, expedients, constants and limiting conditions that have been found by scattered constructors and designers to be applicable to various problems, and in this direction the present volume will prove of value to the student and engineer. It is to be regretted, however, that the author has not been more liberal in his citations of the authority on which the various constants are given. The day has gone by when "because it's in print, it's so," is a currently accepted doctrine, and a careful designer is chary of using formulas and constants with which he has had no previous experience unless he can satisfy himself of their rationale, which usually requires reference to their original source. Possibly, it would be impracticable to trace home many of the statements, as the field of machine design is peculiarly one in which data have been copied back and forth from one volume to another with such liberality that the trail is pretty sure to be lost from time to time.

A work upon "Steam Turbines" by Messrs. T. Stevens and H. M. Hobart, giving the most recent results in practice and having a succinct account of the latest types, will be issued by Messrs. Whittaker & Co. in March. It will contain exhaustive comparisons between steam turbine and piston engine economies, and from the results rational conclusions are formulated as to the respective cases in which these two types of prime movers should be employed. Weights, costs, speeds, number of wheels and blades, and other leading data of the various types are contrasted in tabular form. More complete details than have been published before of many of the most recent steam turbine generating stations on both sides of the Atlantic are included with an unique series of comparative tables. Marine steam turbines are similarly dealt with in some 100 pages, and fuller information than has before appeared is tabulated in form for the readiest reference. The work will extend to some six hundred pages and will be well illustrated.

Combined Lamp Socket and Plug.

With a view to making it practicable to connect conductors with the lamp circuit below the main socket, so that a motor or any other device to be operated by the light circuit may be used where there is only one lamp socket, H. W. Gremmels has patented the combined socket and plug construction for incandescent lamps shown by Fig. 1. The plug is adapted to enter a main socket and the auxiliary conductors are connected with the lamp circuit between the two sockets. Fig. 1 is a section taken through the improved device, and Fig. 2 is a section taken at right angles to Fig. 1. The upper portion of the plug is surrounded by a metal sleeve. The lower portion of the plug is bifurcated and is composed of two arms so as to straddle the stem of the key. On this stem is located a circuit-closing contact. The lamp socket is connected with the insulating plug by a bolt whose head engages the upper part of the socket and whose nut engages the shoulder of the insulating plug. The stem below is shaped to enter the socket of an incandescent lamp and the neck is enclosed by a casing which is connected with the



FIGS. 1 AND 2.—COMBINED SOCKET AND PLUG.

lower casing by screws. Through the central upper portion of the socket is a bolt whose lower extremity is connected with a metal contact consisting of a transverse piece and depending arms through which the stem of the circuit-closing key passes and in which the stem is journaled. To this U-shaped contact is attached a leaf spring occupying a position just above the key stem. When the key is properly adjusted the spring and socket are simultaneously engaged by a contact, thus closing the lamp circuit. The circuit is completed through a contact having the edges connected with the metal shell of the socket by means of the bolt shown at the right of Fig. 1. If it is desired to use a translating device of any character, suitable conductors may be connected with the opposite branches of the light circuit by screws, as shown in Figs. 1 and 2. The translating device connected with the auxiliary circuit may be operated independently of or simultaneously with the lamp as may be desired. The lowermost socket is insulated from the contact connected with the upper plug by a disc of mica.

Single-Phase Trolley for the Vale of Cashmere.

Power from the Jhelum River flowing through the beautiful vale of Cashmere, Northern India, is to be developed for the purpose of operating a single-phase trolley system extending 180 miles through the valley. The power will also be used for operating dredges to deepen the Jhelum River and thus minimize the floods, which periodically devastate the entire country. The plant will also allow of the reclamation of 100,000 acres of valuable rice lands and permit the storage of water for irrigation purposes. Another important use of the power will be for operating the large silk factories at Srinager. In addition, the current will be utilized for lighting in Srinager, and in Abottabad, Murree, and Rawal Pindi, prosperous cities in the British Province of Hazara, lying to the west of Cashmere. The transmission lines to carry the current to these places will aggregate about 150 miles, but ultimately the lines will furnish power to other points, making a total distance of 400 miles over which the electric energy will be distributed.

On the lofty mountains there is plenty of snow in winter, and the avalanches that come down the gorges are very formidable. In the rainy season, too, the vast quantity of rocks or drift wood carried down these gorges after a continuous rainfall form a source of great danger to bridges and other construction works. For this reason a gravity conduit is to be constructed underneath the beds of the ravines, wherever possible, in order to allow everything to slide by without doing damage. Where a large ravine has to be dredged, central piers will be avoided, the flume being carried across on a single span. For the construction of the flume or pipe line, deodar wood will be used. This timber, which is indigenous to the mountains of northwest Himalaya, is nearly allied to the Atlantic cedar. About 5,000 natives are now at work cutting the lumber that will be needed for the flume.

The power house will be of masonry with a double steel roof. A wide veranda will be a prominent feature. The installation is to consist of twelve 1,000-kw generators, to be built by the General Electric Company, arranged for direct connection to Doble turbines delivering 1,765 brake horse-power to the shaft under an effective head of 400 ft.

Other electrical apparatus to be supplied by the General Electric Company will include twelve 60,000-volt transformers, each of 1,000 kw capacity, exciters, high and low-tension switchboards, and the wire for the transmission lines.

Ball Contacts for Sparkers of Gas Engines.

The illustrations herewith show two forms of double-ball contact devices for the electric circuits of gas engines which have recently been introduced by the Crouse-Hinds Company, Syracuse, N. Y. In the contact commutator shown in Fig. 1 the contact is made by means of a cam passing between two steel balls held in place by coiled springs. This method is claimed to assure a positive contact because the balls must come in contact with the cam as the latter passes between them.

The cam is a solid piece with no movable parts. The movable parts are on the contacts and consist of two steel balls and springs on each contact, or ball carrier. These parts have to move but once while the cam is making an entire revolution, or in other words, they have four times as much time to get back to place as in a device where the movable part is on the cam. When running at high speeds this is a very important consideration.

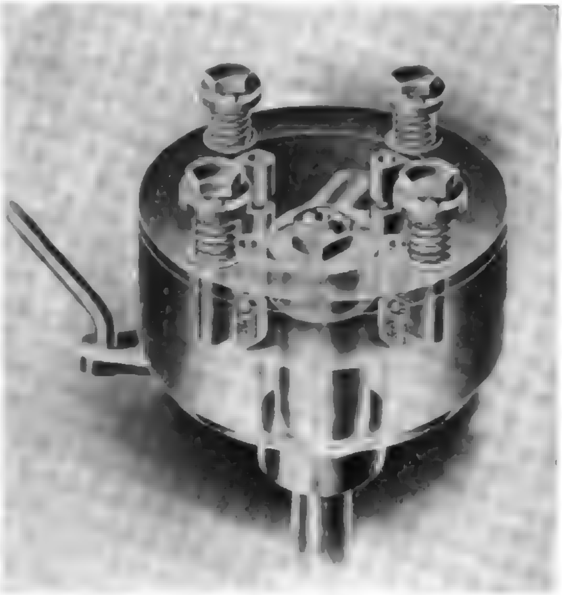


FIG. 1.—CONTACT COMMUTATOR.

The cam is secured to the shaft by a nut, and like all other parts of the commutator, it can be easily removed. The case is made of special hard rubber which resists moisture, oil and heat, and is an especially good non-conductor of electricity. A mica cover permits an inspection of the interior and at the same time keeps the working parts free from dirt.

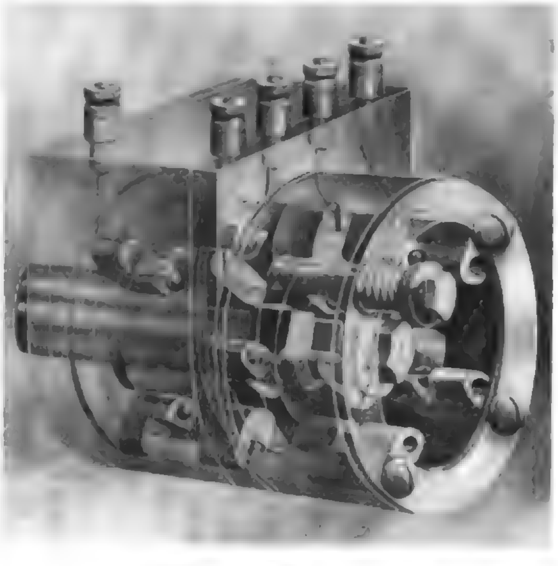


FIG. 2.—CONTACT DISTRIBUTOR.

The principle of the contact distributor, shown in Fig. 2, is exactly the same as that of the commutator. The distributor has two cams and two sets of ball contacts, one set for the timer and the other for the distributor, the only difference being that in the latter the cam is insulated from the shaft. The connection is made and the circuit closed for each cylinder as the cam passes between the balls. As the circuit is closed in the distributor before it is closed in the commutator and as it is broken first in the commutator, there is no possibility of the current following the cam when the latter leaves the contact in the distributor. Moreover, there is no possibility of the current jumping and firing the charge prematurely or firing the wrong cylinder.

Steam Turbine Train Lighting Set.

Heretofore the disadvantages attending the use of a small isolated reciprocating engine have hindered the adoption of the single unit generating plan for train lighting, although it did away with the complications of the regulating mechanism necessary with the axle method of driving the generator. To meet this situation the General Electric Company has designed for train lighting a set consisting of a small Curtis steam turbine direct-connected to an efficient generator. The combination of high speed with rotary motion produces a machine of most compact and simple design. Because of the high speed the generator is small and light, and the absence of reciprocating parts eliminates wear, noise and vibration, all of which play a large part in the use of the ordinary engine. The generator for this outfit is a two-pole, direct-current machine, wound for 85 or 125 volts, depending on the service required. The outfits are supplied in three sizes, one a 15-kw, 80-volt generator coupled to a Curtis steam turbine running at 4,000 r.p.m.; the second a 20-kw, 125-volt generator turbine driven at 4,500 r.p.m., and the third a 25-kw, 125-volt generator driven at 3,600 r.p.m. These turbines are made to operate at pressures from 80 to 200 lb., as desired, and exhaust into the atmosphere.

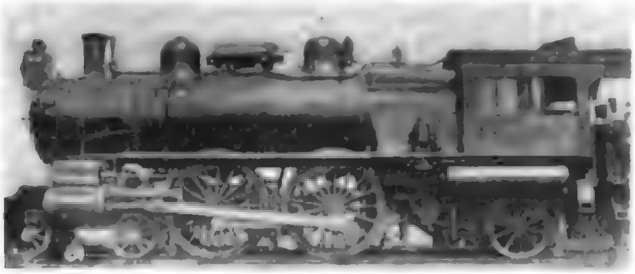


FIG. 1.—15-KW STEAM TURBINE INSTALLED ON LOCOMOTIVE.

On account of the compactness and light weight (1,850 lb. net) of the smaller size Curtis steam turbine generating set it can be mounted upon the locomotive or in the baggage room. When placed upon the locomotive, as shown in Fig. 1, the exhaust connection can be conveniently led into the stack. When located in the baggage car this generating set occupies a minimum amount of space for the power generated, measuring approximately 66 in. by 22 in. In order to be as close as possible to the steam supply and avoid condensation losses, the generating set is generally placed at the front end of the car and connected to the locomotive by means of a flexible steam hose and coupling. As the turbine is exposed to the weather when placed on the locomotive, protective sheet iron casings are fitted. As can be seen in Fig. 3, these casings completely surround both the turbine and generating elements, affording adequate protection against dirt and moisture. In Fig. 2 the set is shown adapted for service in the baggage car. In this case the moisture-proof covers are unnecessary.

FIGS. 2 AND 3.—15-KW STEAM TURBINE DIRECT-CONNECTED TO GENERATOR.

Steam turbine lighting sets of this design are already in use upon a number of railroads of the United States. They are adapted not only for general train lighting, but also for locomotive headlights.

Electric Cut-Out.

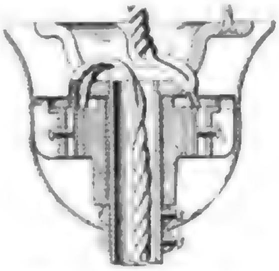


FIG. 1.—ELECTRIC CUT-OUT.

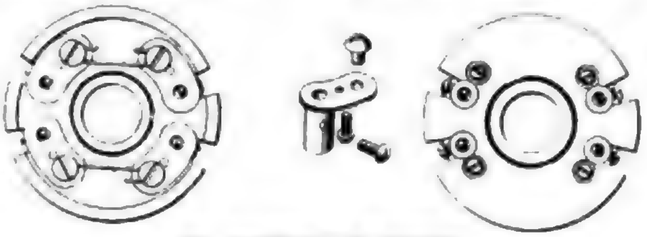


FIG. 2.—DETAILS OF CUT-OUT.

The accompanying Fig. 1 is a vertical sectional view taken through a cut-out recently patented by W. P. Wright. While primarily designed for use in connection with electroliers to form a fusible connection between the circuit wires and the leads to the lamps, it is, of course, capable of use in a general capacity as a cut-out. The device is capable of being housed within any common or ordinary form of canopy and provides for securing the standard to the ceiling independent of the cut-out so that the latter is relieved of any unnecessary weight. The supporting bracket is skeleton in form, so as to provide openings through which the wires may be passed to the cut-out. The body of the cut-out is made of a non-conducting material, such as porcelain, and is provided with an annular channel in the top. At diametrically opposite points the body of the cut-out is intersected by a pair of radial slots, while the top of the body is provided with sockets leading away from the slots. In each of these slots is placed a tubular metallic binding post fastened by a screw from beneath. There is no connection between these pairs of binding posts, but the corresponding members of the two pairs are electrically connected through the medium of the fuse. The connections are made in the manner shown. An insulating sheet of mica is fitted to the upper edges of the flanges and is held in place by the wires which pass through suitable openings in the sheet. The purpose of this insulating sheet is to prevent the escape of flames or sparks which may be occasioned by the burning out of the fuse wires. The cut-out is particularly advantageous in that it is capable of application to any ordinary electrolier or chandelier without changing the latter. The binding posts have been arranged for convenient access to the tops and bottoms to permit of the wires being engaged with the cut-out from the top or the bottom as may be most convenient.

Large Capacity Recording Wattmeters.

The accompanying illustrations show a substantial form of combined indicating and recording wattmeter for three-phase circuits which has been developed by C. Olivetti & Co., Milan, Italy. The instrument operates on the principle of the torsion electro-dynamometer. The novel features reside in the method employed for maintaining the electro-dynamometer coils always in the zero position and in the continuous recording mechanism. In the three-phase instrument there are two pairs of series and shunt-dynamometer coils connected in the manner used with ordinary wattmeters. The moving coils of the two pairs are mechanically mounted on a frame work (at the top of the illustrations) which when it is in its central position possesses a torque in a certain direction proportional to the power in the three-phase circuit. The torque effort is counterbalanced by the torsion of a spring which is caused to tend to return the coil equipment to its zero position by the action of a small electric motor, which is at rest whenever the torsion effort of the spring is balanced by the action of the currents in the two electro-dynamometers, and which turns in a direction to increase or decrease the torque of the spring when it is less or more than that of the dynomometers.

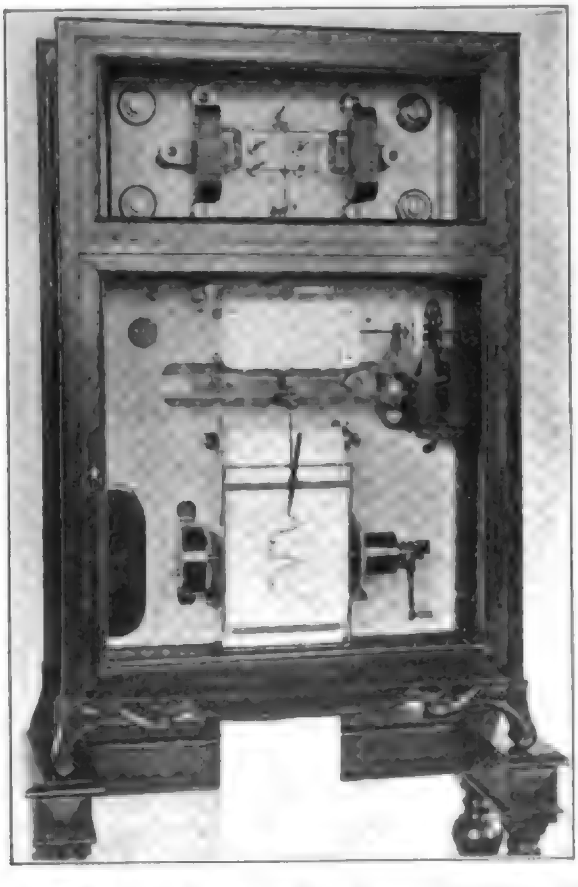


FIG. 1.—COMBINED INDICATING AND RECORDING WATTMETER.

Referring to Figs. 2 and 3, the arm 22 is brought into engagement with either 23 or 24, according to the position of the moving element, 4, of the electro-dynamometers. When 22 touches 23 the motor, 18, revolves in a direction to wind up the spring, 13, and to cause 22 to swing free from 23, and the motor at once comes to rest. If the power in the circuit decreases, 22 touches 24 and the current through the motor, 18, causes it to unwind the spring and to allow 22 again to swing free. Thus the equipment remains at rest only when the dynamometer coils occupy their central position and the spring, 13, is given a torsion proportional to the power in the three-phase circuit.

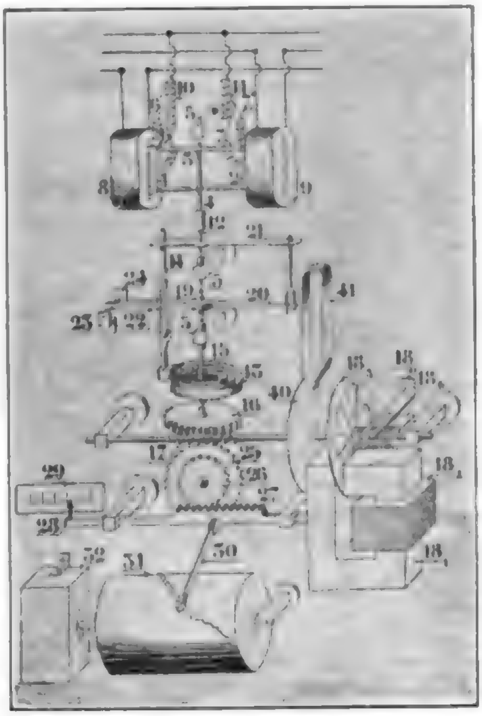


FIG. 2.—SCHEMATIC REPRESENTATION OF WATTMETER.

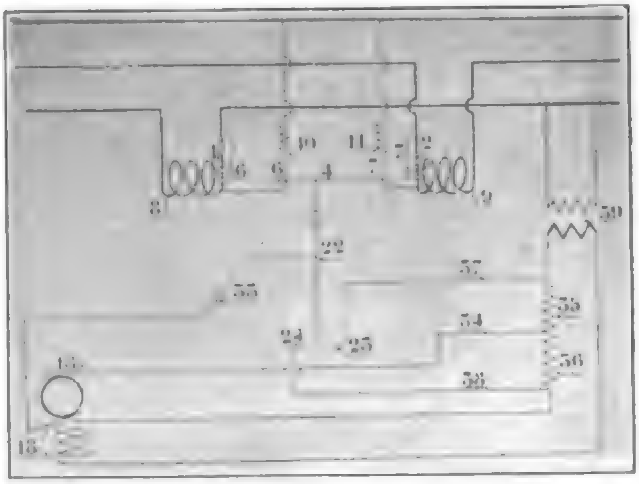


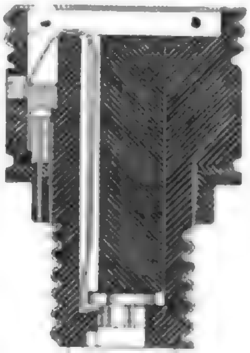
FIG. 3.—DIAGRAM OF THREE-PHASE WATTMETER.

The position of the wheel 26 (Fig. 2) which varies directly with the power in the circuit is indicated at the scale, 29, and recorded by the fountain pen, 30, on a sheet carried by the drum, 31, which is driven by the clock mechanism, 32. The coefficient of elasticity of the spring being constant, the divisions on the indicating scale and on the recording sheet will be absolutely uniform. On the shaft of the motor is mounted a copper disk, 40, which moves between the poles of the permanent magnet, 41, and serves to prevent too rapid movements of the motor armature.

These wattmeters are built for use with series transformers for currents up to 5,000 amperes, and with shunt transformers for electromotive forces up to 50,000 volts. We have been informed that Olivetti & Co. are now building three 8,000-kw, 33,000-volt wattmeters for the Oregon Water Power & Railway Company.

Multiple Fuse Plug.

The accompanying cut shows a vertical section through an improved form of plug patented by Alexander Hepke and Kurt Diener. A plurality of fuses insulated from each other is arranged in the interior of the plug. The lower ends of the fuses are held in fixed position by means of a setting nut and a contact piece. The upper ends of the fuses are bent over the edge of the insulating plug body, which is provided with segment-like recesses on the outside into which is tightly fitted a metallic piece. An end of a fuse is soldered to each of these metal pieces, which are provided with extensions. The lower outside end of the insulating plug body carries a contact shell, the cylindrical upper end of which is provided with extensions, each of which is opposite an extension of the metal pieces previously mentioned. A movable ring surrounds the outside of the plug body and is provided with a pair of contact springs by means of which a pair of contact pieces can be electrically connected. When a fuse blows a new one may be placed in circuit by removing the plug and turning the ring so that the springs can be placed between the contact pieces of the next recess.



MULTIPLE FUSE PLUG.

Auxiliary-Pole Motors.

In many classes of work a wide speed variation is required, and to meet the demands of such services the Westinghouse Electric & Manufacturing Company has developed a line of direct-current motors having a speed range of four to one on a single voltage. This wide speed variation is obtained by field control. The new motors are exactly similar mechanically and electrically to the standard shunt-wound motor except for the addition of auxiliary poles and coils. These are introduced in order to control the field form during the variation of field strength necessary to obtain so wide a range of speed. The cast steel poles with machine-formed coils are placed midway between the main poles and securely bolted to the frame. The construction is very simple and introduces no complications whatever, nor does it make difficult the removal of the main poles and field coils, as is evidenced by the fact that an auxiliary pole and coil can easily be taken out, without in any way disturbing the main field winding, by simply disconnecting the coil connections, withdrawing the bolts which hold the pole to the frame and sliding the pole and coil out parallel to the shaft.

The auxiliary field winding is connected in series with the armature and therefore produces a magnetizing effect which is proportional to the armature current. The auxiliary coils are placed as close to the armature surface as mechanical considerations will permit, and their turns are concentrated at that point. This arrangement adds materially to the performance of the motor as it applies the corrective influence of the auxiliary winding directly at the points where the distorting effect of the armature current is strongest. This arrangement is much more effective than the distribution of the ampere turns along the length of the auxiliary poles. The magnetic field of the auxiliary winding acts in direct opposition to that produced by the armature current. The field distortion usually produced by armature reaction is overcome, and the shape of the magnetic field at the point of commutation is maintained as formed by the main poles, and good commutation is made possible over a wide range of speed. Heavy overloads may be carried momentarily without injurious sparking. The motors are reversible without danger and without readjustment of the brushes, and, as the armature and auxiliary windings are connected permanently in series, it is only necessary to change the external armature connections to reverse the directions of rotation.

AUXILIARY-POLE MOTOR.

Pelton-Francis Turbines.

The Pelton Water Wheel Company, of San Francisco, is about to place on the market a new type of turbine to be known as the Pelton-Francis. The prevailing tendency of electrical manufacturers towards large units and high speeds has encouraged the development of Pelton wheel units, built with particular reference to absolutely continuous service twenty-four hours a day and 365 days in the year, even for the largest units. To anticipate a demand for a high head and large capacity turbine, and to cover a wider hydraulic field, the company has secured the services of a German engineer of wide experience in this class of work, who with the engineering staff of the Pelton Water Wheel Company, has designed the type of wheel above referred to. This consists of a modification of the familiar Francis type of turbine, so well known in this country, Germany and Switzerland, with which are combined some of the special principles of the Pelton system. Preliminary tests are reported to show a remarkably high efficiency, while the design and construction are exceedingly simple and reliable. The Pelton Company is now prepared to furnish complete estimates and specifications covering the Pelton-Francis turbines for all water pressures. This type will supplement, therefore, the Pelton wheel already familiarly known to engineers all over the world.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The outlook for spring trade is favorable. The mild weather stimulates jobbing distribution and crop preparations are active, some planting having been done at the South. Jobbers of dry goods, clothing and notions are shipping large quantities of spring goods. Prices are firmly held, as a rule, except in the markets for farm staples, which are still higher than normal, despite a general reaction. Manufacturing plants report new orders that assure activity still further into the future, and several dividend announcements show gains over recent preceding years, while some New England cotton mills are only deterred from full activity by scarcity of labor. Railway earnings continue to make splendid comparisons with last year's figures, February thus far recording a gain of 26.7 per cent. Foreign trade returns in January for the whole nation far surpassed the same month in any previous year, and the last week at this port shows a gain of $1,141,018 in exports, but a decrease of $3,877,874 in imports as compared with 1905. The season favors activity in building, with a consequent strength of tone in lumber, brick and hardware. Coal is more active and firmer. Collections are on the whole only fair, and money shows a stiffer tendency. Conditions in the iron markets are of an irregular character. Thus new business for future delivery, especially during the third quarter of the year, is smaller, and some of the lower grades are none too strong in price, but producers are well booked ahead and consumers are demanding prompt deliveries. New demand for finished lines of steel is not so active, but the general report is that mills engaged on structural materials are unable to catch up with their orders. Still it is noteworthy that one important independent concern is again soliciting business and promising prompt shipment. Moreover, capacity for production is increasing. However, a number of small orders were booked within the week, one calling for 15,000 tons for bridges in Korea. Copper is dull, business being confined to jobbers. The week closed with a number of sales of lake and electrolytic that footed up well above five million pounds, and as producers forecast the market, the fore part of March will be a season of important sales for domestic and foreign account. Brokers are becoming active in the market for round lots, and the general improvement seems to cover the country. The principal domestic producers quote lake and electrolytic at 18½ to 18¾c. for future delivery. *Bradstreet's* reports 185 business failures during the week ending February 22, as against 208 the previous week and 220 in the corresponding week last year.

RECENT ALLIS-CHALMERS ORDERS.—The equipment for the new Wells Building Company's power plant, Milwaukee, which, when completed, will be one of the best appointed isolated plant equipments in the State, has recently been purchased from the Allis-Chalmers Company, Milwaukee. The new power plant is centrally located in the business district of Milwaukee, within a square of the new fifteen-story Wells Building, also owned by the Wells estate, for which it will furnish light and power and to which connection is made by tunnel. The new equipment will consist of two 24 and 40 by 33-in. Reynolds vertical cross-compound Corliss engines for direct connection to 500-kw engine type generators. The W. W. Russell Card Company, Milltown, N. J., will install an Allis-Chalmers engine and generating unit consisting of an 18 by 30-in. Reliance engine and a 150-kw Allis-Chalmers 240-volt generator. J. Schwarzenwalder & Sons, New York, will install in their Hoboken, N. J., plant an Allis-Chalmers 14 by 30-in. girder frame Reynolds Corliss engine to be belted to line shafting for the operation of wood working machinery. The Electric Company of America, one of the most powerful syndicates of central stations in the country, with headquarters at Philadelphia, recently purchased for one of its constituent companies the Atlantic Electric Light & Power Company of Atlantic City, N. J., two 22 and 36 by 42-in. Allis-Chalmers heavy-duty cross-compound engines for direct connection to generators supplying the motor and lighting load. The new units will be ready for operation some time early in June. The Bruce-Merrian-Abbott Company, of Cleveland, has recently purchased Allis-Chalmers electrical machinery, consisting of a 62½-kw generator and two 30-kw generators. The Nevada Consolidated Copper Company, of San Francisco, whose new 1,000-ton concentrator equipment is being built by the Allis-Chalmers Company, has purchased additional electrical equipment for the plant recently, in the shape of eight 200-kw, oil-filled, water-cooled transformers, with 20,000 volts secondary. The Bates & Clark Company, Seattle, has recently ordered a 250-kw generator with exciter and switchboard from the Allis-Chalmers Company, Milwaukee. The American Graphophone Company, Bridgeport, Conn., ordered recently a number of Allis-Chalmers motors, ranging from 7½ to 25 hp, to be installed in the works at Bridgeport.

ELECTRICAL EQUIPMENT FOR WORSTED MILL.—The General Electric Company has secured the contract for installing the electrical equipment in one of the largest and best equipped factories for the manufacture of worsted yarn in the world, now in course of construction at South Lawrence, Mass., for the Wood Worsted Company. In the power house will be located two main generating units, consisting of a double non-condensing 1,800-hp engine, direct-connected to a 1,500-kw generator and a compound condensing engine with two vertical and two horizontal cylinders, of 5,000 hp capacity, direct-connected to a 4,000-kw generator. There will also be a 100-kw generator for light loads and emergency work; besides a 65-kw, 125-volt, motor-driven exciter generator and a small direct-connected steam unit of the same capacity as a reverse. The generating units will supply current at 40 cycles and 680 volts to a complete and modern switchboard, from which distribution will be made to the various buildings. The switchboard will consist of 33 panels. About 500 hp of induction motors will be required for driving the various groups of machinery. The motors are of the latest G. E. type, wound for 550 volts and range in size from 8 to 175 hp. The general lighting will be done by 200 direct-current arc lamps, the transformation from alternating to direct current being accomplished by means of constant-current transformers and mercury arc rectifiers. Six 25-kw and 10-kw transformers will furnish current for the incandescent lamp illumination.

PELTON WHEEL ORDERS.—The Pelton Water Wheel Company, of San Francisco, reports that a recent order is that of the Yukon Consolidated Gold Fields, a corporation in which the Guggenheim Exploration Company is largely interested. The order consists of two complete units operating under a head of 650 ft., each wheel being direct-connected to a 600-kw, 450-r.p.m. generator, provided with an overload capacity of 1,200 hp each. The power will be transmitted electrically and used in connection with dredging work on the Yukon River. Another order is that of the Empire Electric Power & Irrigation Company, of Empire, Colo., who will install under a head of 560 ft. a Pelton wheel of 1,000 hp capacity, direct-connected to a 450-r.p.m. generator. The exciter will be mounted on the end of the alternator shaft. Power will be transmitted to the mines and mills in the vicinity of Empire, Colo. The Pelton Company is letting contracts for its new works in the Mission district of San Francisco, which are to be much larger and equipped with the latest and best tools, and expects to be established there by July 1 of this year.

THE SPRAGUE ELECTRIC COMPANY, whose motors are extensively used for driving laundry machines, has recently taken an order from the City Steam Laundry, Yonkers, N. Y., for an equipment comprising a generator, switchboard and six motors. The large laundry machines in the New Knickerbocker Hotel, New York City, are to be driven by Sprague motors.

LUMBER MILL EQUIPMENT.—The Allis-Chalmers Company has recently closed a contract with the Weed Lumber Company to furnish an electric power plant for the planing mills at Weed, Cal., including a 700-kw, belt-connected, two-phase Bullock generator and 36 induction motors for operating the machinery.

SALE OF POWER PLANT.—An electric power plant which was in course of construction by the Damask Manufacturing Company, of Roaring River, N. C., at the time its financial troubles arose, is now being offered for sale. This decision was arrived at at a recent meeting of the creditors in Greensboro. The plant is valued at $20,000.

TELEPHONY IN CANADA.—The management of the Bell Telephone Company has completed arrangements for the expenditure this year of nearly two million dollars in the carrying out of an extensive programme of general improvements to its system throughout the Dominion. The company has asked permission of the Dominion Parliament to increase its capital stock from $10,000,000 to $50,000,000 for this purpose. The company is proceeding with the construction of its Uptown Exchange, situated on Mountain St., north of St. Catherine St., Montreal. An order has been given for a new switchboard of the most modern type, which will cost over $200,000. Plans are being prepared for a new building in Westmount, which will be situated next to the present office on Sherbrooke Street. A new switchboard will be required for this exchange also, as the company contemplates changing over all the telephone apparatus in Montreal to the central energy system. In Toronto the growth of business will necessitate the construction of another large exchange in the northwest portion of the city. A block of land has been purchased for that purpose, where an exchange to accommodate ten thousand subscribers will be put in operation. This will make five large exchanges in Toronto. The cost of building and fittings will exceed a quarter of a million dollars. Considerable extensions to buildings and apparatus will be undertaken this year at Ottawa and Brantford also. At Three Rivers a new building has been purchased in order to take care of the growth of the business at that point, at a cost between fifteen thousand and twenty-five thousand dollars. In connection with the large extensions to the long distance service, the company contemplates erecting in Ontario and Quebec this year about 3,500 miles of long distance wire lines and 250 miles of new pole lines. In the Province of Manitoba and in the Northwest about fifteen hundred miles of new lines will be placed in position.

TELEPHONE EQUIPMENT AT QUINCY, ILL.—The switchboard which will soon be installed at Quincy, Ill., is for a complete common-battery multiple system, arranged for an ultimate capacity of 6,400 lines, with an immediate equipment of 3,300 answering jack lines and 3,000 multiple jack lines. The exchange is to have a complete equipment of the Dean harmonic party-line system, including individual indicating ringing keys in each cord circuit, and three sources of harmonic ringing current. One of these is to be a Holtzer-Cabot multi-cycle ringing set, and the other two are to be the new Dean harmonic converters, each capable of ringing the entire exchange when 6,750 telephones are connected for service. These converters are designed to operate from a 24-volt storage battery and consume less than a quarter of an ampere. The power plant for this new Quincy exchange will include duplicate apparatus and power lightning protection equipment. A two-position combined chief operator's and monitor's desk and a three-position wire chief's desk are also to be included. The contract for this equipment, awarded to the Dean Electric Company, of Elyria, Ohio, includes also the furnishing of 3,000 common-battery telephones. Messrs. McMeen & Miller have charge of the engineering of this exchange, and the work of construction is being done by the Union Construction Company, of Quincy, Ill.

PIERSON, ROEDING & CO., INC., of San Francisco, is the style of the concern which represents the consolidation of John Martin & Co. and the Martin Pipe & Foundry Company, both widely known on the Pacific Coast. The executive officers are: F. H. Pierson, president; H. R. Noack, vice-president; H. U. Roeding, secretary, and S. K. Colby, treasurer, the three former being old Martin men, and Mr. Colby being a recent valuable acquisition from the Pittsburg Reduction Company. The new concern has branch offices in both Seattle and Los Angeles, the former office being located in the Colman Building under the management of R. H. Husbands, and the latter in the Pacific Electric Building under the management of H. C. Hopkins. Pierson, Roeding & Co. will continue to act as exclusive Pacific Coast agents for the entire list of companies previously represented by John Martin & Co. Among the more important of these may be mentioned The Locke Insulator Manufacturing Company, of Victor, N. Y.; the Pittsburg Reduction Company, Pittsburg, Pa.; the Lombard Governor Company, Ashland, Mass.; the Ohio Brass Company, Mansfield, Ohio; the Dimmick Pipe Company and the Coosa Pipe & Foundry Company, of Birmingham, Ala.; the Fibre Conduit Company, Orangeburg, N. Y.; Schaper Construction Material Company, New York City.

THE COPPER MARKET continues fairly strong, but dull, and producers report themselves well sold up for February and March, as well as beyond. The general conditions are summarized as follows by the "Copper Gossip," of the National Conduit & Cable Company. The market for copper has had to contend against a dull and uneventful period during the past few weeks; but, notwithstanding this feature of the situation, leading sellers have not given any open evidence of succumbing to depressing influences. There is, however, neither necessity for nor use in denying that considerable sales have been made lately at 18 cents for electrolytic. Over against this fact may be placed another equally important one in some respects namely, that some of the largest holders of the metal refuse to change their quotation from 18½. Buyers are willing to pay 18 cents, but it is not every seller who will accept orders on that basis. Prices, therefore, have been more or less irregular, a condition growing out of the recent prevailing dullness in the market, and one generally utilized by certain operators to further their efforts to create a reactionary tendency."

WIRELESS FOR STEAMSHIPS.—The Ocean Steamship Company, the "Savannah line," on February 26 closed a contract with the Atlantic De Forest Wireless Company for the installation of its system of wireless telegraphy on the steamers *City of Memphis* and *City of Macon*. The De Forest system has been in operation on the Ocean Steamship Company's vessels, the *City of Atlanta* and the *City of Columbus* for a number of months and the new contract for its installation on two more of the company's vessels is the best proof of its practical value. The four ships above named will now be in constant touch with the land from the moment they leave New York until they dock in Savannah. The *Trent* and *Tagus*, of the Royal Mail Steamship line, plying from England to the West Indies, are also under contract for equipment.

ST. PETERSBURG TROLLEYS.—The contract for the equipment of the St. Petersburg trolley system, to cost $10,000,000, is being undertaken by the Russian Westinghouse Company, which is controlled by the American Westinghouse interests. The contract for the first portion of the new lines calls for the conversion of the present horse car lines in the Nevsky Prospect and other important streets in the center of the city. About twenty miles of road will be reconstructed at an expenditure of $6,000,000. This will be followed by thirty miles of electric lines at an additional cost of $4,000,000. Work on the first section will begin at once. The municipal authorities of St. Petersburg will operate the lines. Power will be generated in a turbo-generator plant to be built on the outskirts of the city. The initial equipment will be 10,000 hp, to be increased ultimately to 30,000 hp.

DEVELOPMENT IN PERU, S. A.—Advices from Lima, Peru, state that the mule lines of the Compania Ferrocarrilles Urbano de Lima are to be electrificated and several miles of new track constructed. The contract for the entire work has been assumed by W. R. Grace & Co., of New York. The General Electric Company, of Schenectady, N. Y., will furnish the electric apparatus. Forty-five motor cars of the open type will be used, built by the Stephenson Car Company, of Elizabeth, N. J. Current will be generated at a hydro-electric plant 30 miles from Lima, on the Rimac River.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company's instrument statement for the month of January compares as follows:

	1906.	1905.	1904.	1903.
Gross output	176,607	130,634	90,644	129,837
Returned	63,224	37,700	36,854	43,286
Net output	113,383	92,934	53,790	86,551
Total outstanding	5,811,641	4,573,498	3,833,107	3,236,871

SUPPLIES IN BOSTON.—The United Electric & Apparatus Company, 200 Summer Street, Boston, has been incorporated in Massachusetts with capital stock of $25,000 as manufacturer, dealer, importer and agent in electrical and mechanical specialties. The officers are: President, John McCloskey; treasurer, W. H. Keyes; clerk, J. P. Dorman. The company is the sole manufacturer of the Ziegler patent apparatus and specialties.

POWER IN CHILI.—Duncan, Fox & Co., one of the largest British firms doing business in South America, with branch offices in many of the principal cities, has purchased 100 hectatres of land on the Laja River to establish a hydraulic generating plant with the falls of the Laja River. The current is intended for supplying Consepcion, Talcahuano, Tome and neighboring towns with electric light and power.

ENGINEER WANTED.—The city of Nelson, B. C., is advertising for an electrical engineer for the civic lighting plant, at a salary of $150 per month. Address W. E. Wasson, city clerk.

FIGURES OF FOREIGN TRADE.—The data issued by the Bureau of Statistics of the Department of Commerce and Labor show that the foreign commerce of the United States in the first seven months of the current fiscal year amounted to $1,752,421,330, or an average of $250,000,000 a month in that perod. Should it continue at this rate in the remainder of the year, the total foreign commerce for the fiscal year 1906 would exceed $3,000,000,000, a figure which has not been reached in any previous year in the history of our foreign trade. In the seven months ending with January, imports have increased $70,000,000 over the corresponding months of the preceding fiscal year, and exports have increased $155,000,000. Imports in the seven months ending with January, 1906, were $695,764,566, against $625,914,513 in the corresponding months of last year, and exports were valued at $1,056,656,764, against $901,190,026 in the same months of last year. This gives a larger total of imports, and a much larger total of exports than in the same months of any preceding year. Imports, which had never touched $100,000,000 in a single month prior to 1905, except on one or two occasions as a result of prospective tariff changes, exceeded that sum in six of the twelve months ending with January, while exports exceeded $100,000,000 in each of the twelve months, and in December lacked but a few thousand dollars of touching the $200,000,000 line. The increase in importations occurs chiefly in manufacturers' materials and finished manufactures, while the increase in exportations occurs chiefly in agricultural products and manufactures.

THE GOULD STORAGE BATTERY COMPANY, of New York City, has just opened a branch office in the Crossley Building, San Francisco, Cal., to meet the demands of its rapidly increasing business on the Pacific slope. The new branch is in charge of Mr. E. C. Sharpe, formerly connected with the John A. Roebling's Sons Co. The Chicago office, in the Rookery Building, has secured the services of Mr. R. H. Watson as an addition to its corps of engineers. Mr. Watson has been connected with the Gregory Electric Company, of Chicago, and is well known in the Middle West. A new addition has also been made to the force of engineers in the main office of the Gould Co., at 1 West Thirty-fourth Street, New York City, in Mr. H. N. Powers, who, until recently, was sales manager of the American Automatic Switch Company. Mr. Powers was formerly associated with Mr. Thomas A. Edison, and served in the engineering department of the General Electric Company.

ORDERS FOR TURBO-GENERATORS.—During the first two weeks in February the Westinghouse Machine Company took some of the largest orders that were ever awarded to the East Pittsburg works since the Westinghouse-Parsons steam turbine was introduced. Among these orders were: Phosphate Manufacturing Company, of Lakeland, Fla.; Columbia Electric Street Railway, Light & Power Company, of Columbia, S. C.; Citizens' Light & Power Company, of Adrian, Mich.; Pennsylvania Light & Power Company, of Allegheny, Pa.; E. J. Dupont Company, of Wilmington, Del.; the Kennebec Light & Heat Company, of Augusta, Me.

MILWAUKEE SINGLE-PHASE ROAD.—The Milwaukee Electric Railway & Light Company has recently placed an order with the General Electric Company for single-phase apparatus for the equipment of two extensions which the company is building. One of these extensions is from the present terminal of the Waukesha Beach line on Pewaukee Lake to Oconomowoc, and the other is an extension of the Muskego Lakes line from Muskego Center to Mukwonago and East Troy. The company has adopted single-phase electrical equipment for these outlying lines to avoid the necessity of additional power houses or sub-stations.

MILL FOR ALUMINUM SHEET.—The McClintic-Marshall Construction Company has been awarded the contract for the Pittsburg Reduction Company's sheet mills at Massena, N. Y. This plant will be operated in connection with the works at New Kensington, but the latter plant may be moved to Massena. The new mill will be the largest in the world and will be used for the manufacture of aluminum sheets. The enormous electrical development at Massena, on the St. Lawrence River, has already been very fully described in these pages.

LARGE SIGNAL ORDERS.—The Union Switch & Signal Company, of Swissvale, Pa., has announced the booking of $2,000,000 in orders since January 1, an amount equal to the business it heretofore did in an entire year. This increase has resulted in the addition of new machinery at the factory. Most of the orders call for electric and automatic signaling devices.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was irregular and at times displayed liquidating tendencies. It received professional support, however, despite the adverse factors which came to the front during the week, such as the railroad rate bill, the proposed drastic insurance legislation at Albany and the Supreme Court decision as to the right of railroad companies to mine and deal in coal. At the close of the week renewed strength developed in part of the list in spite of the cloudy Moroccan situation. The favorable news regarding the iron and steel situation failed to stimulate activity in the United States Steel stocks, and the industrials as a group were somewhat neglected. In the electric list there are no marked changes and comparatively little business was done. In the traction group Brooklyn Rapid Transit was the only stock that showed any activity, 155,000 shares having been sold at prices ranging between 78¾ and 83, the last quotation being 82¼, which is a net gain of 2⅝ points. Metropolitan Street Railway declined ¾ point, closing at 116, while Interborough Rapid Transit (on the curb) made a gain of ½, the closing quotation being 228. Inter-Met. common closed at 53 and 4½s at 92¼. Allis-Chalmers common lost ½ point and preferred 2⅛, the closing prices being 21⅞ and 59¾, respectively. General Electric, starting from 170, advanced to 172¼, but receded and closed at 170½, which is a net gain of ½ point. Western Union is a fraction higher, closing at 93¼, but American Telephone & Telegraph is down 1 point, the closing quotation being 140. New York & New Jersey Telephone is quoted at 155¼. Both issues of American Locomotive are slightly higher, common closing at 73 and preferred at 116½. Business on the curb market was irregular, with a general downward tendency, but with occasional rallies. Following are the closing quotations on the Stock Exchange on February 27:

NEW YORK

	Feb. 20	Feb. 27		Feb. 20	Feb. 27
Allis-Chalmers Co.	22⅜	21⅞	General Electric	171⅝	170½
Allis Chalmers Co. pfd.	61⅞	59¾	Hudson River Tel.	...	...
American Dist. Tel.	37	37	Interborough Rap. Tran.	228½	...
American Locomotive	72¾	73⅛	Mackay Cos	60	61¼
American Locomotive pfd.	115⅝	116½	Mackay Cos pfd.	74	74¼
American Tel. & Cable	60	60	Marconi Tel.	...	...
American Tel & Tel.	140½	139½	Metropolitan St Ry	117¾	...
Brooklyn Rapid Transit	81	81	N. Y. & N. J. Tel.	...	...
Electric Boat	26	26	Western Union Tel	93⅛	93¼
Electric Boat pfd	60	60	Westinghouse com.	161¼	162
Electric Vehicle	17	17	Westinghouse pfd.	...	...
Electric Vehicle pfd.	19	19			

BOSTON

	Feb. 20	Feb. 27		Feb. 20	Feb. 27
American Tel. & Tel.	140¾	139⅞	Mass. Elec. Ry. pfd	68	67
Cumberland Telephone	117¾	118	Mexican Telephone	...	4¾
Edison Elec. Illum.	...	...	New England Telephone	...	136¼
General Electric	...	...	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	19¾	Western Tel. & Tel. pfd.	93	..

PHILADELPHIA

	Feb. 20	Feb. 27		Feb. 20	Feb. 27
American Railways	..	52¾	Phila. Electric	.	8
Elec. Co. of America		11⅞	Phila. Rapid Trans.	...	31¾
Elec. Storage Battery	...	79	Phila. Traction	..	..
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Feb. 20	Feb. 27		Feb. 20	Feb. 27
Chicago City Ry.	190	...	National Carbon	86	86
Chicago Edison	...	...	National Carbon pfd.	117	118
Chicago Subway	..	...	Union Traction	...	...
Chicago Tel. Co.	.	..	Union Traction pfd.	...	...
Metropolitan Elev. com	29	27⅝			

* Asked.

PUBLIC SERVICE CORPORATION.—President Thomas N. McCarter has formally admitted that plans are being carried out for strengthening the finances of the Public Service Corporation. It is stated the negotiations contemplate the purchase by J. P. Morgan & Co. of $8,300,000 of the new $12,500,000 stock which the Public Service Corporation arranged to issue at the next annual meeting and the acquisition by the United Gas Improvement Company, which holds one-fourth of the stock now outstanding, of a sufficient amount to give that corporation $8,300,000 of the total issue of $25,000,000. This would leave the Prudential-Fidelity interest, or the Newark investors, with $8,400,000 of the total.

MERGING CHICAGO "L" ROADS.—When merged the elevated electric railroads of Chicago will constitute a notable system with no mean capitalization. Their present extent is 105 miles, but this will be 130 when the South Side and Northwestern extensions are completed. The roads have $51,023,800 in common and preferred stock, and $49,304,150 in bonds.

CINCINNATI GAS & ELECTRIC.—The Cincinnati Gas & Electric Company has voted to increase its capital stock from $31,000,000 to $36,000,000, the proceeds of the sale of the additional stock to be used to extend the natural gas service and the electric lines.

ACQUISITION OF PHILADELPHIA COMPANY.—Official announcement is made of the plan by which the United Railways Investment Company, of San Francisco, will acquire control of the Philadelphia Company, of Pittsburg. The plan does not contemplate the purchase, at present at least, of the entire capital stock of the Philadelphia Company, but only of 320,000 shares of the common stock, which represents a controlling interest. According to the official statement the United Railways Investment Company will exchange $37.50 (face value) in first lien collateral trust twenty-year 5 per cent. sinking fund bonds and $20 (par value) of investment company common stock for each share (par value of $50) of the Philadelphia Company common stock, included in the 320,000 shares to be purchased. Under arrangements with Ladenburg, Thalmann & Co., a syndicate has been formed to acquire from any depositing Philadelphia Company stockholder the common stock of the investment company so payable to such depositor, at a sum equal to $95 a share, so that each depositing Philadelphia Company common stock shareholder may receive, if he prefers, for each share of Philadelphia stock $37.50 in 5 per cent. bonds and $19 cash.

PURCHASE OF SCHENECTADY RAILWAY.—The stockholders of the Delaware & Hudson Company have authorized an increase of $7,000,000 in the company's capital stock to make effective the convertibility clause in the proposed issue of $14,000,000 4 per cent. ten-year gold debenture bonds. The proceeds of these bonds will be used to refund to the company's treasury the money spent for the half interest acquired in the Schenectady Railway Company, to pay for the stock of the United Traction Company of Albany, recently acquired by the Delaware & Hudson Company, and in addition to provide funds for improvements upon the company's lines in Pennsylvania. The debentures which are to be issued may, at the option of the holder, be converted into the company's stock at 200 at any interest period between June, 1907, and June, 1912. Up to June, 1912, the new stock authorized is to be held available for issuance against the surrender of the convertible bonds. After that date the Board of Managers is authorized to apportion the stock pro rata among the stockholders, or may otherwise dispose of it, but in no case is the stock to be disposed of for less than par. The Delaware & Hudson Company now has outstanding $40,900,000 of stock.

NATIONAL CARBON REPORT.—The steady growth of the carbon industry would indicate that although the introduction of inclosed arcs may have checked the increase in the lighting field, other demands for carbon have sprung up, more than compensating. The annual report of the National Carbon Company proves this. It is for the year ending January 31, 1906. The income account compares as follows:

	1906.	1905.	1904.	1903.
Net earnings	$890,764	$846,307	$736,441	$594,371
Preferred dividends	315,000	315,000	315,000	315,000
Balance	$575,764	$531,307	$421,441	$279,371
Common dividends	192,500	82,500	....	....
Balance	$383,264	$448,807	$421,441	$279,371
Charged off, deprec., etc.	353,513	383,336	280,429	256,637
Surplus for year	$29,751	$65,471	$141,012	$22,734

The company has $4,500,000 of preferred stock and $5,500,000 of common.

AMERICAN DISTRICT TELEGRAPH.—The American District Telegraph Company of New Jersey, which represents the consolidated "mesenger" business of the leading cities, has issued its annual report for the year ending December 31, 1905. The capital stock of the company is $9,754,785. The business shows as follows:

	1905.	1901.		Changes.
Gross	$2,534,697	$2,389,971	Inc.	$144,726
Expenses	1,842,879	1,691,176	Inc.	151,703
Net	$691,818	$698,795	Dec.	6,977
Dividends	390,049	389,959	Inc.	90
Surplus	$301,769	$308,836	Dec.	$7,067
Previous surplus	55,871	111,338	Dec.	55,467
Total surplus	$357,640	$420,174	Dec.	$62,534
Appropriation for constructing new equipment, etc	310,832	364,303	Dec.	53,471
Total surplus	$46,808	$55,871	Dec.	$9,063

EDDY ELECTRIC COMPANY RECEIVERSHIP WOUND UP.—Norman McD. Crawford has filed in the Superior Court his final account as receiver of the Eddy Electric Company, of Windsor, Conn. The account was approved and Judge Wheeler issued an order winding up the receivership. The declaration of a final dividend of 3¼ per cent was ordered, making total payments of 48¾ per cent on the allowed claims. When the company went into the hands of a receiver in 1902 its liabilities aggregated $100,000, and the appraised value of its assets at the time was about $35,000. The largest creditor was the City Bank of Hartford, whose claim was $42,000. The business of the company has been taken over by the Eddy Manufacturing Corporation, which is controlled by the General Electric Company.

GREAT TELEPHONE GAINS.—The annual report of the Chesapeake & Potomac Telephone Company, presented February 10 by President U. N. Bethell, shows wonderful gains in the territory. The stations in the city of Washington January 1 were 21,202, a gain of 38.4 per cent; in Baltimore, 23,285, a gain of 48.7, and elsewhere 8,133, a gain of no less than 78.9 per cent. The total revenue was $1,953,735, the expenses were $1,464,545; the interest charges, $281,169, the depreciation account $147,160, and the credit balance to surplus $60,859. The additions to the construction account in 1905 amounted to $1,017,361. A great deal of new work is still to be done and land has been secured for new buildings in Washington. Mr. F. H. Bethell is the general manager of the company.

N. Y. & N. J. TELEPHONE.—The annual report of the company shows total gross income of $6,217,288 and total expenses of $4,575,845, a gain in each case of about one million over the previous year. The gain in subscriber's stations in Long Island in 1905 was 17,066, and in New Jersey 14,659, or 31,725, and the grand total for the whole territory at the beginning of this year was 112,049, of which 56,610 were on Long Island. The company has a capital stock of $17,360,000 and general mortgage bonds of $1,250,000. The surplus at the end of the year was $3,997,828.

TELEPHONY IN PENNSYLVANIA, as in other States, shows a rapid and enormous growth. A list of eleven companies exhibit this year $72,210,000 capital stock and $21,650,000 bonds authorized, whereas the amounts last year were $19,810,000 and $3,635,000. The Bell Telephone Company of Philadelphia, which has been authorized to raise its capital from $16,000,000 to $30,000,000, had in 1900 a capital of only $6,000,000 authorized. The new stock to be issued will be $14,000,000 in the shape of 280,000 shares of the par value of $50 each. The issue of the new stock is left, as to time and price, to the discretion of the directors.

UNITED STATES TELEPHONE.—The United States Telephone Company has issued its annual report for the year ended December 31, 1905 The income account compares as follows:

	1905.	1904.	1903.	1902.
Gross	$479,463	$418,308	$379,235	$306,069
Net	168,858	152,168	139,957	123,081
Other income	6,831	....	319	29
Sur. ov. chgs., resv., dep., div., etc.	41,481	40,154	37,110	23,235

The company has a capital stock of $500,000 preferred, $2,000,000 common and $2,260,000 mortgage bonds.

STOCK FOR EMPLOYEES.—The Michigan State Telephone Co., at the suggestion of President W. A. Jackson, recently extended to its employees an opportunity to buy the preferred stock. No new stock was issued, but several hundred shares was gradually bought up in the Boston market and sold to the employees at 90, or 5 points under the present market price. About $60,000 worth of stock was taken. It is the policy of the company to allow its employees to make investments in the securities under the most favorable terms.

NEW WESTINGHOUSE BONDS.—It is officially announced that the shareholders of the Westinghouse Electric & Manufacturing Company have exercised their rights to subscribe to the new issue of bonds to the aggregate of $7,109,800, equivalent to 85 per cent of the amount available, which would have been greatly exceeded had important shareholders been able to secure more than their pro rata amount. The remainder, purchased by Kuhn, Loeb & Co., amounts to about one-eighth of the application for participation by the underwriting syndicate.

DIVIDENDS.—Directors of the Butte Electric & Power Company have declared a dividend of 5 per cent on the preferred stock for 1906, payable in quarterly installments of 1¼ per cent each on the first days of May, August and November, to stockholders of record on the 26th day of the months preceding the payments. The directors have also declared a dividend of 1 per cent on the common stock, payable March 15, to stockholders of record March 10.

GENERAL NEWS.

Construction Notes.

PHENIX, ALA.—Warren Williams, Mayor, writes that at some future time it is proposed to construct an electric light plant, but nothing definite has yet been done.

MOBILE, ALA.—Harry Pillans is behind a project to build a new street railway system here and has secured a franchise for this purpose from the General Council. It is stated that Capt. J. T. Jones, of Gulfport, Miss., is associated with Mr. Pillans in this undertaking.

MOBILE, ALA.—George S. Leatherbury, Jr., Anthony Vizard and others have acquired an option on the Bay Shell Road, Mobile's famous driveway, and it is reported that they contemplate building thereon an electric railway to extend along the Mobile Bay shore to Dog River with such further extensions as conditions may warrant.

BENTONVILLE, ARK.—An electric railway is proposed between Siloam Springs and Bentonville. Dr. Higley is largely interested.

STAMPS, ARK.—The Telephone Company has decided to erect at once a building suitable to the needs of a telephone system to accommodate a population of 5,000.

PINE BLUFF, ARK.—The Pine City Electric Company is increasing its facilities in order to provide for its growing business. John Bloom has recently acquired an interest in the company, having recently resigned his position as city electrician.

SAN FRANCISCO, CAL.—The United Railroads will build a direct car line westward to the Ocean Beach. by August 1.

ANAHEIM, CAL.—Edward B. Merritt, City Clerk, writes that an election will be held on April 14 to vote on issuing bonds for water works and electric light plant.

GALT, CAL.—That Galt is to have electric lights is now nearly an assured fact. Contracts are being signed with the agent of the American River Electric Company.

REDWOOD CITY, CAL.—Charles F. Grondona has applied to the Board of Supervisors of San Mateo County for a franchise to supply gas and electricity within and in the vicinity of the town of Pescadero.

SAN FRANCISCO, CAL.—The new plans for the Geary Street, Park & Ocean Railway have been approved. Bids for the reconstruction of the line will soon be called for. The cost of the work is estimated at $328,000.

REDLANDS, CAL.—The papers showing an increase in the capital stock of the Redlands Southwestern Home Telephone Company from $50,000 to $100,000 have been filed with the County Recorder at San Bernardino.

WOODLAND, CAL.—The Yolo County Consolidated Water Company has closed a deal whereby it acquires complete control of the waters of Clear Lake and its water power possibilities, which are said to be of considerable magnitude.

LOS ANGELES, CAL.—The Home Telephone Company of Los Angeles has purchased a piece of property in the business center where additional equipment costing $1,000,000 will be installed. The company will soon begin the construction of its plant in Oakland and expects to secure a franchise in San Francisco shortly.

PLACERVILLE, CAL.—Work has been commenced on the American River Electric Company's new dam near Mosquito. The dam will be 40 feet high and 600 feet long. The dam is to be built of earth and will be 264 ft. wide at the bottom and 20 ft. wide at the top. It will take two months to complete the work. The dam will hold between 17,000,000 and 18,000,000 gallons of water.

SACRAMENTO, CAL.—The American River Electric Company is an electric power company, organized a few years ago for the purpose of bringing electric power into the valley towns from a point in El Dorado County. It has been decided by the directors of the company to create a bonded indebtedness of $1,000,000, by issuing bonds payable in thirty years at the rate of 5 per cent. Bonds in the denomination of $1,000 each are to be issued. These bonds will be secured by a mortgage upon all property, real and personal, belonging to the electric company.

SAN FRANCISCO, CAL.—The Snow Mountain Water & Power Company, which was recently incorporated here, will take over the interests of the Eel River Power & Irrigation Company. The latter concern has been working for a year on an electric power system for the transmission of current 18 miles to Ukiah. The machinery has been ordered and a 10,000-hp plant is expected to be in operation by next November. The new corporation will be prepared to operate on a larger scale and extend the lines to increase the rather limited market to be reached under the original plans. All but 800 feet of the 6000-ft. tunnel, which will conduct the discharge water from the power plant into the Russian River, has been bored.

SANTA CRUZ, CAL.—The Bay Counties Power Company is surveying for a power-transmission line from Santa Clara Ridge to Boulder Creek, and thence down San Vicente Creek to the new $3,000,000 cement plant of the Napa Company's works on the cost. Surveys are also under way from one of the Santa Clara stations of the Bay Counties Company for a power line over Big Basin Ridge into Boulder Creek. The plans of the Bay Counties Company are said to include the absorption of the private electric light plant in Boulder Creek, and the citizens of Boulder Creek are furthering a plant to light the new highway into Big Basin Park with electricity. This road is eight miles in length, and if this plan goes through it will be the longest country road lighted with electricity in the State.

SAN FRANCISCO, CAL.—Fire broke out in the central station of the San Francisco Gas & Electric Company early on February 22. The blaze started in a new addition to the building, where new dynamos were being installed. The building contained a number of crude oil and gasoline tanks, and explosion after explosion followed, but fortunately within heavy brick walls, and none of the firemen was hurt. The interior new section of the building was burned out completely. The building was the source of electric light and power for the central portion of the city, and all the downtown streets and buildings were in darkness, save where gas fixtures were in working position. The fire also shut off all downtown telephone service and played havoc with the service of the telegraph company. Many wires running out of the city were rendered useless. The loss will be large.

BOULDER, COL.—J. J. Henry, of Denver, who is reported to hold an option of the Boulder Electric Company, has secured a franchise from the County Commissioners for poles and transmission wires on county roads.

FLORENCE, COL.—The City Council has granted to Thomas Robinson, of this city, a 25-year franchise to construct an electric railway in Florence, which is intended by the promoter to connect with several towns of the county. The franchise is not to conflict with the one granted F. S. Granger, work on which will commence March 1. Mr. Robinson says he expects to extend the road to Pueblo eventually.

NORWICH, CONN.—The plans will be completed soon for the new telephone building to be erected in this city by the Southern New England Telephone Company.

EAST HARTFORD, CONN.—The Glastonbury Power Company will offer a bid for the city lighting when the present contract of the Hartford Electric Light Company expires.

WILLIMANTIC, CONN.—Civil Engineer Miner and three assistants, of the New York, New Haven & Hartford Railroad Company, are in the city to survey the proposed electric railway between Willimantic and Coventry, the rights of which the New York, New Haven & Hartford Company purchased a short time ago from the Willimantic Traction Company.

NEW BRITAIN, CONN.—Chairman Frank L. Traut of the committee on lighting, states that the committee will recommend to the Council that the city be lighted the coming year on an all-night and every-night schedule, instead of the moonlight schedule, which has been followed in New Britain for many years. The committee is of the opinion that because of the better rates the city will make for its lighting the difference in the total cost to the community will not be perceptibly greater than heretofore, while the service will be much more adequate.

SOUTH MANCHESTER, CONN.—The Consolidated Railway Company, the new owners of the Hartford, Manchester & Rockville Tramway Company, has had representatives at the power station located on the west side of the South Manchester Railroad tracks and north of West Center St. They have gone over the machines and have looked into the amount of land owned by the company on which it might be possible to extend the power station. The water power was given consideration and every detail looked after. An inventory was made of all the machines and apparatus and reported to the New Haven office. This investigation has given rise to the report that the company intends to increase its plant here and furnish power for all of the trolley cars on the east side of the Connecticut River.

WASHINGTON, D. C.—An expenditure of over $75,000 has been decided upon by the Washington Railway & Electric Company for the construction of a large electric power plant.

WASHINGTON, D. C.—Bids will be received until March 13 at the Bureau of Supplies and Accounts, Navy Department, Washington, D.. C., to furnish at the Navy Yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 383, incandescent lamps, electrical supplies and conduit couplings. Applications should designate the schedule by number. H. T. B. Harris, Paymaster-General, U. S. N.

AUGUSTA, GA.—This city is reported to be considering the construction of a municipal electric light plant.

ATLANTA, GA.—The Atlanta Telephone Company will build a new exchange.

ROME, GA.—The contract for building the new telephone exchange for the Southern Bell Telephone & Telegraph Company, to be built on Broad Street and Fourth Avenue, have been awarded to T. C. Thompson & Bro.

SENORIA, GA.—J. B. McCrary, of Senoria, will install a 100-kw Allis-Chalmers 2300-volt generator with belted exciter at Ocilla, Ga., to be driven from a Reliance engine, 14 x 24 in., designed for right-hand drive. The new unit will be used for lighting purposes at Ocilla.

ATLANTA, GA.—The North Georgia Electric Company, through General A. J. Warner, has notified Mayor James G. Woodward that the company would accept the franchise granted by the city to the company for doing an electric lighting and power business in Atlanta and the written acceptance has been filed with the city attorney by the North Georgia Electric Company instead of the Southern Light & Power Company, as the latter company did not have a Georgia charter.

COLUMBUS, GA.—The Columbus Electric Company, which was recently organized to take over the North Highland power plant and riparian rights of the Columbus Power Company, property of the Chattahoochee Falls Company, of North Columbus, and the property of the Coweta Power Company, is arranging to build at once a steam plant of 3000 hp as an auxiliary to the North Highlands power plant. A dam will be constructed capable of developing 15,000 hp in addition to that of the steam plant. The power thus developed will be utilized to operate a large paper mill and other industries about to be started.

WARDNER, IDAHO.—The Bunker Hill & Sullivan Mining & Constr. Company, of Kellogg, Idaho, which operates the local electric light plant, contemplates installing a large storage battery equipment for 500-volt service. S. A. Easton, Kellogg, Idaho, manager.

THOUSAND SPRINGS, IDA.—It is stated that a power plant is to be erected at Thousand Springs, Lincoln County. Work will begin in the spring. Material is already being placed on the ground. The three-foot pipe is being hauled from Grand View. Thousand Springs is owned by Attorney Guy C. Barnum of Shoshone.

PAYETTE, IDAHO.—The Idaho Light & Power Company, recently organized and incorporated for the purpose of developing power from the Payette River for transmission to Payette, Weiser, Ontario and other places, is preparing to begin active work as soon as the weather will permit. The ditch will leave the river at a point 13½ miles above Payette and will run down the valley to within about 4 miles of Payette. At this point the water will have a drop of about 40 feet back into the river. Here the plant will be located and it is expected to develop 2500 hp.

SHOSHONE, IDAHO.—Representatives of the Byllesby Engineering Company, of Chicago, have been here examining the feasibility of a power plant of 40,000 hp. They state that it is their opinion that there is plenty of water in the rivers near Shoshone to generate the power and run the plant during the high-water season, but they are doubtful of there being sufficient during the summer when so much water is used for irrigation purposes and the streams are low. Should it be found that sufficient water can be had the year round to run a 30,000-hp plant, they will build. It is proposed to transmit electricity from Shoshone to Pocatello, Ogden, Salt Lake City and other points for lighting and other purposes. A large amount of money is involved in the project if it goes through.

PEORIA, ILL.—Work has been started on the construction of the large power house of the Interurban Company.

WILLIAMSFIELD, ILL.—Williamsfield Trunkline Telephone Company has increased its capital stock from $1,000 to $2,000.

PETERSBURG, ILL.—The Petersburg Electric Light Company is contemplating changing to an enclosed-arc street lighting system. R. H. Abbott, manager.

CARBONDALE, ILL.—A certificate has been filed by the Farmers' League & Community Telephone Company, increasing its capital stock from $2500 to $5000.

HILLSBORO, ILL.—The McKinley syndicate has bought the franchise for the proposed electric railway line between Springfield and Lincoln, and the line will be built this summer.

SAYBROOK, ILL.—The Saybrook Electric Light, Heat & Power Company is contemplating putting in a water works system, also a heating system this season. R. N. Cooper is manager.

LINCOLN, ILL.—The village board of trustees, at its regular monthly meeting, granted C. A. Scott a franchise to extend what is known as the Farmers' Telephone line into the village.

HILLSBORO, ILL.—At the City Council meeting of Coffeen, a 20-year plant was discussed at the same meeting and the plan of securing lights from the Edison Company of Brooklyn was also considered.

URBANA, ILL.—Proposals will be received by the University of Illinois until 10 a. m. March 5, 1906, for the general contract work, for the heating, for the plumbing, and for the electric work of the auditorium to be erected on the grounds of the university. S. A. Bullard, Chairman of Committee on Buildings and Grounds.

WINDSOR, ILL.—J. LeForge, of Windsor, writes that he proposes constructing an electric light plant at a cost of $7,000.

ALTON, ILL.—The Star Telephone Company, of Upper Alton, and the Bell Telephone Company, have consolidated, and connection between the two lines was established February 20 at Upper Alton. The capital stock of the new concern will be increased materially.

REDKEY, IND.—Earl Coble is interested in the construction of an electric light plant.

SHELBYVILLE, IND.—A company has been organized here, with C. W. Bouslog as president and J. C. Wink, secretary, to construct water and light plants.

RICHMOND, IND.—C. H. Rogers, superintendent of the municipal electric light and power plant, writes that it is planned to install a 750-kw unit this season.

MOROCCO, IND.—W. B. Harpole, proprietor of the Morocco electric light plant, expects soon to put in a 100-kw generator and a 125-hp Corliss engine and to rebuild the plant.

WARREN, IND.—Columbus Harrold has asked for a franchise to install a telephone plant in the town of Warren. The franchise is for fifty years and the wires are to be placed in alleys wherever possible.

BRAZIL, IND.—President McKay, of the Indianapolis & Ohio Valley Traction Company, has been in the city making preparations for the survey of the two branch lines which the company has decided to build.

WYNNEWOOD, IND.—J. O. Swingley, Mayor, writes that the date for the opening of bids for the construction of a combined system of water works and an electric light plant has been extended from February 14 to March 10.

TERRA HAUTE, IND.—The Citizens' Independent Telephone Company has been reorganized. A bond issue of $1,000,000 was ordered, the first $200,000 of which is to pay for the West Terre Haute plant taken over recently and for extensive improvements.

PRINCETON, IND.—C. F. Stevens, who has been connected with the Princeton Independent Telephone Company since it was organized, has sold his interest here and at Hazleton and will put in an extensive system through the country east of this city, with the central exchange at Oakland City. A new independent system will soon be installed at Evansville and these lines will be connected with that city.

FORT GIBBON, I. T.—Sam. J. Brown, W. H. Rosekrans and other Chicago capitalists have made application for an electric power and light franchise at this point.

REINBECK, IA.—The electric light plant here was recently destroyed by fire.

ESSEX, IA.—The Electric Light & Power Company has decided to rebuild its plant.

KEOKUK, IA.—The Mississippi Valley Telephone Company is planning to rebuild its entire system.

FREMONT, IA.—W. B. Dunsmore and others have purchased the Farmers & Traders Telephone Company.

CLINTON, IA.—The Iowa Telephone Company will erect an exchange building here and a system of underground conduits.

CRESTON, IA.—Surveyors in the employ of the Creston, Winterset & Des Moines Electric Railway Company are in the city making a survey of a number of the streets of the city.

BURLINGTON, IA.—Extensive improvements are planned by the Mississippi Valley Telephone Company of this city. The exchange is to be rebuilt with a capacity of 2,000 telephones and the wires will be put under ground.

WAVERLY, IA.—The electric light committee is considering plans for installing a 100-hp boiler and a 250-hp Corliss engine in the municipal lighting plant. Part of the old lines will be rebuilt and the system changed to three-phase alternating current.

IOWA FALLS, IA.—The Iowa Telephone Company is conducting an aggressive campaign in the extension of its business in this part of Iowa this winter. Exchanges are being placed in new cities and towns as fast as the work can be accomplished.

OSAGE CITY, KAN.—The city is figuring on installing a $15,000 electric light plant.

BELLEVILLE, KAN.—This city is going to vote on bonds this spring to establish an electric light plant.

CHANUTE, KAN.—This city is to have a street railway system. R. C. Rawlings has accepted the city's terms.

CHAPMAN, KAN.—W. J. Schaffer is preparing to install an electric light plant in Chapman in connection with his mill business.

HUTCHINSON, KAN.—The Hutchinson Water, Light & Gas Company is improving its electric light plant, spending about $75,000.

HUTCHINSON, KAN.—The Hutchinson Interurban Railroad Company expects to construct about eight miles of track within the city, which will be extended as the business requires.

WICHITA, KAN.—It is said that the Wichita Railroad & Light Company has recently purchased a site here upon which an electric power plant will be erected at an estimated cost of $200,000.

COLUMBUS, KAN.—It is stated here that the Mineral Cities Electric Railway Company will start construction work here within a month on a new electric line to Pittsburg through Mineral and Cherokee.

SALINA, KAN.—A franchise for an electric street railway system here has been given to E. S. Allnut, of Pueblo, Col., who some time ago asked for a franchise from the city for the construction of an electric street railway.

WICHITA, KAN.—The United Electric Company, of Wichita, recently purchased for the United Sash & Door Company, also of Wichita, an equipment of twenty Allis-Chalmers motors for direct driving the various woodworking machines.

IOLA, KAN.—Several improvements are being made on the system of the Iola Railroad Company by Lee Massengale, who recently assumed charge as general manager. The capacity of the power plant is being increased by the addition of a Russell engine, direct-connected to a 200-kw Walker generator.

PITTSBURG, KAN.—The extension of the electric railway line of the Pittsburg Railway & Light Company is now practically completed to Weir City, 10 miles southwest of Pittsburg, and 6½ miles beyond Chicopee, the former terminus of the line. A further extension south from Weir City to Columbus, 13 miles distant, is now being built. A power house to contain one 300-kw direct-current generator is being erected at Scammon.

BATON ROUGE, LA.—Work has begun on the construction of the new telephone exchange for this city.

RAYNE, LA.—The Town Council has decided to extend the water works, electric light plant and improve the streets in South Rayne.

YARMOUTH, ME.—John A. Jones, city engineer of Portland, has completed survey and plans for a connecting link between the Portland & Yarmouth and the Portland & Brunswick Electric Railways at Yarmouth.

CENTREVILLE, MD.—The Chestertown Electric Light Company has submitted a proposition to establish an electric light system here.

HYATTSVILLE, MD.—The House has passed the bill authorizing this city to issue $12,000 bonds for a municipal electric light plant. An election will probably be held in March or April to vote on the same.

PITTSFIELD, MASS.—The Pittsfield Street Railway Company has just signed a contract for a new power house to cost $125,000.

TAUNTON, MASS.—Alderman Bent, of Ward Four, has had a conference with East Taunton residents in regard to the prospective movement for an extension of the electric light system to that village.

MANSFIELD, MASS.—The electric light commissioners estimate that the income of 1906 will show an increase of over $3,000 over 1905. They recommend the addition of a 300-hp unit to the present equipment.

LUDLOW, MASS.—John Heydt, of Indian Orchard, has purchased the Harris mill property which has been idle for some time. It is one of the best water powers in this vicinity and can be devoloped to generate electricity enough to supply the town.

EAST BRIDGEWATER, MASS.—A committee was appointed at a recent meeting for the purpose of looking into the feasibility of the town securing better street lighting.

WOBURN, MASS.—The Woburn Board of Public Works has held a conference with the Edison Company in relation to a new lighting contract. The present contract, under the old Woburn company, is based on moonlight schedule of about 1,500 hours, at $11,610 per year. The new form, presented under a five-year contract, is said to give light all night every night, at about 38.25 hours, for $13,930 per year. The city has 90 arc and 374 incandescent lamps.

COLONIA, MICH.—The Bainbridge Telephone Company has increased its capital stock from $2,000 to $10,000 that its scope of work may be enlarged.

BIG RAPIDS, MICH.—The committee on street lighting has been instructed to advertise for bids on street lighting for another term of three to five years.

FORT BRADY, MICH.—Bids will be received until March 19 by the Constructing Quarter Master, U. S. A., for electrical fixtures and wattmeters in certain buildings here.

FREMONT, MICH.—Several business men have organised a company to secure the right of way and accomplish other preliminary work necessary to secure the construction of an electric railway.

MANTON, MICH.—The Independent Telephone Company from Sherman is working this way and the promoters hope to secure enough subscribers along the road to be able to put their line through next spring.

LANSING, MICH.—The Michigan Power Company is reported to have purchased property on Grand St. and will construct a power house which will cost, with equipment, about $250,000. W. S. Schott, of Chicago, Ill., is engineer.

MANCELONA, MICH.—The Mancelona Electric Light & Power Company contemplates changing its plant to operate with alternating current, in which case it will be in the market for transformers, meters, and other necessary equipment. Fred Wildi is owner and manager.

GRAND HAVEN, MICH.—Merchants and manufacturers of this city are awaiting with much interest the decision of the city officials in regard to furnishing day power from the municipal electric light plant. It is thought that favorable action will probably be taken in the matter, inasmuch as there is considerable demand for the service.

MORENCI, MICH.—The electric light plant now in course of construction at Morenci will be ready for operation shortly. The contract at Morenci calls for 32 arc lights and the company will have power for between 2,500 and 3,000 incandescents. They will probably furnish light for Lyons and Fayette, two good sized towns near Morenci, by extending their wires to those places. The last-named towns are eager to enter into a contract with the Ohio Valley Company for lighting

MANISTEE, MICH.—The petition of William Douglas for permission to dam the Manistee River near Sherman, Wexford County, has been acted upon favorably by the Board of Supervisors of that county. The Manistee River Power Company has been organized to take over the rights given to Douglas, but it is said that the Buckley & Douglas Lumber Company of the M. & N. E. Railroad is back of the power company. The dam will be about 45 feet high and will raise the water level about 30 feet, with which head 3000 hp can be obtained. It is planned to install three turbo-generators of 1000 hp each.

DETROIT, MICH.—The prospects for new construction of interurban lines in Michigan during the coming year are better than ever before. The following is a summary of projects for which plans are in hand now: The Detroit-Bay City Traction Company has commenced work on its line. The Grand Rapids & Ionia, the Grand Rapids, Belding & Greenville and the Ionia & Owosso lines are part of the interurban system which ex-Governors John T. Rich and A. T. Bliss and their associates plan to construct. The Lansing-Jackson line is to be a part of the Mills-Elliott-Moore system, for which it is proposed to make Lansing the center. The same company is planning to extend its line, which is completed to Pine Lake, north to Owosso, and some of the right of way and other details have been completed for that road. West from Lansing to Grand Ledge a line is projected by the Platt Power & Heating Company of Lansing. The company has secured a number of water-power rights along Grand River, and as soon as the stations are established it proposes to construct the road. The Kalamazoo, Lake Shore & Chicago Traction Company has purchased of the Michigan Central the stretch of track between Kalamazoo and Mattawan which the steam road abandoned when it straightened its main line. The St. Joe River Traction Company proposes to construct a line from St. Joseph to Dowagiac, and has made application for crossings over the Pere Marquette, near St. Joseph, and over the Big Four at Eau Claire. The line from Benton Harbor to Niles is one that the South Bend & Southern Michigan Railway proposes to build as the beginning of a line through to South Bend. Recently there have been articles filed by a company known as the Kalamazoo-South Bend Traction Company, but nothing is known as yet concerning its plans. The Detroit, Ann Arbor & Toledo line is one that John O. Zabel, of Petersburg, is promoting, and it is said that some work has already been done. The line from Owosso to Durand is planned as an extension of the present interurban line between Owosso and Corunna, and the company has secured right of way and franchises for it.

GIBBON, MINN.—This city contemplates issuing bonds for a municipal electric lighting plant.

BUFFALO, MINN.—The question of constructing an electric light plant is under consideration here.

KENYON, MINN.—It has been estimated that a municipal electric light plant could be constructed here at a cost of $12,000.

CROOKSTON, MINN.—It is stated that bids will be received until March 6 by the Board of County Commissioners for installing a lighting plant at the county jail.

ST. PAUL, MINN.—The Northern Heating & Electric Company, successor to the Northern Manufacturing Company, has applied to the City Council for a franchise covering the entire city.

HASTINGS, MINN.—The City Council has adopted a resolution, providing for the issue of $50,000 bonds for water works and lighting plant, to be submitted to the voters at the coming election.

MINNEAPOLIS, MINN.—The Northern Manufacturing Company, of St. Paul, which has entered the field as a public electric lighting and heating concern, filed an amendment to-day to its articles of incorporation. The name is changed to the Northern Heating & Electric Company, and the capital stock is increased to $1,500,000.

ST. PETER, MINN.—Officials of the Cannon Valley Telephone Company are planning extensive improvements to be made on their system the coming summer. They have placed an order for $4,000 worth of material to be used in building extensions and will expend large sums in remodeling several of their exchanges.

ST. PAUL, MINN.—The St. Paul Gas Light Company, which recently authorized an increase of $1,000,000 in its capital stock, will not spend the full amount in improvements right away, but it is expected that within one or two years $600,000 will be invested. A large addition to the electric light plant on Hill Street has been decided upon. The building for this was commenced last year. A 1500-kw turbo-generator set and four boilers of 2,400 hp will be installed, with modern machinery for stoking and handling coal. The new Hill Street generators will furnish alternating current. The Cedar Street power house will be equipped with a new 500-kw motor generator set for direct current. Large extensions to the Edison downtown system are proposed. New cables will be run, and about a mile of new sandrock tunnels will be projected.

ABERDEEN, MISS.—Additional water and electric light bonds to the amount of $20,000 have been sold.

ABERDEEN, MISS., will install a 250-kw Allis-Chalmers alternator, 3-phase, 60-cycles, and a 60-kw machine of the same description with belted exciters and switchboard complete, recently purchased from the Allis-Chalmers Company.

HATTIESBURG, MISS.—The Home Telephone Company, of Chicago, which already has a franchise for a system here, is perfecting plans for the construction of the system at once. A force of workmen and engineers will soon be at work.

ANACONDA, MONT.—W. H. Reber has petitioned the City Council for a franchise for an electric light plant.

BUTTE, MONT.—W. H. Reber has asked the city to grant a franchise for an electric, heat and power plant.

BUTTE, MONT.—At a special meeting of stockholders of the Butte Electric Company, the proposition to increase the stock of the company from $2,000,000 to $5,000,000 was carried. Of this new capital only $1,000,000 will be issued at once, the balance being held in reserve.

CLINTON, MO.—This city has voted to issue bonds to the amount of $100,000, to construct municipal light and water plants.

NEW MADRID, MO.—H. B. Day, owner of the New Madrid light, heat and power plant, expects soon to install a complete steam-heating system, including a 100-hp boiler, heater, pump, pipe line, steam traps, etc.

HIGHLAND, MO.—The town of Highland, which is shortly to have a railroad, a spur to be run from the Grand Island road at Stout to that place, has also granted a franchise to a Chicago man to build and operate an electric light plant here.

ST. LOUIS, MO.—A large factory building is to be erected here for the Cram Writing Machine Company. The building will be thoroughly equipped with electric power. The company is at present located at 107 Walnut Street, and A. G. Meier is general manager.

SPRINGFIELD, MO.—The Springfield Traction Company has been recently acquired by Eastern interests. The present management will continue to operate the system until early in the spring, when the new company will assume control and make several improvements.

BOONVILLE, MO.—Two routes have been suggested for interurban lines in this section of the State of Missouri. One runs from Lupus on the Missouri River, connecting there with the river route of the Missouri Pacific, west fifty miles to Sedalia. The other route is from Boonville, where the two railroads mentioned cross, southeast to California in Moniteau County on the main line of the Missouri Pacific, thence south to Eldon, intersecting the east and west Rock Island road, a distance of about fifty miles. Percy W. Johnson, of Boonville, may be addressed.

LEXINGTON, N. C.—The town has placed an order for about $3,000 worth of new electrical machinery to be installed in the city electric light plant, including a 100-kw generator.

LINCOLN, NEB.—The Citizens' Street Railway Company will begin the work of building a street car line in the spring.

TECUMSEH, NEB.—There is some talk here of constructing an electric light plant.

TABLE ROCK, NEB.—This city is to have an electric light plant in the near future. J. R. Sutton and others are interested.

GIBBON, NEB.—The Village Council has granted J. H. Davis & Son a franchise for the construction and maintenance of an electric light and power plant.

BRANCHVILLE, N. J.—The Branchville Electric Power, Water & Lighting Company (C. H. Chrisman, manager, Branchville) is reported to have decided to expend about $15,000 in improvements.

LACONIA, N. H.—Mr. H. B. Rust, of Providence, R. I., one of the managers and owners of the Laconia Electric Light Company, recently stated that the company is now selling power practically up to the full capacity of its water power at Lakeport and the 250 horsepower additional of the big crude petroleum engine at the power station. There is a demand for more power, and the company proposes to supply the demand by installing as soon as possible another 250-horsepower engine, which has already been ordered, and will be delivered about July 1st, and put in operation in season for the summer business when the traffic on the street railway is the heaviest. The company is also to enlarge its power station at Lakeport to accommodate this new engine and others which may be added later, and will enlarge the building so as to furnish room for two more engines in addition to the one which is to be installed now

SASKATOON, N. W. TER.—A proposition has been submitted to Town Council, by John Wylie, of New York, N. Y., to construct an electric light and power plant at Saskatoon.

AMITYVILLE, N. Y.—It is stated that the Long Island Railroad will soon apply for a franchise here for the construction of an electric railway.

ELMIRA, N. Y.—Elmira Corning & Waverly Street Car Company has been granted a franchise for an electric railway.

NEW YORK, N. Y.—The Pennsylvania Railroad Company is to build a large electric power station on the south side of Thirty-first Street, between Seventh and Eighth Avenues.

LOCKPORT, N. Y.—The Lockport Gas & Electric Light Company has petitioned for a franchise to construct a 12,000-volt transmission line around the western part of the city, to furnish power in East Lockport.

CHATEAUGAY, N. Y.—The Chasm Power Company will extend its line to Malone this spring, where it has recently secured contracts for 225 hp. W. T. Thayer, manager.

ALBANY, N. Y.—The local telephone companies are planning various extensions to their systems. The Home Telephone Company has just closed a deal whereby it secures the line from Ravena to Coeymans on the east and west to Indian Fields.

DESPATCH, N. Y.—The mill and buildingowned by the Monroe Heat & Light Company, located four miles north of this village, was destroyed by fire a short time ago. The loss is over $8,000. The building contained an expensive dynamo, which had not yet been used.

COHOES, N. Y.—At the meeting of the Common Council recently the Hudson River Power Company asked for a franchise to install its wires and poles in the city for the purpose of furnishing power to manufacturers, which was referred to the Lamp and Gas Committee.

SYRACUSE, N. Y.—Chief Engineer B. C. Wolverton, of the Central New York Telephone & Telegraph Company, is making up a list of the material and supplies needed in the subway which the company will make in this city in the spring, starting the work just as soon as the frost is out of the ground. Orders will be placed in the near future.

NEW YORK, N. Y.—Bids will be received until March 24 at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for two turbo alternators and accessories for the Navy Yard, New York, as per specification 1481, at an estimated cost of $30,000; also until March 31, for furnishing boilers, stokers, engines, motors, smokestack, etc., for the power plant for the New York Navy Yard, as per specification 1483, at an estimated cost of $139,000.

LOCKPORT, N. Y.—The demand for power from the Niagara, Lockport & Ontario Power Company has decided the company to construct another line from Rochester into Syracuse. Corps of engineers are at work on the survey. This will be the third transmission line erected by the company between Rochester and Syracuse. The construction of the line will be begun in the spring. The company has another contract to deliver power to the Syracuse Rapid Transit Company, operating the trolley lines in Syracuse. That contract calls for a current of from 15,000 to 20,000 horse-power, practically the capacity of one line. As one line will stop for the time being at Rochester and the contract with the Syracuse trolley company will call for the capacity of the other, the immediate construction of at least a third line is required. At the same time it is desirable that a fourth line—the third between Rochester and Syracuse—be built. This is the one for which the surveys are about to be begun.

OGDENSBURG, N. Y.—The Northern Power Company, which has its pole line from Hannawa Falls to this city completed, has been making arrangements through the Ogdensburg Power & Light Company to supply electric power to Prescott and Brockville, Can. The proposition met with approval by the Canadian towns, but since it was made unexpected competition has asserted itself. The large and valuable water power at Waddington has always attracted the attention of capital and would probably have been developed years ago had not the mammoth plant at Massena been started. Recently, however, A. J. Logan, a resident of Morrisburg, Ont., opposite Waddington, became the owner of the Waddington power and has already quietly invested a large amount of money for the development of this power for the purpose of generating electric power. This new company has laid before the councils of Brockville and Prescott propositions for cheap electric power, and it is claimed will also enter into competition with the Northern Company in this city. The Waddington plant has the advantage of being much closer to the city than the others.

SEBRING, OHIO.—The electric light plant will be repaired and improved.

YOUNGSTOWN, OHIO.—The work of extending the line of the Youngstown & Southern Railway Company will be started May 15.

CANAL DOVER, OHIO.—Fire is said to have destroyed the barns and sub-station of the Canton & New Philadelphia Railway Company.

CAMBRIDGE, OHIO.—Herbert O. Barber, who has been interested in traction building in this district, is promoting an electric railway in Wyoming.

ZANESVILLE, OHIO.—Col. A. E. Boone claims to have arranged with John Bane, of Detroit, to finance the proposed road from Zanesville to Parkersburg.

DAYTON, OHIO.—The Dayton & Xenia Traction Company is figuring on building a line either to Wilmington or to Washington C. H.; possibly to both places.

COLUMBUS, OHIO.—An ordinance has been prepared asking for a bond issue of $140,000, to be used in improving and enlarging the city electric light plant.

CINCINNATI, OHIO.—The Cincinnati, Georgetown & Portsmouth Railway Company will shortly place a contract for the extension of its road from Russellville to West Union.

CELINA, OHIO. The Muncie & Portland Traction Company has applied for a franchise in Celina. The line will be in the direct route from Toledo and Cleveland to Indianapolis.

CANTON, OHIO.—The Canton-Akron Railway Company is planning to erect a new car barn and sub-station at Canal Dover to replace the buildings destroyed by fire a short time ago.

YOUNGSTOWN, OHIO. The Youngstown & Ohio River Electric Railway Company is projecting an electric line from Youngstown across Mahoning and Columbiana Counties to East Liverpool.

COLUMBUS, O.—The Erner Hopkins Construction Company, Columbus, O., has purchased 26 new Allis-Chalmers, 240-volt motors for installation in the Marvin Wood Working Company's plant at Columbus.

CLEVELAND, OHIO.—The purchase of the Detroit, Toledo & Monroe Short Line by the Detroit United Railway indicates that an effort will be made to develop a through service on the traction lines from Cleveland to Detroit.

MARION, OHIO.—The Columbus, Delaware & Marion Railway Company has applied for a franchise to enable it to build three additional miles of city line in Marion. It is stated that work on the extension to Bucyrus is to start at once.

TOLEDO, OHIO.—H. C. Stahl, of Bellevue, has been elected president of the Toledo, Ann Arbor & Detroit Railway. The road, which is partly completed, has been tied up as the result of suits. Toledo stockholders now have control of the enterprise and it is believed that the line will be completed this year.

CLEVELAND, O.—The lowest bid opened on February 21 for electrical supplies needed for the South Brooklyn municipal electric plant was submitted by the Jandus Electric Company for $4,160. The Skinner Engine Company submitted the lowest bid for the lighting and power plant for the city hall, at $5,307.

LORRAIN, OHIO.—The annual meeting of the Black River Telephone Company was held recently, at which time it was decided to extend the lines to the east, west and south of the city. The superintendent of construction will prepare an estimate of the cost of the improvement and definite action will be taken at a subsequent meeting.

JEFFERSON, OHIO.—At the meeting of the County Commissioners recently the plans for installing an electric lighting plant at the county infirmary, which has been prepared under the directions of the commissioners and infirmary directors, were approved by both boards and the auditor was instructed to advertise for bids for the construction of the same.

GALION, OHIO.—S. N. Blake of Providence, R. I., has been in town with plans for the power plant of the Crawford Gas & Electric Company. The building will be located north of the Geer Works building and near the Wetstone Creek. The size will be 60 x 75 ft. The building will be modern, constructed of brick and stone. The contract will be awarded within the next thirty days.

TOLEDO, OHIO.—The Toledo Gas, Electric & Heating Company will be a bidder for the contract now held by the Toledo Railway & Light Company with this city. The contract between the city and the Toledo Railways & Light Company expires on January 1, 1907. If the company is successful in securing the contract, a large amount of money will be expended in improvements during the next ten months.

ENTERPRISE, ORE.—The Enterprise Electric Light Company will extend its circuits about three miles in the spring. E. J. Forsythe, manager.

MILTON, ORE.—Thomas Taylor, superintendent of the city electric light plant, writes that the authorities are about to increase the capacity of the plant by the addition of a 60 or 90-kw, single-phase, 125-cycle General Electric generator and a 30-kw transformer in order to provide for a day power service.

ASHLAND, ORE.—The city has closed a deal with the Ashland Electric Power & Light Company whereby it purchased from the company all its water and property rights in Ashland Creek and contracts for five years' lighting for $10,000. The system will be greatly improved and extended at a cost of $4,000.

TOLEDO, ORE.—The City Recorder writes that there is a good opening here for the establishment of an electric light plant. It is stated that from 60 to 100 hp may be developed at a point about 8 miles distant. There are three other towns along the bay, which might be furnished with electric power from the same plant.

LA GRANDE, ORE.—The Grand Ronde Electric Company is making plans for the installation of a pumping plant of 200-horsepower on the Grand Ronde River near Imbler. This proposition is under consideration by the electric company and the sugar company, which has a large acreage of beet lands in that vicinity. The project will be carried through if the two companies come to an agreement. The electric company has given orders for material for the extension of a power line from La Grande to Imbler. The cost of a line for the transmission of the amount of power desired is about $1,000 a mile. At this rate the Imbler project will involve the expenditure of $12,000.

POINT MARION, PA.—The Bell Telephone Company will establish an exchange in this place in the near future.

ALLENTOWN, PA.—The Allentown Rolling Mills recently purchased through the Philadelphia office of the Allis-Chalmers Company three 50-kw induction motors, 500 volts.

WASHINGTON, PA.—The Pittsburg Railway Company has completed the preliminary arrangements for building the Castle Shannon-Canonsburg Road, which will be the means of connecting Washington and Pittsburg by trolley.

NEW CASTLE, PA.—Sharon Councils have passed a 70-year franchise ordinance, granting to the Shenango-Midland Street Railway Company the right to construct and maintain an electric street railway system in that borough.

READING, PA.—C. C. Long, of Reading, Chief Engineer of the United Traction Company, writes that plans and specifications have not yet been prepared and nothing definitely determined with regard to constructing the power plant of the Reading Power Company.

SUNBURY, PA.—At the annual meeting of the Middlecreek Electric Company, Waldo Shipman was elected superintendent of construction. The turbines and electrical equipment for the water power plant south of Selinsgrove have been ordered. A sub-station will be erected in Sunbury. The pole line from Northumberland to Selinsgrove will be built as soon as the weather permits.

PHILADELPHIA, PA.—It is reported that a new electric trolley road will be built by the Trenton Short Line Railroad connecting the Frankford Avenue Elevated Road of the Philadelphia Rapid Transit system with Trenton via the Philadelphia, Bristol & Trenton Street Railway Company. An agreement for the interchange of traffic has been made which will enable passengers to ride from 63d and Market Sts. via the subway to Trenton without change of cars.

PROVIDENCE, R. I.—Commencing at the Park Avenue, Woonsocket end, four miles of double track will be laid this spring on the Providence & Burrillville Electric Railway. The double-tracking of the entire line will not be completed for some time.

NORTH KINGSTOWN, R. I.—There seems to be little doubt that the town will in the near future have a water and sewerage system installed, as the Wickford Light & Water Company has, it is understood, made a contract with F. E. Shaw to install the system and work is expected to begin in the early spring. Plans are also under way by this same company to extend its electric lighting system to the several villages in this vicinity.

KINGSTREE, S. C.—J. G. McCutchen, City Clerk, writes that a committee, including John A. Kelley, Chas. W. Stoll and others are negotiating with parties looking to the construction of an electric light plant.

ANDERSON, S. C.—The Savannah River Power Company has awarded the contract for the construction of its big dam across the Savannah River at Gregg Shoals. Under its terms the work is to be completed by the 1st of next October, in which event the plant will be in operation by the end of the year. The company is capitalized at $1,000,000.

STURGIS, S. D.—Allison Bros. & Bartlett, of Lead City, have purchased the Sturgis electric light plant.

SIOUX FALLS, S. D.—Construction work on the new electric line from here to Parker will be begun in about 60 days.

SPEARFISH, S. D.—A traction company is developing power on the Red Water River, and will transmit it to this point.

BRYANT, S. D.—J. M. Cripa, of South Omaha, Neb., is reported to be considering the question of installing an electric light plant at Bryant.

PETERSBURG, TENN.—The local telephone exchange will be greatly improved and enlarged.

OZONA, TEX.—A. C. Mayers, of San Antonio, is preparing to construct an ice and electric plant.

McGREGOR, TEX.—Fire destroyed the telephone exchange here recently, entailing a loss of about $2000.

HUBBARD CITY, TEX.—The City Council has granted the electric light and ice plant franchise to W. A. Bass.

FORT WORTH, TEX.—A new telephone building is being erected by the Southwestern Telephone & Telegraph Company.

SWEETWATER, TEX.—The Sweetwater Light & Power Company expects in a short time to extend its lines about 2½ miles. H. L. Anderson, manager.

GONZALES, TEX.—The Gonzales Telephone Company has a force of men engaged in stringing an overhead cable of telephone wires on the principal streets in the business part of the town.

BARSTOW, TEX.—A franchise has been granted by the Commissioners' Court of Ward County to the Pecos Valley Light & Power Company, which consists of Pecos, Barstow and Gainesville people, who propose to take water from the main canal at the flume, as the plant is to be operated by water power. Members of the company say that the machinery is ordered, all stock having been subscribed and that work will begin in thirty days.

SALT LAKE CITY, UTAH.—The Inter-Mountain Power Company expects to construct its proposed plant and have it in operation this year. James J. Chambers is president and manager.

LOGAN, UTAH.—The managing committee of the municipal electric light plant is considering plans for building a new power house 5 miles east of Logan. T. E. Daniels, Jr., is superintendent.

OGDEN, UTAH.—Bids will be received until March 14 by James Knox Taylor, Supervising Architect, Washington, D. C., for the installation of a conduit and electric wiring system for the U. S. Post Office and Court House at Ogden.

LEXINGTON, VA.—The Lexington Light & Power Company is reported to have decided to improve and enlarge its plant. R. E. Hutton is secretary.

NORFOLK, VA.—It is the purpose of the Norfolk Railway & Light Company to construct a new power house, install new machinery and make other improvements, all of which will aggregate $1,000,000.

RICHMOND, VA.—A franchise has been prepared authorizing the use of the city streets of the town of Burkeville, Va., for the purpose of constructing a telephone system. Bids for the above franchise will be received at Burkeville until March 12.

RADFORD, VA.—T. L. Pickle, superintendent of Radford Water Power Company, writes that the company is putting in a Westinghouse slow-speed alternator, direct-connected to a water wheel of 300-kw capacity, and will during the next twelve months duplicate it and possibly add one 36-in. twin water wheel.

WINCHESTER, VA.—The Winchester Electric Light Company has sold to the Winchester & Washington Railway Company its electric lighting plant in this city for $12,000. The latter company is building a $200,000 plant at Millville, Jefferson County, W. Va., and has secured a franchise for lighting and electric power in Winchester, Berryville, Charlestown and other nearby towns.

NORFOLK, VA.—The sum of $1,000,000 will be expended by the Norfolk Railway & Light Company for a new power house and new machinery, with other improvements, according to the statements of the general manager of the company. In this connection it is hinted by some that this company will eventually merge with the Bay Shore Company, but this is denied by the parties interested. The contemplated improvements of the Railway & Light Company will give Norfolk one of the finest plants of the kind in the South at this time.

SOUTH RYEGATE, VT.—M. F. Sargent has purchased of his brother, Marcus, the water privilege and shop at Holtonville. It is rumored that an electric plant will soon be built at that place.

NORTHFIELD, VT.—Moody & Almon are making plans to furnish 125 hp of electricity to operate the machinery of the International Mining Company's talc mill at Moretown, and the citizens of Moretown and Waitfield are anxious to enter into a lighting contract with the firm on terms similar to those at this place.

VANCOUVER, WASH.—The Vancouver Electric Light & Power Company is considering increasing the capacity of its plant shortly. J. R. Harvey is manager of the company.

SEATTLE, WASH.—The Seattle Electric Company, of which H. H. Grant is manager, proposes constructing a power plant to cost from $300,000 to $400,000. Engineers, Stone & Webster, 84 State St., Boston, Mass.

SEATTLE, WASH.—James A. Moore, representing local capital with eastern relaions, has asked the city council for a franchise in Seattle to build an electric road to traverse part of the city and go to the sound cities and to Vancouver, British Columbia.

PROSSER, WASH.—The City Council has voted to enter into a contract for three years with the Prosser Falls Land & Power Company to light the business portion with eight 1200-cp arc lights, the city paying $7.50 per month for six and getting two free; under the franchise additional lights are to be furnished at $5.50 per month each. The city is lighted at present by incandescent lights furnished by the Prosser Electric Company, of which the city must take 10 lights. It is proposed to discontinue 12 lights it is now taking of that company to make way for the arc lights, thus effecting a saving of $18 a month to help pay for the arcs.

SEATTLE, WASH.—The erection and construction of a light and water station to generate 10,000 hp, to supply industries in Seattle and Tacoma, is to be begun shortly at a point on Green River, adjacent to the mining town of Franklin. Eastern capitalists, principally from Pennsylvania and represented by Andrew Kennedy, are financing the deal, which will involve an expenditure of close to $1,000,000. The plans of the incorporators include the furnishing of power to the Seattle, Renton & Southern Railway, of this city, and to varied industries in this city and Tacoma, and, if a deal can be closed, the furnishing of a city water supply for Tacoma. For the past month representatives of the Eastern backers have been in this city and on Green River looking over the ground and acquiring options on water-shed property. Negotiations are now pending with the stockholders of the Seattle, Renton & Southern Railway to supply electricity for transportation purposes.

CHETEK, WIS.—W. J. Garvin will install an electric light plant here.

ONALASKA, WIS.—The Wisconsin Light & Power Company has been granted a franchise here.

MILWAUKEE, WIS.—A new system of heating and lighting is to be installed in the county jail.

MARINETTE, WIS.—The Wisconsin Telephone Company intends to make extensive improvements this year in its system at this point.

MILWAUKEE, WIS. The Pabst Brewing Company is to expend $400,000 in the installation of an electrical system for running its entire plant

CUMBERLAND, WIS.—The city contemplates the issue of bonds for $10,000, to install an electric light plant. An election will be held in the spring to vote on a bond issue.

MILWAUKEE, WIS. The Wisconsin Telephone Company will erect a two-story brick addition to its South Side exchange. The proposed improvements will cost about $20,000.

MILWAUKEE, WIS.—The Town Board of Norway, Racine County, has granted a franchise to the Milwaukee Heat, Light & Traction Company, to build an electric line through that town.

CHETEK, WIS.—K. Rosholt, of Eau Claire, has purchased from the Wisconsin Power Company, of Menomonie, Wis., the dam and flour mill here, and with it all water rights and privileges. He expects, it is said, to put in an electric light plant and other industries.

LA CROSSE, WIS.—Extensive plans for the improvement of the system of the La Crosse City Railway Company, requiring an extension of the franchise for about two miles of streets, at a cost of $30,000, have been laid before the special railroad committee of the Common Council.

KENOSHA, WIS.—The recently incorporated Chicago, Kenosha, Milwaukee & Lake Geneva Electric Railway has presented to the Council an application for an ordinance granting right of way through Kenosha. It is stated that the company plans to build from Kenosha to Milwaukee at once.

BLACK RIVER FALLS, WIS. Preparatory work for the great power dam to be built on Black River, a few miles above here, is being rapidly pushed, and a crew of fifty men is clearing the 1,000 acres that will be flooded The wood is being taken off and the land will be left clear for the lake, which will be from one-half to three miles wide and five miles long. Work on the dam will begin as soon as spring opens The dam will be nearly half a mile long and 47 ft. high and will be made of solid concrete It will give a fall of 90 ft and will develop 12,000 horsepower for the manufacture of electricity. This will be transmitted to La Crosse and it is also intended for the new electric railroad. It is said that $1,000,000 will be expended in the new enterprise

SHEPHERDSTOWN, W VA The Martinsburg Power Company (H. B. Shoemaker, of Martinsburg, manager) has petitioned the Jefferson County Commissioners for a franchise to erect a line of poles and wires from dam No. 4 about 4 miles north of this place to Sheperdstown and Kearneysville.

WHEELING, W VA It is understood that the stockholders of the Benwood Electric Light Company authorized improvements and additions to the plant entailing the expenditure of a large sum, which will be commenced early in the spring. The Ohio Valley Company absorbed the Home Electric Light Company, and the Benwood and McMechen Electric Light Company several months ago.

REVELSTOKE, B C.—The Town Council is considering rough plans for an electric power plant. Address Town Clerk.

NEW WESTMINSTER, B. C.—The British Columbia Electric Street Railway Company is having plans made for a line from here to Port Moody, a distance of 10 miles.

WINNIPEG, MAN., CAN.—The Street Railway Company will lay a double track on Portage Avenue, as far as the city limits, this year.

STRATHCONA, ALB., CAN.—The Council has decided to install an electric light plant at an estimated cost of $35,000, and will shortly call for bids. Address Will Godson, Strathcona, Alb.

RED DEER, CAN.—The Red Deer Electric Railway Company is preparing plans for the construction of lines to the neighboring villages of Pine Lake, Hill End, Edwell, Penhold, Markerville, Evarts, Blackfalds and Content. Construction will be started this spring.

VIRDEN, MAN.—The Town Council is considering several propositions for the installation of an electric lighting plant. A. C. MacDougall is town clerk.

BRANDON, MAN.—The Brandon Electric Light Company has decided to increase both of its plants and will install additional machinery. Address George A. Patterson, manager.

MEXICO CITY, MEX.—The National Railroad Company of Mexico is preparing to install electric power for the operation of its large shops at Santiago.

TAMPICO, MEX.—The Borde Electric Light Company is extending its lighting system to Dona Cecilia and intermediate points. Additional machinery will be installed by the company. C. C. Freston is manager.

GRAND FALLS, N. B.—The Grand Falls Power Company has filed plans for developing the power at Grand Falls.

MONCTON, N. B.—The City Council has decided to petition the Legislature for permission to issue $60,000 bonds for improving and extending the water works and electric light plant.

MONTREAL, QUE.—The Montreal Park & Island Electric Railroad Company has decided to build a number of extensions this year.

MONTREAL, QUE.—It is announced that the Montreal Terminal Railway has passed into the hands of the Montreal Street Railway for something less than $500,000. It is also announced that with the increased capital at its disposal a series of extensions will be entered upon by the Montreal Street Railway this summer. Plans are being prepared for a $1,000,000 power house.

BRANTFORD, ONT.—The Western Counties Power Company is reported to have decided to erect a pole line between Brantford and Hamilton.

TORONTO, ONT.—The Ontario Government is considering installing an electric light plant in the Parliament buildings. J. J. Foy, Minister of Public Works.

STRATHROY, ONT.—Plans are being made for the installation of a new 150-hp engine and a 50-kw, 60-cycle generator. The power house will be enlarged and the lines extended about two miles. Alex. Reid is manager and superintendent.

COPPER CLIFF, ONT.—The Canadian Copper Company is surveying the line between here and Creighton with the intention of transmitting electric power to its property there. The operation of the company's entire plant by electricity is being considered.

PORT ARTHR, ONT.—Messrs. Cassels, Brock, Kelly & Falconbridge, solicitors, of Toronto, are applying on behalf of a syndicate for permission to develop electrical energy in the municipality of Shuniah and to supply light and power to the towns of Port Arthur and Fort William for manufacturing and residence lighting purposes.

OTTAWA, ONT.—The Ottawa Power Company is reported to have petitioned the Council for permission to excavate a canal 30 feet in width across Middle St., Victoria Island, to divert water to the company's pond The work is said to include the bridging of the canal over the street.

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New Incorporations.

NAPA, CAL. Articles of incorporation of the Cache Creek Electric Company have been filed in the County Clerk's office. The company intends to generate and distribute electricity for lighting and power purposes in Lake and other counties, and will erect buildings and install machinery for that purpose. The principal place of business is to be in Napa. There are three directors, E. H. Winship and R. Raymond, capitalists of Napa, and F. W. Williams, of San Francisco. The capital stock is placed at $1,000,000.

SPRINGFIELD, ILL.—Articles of incorporation have been filed by the Franklin & Waverly Railway Company, with its principal office in Chicago. The capital stock is $50,000.

CHICAGO, ILL.—The Chicago, Blue Island & Joliet Traction Company has been incorporated with a capital stock of $1,500,000. The officers of the new company will consist of those now presiding over the Chicago Southern Traction Company, the capital stock of which was recently increased to $3,500,000.

GREENVILLE, ILL.—Some prominent business men of this city have organized the Bond County Telephone Company, with a capital stock of $3000.

FORMOSA, KAN.—The Formosa Mutual Telephone Company has been incorporated with a capital stock of $7,500.

IOLA, KAN.—A company has recently been formed here, with a capital of $10,000, to take over the property of the Katy Telephone Company and establish a local exchange in this city.

LONG ISLAND, KAN.—The High Line Telephone Company has been incorporated with a capital of $1,650.

EXCELSIOR, KAN.—The Centerville Rural Telephone Company has been incorporated with a capital of $1,020.

HUTCHINSON, KAN.—The People's Water, Light & Power Company has been incorporated and has asked for a street franchise here. Among the directors are Emerson Carey, K. E. Sentney, T. J. Templar and J. S. George.

McDONOGHVILLE, LA.—The McDonoghville Water, Power & Improvement Company has been incorporated with a capital of $100,000 by Henry Hart, Louis H. Marrero, H. L. Sander and others.

AUGUSTA, ME.—The Augusta, Waterville & Oakland Street Railway Company has filed articles of incorporation, with a capital stock of $75,000. The directors are Edwin J. Lawrence, S. A. Nye and Amos S. Gerald, of Fairfield, and Cyrus W. Davis and Ralph M. Gilmore, of Waterville.

SEDAN, MINN.—The Sedan Telephone Company has been incorporated with a capital of $2,500.

ALBANY, N. Y.—The Rochester, Scottsville & Caledonia Electric Railway Company has been incorporated. The capital is $500,000 and H. U. Brewster and J. N. Beckley are among the directors.

STAMFORD, N. Y.—The West Branch Light & Power Company, with a capital of $50,000, has been organized and incorporated by J. P. Grant, C. E. Grant and L. P. Grant.

CALDWELL, OHIO.—The Caldwell, Athens, Gloucester, Corning, Nelsonville & Belpre Tramway Company has been incorporated by A. E. Boone, M. E. Boone, F. Z. Terry, E. O. Boone and J. W. Marquard.

BELLAIRE, OHIO.—The Bellaire Southwestern Traction Company has been incorporated by H. C. Ford, A. A. McCaslin, A. M. Snyder, of Cleveland, and E. G. Derr and G. O. Nagle, of Wheeling. The company proposes to build a line from Bellaire down the Ohio River to Shadyside and Neff, a distance of about ten miles. The parties mentioned are prominent in the Wheeling Traction Company and that company is probably back of the project.

CRESCENT, OKLA.—The Crescent Telephone Company has been incorporated with a capital stock of $20,000.

GUTHRIE, OKLA.—Secretary Filson has issued a territory charter to the Lawton, Denton & Dallis Electric Railway Company. The company has a capital of $250,000, and was organized to build a line from Lawton to Dallas, a distance of 150 miles. The incorporators are S. E. McCully, Charles Henderson, J. T. Chambers, J. W. Lowrey, all of Sanger, Tex., and S. H. Iles and W. O. Allen, of Meers, Okla.

GUTHRIE, OKLA.—The Shawnee-Tecumseh Traction Company, which proposes to build an interurban line between those two towns, has been granted an Oklahoma charter. The capital stock is $500,000, the estimated cost $1,000,000, and the principal offices will be in New York, with other offices at Shawnee, this state, and Titusville, Pa. The incorporators are Alfred Hare, of Tecumseh; Grace Carleton, S. P. Maury, J. H. Woods and John W. Jones, of Shawnee, and G. S. Brubaker and A. M. Wallace, of Philadelphia.

PITTSBURG, PA.—The Washington & Independence Street Railway Company has filed articles of incorporation, with a capital of $12,000. Derr B. Neagley is president.

PITTSBURG, PA.—The West Middletown Electric Street Railway Company has been incorporated to build two miles of trolley line in Washington County. The company has a capital of $12,000. Derr B. Neagley is president, and the other directors are C. H. Robinsteen, J. K. Neagley, H. H. McClure and W. H. Armstrong.

FEDORA, S. D.—The Citizens Economic Telephone Company has been incorporated with a capital stock of $2,500.

OZONA, TEX.—A company has just been organized, known as the Ozona Improvement Company, for the purpose of operating the water works, and an ice and electric light plant in that town. Mayer & Co., of San Antonio, Tex., have the contract, and expect to have the plant in operation by May 15, this year.

SPOKANE, WASH.—The Inland Power & Electric Light Company has been incorporated with a capital of $1,000,000.

SEATTLE, WASH.—Articles of incorporation have been filed with the Secretary of State for the Washington Northern Railroad Company, organized for the purpose of building a road from Seattle to Portland. Jacob Furth, J. G. Trenholm and F. K. Struve are the incorporators, the capitalization is $500,000, and the principal place of business is located in Seattle. The company may use either steam or electric power.

TACOMA, WASH.—The Home Telephone Company of Puget Sound has been incorporated with a capital of $5,000,000 by E. F. Webster and C. E. Sumner.

KENOSHA, WIS.—The Chicago, Kenosha, Milwaukee & Lake Geneva Electric Railway Company has been incorporated. James Cavanaugh and L. Wattles are among those interested.

MONROE, WIS.—Articles of incorporation have been filed in the office of the Register of Deeds by the Brooklyn Telephone Company, having a capital stock of $10,000.

OSHKOSH, WIS.—The Interstate Construction, Gas & Electric Light Company has been incorporated with a capital of $100,000. The incorporators are William and Sinclair Mainland and A. E. Thompson.

NIAGARA FALLS, ONT., CAN.—The Ontario Distributing Company has been incorporated with a capital of $100,000, to carry on a general light, heat and power business. The provisional directors include J. H. Symmes, G. G. Durham and F. C. McBurney, Niagara Falls, Ont.

FINCH, ONT.—The Finch Electric Light & Lumber Manufacturing Company has been incorporated with a capital of $50,000, to install an electric light plant. The directors are M. A. Smirl, Jacob McQuaig, G. L. McLean, Finch, Ont.

PORT ARTHUR, ONT.—Application has been made for the incorporation of the Fort William & Port Arthur Terminal Railway & Bridge Company, with power to build an electric railway across the islands in the Kaministiquia River. Messrs. Bowler & Sinclair, solicitors, Tilsonburgh, Ont., are acting for the applicants.

MONTREAL, QUE.—R. F. T. Pringle & Co. have been incorporated and will erect a factory here at a cost of $30,000, to manufacture electrical supplies.

MONTREAL, QUE.—A. Prudhomme & Fils have been incorporated here with a capital of $145,000, to manufacture electric motors, etc. The charter members include A. Prudhomme, H. Godin, S. Beaudin, Montreal.

Legal.

CONTRACT FOR CURRENT.—The Appellate Court of Indiana, Div. No. 2, has rendered a decision in an appeal from the Superior Court of Marion County, affirming an order overruling a demurrer to the bill of complaint. The questions involved relate to an exclusive contract made to take current, by the defendant, from the Indianapolis Light & Power Company; the defendant later connecting to the circuits of the Merchants' Heat & Light Company. The points in the decision are as follows: (1) A stipulation, in a contract for the purchase of electric current, providing that the applicant agrees to use enough current, if it is measured by the watt, to make a monthly bill of a dollar, or pay that amount, should sufficient current not be used, was a part of the direct obligation of the contract, and did not constitute an agreement for liquidated damages in case of breach. (2) Where a contract to purchase electric current for a period of five years provided that, in consideration of the rate fixed, the consumer should not use any electric current on the premises not furnished by complainant, complainant was entitled to an injunction to restrain the consumer from so using current furnished by others, though the contract was not one that a court of equity could compel defendant to specifically perform. (3) Complainant, a public service corporation, supplying electricity and bound to supply applicants on certain conditions, contracted to supply defendant at a special price per 10,000 watts used for a period of five years; defendant agreeing that during such period no current furnished by any other company should be used on the premises, and that he would pay at least a dollar a month. Held, that for a breach of such contract by defendant in disconnecting complainant's wires, and using electricity furnished by another, complainant had no adequate remedy at law.

Obituary.

MR. C. S. H. SMALL.—We regret to note the death of Mr. Charles S. H. Small, Southern traffic chief of the Western Union Telegraph Company, New York City, who succumbed last week to œdema of the lungs at St. Mary's Hospital, Passaic, N. J., while being carried into the hospital from his home. Mr. Small was well known as a telegraph expert and had a wide acquaintance in the electrical field. He was president of the New York Electrical Society 1883-4.

MR. HENRY RUSTIN.—It is with deep regret that we note the death of Mr. Henry Rustin at Florence, Neb., from tuberculosis. He was born at Omaha in 1865 and was a graduate of the Phillips Andover Academy and the Sheffield Scientific School. At the Omaha Exposition in 1898 he installed the electric plant and street railway and had complete charge of all the lighting, and where he proved himself an apt pupil in the science of illuminating engineering and decorative lighting under the late Luther Stieringer. At Buffalo, at the Pan American, Mr. Rustin again carried out Mr. Steiringer's ideas in the beautiful tower lighting and introduced many novel schemes and ideas of his own. As soon as the Louisiana Purchase Exposition was contemplated the services of Mr. Rustin were engaged for the electrical departments. His health then gave way. He was a member of the American Institute of Electrical Engineers. He married in 1894 Miss Lola Goodwin, who survives him.

PROF. S. P. LANGLEY.—We regret to announce the death of Prof. S. P. Langley at Aiken, S. C., on February 27, after a paralytic stroke. This distinguished physicist was born at Roxbury, near Boston, in 1834. He early showed a keen interest in astronomy, but though he afterward received honorary degrees from various great universities he had no college education. After being graduated from a high school he hesitated for several years between the professions of civil engineering and architecture. On his return from a two years' trip abroad in 1865 he was appointed an assistant at the Harvard Observatory, a position which he soon gave up for that of Assistant Professor of Mathematics at the Naval

Academy at Annapolis. His work in enlarging the Annapolis Observatory led to his appointment as Director of the Allegheny Observaory at the Western University of Pennsylvania. This was in 1867, and he remained Director for twenty years. During this period he introduced many reforms and improvements, including a railway time service. In 1870 he began his studies in solar physics, a field in which he became a recognized authority. He was appointed Secretary of the Smithsonian Institution in 1887. The value of his work at the Institution is well known, but perhaps the most popular of his achievements was the establishment of the National Zoological Park. Prof. Langley received the degree of LL.D. from Harvard, Yale, Princeton, Wisconsin and Michigan. Oxford made him a D.C.L. and Cambridge a D.Sc. He was a member of the French Institute, a Fellow of the Royal Astronomical Society of London, a Trustee of the Carnegie Institute, and a member of the National Academy of Science and other learned societies. He was elected President of the American Association for the Advancement of Science in 1886. The following year he received the gold and silver medals of the American Academy of Arts and Science and the Rumford Medal of the Royal Society of England.

Personal.

MR. ARTHUR GIESLER.

MR. ARTHUR GIESLER.—At Snoqualmie Falls there was placed in operation last year the largest single water turbine in the world—10,000 hp at 260 feet head, this single wheel developing as much power as the entire former installation consisting of ten impulse wheels. Mr. Arthur Giesler, as chief engineer and designer of hydraulic installations for the Platt Iron Works Company of Dayton, has been responsible for the recent hydraulic successes exemplified in the Snoqualmie Falls installation, Montmorenci, Honk Falls, New Milford, Truckee River General Electric Company, and at least a score of other equally notable installations, where the efficiency of the water wheel has been a pleasing surprise to managers and owners and to the engineering world. Mr. Giesler has been actively identified with water wheel design and installation for practically his entire life. Beginning in 1869, he erected at Dirschau, Prussia, for Professor Fink of Berlin, Fink's first reaction turbine, equipped with what is known as the "Fink Gate." Born in the city of Dantzig, Mr. Giesler received his education at and graduated there, and finished under the tutorship of Professor Stahl at Dantzig, specializing in general and hydraulic engineering. After volunteering and serving for two years in the Franco-Prussian war, he entered the employ of the well-known German engineering and manufacturing concern of G. Luther, of Braunschweig, who were one of the pioneers in hydro-turbine design. Coming to America in 1882, Mr. Giesler entered the employ of the Stillwell-Bierce and Smith-Vaile Company, becoming shortly assistant superintendent and subsequently superintendent of works and chief engineer, which position he retained up to the date of his resignation from the Platt Iron Works Company. Mr. Giesler possesses entire familiarity with the latest practice in hydro-turbine engineering in every part of the world, maintaining a personal acquaintance with manufacturers in Europe and making frequent visits to their various establishments. He has had exceptional opportunities for availing himself of their cumulative experience. On the occasion of Mr. Giesler's most recent trip abroad, he examined all the important installations of turbine pumps in Europe. When the Sulzer Brothers, the consulting engineers for the Simplon Tunnel, heard of Mr. Giesler's presence in Switzerland, they enabled him to examine its pumping and other features and he was probably the first American who passed through the tunnel, the actual cutting through having been effected just prior to his arrival. An important contribution to hydro-electric developments was the Giesler governor, designed to make possible the operation of street railways from water power plants. After demonstrating the feasibility of such a device and observing, however, its commercial limitations, Mr. Giesler allowed its developments to be taken up by others, occupying himself with more remunerative work.. Last week Mr. Giesler established himself in New York with offices at 170 Broadway, New York City, as consulting engineer, devoted to the specialty with which he is most familiar, viz., hydro-turbine power plants and hydro-turbine pumping stations.

MR. C. F. GREENWOOD, of the Cuban Electrical Company, has applied for a concession to construct electric tramways in Regla and Guanabacoa.

MR. S. INSULL, president of the Chicago Edison Company, has gone on a brief trip to England on personal affairs, and will not make a long stay.

MR. G. W. HUBLEY, superintendent of the Louisville (Ky.) Lighting Company, has been a recent visitor to New York City, on business in relation to the development of the corporation.

MR. EDWARD E. WINTERS, assistant to the president of the South Covington & Cincinnati Street Railway Company and the Union Light, Heat & Power Company, has been a welcome visitor in New York during the present week.

MR. JOHN L. LIVERS, of Luray, Va., has been engaged by the Shenandoah River Light & Power Company as engineer to erect its power plant on the Shenandoah River. Water wheels and generators of a capacity of 600 hp will be installed.

MR. T. A. EDISON and family have gone this week to their Florida plantation and will there spend the entire month of March, returning early in April. This holiday is one that Mr. Edison looks forward to with much zest after the hard work of the winter.

MR. JOHN C. REILLY, so long active in the technical management of the New York & New Jersey Telephone Company has just been elected a member of the board of directors of this rapidly growing corporation. He will continue his general superintendency of the system.

DR. LEE DE FOREST, in a recent interview quoted in the *Spokane Chronicle*, stated that with wireless telegraph methods and apparatus, he is working on the problem of power transmission without wires, beginning with small quantities for exploding torpedoes or dynamite in mines.

MR. P. W. DAVIS.—Mr. Philip W. Davis has resigned from the position of engineer for the Electric Storage Battery Company's Boston office, and will engage hereafter in general engineering practice in the office of Mr. Charles K. Stearns, mechanical and electrical engineer, 93 Federal street, Boston.

NEW YORK ELECTRICAL SOCIETY.—At the meeting of the New York Electrical Society, Feb. 21, the following-named gentlemen were elected members: Isaac Fidler, Paterson, N. J.; Harry C. Fling and Harry Sickhardt, of New York City; Daniel Hurley, Harrison, N. J.; James H. Rogers, James L. Wiltse, S. B. Burroughs, James K. Hooper, Carlton A. Groves and Richard E. Brown, of Brooklyn, N. Y.

MR. W. M. WALMSLEY has been appointed general manager of the Sao Paulo Tramway, Light & Power Company, Ltd., at Sao Paulo, Brazil, and will sail to assume the duties of that office on March 5. Mr. Walmsley was engineer of the Electric Traction Company and the Fairmount Park Transportation Company, of Philadelphia, and chief engineer and general manager of the MacAfee Company, during which time he built and operated the Augusta-Aiken Railway, the Ohio River Electric Railway, the Blue Grass Traction Company, New Orleans & Ponchartrain Railway, etc.

MR. J. J. WOOD, the inventor and electrical engineer of the Fort Wayne Electric Works, has sustained a staggering bereavement in the sudden death of his wife while they were visiting New York City recently. Mr. Wood had come on to attend to some legal matters, and he and his wife had spent the evening at the theatre. They had returned to the Hotel Astor barely a few minutes when Mrs. Wood was taken ill and died almost immediately. Mrs. Wood was a native of New York, but had lived in Fort Wayne some sixteen years, marrying Mr. Wood there in 1897. She was of most charitable disposition and the Fort Wayne *Journal Gazette* in speaking of her life says: "The objects of her benefaction are numbered by the score."

MR. A. L. COLBY.—Mr. Albert Ladd Colby has just announced that he has opened an office as consulting and inspecting engineer and iron and steel metallurgist. He has postponed the announcement until after the annual meeting of the Association of American Steel Manufacturers, when he resigned as secretary, being illegible as he was no longer connected with the steel manufacturers. Mr. Colby has had over 20 years' experience in the steel business, for 18 years of which time he was connected with the Bethlehem Steel Company. He has visited all the prominent works abroad and was a juror in metallurgy at the Paris Exposition in 1900. For the past three years he was nickel steel expert for the International Nickel Company. He has written a book on steel specifications, and is a frequent contributor to the technical press and the many scientific societies, of which he is a member.

MR. GEORGE H. DANIELS, the advertising manager of the Vanderbilt Railroad systems, was given a testimonial dinner in the ballroom of the Waldorf-Astoria on Tuesday, February 20, when over 500 leading railroad managers, newspaper proprietors, editors of magazines and other journals assembled to do honor to "Uncle George." Some excellent speeches were delivered, especially that of Mr. Daniels, who said: "This honor is not simply personal. As I look upon it, it is a tribute to an idea, and when you study the history of the world, in ancient as well as modern times, you will find that ideas are all that is left. It is the idea of advertising that brought out this demonstration. Advertising underlies any business on earth except robbery. If you have anything to sell you must advertise it, and the man without advertising is the man without any real foundation for his business. The railroads have discovered this, and the fact that a great system of railroads decided that it was wise is an indorsement of the idea." A number of electrical men participated or served on the committees, including Messrs. C. W. Price, T. C. Martin, J. M. Wakeman, R. D. Lillibridge, C. D. Marsh, Melville E. Stone, H. D. Estabrook.

News of the Trade.

THE TRIUMPH ELECTRIC COMPANY, of Cincinnati, O., has placed its Northwest Pacific agency in the hands of the Hallidie Machinery Company, Seattle, Wash. The sale of Triumph apparatus will be pushed in that territory more actively than ever before.

FORD, BACON & DAVIS.—The well-known engineering firm of Ford, Bacon & Davis, New York City, retained by the Memphis Street Railway Company, Memphis, Tenn., in the reconstruction of its present properties, has recently let contracts for the Memphis Company to the Allis-Chalmers Company, for furnishing a 34 and 72 x 60-in. Reynolds vertical cross-compound engine to be used in direct connection with a 2000-kw direct-current generator.

A LARGE ROOFING ORDER.—In rebulding the factories of the Ohio Brass Company, Mansfield, O., which were partially destroyed by fire last year, the order for roofing was placed with the H. W. Johns-Manville Company through its Cleveland branch. The roofing to be used is the well-known "J-M Asbestos Roofing," which is coming into very general use for large manufacturing establishments, railroad depots and all large buildings. The plant of the Ohio Brass Company is one of the most prominent in the State, and its equipment throughout is of the most modern character. The size of the order, which amounted to 850 squares, resulted in the keenest competition with all the roofing concerns in the country.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York. Next meeting, Chattanoga, Tenn., May 1-4, 1906.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York.

Association of Edison Illuminating Companies. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting September, 1906.

Association of Railway Telegraph Superintendents. Secretary, P W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electrical Contractors' Association of New York State. Secretary, F. Fish, 123 Mill St., Rochester, N. Y. Next meeting, New York City, June 19, 1906.

Electrical Salesmen's Association. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings second and fourth Thursdays each month.

Electrical Trades Association of Canada. Secretary, J. A. Mann, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electric Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Des Moines, April 19 and 20, 1906.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia. Next meeting, Des Moines, April 18 and 19, 1906.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, March 13, 14 and 15, 1906.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., October, 1906.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electric Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

Missouri Independent Telephone Association. Secretary, James F. Barnett.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn. Next meeting June, 1906.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

New York State Independent Telephone Association. Secretary, T. S. Lane, 536 Ellicott Square, N. Y. Next meeting, Elmira, N. Y., June, 1906.

Northwestern Electrical Association. Secretary, B. C. Adams, Madison, Wis.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretry, F. W. Bullard, Cleveland, O. Next meeting, Pittsburg, Pa., May 17, 1906.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, O.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore. Next annual meeting, June 19, 1906.

Pennsylvania State Independent Telephone Association. Secretary, H. E. radley, 135 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D.

Southwestern Electrical and Gas Association. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, second Tuesday in May, 1906.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York. Special meeting, Elmira, N. Y., March 29, 1906.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt. Next meeting, July 10 and 11, 1906.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electrical Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED FEB. 20, 1906.
(Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.)

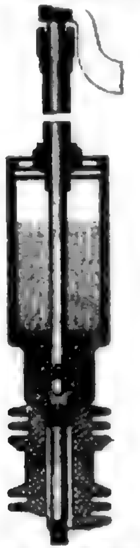
812,825. RAILWAY SWITCH OPERATING APPARATUS; Clyde J. Coleman, Rockaway, N. J. App. filed Feb. 4, 1905. The switch point is thrown by a piston in a cylinder containing an expansible fluid. The cylinder also contains a heat coil so as to heat and expand the fluid by an electric current.

812,851. TROLLEY FOR ELECTRIC CARS; John H. Kinter, Indiana, Pa. App. filed Aug. 5, 1904. Above the trolley wheel is fixed to rotate in a horizontal plane a four-pronged member which retains the wheel against the conductor and rotates to permit the passage of hangers, guy wires, etc.

812,872. INCANDESCENT ELECTRIC LAMPS; Herschel C. Parker, New York City, N. Y. App. filed April 8, 1905. An incandescent electric lamp, comprising a tube of highly refractory material which is permeable to light, a highly refractory conducting film on the inner surface of the tube, and connections at the tube ends for the said conductive film.

812,878. TURBINE DRIVEN MACHINERY; Augustus C. E. Rateau and Gaston Saulter, Paris, France. App. filed Aug. 17, 1903. The combination with electric generators connected in parallel to a main circuit, of high pressure and low pressure turbines, each driving a corresponding generator, means for causing motive fluid to pass through said turbines in series to operate the same as a unit, an obturator controlling the supply of motive fluid to the first turbine of the series, and a governor for operating said obturator responsive to changes in the total load on said main circuit.

812,880. SWITCH OR CIRCUIT BREAKER FOR HIGH POTENTIAL CIRCUITS; Edwin W. Rice, Jr., Schenectady, N. Y. App. filed Dec. 30, 1899. A rod or plunger is movable in a cylindrical casing containing oil and may be pushed into a metallic socket so as to complete the circuit.


812,880. — Switch or Circuit Breaker for High-Potential Circuits.

812,881. HANGER OR EAR FOR OVERHEAD ELECTRIC TROLLEY WIRES; Abraham Richardson, Blackpool, England. App. filed Feb. 6, 1905. The hanger is made in two halves which fit together to embrace and hold the trolley wire. The screw for supporting the hanger has a surrounding ferrule which serves to clamp the two halves of the hanger together.

812,900. RAIL BOND; Edward G. Thomas, Cambridge, Mass. App. filed Dec. 24, 1902. A bond for surface road rails designed to be located beneath the fish-plates. Comprises a bundle of copper ribbons with a clamping plate at each end arranged to be screwed to the rail.

812,949. ELECTROMAGNETIC POWER GENERATOR; Joseph L. Potter, Indianapolis, Ind. App. filed May 26, 1905. A toy motor having a pair of electro-magnets and separate pivoted armatures therefor. The armatures alternately impinge against a pair of crank shafts spaced 90 deg. apart..

812,954. ANNUNCIATOR DROP; Charles E. Scribner, Jericho, Vt. App. filed June 24, 1905. Details of annunciator drop for telephone service employing two electro-magnets in axial alignment with one another, and rod connections from their pivoted armatures to the drop mechanism.

812,965. ELECTRICAL HEATER; Emma L. Vaughn, San Francisco, Cal. App. filed Oct. 14, 1905. A perforated tin casing is covered with asbestos and contains an ordinary electric lamp which serves to supply the heat thereto.

812,969. ELECTRIC WELDING MACHINE; William C. Winfield, Warren, O. App. filed Jan. 9, 1905. For welding sheet metal cans. A pair of discs are made the terminals of an electric circuit and are borne against the seam of the can to be welded. The can and discs are rotated slowly as the welding progresses.

812,980. SELF SOLDERING HEAT CARTRIDGE AND PROTECTIVE APPARATS; Frank B. Cook, Chicago, Ill. App. filed Nov. 26, 1904. Various details of thermal cut-out having spaced carbon blocks for lightning arrester and thermal cartridges held between spring blades. The cartridges are specially constructed with a form of graphite rods and are self-soldering.

813,048. ANODE; Louis Levett, New York, N. Y. App. filed May 9, 1905. Mechanical details of construction of anodes for electroplating, the chief feature being the combination of a core with a removable metal portico surrounding it.

813,052. ELECTRIC BRAKE FOR VEHICLES; Joseph N. Mahoney, Astoria, N. Y. App. filed Nov. 8, 1901. An electric braking system comprising opposed braking surfaces and means for controlling the pressure between them by two currents, one of which varies relatively to the speed of the car, and the other of which is appropriately controlled, whereby the pressure between the braking surfaces is varied in relation to the speed of the vehicle.

813,053. SHOE; John G. Marchand, Buffalo, N. Y. App. filed July 1, 1905. In addition to the inner sole, a fibrous inner cushion is provided, and around the edges of this cushion, and extending beneath the inner sole, are zinc and copper strips which are designed to produce a galvanic action.

813,082. MECHANICAL AND MAGNETIC TOY; Herbert Cottrell, Newark, N. J. App. filed Feb. 27, 1905. An inertia wheel has a friction drive connection with a rotating turn table which moves over the surface of permanent magnets. These produce unusual motions of magnetic puppets on top of the turn table.

813,083. ELECTRICALLY CONTROLLED REGULATING VALVE FOR HUMIDIFYING AND HEATING SYSTEMS; Stuart W. Cramer, Charlotte, N. C. App. filed Dec. 29, 1904. Both the dry bulb thermometer and the wet bulb thermometer have platinum electrodes fused therein which establish an electric circuit to control the moist air supply in case of certain predetermined relative movements of the two mercury columns.

813,093. BINDING POST; Edwin C. Henn, Cleveland, O. App. filed May 9, 1905. The binding post has a longitudinally ribbed shank which may be driven to a carbon block so as to give an improved electrical contact therewith.

813,101. CLOSED CONDUIT FOR ELECTRIC RAILWAYS; Augustus W. Lohnmann, Sr., Chattanooga, Tenn., and John Pruis, Chicago, Ill. App. filed Mar. 22, 1905. A conduit system in which the grip slot is normally closed by spring shutters. The shutters have wedge faces so as to be displaced during the passage of the collector shoe. A sectional conductor is also provided which is temporarily energized during the passage of the car.

813,105. PRIOCESS FOR DECOMPOSING WATER BY ELECTROLYSIS; William F. M. McCarty, Rocky Ridge, Md. App. filed Nov. 8, 1904. Metallic sodium is added to acidulated water, which is then subjected to electrolysis.

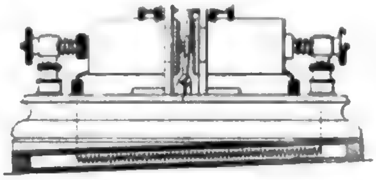
813,113. ELECTRIC HEATER; Austin A. Pratt, Los Angeles, Cal. App. filed June 21, 1905. A portable electric stove having a sheet iron casing with a circular row of resistance coils vertically supported therein between insulating blocks.

813,119. ELECTRIC LOCK STRIKE; Harry F. Smith, Richmond, Va. App. filed Jan. 4, 1905. A means for unlocking exit doors, etc., in an emergency. The latch is spring pressed open and is normally held closed by a detent which can be released by an electro magnet.

813,154. AUTOMATIC SWITCH FOR ELECTRIC RAILWAYS; Victor Joksch, of Karlin-prague, and Josef Petrik, Prague, Austria-Hungary. App. filed May 26, 1905. A special conductor is hung adjacent the usual trolley wire at the switch point. A special contact brush is also spring supported upon the harp to contact with said special conductor. When the switch point is to be thrown a special circuit is completed through said brush and conductor.

813,161. SELF-WINDING ELECTRIC CLOCK; Max Menkin, New York, N. Y. App. filed Mar. 30, 1904. The power magnet has curved pole faces which exert a force to rotate an armature with poles concentric thereto. The magnet is periodically energized to wind up the main spring.

813,184. RELAY; Angel Vera and Luis G. Vera, Queretaro, Mexico. App. filed Nov. 26, 1904. A telegraph relay designed to suit varying line conditions without adjustment. For this purpose it has two opposed magnets, one slow acting, with a complete magnetic circuit and fine wire, and the other quick acting with coarse wire and in an interrupted magnetic circuit.


813,184.—Relay.

813,201. SPEED CONTROLLING SYSTEM; Adolph L. DeLeeuw, Hamilton, Ohio. App. filed Aug. 7, 1905. A control system for electrically driven machine tools having a slow cutting and a quick return stroke. The controller is specially connected to the mechanical parts so as to give a high speed return.

813,230. SERVICE METER FOR TELEPHONE EXCHANGES; Frank R. McBerty, Evanston, and Edward B. Craft, Chicago, Ill. App. filed June 10, 1905. A service meter comprising a tilting lever, electro-magnetic mechanism for moving said lever in either direction, a switch controlling the circuit connections of said mechanism, a catch adapted to lock said switch in its actuated position, and a registering train operating the movement of said lever in one direction, said lever being adapted in such movement to operate said catch to release the switch, said lever when moved in the opposite direction releasing said switch without effecting a registration.

813,262. AUTOMATIC STARTING DEVICE; Herbert A. Warden, Frederick Manns and William H. Decker, Newburgh, N. Y. App. filed June 30, 1904. The motor is belted to a lead screw, the nut of which is joined to the starter arm so as to gradually move the same over. The nut is arranged to slide idly back after the completion of its movement.

813,269. GALVANOMETER; Philip R. Wynne, Boston, Mass. App. filed July 14, 1905. Details of a galvanometer having a vertical permanent magnet with a coil suspended between its poles, the magnet being supported on non-magnetic stilts so as to be held away from the base plate.

813,287. ELECTRIC TRACTION SYSTEM; James P. Gorman, Jr., New York, N. Y. App. filed Mar. 31, 1905. The cars have longitudinal conducting bands along their side walls and near the car roof which contact with fixed conductor plates on poles along the roadway.

813,297. ELECTRICAL SAFETY DEVICE; Elwood B. Hosmer and William N. Dietrich, Montreal, Canada. App. filed June 30, 1902. A cut-out switch having an arm spring impelled to open position but normally restrained by a detent. The detent is released by the movement of a polarized relay in a branch circuit.

813,330. TELEPHONE SYSTEM; Ralph Sherer, Eaton, O. App. filed Oct. 17, 1904. A selective telephone system comprising talking and ringing circuits, a plurality of movable bars having contact plates arranged in the talking circuit, a plurality of electro-magnets arranged in the ringing circuit, pawls actuated by said magnets adapted to lift the bars step by step, and means for cutting out the electro-magnet at the calling station.

813,353. INSULATOR; Huntington B. Crouse, Syracuse, N. Y. App. filed Apr. 18, 1904. A container for a fuse plug comprising an insulating cup having a recess on one side to receive the usual metallic fixtures which support the threaded shell for the fuse plug.

12,453. ELECTRIC METER; a watthour meter is provided with an upper inverted end-thrust bearing, and with a magnetic suspension device for supporting the rotating element of the meter. The end-thrust bearing serves to aline the shaft at the upper end and to prevent lateral deflection thereof mechanically.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the Electrical World 16,500 *copies are printed. The total circulation of the* Electrical World and Engineer *for the year* 1905 *was* 712,500 *copies, an average of* 13,702 *copies per issue.*

NEW YORK, SATURDAY, MARCH 10, 1906.

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ELECTRICAL EXPORT TRADE.

The electrical export trade is holding up remarkably well, and the figures of last year are more than made good by those of January. It appears that the export of electrical instruments, for the month, including telegraphs and telephones, was $529,253, as compared with $387,610 last year, and that the total for the seven months was $3,519,566 as compared with $2,692,460. A gain of nearly a million in the period is decidedly encouraging. The export of electrical machinery was also excellent, being $799,939 as compared with $564,999; while for the seven months' period, it was $4,385,366 as compared with $4,032,116. The gain in this instance is only $350,000, but that is not bad in view of the large business done last year, running far ahead of 1904, when the total of machinery for the seven months was but $2,802,251.

The exports were well distributed, but it is interesting to note that Japan is taking much less than she did during the strenuous times of war in 1905, her requirements of electrical machinery from us having fallen off from $613,900 in the seven months of last year to $390,133; while in January she took only $39,046. The Philippine business also declined, over the seven months, from $152,159 to $62,934, but British Africa doubled up on $74,529, France exhibiting an even greater gain. All told, there is a cheerful indication of permanent and growing demand about these figures.

THE ART OF TELHARMONY.

In recording the history of electrical development throughout the world, this journal often enough has had occasion to describe interesting and important improvements in details of existing art. But it is not often our privilege to announce the birth of a new electrical art. Such an event we to-day bring to public attention in describing on another page the Cahill telharmonic system. It is rare indeed that a great original invention waits for technical presentation until it is ready for immediate commercial application. Such has been the desire of Dr. Thaddeus Cahill, the inventor, who has given to us a realization of one of the most fascinating among Bellamy's dreams in "Looking Backward." Beautiful music is to-day being produced in a dingy shop in Holyoke, Mass., from a group of alternating-current dynamos—directly produced from the dynamos, without intervention of tinkling cymbal or of sounding brass, or of twanging string. And the music may be heard whenever a wire can be stretched. The telephone may be said to have been delivered of its first-born, for it is through a telephone that this music is hereafter to be heard—but in tones loud enough to fill the greatest auditoriums. A new field is also opened to the composer, who may deal with the familiar qualities of sound and with others never heard before. A new field likewise is opened to the performer, who may interpret with a delicacy of control never possible heretofore on any known instrument.

Future Paderewskis sitting in New York may be heard in ten thousand places miles apart and in each place the original effect is heard. In each place music is produced not reproduced. Hence a new field is open to the inventor, able to provide the means by which one artist or one orchestral group is multiplied into ten thousand. Happily the necessary limitations of manufacture will prevent any serious hardship to the professional musicians of to-day, in the introduction of the new system. They will have time to adjust themselves to the new conditions which, it seems, must dominate many branches of their art in the future. Nor will the manufacturers of our familiar instruments be injured at once—though they must obviously take immediate account of the Cahill telharmonium. No matter how much we may industrialize and commercialize any product, there will, of course, always be a demand for the original, individual, separate and exclusive work of an artist.

Its first appearance in New York three months hence, of this invention, will be as a central station instrument of imposing size. The business plan is that the music shall be sold first to hotels, restaurants, theatres, concert halls, department stores, and to such private persons as are able to command any novelty. It will probably not be difficult to place with such selected customers all of the four or five thousand outlets which the present machine can supply. But the invention lends itself also to the establishment of "isolated plants." It will soon be known in private use —a small instrument of piano size giving various sound qualities and played upon by the individual home musician. The metropolis of work-a-day America will thus witness the triumph of an American inventor who, if what we have set forth is true, has done more for the art of music than has been done by any other separate invention since the time of Pythagoras. That such a revolution should be worked by electricity was to be expected. It is a pleasure to us to name a new man—Cahill—and a new thing—"Telharmony"—as among the notable achievements of our modern day. Another great electrical industry has been created. Let us hope that those who control it will make moderate use of their patent privilege, leaving to the public a large part of the benefit due to an enormous decrease in the cost of one of civilization's necessities.

The Benefit of Cheap Power to a Town.

The account given elsewhere of the Janesville, Wis., central station contains much that is suggestive to those operating plants under somewhat similar local conditions. One deduction is the benefit of a day power circuit to the growth of a small town. To be sure, no central station company is going to start a day power circuit purely to benefit a town without some adequate return, but once such a service is started, the company should not fail to bring the importance of the power service prominently before the people as a factor in influencing the location of small industries in the town. This in itself has an indirect advertising value as it gets the owners of industries already in the city in the way of thinking that electric power is the proper thing. Many small factories were influenced to locate in Janesville by reason of the cheap and reliable power supply offered by the central station, which carries the greater part of its load by water power. Mr. Korst does not consider, however, that residence lighting should be given a secondary place, since this service takes current during the day and on Sundays and holidays, when the station load is low. Not a few central station men are coming to consider that the residence lighting load also is to be compared favorably with that obtained from the business districts for the reason that it continues through the evening and gives an all-around better load curve than store lighting in a town where stores close every evening promptly at six o'clock.

Rate Regulation Lessons.

In another column mention is made of the progress of the investigation of electric light rates in Chicago, and of the voluntary offer of the Chicago companies to reduce maximum rates. As in the case of the New York Telephone Company last year, the movement to regulate the rates was thus met in a spirit far different from that so often displayed by public service attorneys in handling such situations—that of standing on legal rights and fighting, incidentally to the great profit of said attorneys. The Chicago companies bowed to the claim of the moral right of the community to have a voice in fixing public service rates, and virtually waived any legal rights upon which they might have stood. Their position in offering to open their books to the investigation of the Council committee and to reduce rates not only has won warm favor from the public and the press, but naturally has constrained those dealing with it in the present proceedings to adopt a reasonable attitude. The intention of the Iowa Electrical Association to have the question of rate legislation in all its aspects discussed at sessions open to the public is another move in the right direction. The attitude of public service corporations in approaching these questions should be a willingness to bring out the facts and to co-operate in working out the best possible solution. They will by so doing fare much better in the long run than by assuming an uncompromising attitude at the start, and thereby arouse hostile sentiment.

The action of the Chicago companies in voluntarily reducing maximum rates and abolishing last year the minimum bill of $1 per month raises an interesting question in equitable rate making. There is little doubt that the short-hour users who pay the maximum rate and the small users who pay minimum bills many months in a year are unprofitable customers. Any movement to reduce maximum rates or abolish minimum bills is sure to be popular because it affects so many customers. It is equally sure to be inequitable because it makes the profitable class of customers pay the losses on the business of the small and the short-hour consumers. A company may figure that for the sake of popular approval it can do a small percentage of its business at a loss, but it is certainly contrary to all our modern theories of so adjusting rates that each consumer shall bear his true share of the whole expense.

Calculation of Dynamo Sparking Constants.

We publish, on page 525 of this number, an article on this subject by Mr. A. Press. It forms in one sense a sequel to an article by the same author on page 1027 of the preceding volume (December 16, 1905). Some of the formulas in the earlier article have undergone a considerable modification in this new article, but this change is to be welcomed if it comes from a careful comparison of a large number of dynamos in known practical operation. The theory of sparking at commutators is, in one form or another, as old as the practice of building direct-current dynamos. A number of empirical formulas have been offered by engineers, at different stages of the dynamo development. The literature of the subject is bulky to the verge of tediousness. The full theory of the seemingly simple phenomena of commutation is admittedly so complex, that it is probably hopeless to seek a formula that will deal with the matter from a strictly physical standpoint. All we can hope for, at present, is an empirical theory based upon the fundamental principles of what would support a full scientific theory, but checked by experience on a large number of actual commutators in daily use.

The empirical formulas offered by Mr. Press are apparently not difficult to apply. It would be, however, very desirable to have a table furnished which would show the actual values of the critical quantities considered in a large number of recognized machines, in such a manner that the tabulated value could be checked by each engineer from his own experience, and the results of the empirical formula compared. It is only in such a way that general confidence in a new empirical formula can speedily be secured. Our engineering formulas used in the construction of dynamo machines are mostly capable of considerable precision, and have shown themselves in practice to be reliable. Our empirical formulas relating to the sparking limitations of commutators are not in so satisfactory a condition. There is still discussion and difference of opinion over them. Consequently, it is a matter of considerable importance that any new empirical spark limit formula should be thoroughly tested and elucidated by numerous examples.

INAUGURAL ADDRESS OF THE PRESIDENT OF THE BRITISH INSTITUTE OF ELECTRICAL ENGINEERS.

The inaugural address of Mr. John Gavey to the British Institution of Electrical Engineers covers a wide field in telegraphy and telephony, subjects with which, as head of the electrical engineering department of the British Post Office, he is entirely familiar. The address contains a collection of interesting and valuable statistics. From this standpoint alone, it is one of the most noteworthy recent additions to electrical engineering literature in the telegraphic and telephonic departments. The growth of telegraphy in the United Kingdom, judged by the number of telegraph instruments installed, appears to have been fairly steady at about 6 per cent per year for the last 25 years. On the other hand, the growth of telephony in the hands of the Post Office has been at a much more rapid rate, so that at the present time the growth in line conductors is nearly all on telephonic account. Some brief world statistics or estimates are offered of the development of telegraphy and telephony in all civilized countries up to the year 1902. They indicate that there were then over 3½ millions of miles of telegraph wire, and nearly 7½ millions of miles of telephone wire in use. If we allow two miles of wire to the mile of telephone circuit, or assume metallic circuits for all telephony, this would mean that the total length of telegraph and telephone circuits in the world were about the same for the date referred to, and either would more than girdle the sun. The total number of telephone instruments connected was about 3½ millions, or nearly one per mile of circuit; while the number of telegraph instruments installed was about ¼ million, or about one to fourteen miles of telegraph circuit. At the present time, the rate of telephonic increase is far greater than the rate of telegraphic increase.

The tendency in Great Britain at the present time is in the direction of placing the telegraph trunk lines across country underground, and leaving the telephone wires overhead. A main underground cable of telegraph wires from London to Glasgow is shortly to be completed, and a speed of 200 words per minute, through one repeater, is expected. This is a distinct achievement, rendered possible only by the substitution of paper and air for gutta-percha, as an insulator. A complete trunk system of underground conductors is expensive, but it forms a valuable national asset, since it places internal telegraph communication beyond the ordinary reach of climatic disturbances. This movement towards sheltering the telegraph trunk lines in the lap of mother earth is one on which the government of Great Britain is to be congratulated, as securing an important link in international communication, so essential to the development of general civilization. Full and courteous acknowledgment is given in this broad-gauged paper to American methods in one direction and to British manufacturing enterprise in another.

COMMUTATION IN SINGLE-PHASE MOTORS.

The greatest difficulty which has been encountered in the design of alternating-current motors of the commutator type has resided in the unavoidable e.m.f. produced at the coil under the brush due to the variation in the field magnetism. To the existence of this e.m.f. can be attributed the lack of progress in the development of this type of motor previous to the last few years. Although numerous schemes have been devised for compensating for this e.m.f. when the armature is in motion, no method has as yet been proposed by which it can be neutralized when the armature is stationary, on account of the fact that both the flux which causes the e.m.f. and the coil in which the e.m.f. is generated, are necessary for the successful operation of the motor. It follows, therefore, that while many forms of this type of motor commutate satisfactorily near synchronism, or under speed conditions, all forms of alternating-current commutator motors are equally disadvantageous with reference to the e.m.f. to be short-circuited by the brush at starting.

Of the many methods which have been proposed for minimizing the effect of the short-circuited e.m.f. in the coil under commutation, those which involve the use of resistances in series with the coil seem to have been most successful. Both the short-circuit current and the main motor current must pass simultaneously through these resistances as they are ordinarily inserted in the coil circuit. As far as concerns commutation, it is desirable that the value of these resistances be as large as possible, while the loss of power due to the passage of the main motor current through them dictates that the value be kept quite small. Even on the score of efficiency alone an extremely small resistance would result in an enormous loss due solely to the short-circuit current, so that there exists a definite value which produces the best general efficiency of the motor or the most nearly perfect performance of the machine. On page 522 of the present issue is given an interesting discussion by Mr. Marius Latour of the commutation of single-phase motors as affected by the loss of power at the contact between the brush and the segments. The complete solution of the problem is quite difficult, but the author has rendered the task relatively simple by treating the commutation by three different methods, each of which is incomplete in itself, and then finding certain relations which exist between the individual results, the combination of which affords an adequate view of the complete solution. The assumption is made that the heat produced at the brush should be a minimum, and three criteria are employed, namely, the average quantity of heat produced per second and per square centimeter under the brush; the average quantity of heat produced per second and per square centimeter at the edge of the brush, and the voltage between the brush and bar at the moment when the brush leaves the bar. The author shows that with a brush of a certain width it is advantageous to cover as many commutator segments as possible, but that for practical purposes two or three segments are sufficient. Although the expressions for determining the conditions which render the heating at the brush a minimum are complicated, for any certain design of motor the major portion of the expression becomes a constant and the solution of the resultant equations is quite simple.

A. I. E. E. Election.

The Philadelphia branch of the American Institute of Electrical Engineers has mailed a postal card to all members of the Institute repudiating a circular (of which note was made in these columns following its issue), dated February 10 and sent out with a nomination ticket headed by Dr Sheldon, which ticket purported to have the sanction of the Philadelphia members. The postal card states that no such committee as referred to in the circular was appointed and that the circular was entirely unauthorized. The circular, moreover, bore an address in Philadelphia which does not exist. This official communication, though dated February 20, is post-marked March 1, and thus did not reach members until too late to counteract the effect of the bogus circular at which it was directed.

Development of Southern Water Power.

At no time has more attention been directed to the development of Southern water power than the present, and several large schemes are being carried out. Stone & Webster, of Boston, have recently arranged for the purchase of the Columbus Power Company, the Coweta Power Company and the Chattahoochee Falls Company. The purchase of these companies, together with some additional lands known as the Standing Boy Creek properties, gives control of all water power property practicable for development on the Chattahoochee River between Columbus, Ga., and a small completed development just below West Point, situated about thirty miles above Columbus. It is estimated that 75,000 hp can be developed within a distance of 15 or 20 miles of the city of Columbus.

The properties acquired will be merged in a new company to be called the Columbus Power Company. The capitalization will include $4,000,000 of 30-year 5 per cent gold bonds, of which $1,375,000 will be sold forthwith, $1,650,000 will be certified on the execution of the mortgage, and $275,000 will be held in the treasury. The bonds are guaranteed by the Columbus Electric Company and are callable at 110 and interest. The sinking fund is to be 1 per cent per annum, of bonds issued, the first payment to be due in 1912. The preferred stock authorized is $350,000, to be fully issued, and redeemable at 103; preferred as to dividends and in case of liquidation. The common stock is $1,500,000, which will also be fully issued.

The first step in the development of this water power property will be the construction of a 3,000-hp steam plant to supplement the existing hydraulic plant of the present Columbus Power Company. This will increase the generator capacity to 11,000 hp. Additional hydraulic development will be made from time to time as may be necessary to meet the demands for power

All of the common stock of the new company, together with a portion of the preferred, will be held by the Columbus Electric Company, a Stone & Webster property, which owns all the securities of the Gas Light Company of Columbus, and practically all the securities of the Columbus Railroad Company These latter named sub-companies do the entire gas, electric light, electric railway and retail power business in the city of Columbus.

It is expected that the proposed development will greatly stimulate the growth of the city of Columbus and lead to the establishment of many new mills and manufacturing enterprises which are based more or less upon an abundant and steady supply of cheap power.

Limiting Public Service Corporate Stock.

Mr. H P. Nichols, who is in charge of the bureau of franchises of the New York Board of Estimate, has inserted in a recent franchise contract with a new company a clause prohibiting the issuance by it at any time of stock or bonds, without the consent of the board. In his report on the subject he speaks of overcapitalization as one of the crying evils of the day, and says: "This is frequently a capitalization of anticipated profits, and has a direct bearing upon the cost to the consumer of the product manufactured by the company so capitalized. If a company whose capitalization or whose funded debt is many times the value of its tangible property, and especially if the company has a monopoly of the business in which it is engaged, there is a temptation to that company to charge for its product an amount far beyond what would be sufficient to pay the cost of production plus a fair return upon an amount which would represent the actual value of the plant.

"There are railroad companies in the City of New York whose capital stock outstanding and whose funded debt each are equal to many times the value of the tangible property. Probably the same may be said of other public service corporations in the city.

"The city is, in a way, a partner in the business which requires the use of public property such as that conducted by railroad companies, gas companies, telephone companies or other enterprises requiring the use of public streets. These companies are supported by the revenue obtained from their patrons, while the city is, or should be, financially reimbursed for the occupation of public property. The occupation of the streets is absolutely necessary for these companies to carry on their business. On the other hand, it is to the city's interest that citizens be supplied with the conveniences or necessities which may be furnished by such companies at reasonable rates if the right is given for the streets to be occupied for that purpose.

"The authorities are, therefore, interested in the business to such an extent and any contract entered into between the city and the company applying for rights, should be such as will protect those citizens against a possibility of unfair charges, and if overcapitalization tends to develop such charges, then the contract should be sufficiently broad in its terms to prevent overcapitalization.

"Should public service corporations receiving rights from the city fail in the future to give the people adequate service and for that or other reasons the city government deems it necessary to take control of such property, it will be impossible to do so by a payment of a fair value of the property if such company is overcapitalized without, perhaps, doing an injury to innocent investors in stocks or bonds, which have been issued in excess of the value of the property."

The Iowa Electrical Association Programme.

President Austin Burt and other officers of the Iowa Electrical Association have prepared a programme for the next Iowa Electrical Association convention that appears to fully sustain the reputation of that association for getting up papers and discussions of great practical value to the central station men of that State. The convention will occupy two days, April 18 and 19, with the probability of an evening session on the first day. The second day will be largely given up to a thorough discussion of the rate legislation question, to which the public will be invited. The idea is to have as complete an airing of the subject as possible that public sentiment in the matter of rate regulation be guided in rational channels.

The programme for the meeting as announced by Secretary George S. Carson, of Iowa City, is as follows: Address of welcome. President's address. Reports of secretary, treasurer, Executive Committee and Finance Committee. Report on progress, by J. R. Cravath, of Chicago, western editor of the ELECTRICAL WORLD. Report of Committee of Facts and Factors, by D. F. McGee, Red Oak. "Central Station Publicity," by Frank B. Rae, Jr., of the C. W. Lee Company, Newark, N. J. "Economy of Mechanical Stokers and Ash Machinery in Small Stations," by C. F. Freehauf, of Cresco. "Economy of Condensing Plants in Small Stations," by W. A. Mall, of Belle Plain. "Effect of Boiler Compounds on Engine Lubrication," by L. W. Gill, of Manchester. "Line Losses and Economical Distributions," by J. A. Innes, of Eagle Grove. "Care and Maintenance of Meters," by A. W. Zahm, of Mason City, and H. G. Gorr, of Dubuque. "Some Practical Experience with Steam Turbines," by C. E. Stanton, of Dubuque, and Niels Christensen, of Waterloo. "Experiences with Grounded Secondaries," by H. G. Gorr, of

Dubuque: Thomas Sloss, of Cedar Rapids, and W. P. Cosper, of the Garton-Daniels Company. "Effect of Day Load on Station Economy," by J. P. Jones, of Cedar Falls; T. H. Richardson, of Boone; W. J. Greene, of Cedar Rapids, and J. Walsh, of Davenport. "Ways and Means of Increasing Business in Towns under 5,000," by W. S. Mead, of Parkersburg; O. E. Brownell, of Lake City; Joseph Hutchinson, of Manchester, and Thomas Ferris, of Osage.

The discussion pertaining to rate legislation includes the following: "Depreciation of Electric Properties," by Prof. G. W. Bissell, of Iowa State College, Ames. "Unreasonable and Unrestrained Rate Agitation," by L. Y. Sherman, Lieut.-Governor of Illinois. "Equitable Rates," by George McLean, of Dubuque. "Legal Status of Rate Regulation," by Mr. Hurd, of Dubuque. "Political Status of Rate Regulation," by Hon. M. J. Wade, of Iowa City.

Convention headquarters will be at the Kirkwood Hotel. Supply houses are invited to make exhibits and have representatives in attendance. The Iowa Street & Interurban Railway Association will hold its convention April 19 and 20, thus synchronizing with the other society.

The German Submarine Cable Network.

A very interesting review is presented by U. S. Consul Liefield, of Freiburg, Germany, on the development of the German submarine cable system. He calls attention to the significant fact that the new cable from Yap, in the Caroline group, to Shanghai, furnishes the final link in the first non-British cable to encircle the globe. He gives also the following data:

The year 1905 has been for the German cable industry a very significant one, for it not only gave to Germany a great many new cables, but the advantages and advancements made in sea cable technic can be said to have been in every respect first-class. It is claimed that the rapidity and precision with which the newest German cable from Shanghai to Yap, in the Caroline Islands, was laid, which had been finished and ready for use on November 1, are unexcelled.

The number of German cables which have a length of over 62 miles has been increased through this new cable to thirteen and are as follows: Emden-Borkum-Lowestoft (England) (1871), 261.5 miles; Hoyer-Westerland-Arendal (Norway) (1879), 293.3; Emden-Valentia (Ireland) (1882), 984.8; Emden-Borkum-Vigo (Spain) (1894-96), 1,304.2; Sassnitz-Trelleborg (Sweden) (1898), 72.7; Emden-Borkum-Horta (Azores) New York (1900), 4,790.1; Tjintau-Tschifu (China) (1900), 283.9; Tsintau-Shanghai (China) (1900), 436.2; Emden-Borkum-Bacton (England) (1901), 288.9; Emden-Borkum-Horta (Azores) New York (1903), 4,911.9; Konstanza (Roumania) Constantinople (1905), 213.1; Menado (Celebes) Yap (Caroline) Guam (Ladrones) (1905), 2,018.8; Shanghai-Yap (Caroline) (1905), 2,229.4.

Of these the Emden-Valentia and Emden-Borkum-Horta belong in common to Germany and England; Sassnitz-Trelleborg in common to Germany and Sweden, Emden-Borkum-Vigo and Emden-Borkum-Horta to the German Atlantic Company; Konstanza, to the East European Company; Menado-Yap and Shanghai-Yap to the German-Netherlands Company, and only the remainder can be considered as the sole property of the German Empire. The Emden-Valentia was formerly the only telegraphic communication with America, but ceased to be used when the real German Atlantic cables, Emden-Borkum-Horta and Tjintau-Tschifu, were completed. Besides these large ocean cables there are a great number of shorter ones which are partly in use between the various German seaports, and between Germany and neighboring countries. For example, there is a cable 51.57 miles long from Arkona to Trelleborg, Sweden, which has been in use since 1865, and besides these there are three African cables which have been rented from the owners, the different English cable companies. These are as follows: East Africa, Sansibar-Bagamoya-Dar-es-Salaam, 84.5 miles; Southwest Africa, Swakopmund-Mossamedes, 152.8 miles; Kameron, Boony-Duala of 209.4 miles. Of these, the first two belong to the Eastern and South African Telegraph Company, and the last to the African Direct Telegraph Company.

Altogether Germany has over 18,816 miles of cables, of which, however, only about 3,293 miles are owned by the Government. The total cable length of the earth is between 273,402 and 279,616 miles, from which will be seen that Germany's percentage is, notwithstanding all the progress which had been made in the last year in that direction, very modest. Really, only about one-fifteenth of the total cable length is German, while England has more than two-thirds. Not more than two years ago, however, Germany's part was no more than one-twentieth, so it is evident that since that time Germany has made great strides forward.

From Europe to east Asia and to the Chinese coast there are the land telegraphs and sea cables of the Danish Great Norse Telegraph Company. The Atlantic Ocean is traversed not only by the English telegraph lines but also by the American, French, and German cables. These are, through the various service lines of the United States, combined with the western coast of America, and from San Francisco the American Pacific cable extends via Guam to the Philippines. In Guam, however, the German-Netherlands cable system branches off to Yap, from which place the new cable has made a new bond of union with the German and Danish lines on the Chinese coast. The cable Shanghai-Yap assures to Germany henceforth a telegraphic union with the Ladrone and Caroline islands independent of English influence, and these islands are German colonial possessions, besides also the union with the Great Sunda Islands and the important Dutch colonial possessions in Farther India, which are so important also for the German commerce.

The Shanghai-Yap cable line has been laid in greater sea depths than any other cable. Up to a few years ago there was no cable in a greater ocean depth than 16,404 ft. The American cable in the Pacific Ocean was in 1903 laid in depths to 20,469 ft. The cable Menado-Yap-Guam, which was laid in the year 1905 by the German cable steamer *Stephan*, surpassed this record, inasmuch as it was obliged to lay the cable in depths of 22,966 ft., and to lay the cable Shanghai-Yap, which work was also the task of the cable steamer *Stephan*, it was even necessary in the vicinity of Liukiu Islands to reach depths of 26,246.96 ft., which is one of the deepest places to be found anywhere in the oceans. The cable was manufactured in Germany by the North German Sea-Cable Works in Nordenham at the mouth of the Weser.

Discussion on the Single-Phase Motor in Central Station Work.

A meeting of the Chicago branch of the American Institute of Electrical Engineers was held February 27, at which Mr. W. A. Layman, general manager of the Wagner Electric Manufacturing Company, of St. Louis, read a paper on the "Present Status of the Single-phase Motor in Central Station Work." Mr. Layman classified commercial single-phase motors under three general heads: The commutator type, the synchronous motor and the modified polyphase induction motor. He then reviewed the principal patents having a bearing on the motors made by the Wagner Electric Manufacturing Company to-day. The first patent mentioned was issued to W. A. Anthony, D. C. Jackson and H. J. Ryan, September 11, 1888. It shows a commutator type repulsion motor in which the field coils of the motor are connected to the single-phase supply line and the armature circuit is closed through a resistance connected between the brushes. The next patents mentioned were granted to Prof. Elihu Thomson in 1889 and 1890. In these were shown an armature open-circuited at the start and short-circuited like an induction motor when up to speed. This type was stated to have never proved successful in practice. It remained, the author said, for Prof. E. Arnold, a German engineer, to make the final practical combination which is used in the Wagner constant-speed motors of to-day.

The Arnold patents referred to as covering the present Wagner construction were issued August 6, 1895, and June 23, 1896. They show a motor started as a repulsion motor with short-circuited brushes bearing on a commutator. After the motor is up to speed the brushes are lifted off the commutator and the armature winding is short-circuited automatically. He mentioned also a patent issued to Ludwig Gutmann in 1894 showing a motor having its fields excited by a single-phase alternating current and a ring armature cross-connected at various points. He then briefly referred to the split-phase motor patents of Tesla. He spoke briefly of the contest waged in the early nineties between the General Electric, Ft. Wayne and Wagner companies over a single-phase motor which operated practically like a self-excited rotary converter started from the alternating-current end. This type of motor was abandoned on account of the excessive voltage disturbance it created on single-phase lighting feeders while being started. He then gave circuits of the elevator motor now being made by the Wagner company, which is the design of Leo Schueler, a German engineer.

This motor was designed for frequent stopping and starting in elevator or crane service without excessive line disturbance. The field coils of this motor are star connected, only two legs of the circuits being in use at once. A two-point switch (by means of which either one of two legs of the star connected field coils may be joined to the supply line) is used for reversing the motor. The motor armature is provided with a commutator upon which brushes bear during starting. Between these brushes is a resistance which is permanently adjusted at the time the motor is installed. The motor also has collector rings through which current is taken off at three points from the armature windings. Between the collector ring brushes, are placed resistances which are varied by the lever of the elevator controller. This motor when operated as a purely repulsion motor would give about 60 per cent of its full-load capacity; hence the advantage of operating it as an induction motor when up to speed. He said the manufacturers of this new motor had made no great effort to introduce it during the 18 months it had been on the market, but had placed a number on trial in different parts of the country to determine its performance, which has been all that was expected. He also referred to the fact that series commutator types of single-phase motors are being developed by both the General Electric and the Westinghouse companies for railway work, and also for the operation of elevators and cranes from single-phase, 60-cycle central station circuits.

In response to a question from Chairman Miller as to the present commercial status of the split-phase motors in which condensers are used to give a rotating field with single-phase supply, Mr. Layman said that the size of condenser needed was so great that the cost was excessive, being about 50 per cent of the price of the motor. His company at one time attempted to use condensers in parallel with its single-phase induction motors in order to compensate for the lagging current and bring the power factor of the equipment to unity. Condensers were found to be more trouble and expense than they were worth.

Mr. J. R. Cravath said that the single-phase motor situation was at present one of great interest to a large class of small central station men who were considering enlarging their motor business and who already had single-phase lighting distribution systems. It is also of considerable interest to companies operating polyphase distribution systems, because with single-phase motors as now developed it is not necessary to extend polyphase distribution into single-phase territory to handle motor load except where large motors are needed. The development of single-phase motors for elevator and crane work will put a central station in a position to use single-phase circuits for any class of work done by direct-current motors with the exception that had been noted by Mr. Layman, namely, the operation of variable-speed motors at different constant speeds, as in machine-tool driving. He asked for an expression of opinion as to whether it was advisable for a small company operating a single phase lighting and power system when enlarging its plant to purchase three-phase generators with a view to the use of three-phase motors for larger motor work, or whether it would be better to adhere to a strictly single-phase system throughout.

Mr. H. B. Gear spoke very favorably of the performance of the Wagner motor on the Commonwealth Electric Company's lines in Chicago. This company has polyphase distribution with single-phase branches. All motors of 5 hp and under are single-phase Wagner machines, as the company cannot afford to run three-phase circuits and install the necessary transformers for three-phase motors of less than 5 hp. He thought, perhaps, Mr. Layman had not emphasized sufficiently one good feature of the Wagner motor, which was that it will automatically and safely start itself after any momentary interruption of the circuit. This is not true of either direct-current or polyphase motors. He thought, perhaps, the Schueler elevator motor described by Mr. Layman would be found to disturb the voltage on the majority of single-phase lighting circuits too much. The disturbances caused by starting constantly running motors on a single-phase lighting circuit come only at infrequent intervals and those often in the day time.

A 10-hp Wagner motor used for elevator work, however, must be on a large feeder close to the station if it is not to disturb the lighting service, as it is started many times a day, and its use continues through the evening when good voltage regulation is most essential for the lighting service. The dividing line between three-phase and single-phase motors in Chicago in the past had been placed at 5 hp, mainly on account of the objection of the customers to the extra price charged for the single-phase motor as compared to the three-phase. When the motor was as small as 5 hp, the company had to draw the line because of the transformer and line expenses. As a matter of fact it would be cheaper for the company to insist on the single-phase motors as high as 10 or 15 hp. In answer to Mr. Cravath's question as to the use of single-phase or three-phase generators in enlarging a small single-phase plant, he thought that if a company contemplated operating motors as high as 50 hp with a plant capacity of, say, 300 or 400 kw, the generating station should be three-phase. The starting current of large motors would then be divided between three phases so that the disturbance of lines would be less. In small plants where the largest motors would be of 15 hp, it might be better to adhere to the single-phase system entirely.

Mr. Layman, taking up this same question, advocated the use of three-phase generators, even though much of the distribution was single-phase. The three-phase generator can be purchased at about 25 per cent less per total kw of capacity, so that it is about as cheap as a straight single-phase generator even if only one phase is loaded, while there is always the opportunity of operating polyphase distribution from it. He thought the four-wire, three-phase system used by the Commonwealth Electric Company in Chicago to be the best one yet worked out for large companies. At Newark, N. J., three-phase generators are used, although the distribution is almost entirely single-phase. In answer to a question as to why larger single-phase motors are not built, Mr Layman replied that the principal reason is that there has not been sufficient demand for them. He pointed out the fact that it is not safe for a central-station company to offer its customers a choice of several kinds of motor, because the customer will always choose the cheapest motor without regard to its bearing on the central station's distribution system. It is best for the central station company to adopt a definite policy as to the kind of motor to which it will connect, and adhere to it.

The Manila Telephone Plant.

Shipments of copper wire and cable were recently made from San Francisco to Manila, for the completion of the new telephone system now being established by the Philippine Telephone & Telegraph Company. The switchboards have been shipped and they will be installed by American electricians who have gone to Manila for that purpose. It is expected that the Manila system will be in complete operation by July 1. The company expects to extend its service from Manila to the densely populated districts of the islands.

CURRENT NEWS AND NOTES.

WEST VIRGINIA INDEPENDENT TELEPHONE INTERESTS.—One hundred managers and directors of independent telephone lines in West Virginia met February 22 and 23 in Parkersburg, W. Va., for the annual convention of the West Virginia Independent Telephone Association. J. W. Hoge, of Cleveland, made an address on "The Future of Independent Telephony."

MEN OF SCIENCE.—A very interesting quarto volume, "Men of Science," edited by Prof. J. McK. Cattell, of Columbia University, New York, has just been issued by the *Science Press*, of Garrison, N. Y. It is a biographical directory of American men of science, and in addition to giving the main facts in their technical or scientific career, gives a note as to the particular branch of study, investigation or original research in which they are interested. In many respects it is an extremely useful publication.

WARREN & JAMESTOWN SINGLE-PHASE RAILWAY.—In the description in our issue of February 17, of the Warren & Jamestown single-phase railway, the Warren terminal of the line was erroneously located in Ohio, instead of Pennsylvania. The lines run from Warren, Pa., in the oil and natural gas district, to Jamestown, N. Y., on the shore of Lake Chautauqua, and passes through Ackley, Russel and Glade, Pa., and Falconer, Frewsburg and Fentonville, N. Y. Stops are made at 53 stations along the line, the length of which is 22½ miles.

ELECTRICITY IN INDIA.—Reports from Bangalore, the "Jungle City," state that electrical transmission of power is being carried out on a large scale. The city is well lighted by electricity, current for which is supplied from the plant located on the Cauvery River, 40 miles distant. The same plant furnishes the motive power for the mills of the Kolar gold field, which has paid $5,000,000 in royalties to the State and $50,000,000 in dividends to the share holders. The Cauvery enterprise is characteristic of the spirit which is making Mysore the model state in India.

URANIUM ORE.—U. S. Consul Ledoux reports from Prague that uranium ore can now be secured from the Austrian government mines of Joachimsthal, Bohemia. For post parcels the cost is $3.32 per pound; in larger shipments, according to the assay, 50 per cent ore at $2.22, and 60 per cent ore at $2.66 per pound. The Austrian authorities inform Mr. Ledoux that the residue, pitchblende, is not available for sale. Consul Ledoux also advises that the historical Wolfram tin ore mines in northern Bohemia have been reopened by the Schönfeld-Schlaggenwalder-Wolfram-Zinnersgruben Gewerschaft.

NEW ORLEANS-ST. LOUIS WIRELESS.—On February 28 the new high-power long-distance wireless telegraph station at New Orleans was put in operation by President Abraham White, of the American DeForest Wireless Telegraph Company. Since that time messages have been exchanged between New Orleans and St. Louis nightly. As a matter of fact, the New Orleans station was erected for the purpose of communicating with ships in the Gulf of Mexico, and with stations on the Gulf, at Mobile, Southwest Pass, Galveston, Pensacola and Key West. At night time the station can also communicate with Havana, St. Louis and other inland points that have high-powered equipments.

GROWTH OF N. E. L. A.—Mr. W. C. L. Eglin, secretary of the National Electric Light Association, states that the interest in the convention at Atlantic City is unprecedented, for so early a date. A number of manufacturing companies have applied for membership in the Association for the express purpose of securing exhibition space, and many others have expressed their wish or intention to do so. The growth in the active and associate classes has also been notable, including some thirty central station companies, and two score individual members. Preparations of the most extensive character for the June convention are being made.

POWER DEVELOPMENT IN COLORADO.—According to reports, the engineers who have been employed to consider the latest Colorado power proposition have completed their work and their report is now in the hands of the New York capitalists who are promoting the project. The report, it is said, is favorable, and plans are under discussion for the organization of a company to build an electric power plant at Lafayette, Col., with an initial capacity of 10,000 hp. From this point the system would be extended to Cheyenne, Wyo., and possibly to Fort Russell, and in the other direction to the gold mines in the vicinity of Boulder and the Gilpin County mines and mills. The proposed system will cover an area in northern Colorado about 160 square miles in extent.

CONTROL OF RATES FOR PUBLIC SERVICE.—The Los Angeles, Cal., City Council, acting under the new public service law, has begun the work of regulating the charges for service to the public by the several corporations of the city operating public utilities. The maximum rate for gas to be charged in the city was fixed at 85 cents a thousand cubic feet. Eleven cents per kw-hour for electric light and 10 cents per kw-hour for electrical power was fixed as the maximum charge for that service. All of these rates are practically the same as those now being charged by the corporations operating these franchises, and there will probably be no contest in the matter. In the matter of regulating the charges of the two telephone companies doing business in the city, a committee was appointed to consider the subject. The two telephone companies maintain a different schedule of prices, and it is expected that opposition will be encountered in the fixing of their rates. All fixed rates will take effect July 1.

GAS IN GREAT BRITAIN.—Vice Consul-General Westacott, of London, sends interesting information on the gas business in Great Britain, as shown by the Gas World Year Book, just published. There are 1,252 gas plants in England, 259 in Scotland, 110 in Ireland, 135 in Australasia, 52 in Canada, 15 in other British possessions, and 15 British gas companies operating on the Continent and other parts of the world. All large Scottish towns own their gas works, which produce 83.8 per cent. of the total, while in England only 31.3 per cent is so made and in Ireland 44.9 per cent. The largest gas company, the London Gas Light & Coke Company, makes 22,000,000,000 cu. ft. of gas per year and charges 59 cents per 1,000, while some of the other 11 London companies charge a good deal less, notably the South Metropolitan Company, which charges 48 cents, and the Wandsworth Company, whose charge is 52 cents. Gas cooking stoves grow in favor, the number having increased 250,000 last year in the United Kingdom.

RATE QUESTION IN CHICAGO.—The result of the last meeting of the gas and electric light committee of the Chicago City Council with the representatives of the Commonwealth Electric Company and the Chicago Edison Company was an offer on the part of the companies to reduce their maximum rates from 16 cents per kw-hour to 14 cents per kw-hour during the next two years and to 12 cents per kw-hour for the three years following that. The companies have at all times shown a disposition to meet the city half way in the question of establishing equitable rates. They have offered to show their books to the committee or its representatives and have taken the position that the city has the right to regulate the maximum rate that shall be charged, but that it cannot go farther than that and require the same rate per kw-hour for all classes of service. City Electrician William Carroll and Bion J. Arnold, as consulting engineer, are to make a report later on the cost of supplying electric service at various points in the city.

A PROTEST AGAINST ACETYLENE.—A delegation of citizens from Grand Crossing, a suburban district of Chicago, headed by Alderman Hunt, appeared before a council committee in Chicago recently to protest against the establishment of an acetylene gas plant there, and asked that no ordinance be passed which would permit of the storage or manufacture of the dangerous material in the city.

TROLLEY FUNERAL CORTEGE.—Rev. Martin Van de Laar, a priest of South Chicago, Ill., was buried at that place a few days ago, the body being conducted to the cemetery on a trolley car, which was followed by 20 other cars full of mourners. Nearly 2,000 parishioners paid 5 cents each to ride on the trolley conveyances to give final honors by their presence to the departed humanitarian, and thereby they fulfilled his last expressed wish, as set forth in the will, that the obsequies over his body should be as simple as possible and should reduce expense on the part of the mourners to as small an amount as conditions would allow.

TELEPHONY IN JAPAN.—In his interesting articles on Japan, now being published by the Sunday edition of the New York *Sun*, the Hon. W. J. Bryan touches upon government ownership of public utilities in that country and incidentally upon the telegraph and telephone service. "Japan," he says, "has a telegraph system and a telephone system operated by the national Government. Telegrams are sent at the same rates to all parts of the empire, and the service is satisfactory. The telephone service is not so good, for, while it is all right as far as it goes, the system is not extended as rapidly as the demand requires. In Tokio, for instance, those who want to install telephones have to wait until some one discontinues his telephone or is willing to sell it, and a bonus is often demanded. If the local telephones were owned by the city and only the interurban lines managed by the Imperial Government, the service would respond more quickly to the needs of the community."

"SKIN-DEEP MEASURES."—Mr. J. M. Patterson, Commissioner of Public Works under Mayor Dunne, of Chicago, has resigned because he says that, as a socialist, he cannot approve the present "skin-deep measures" of municipal ownership. He says: "It was through a common belief in the cause of municipal ownership of municipal utilities that I first became acquainted with you, and in this letter of resignation I desire to express publicly just how my views on this subject have changed. They have not diminished. They have enlarged. I used to believe that many of the ills under which the nation suffers, and by which it is threatened, would be prevented or avoided by the general inauguration of public ownership of public utilities. But my experience in the Department of Public Works has convinced me that this policy would not be even one-fourth of the way sufficient." In Great Britain, he declares, where municipal trading has been highly and successfully developed, the problem of the unemployed is becoming of tremendous and sad intensity. In Germany, where government ownership of railroads has been inaugurated and municipal ownership of public utilities is paramount, the poor are growing poorer and the rich richer, with an acceleration hardly less than that "so evident in the United States."

INDIANA INDEPENDENT TELEPHONE.—At the second quarterly meeting of the Indiana Independent Telephone Association for the First District, held in Elkhart on February 27, the greater part of the session was given up to a discussion of a plan to restrain all independent companies from maintaining traffic arrangements with the Bell Telephone Company. It was maintained that there could be no middle ground or compromise between the two companies; that every telephone belongs to either one or the other; and it was suggested that any independent telephone company connecting with the Bell system should be treated as a Bell company and cut off from all connection with the Independent system. There was no one present to defend the action of a few small companies in this district, charged with maintaining traffic relations with the Bell company, and the following resolution was unanimously adopted: "That any telephone company in this district, having either direct or indirect traffic relations with the Central Union (Bell) Telephone Company, be cut off from all traffic relations with the Independent telephone companies of this district, providing such company refuses to sever its connection with the Bell company after receiving due notice to do so from the president and secretary of the district association."

FEATHER RIVER POWER.—Many years ago, as some of our readers will remember, the earliest Sprague power motors were employed in pumping operations on the Feather River, California, in order to get at gold in the river bed. The river is again to be attacked to deliver 300,000 hp over circuits 180 miles long, in the Sacramento Valley. It is the plan to construct a reservoir covering approximately 9,000 acres at the Big Meadows near the head waters of the Feather River. This reservoir will receive the drainage of over 600 square miles. From the reservoir the water will be conducted through a tunnel a mile and a half long into an adjoining valley, which will be converted into a smaller reservoir, from the outlet of which will be a drop of 2,000 ft., to the power house. After being used at this point the water will be again taken from the river a number of miles below at the famous Big Bend Tunnel, built over 20 years ago by Dr. R. V. Pierce, of Buffalo, and associates at an expense of $1,250,000, and here a second electric development will be made. This tunnel is 12,000 ft. long, 16 ft. high and 15 ft. wide at a point known as the Big Bend, where the Feather River, after running 13 miles around a mountain and falling 600 ft., goes back to within 12,000 ft. of the upper bed on the other side of the mountain. The purpose of the tunnel, as noted above, was to drain the 13 miles of river bed in order to extract the gold in the gravel, but after diverting the waters of the river its bed was found to be formed of boulders so huge that little progress could be made with the mining work, and the tunnel was abandoned. The work done at that time was illustrated in these pages.

ENGLISH TRAIN LIGHTING.—Note is made of the Leitner-Lucas system of train lighting in England, reference to which has already been made in these pages. The system has recently had a trial on the Great Western Railroad, and the officials appear to be impressed with the advantages. In the trial "the dynamos were sealed up entirely—that is, oil wells, brush and reversing gear. The automatic cut-outs were similarly placed under seal, as well as the storage battery, the sealing being done by the railway company in such a way that no replacements or repairs could be made, no oil added to the oil wells or any part of the machinery, and no water or acid added to the batteries. Mr. Leitner's claim was that he would, under those conditions, light the carriages designated during the time they would cover a distance exceeding the circumference of the earth at the equator, and during the most exacting period of the year, from October to the end of December. Any failure of light, however temporary, would have to be recorded, and the slightest repair, replacement or addition of oil, etc., would necessitate the breaking of the seals, which would either terminate the test or, in any case, be recorded. On Monday night, January 1, the distance had been exceeded, the two coaches used for the test, on arriving at Paddington from Cornwall, having covered 25,200 miles. The lights had not failed on any occasion, the illuminant being as bright on the last journey as on the first. During the twelve weeks in which the test has been operating the train has moved at varying speeds in either direction, reversing several hundreds of times; it has kept the battery of accumulators automatically charged, discontinuing when sufficiently charged. The lamps have been kept supplied with an electric current at a practically constant voltage, running or standing. The seals were taken off in the presence of a number of officials of the railway company, and several electrical engineers. It was found that though the dynamo had not had a drop of oil, nor the accumulators a drop of water or acid, they were in first-rate condition, and could have gone on for another month or more still under seal and supplied a good and sufficient light."

TELEPHONE TOLLS.—A bill providing for uniform telephone tolls of 5 cents a message at all pay stations in cities of 500,000 population in New York State, has been reported on favorably to the Assembly by its General Laws Committee.

TORONTO BRANCH, A. I. E. E., will hold a meeting on March 9, when it will consider the paper on "Self-Exciting Alternators," abstracted by Prof. Rosebrugh, and on March 23, when it will consider the subject of "Suburban Railways," presented by Mr. C. H. Wright.

TELEGRAPHONES FOR THE BLIND.—Dr. George M. Gould, of Philadelphia, proposes that the telegraphone shall be used for the better instruction of the blind, to the exclusion of Braille and all other forms of raised letters. Dr. Gould is a leading ophthalmologist. In a paper written for scientific study he discusses the telegraphone and pronounces it ideal for the instruction of those who can hear but cannot see.

CLEVELAND TROLLEYS.—Mayor Johnson, of Cleveland, is still agitating the subject of the sale to the city of the local trolleys and has recently expressed the opinion that if the city should buy the property at a capitalization of $12,000,000 it would pay for itself in eighteen years. The president of the Cleveland Railway Company holds that this is altogether erroneous. Mayor Johnson, on behalf of the city, has offered to lease the company's lines. No answer has been given to the offer.

POST STAMPING LETTERS.—United States Consul-General Guenther, of Frankfort, sends an item from German papers that a new stamping machine for letters has just been tested at the Berlin post office. The machine has been constructed by the Norwegian mechanic Krag. It is operated by electricity and works so fast that it is said to stamp 1,800 letters per minute, which would make 108,000 letters per hour. Similar machines of American design have long been in use in the United States.

NEW YORK CITY LIGHTING.—Note was made recently of the lower schedule of prices offered by the lighting companies in Greater New York for city lights. Mr. C. L. Lacombe, chief engineer of light and power in the Department of Water, Gas and Electricity, has made an analysis of the figures and shows that in spite of a large increase in the number of lamps the city bill for the illumination of streets, parks, public buildings, etc., will be less by $779,797. The total amount for 1906 under the new schedules is $2,954,236.

NEW SWISS SEARCHLIGHT.—United States Consul Keene reports from Geneva on a new searchlight recently tested at Caux, designed by E. Cuenod, showing objects clearly at 6½ miles, with diameter of projector 3.28 ft. "The great advantage of this searchlight is that it may be electrically handled in all directions by wire from a distance of 656 ft. from the motor car, which transports it and sends it to the required spot. It thus enables the driver and observer to send the rays to any place they desire without being blinded by the light, and places them under shelter from the enemy's fire. The new searchlight has already been submitted to certain high French officers, and will shortly be examined by the German general staff."

FRANKLIN IN FRANCE.—Ambassador McCormick and Premier Rouvier are planning a notable Franco-American celebration on the occasion of the unveiling of the statue of Benjamin Franklin on April 20 in Paris. Ex-Postmaster-General Charles Emory Smith, of Philadelphia, will be the chief speaker, and it is probable that ex-President Cleveland and ex-President Loubet will be asked respectively to head the American and French honorary committees. The statue of Benjamin Franklin referred to is a duplicate of that which stands in front of the Philadelphia Post Office. This replica will stand close to the site of the home occupied in Paris by Franklin. It is the gift of John H. Harjes, the American banker of Paris, to the municipality of that city. It is of bronze. The sculptor of the original is Mr. John J. Boyle, of New York.

IN THE BRITISH NAVY.—The First Lord of the Admiralty in connection with the estimates presented last week, stated that the question of firing guns by dynamo power had been definitely settled, and that wireless telegraphy had been extended in the navy.

PHILADELPHIA WATER.—Note was made last week of the complaints as to the bad condition of the New York municipal water supply and the accusation of $10,000,000 graft in it by the New York *World*. A telegram from Philadelphia as to the city supply there says: "The city is suffering as it never did before because of the intolerable water conditions. There are 2,300 cases of typhoid fever under treatment, all due, it is believed, to the fact that the great majority of the wards are supplied with water by pumpage from the Delaware and Schuylkill Rivers. To-day the water is simply filthy—so black and full of coal dust that the taking of a bath is out of the question. The mild weather has thawed the ground at the mines and dust has poured into the river, ultimately to be served to Philadelphia in the water used for drinking, cooking and the bathtub."

SERVICE TO THE PUBLIC.—Discussing the subject of large fortunes in the *Independent*, Mr. Thomas F. Ryan, who is so largely interested financially in enterprises based on franchises, says: "Fortunes which sometimes look excessive may be the result of rendering great services to the community. If a man by intense mental application or natural aptitude can introduce economies into railroad management, he is worthy of a large salary. The salary would not in any case absorb the entire saving made to the stockholders of the railroad and to the public by the reforms introduced. In some cases this claim of the inventor is compensated by the royalties paid under the patent law; and there are many services rendered in the matter of organization which are not patentable, but afford as striking benefits as patents. Take away the opportunity for winning either money or distinction by rendering such services, and few men, as human nature is constituted, would render them. It is right that competition between men should be brought within constantly narrower and narrower rules of justice. This is possible without taking away the initiative which makes men do things, and seems to me the direction in which, in spite of obstacles, humanity is tending."

TROLLEYS IN BROOKLYN.—The demands made upon capital for the development and improvement of lighting and trolley systems already in existence are not realized until a clear statement is made in regard to the subject. Thus Mr. E. W. Winter, president of the Brooklyn Rapid Transit Company, in an open letter to Borough President Coler, takes the opportunity to show how large and persistent have been the expenditures on the much-abused Brooklyn trolley system, and says: "It will perhaps be accepted even by you as some evidence of the sincerity of our purpose to improve transit conditions in Brooklyn that there has been expended to that end, within the three years last past, upward of $19,000,000, besides a much larger amount than ever before in the same period for maintenance and repairs, and that new work of construction and improvement, amounting to more than $8,000,000, is authorized for the present calendar year. The credit which has enabled this company to procure this very considerable sum of money has not been built up and sustained by decrying the conditions and institutions of Brooklyn. Much has been truthfully spoken against transit facilities in Brooklyn, and much has been said that truth could not justify. The evil effect of a habit of mischievous exaggeration which has befallen some of us when discussing this subject is reflected more or less on every legitimate business interest in the borough, while serving also to enhance the financial and physical difficulties inherent to the transit situation. Whether or not the Brooklyn Rapid Transit Company will be able steadily to proceed with the work which it has undertaken depends on the continuance of that confidence on the part of investors—not speculators—which it has succeeded in creating, and the measure of co-operation given it by the city government and the Brooklyn public, which, for its own interest, this company desires efficiently to serve."

STATE MILITARY ENGINEERING DEPARTMENT.—Under authority of an act passed by the last Legislature, a section of engineers is being recruited by the Indiana Military Department to represent civil, mechanical and electrical engineering.

VIRGINIA ELECTRIC LIGHT REGULATION.—A bill has been presented in the Virginia Legislature by Delegate Barrett, of Newport News, Va., empowering the Corporation Commission of Virginia to regulate the rates charged by water, gas and electric light companies throughout the State.

NEW YORK STATE STREET RAILWAY ASSOCIATION.—A special meeting of the Street Railway Association of the State of New York has been called to meet at Elmira, N. Y., March 29. The conference will be devoted to the reading of papers and discussion on topics pertaining to operation and management. These quarterly meetings are to be a regular feature of the association's work.

WATER PURIFICATION EXPERIMENTS.—Experiments are to be carried on under the direction of Prof. George D. Shepardson, of the University of Minnesota, at the Minneapolis City Water Works to determine the feasibility of treating the city water electrically. Prof. Shepardson says that some preliminary tests indicate that a comparatively small amount of electrical energy properly applied will kill most of the bacteria in the water.

NEWS BY TELEPHONE.—Gathering the news of central Iowa by telephone instead of by mail and telegraph is an innovation proposed by one of the large independent telephone companies of that part of the State. The plan includes the employment of a news gatherer at each point touched by the line, the duty of this employe being to gather and transmit to central points the news suitable for the daily papers of the State.

ONTARIO MUNICIPAL POWER COMMISSION REPORT.—The Ontario Municipal Power Commission will submit a plan for municipal electrical development enterprise, and if the recommendations are acted on promptly by the municipalities the work of construction will be commenced in the spring of 1907, and by the early part of 1910 electricity may be distributed throughout the various municipalities which become co-partners in the enterprise.

AN UNUSUAL MUNICIPAL OWNERSHIP PROPOSITION.—The City Council of Marion, Ind., is considering a proposition from the Diesel Engine Company, of Indianapolis, whereby the latter agrees to place machinery in the Marion city light plant and to furnish street lights for the city on a basis of 300 lamps at $55 a lamp a year, or 350 lamps at $47.50 a year each, the city to receive all income from the commercial lighting, and at the expiration of ten years the plant, valued at $100,000, to become the property of the city.

TAYLOR'S FALLS-MINNEAPOLIS TRANSMISSION.—Mr. Lee H. Parker, electrical engineer with Stone & Webster, lectured before the engineering students at the University of Minnesota on February 23 upon the development of water power at Taylor's Falls and its transmission to Minneapolis by the Columbia Improvement Company. The lecture was profusely illustrated with lantern slides showing views of the work at the water power in various stages of progress, plan and sections of power house, electric circuits, sub-stations, etc. The first installation of electric equipment will include four 3,000-kw, revolving-field, three-phase generators with transformers stepping from 2,300 to 50,000 volts at which pressure power will be carried 41 miles over a three-phase line consisting of 0000 copper, 19-strand cable on a 6-ft. center. At the outskirts of Minneapolis step-down transformers will reduce the pressure from 45,000 to 13,200 volts at which pressure the energy will be carried to the main station of the Minneapolis General Electric Company, where it is again reduced to 2,300 volts. The present pole line is nearly one side of a 60-ft. private right of way, leaving room for a second pole line to be erected when the installation is complete.

A HIGH BRIDGE.—It is stated that the famous Royal Gorge, near Canon City, Col., will be spanned by a bridge to be used in connection with an interurban electric railway system in Fremont County. The bridge will be 2,800 ft. above the hanging bridge of the Denver & Rio Grande Railroad at the bottom of the canon.

ANOTHER BIG CONTRACT LET.—The Southern Power Company has purchased another big order of electrical machinery which is to be used in the equipment of the transmission line from Great Falls up the river to the Catawba Power Plant, near Rock Hill, S. C. The contract for $50,000 worth of transformers, switchboards and other supplies has been let to the General Electric Company. This is in addition to the contract for $250,000 made some time ago with the Westinghouse Company for equipment to be used in the plant at Great Falls.

CHAIR OF ELECTRICAL ENGINEERING.—The council of Armstrong College, Newcastle, England, has decided to found a chair of electrical engineering in that institution. The policy of the authorities has been to make the college one of the foremost technical schools in the world, and it is realized that this worthy ambition could not be attained without paying attention to electricity. Moreover, Newcastle has become the center of a great development in its railways, shipyards, mines, etc., where facilities for study at first hand are presented on the spot, while some of the most important transmission enterprises in England have Newcastle as a focus.

OWNERSHIP AND FRANCHISES.—The American Academy of Political and Social Science, in its *Annals* for January, has devoted nearly the entire 258 pages to a treatment by various authorities and experts of the questions and data relative to "Municipal Ownership and Franchises." It is one of the most important and interesting monographs of the kind of recent publication and deals with results in London, New York, Glasgow, Chicago, Boston, Madrid, Baltimore, Philadelphia, etc., as well as such States as Missouri and Massachusetts. The writers are, in general, well-known men, and the arguments and facts presented are weighty. The part is issued at the price of one dollar, the society publishing its transactions every two months in this manner.

BROOKLYN MUNICIPAL TROLLEY.—In accordance with his declared intention, Borough President Coler, of Brooklyn, has prepared a bill for introduction in the Legislature this week to amend the charter so that the city may construct a municipal street railway in Brooklyn from the Bridge out to East New York, Jamaica, and points further east. Under the Coler bill the city would not necessarily operate the line. The tracks, stations and equipment would be constructed and furnished by the city and the Board of Estimate would have the power to lease the line to any existing road or to any new road for twenty-five years, with renewal privileges on revaluation. The bill provides that the construction of the road shall be under the direction of the Borough President. The Rapid Transit Commission is wholly ignored.

MUNICIPAL OWNERSHIP QUESTION AT LINTON, IND.—A proposition is before the City Council for the sale of the municipal electric lighting plant, which for the past six years has been owned by the city, and local sentiment is about equally divided as to whether municipal ownership in this case has proven a success or a failure. The plant is at present self-sustaining, but the rapid growth of the city has made it inadequate to the demands upon it. It is stated that about $18,000 must be expended in order to bring the plant up to present demands. The original price paid for the plant was $19,000, and the Indiana Electric Transmission Company now offers $15,000, the city to retain the ground upon which the buildings stand and which is quite valuable. The company, it is understood, further agrees to fix a rate as low as the present scale, to extend the service, move the plant to the edge of the city, furnish twenty-four-hour service, and to make this a central point for distribution of electricity for light and power to neighboring towns.

The Generating and Distributing of Music By Means of Alternators.

ONE of the most interesting applications of electricity which it has been our pleasure to record recently is found in the Cahill electric music-generating system, the general features of which are indicated in the accompanying illustrations.

Broadly considered, this music-generating system differs from previous systems of producing music in that it is purely electrical. Heretofore music has been produced by strings, reeds or pipes, which set the air in vibration. In some cases these vibrations of the air have been copied by a microphone and transmitted electrically to one or more telephones at a distance. But in all such systems of copying music electrically at a distance serious difficulties have developed. In the first place the vibrations of the air initiated by a violin, piano or organ are of but little power. A small fraction of this feeble power only is available to actuate the microphone. The microphone, as every one knows, has serious limitations. It magnifies feeble sounds, but is unable to magnify a loud sound. Further, the various transformations involved, first in changing the vibrations of the air into vibrations of the microphone diaphragm, then in producing from this diaphragm variations of the battery current; thirdly, in producing by induction from these variations in the primary corresponding vibrations in the secondary or line circuit, which (fourthly) in turn produce variations in the strength of the field of the receiving magnet at a distant point, which latter variations produce in their turn the vibrations of the receiving diaphragm and of the air—these many transformations result in a distortion of wave shape, which commonly entails serious injury to the musical beauty of the sound. Moreover, apart from any question of distorted waves and altered qualities, the sounds transmitted by microphones are feeble, so that it is usually necessary to hold the receiver to the ear—a condition which interferes seriously with musical enjoyment.

But in the system of generation invented and developed by Dr. Cahill, electrical vibrations are produced to initiate the sounds, which are as loud at each receiving station as if an orchestra were on the spot. A battery of alternators of different frequencies is used, answering in a general way to the strings of a piano or the pipes of an organ. One or more performers play upon piano keyboards. The keys of these operate switches, so as to bring the several alternators into action on the lines or mains as required. Across these mains receiving telephones are connected, just as incandescent lamps are in the Edison lighting system. With each receiving telephone a large paper horn is used. The net result of the system is that instead of the feeble vibrations of the air acting upon a microphone, and thus through numerous transformations as above detailed upon the receiving telephone, the performer is enabled to bring to bear upon the line the full power of a large alternator, or of a group of such alternators. These alternators are specially constructed so as to produce sounds whose purity and musical beauty exceed the finest pipe and closely approach a good string tone.

In no respect, then, it will be seen, is the electrical music like that from a mechanical piano or other mechanical musical instrument. In fact, there is no *musical* instrument in the system in the sense in which that word has been understood heretofore, for there is not a string or reed or sounding pipe in the whole apparatus. The vibrations in the first instance are purely electrical, and it is not until the electrical disturbance reaches the telephone receiver that the sound is produced. The performer listens to a receiving telephone just as his auditors do, a few feet, or it may be some miles, away. The wave distortions which the coils, line and diaphragm may produce in the wave forms transmitted is of little or no consequence, since the musician hears what his auditors hear, and if the coils and line and diaphragm tend to "rub down" the higher harmonics, he, all unconscious of this electrical action, simply sets the stops or presses the keys so as to produce the result his ear demands—and produces it.

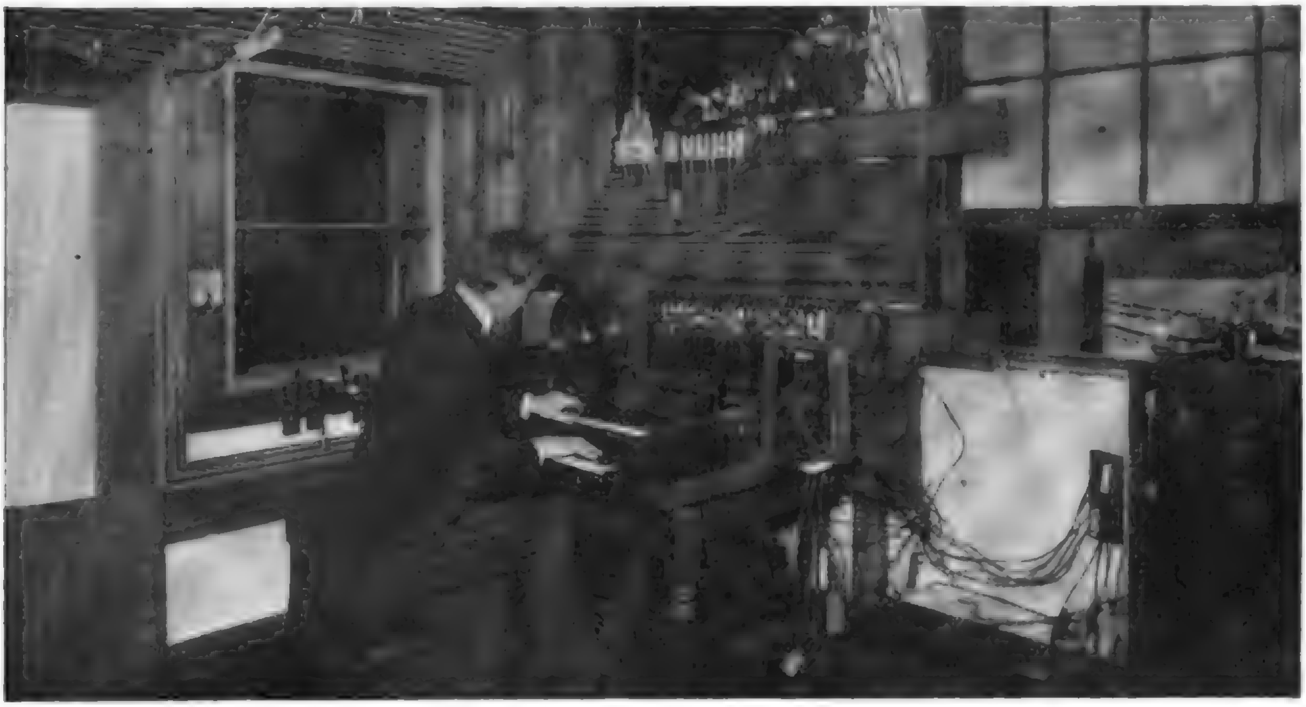


Fig. 1.—Electrical Music Transmitter in Operation.

Figs. 1 to 4 illustrate various portions of the inventor's first apparatus.

It is not the purpose of the present article to describe the mechanical details which are embodied in the construction of the electrical machinery, but merely to outline the general features of the apparatus. The generating set consists of a number of inductor alternators of simple construction. The fixed or stator part of each carries both the field and the armature windings. The rotors are mounted upon shafts; the shafts are geared together; and the number of teeth or poles in the several rotors and the angular velocities of the shafts are suitably arranged so as to produce the notes of the compass through five octaves. The tuning is remarkably good, and from the nature of things, absolutely unchangeable.

The armature coils, wound on the stators, are connected with switchboards, controlled by two keyboards, upon which the performer plays as on a piano, and a number of expression devices, which are actuated by his touch, make the hearer conscious that the soul of the musician is in the music. The depressing of a key closes a ground tone circuit and one or more other circuits corresponding to harmonics of that ground tone. A number of inductoriums or tone mixers serve to build up from the simple or sinusoidal waves of the alternators, complex resultant vibrations. Thus, several alternators contribute their waves to produce a single note, when that is of a rich or string quality. Several such notes on a single keyboard are combined electrically into more highly composite vibrations, which when they reach the ear appeal to it as musical chords of great beauty. In some cases the complex vibrations from different keyboards are further combined into still more highly composite vibrations, so as to produce several voices or parts as a violin and a 'cello, or a clarinet and flute in the same receiver at the same instant. Some of these superpositions of vibrations are produced conductively and some magnetically.

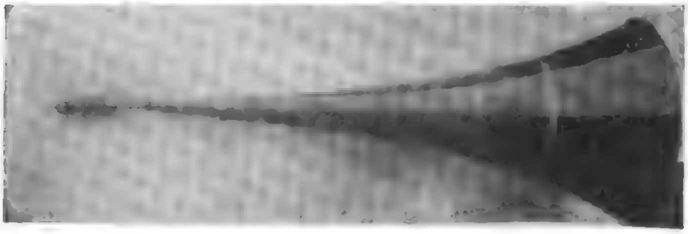


FIG. 2.—ELECTRICAL MUSIC RECEIVER.

Without taking space to describe the exact details of these various vibration-combining devices, it may be said that they are special forms of inductoriums, having usually a plurality of primary circuits into which vibrations from different alternators are fed, and a combining secondary circuit in which resultant vibrations are produced, equivalent musically and electrically to the several series of vibrations in the several primary circuits. Some of these inductoriums have iron circuits almost closed; others have open iron circuits, while still others are air-core transformers—entirely without iron. Fig. 5 shows a "tone-mixer" in which the electrical vibrations are combined magnetically.

In a certain sense this system is a novel mode of distributing power electrically, the power being sent out in the shape of *musical electrical waves* so as to produce music perhaps in a thousand, or with a larger apparatus in ten thousand, parlors at the same time. The feature of using alternators for initiating the vibrations makes it possible to produce music at a great number of places simultaneously, with sounds soft or loud as the musician desires. Contrary to what one might suppose, the tones are remarkably pure and beautiful, nor is there the least suggestion of the friction and diaphragm noise that belongs to the phonograph, and the loud speaking telephone.

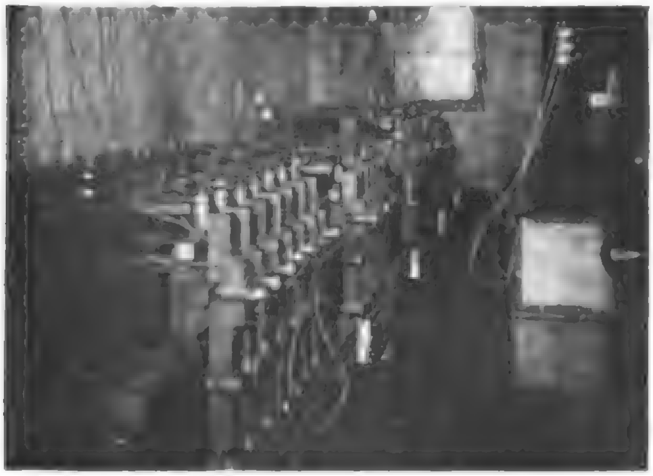


FIG. 3.—GROUP OF INDUCTOR ALTERNATORS, THE SOURCE OF POWER.

Apart from its interest as a means of distributing music from a central station, the Cahill system of original electrical generation has some musical possibilities which none of the existing instruments of music possess. Thus, for example, the intonation strikes the listener as remarkably good, and a glance at the steel inductors on the shafts and the steel gears connecting them shows that the tuning must be as permanent as it is perfect.

In the next place, the system of building up the quality of tone desired, by mixing with the ground tone one or many harmonics, with any strength desired, opens up a new field of timbre control. The wood-wind, brass and string tones of the orchestra are easily produced, by mixing the required harmonics in the required proportions. A musician in Dr. Cahill's laboratory showed our staff correspondent that a mere ground tone produces a clear, pure flute note, a ground tone with the third and fourth harmonics of suitable strength produces the sound of a clarinet, while to imitate the violin all the harmonics up to the eighth were necessary. Another combination of harmonics, in which the seventh and eighth are strong, gives the characteristic blare of brass. In addition to reproducing the leading orchestral tones, a skillful performer can mix the harmonics so as to produce musical timbres unknown before. These new qualities are a striking feature of the electrical music.

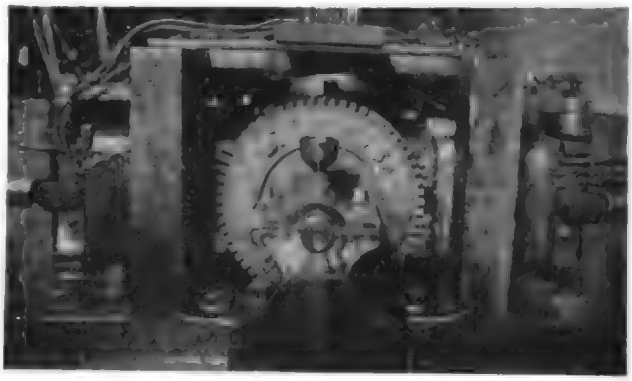


FIG. 4.—VIEW OF ROTOR OF HIGH-FREQUENCY INDUCTOR ALTERNATOR.

Equally striking with this novel timbre control is the delicacy of the expression, dynamically considered. By the touch of the hand the performer controls the attack and sostenuto and varies the note at every instant. The musicians at the Cahill laboratory produced very good vibrato effects, and crescendos and diminuendos not inferior to those produced by a good violin. And when imitating the violin and 'cello the performer controlled, by his touch, the quality and power of the tone so perfectly that the auditor felt sure he heard the bow gliding across the string. The singularly pure quality of the tones and the remarkable control over them which the performer possesses take the listener by surprise. It is a curious system in which a battery of powerful alternators at a central station may be used to vibrate diaphragms all over a great city, producing music in thousands of homes, while the electrical forces are so perfectly under the control of the performers' fingers that they respond to their musical feelings more perfectly than any existing instrument, saving the violin, viola and 'cello.

Dr. Cahill has been engaged in perfecting his apparatus for years and it seems to have reached the commercial standpoint. That the installation has long since passed the experimental stage will be appreciated when it is known that there is now in use in the inventor's laboratory at Holyoke, Mass., in addition to the instrument already described a central station plant containing one hundred and forty-five directly-coupled inductor alternators. These alternators are arranged in eight sections or panels, each inductor being mounted on an eleven-inch steel shaft. The bed plate of the machine is built up of eighteen-inch steel girders, mounted on brick piers, and is more than 60 ft. long. The switchboards are in ten sections and contain nearly two thousand switches. These are controlled from a distant keyboard through an electro-magnetic action. There are numerous transformers, one of which is seen in Fig. 5, and many rheostats and other regulating devices, including in the aggregate thousands of coils or sections. The whole plant weighs nearly two hundred tons, and has cost approximately two hundred thousand dollars. This apparatus was built for lease to the New England Electric Music Company, of which Mr. F. C. Todd is president. A second large apparatus is well under way and is likely to be completed in two or three months.

The inventor's first complete apparatus, which is illustrated in the drawings, and which we have described, was built in Washington some years ago. The larger work has been done at Holyoke, where the Cahill laboratory has been located for the last four years.

From the superficial description given above it is evident that the constructional features of the electrical mechanism are exceedingly elaborate. It is believed, however, that the results obtained fully justify the means employed. There can be no doubt as to the absolute accuracy of the relative pitches of the various notes produced, nor as to the beauty and purity of the resultant music. Although the horn of the receiver resembles that of a phonograph, there is nothing about the music itself to suggest the phonograph, the harsh sounds and disagreeable overtones of which are entirely lacking. The quality of the sound is pure and sweet and the volume is such that the largest known auditorium can be served without the use of an excessive number of receivers, while the character and expression of the music is under the control of the musician to an extent not previously reached in any musical instrument.

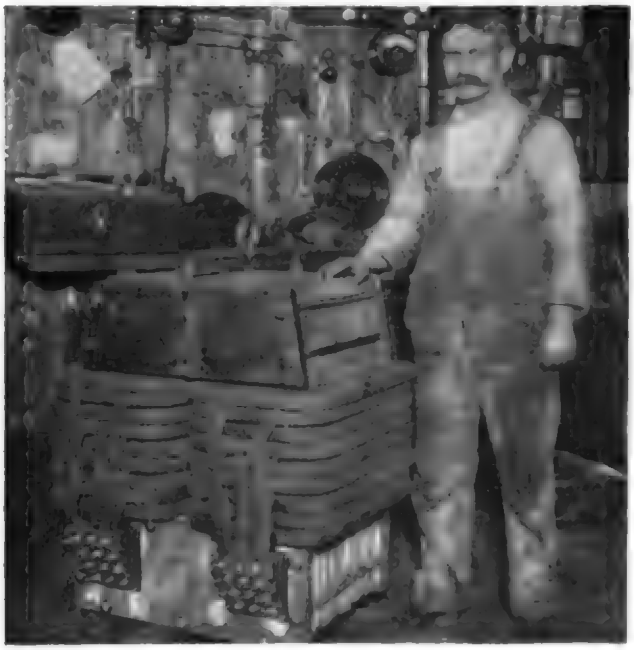


FIG. 5.—TONE-MIXING TRANSFORMER.

The question will naturally arise in the mind of the reader as to the practical use of this complicated and expensive apparatus. The plans of the inventor are to distribute music from a central station to hotels, restaurants, theatres and private homes. The remarkable purity and strength of the sounds produced electrically, enabling a few performers at a central station to produce orchestral music at a thousand places, strikes the imagination and it seems not improbable that at no distant day orchestral music for the dinner table will be as common in the homes of the people as it is now in the great hotels. Music of different sorts during the evening and slumber music during the small hours of the night, coming to the listener by electricity from a central station, seem likely in a few months to be accomplished facts in one or more American cities.

Dr. Cahill's work is covered, it is said, by numerous patents and pending applications in this country and abroad.

Electrical Engineering Classification.

BY ALLEN S. PEARL.

Referring to the excellent article by Mr. George Parsons in the ELECTRICAL WORLD AND ENGINEER of November 25, 1905, on "A Topical Classification for Electrical Engineering References," and the comments thereon by Mr. A. G. Voge in the issue of January 20, the writer has put in use a similar classification adapted to the needs of an electrical supply house correspondent or purchasing agent which apparently embodies the greatest simplicity, ease of reference and flexibility, with a minimum amount of clerical work to keep in working condition. A filing cabinet is used with three vertical rows of drawers, the contents of which are arranged in the same order as material in the general catalogue of the supply house. Beginning at the upper left drawer these are marked with cards as follows:

1.	Pages 9 to 36.	Switches and accessories.
2.	Pages 67 to 125.	Cut-outs and fuses.
3.	Pages 126 to 162.	Sockets and fittings.
4.	Pages 103 to 253.	Fixtures and fittings.
5.	Pages 254 to 255.	Signs and flashes.
6.	Pages 256 to 271.	Incandescent lamps.
7.	Pages 272 to 286.	Arc lamps and arc lamp sundries.
8.	Pages 287 to 288.	Marine supplies.
9.	Pages 289 to 300.	Insulating material (mica cloths, etc.).
10.	Pages 301 to 356.	Pole line material.
11.	Pages 357 to 413.	Tools.
12.	Pages 414 to 442.	Wires and cables.
13.	Pages 443 to 462.	Conduit and fittings.
14.	Pages 463 to 498.	Insulations and fittings.
15.	Pages 499 to 543.	Instruments and transformers.
16.	Pages 544 to 567.	Switchboards, panel boards.
17.	Pages 568 to 576.	Dynamo brushes and commutators.
18.	Pages 577 to 591.	Circuit breakers and lightning arresters.
19.	Pages 592 to 594.	Dynamos and motors.
20.	Pages 595 to 610.	Rheostats and dimmers.
21.	Pages 611 to 627.	Telephones and accessories.
22.	Pages 628 to 642.	Bells and annunciators.
23.	Pages 643 to 672.	Batteries and pushes.
24.	Pages 673 to 678.	Automobile supplies.
25.	Pages 679 to 690.	Speaking tube supplies, novelty goods and blasting apparatus.
26.	Pages 691 to 713.	Gas lighting and burglar alarm supplies, fire alarm and telegraph apparatus.
27.	Pages 714 to 724.	Heating apparatus.
28.	Page 730	Sewing machine motors, fan motors and exhaust fans.
29.	Pages 730 to 745.	Tables.

The index to the general catalogue thus becomes an index as well to the contents of the cabinet, showing in which drawer a circular describing a given article may be found, as all circulars describing switches and accessories are put in drawer 1, etc. If in doubt under which class an article comes, all that is necessary to do is to find its name in the index of the general catalogue, and the page number shows in which drawer its descriptive circular may be found. Each drawer is indexed alphabetically and the circulars are filed under the names of the firms issuing them. If a circular covers more than one class of material, several copies are used, one being filed in each drawer containing circulars of one of the classes covered, no cross-indexing therefore being necessary. Should a drawer be filled, another drawer below it is used for *L* to *Z* circulars, shifting the succeeding drawers on one space. A few extra copies of circulars may be kept to enclose with quotations. Notes, articles, quotations, advertisements, etc., are filed with the circulars. By marking the discounts on the front page of each circular not intended for enclosure, a complete cost system is maintained, no "cost book" with its clerical work being necessary. When it is remembered that one discount usually applies to an entire circular, the amount of labor necessary to keep a cost record in this way as compared with a cost book record with a page for each item, is apparent.

With such a cabinet, and after filing for a few months the new circulars that come daily in the mail, new advertisements in the electrical journals, etc., a correspondent is able to quote instantly on almost any article on the market.

Anyone who has been called upon to quote on or purchase an article of which he has a dim recollection of having seen described "somewhere" some time, and which is not being advertised in current periodicals, will appreciate the immense amount of time saved by being able to lay hands upon a drawer containing a descriptive circular. It is then an easy task to run through the contents of one drawer unless the name of the manufacturer is known, in which case one can open the file to the circular at once.

Commutation in Single-Phase Motors at Starting.

By Marius Latour.

THE use of the single-phase motor for traction purposes in the future depends essentially on the way the difficulties connected with the commutation at starting are overcome. It is therefore surprising that the authors who have treated the different diagrams referring to the single-phase motor have neglected this phase of the subject.

I have published in the Electrical World and Engineer of December 3, 1904, an article treating the conditions of commutation at starting in the case of a motor without resistance leads. By theoretical considerations the conclusion was reached that from the point of view of commutation at starting all types of motors are alike, and that the improvements that one might expect to produce by changing the number of poles, the speed of the motor, etc., are rather illusory.

In the same article, however, was shown the desirability of obtaining the required voltage of the rotor by means of a winding which gives the largest possible number of bars on the commutator, so that for a reduced width of the brush (9 to 12 mm.) several bars are still covered by the latter. It was also shown that the voltage of the rotor must be so chosen that the potential difference between two consecutive bars under the brush stands in a certain relation to the ohmic drop due to the line current in the brush. In the case when two bars are covered, for instance, this relation is represented by the formula:

$$e = \sqrt{2.4}\ k$$

in which e represents the voltage per bar and k the ohmic drop of the line current in the brush. With most resistant carbon brushes e cannot very well exceed in general 2.5 volts, even for a commutation corresponding to an evolution of 40 watts per square cent. of the surface of contact.

The voltage for a single-phase motor at 25 cycles giving the minimum rubbing surface for such a commutation (40 watts per square centimeter) would consequently lie below 200 volts. If, therefore, it proves to be necessary to use the same motor as a 250-volt direct-current machine, the conditions for commutation become unfavorable. The low voltage suitable for a single-phase motor has besides the disadvantage of necessitating the introduction of large currents into the rotor. This disadvantage disappears, however, in the case of the repulsion motor where the current is generated in the rotor itself as well as in the case of a compensated repulsion motor of my type in which one has to introduce only the magnetizing current.

In the study of commutation contained in the article, referred to above, the average quantity of heat developed per square cent. and per second under the brush was taken as a criterion of the quality of commutation. The general mathematical treatment of the commutation based on the consideration of the heat produced under the brush has been applied by Mr. Th. Reid (see *Transactions* of the American Institute of Electrical Engineers, May, 1905) to the case of direct-current machinery. Mr. Reid lays special emphasis on the quantity of heat which is produced at the very edge of the brush. It is evident that a complete theory of the sparking in the process of commutation must consider both the total quantity of heat developed under the whole surface of the brush divided by the surface of contact and the quantity of heat per square centimeter which is produced at the edge of the brush. The authors who studied the commutation at first committed the error of considering only the voltage between brush and bar at the moment when the short-circuit is opened as a criterion of the commutation, neglecting all the conditions which preceded the breaking of contact. The theory which would consider only the edge, and neglect the fact that the conditions at the edge are influenced by the conditions prevailing at the neighboring portion of the brush, would also be inadequate. In the first theory no integration at all is performed; in the second the integration performed refers only to the time, while in the theory applied in my article mentioned above integration is performed with respect to both time and space. In reality none of these three points of view considered separately gives a complete representation of the phenomena taking place, and accordingly none of them is a perfectly true measure of the quality of commutation.

However, when no resistance leads are used, experiments show that single-phase traction motors constructed in accordance with the requirements of the theory developed in the article mentioned above give a perfect commutation at starting. As the quantity of heat generated on the commutator is minimum, and as this result is obtained with the minimum of rubbing surface, according to this method, the other two methods mentioned above cannot possibly lead to any further improvement.

In the case when resistance leads are used, the dissymmetry in the behavior of the brush as a whole and of the edge is increased to such an extent, and the difference between the quantities of heat generated per square centimeter when referred to the whole surface of the brush or only to its edge is so large, that for the complete study of commutation all three points of view mentioned above must be applied conjointly.

In what follows, a study is made of the commutation when resistance leads are used. I have already shown (see Electrical World and Engineer, January 16, 1905) that the resistance leads allow the rubbing surface on the commutator to be reduced for the same amount of energy produced per square centimeter under the brush, and the use of resistance leads might consequently be of great help.

In beginning the study, it is well to call attention to the remarks made in my previous articles as contributing to the simplification of the problem:

1st. The starting of the motor is considered to be equivalent to a rotation with an infinitely small velocity so that the e.m.f. generated by speed in the short-circuited coil need not be considered. The division of the line current in the different leads and the value of the short-circuit current are regulated merely by the interposed ohmic resistances in accordance with the Kirchhoff law, the local reactance of the short-circuited coil being considered negligible.

2d. The short-circuit current in a single-phase motor can be considered to be approximately in quadrature with the line current if one neglects the leakage reactance of the short-circuited coils. It follows from this remark that it is permissible to calculate separately the quantities of heat produced by the short-circuit current and by the line current and to add them afterwards.

Let us first study the commutation, taking as a criterion the voltage between brush and bar at the moment when the brush leaves the bar. Consider Fig. 1, in which the brush covers three bars. Let e be the e.m.f. developed in each coil by the variations of the field of the motor and assume at first that no current is introduced through the brush, so that the short-circuit current alone flows in the short-circuited coil. By reason of symmetry the conductor, 2, is free of current. The potential of the brush is accordingly the same as that of the point, O, of the winding. Under these conditions the difference of potential between the brush and the bar 4, which it is just leaving, equals $2e$. If the brush covered m bars the difference of potential, v_1, between the brush and the bar leaving the brush would be

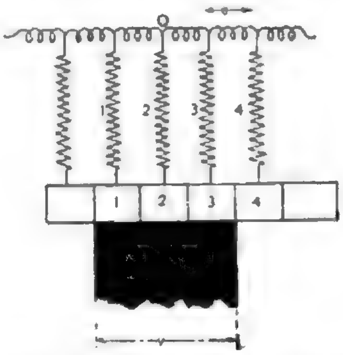


FIG. 1.—BRUSH COVERING THREE WHOLE SEGMENTS.

$$v_1 = \frac{m-1}{2}e + e = \frac{m+1}{2}e.$$

Let v represent the difference of potential developed on the commutator over a length equal to the width of the brush.

Then one has:

$$m\,e = v$$
$$e = \frac{v}{m}.$$

Consequently the potential difference between the brush and the bar which the brush is leaving will be equal in the moment of rupture to:

$$v_1 = \frac{m+1}{2\,m}v.$$

These considerations show that if the width of the brush is given in addition to the value of v (that is to say, the voltage of the motor is known indirectly), then it is advisable to choose a winding which gives the largest number of bars under the brush in such a way as to subdivide the voltage, v, as much as possible. However, with a winding capable of giving a very large value to m, v_1 cannot be reduced below the limiting value, which is equal to $\frac{v}{2}$. Since with two bars, and with three bars, covered by the brush, one has, respectively,

$$v_1 = \frac{3}{4}v$$
$$v_1 = \frac{2}{3}v$$

it is seen that the sub-division of the voltage, v, into two or three parts is practically sufficient, especially if one considers that a small further reduction of v_1 involves the use of a much more expensive winding and commutator.

In studying the commutation at starting from the point of view of the quantity of heat produced under the brush per square centimeter, in the case where no resistance leads are used practically the same conclusions have been arrived at. It can be shown that for an infinite value of m, and the voltage, v, short-circuited under the brush indefinitely sub-divided, the quantity of heat produced under the brush by the short-circuit current can be reduced to one-half of the value corresponding to $m = 1$.

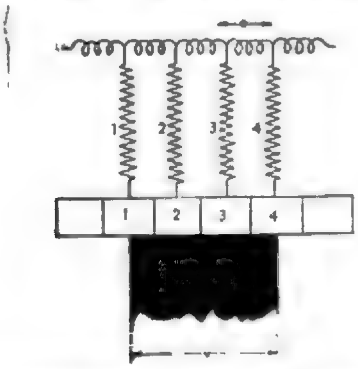


FIG. 2.—BRUSH COVERING TWO WHOLE AND TWO HALF SEGMENTS.

With two bars under the brush, one finds, however, that the quantity of heat per square centimeter is already reduced to 5/6 of the same value. Both points of view lead accordingly to the same conclusion, that is, that two or three bars under the brush are practically sufficient.

In what follows, it will be assumed that three bars are used under the brush in connection with resistance leads.

Let us call I the line current introduced through the brush, S the total surface of contact between brush and commutator bars, $s = \frac{S}{3}$ the surface of contact for a single bar, r the resistance of the resistance leads, ρ the resistance per square centimeter of the contact (1) and let β be the ratio $r : \frac{\rho}{S}$. If we consider only the circulation of the line current through the brush and the resistance leads, we see that the difference of potential between the brush and the bar, 4, leaving the brush will be:

$$\frac{I}{3}\frac{\rho}{s}(1+\beta).$$

Taking now into account the voltage produced by the variation of the field of the motor, the resultant voltage between the brush and the bar, 4, will be:

$$\sqrt{\left[\frac{I}{3}\frac{\rho}{s}(1+\beta)\right]^2 + \left[\frac{2}{3}v\right]^2}$$

As was shown in the previous article, the product $(v\,I)$ depends only on the capacity of the motor. For a given armature provided with given resistance leads and out of which we must get a certain starting torque the minimum of the expression above will consequently be reached when

$$\frac{I}{3}\frac{\rho}{s}(1+\beta) = \frac{2}{3}v = 2\,e.$$

This would mean that the short-circuit e.m.f. e between two consecutive bars should be chosen equal to one half of the ohmic drop through the brush and the resistance leads due to the line current.

Let us now study the commutation taking as a criterion the average quantity of heat produced per second and per square centimeter under the brush.

We shall calculate separately the quantities of heat produced by the line current and by the short-circuited current. Let us call i_1, i_2, i_3, i_4 the parts of the line current, I, which flow in the resistance leads 1, 2, 3 and 4, respectively. Let us call x the ratio between the surface, s_1, of the bar 1 covered by the brush and the total surface, s, of that bar which can be covered by the brush.

The resistances interposed between the brush and the winding are, respectively,

$$\frac{\rho}{s}\left(\frac{1}{x}+\beta\right)$$
$$\frac{\rho}{s}(1+\beta)$$
$$\frac{\rho}{s}(1+\beta)$$
$$\frac{\rho}{s}\left(\frac{1}{1-x}+\beta.\right)$$

In accordance with the Kirchhoff laws we have then the following equations:

$$(1)\quad i_1\frac{\rho}{s}\left(\frac{1}{x}+\beta\right) = i_2\frac{\rho}{s}(1+\beta) = i_3\frac{\rho}{s}(1+\beta)$$
$$= i_4\frac{\rho}{s}\left(\frac{1}{1-x}+\beta\right)$$

$$(2)\quad i_1 + i_2 + i_3 + i_4 = I.$$

From these equations one calculates:

$$i_1 = I\,.\,\frac{1+\beta}{2(1-2\beta)}\,.\,\frac{x\left(x-\frac{1+\beta}{\beta}\right)}{x^2 - x - \frac{3(1+\beta)}{2\beta(1+2\beta)}}$$

---

(1) In what follows the assumption is made that ρ has a constant value for all current densities. This would not be true for low-current density, but is approximately true for the very high densities which are used in the starting of single-phase motors.

$$i_4 = I \cdot \frac{\beta}{2(1+2\beta)} \cdot \frac{x^2 - x - \dfrac{1+\beta}{\beta^2}}{x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}}$$

During the time the bar, 1, enters under the brush and the bar, 4, leaves the brush, the total quantities of heat produced under the brush by the currents, i_4 and i_1, are respectively equal to the total quantities of heat produced under the brush by the currents, i_2 and i_3.

The average quantity of heat produced per second under the brush by the currents, i_1 or i_4, will be:

$$\frac{\rho}{s} I^2 \frac{(1+\beta)^2}{4(1+2\beta)^2} \int_0^1 \frac{x\left(x - \dfrac{1+\beta}{\beta}\right)^2}{\left[x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right]^2} dx$$

The average quantity of heat produced per second under the brush by the currents, i_2 or i_3 will be:

$$\frac{\rho}{s} I^2 \frac{\beta^4}{4(1+2\beta)^2} \int_0^1 \frac{\left[x^2 - x - \dfrac{1+\beta}{\beta^2}\right]^2}{\left[x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right]^2} dx$$

The average of the total quantity of heat produced per second under the brush by the line current, I, will then be:

$$\frac{\rho}{s} I^2 \frac{1}{2(1+2\beta)} \left[(1+\beta)^2 \int_0^1 \frac{x\left(x - \dfrac{1+\beta}{\beta}\right)}{\left[x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right]^2} dx + \beta^4 \int_0^1 \frac{\left(x^2 - x - \dfrac{1+\beta}{\beta^2}\right)^2}{\left(x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right)^2} dx \right]$$

This power divided by the total surface $S = 3s$ of the brush gives:

$$q_i = \rho \frac{I^2}{S^2} \cdot \frac{3}{2(1+2\beta)^2} \left[(1+\beta)^2 \int_0^1 \frac{x\left(x - \dfrac{1+\beta}{\beta}\right)^2}{\left[x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right]^2} dx + \beta^4 \int_0^1 \frac{\left(x^2 - x - \dfrac{1+\beta}{\beta^2}\right)^2}{\left(x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right)^2} dx \right] = \rho \frac{I^2}{S^2} f_1(\beta).$$

$f_1(\beta)$ must be considered as a numerical coefficient by which the quantity of heat produced by the line current under the brush when no resistance leads are used, must be multiplied in order to obtain the actual quantity of heat produced by the line current when the resistance leads used have β times more resistance than the contact resistance per bar.

In order to calculate the quantity of heat liberated by the short-circuit current, let us call j_1, j_2, j_3, j_4 the different values of the short circuit current in the conductors, 1, 2, 3, 4. According to the Kirchhoff laws we have the equations:

$$j_1 \frac{\rho}{s}\left(\frac{1}{x} + \beta\right) - j_2 \frac{\rho}{s}(1+\beta) = e$$

$$j_1 \frac{\rho}{s}\left(\frac{1}{x} + \beta\right) - j_3 \frac{\rho}{s}(1+\beta) = 2e.$$

$$j_1 \frac{\rho}{s}\left(\frac{1}{x} + \beta\right) - j_4 \frac{\rho}{s}\left(\frac{1}{1-x} + \beta\right) = 3e.$$

$$j_1 + j_2 + j_3 + j_4 = 0.$$

The total quantity of heat produced per second and per square centimeter under the brush will be:

$$q_i + q_j = \rho \frac{I^2}{S^2} f_1(\beta) + \frac{e^2}{\rho} f_2(\beta).$$

As the product (eI) is given by the starting torque, this quantity will be the minimum when

$$q_i = q_j$$

or when

$$\rho \frac{I^2}{S^2} f_1(\beta) = \frac{e^2}{\rho} f_2(\beta),$$

or when, if we call k the ohmic drop due to the line current in the brush, for the average current density $\dfrac{I}{S}$

$$e = k \sqrt{\frac{f_1(\beta)}{f_2(\beta)}}.$$

Let us now study the commutation, taking as a criterion the average quantity of heat produced per second and per square centimeter at the edges of the brush.

The current density at the edge of the brush bearing on the bar, 1, will be the resultant of the current density δi due to the line current and the current density, δj, due to the short-circuit current. The average quantity of heat produced per second and per square centimeter will be the average value of

$$\rho\, \delta i^2 + \rho\, \delta j^2.$$

As we know the value of i_1 and j_1, it is very easy to determine each one of these quantities. We have

$$\delta i = \frac{i_1}{s_1} = \frac{I}{S} \frac{3(1+\beta)}{2(1+2\beta)} \frac{x - \dfrac{1+\beta}{\beta}}{x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}}$$

$$\delta j = \frac{j_1}{s_1} = \frac{e}{\rho} \frac{3}{2\beta} \frac{x - \dfrac{2(1+\beta)}{1+2\beta}}{x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}}.$$

Finally, we obtain for the quantity of heat, $q\delta i$, produced per second and per square centimeter at the edges of the brush by the line current,

$$q\delta_i = \rho \frac{I^2}{S^2}\left[\frac{3(1+\beta)}{2(1+2\beta)}\right]^2 \int_0^1 \left(\frac{x - \dfrac{1+\beta}{\beta}}{x^2 - x - \dfrac{3(1+\beta)}{2\beta(1+2\beta)}}\right)^2 dx = \rho \frac{I^2}{S^2} f_3(\beta).$$

From those equations one calculates:

$$j_1 = 3c\frac{s}{\rho}\frac{1}{2\beta}\frac{x\left(x-\dfrac{2(1+\beta)}{1+2\beta}\right)}{x^2-x-\dfrac{3(1+\beta)}{2\beta(1+2\beta)}}$$

$$j_2 = c\frac{s}{\rho}\frac{1}{2(1+\beta)}\frac{x^2-x-\dfrac{3(1+\beta)}{\beta(1+2\beta)}(1-x)}{x^2-x-\dfrac{3(1+\beta)}{2\beta(1+2\beta)}}$$

It follows from the same considerations we have exposed in studying the quantity of heat produced per second under the brush by the line current that the average quantity of heat produced per second and per square centimeter under the brush by the short-circuit current is:

$$q_j = \frac{c^2}{\rho}\cdot\frac{3}{2}\left[\frac{1}{\beta^2}\int_0^1\frac{\left(x-\dfrac{2(1+\beta)}{1+2\beta}\right)^2}{\left[x^2-x-\dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right]^2}dx + \frac{1}{g(1+\beta)^2}\int_0^1\frac{\left(x^2-x-\dfrac{3(1+\beta)}{\beta(1+2\beta)}(1-x)\right)^2}{\left(x^2-x-\dfrac{3(1+\beta)}{2\beta(1-2\beta)}\right)^2}dx\right] = \frac{c^2}{\rho}f_2(\beta)$$

$f_2(\beta)$ being again a numerical coefficient like $f_1(\beta)$; and for the quantity of heat, $q\delta_j$, produced by the short-circuit current:

$$q\delta_j = \frac{c^2}{\rho}\frac{K}{4\beta^2}\int_0^1\frac{\left(x-\dfrac{2(1+\beta)}{1+2\beta}\right)^2}{\left(x^2-x-\dfrac{3(1+\beta)}{2\beta(1+2\beta)}\right)}dx = \frac{c^2}{\rho}f_4(\beta)$$

$f\ (\beta)$ and $f_4(\beta)$ are, like $f_1(\beta)$ and $f_2(\beta)$, numerical coefficients. As the product $(c\,I)$ is given, and is constant, the total power lost, $q\delta_t + q\delta_j$, will be minimum when $q\delta_i = q\delta_j$, or when

$$\rho\frac{I^2}{S^2}f_3(\beta) = \frac{c^2}{\rho}f_4(\beta),$$

which implies the relation:

$$c = k\sqrt{\frac{f_3(\beta)}{f_4(\beta)}}.$$

The values of the coefficients, $f_3(\beta)$ and $f_4(\beta)$ are given as soon as one knows the finite integral:

$$\int_0^1\frac{(x-a)^2}{(x^2-x-b)}dx = \frac{1}{2b}+\frac{2a(a-1)}{b(1+4b)} + \frac{4(a^2-a-b)}{(1+4b)^{3/2}}\cdot\log\frac{\sqrt{1+4b}+1}{\sqrt{1+4b}-1}$$

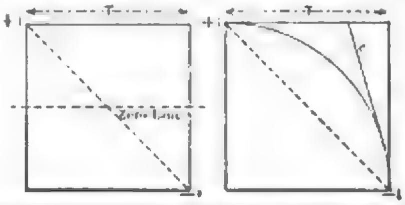
As to the finite integrals contained in $f_1(\beta)$ and $f_2(\beta)$, they do not present any special difficulty, but they give more complicated expressions. For that reason, it is intended in a subsequent article to publish the mere geometrical representation of $f_1(\beta)$, $f_2(\beta)$, $f_3(\beta)$ and $f_4(\beta)$, when β varies from $\beta = 0$ (which value of β corresponds to leads of negligible resistance) to $\beta = 5$ (which value of β corresponds to resistance leads of a comparatively very high resistance). In the same article will be given the corresponding curves when only one bar, and when two bars are covered by the brush, so that a general numerical discussion will be possible.

Calculation of Dynamo Sparking Constants.

BY A. PRESS.

THE elements entering into commutation theory are so numerous that a shortened form of calculation must be of paramount importance to the designing engineer. As has already been shown (see ELECTRICAL WORLD AND ENGINEER, December 16, 1905), there are three criteria of sparking. The one depends upon the magnetic momentum of the short-circuited coil; that is, the flux linkages, which change from one direction to the opposite. The second is the voltage generated in the coil due to the coil cutting lines of force, and the third is the voltage drop in the short-circuited coil spanned by the tip of the brush at the last instant.

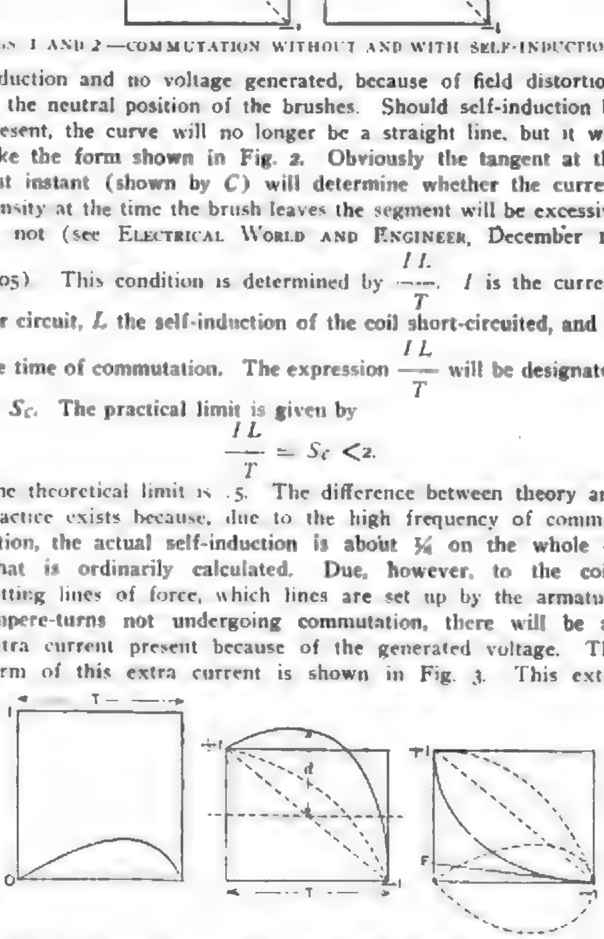
Fig. 1 gives a graphic representation of the current in the short-circuited coil during the period of commutation with no self-induction and no voltage generated, because of field distortion, at the neutral position of the brushes. Should self-induction be present, the curve will no longer be a straight line, but it will take the form shown in Fig. 2. Obviously the tangent at the last instant (shown by C) will determine whether the current density at the time the brush leaves the segment will be excessive or not (see ELECTRICAL WORLD AND ENGINEER, December 16, 1905). This condition is determined by $\frac{I\,L}{T}$. I is the current per circuit, L the self-induction of the coil short-circuited, and T the time of commutation. The expression $\frac{I\,L}{T}$ will be designated by S_c. The practical limit is given by



FIGS. 1 AND 2.—COMMUTATION WITHOUT AND WITH SELF-INDUCTION.

$$\frac{I\,L}{T} = S_c < 2.$$

The theoretical limit is .5. The difference between theory and practice exists because, due to the high frequency of commutation, the actual self-induction is about ¼ on the whole of what is ordinarily calculated. Due, however, to the coils cutting lines of force, which lines are set up by the armature ampere-turns not undergoing commutation, there will be an extra current present because of the generated voltage. The form of this extra current is shown in Fig. 3. This extra current must be added to the current shown in Fig. 2 and thereby one arrives at Fig. 4. An inspection of Fig. 4 will show that if the generated voltage is high enough the current density in the brush may reach such high values that glowing may occur. The point of glowing depends upon the quality of the brush and is in the neighborhood of 100 amp. per sq. in. A point of high current density is indicated by the ordinate, d. The generated voltage just spoken of will be designated by R_g and should not exceed 10 in value. If



FIGS. 3, 4 AND 5.—EXTRA CURRENT OF COMMUTATION DUE TO SPEED-GENERATED VOLTAGE.

s = number of commutator bars covered by the brush,
t = turns per coil,
K = kilowatts output or input,

p = number of poles,
F = flux in mega lines per pole,
l = gross length of armature iron in inches,

then $R_v = \sigma \times \frac{6.12}{100} \times t \times \frac{K}{p F} \times l'' < 10.$

Theoretically, the constant used above should be 3.06 instead of 6.12.

Referring again to Fig. 4, to obtain good commutation, the resultant curve as shown has to be modified to bring it as close to the straight line curve of Fig. 1 as will insure good commutation. This is done by so adjusting the position of the brushes as to cause an actual negative, R_v, which corrects for the former positive R_v, and even the upward bulging in the commutation current curve shown in Fig. 2. Thus by adding the negative, R_v, to Fig. 4 one obtains finally Fig. 5. The tangent at the last instant is now shown by F. The negative, R_v, is obtained by moving the brushes forward or backward so as to obtain a commutating field.

The condition $S_c = \frac{I L}{T}$ includes all the members entering into the equation for R_v. There is, however, one correcting term which if calculated will enable one to determine the former without difficulty. This factor is the number of lines per centimeter-ampere that the coil generates, expressed as Σ. In other words, it is a self-induction factor. Thus:

v = ventilating factor = $\frac{\textit{net length of armature iron}}{\textit{gross length of armature iron}}$

ϕ = a mutual induction factor, and its magnitude depends on whether the coils undergoing commutation at two brushes simultaneously lie in the same slots or not. This factor is 1.0 for full cord windings and is .5 for fractional pitches when the actual pitch differs from the full pitch by at least one tooth.

λ_a = lines per centimeter-ampere of conductor for open-type slots, with mutual induction; one may take $\lambda_a = 1.25 \rho$.

ρ = ratio of depth of slot to width of slot.

l_s = length of single end connection.

l = gross length of armature.

λ_s = lines per centimeter-ampere for the end connections.

$$\Sigma = v \phi \lambda_a + \frac{l_s}{l} \lambda_s.$$

The end connection self-induction is given by the formula:

$$\lambda_s = .46 \left\{ \log \left(\frac{l_s}{d_s} \right) - .2 \right\}$$

This is of course based upon the self-induction of two parallel wires. The term d_s stands for the diameter of a circle giving the area of one-half of the slot. The theoretical value for λ_a at ordinary frequencies is $\frac{1.25 \rho}{.5}$, the lines above the top of slot being neglected. The reasonableness of the short formula, $\phi \lambda_a = .025 \rho$, with $\phi = .5$, is easily perceived when one observes that the theoretical value is $.43 \rho$ under the limitation specified.

Having obtained the value of Σ, S_c is given by

$$S_c = \frac{R_v \,.\, \Sigma}{12}.$$

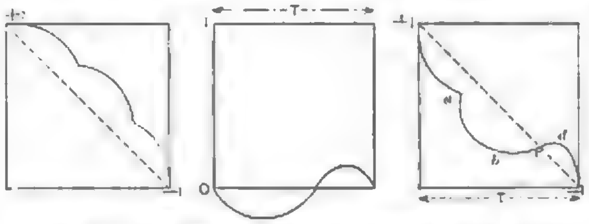
This apparent S_c has to be divided by the voltage drop per brush to obtain the real S_c, which is a measure of the sparking qualities. It should be less than 2. The third criterion is of importance when the S_c is near the limit, 2, in which case the copper drop per coil is the determining factor. Designating by W_t the resistance of the commutated coil in ohms and by $I W_t$ as the copper drop,

$$W_t = \frac{1.575 \times 10^{6} \times t \times (l + l_s)''}{A}.$$

where A is the area of conductor in square inches. The ratio of $\frac{I W_t}{V}$ should be less than .12. The symbol V stands for the brush voltage drop.

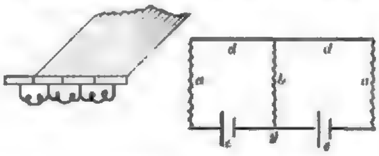
These formulæ will be found quite easy of computation, and have been checked over for a very large number of machines. In every case the sparking qualities have been determinable from the magnitude of the sparking constants.

It may be interesting to add that from the character of the burning at the brush the form of the current curve of commutation can be pretty fairly conjectured. Thus, in a case when there was a distinct marking on a brush, it would be foretold that the brush occupied the actual neutral field position. In this instance there were three bars covered. The first part of the brush was highly polished, the second rather dullish and the third distinctly burned. Evidently the brush commutated properly in the first part of the time, and in the last stages of commutation the coil was poorly commutated. The curve, neglecting the cross field, would have been as shown in Fig. 6. The R_v current of commutation because of brush position with respect to the field is shown in Fig. 7. Superimposing Figs. 6 and 7 one obtains Fig. 8. The parts $a\ b\ c$ and $c\ d$ give the dulled portions of the brush. It may be objected that the commutation of more than one coil simultaneously by increasing the time of commutation faster than the added mutual induction of the added coils would, presumably, benefit commutation. This, however, is a false view since it takes notice of only part of the whole actual phenomenon. What really causes the commutation to become worse is that the coils short-circuited are not in parallel, but in series. The added mutual induction is part only of the consequence of covering more than one brush.



FIGS. 6, 7 AND 8.—COMMUTATION CURRENT WITH THREE BARS COVERED BY THE BRUSH.

Those who have had some experience with the multi-voltage systems will easily follow the subjoined reasoning. Referring firstly to Fig. 9 with three bars covered, as shown, there are two generated electromotive forces in series and the diagram reduces to Fig. 10. The limbs a, b, a represent contact resistances. The line $d\ d$ is a short-circuiting strip which represents the negligible resistance of the brush. It is now obvious that the strip $d\ d$ must be at half potential relative to the end of a cell that is to the point g. Joining the limb $d\ d$ to the cells $e\ e$ by means of b, only makes an equipotential contact. It must, therefore, result in a condition of things in which the two cells are virtually in series. The same sort of reasoning applies to three cells or more. In all cases the short-circuiting strip will be at one-half the potential of the entire number of cells short-circuited. The mathematically-inclined can check the result, however, by means of Kirchoff's laws and by adopting the Strutt method of networks. Thus in the formula given above the magnitudes of both the S_c and the R_v depend upon the number of commutator segments covered by the brush proportionately.



FIGS. 9 AND 10.—REPRESENTATION OF ELECTROMOTIVE FORCES WHEN THE BRUSH COVERS THREE BARS.

In the former article upon commutation, in the formula for the R_v current, the self-induction drop of the coil was neglected. Taking the latter into account, results in the criteria themselves remaining the same; but the formula for the current density at the last instant becomes

$$i_a'' = I_a \left\{ \frac{1 + \frac{IW}{V} + \frac{R_v}{V}}{1 - \frac{L}{RT}} \right\}$$

At the Asheville meeting of the A. I. E. E. there occurred an extended discussion on a paper having the title "Limitations in Direct-Current Machine Design," and Mr. Senstius, the author, contended that the limit of capacity of a 300-volt generator was 1,800 kw, a point to which Messrs. Dunn and Steinmetz called particular attention, stating that at the Edison stations in Chicago and Cincinnati 2,500-kw, 300-volt generators were in operation showing in Mr. Steinmetz's words that "the deductions in the paper on 'Limitations in Direct-Current Machine Design' were expressed more broadly than warranted." The facts show that these machines operate satisfactorily, and this is entirely borne out by the formulæ given above.

If one will inspect the formula for R_v postulating a one-turn winding and two bars covered by the brush, he will see that the only variables remaining are the capacity of the machine, the length of the armature and the total flux. Now the total flux is proportional to the diameter times the length, if the magnetic density is kept constant. Hence it reasonably follows that only a certain maximum capacity is possible for a given diameter. The value of the S_c is really more dependent upon the shape of the slots and, therefore, the above general reasoning properly applies. The limit just referred to is by no means reached by any of the particular dynamos in question and the theoretical corroboration will, therefore, be of interest.

There being 1,728 commutator segments in one of these machines, the number of bars covered by the brush is $2.21 = \epsilon$. The output on full load is 2,500 kw. There being 48 poles, each having a pole flux of 7.3 mega lines, and the winding being a one-turn multiple, with a gross length of armature of 14.25 in., the value of R_v is 13.7:

$$R_v = 2.21 \times \frac{6.12}{100} \times 1 \times \frac{2{,}500}{48 \times 7.3} \times 14.25 = 13.7.$$

The slot dimensions are 1.3 in. by .58 in. If there are 18 slots per pole and the coil throw in slots is 17, the mutual induction factor is .5 and

$$\Sigma = \lambda_a + \frac{l_s}{l} \lambda_s = 1.15 + \frac{27.2}{14.25} \times .64 = 2.37.$$

Thus, the S_c follows by

$$S_c = \frac{13.7 \times 2.37}{12} = 2.7,$$

and if the current density in the brush is 34.3 amp. per sq. in., with a brush drop of 1.55 volts for this density, with Le Valle Vitæ brushes,

$$S_c = \frac{2.7}{1.55} = 1.74.$$

Thus, in this case the limit of 2 is not even reached. Therefore, the calculation indicates that the machine will carry its full load without sparking with the brushes in the neutral position. If the brushes are given a slight permanent lead forward, as is invariably done, then the generator will carry a 25 per cent overload without visible sparking and without spitting of brushes between no load and this value of overload. In the latter instance the $S_c = 1.03$, the $R_v = 17.1$, and the brush drop is 1.75 volts per brush. Although in this machine the copper drop of the short-circuited coil has little bearing on the sparking because the S_c is less than 2, it will be of interest to include the same:

$$W_t = \frac{1.575 \times 10^{-6} \times (12.25 + 27.2)}{.1 \times .4} = 00163 \text{ ohm}.$$

The copper drop of the short-circuited coil at the last instant will be, if the current per circuit is $\frac{8{,}333}{4.8} = 173$ amp., $173 \times .00163 = .282$ volt. The brush drop would be 1.55 volt, and thus

$$\frac{IW_t}{V} = \frac{.282}{1.55} = .182.$$

Progressive Work of the Janesville, Wis., Electric Company.

Janesville, Wis., a town of 13,770 population, located on the Rock River in southern Wisconsin, is supplied with electric light and power by the Janesville Electric Company from three generating plants.* The principal or central plant is in the center of town and is a combined steam and water power plant. Just below Janesville at Monterey is a water power plant with steam reserve, and 12 miles above Janesville is a small water power plant supplying current over a 6,600-volt transmission line. There is enough water power to carry the load except occasionally at the peak, when the steam plant at the central station is started. The steam plant at Monterey is kept only for use in case of a breakdown of some other part of the generating system. The boilers are kept empty and the packing removed from the engines, but the plant can be started on a few hours' notice. A pump belted to the water wheel shaft is used for filling the boilers.

DEVELOPMENT OF SMALL FACTORIES.

In the paper read before the recent Northwestern Electrical Association at Chicago on "Suggestions for Increasing the Power Output of Central Stations," Mr. P. H. Korst, manager of the Janesville plant, dwelt upon the cheap supply of electrical energy for small manufacturing enterprises as an important factor in the growth of a town. Mr. Korst's own city, Janesville, is a good example of this, as it is a town having a large number of small factories. One thing which has influenced the location of some of these factories in Janesville is the cheap power supply. Mr. Korst in building up this plant has realized that with water to carry the day power load, he could afford to make a very reasonable rate. He has further realized that by advertising the advantages of Janesville as an electric power center, he would secure the co-operation of the Janesville press and public and incidentally advertise central station service for all purposes. As a result of its effort in this direction the company has connected about 400 motors with an aggregate capacity of 700 horse-power.

RATES.

The rate for power is 5 cents per kw-hour. For each motor of 1-hp and less rated capacity, a minimum charge of $1.25 per month is made, and for each motor of over 2-hp a minimum charge of $1.00 per month per hp or fraction thereof.

Energy used for incandescent lighting and low-tension arc lamps is sold at 10 cents per kw-hour. The minimum bill for incandescent lighting is $1 per month and $2 per month for each enclosed arc lamp. On all bills 5 per cent discount is allowed for payment within 12 days. Discounts on lighting and power bills according to quantity used are made as follows:

Bills of from	$5.00 to $10.00	per month,	5	per cent discount.
	$10.00 to $20.00	" "	10	" " "
	$20.00 to $30.00	" "	15	" " "
	$30.00 to $40.00	" "	20	" " "
	$40.00 to $50.00	" "	25	" " "
	$50.00 and over	" "	30	" " "

LAMP RENEWALS.

Free lamp renewals are furnished on regular clear bulb lamps of 10, 16, 20, 24 and 32-cp when the customers return the glass bulbs unbroken to the office of the company. Lamps accidentally broken, lost and not accounted for by customers, are charged to them at 20 cents for the 10, 16, 20 and 24-cp sizes and 30 cents for the 32-cp. Lamps other than the regular shaped

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*A description in detail of the Janesville plant was given in the *Electrical World and Engineer*, dated Dec. 31, 1904.

clear bulb are charged extra as follows: Frosted, 5 cents each; dipper, 5 cents each; colored glass, blue, green or purple, 12 cents; colored glass, ruby or opal, 20 cents. Lamps for decorative or other special purposes are supplied to customers at approximately cost. The company uses lamps of 3.1 watt consumption.

FLAT-RATE SIGN AND DISPLAY WORK.

The principal business street of the town shows that the company has been active in pushing the sign and display lighting business, and the books of the company show that there are connected the equivalent of 430 lamps of 16-cp on flat-rate sign contracts, and that the average consumption of energy is 3,300 kw-hours per month. There are 1,211 lamps of 2-cp in use on electric signs and 92 of 16-cp. In window and decorative lighting there are 57 lamps of 2-cp, 12 of 8-cp and 81 of 16-cp. There are 42 contracts on a flat rate for this class of lighting. The following table shows the rates per year for flat rate sign lighting:

	1,852 hours, dusk at 11:00 P. M.	4,327 hours, dusk to dawn.
2 C.P.	$1.26	$2.11 per annum.
4 C.P.	2.52	4.22 " "
8 C.P.	4.73	7.89 " "
16 C.P.	8.47	14.73 " "

Where the company owns the sign 2/5 of the cost of the sign is added to the annual amount which lights come to as figured above, and a three-year contract is required. Ten per cent discount is given if the lamps are not on during peak in winter. All is subject to 5 per cent discount if paid by the 12th of the month.

CAPACITY AND LOAD.

The total connected load consists, besides the 700-hp in motors before mentioned, is the equivalent of 18,000 incandescent lamps of 16 cp, 150 low-potential arc lamps, 210 alternating-current street arc lamps and 25 incandescent street lamps of 50-cp. About one-quarter of the total incandescent and power load is alternating current. The balance is 110-220-volt direct current. The company supplies current for the operation of the street railway. It has some 500-volt generators in its central power station and can also connect two 250-volt, direct-current generators in series on the railway when necessary. The alternating-current generators in the central power station can be used either as motors or generators, being run as motors when power is being received from the other power stations and is needed in the shape of direct current. The total output for December, 1905, amounted to about 200,000 kw-hours at the switchboard. The direct-current peak on an ordinary day the last week in December, 1905, was 1,560 amperes at 110 volts. The afternoon of the same day the output was 700 amperes, most of which was power, which shows the importance of the power load in Janesville.

Three-phase alternating-current generators are employed. The street arc lamps are operated off of two phases of the three-phase bus-bars, the voltmeter being connected across this latter phase. The company has developed at its three plants water power to the amount of 1,100-hp and has a steam reserve of 750-hp, which is idle most of the time. The investment in water power plants is about $300,000, so that the interest charges are much higher than on a steam plant of similar capacity. Plans are now being made by D. C. and W. B. Jackson, of Madison, who are consulting engineers for the company, for the reconstruction of the lower plant at Monterey. The present hydraulic plant was formerly owned by a mill at that location.

ELECTRIC HEATING.

Good progress has been made in the introduction of electric flat irons for household and factory use. About 40 of these irons are in service and 25 heating pads. In order to get the flat iron business started, the company makes a standing offer to furnish customers with flat irons for 30 days free trial. A number of irons is constantly in use at the factory of a knitting company. The users took a dislike to these at first, but would not be without them now. In another factory, that of a clothing company, a 20-lb. iron and a 6-lb. iron are in use.

In one factory where electric flat irons have been introduced, it has been found that operators can do from 10 to 15 per cent more work than with gas-heated irons. These specific figures should be of considerable value to central station solicitors in pushing the electric flat iron business as well as to those writing advertising copy.

SPECIAL OFFERS.

The company made this year a special offer of 50 per cent reduction on all lighting bills for the first four months for any residence connected between January 1 and March 1. This has the effect of counteracting the lull in new business immediately after the holidays and getting customers connected before the advent of long hours of daylight in spring gets them out of the notion of electric light for the year.

A special effort is made to get residence business because Mr. Korst believes that when secured in large enough quantities it is even better than store lighting in a town where the stores close at 6 o'clock every evening. One way of securing residences as customers has been to get them to take a 16-cp porch light at a flat rate of 50 cents per month. After this is installed, the question of a hall light is taken up and then a meter is put in. It is only a question of time until the lighting of the whole residence is secured. Two large institutions having isolated plants are located in or near Janesville. In this case the isolated plants have proved a blessing in disguise, as the company is able to furnish service during the day time cheaper than the isolated plant, letting that take the undesirable peak load. At the county insane asylum the company furnishes lighting service entirely during the summer and pumps water, this pumping not being done during the peak. At the School for the Blind it furnishes day service, and is prepared to take the load if the isolated plant breaks down.

The wiring of customers' premises is not carried on as a business by the Janesville Electric Company. A separate company, the Janesville Contracting Company, of which Mr. Korst is the manager, undertakes this work.

The neutral wire on the secondaries of transformers and on the three-wire direct-current network is grounded as a safety precaution. The ground used is a galvanized-iron pipe 6 ft long, which is driven into the ground and has a ground wire soldered to it.

ADVERTISING.

About $50 per month is spent on daily newspaper advertising. Soliciting is done by Manager Korst and two others who spend part of their time at this work. A contract has recently been made with the C. W. Lee Company, of Newark, N. J., for six months' service of the little bulletin entitled "Electric Service," published for the use of central station companies. This is mailed to customers. A number of other publications have been issued by the company. In December, 1904, when the company completed its new power plant, an illustrated description was printed in pamphlet form as an advertisement of the company's power service. Another booklet of a size for enclosure in an ordinary envelope has been published during the past year setting forth in general the advantages of electric service and giving a list of the motors installed in Janesville. Two pages are given to advice to owners of unwired houses in which it is shown that the wiring and installation of good electric light and fixtures in a house is a better investment than anything else that can be made around it. In the past four years the number of concerns using electric power in Janesville has tripled, while the number of residences illuminated by electricity has been quadrupled. Seven hundred meters are now installed, the net gain in the past year being 200.

One of the company's recent advertisements is given here because of its originality and the excellent way in which it covers the ground. It reads as follows:

"LIGHTCRAFT

means getting the best and most light for your money, so arranged that you get every possible advantage, such as artistic effect, the most light where needed and the least waste.

"EXPERT TREATMENT.

"Every situation needs a special treatment. We have experts in lightcraft who are at your service for the asking. Our interests are identical with yours in getting results, results to you in the best illumination possible, to us in a satisfied customer who will get us others. Call, telephone or write to the Janesville Electric Company."

To carry on the business of the company, 17 persons are required. This does not include eight wiremen working for the Janesville Contracting Company on inside construction work for new customers. In the operation of the power plant four men are required at the central plant, two for each shift. At the Monterey plant there is one man for each shift. At the Fulton plant only one man is employed, but the plant is not operated 24 hours. Besides the station men there are four linemen, one trimmer, one meterman, one meter helper and one electrician. Two persons are employed in the office. An adding machine was recently put in the office on trial and found to be so useful that it was retained.

The company maintains a very attractive office and store room on the main street. This is open from 7 a. m. to 9 p. m. It is brilliantly lighted and has on display a large stock of electric fixtures and also motors and heating appliances.

PUBLIC HEATING DEMONSTRATION.

A public heating and cooking demonstration was held February 9 and 10 last, which excited much local interest. A recent letter from Mr. Korst as to this says:

"The results of our cooking demonstration were fairly satisfactory. We did not expect much in the way of immediate results, our idea being to show the people that when a house is wired for electricity the service need not be confined merely to lighting. The novelty of the demonstration also will cause ladies who visited it to chat about it and in this way the name of the company will be kept before the people. We sold six irons and have a good prospect for a complete electric kitchen. Much interest was shown in the other utensils and we will undoubtedly sell more later in the season. A demonstration of this kind would bring better results in the summer time because the people would then be more impressed by the absence of heat and would also be ready to begin immediate use. In the winter, many people keep their kitchen fire up with coal for the heating effect in the house as well as for cooking, and this makes it difficult to sell irons and cooking apparatus at this season."

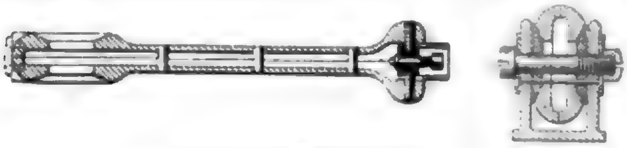
New Telephone Patents.

REPEATER CIRCUIT.

Mr. A. J. P. Bertschy, of Woodstock, Ill., has patented a repeating circuit for use when a successful repeater may have been found. In this circuit two repeaters are to be used at the repeating station, one effective each way. The diaphragm of each repeater is associated with a contact point in a manner such that the virtual resistance of the contact increases materially with the diaphragm in vibration. This contact controls the circuit of a shunting relay, the contacts of which shunt the other associated repeater. Thus, each repeater, through its shunting relay, may shunt out the other, according to which starts its vibration first.

TRANSMITTER ARM.

The accompanying illustration gives two sectional views of a new hollow transmitter arm patented by W. D. Gharky, of Philadelphia. It is designed particularly to fit that style of transmitter having integral connection lugs, as evidenced by the construction of the outer end. The hollow arm serves as a closed channel for the flexible cord, while the cone arrangement at the base renders clamping easy.



GHARKY TRANSMITTER ARM.

CIRCUIT PROTECTION.

E. A. Terpening, of Genesee, Ill., has found that receivers and induction coils legged to one side of a line and open at the switch hook contacts are subject to damage by lightning. To prevent this he advises the short-circuiting of these instruments, and to this end extra switch hook contacts are arranged to connect a short-circuit from the open point to the closed line whenever the receiver is on the hook.

INTERCOMMUNICATING SWITCH.

A self-releasing intercommunicating switch upon the push arrangement has been invented by A. G. Gilgen, of Passaic, N. J., his patent having been assigned to the New York Automatic Telephone Company. Locking bars which rotate upon longitudinal axes serve to unlatch and restore the pushes when the receiver hook is depressed. The return of the plug pushes to normal is accomplished by the back pressure of the contact springs. When a plug is depressed this contact spring rides up upon a portion so shaped that there is no tendency to return the push, there being merely a clamping action. When the hook is depressed, thus rotating the bars, these latter drive the plugs back until the restoring action of the springs begins.

STEP-BY-STEP SYSTEMS.

Three step-by-step party-line systems have recently been patented by Messrs. W. Palmer, Jr., of Rincon, New Mexico; P. T. Geyerman, of Brewster, Minn., and E. A. Buell, of De Kalb, Ill., respectively. These involve in various combinations the elements of their predecessors. While the adaptations are novel, there is nothing to indicate that these systems will accomplish more in practice than the earlier ones.

LETTER TO THE EDITORS.

High-Voltage, Direct-Current Railway Work.

To the Editors of Electrical World:

Sirs:—I note with interest Mr. Sprague's article on "The Reincarnation of an Electrical Idea" in the February 24 issue of the Electrical World. There seems to be great interest and evident concern regarding the advantages arising from the use of auxiliary poles in direct, as well as alternating-current motors and generators, and engineers are beginning to appreciate the fact that more economic proportions of electrical machines may be obtained through the use of this expedient. This principle, although not new, has been only recently brought to a state of perfection which allows it to be commercially utilized, and some of the results which we have obtained by its practical application to our "inter-pole" motors have revolutionized, to some extent, the design of commutating machines, and Mr. Sprague's indorsement at the present time is greatly appreciated.

It is to be noted that although Mr. Sprague had the idea he states that he did not insert any actual polar projections. In one of our recent trade publications, from which Mr. Sprague quotes at length, we call attention to the sparkless operation of the "inter-pole" motors, under conditions which render the ordinary type uncommercial, as well as to the reduction in size and weight of these motors, compared with the ordinary type. More torque, per ampere per pound of material in our motors, is obtained than in any other type on the market to-day. This naturally suggests the utilization of the auxiliary pole feature in motors for service where space is limited, and no better instance of the desirability of making full use of this maximum torque per ampere is furnished than in the ordinary railway motor. By its use it is possible to obtain a flexibility and economy of operations in railway service far superior to that now furnished by the so-called "standard" direct-current equipment used almost exclusively to-day.

Although the article above referred to suggests certain advantages which may rise from the use of this type for railway equipments, the author does not indicate any definite methods by which these results are to be obtained. It might be of interest to you, and to railway engineers at large, to know that we have developed and protected our "inter-pole" motor and controller systems along these lines to such a degree that we are able to state that without any more energy consumption than that required by the "standard" equipments they will give a considerable increase in the schedule speeds of existing railroads, or render it possible to retain present schedules at a lower energy consumption, and, therefore, enabling more to be operated from existing railway plants or the same number of cars at less expense.

Some idea of the enormous flexibility of our motors may be gained when we consider that the standard 500-volt types may be successfully operated on voltages up to 1,000 volts, and that they stand tests of 100 per cent overload in fields of only 10 per cent of the ampere-turns or normal rating absolutely without sparking. This at once suggests control systems vastly superior to any at present in commercial operation, giving almost an unlimited number of efficient running speeds as well as making it possible to operate on voltages never before attempted in direct-current railway work, even up to 2,000 volts. Also the advantages of using low voltages in cities and high voltages outside can be secured without the complications of carrying two sets of controlling apparatus on the same car, as is now done on the alternating-current-direct-current systems and the saving in the cost of feeders and the elimination of many sub-stations would be the direct result of thus being able to operate with the same motor on higher direct-current voltages. That is, on the main line, we could use 1,500 or 2,000 volts, but on branch lines or in towns or cities, the same motors could be operated on 500 volts with high efficiencies.

We are pleased to note that such an eminent authority as the author of the article referred to above has called attention to this basic principle upon which all of our motors have been designed and which we were the first to place on a commercial basis. It is wonderful to note what an intuitive grasp of the possibility of motor development Mr. Sprague had even in the early days, and that his predictions of the future of this type of motor in railway work have already been proven by our own experience.

BAYONNE, N. J. THE ELECTRO-DYNAMIC COMPANY,
Per G. H. Condict.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Starting of Single-Phase Commutator Motors.—RICHTER.—A discussion of the difficulties which single-phase commutator-motors offer during the starting operation. The author discusses the inherent difficulties and illustrates his theoretical explanation by results obtained in the testing department of the Siemens-Schuckert Works. The discussion is not intended to be exhaustive but only to explain the main difficulties and to show to what extent they may be obviated by different remedies. In all commutator-motors which have become of practical importance, windings of the armature are short-circuited by the brushes, while at the same time a magnetic flux—in general the excitation flux—passes through them. This flux produces an e.m.f. in the short-circuited coil, the e.m.f. being directly proportional to the frequency of the alternating current. This "e.m.f. at rest" can be obliterated by an opposing e.m.f. "of motion" if the armature revolves and if in the motor a "cross field" of proper intensity and phase is produced (as for instance in the repulsion motor). On the other hand, there does not exist so far any means of obliterating the obnoxious "e.m.f. at rest" while the rotor is at rest or during the starting operation. This e.m.f. in the short-circuited coil produces a current which increases the losses of the motor, especially at the commutator, and which causes sparking at the brushes and makes the starting of the motor most difficult. The author points out that just at starting the alternating-current commutator-motor is much inferior to the direct-current motor. He shows from actual experimental results that in starting the same power may be consumed as at full-load even if the losses in the starting transformer are not at all considered. If the latter would be considered it would be found that the total losses in starting with alternating-current and a starting transformer are even greater than in starting with direct current and ohmic resistances. The author discusses at some length the different remedies which have been suggested. The short-circuit currents in the armature coils short-circuited by the brushes make the starting operation difficult in two respects. First they produce a phase difference between the armature current and the flux and thereby increase the motor current; second, they increase the current passing through the brushes, heat the commutator, and increase the losses. Partial remedies to overcome the first disadvantage are the use of hard and thin carbon brushes, the increase of the reluctance of the magnetic circuit, the use of separate brush sets and in certain cases the employment of an induction coil in shunt with the excitation winding; but a complete remedy may be obtained only by using resistances inserted between winding and commutator. All these remedies have disadvantages. The use of thin brushes may lead to interruption of service since the hard carbons are brittle and break easily which will happen, for instance, if the wear and tear of insulation and copper is not the same. Further, there is an increase of the friction losses of the brushes since the pressure per unit of surface must be greater with thin brushes than with thick ones. An increase of the reluctance of the magnetic circuit increases the excitation voltage and the copper weight of the motor, also perhaps the iron losses. The use of separate sets of brushes requires a transformer and is effective only with very narrow brushes. A shunt-connected induction coil offers only small advantages if the stray field between excitation winding and short-circuited armature coil is large. Resistances between winding and commutator can be placed in the motor only with difficulty if they are chosen so large as to be effective. To overcome the second disadvantage mentioned above—namely the increase of losses—there is really only one remedy, that is, the use of resistances between winding and commutator.—*Elek. Zeit.*, February 15.

Voltage Regulation of Alternators.—LEGROS.—A mathematical paper on the calculation of the rheostats for the regulation of the voltage of alternators by either of the following two methods: In the first method a rheostat is connected in series with the shunt-winding of the exciter; in the second method it is connected in series with the excitation of the alternator in the main circuit of the exciter.—*L'Eclairage Elec.*, February 10, 17.

Direct-Current Dynamo Construction.—JORDAN.—An article illustrated by a great many diagrams describing in detail the winding of a typical direct-current armature.—*Elec. Jour.*, January.—The physical and other qualities demanded by the commutator and some details of commutator construction are discussed in *Elec. Jour.*, February.

Lights and Lighting.

Train Lighting.—VALBREUZE.—An illustrated description of the following systems of electric train lighting: Pieper-L'Hoest, Boese, Denhan, Siemens-Schuckert, Leitner-Lucas.—*L'Eclairage Elec.*, Feb. 10. The last named system is also described with illustrations in Lond. *Eng'ing*, February 16.

Power.

Large Motors for Reversing Mills.—A note stating that the Allg. Elek. Ges., of Berlin, is at present engaged in equipping the rolling mills of the Hildegardenhütte in Teschen with electric motors having a maximum output of 10,000 hp and some rolling mills belonging to the State Railroads at Budapest with 12,000-hp motors. The same firm is also providing the electric drive for the reversing mills of the Rombach iron works. These reversing rolling mills are to be directly driven by two 6,500-hp motors, and during the first part of the rolling operation the motors have to reverse six or seven times in a minute.—Lond. *Elec.*, February 16.

Induction in Transmission Circuits.—SCOTT.—An illustrated lecture giving an elementary consideration of the physical basis underlying self-induction and mutual induction in transmission circuits.—*Elec. Jour.*, February.

Traction.

Comparison Between Single-Phase and Three-Phase Equipment.—DE MURALT AND ARNOLD.—In an article of de Muralt the author takes the case of the Sarnia tunnel of the Grand Trunk Railway and analyzes the difference in cost of operation and efficiency of the service if three-phase motors should be used instead of single-phase. The author claims that by using the three-phase system there would be a saving in the first cost of installation, amounting to at least $100,000 out of a total of $500,000. In comparing the cost of operation, he estimates that 28 per cent of the cost of energy could be saved, mainly on account of recuperation of energy. B. J. Arnold, consulting engineer of the Grand Trunk Railway for this installation, replies to the article. He fully recognizes that there are conditions under which the three-phase system can show advantages so far as economy of operation is concerned, but in deciding upon the type of apparatus to adopt for a given installation there are many things to be taken into consideration aside from operating efficiency. Not the least of these are: First cost of installation, the commercial availability of the apparatus and convenient access to the manufacturer furnishing it. These three points will generally govern where the difference in efficiency of operation between systems is small. Regarding the first cost of single-phase and three-phase installation he states that while he has been led to believe that three-phase railroad equipment could be purchased for about the same cost as direct-current equipment, and therefore for less than single-phase equipment, when bids were asked for an installation of considerable magnitude upon a road with which he is connected, the tenders for the three-phase installation taken as a whole were much higher than those of either the direct-current or single-phase installations. He presumes, however, that if three-phase apparatus was manufactured in this country, this condition would not hold.—*St. R'y Jour.*, February 17.

Heavy Electric Traction.—SHEPARD.—A note on some features of heavy electric traction. In steam railway operation the economical movement of traffic is in large volume, that is, by long and heavy trains. The principal limits to development in this direction are found in the steam locomotive. The length of its rigid wheel base, the maximum weight on a pair of drivers and the steaming capacity cannot be materially increased. The electric locomotive operated from a high voltage trolley possesses certain fundamental features which adapt it to overcome these limitations. The high voltage trolley with sub-stations widely separated so reduces the cost of the transmission system that it it is no longer imperative to keep the load upon the system in small distributed units. The multiple control system overcomes the limitations of rigid wheel base and the weight on drivers of the steam locomotive. The horse-power which can be applied to the drawing of a train by locomotives is limited by the boiler capacity, but in the electric system it has no corresponding limit, as all trains receive their power from a large power plant. Instead of supplying one thousand horse-power to each of two trains running ten miles per hour an electric power house can supply two thousand horse-power to a single train at twenty miles per hour with equal facility, thereby reducing the number of train-hours for the handling of a given traffic.—*Elec. Jour.*, February.

Gas Power in Railway Plants.—BIBBINS.—A long illustrated article on gas power in the operation of high-speed interurban railways, from the experience on the Warren and Jamestown railway system. The results obtained are very satisfactory.—*Eng'ing Record*, February 17.

French High-Speed Electric Parcel Post.—As was already briefly noticed in the Digest, a French company called "Société des Chemins de Fer Electro-Postaux," has recently carried out successful trials on a circular and experimental high-speed electric parcel railway on a route 1 km. (0.62 mile) in diameter. The experimental parcel trolley car appears to have been 25 ft. long with pointed ends, and its cross-section 1 metre (3 ft. 3⅓ in.) square. This car was suspended from the track rail by two running wheels and guided by two pairs of side rollers. Each running wheel is belt-driven from a three-phase motor, 31½ in. in diameter. The current was collected by means of three collectors of the bow type. It is proposed to build such parcel posts between large cities, with two tracks (one for either direction of traffic), built one above the other in an underground tunnel of elliptical shape. It is not stated what speed was attained in the trials, but the promoters seem confident that a speed of 155 miles per hour can be safely maintained in practice with parcel trolleys carrying a useful load of 10 cwt.—Lond. *Elec.*, February 16.

Electric Railway Engineering.—The conclusion of the long discussion which followed the paper of Carter which was recently abstracted in the Digest. A majority of the speakers expressed themselves in favor of single-phase, while Carter maintained the position taken in his paper that with a severe suburban service the single-phase system could not hold its own against the direct-current system. He did not deny the necessity for using single-phase for main line working. Hobart advocated high-tension direct-current motors. He thought that "a fraction of the expenditure in developing the single-phase motor up to its present stage—which was considerably wanting when subjected to direct comparison—would have produced a highly satisfactory continuous-current high-voltage motor, and he trusted that manufacturers would give this their consideration."—Lond. *Elec.*, February 16.

Electric Railway Engineering.—The first part of a serial on electric railway engineering based on a course of lectures by Renshaw. The first paper by Wynne deals with general principles relating to the operation of cars or trains, the second paper by Webster to motor construction.—*Elec. Jour.*, January and February.

Overhead Equipment.—See the abstract under Wires, Wiring and Conduits.

Installations, Systems and Appliances.

British Central Station.—An illustrated description of the municipal central station of Mansfield, which is worked in conjunction with a refuse destructor treating 200 tons or so of refuse per week. There are three 240-kw compound-wound generators; their voltage is 480 to 600, being suited for either lighting or traction purposes. The latest one of the three generators installed has interpoles or commutation poles, and this is said to be the first application of this principle in British central station practice. The equivalent 8-cp lamp connections at the present time amount to 25,000, and for the street lighting 40 Gilbert arc and 14 ¼-ampere Nernst lamps are in use. The tramway consists of some 10 miles of route.—Lond. *Elec., Rev.*, February 16.

Heating and Lighting Plant.—GRAY—An illustrated description of the central heat, light and power plant of Bryn Mawr college. Electric distribution is on the direct-current, three-wire system with 250 volts between the outers.—*Eng'ing Record*, February 17.

Wires, Wiring and Conduits.

Overhead Equipment.—TWEEDY AND DUDGEON.—The first part of a paper read before the Birmingham section of the (Brit.) Inst. Elec. Eng. on the construction and maintenance of overhead equipment. The authors first speak of pole construction. "If engineers could persuade themselves that 18 in. sag in a 30-ft. span and 2 ft. across a 40-ft. road is neither unsightly nor detrimental, and would insist that the span wires are not pulled up any more than that, they would find the light poles which they have cast aside strong enough for 75 per cent of the construction, allowing heavier poles for curves and the like on 25 per cent of the line." When poles are subjected to less strain the quality of the concrete setting may also be reduced. Cast-iron bases are considered a luxury; if they are not to be given up, they should at least be drained and ventilated. The question of ventilation applies with almost greater force to the poles. "Another luxury, for which there is no more excuse than the base, and to which the objections are even stronger, is the cast-iron collar which conceals the joints in sectional poles." The authors then briefly discuss section pillars, span wires, bridle and pull-off wires, guard wires and hangers. Malleable iron hangers have the advantage over those made of bronze that no local

The authors mention the following incidents: "On the whole of one route, 5½ miles long, the hangers are of bronze; on another route, 4 miles in length, and a branch of the first, they are of galvanized malleable iron. While the span wires where they clasp the bronze hangers, are practically eaten through and have broken in several cases, the galvanizing of the span wires under the malleable iron hangers and on the hangers themselves is as good as it was when put up. That is conclusive evidence that the decay of the first span wires was not caused by rust. The same action occurs wherever the span wire is attached to secondary insulators in which the eyes are of brass." In discussing insulators the authors emphasize that electrolysis is the main factor concerned in the destruction of both iron and brass bolts. To obviate the troublesome failures of this kind they think that "entire prevention can be obtained by the insertion of a shield between the trolley-wire ear and the hanger, in order to keep the bolt dry. The trolley wheels cannot then throw water into the interior of the hanger, and neither rust nor electrolysis can corrupt. Secondly, the form of the hanger may be altered, making it nothing more than a metallic link between the ear and the span wire, and providing for insulation by means of two (three per span) external and independent insulators. Lastly, the hanger may be composed of homogeneous insulation, such as glazed porcelain, something in the shape of a cable sealing-end, through the center of which a plain metal bolt is passed. Whatever form the primary insulator takes it must be kept dry, or leakage and carriage of metal will start. Therefore, this porcelain insulator should be provided with a hood of some light material to guard it against rain, and with the shield mentioned above to prevent access of moisture from the trolley wheels." The authors then discussed secondary insulators and the leakage and electrolysis across them. The paper is to be concluded.—Lond. *Elec.*, February 16.

Slide Rule.—Roberts.—An article describing a method of making a simple slide rule for wiring calculations.—*Elec. Jour.*, February.

Electrophysics and Magnetism.

Coupled Oscillators.—Fischer.—If two condenser circuits or other electric oscillators of the same frequency are not coupled extremely loosely, two oscillations of different frequency and damping are generated in each circuit. If, in accordance with the Hertz-Bjerknes method, these two oscillations are made to act upon a condenser circuit of variable frequency, resonance curves with two maxima are obtained. The frequencies and decrements are easily measured by that method if the circuits are fairly closely coupled, since in that case the two maxima are separated by a region of zero resonance. But when the coupling is loosened, the two maxima gradually coalesce, and the Bjerknes method can no longer be employed. For this case the author has worked out a new method proposed by Zenneck, by means of which each of the two maxima can be studied separately on Bjerknes' principle. It is essential that the oscillations of the same frequency in the two systems shall have nearly the same phase, or else differ by 180 deg. The arrangement is shown in Fig. 1, where *I* and *II* are the oscillators, *B* a bolometer, *C* a variable condenser, and *M* the measuring circuit. If 4 is coupled with 2, and the measuring circuit is brought into resonance with one of the oscillations, then on adjusting the coupling of 1 and 3 to a minimum, the only maximum shown is that of the other oscillation.—Lond. *Elec.*, Feb. 16; from *Ann. d. Phys.*, No. 1, 1906.

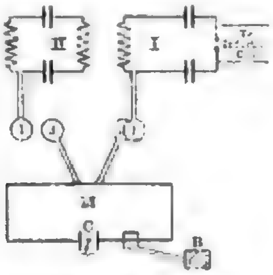


FIG. 1.—COUPLED OSCILLATOR.

Alpha Rays—Rutherford.—A second paper on some properties of the alpha rays from radium. The points brought out in this paper are summed up as follows: The rays from radium in radioactive equilibrium are complex and consist of alpha particles projected with different velocities. The alpha particles decrease in velocity in their passage through air and through aluminum. The absence of increased deflection of the rays from a thick layer of radium after passing through aluminum, observed by Becquerel, is a necessary consequence of the complexity of the rays. The decreasing curvature of the path of the rays in air, observed by Becquerel, is also a necessary consequence of the complexity of the rays. There is evidence of a distinct scattering of the rays from radium C in their passage through air.—*Phil. Mag.*, January.

Absorption of Alpha Rays.—McClung.—An investigation of the absorption of the alpha rays from radium by matter. The author used as the source of the alpha radiation the radioactive matter deposited on a wire which had been suspended in a vessel containing the emanation from radium. His results are in accordance with former measurements of Bragg and Kleeman. The author studied the absorption of alpha rays by air and aluminum. One layer of aluminum 0.00031 cm. in thickness absorbs as much alpha radiation as 0.5 cm. of air. The agreement between several of his results points strongly to the conclusion that the ionizing, photographic, and phosphorescent effects of the alpha rays from radium are all due to the same cause, and that it is very probable that in each case the effect produced is primarily one of ionization.—*Phil. Mag.*, January.

Rate of Decay of Radioactivity.—Bronson.—An account of an experimental investigation of the effect of high temperatures on the rate of decay of the active deposit from radium. The main results are as follows: Temperatures between 700° and 1,100° C. do not permanently affect the rate of decay of the active deposit from radium. Radium *B*, and not radium *C*, has the longer decay period. The previous values of twenty-eight and twenty-one minutes are too large for the decay periods of radium *B* and *C* respectively, and twenty-six and nineteen minutes are much closer to the true values.—*Phil. Mag.*, January.

Uranium.—McCoy.—An account of an experimental investigation of the relation between the radioactivity and the composition of uranium compounds. Radium is between 3.3×10^6 and 4.25×10^6 times as active as uranium.—*Phil. Mag.*, January.

Constitution of Atom.—Lord Rayleigh.—A mathematical paper on electrical vibrations and the constitution of the atom. The author refers to Thomson's view of an atom being composed of a large, but finite number of negative electrons within a sphere of positive electrification, and investigates what becomes of the theory when the number of electrons becomes infinite. He makes some critical remarks on the application of Thomson's views to the explanation of spectrum analysis. The issue also contains a paper by the same author on the constitution of natural radiation with reference to a recent publication by Larmor.—*Phil. Mag.*, January.

Units, Measurements and Instruments.

Iron Core Alternating-Current Instruments.—Sumpner.—A description of various new kinds of alternating-current instruments, in which the author endeavored to imitate the model of the permanent-magnet moving-coil instrument for direct-current circuits. The instruments, which comprise ammeters, voltmeters and wattmeters, are characterized by having a moving-coil circuit and a fixed electromagnet. An electromagnet introduces in general errors of two kinds; the magnetism produced may differ from what is required in its amount or in its phase and wave form. These points are discussed and four diagrams are then given (Figs. 2 to 5) which show how the instrument may be

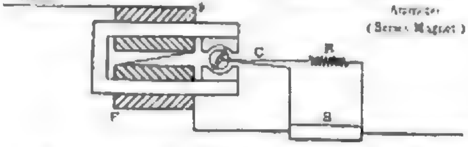


FIG. 2.—ALTERNATING-CURRENT AMMETER.

connected to the circuit for the various purposes of an ammeter, a wattmeter or a voltmeter. The instrument has two circuits, each of which may be connected with the mains in series or in shunt. There are thus four cases to consider. Figs. 2 and 3 represent the ammeter and wattmeter, each with a series-wound electromagnet. Figs. 4 and 5 represent shunt magnet instruments, the former denoting a voltmeter, and the latter a wattmeter. In Fig. 4 the moving coil, *C*, is put across the mains in series with a condenser, *K*. In Fig. 5 the moving coil, *C*, forms part of a circuit including a large non-inductive resistance, *R*, and the secondary, *S*, of a small transformer whose primary *P*, is traversed by the main current. This transformer must have a magnetic circuit of constant reluctance. In both of these cases the moving coil current is in quadrature with the electrical quantity producing it. Thus in Fig. 4 it is proportional to the rate of change of the voltage, while in Fig. 5 it is proportional to the rate of change of the current. The reason for securing the quadrature relationship is to be found in the action of the electromagnet when excited by the voltage of the mains. With a magnet of good design the induced voltage in the windings due to the changing magnetism in the iron will be so large compared with the copper drop that the former will not appreciably differ from the voltage of the mains. The magnet flux, *F*, and the line voltage, *V*, will be in quadrature, since *V* will be proportional to the rate of change of *F*. The moving coil current, *C*, will be caused by *Q*, the second electrical quantity affecting the instrument. In Fig. 4 *Q* is the line voltage *V*, while in Fig. 5 *Q* is the load current *A*. Thus the average product of *VQ* is either the square of the voltage for Fig. 4 or the power in watts for Fig. 4. The deflection of the instrument is dependent on the average product of *CF*. Now it can be proved mathematically that whatever the frequency or wave form, the mean value of *VQ* is proportional to the mean value of *CF*, provided exact quadrature relationships are obtained—that is, if *V* varies as the rate of change of *F*, and if *C* varies as the rate of change of *Q*. Under these circumstances the deflection of the instrument will measure either the voltage or the watts if the instrument connections are those of Fig. 4 or Fig. 5 respectively. The shunt magnet has a striking property most valuable for instrument purposes. Its magnetism is determined by the voltage, and variations in the permeability of the core do not alter the ratio between the two. If the voltage doubles the magnetism must also double, whether the permeability varies or remains constant. This is strictly correct only if the resistance of the winding is zero. The author points out that the characteristics of the electromagnet when excited by a series or shunt winding form a striking contrast and explains why for an ammeter the series magnet must be used. —Lond. *Elec.*, February 2.

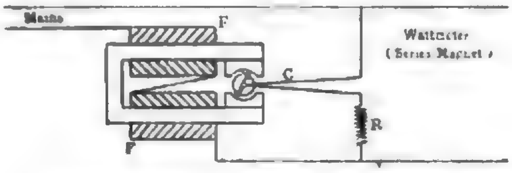


FIG. 3.—ALTERNATING-CURRENT WATTMETER.

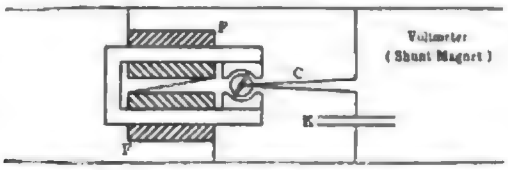


FIG. 4.—ALTERNATING-CURRENT VOLTMETER.

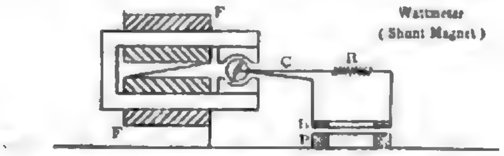


FIG. 5.—ALTERNATING-CURRENT WATTMETER.

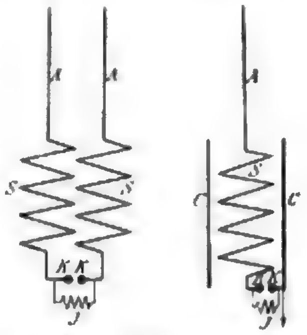
Series Transformers for Wattmeters.—Wild.—Alternating-current wattmeters and ammeters when used with currents above 100 or 200 amperes are generally worked with series transformers. The main object is to avoid the large errors due to the effect of eddy currents that occur when a conductor of large section is brought into the instrument itself. The use of the series transformer may also introduce serious errors unless it is carefully designed. In order that accurate results may be obtained it is necessary that the current ratio of the transformers be as nearly as possible equal to the winding ratio, and also the phase difference between primary and secondary currents as small as possible. This result must be obtained by reducing the core loss and magnetizing currents to a minimum and by paying very careful attention to the question of magnetic leakage. A design of transformer adopted by the author is described in detail. Incidentally the author mentions some determinations of core loss which bring out rather an interesting fact not hitherto published—namely, that between values of Bmax of from 200 to 400 the core loss reckoned in watts increases as about the 2.7th power of Bmax, which contravenes the Steinmetz law (or rule), and is quite different from results commonly obtained at ordinary transformer iron at maximum densities of 2,000 to 8,000.—Lond. *Elec.*, February 16.

Resolving a Periodic Wave Into Its Harmonics.—A mathematical paper by Lyle on an expeditious practical method of harmonic analysis in *Phil. Mag.*, January.—An article illustrated by diagrams on a graphical method of harmonic analysis by Harrison in Lond. *Eng'ing*, February 16.

Phase Meter.—Sumpner.—His full paper on the mathematical theory of phase meters, an abstract of which has been noticed in the Digest.—*Phil. Mag.*, January.

Telegraphy, Telephony and Signals.

Resonator for Wireless Telegraphy.—Koepsel.—The closed oscillation circuit adopted first by Braun and later by others has a great advantage over the original Marconi sender, since it permits a considerable increase of the energy of the system, on account of a greater capacity. The author has endeavored to design an open resonator of large capacity. A successful open resonator would be much simpler in operation and would not require as careful tuning as the closed type adjustment. The resonator of the author is shown in Fig. 6, in which the vertical wires, *AA*, before they are connected with the spark-gap, *KK*, are wound in coil form, whereby the coils may be placed either side by side or may be wound one above the other. By changing the distance of the two coils it is possible to increase the capacity of the system at will while the self-induction of the same (which is identical with the mutual induction if the system is considered as a whole) may be diminished at will down to a practical limit. By changing the distance between the two coils it is therefore possible to adjust the self-induction and capacity. Nevertheless the system—like the ordinary open resonator—will always remain in resonance. The number of windings of the two coils may of course be chosen at will. For instance one coil may consist of many windings, the other of only one. If the latter is earthed the arrangement shown in Fig. 7 is obtained which consists of a coil, *S*, connected to the vertical wire, *A*, the coil, *S*, being surrounded by an earthed cylinder, *C*. This open resonator has the advantage that the tuning process is much easier so that, with one and the same vertical wire, different



FIGS. 6 AND 7.—RESONATORS.

wave lengths may be transmitted or received. The author discusses in a general way the advantages of the system, but it does not seem that he has yet tested it by experiments.—*Elek. Zeit.*, February 15.

Automatic Circuit Breakers.

The accompanying illustrations show the type C line of automatic circuit-breakers which have been developed by the British Thomson-Houston Company. A form G breaker is indicated in Fig. 1. This circuit-breaker is provided with a toggle joint, which makes the action quick and positive. The main contacts are of laminated copper, and the secondary or arcing contacts are of carbon, which can be easily removed. This form of breaker is intended for use with either direct or alternating-current circuits.

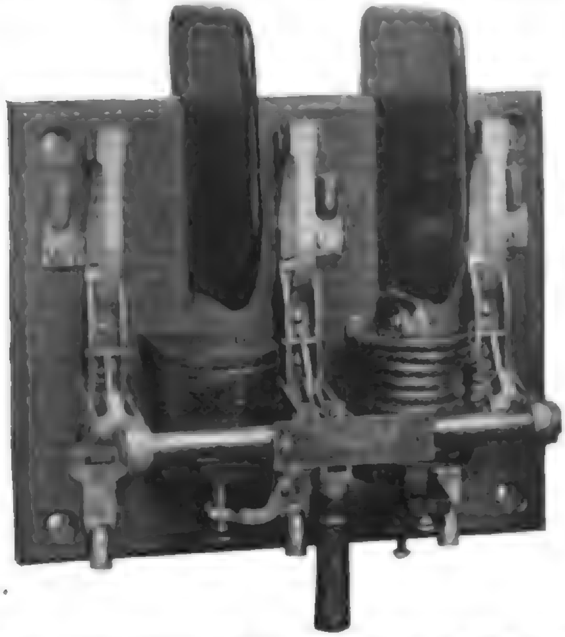


FIG. 1.—CIRCUIT-BREAKER WITH ONE OVERLOAD AND ONE LOW-VOLTAGE COIL.

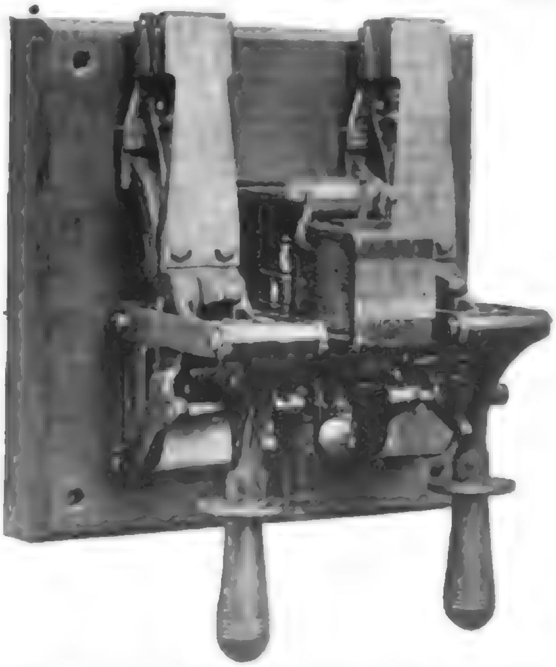


FIG. 2.—CIRCUIT-BREAKER WITH LOW-VOLTAGE ATTACHMENT.

In the form P breaker, one model of which is shown in Fig. 2, three distinct contacts are employed, the main contact, the auxiliary copper contact and the auxiliary carbon contact. These are arranged one above the other in the direction in which the arc naturally tends to travel, thus removing the danger of transfer of the arc on to the main contacts owing to draughts. A quick break is secured without the aid of any auxiliary springs, and the trip is of the gravity type, being also independent of springs.

A form K is shown in Fig. 3. These breakers are especially designed for the heaviest service. All movements are in a vertical edgewise plane, and all parts are so arranged as to allow a number of circuit-breakers to be mounted in line on short centers with maximum clearance. The main current carrying parts consist of two studs through which the current is led from the back of the board into the working parts at the front. The copper laminations are forced into contact by a toggle mechanism giving high pressure at the end of the stroke with minimum effort of the operator and minimum load on the trip or catch. The spreading of the laminations gives a powerful spring action which promptly throws the moving parts to the open position when the circuit-breaker is tripped from the catch. The opening action is completed by gravity, no auxiliary springs being required.

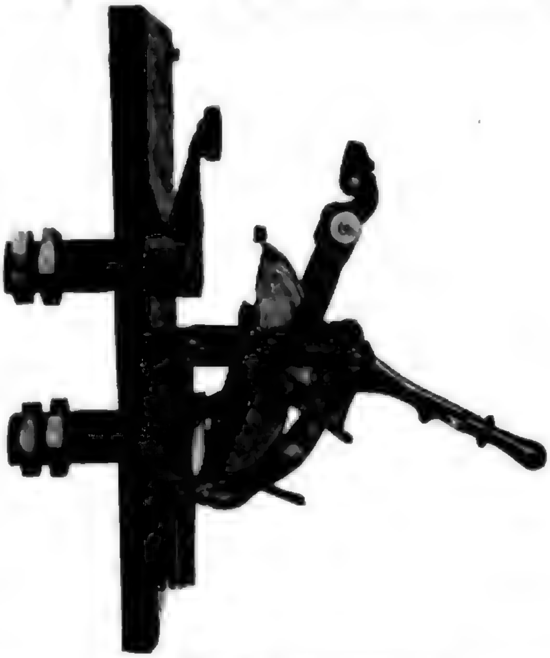


FIG. 3.—6,000-AMP. CIRCUIT-BREAKER.

The American agent for these breakers is the General Electric Company, Schenectady, N. Y.

Single-Phase Road for Milwaukee, Wis.

The Milwaukee, Wis., Electric Railway & Light Company has made a contract with the General Electric Company for single-phase equipment to be placed on two of its longer suburban lines. One of these lines will extend from Waukesha to Oconomowoc, a distance of twenty miles, and the second will operate between Hale's Corners and Mukwonago, a distance of sixteen miles. Both lines will be operated at a potential of 3,300 volts, and in addition the motors are designed to run on the existing seven miles of 550-volt direct trolley line between West Allis and Milwaukee.

The motors to be furnished for this equipment are the standard General Electric alternating type, shown in the illustration. Each of the ten cars comprising the initial equipment for the road will be furnished with four motors of 75 hp each. These are of the compensated type, comprising an armature similar to the ordinary standard direct-current, bar-wound form, with mica insulated coils. The motor fields consist of laminated pole pieces over which are slipped the spools of the exciting winding; the compensating winding consists of a bar winding inserted in the pole faces and permanently connected in series with the armature winding. The 75-hp motor is wound for four poles and has a maximum speed of about 1,400 r.p.m.

These equipments will in general be operated as single cars, but occasionally will be run in two-car trains. For the flexible control of these train combinations the Sprague-General Electric system of multiple unit control will be used, adapted for operation on alternating current. The compensator for use in these cars is of the oil-cooled type, and is wound for 3,300 volts on the primary, with five different secondary taps for controlling the speed of the motor. In order that the acceleration may be smooth special devices are employed so that there will be no break in the circuit from one tap to the next during a change in speed.

75-HP ALTERNATING-CURRENT RAILWAY MOTOR.

The speed regulation is so devised that the running speed will be the same on both the alternating and direct-current portions of the line.

Distribution to the various transformer sub-stations on this line will be at 33,000 volts. At the stations the current will be fed to the trolley line at 3,300 volts. For this latter the General Electric catenary construction will be used. It is proposed to have this line in operation during the fall of 1906.

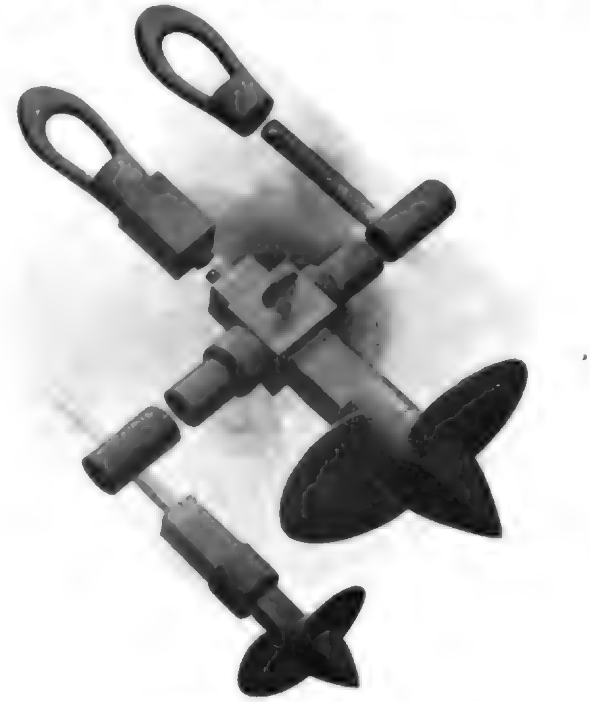
Guy Anchors for Electric Poles.

A number of material improvements have been made in the Stombaugh guy anchor, the patents of which are owned by W. N. Matthews & Brother, 227 North Second Street, St. Louis. A new type is herewith shown. The 5 and 6-in. anchors are now made with a square shank of equal size permitting the use of the same wrench for both anchors, whereas formerly separate wrenches were necessary.

In the past, considerable trouble has been caused the users of the 5 and 6-in. anchors by defective welds in the rods and eyes. A full rod is now used with no welds. The eye is drop-forged and threaded to the rod. A much larger eye is thus permissible and the eyes are now made amply large to accommodate standard guy thimbles. This eye is made smooth and of such shape as to do away with the absolute need of the thimble.

The hollow shaft is made of seamless square tubing of much greater torsional strength than the old style round tube. It is further reinforced by a malleable iron square key that fits the square shanks of the anchors. This key is brazed on. The handles are attached to a sliding cross that is held at any point on the shaft by means of a non-removable set-screw. This sliding cross is a great convenience when screwing the anchor into the ground, as the maximum amount of leverage can always be had at all stages of the installation.

In installing the anchor, the hollow shaft is slipped over the rod after removing the eye. It is keyed firmly to the square shank of the helix, and the eye is then replaced on the end of the rod. The eye will serve to hold the wrench firmly in place during installation. The handles are then slid down the shaft to a convenient point, and then the anchor is screwed in until the handles get too close to the ground for further manipulation. The set screw is now loosened and the handles are slid back again to a more convenient position for work, when the process is repeated as before until the anchor is driven in to the required depth. The eye is then removed, the wrench pulled out, the eye replaced, the guy strand is attached, and the pole is anchored securely in a period not exceeding 15 or 20 minutes.



STOMBAUGH GUY ANCHORS.

The Hatch Storage Battery.

The new Hatch accumulator, as such it might be termed, although it gave most satisfactory practical results wherever installed, has been improved upon and carried to a greater degree of perfection within the past year. The capital of the company has been increased to allow for extending its plant and the handling of some very large contracts for which its old facilities were entirely inadequate.

The battery has been described previously in our columns and its general features are well known. The positives are enclosed in a porous stiff pottery envelope and do not deteriorate by the falling away of the active material, while there is no accumulation of mud in the base of the cell. At the same time the negatives are directly exposed to the electrolyte, thus providing for the free escape of the gases generated at the negative. The entire surface of all the Hatch metallic electrodes is covered by the active material, and no current can pass without going through the active material. The exposure to the electrolyte is the maximum, and hence the internal resistance is correspondingly reduced to the lowest point.

Moreover the introduction of the porous diaphragm breaks up the bubbles in the electrolyte and equalizes the flow of gases on charge, so that at no time are the fumes annoying, nor do the containing jars become covered with the spray of the solution, while in the use of wooden lead-lined boxes they never become saturated, it is said, as in the case of batteries of the open grid type. There is, moreover, freedom from the difficulties of rapid disintegration, due to discharge at high rates, or from the giving up of the oxygen from the positive plate, when the minute explosions in the mass of the active material tend to break it up gradually and to slough off the loosened particles. The Hatch accumulator, it is stated, does not from such a cause lose its original capacity or short-circuit through the sludge in the bottom of the cell. The Hatch Accumulator Company has its headquarters at 60 State Street, Boston.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Trade conditions are favorable and country buyers are making liberal purchases. All reports foreshadow an early and active spring, and crop reports are generally satisfactory. The iron and steel markets were quiet, but the consumption is very heavy. Shipments of finished materials are of unprecedented proportions, but mills are still well booked ahead. It is stated that a large amount of structural material business is in sight, the orders last month being very heavy. The demand for copper has improved and prices are higher. The week ended with some notable sales for deliveries extending through May and June at 18½ cents for lake and electrolytic. Casting copper is in good request, and there are fair amounts available for pressing requirements. The best brands fetch 18¼ cents. The visible supply of electrolytic is next to nothing. Few of the plants are able to get the volume of metals for keeping the works running to full capacity. Production is slowly increasing in the West and Southwest, but domestic consumption, especially by the electrical trades, keeps equal march with the increased output. Old copper is firm and there is little of it at home or abroad. Old copper wire, in a round lot, brought 18 cents. *Bradstreet's* reports that February failures were 762 in number and liabilities were $9,549,860. The number of casualties was the smallest, with one exception, in February for 14 years past, and was 10 per cent less than a year ago. Liabilities show an increase of 6 per cent over February, 1905, but are 40 per cent less than in February, 1904. The heaviest decrease in number of failures from a year ago was in the South, and the only important increase in liabilities, that reported by the western group, is explained by bank failures in Illinois. Business failures for the week ending March 1 numbered 180, against 186 the week previous and 206 in the like week of 1905.

ALLIS-CHALMERS STEAM TURBINES.—Following the starting of the 1,500-kw Allis-Chalmers turbine unit at Utica, N. Y., 60-cycle, 2,500-volt, two-phase, for the Utica Gas & Electric Company, and the recent installation of a 5,500-kw, 25-cycle, 6,600-volt, three-phase unit at the Williamsburg Station of the Brooklyn Rapid Transit Company, the Allis-Chalmers Company has installed and now under construction 28,000 kw in turbine alternator units. The New York Edison Company, New York City, has on order a 1,500-kw unit, 60 cycles, 2,500-volts, two phase; the Westchester Lighting Company, New Rochelle, N. Y., a 1,500-kw 60-cycle, 13,200-volt, three phase unit; the United States Locomotive Equipment Company, Dayton, O., a 1,500-kw, 60-cycle, 2,500-volt, three phase unit, and the Memphis Consolidated Gas & Electric Company, Memphis, Tenn., a 1,500-kw unit, 60 cycles, 2,500 volts, three-phase. The city of Jacksonville, Fla., recently purchased two 500-kw, 60-cycle, 2,300-volt, three-phase units, and the Western United Gas & Electric Company, of Aurora, Ill., will install a 500-kw Allis-Chalmers turbine and alternator, 60 cycles, 2,200 volts, two-phase. Three 1,500-kw units, 60 cycles, 2,300 volts, three-phase, have been purchased by Mr. John I. Beggs, president of the Milwaukee Electric Railway & Light Company, Milwaukee, for installation in the power house of the handsome new terminal station and office building, which is rapidly nearing completion. The latest additions to the list are the Kokomo, Marion & Western Traction Company of Kokomo, Ind., recent purchasers of a 1,000-kw, 60-cycle, 12,300-volt, two-phase unit, and the Western Canada Cement & Coal Company of Calgary, Canada, which has just placed an order for three units, each of 1,000 kw, 25 cycles, 600 volts, three-phase. For direct connection to each of the turbines mentioned above, the Allis-Chalmers Company furnishes the Bullock alternating-current generator, built at its electrical works in Cincinnati.

MORRISBURG MUNICIPAL PLANT.—Tenders will be received until March 20 by A. A. Logan, Reeve of Morrisburg, Ont., Canada, as follows: For erecting and fully completing in the most advanced methods an electrical development plant of 1,100 electrical horse-power under 9 ft. 6 in. head of water. The tenders to include all and every expense from the beginning of the excavating of earth to the fully developed power, together with about one mile of transmission line from the site of the power plant to the Canada Tin Plate & Sheet Steel Company's buildings, including cable across the Williamsburg Canal, excepting such expenses only as the council of the village of Morrisburg may see fit to incur in the way of inspecting, engineering, etc. All plans and specifications must after selection by the council of Morrisburg be submitted to the Department of Railways and Canals of Canada for their approval before contract can be let thereon. No expense to be incurred by the village of Morrisburg in connection with any tender or plans and specifications submitted for approval. It is desirable to have voltage, etc., to conform to the present electric light plant, namely, volts (no load), 2,080; (full load), 2,300; three-phase frequency, 60 cycles per second. As it is desirable to complete this plant as quickly as possible, each tender should state length of time they will require to do the work in.

POWER IN MICHIGAN.—The Michigan Power Company, of Lansing, is a reorganization of the Piatt Power & Heat Company. The object of the reorganization is for the more extensive development of the water power of Grand River. The capitalization of the new company is $2,500,000, and it is expected that within the next two years at least $1,250,000 will be expended in the construction of additional dams on Grand River and the erection of a new central power heating plant in Lansing, for which franchise has been secured. With the completion of all the power projects of the new company, it is anticipated that 15,000 horse-power will be secured. The financial business of the reorganized power company has been conducted by Devitt, Tremble & Co., of Chicago. The officers of the Michigan Power Company will be: President, A. A. Piatt; vice-presidents, F. B. Piatt and C. C. Carnahan; treasurer, M. A. Devitt; secretary, D. O. Watson. Plans for the new central power and heating plant and for dams at Dimondale and Eagle are now being prepared by W. H. Schott, of Chicago.

WISCONSIN ENGINE COMPANY.—The Wisconsin Engine Company, of Corliss, Wis., W. P. Marr, secretary, acquired by purchase on February 21 the entire plant and equipment, including the patterns and drawings of the Brown Corliss Engine Company. The old force of skilled artisans has been retained, and, as there has not been any interruption in the operation of the works, the Wisconsin Engine Company is prepared, it states, to engage to build Corliss engines and make unusually prompt delivery. The facilities of the plant are to be increased.

PRESSED STEEL POLE FACTORY.—The Pressed Steel Pole Company, of 505 Times Building, Pittsburg, Mr. John Noland, secretary and general manager, advise us that their new factory is rapidly advancing to completion. The building with all the foundations and handling facilities is practically complete and ready for the installation of machinery, and the plant, it is expected, will be delivered and erected ready for operation during March.

CARS FOR ATLANTIC CITY LINE.—The Wason Car Manufacturing Company has received another order from the Pennsylvania Railroad for eleven large electric cars, to be used on the line between Atlantic City and Camden. The contract calls for five electric passenger cars and six mail and baggage cars, built on the same plan as the other cars. It is a $75,000 order, and is the second from the railroad in a few months.

INDIANAPOLIS, IND.—One of the largest orders ever awarded the Pope Motor Company, of this city, has been placed by the Anheuser-Busch Brewing Company, of St. Louis, Mo., and calls for ten large trucks with an individual capacity of one ton. They will be used for delivery and freight purposes and represent an aggregate cost of $40,000.

THE BALDWIN LOCOMOTIVE WORKS have received an order from the Pennsylvania Railroad for the motor and trailer trucks for the West Jersey & Sea Shore electric line to Atlantic City, the electrical equipment of which is to be furnished by the General Electric Company.

CURRENT FOR ELEVATED.—The Chicago Edison Company is to supply current en bloc to the Metropolitan Elevated system of that city, and the railroad has let contracts for two sub-stations, for $100,000, to receive and distribute the current.

ESCALATOR FOR HARLEM, N. Y.—The Otis Elevator Company, which put up the escalators at Twenty-third Street and Thirty-third Street on the elevated and at Manhattan Street on the Subway, will also construct one at Eighth Avenue and One Hundred and Twenty-fifth Street. After the order is placed it will take 90 days to make as large an escalator as will be needed. Then it takes two or three weeks to install it. The total cost of the change will probably amount to $50,000. It is estimated that from 18,000 to 20,000 persons make the climb at 125th Street every day. There are three long flights of stairs from the street level to the platform of the elevated road, but there are four Otis elevators running to one flight below the platform.

SHIPYARD EQUIPMENT.—The Cleveland office of the Westinghouse Electric & Manufacturing Company has secured a contract from the American Shipbuilding Company for electrical equipment for a power plant to be erected at the Lorain shipyards. There will be two 400-kw generators driven by two 500-hp Atlas engines and two 300-hp vertical type motors will be direct-connected to centrifugal pumps for removing the water from the dry docks. There will also be a 50-hp motor direct-connected to a centrifugal pump for the power station.

TELEPHONE SWITCHBOARD ORDER.—The Dean Electric Company, of Elyria, Ohio, is installing a new switchboard for the Medina Telephone Company. It is a central-energy two-section, five-position board with facilities for party-line service.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market assumed a waiting attitude owing to higher money with continued uncertainty about prospective deals and also about the coal strike situation. At the same time the market rallied easily on the shorts and displayed resistance to attacks of that character. The general impression in Wall Street regarding the coal trade situation is that a miner's strike is less probable, but, on the other hand, a good deal of attention is being given to the discussion of the railroad rate bill in the Senate, and there has also been more or less uncertainty about some of the pending deals, notably the one which has been so much talked about between the Great Northern Railway and the United States Steel Corporation, with regard to the ore lands of the former company. United States Steel shares sold off at first with the rest of the market and were not especially prominent. Metropolitan Street Railway and Metropolitan Securities were the objects of liquidation prior to the announcement of the success of the Interborough-Metropolitan deal. Various industrial stocks also showed a good deal of irregularity. Allis-Chalmers common is down 1½ points and preferred 3¾, the closing quotations being 20⅛ and 56, respectively. General Electric closed at 167¾, which is a net loss of 2¾ points, and Westinghouse lost 1 point, closing at 160. American Locomotive common closed at 68⅝, a decline of 4⅝, and preferred at 116, a loss of ½ point. The traction stocks are all lower with the exception of Interborough Rapid Transit, which made a net gain of ½ point, closing at 228½. Brooklyn Rapid Transit lost 2⅛ points net, the closing quotation being 80⅛, and Metropolitan Street Railway closed at 116, having dropped as low as 111 during the week, this being the bottom price of the year. The lowest quotation for this stock in 1905 was 114. Interborough-Metropolitan is quoted on the curb market at 53, and 4½s, 91½. Western Union Telegraph made a net gain of ⅜ point, closing at 93⅝, and American Telephone and Telegraph declined 2 points, the last quotation being 138. The only feature of the curb market during the week was the continued liquidation throughout the list, the center of pressure being the local traction group. The copper stocks were also freely sold. Declines extended to three to five points in some issues. The influencing factors were the same as governed in the general stock market. The above table shows the closing quotations of the stock market of March 6.

	Feb. 27	Mar. 6		Feb. 27	Mar. 6
NEW YORK					
Allis-Chalmers Co.	21⅝	20⅛	General Electric	170½	167¾
Allis-Chalmers Co. pfd.	59¾	56	Hudson River Tel.	...	...
American Dist. Tel.	37	37	Interborough Rap. Tra.	...	228½
American Locomotive	73¼	68⅝	Mackay Cos.	61¼	60
American Locomotive pfd.	116½	116	Mackay Cos. pfd.	74¼	72¾
American Tel. & Cable	90	93	Marconi Tel.	...	...
American Tel. & Tel.	140	138	Metropolitan St. Ry.	...	116
Brooklyn Rapid Transit	82¼	80⅛	N. Y. & N. J. Tel.	...	...
Electric Boat	26	27	Western Union Tel.	93¼	93⅝
Electric Boat pfd.	60	66	Westinghouse com.	161	160
Electric Vehicle	17	17	Westinghouse pfd.	...	...
Electric Vehicle pfd.	19	16			
BOSTON					
American Tel. & Tel.	139⅜	138¼	Mass. Elec. Ry. pfd.	67	67
Cumberland Telephone	118	118⅜	Mexican Telephone	4⅜	4⅛
Edison Elec. Illum.	...	248½	New England Telephone	136½	135⅝
General Electric	...	167¾	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	19¼	18⅝	Western Tel. & Tel. pfd.	...	90
PHILADELPHIA					
American Railways	52¼	51	Phila. Electric	8	7⅞
Elec. Co. of America	11⅛	11⅜	Phila. Rapid Trans.	31¾	30⅝
Elec. Storage Battery	79	78	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			
CHICAGO					
Chicago City Ry.	...	193¼	National Carbon	86	82
Chicago Edison	...	160	National Carbon pfd.	119	120
Chicago Subway	...	...	Union Traction	...	...
Chicago Tel. Co.	...	130	Union Traction pfd.	...	...
Metropolitan Elev. com.	27⅛	28			

* Asked.

CAHILL TELHARMONIC COMPANIES.—We understand that the commercial organization of the Cahill Telharmonic interests (elsewhere explained in this issue) is somewhat as follows: Three exploiting companies, licensed by the inventor, have been former, one for New York State, one for the New England states and one for the Pacific Coast states. In the first two companies named the following gentlemen are directors: H. Carrol Brown, banker; J. William Middendorf, banker; Douglas H. Gordon, president International Trust Co.; A. H. S. Post, vice-president Mercantile Trust Co.; N. W. James, capitalist; F. C. Todd, manager Baltimore office General Electric Co., all of Baltimore; J. G. White, president J. G. White & Co., of New York; Oscar T. Crosby, late general manager Railway Department General Electric Co., of Washington, D. C. The latter is also president of the New York Music Co., and Mr. F. C. Todd is president of the New England Electric Music Company. Both have their temporary headquarters in the Continental Trust Building, Baltimore, Md., but are now engaging New York and Boston offices. The New York Company, through the Telharmonic Company of Greater New York, will make the first installation, for which a lease is now being closed on a prominent Broadway corner. Other local companies throughout New York and New England will be formed at an early date. The Pacific Coast Telharmonic Company has its headquarters in Seattle, Wash. Its officers are Mr. Jas. W. Smith, president; Mr. T. O. Abbott, general manager, and its directors are prominent business men of Seattle.

THE LOS ANGELES-PACIFIC DEAL.—The report is current that the Los Angeles-Pacific Railway Company has disposed of its properties for $6,000,000. The purchaser is said to be E. H. Harriman, of the Southern Pacific, together with Kuhn, Loeb & Co. and the Standard Oil Company. That Mr. Henry E. Huntington does not figure in the transfer, in spite of the generally accepted theory that he has long held an option on the property, is conceded. At the Huntington railway quarters in Los Angeles it is said that such a transfer of the Los Angeles-Pacific would be undoubtedly regarded by Mr. Huntington as a hostile move. For many years Mr. Huntington has been on the most friendly terms with both E. P. Clark, president, and Gen. M. H. Sherman, vice-president of the railway company. It is said that the purchase price of $6,000,000 will be equally divided between Mr. Clark and Gen. Sherman. With the absorption of the Clark-Sherman interests by Mr. Harriman and his associates, it is highly probable that the Southern Pacific's Santa Monica steam line will be electrified at an early date. E. P. Sherman, son of Gen. M. H. Sherman, has been appointed as general superintendent of the Los Angeles-Pacific Railroad Company, while Mr. C. H. Ellison, lately of the Southern Pacific, has been made chief engineer.

ROCKY MOUNTAIN BELL.—One of the rapidly growing Bell organizations is the Rocky Mountain Bell Telephone Company, which has issued its report for the year ending December 31, 1905. It shows as follows:

	1905.	1904.	1903.
Gross earnings	$1,221,774	$1,043,410	$863,144
Expenses	1,003,042	871,640	648,101
Net income	$218,731	$171,761	$215,042
Dividends (6 per cent)	140,228	135,888	134,863
Surplus	$78,503	$35,873	$80,179

TRACTION AROUND BUFFALO.—The report of the International Traction Company of Buffalo, for all systems, shows a gross for the year ending December 31, 1905, of $4,484,643, expenses of $2,483,663, and a net total income of $2,069,542. Interest, taxes and rent, etc., amounted to $1,652,376, expenses for improvements were $345,310, and the net surplus was $71,856. President Pierce, of the International Traction Co., in his report to the stockholders, says that within the last year the company has made long-time contracts for the purchase of power for the Tonawanda-Lockport-Olcott district; besides, agreements with several suburban roads by which their cars will be brought into the center of Buffalo over the lines of the company. The entire capital stock of the Electric City Railway Co of Niagara Falls, N. Y., has been purchased at a cost of $108,500. This company owns valuable franchises and has four miles of track constructed. All of the equipment of the International Traction Co. is in use, and 150 new cars, to cost $900,000, have been ordered.

BIRMINGHAM, ALA., BONDS.—The Birmingham Railway, Light & Power Company is offering through Perry, Coffin & Barr and N. W. Harris & Co. $4,633,000 general mortgage refunding 4½ per cent gold bonds, due April 1, 1954; optional for retirement at 105 and interest after 1909. The company controls the lighting and traction services of a population of 133,000, and in 1905 did a gross business of $1,630,000, with net earnings of $721,623. Dividends of 6 per cent have been paid on the $2,500,000 preferred stock since organization and at the rate of 3 and 4 per cent since 1903 on the $3,500,000 common. Of the bonds, $3,058,000 has already been issued out of a total $10,000,000 authorized. The franchises in Birmingham are unlimited or for electricity and gas outside the city are either unlimited or for 20 and 30-year terms. The traction system includes nearly 114 miles.

MASSENA POWER CO. SOLD.—It is announced that the Pittsburg Reduction Company, which is controlled by the Mellons and other capitalists of Pittsburg, has taken over the St. Lawrence River Company, which owns the large water power plant at Massena, New York. The Reduction Company is the principal customer of the St. Lawrence River Power Company, which also serves five or six other industrial establishments in the same neighborhood. The Power Company has outstanding, in addition to $500,000 5 per cent bonds, $3,500,000 of preferred stock and $3,000,000 of common stock. The company is taken over by the Pittsburg Reduction Company on the basis of an issue of $4,000,000 4 per cent. Pittsburg Reduction Company bonds in exchange for all the capital stock of the Power Company. The Reduction Company, moreover, guarantees the principal and interest of the $500,000 St. Lawrence River Power Company bonds.

MASSACHUSETTS LIGHTING COMPANIES.—Gavet & Porter, of Boston, have issued a special circular calling attention to the shares of the Massachusetts Lighting Companies as an investment. This is a consolidation formed under state laws in October, 1903, and the shares are non-taxable. It controls gas and electric companies in the towns of Arlington, Clinton, Leominster, Milford, Spencer and in Worcester county. In all, a population of 100,000 is served. At present it is paying 5 per cent dividends in quarterly instalments. For the year 1905 the net profits were $36,590. Five per cent dividends on $605,500 outstanding stock would call for $30,275, leaving a surplus above dividend requirements of $6,315. The balance sheet shows an apparent floating debt of $41,638, under the head of "bills and accounts payable," offset by "cash and accounts receivable" of $37,196.

DULUTH EDISON BONDS.—The Duluth, Minn., Edison Electric Company is offering $1,000,000 first mortgage 5 per cent. sinking fund gold bonds, due February 1, 1931. The company has $1,000,000 preferred stock and $500,000 common, and the authorized issue of bonds is $2,000,000. The company for the year ending January 31, 1906, reported gross earnings of $262,420 and operating expenses of $131,880, with a net of $130,540, or two and a half times the interest charges on this bond issue. The territory is growing rapidly and the company has a plant of about 3,000 hp, which will soon be supplemented by 5,000 hp of motor generator sets, taking current from the St. Louis River plant of the Great Northern Power Company. The franchise is unlimited. The bonds are being marketed by Perry Coffin & Burr and N. W. Harris & Co.

BELL TELEPHONE OF CANADA.—In order to keep up with the demand for extensions and new exchanges, the Bell Telephone Company, of Canada, at its annual meeting secured authority to apply to Parliament for permission to increase the capital from $10,000,000 to $50,000,000. President Sise said as much new stock would be issued each year as would be needed for extensions. The annual statement showed gross earnings of $3,517,000, operating expenses $2,615,000, leaving net profits of $902,000. During the year $1,010,000 was added to the plants and patent account, bringing it to $11,184,000. The company secured 12,035 new subscribers and now has 78,195 rent paying instruments. Dividends of $650,215 were paid in 1905.

LIGHTING IN BROOKLYN, N. Y.—The income of the Edison Electric Co., of Brooklyn, N. Y., for the year ending December 31, 1905, was $2,542,733, the operating expenses were $1,351,208, interest and discount, etc., were $702,067, and the net earnings transferred to the Kings County Electric Light & Power Company were $437,872. This holding company paid $400,000 in dividends and showed a net balance for the year of $74,629. The Edison Company has a capital stock of $5,000,000, and consolidated mortgage 4 per cent gold bonds, $4,275,000. The Kings County Company has a capital stock of $5,000,000 first mortgage 5 per cent gold bonds of $2,500,000, and purchase money 6 per cent gold bonds, $5,176,000.

BIG TROLLEY TRANSFER.—The important group of trolley systems in Ohio, known as the "Appleyard group," have passed into the ownership of the Widener-Elkins syndicate. The network includes about 170 miles of road, for which the syndicate paid $1,210,000 and assumed debts to the amount of probably $3,800,000. Apparently there will be little left for tne stockholders. Extensions are planned for some of the lines. Mr. W. K. Schoepf is the active head of the syndicate, and Mr. Theodore Stebbins is the general manager of the system which he has been actively directing with success for some time past. The purchase gives the syndicate immediately continuous lines from Cincinnati to Zanesville, O.

PACIFIC STATES TELEPHONE.—The Pacific States Telephone Company for the year ending December 31, 1905, shows as follows:

	1905.	1904
Total revenue	$7,687,523	$6,824,506
Operating expenses	5,927,054	5,135,485
Net revenue	1,760,469	1,689,021

The company had on December 31, 1905, a total of 242,088 subscribers. Expenditures for maintenance during the year amounted to $2,450,000. The company has $15,000,000 stock outstanding, with no bonded debt, but it has assumed the bonded obligations of one of its sub-companies amounting to $3,000,000.

COLORADO TELEPHONE ANNUAL.—The former directors and officers of the Colorado Telephone Company have been re-elected. President E. B. Field reports gross earnings for year ending December 31, 1905, $1,793,526; net earnings, $306,432. Value of real estate and plant, $6,141,121; number of subscribers, 45,745, a gain of 8,043. Mr. Field says: "To meet the demand for additional telephone service we have decided to offer this year at par to our stockholders $1,400,000 treasury stock." Numerous contemplated improvements and extensions in Colorado and New Mexico are referred to in the report.

INTERBOROUGH MERGER STOCK.—The Interborough-Metropolitan Company, which is the holding company in the New York City traction merger, on March 2 filed with the Secretary of State a certificate of increase in capital stock from $15,000 to $155,000,000. When the company was incorporated in this state recently the capitalization was fixed at $5,000 preferred and $10,000 common stock, and the certificate just filed increased the amount of the preferred stock to $55,000,000 and the amount of the common to $100,000,000.

CUYAHOGA TELEPHONE COMPANY.—J. S. Brailey, J. K. Secor and others of Toledo have made a proposition to the Everett-Moore syndicate of Cleveland for a controlling interest in the stock of the Cuyahoga Telephone Company, the independent plant in that city. These gentlemen already own a large block of Cuyahoga securities, but they desire to acquire control of the property. Their experts are now making an examination of the plant and system.

ELECTRIC PROPERTIES IN DAVENPORT.—A dispatch from Davenport, Iowa, states that papers were signed February 17 by which Eastern capitalists bought all the traction, electric light, power and gas properties in Davenport, Iowa, and Rock Island and Moline, Ill., and the interurban line from these cities to Watertown, Ill. The purchase price is approximately $6,000,000.

RECEIVERSHIP.—The Marquette County Gas, Light & Traction Company, operating the traction system serving Ishpeming and Negaunee and the gas and electric lighting plants there, has gone into the hands of a receiver. E. B. Finch, secretary of the company, has been appointed receiver upon application of the trustees, the Merchants' Loan & Trust Company, of Chicago.

HUDSON RIVER POWER.—The Hudson River Electric Power Company shows a gross for January of $76,038, as compared with $50,783 last year, and a net of $40,217.

GENERAL NEWS.

Construction News.

DOTHEN, ALA.—The City Council has decided to purchase a new engine and dynamo for the electric light plant.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company will build several miles of new street car lines within the city limits within the next twelve months.

GOODWATER, ALA.—It is stated that bids will be received now for constructing a hydro-electric power plant near Goodwater, or any part of same. Specifications will be furnished by L. W. Allen, town clerk.

JONESBORO, ALA.—Jonesboro is to have electric lights, and wires are being installed in some of the buildings. This is the first move of the Birmingham Railway, Light & Power Company toward the construction of the new line to this place.

LUJANE, CAL.—The U. S. Reclamation Service, at Lujane, Cal., has recently ordered a 75-hp Allis-Chalmers type motor for installation at Lujane.

MARYSVILLE, CAL.—The Northern California Power Company, Marysville, Cal., has recently made a purchase of a number of Allis-Chalmers oil-filled, self-cooled transformers for capacities 50 and 75 kw.

SAN FRANCISCO, CAL.—City Engineer Woodward has submitted his corrected plans and specifications for the reconstruction, under municipal control, of the Geary Street Railway, and they have been accepted by the Board of Supervisors.

FULLERTON, CAL.—It is reported that an application has been made to the Board of Trustees for a franchise to operate an electric lighting and power system in Fullerton, and bids for the franchise will be received until April 9. G. A. Ruddock is city clerk.

SAN FRANCISCO, CAL.—A petition has been presented to the Public Utilities Committee of the Board of Supervisors by the Home Telephone Company for the establishment of an independent telephone system. The company will invest $2,000,000 in labor and material within twelve months, and $4,000,000 within three years. The Committee is considering the matter.

SANTA ROSA, CAL.—The City Council has authorized Mayor Overton to sign a contract with the Santa Rosa Lighting Company for pumping water and lighting the streets for an indefinite period for $833 a month. It costs the city almost twice that sum under the present arrangement, whereby the municipality operates its own pumping plant and pays the company something like $500 for lighting alone. The company will install a new plant and use electricity for operating the pumps. The city now uses steam for power.

LOS ANGELES, CAL.—According to recent reports the energy of the Colorado River is to be transmitted to Los Angeles, in accordance with plans now being matured by local and Philadelphia capitalists. First, the power is to be distributed among the mining camps on the Arizona and Nevada border, and ultimately brought here. It is claimed that between the Grand Canyon of the Colorado and the Black Canyon it is possible to take advantage of certain sites and develop 500,000 hp. After an investigation of other electric transmission power plants in the State, the waters of the Black Canyon were filed upon over a month ago to the extent of 250,000 miners' inches, by William Carruthers and John Campbell. Plans are now being prepared for a concrete dam 200 feet high. The dam is to be constructed at the lower end of the canyon, and with the fall thus obtained it is calculated that 110,000 hp will be developed at the minimum flow. This power is to be transmitted at a potential of 45,000 volts in the first instance to the mining camps on either side of the Colorado River—Searchlight, Bullfrog and Tonopah, on the Nevada side; and Gold Roads and Chloride on the Arizona side being among the most notable—and later to the coast. The direct line across the desert to Los Angeles would be 260 miles in length, the longest power line in the State.

GUNNISON, COL.—Geo. H. Sethman, of Denver, has secured the contract for constructing water works and an electric light plant for $109,000.

COLORADO CITY, COL.—A committee has been appointed, consisting of Mayor Murray, Alderman C. E. Corporan and others, to investigate the probable cost of a municipal electric light plant.

DENVER, COL.—Announcement was made at the annual meeting of the stockholders of the Colorado Telephone Co. that it will spend between $1,400,000 and $1,800,000 for the improvement of its lines in the Rocky Mountain region during the coming year. The increase in mileage for the past year was 12,816 miles for exchanges and 900 miles of tolls. The toll lines are now 14,569 miles long and the exchanges 78,463 miles.

PLAINFIELD, CONN.—It is reported that the Consolidated Railroad Company is again considering the advisability of securing the water power privilege at the Quinesaug River, two miles west of this village, supposedly for an electric power plant location.

NEW BRITAIN, CONN.—At a recent meeting of the committee on water supply and lights, the estimates were made up for the ensuing year. It was stated that an appropriation of $10,000 will be needed. It was decided that when the new contract is made it shall be for all-night every-night service, instead of on the present moonlight basis.

HARTFORD, CONN.—The Construction Railway Company, operating the Hartford Street Railway and the third-rail line between Hartford and New Britain, contemplates connecting the tracks of the Hartford Company with those of the third-rail line so cars of the latter can be operated into Hartford to the Union Station. This will mean the equipment of the third-rail line with the overhead trolley for its entire distance.

WASHINGTON, D. C.—Bids will be received until March 20 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Schedule 389, motor, incandescent lamps, voltmeters, conduit fittings; schedule 391, electrical supplies, etc.; also until March 27 to furnish at the navy yard, Pensacola, Fla., and the naval station, New Orleans, La., a quantity of naval supplies, as follows: Schedule 397, incandescent lamps, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-Gen., U. S. N.

LAKE BUTLER, FLA.—The Council has granted to S. H. Mallory a 20-year franchise to operate a telephone exchange in Lake Butler.

PALM BEACH, FLA.—Mr. C. B. McDonald, chief electrician of the Hotels Royal Poinciana and Breakers, Palm Beach, informs us that they propose making extensive improvements in their power stations, house wiring, etc. Catalogue and circular trade matter is requested by Mr. McDonald as to electrical machinery, transformers, meters, insulated wire, etc.

WAYCROSS, GA.—The Waycross Electric Light & Power Company, Waycross, Ga., has recently purchased a 175-kw Allis-Chalmers generator and exciter.

CAIRO, GA.—The town is just completing a municipal lighting and water system and soon the entire city will be lighted by electricity generated at the city's plant.

SYLVANIA, GA.—The question of a municipal electric light plant for the town is being discussed. It is said that a plant could be installed for about $1,600, which would be adequate for the town's needs.

MARIETTA, GA.—The Georgia Mfg. & Public Service Company, Marietta, Ga., has recently purchased an 18 and 36 x 42-in. Reynolds heavy duty cross compound Corliss engine from the Allis-Chalmers Company, builders, Milwaukee.

FREEPORT, ILL.—The People's Telephone Company has been granted a franchise for the construction of a system in Flora.

CHICAGO, ILL.—The Crane Company of Chicago has recently purchased a number of small Allis-Chalmers motors, ranging from 7½ to 25 hp.

JOLIET, ILL.—The American Steel & Wire Company, Joliet, Ill., will install a number of new Allis-Chalmers, 25-hp, direct-current motors, recently ordered.

ROCK ISLAND, ILL.—An agreement has been reached between the Council and the Union Telephone Company and the company will now proceed with the extension of its lines.

GRANITE CITY, ILL.—The Kinloch Long-Distance Telephone Company is preparing to put up a building at Granite City and has let the contract. It will be a two-story structure and will cost about $8,000.

CHICAGO HEIGHTS, ILL.—The Mordon Frog & Crossing Company, of Chicago Heights, Ill., has recently purchased new electrical equipment as follows: One 200-kw Allis-Chalmers type generator, one 30-kw generator and one 30-kw engine type exciter.

SHELBYVILLE, ILL.—The stockholders of the Windsor Mutual Telephone Company have increased the capital stock of that company from $2,500 to $5,000, the increase being necessary on account of the continued demand for telephones along the line.

DUQUOIN, ILL.—The Ohio & Mississippi Telephone Company has taken over the properties and franchises of the Duquoin, Anna, Marion & Carbondale telephone companies. The new company has a capital stock of $100,000 and has established its general offices at Carbondale.

AURORA, ILL.—The Western United Gas and Electric Company, of Aurora, Ill., in selecting the new power and electrical equipment for addition to its present power facilities, recently purchased a 400-kw steam turbine and turbine alternator from the Allis-Chalmers Company, Milwaukee. This unit is the Parsons horizontal, multiple expansion, parallel flow type with a speed of 3600 r.p.m. The turbine alternator is a 2200-volt, 3-phase, 60-cycle machine. The complete unit will be used in connection with the present power house equipment for power and lighting purposes. It is expected that it will be ready for operation early in July.

EDWARDSVILLE, ILL.—The entire plant, franchise and property of the Granite City, Venice & Madison Electric Light Company has been taken over by the McKinley syndicate, operating an electric interurban line through Illinois cities. The Tri-City Company owns a main plant in

Venice and franchises for operating in Granite, Venice and Madison, as well as contracts for the municipal lighting of these three cities. The new management has taken charge. The business will be handled from the main McKinley office in Edwardsville, with a representative on the ground. The McKinley Company acquired the Edwardsville Light & Power plant two months ago.

OWENSVILLE, IND.—The Independent Telephone Company of this city is to install a new switchboard.

INDIANAPOLIS, IND.—The T. B. Laycock Mfg. Company, Indianapolis, Ind., will install twenty standard Allis-Chalmers induction motors, recently purchased.

GOSHEN, IND. Improvements to the plant of the Central Union Telephone Company are being discussed. The company expects to spend about $50,000 on the local system.

STONY HILL, IND.- Mr. Neal, of Patriot, has been trying to interest the people of this place in the construction of a telephone line here, but nothing definite has been done.

SCOTT CREEK, IND.—The Scott Creek Telephone Company will receive bids for the construction and installation of a telephone plant. George T. Shuck is president of the company.

GOSHEN, IND.—Plans are being discussed for the building of an electric railway between Sturgis, Mich., and Klinger's Lake, north of Elkhart. C. A. Freeland is interested in the project, it is said.

NOBLESVILLE, IND.—T. C. McReynolds, manager of the Kokomo Railway & Light Company, has purchased the electric light and ice plant at Noblesville and organized a new company which will build a new power plant and change the distribution system from 133 cycle, single phase to 60 cycle, two phase. The new company is the Noblesville Light, Heat & Power Company. The capital is $50,000 and the bond issue will be $75,000. The officers are T. C. McReynolds, of Kokomo, president and manager; Frank Holliday, of Indianapolis, secretary and treasurer. The directors are John H. Holliday, Alex. Holliday, Frank Holliday and Oscar Henderson, all of Indianapolis.

MUSKOGEE, I. T.—Engineers are making the surveys for the new trolley line which is projected by the Muskogee Electric Traction Company between Muskogee and Fort Gibson.

MARLOW, I. T.—Bids will be received until March 21 by the Mayor for furnishing material needed in the construction of a water and light system for the town. There will be required boilers, pumps, engine, alternating-current generator, switchboard, cast-iron pipe, standpipe, valves and hydrants. Specifications may be had by addressing the O'Neil Engineering Company, Dallas, Tex.

PHILLIPS, I. T.—The B. A. Electric & Tel. Mfg. Company, of Kansas City, has recently purchased for the Consumers Ice Company, of Phillips, I. T., a lot of equipment for an electric light plant which will consist of the following: One Allis-Chalmers, 18 x 30-in. Reliance engine, belted to a 180-kw, 1100-volt, 60-cycle Allis-Chalmers generator and a 6-kw exciter, rheostats, etc. The new outfit is expected to be ready for operation early in May.

BARTLESVILLE, I. T.—The Bartlesville Electric Light & Power Company, Bartlesville, I. T., has recently purchased additional power house equipment, consisting of a 14 and 24 x 42 in. Fraser & Chalmers tandem compound Corliss engine, a 200-kw direct-current generator, a 60-kw Allis-Chalmers motor generator set and a 24-kw belted exciter. The new outfit will be used in conjunction with the present installation to carry the increased power and lighting load.

SHENANDOAH, IA.- The Shenandoah electric lighting plant is to be rebuilt and enlarged at an estimated cost of $25,000.

INDEPENDENCE, IA.—The telephone company is making arrangements to place its wires underground in the business section of the city and will extend its system throughout the city.

SIOUX CITY, IA.—The Sioux City Traction Company will add a new Allis-Chalmers heavy duty, cross compound Corliss engine, 30 and 56 x 60-in., to its present power house equipment.

CEDAR RAPIDS, IA.—The T. M. Sinclair Company, of Cedar Rapids, Ia., is a recent purchaser of a number of motors, types "B" and "H," ranging from 5 to 50 hp and furnished by the Allis-Chalmers Company, Milwaukee.

CLAY CENTER, KAN.—The citizens are in favor of establishing a municipal electric light plant.

NEODESHA, KAN. The local telephone system is said to have been purchased by C. S. Leeds, who will make a number of improvements in the lines.

HOLTON, KAN. An election will be held March 29 to vote on issuing $25,000 bonds for water works and an electric light plant. Burns & McDonnell, Kansas City, Mo., are the engineers.

NEODESHA, KAN. The parties who are asking for a franchise to operate an electric railway on the streets of Neodesha are S. W. Brewster, G. N. Lindsay and Major Massey, all of Chanute, and a Mr. Welch, a civil engineer from Kansas City. Later the line will also be extended to Independence.

BOWLING GREEN, KY. The Home Telephone Company is to establish an exchange at Russellville.

JEFFERSON, KY. A number of deeds for right of way have been filed here for the Louisville & Northern Traction & Lighting Company.

PADUCAH, KY.—The Board of Aldermen have voted to award to the street car company a contract to furnish 75 street lamps during the present year. The city will furnish the remainder of the lights.

LOUISVILLE, KY.—The Louisville Lighting Company estimates the cost of laying its wires underground, in accordance with the ordinance now under consideration, at about $350,000, and it is probable that the total cost to all electric and telephone companies will be in the neighborhood of $1,000,000.

LOUISVILLE, KY.—Extensions and improvements aggregating more than $800,000 were decided upon at the annual meeting of the Louisville Railway Company, held a few days ago. The following officers were elected: T. J. Minary, president and general manager; Alex. P. Humphrey, vice-president and general counsel, Samuel G. Boyle, secretary and treasurer.

NEW ORLEANS, LA.—Bids will be received until March 31 by Mordecai T. Endicott, Chief Bureau Yards and Docks, Navy Department, Washington, D. C., for constructing a power house and chimney at the naval station, New Orleans, as per specification No. 1482. Estimated cost, $30,000.

BATON ROUGE, LA. An extension and a rebuilding of the whole plant and several branches of the Baton Rouge Electric & Gas Company will be made if the City Council will grant the company the privilege of extending its lines over a number of the streets of the city. The plan is for the reorganization of the present street railway company, headed by John D. Fisher, as president.

DEXTER, ME.—A committee has been appointed to investigate the feasibility of establishing a municipal lighting plant, before deciding upon the offer of the Sebasticook Power & Lighting Company.

BRUNSWICK, ME.—Changes have been made in the directorate of the Lewiston, Brunswick & Bath Street Railway Company, due to the recent purchase of a controlling interest in the company by Pennsylvania capitalists represented by John R. Graham.

STOCKTON SPRINGS, ME.—The railroad company has decided to establish an electric light plant for illuminating the piers, docks, yards and stations belonging to the system in this locality. The line will extend from Cape Jellison pier in Stockton to Mack's Point in Searsport. Eighty-two arc lamps will be installed and between these incandescent lamps will be placed.

BRIDGTON, ME.- Massachusetts capitalists have become interested in the proposition to build an electric railway from Harrison to South Windham, and it is believed that the proposed road will be built within a year. The charter granted to the Westbrook, Windham & Naples Railroad Company covered a route through Windham, Naples, Bridgton and Harrison. The company sold out to the Portland Railroad Company after the line from Westbrook to South Windham was built.

LAUREL, MD.—The Laurel Improvement Association has decided to petition the Mayor and Council to establish an electric light plant on Patuxent River.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company is resetting its poles and thoroughly overhauling its electric lines.

MIDDLEBORO, MASS. The municipal electric light plant will probably be enlarged shortly in order to provide day service for lighting and power purposes.

WINCHESTER, MASS.—The town is discussing the advisabality of establishing a municipal electric light plant. Great dissatisfaction is expressed with the service of the present company.

READING, MASS.—Steps are being taken to establish a Board of Public Works which will have administrative jurisdiction over the municipal light plant and the water works. It has also been proposed to operate the pumping plant from the electric light plant, which will necessitate a power line between the two plants, electric motors, transformers and two new pumps to be operated by electricity.

SAULT STE. MARIE, MICH. An election will be held to vote on the construction of an electric light plant.

BELLAIRE, MICH.—Henry Richardi, of Bellaire, Mich., will install a 375-kw Allis-Chalmers generator, a 25-kw generator and a number of oil-filled, water-cooled transformers recently purchased.

DETROIT, MICH.—An effort is being made to obtain a charter for a subway and system of connecting surface lines in Detroit, to compete with the Detroit United Railway. Mayor Codd and Frank C. Andrews are the local promoters and Prendergast & Rawson, of New York, are said to be financing it.

MT. MORRIS, MICH.—The supervisors of Genesee township have granted to the Detroit, Flint River & Saginaw Valley Railway Company a right of way through that township for an electric railway to connect Detroit and Saginaw.

ST. CLAIR, MICH.—The St. Clair aldermen who caused a deadlock in the Council for seven weeks by objecting to the city entering into a contract to purchase electric power for the operation of the water works, have been finally voted down, the Mayor casting the deciding ballot.

KALAMAZOO, MICH.—Mayor Walter H. Taylor has drafted a tentative franchise for a loop line, to be used by all roads. While the franchise provides that it be built by private capital, there is a clause that the municipality can buy the property at the expiration of the franchise.

BOYNE CITY, MICH.—The Boyne City Electric Light Company has just closed a deal whereby it secures three acres of land along the river front. The company will begin the erection of a new power plant early in April. Prominent Grand Rapids capitalists are behind the enterprise.

BIG RAPIDS, MICH.—The plant of the W. F. Doniey Electric Light & Power Company has been put out of commission for an indefinite length of time by the washing out of the company's dam at Big Rapids. The contract for the commercial incandescent lighting has been turned over to Jones & Green.

DEER RIVER, MINN.—The Mesaba Telephone Company has been granted a franchise for a local exchange and will proceed to install a telephone system here.

CROOKSTON, MINN.—Senator A. D. Stevens is interested in the development of water power on Red and Red Lake Rivers. Probably $300,000 will be expended for this purpose.

MINNEAPOLIS, MINN.—Cheaper electric light and power for Minneapolis is promised in the announcement that a party of eastern capitalists will expend $3,000,000 in developing the Elk River properties of the Minnesota Power & Trolley Company and will operate in Minneapolis in competition with the Minneapolis General Electric Company, under the ordinance of the former company passed by the City Council 15 months ago. Under the terms of the franchise the company will furnish electric lights to the city at $58.50 per lamp, as compared with the present price of $94 per lamp; a fixed scale of lighting rates is offered to consumers ranging from 10 cents per kw-hour to consumers whose annual bill is $100 or less; to 5 cents per kw-hour on contracts amounting to $2000 a year; a power scale of 5 cents per kw-hour on $100 contracts ranges to 3 cents per kw-hour in excess of $500 a year; all rates are subject to revision after ten years at each five-year period; the city is to have the right of purchase after ten years of all the property of the company in the city; and the plant must be completed and in operation by November 1, 1907. The development will call for the erection of a 36-feet dam across the river, private right of way for the transmission line from the power plant to the city must be secured, and the local work will consist of the construction of sub-stations, pole lines and conduits. An initial development of 20,000 to 25,000 hp is planned.

NATCHEZ, MISS.—The Board of Mayor and Aldermen has decided to petition the Legislature for permission to issue $75,000 bonds for an electric light and power plant.

JACKSON, MISS.—The officials of the Cumberland Telephone Company announce that they are going to build a line along the right of way of the Gulf and Ship Island Railroad, south from Jackson, and that they are now acquiring the right to construct.

LIVINGSTON, MONT.—John L. Bright has petitioned the Council for a franchise for an electric light plant.

BUTTE, MONT.—The Montana Independent Telephone Company has petitioned for a franchise to establish a local exchange.

HELENA, MONT. The Home Telephone & Telegraph Company, of Portland, Ore., is seeking a franchise to establish its system here.

MADISON, MO. The Mutual Telephone Company is preparing to build a central exchange office in this city.

CARROLLTON, MO. The Bell Telephone Company is making arrangements to place underground its wires in the central portion of the town.

CLINTON, MO.—The citizens have voted to issue $100,000 bonds for water works and an electric light plant. Engineers, Burr & McDonnell, of Kansas City.

FAYETTE, MO. A new company has been organized, with a capital of $200,000, for the purpose of consolidating the independent telephone systems in Cooper County.

SEDALIA, MO.—The Bell Telephone Company is perfecting plans to establish a new plant here and will install a switchboard of much greater capacity than the present one.

ASHLAND, NEB.—The Ashland Mill & Electric Light Company has decided to rebuild its dam on Wahoo Creek, and remodel its mill race and water gates. F. E. White, general manager.

LAS VEGAS, NEV. The capacity of the electric light plant is being increased to provide for additional lights which are being installed.

YORINGTON, NEV.—The interests of T. B. Gamble, G. J. Fee, W. N. Harris and Thomas Harris in the Walker River Electric Company that is to erect a large power plant on the Walker River and build an electric line from Wabuska to Bodie, Cal., have been taken over by Mr. Fencher, of San Jose, Cal., who will arrive here soon to look after the preliminary work and the construction of the electric plant. The company has already acquired valuable power sites on the river.

TRENTON, N. J.—Because of the reduction in the bid of the Public Service Corporation for the lighting of the city, 35 new arc lamps will be added to the number now in use in the city. The new contract makes a price of $85 per lamp, against the former price of $92.72.

EAST ORANGE, N. J.—The Council has passed an ordinance authorizing the Ordinance and Street Lighting Committees to engage an engineer to investigate and report on the feasibility of installing a plant for the cremation of garbage, and to furnish electric lights for the streets.

BUFFALO, N. Y.—An item of $250,000 has been added to the budget, to be used in the establishment of a municipal electric light plant.

WEST POINT, N. Y.—Bids will be received until March 17 by the Quartermaster at West Point for erecting a power house, excepting the steel construction.

GLENS FALLS, N. Y.—Hudson River Electric Power Company has been notified to be in readiness on September 1 to deliver electric power for the operation of the West Shore Railway between Utica and Syracuse.

PLATTSBURG, N. Y.—The Knickerbocker Pulp & Paper Company, of Plattsburg, N. Y., will install four 450-kw Allis-Chalmers water-wheel type generators and a 75-kw belted exciter, recently purchased. The new outfit will be used for the electrification of the present mill at Plattsburg.

UTICA, N. Y.—Extensive improvements are contemplated in this section by the Bell telephone interests, and at a recent meeting an appropriation of $2,000,000 was voted for the purpose. Most of this will be expended in the large territory operated by the Central New York and Empire State Companies.

UTICA, N. Y.—Application has been made to the State Gas Commission by the Utica Electric Company for permission to increase the amount of its capital stock from $2,000,000 to $3,500,000, of which amount $342,000 will be used to pay floating indebtedness and provide as far as possible for the construction of transmission lines and the purchase of rights of way. It is proposed by the company to extend its lines from Trenton to Rome, from Utica to Rome and from Utica to Frankfort, Ilion, Mohawk, Herkimer and Little Falls.

ROME, N. Y.—The Hudson River Electric Power Company has closed a contract with the Utica & Mohawk Valley Railway Company to supply the power for the electric service between Utica and Syracuse and the power company's architects and electricians are at work preparing plans for the enlargement of the Utica plant to accommodate the machinery, which will furnish the increased demand for power. The electric company will more than double the capacity of the present building on the flats and will install larger and modern machinery. It will also build one or more substations between Utica and Syracuse for the transmission of power.

CHARLOTTE, N. C.—M. B. Speir, superintendent of the Southern Bell Telephone Company, announces that his company has acquired by purchase the telephone exchange at Statesville, N. C. There are more than 300 lines at Statesville. That city will be connected with Charlotte by a long-distance line and a toll line to Salisbury will soon be completed.

WASHBURN, N. D.—August E. Johnson has been granted a franchise for constructing telephone lines in Goodrich.

ANAMOOSE, N. D.—A petition has been filed for a franchise to establish rural telephone lines in this vicinity.

ELLENDALE, N. D.—Mayor Leiby and others are reported to have formed a stock company to construct an electric light plant.

NEWARK, OHIO.—The Newark Light & Power Company has decided to construct a new power plant, to cost about $100,000.

NILES, OHIO.—Bids will be received until March 21 by B. L. Logan, City Auditor, for $12,000 bonds for improving and equipping the municipal electric light plant.

MASILLON, OHIO.—The Board of Public Service has rejected the bids recently submitted by rival lighting plants in this city and has advertised for new bids to be opened March 16. The rejection was on account of some irregularity.

ALLIANCE, OHIO.—S. F. Haynes, right-of-way agent for the proposed Sandy Valley Traction Company, states that 90 per cent. of the required right of way has been secured.

YOUNGSTOWN, OHIO.—The Pennsylvania & Mahoning Valley Railway Company is reported to be considering the building of a new route from Youngstown to New Castle.

COLUMBUS, OHIO.—The State Finance Committee of the Legislature has recommended the passage a bill appropriating $25,000 for the construction of a municipal electric light plant.

AVONDALE, OHIO.—Architects Tietig & Lee, Commercial Tribune Building, Cincinnati, are preparing plans for a power plant and steam laundry for the Jewish Hospital at Avondale, to cost about $40,000.

DALTON, OHIO.—Citizens of this place are endeavoring to induce the Canton & Akron Railway Company to extend its Brookfield branch line to Dalton and they offer concessions in the way of right of way.

AKRON, OHIO.—Thomas L. Childs, promotor of the Cleveland, Akron & Massillon Railway, says that he has completed arrangements for financing the line between Akron and Massillon and that it will be built this year.

CHILLICOTHE, OHIO.—A. G. Moser, general manager of the Chillicothe Street Railway & Electric Light Company, states that the company is planning to install a new engine and generator. He is investigating various makes before placing contracts.

CLEVELAND, OHIO.—The construction of a 16-mile line from Sandusky to Clyde, thus connecting two divisions of the Lake Shore Electric Railway, has been definitely decided upon by that company. The branch will cost approximately $200,000.

FREMONT, OHIO.—The promoters of the Sandusky, Fremont & Tiffin Electric Railway claim to have arranged for the financing of the road between Fremont and Tiffin, and it is stated that arrangements have been made to start construction work in the spring.

McCONNELSVILLE, OHIO.—The Triadelphia-Sayre Telephone Company is constructing a line from Porterville to this city by way of Triadelphia. When completed it will add over a hundred telephones to the Morgan County system. It will be a metallic circuit.

CLEVELAND, OHIO.—The Cleveland Construction Company has practically completed surveys for the line from Youngstown to East Liverpool, nearly all of the right of way has been secured and it is stated that construction work will be started in the very near future.

EAST LIVERPOOL, OHIO.—The Ohio Valley Traction Company, which proposes to build an electric railway from Vanport, Pa., to Smith's Ferry, Pa., has been incorporated under Pennsylvania laws by S. L. Tone, C. S. Mitchell, J. L. Foster, W. B. Carson and A. W. Stevenson.

CLEVELAND, OHIO.—The deal for the purchase of the Detroit, Monroe & Toledo Short Line by the Detroit United Railway will be consummated within a few days. In the very near future through cars will be operated from Cleveland to Detroit by way of the Lake Shore Electric and the Short Line.

HAMILTON, OHIO.—The Mosler Safe Company, of Hamilton, O., has recently purchased more Allis-Chalmers type "N," direct-current motors for installation at the Hamilton plant. The new outfit lately ordered consists of eighteen 9-hp and ten 6-hp motors, one 17½-kw multiple voltage balancing set and a switchboard equipment for same.

PAINESVILLE, OHIO.—Citizens of Painesville are endeavoring to induce R. C. Bacon, of Jefferson, who proposes to build an electric railway from Jefferson to Chardon, to build to Painesville instead of to the other place. It is claimed that Painesville would give a more direct route to Cleveland and that the territory would be better.

PAULING, OHIO.—An election will be held March 19 for the purpose of deciding the question of issuing $10,000 in bonds for municipal ownership of the electric light plant, which is now owned by Columbus Grove capitalists, among whom are G. W. Core, James M. Viers and others. Their contract for lighting in Paulding expires in October of next year.

CINCINNATI, OHIO.—It is said that J. G. Schmidlapp and the Cincinnati Traction Company have come to an agreement over the proposed elevated electric railway from Norwood to the heart of Cincinnati, and that the city company is now prominently identified with the project. Mr. Schmidlapp is endeavoring to secure a franchise from the City Council and the indications are that he will be successful.

SPRINGFIELD, OHIO.—The sale of the Springfield, Charleston, Washington C. H. & Chillicothe Traction Company at receiver's sale recently to a syndicate headed by E. W. Christy, of Cleveland, has been confirmed by the courts. The new owners expect to extend the line to Washington C. H. this summer and plans are being made for a power station and car house at that place. Secretary F. J. Southard, of the new company, has opened general offices in the Bushnell Building and will have charge of work on the extension.

AKRON, OHIO.—The Akron People's Telephone Company has placed a contract with the Automatic Electric Company, of Chicago, Ill., for an automatic switchboard covering the entire system in Akron and surrounding villages. A new building is to be erected and provision will be made for a capacity of 10,000 lines. The initial installation will be for 3700 lines, which gives the company an increase of 500 over the present capacity. New instruments will replace the old throughout. It is the intention to have the system in operation by January 1 next.

YOUNGSTOWN, OHIO.—Strong competition seems likely to occur between the Youngstown & Southern Railway, now operating the line between Youngstown and Columbiana, and the Youngstown & Ohio River Railway, projected by Cleveland people. The latter company is headed by J. R. Nutt, Will Christy, George Stanley, Warren Bicknell and Max Goodman, of Cleveland. It is claimed that arrangements for financing the project have been practically completed, and that the road will undoubtedly be built this year. A large amount of money has already been spent in surveys and right of way.

DAYTON, OHIO.—The plant of the Dayton Lighting Company, which recently underwent an entire alteration, with extensive additions, has been recently placed in operation again. The new power plant, among other features, has added a 1500-kw Allis-Chalmers turbine generator unit, which was installed through the United States Locomotive & Equipment Company, of New York City. This unit operates at a speed of 1800 r.p.m., generating current of 60 cycles, 3 phase, at 2500 volts. The condensing apparatus used in conjunction with the turbine unit was also furnished by the Allis-Chalmers Company, who superintended the erection of the entire unit.

CLEVELAND, OHIO.—The Board of Public Works, of Cleveland, has placed a contract with the Ideal Engine Company for two 100-hp engines and with the Triumph Electric Company for one 50-kw and one 75-kw generator, which will be installed in a plant to supply light and power to the city hall. The city has also received bids for 200 arc lamps for the South Brooklyn municipal light plant, and the contract will be awarded as soon as the efficiency tests are made. It is thought to be the aim of Mayor Johnson to increase the capacity of the South Brooklyn plant sufficiently to light the entire South Side, as a step towards a municipal plant for the entire city."

BANDON, ORE.—The City Council has granted a 20-year franchise to the Bandon Electric Company to construct an electric light plant.

PORTLAND, ORE.—Work is progressing rapidly on the underground system of the Home Telephone & Telegraph Company. When completed there will be more than fifteen miles of trench, and of this amount over one-half is now ready for the cable.

LA GRANDE, ORE.—Walter M. Pierce has closed a deal whereby the Union electric light plant, operated for a number of years by the Hutchinson sisters, becomes the property of the Grande Ronde Electric Company. As soon as transformers can be procured, Union will be connected with the Cove and La Grande power stations.

LAWTON, OKLA.—George Baumhoff, of St. Louis, is in Lawton making arrangements for constructing an electric railway from Lawton to Craterville, the summer resort in the Wichita Mountains by way of Fort Sill. The line will also traverse the city of Lawton.

GUTHRIE, OKLA.—The Oklahoma City, Lexington & Sulphur Springs Electric Railway, now under course of construction, has been purchased by the Commonwealth Trust Company, of St. Louis, which announces its intention of carrying out the plans outlined by the original promoters.

ASHLEY, PA.—The People's Telephone Company will establish an exchange here.

DUNN'S STATION, PA.—The Farmers' Telephone Company is to build a telephone line from Dunn's Station to Amity.

SUGAR RUN, PA.—A farmers' telephone line is to be built from Sugar Run to connect with the Bradford County Telephone Company at Wyalusing.

ELLWOOD CITY, PA.—The Pennsylvania Power Company, Ellwood City, Pa., has purchased a 225-kw Allis-Chalmers water-wheel type generator.

MEADVILLE, PA.—H. S. Robinson, City Clerk, writes that at the election February 20 the citizens voted to issue $58,000 for improvements. This money will be expended for improvements to the electric light plant, sewers and paving.

WAYNE, PA.—J. R. Wiggins & Co. have asked for sub-bids on the plans of Architect J. T. Windrim for a two-story brick and terra cotta telephone exchange which is being erected in this city for the Delaware & Atlantic Telephone & Telegraph Company.

SCRANTON, PA.—Messrs. J. G. White & Company, of New York City, have recently purchased for G. H. Walbridge, Scranton, Pa., two Allis-Chalmers horizontal, cross-compound engines, 23 and 36x42-in., direct coupled to two 500-kw Allis-Chalmers alternators, together with other electrical equipment.

SCRANTON, PA.—The Lackawanna Light Company, formerly the West Scranton Light & Heat Company, has purchased ground for the power house, and the contract for the erection of the building will be let in a few days. The new building will cost about $20,000, and it is proposed to install about $100,000 worth of machinery. The work of laying conduits and stringing wires will begin immediately, preparatory to competing with the older company in the lighting and heating field.

WAGNER, S. D.—John Abasher, of Wagner, writes that he proposes constructing an electric light plant, at a cost of $10,000.

MILBANK, S. D.—The Grant County Telephone Company will install a central-energy system in Milbank. The contract for the new system has been given to the Kellogg Switchboard & Supply Company, of Chicago. Plans are also under consideration for the extension of the line to Alban township.

BAMBERG, S. C.—Bids will be received until March 15 by the Board of Public Works (A. W. Knight, secretary) for furnishing material and installing complete an electric light plant, to consist of two 100-hp high-pressure boilers with cross flue and stack, one 150-hp Corliss engine, one 100-kw Allis-Chalmers 2 or 3-phase revolving-field or inductor generator, 31 arcs, twenty-five 50-cp series lamps with regulator, etc. J. B. McCrary, engineer.

NASHVILLE, TENN.—The Nashville Mutual Telephone Company is to construct lines to Venedy, Okawville and Addieville.

TRENTON, TENN.—The City Council has about completed the purchase of the electric light plant for the city, owned by Freeman & Wade. The price to be paid is $11,000.

GALLATIN, TENN.—G. W. Schanberger and W. H. Sprandlin, of Gallatin, are interested in the Great Cumberland Falls Company, which proposes establishing a lighting and water plant to supply this place and several counties.

MEMPHIS, TENN.—The Memphis Consolidated Gas & Electric Company, of Memphis, Tenn., has recently purchased a 1500-kw Allis-Chalmers turbo-generator unit, with condensing and auxiliary apparatus, for installation at Memphis. The new unit is of the horizontal parallel flow type, designed to operate at a speed of 1800 r.p.m. and generate a current at 60 cycles, 3 phase of 2500 volts; the jet condenser and auxiliary pump to be furnished and also built by the Allis-Chalmers Company. This unit will run in parallel with other units of similar type or with a reciprocating engine unit built for parallel operation, properly dividing the load so as to prevent surging.

UVALDE, TEX.—The City Council has granted two franchises for electric light plants, one to E. L. Burks and associates, the other to Tom Brown and associates.

CANADIAN, TEX.—The Stockmen's Telephone Company, of Canadian, is building lines to Lipscomb and Ochiltree, as well as towns in Beaver and Woodward Counties, Oklahoma.

GALVESTON, TEX.—Application has been made by the Houston-Galveston Traction Company, backed by Houston capital, for a franchise over the streets of Galveston, and the matter has been taken under consideration by members of the Galveston City Commission. An application for a franchise over the streets of Houston is now pending before the authorities of that city.

ALTA, UTAH.—Arthur Murphy, of Alta, has applied to the State Engineer for permission to divert twenty second-feet of water from Little

Cottonwood Creek, the elecetricity developed to be transmitted to Little Cottonwood mining district.

HOLLIDAY, UTAH.—Thomas A. Howard, of Murray, has petitioned the State Engineer for permission to divert seven second-feet of water from Spring Creek, the power produced to be used for electric lighting and power purposes in Holliday.

SALT LAKE CITY, UTAH. James J. Chambers, president of the Inter-Mountain Company, writes that bids will probably be received about May 1 for the proposed electric plant, to cost about $600,000. Engineer, Frank C. Kelsey, of Salt Lake City.

MURRAY, UTAH.—F. M. Lyman, Jr., of Salt Lake City, engineer and secretary of the company recently organized to construct an electric light and power plant in Mill Creek, writes that the proposed plant will cost $200,000. M. Miller, of Murray, is president.

FARMINGTON, UTAH.—At a meeting of the stockholders of the proposed Davis County Electric Light & Power Company, a temporary organization was established. N. T. Porter, of Centerville, was acting chairman, with Bert Reading as secretary. The following board of directors was appointed to act until the permanent organization is effected at the first annual meeting to be held the last monday in March: James A. Eldredge, Woods Cross; David Stoker, Bountiful; N. T. Porter, Centerville; J. E. Willey, South Bountiful; A. L. Clark, Farming, Henry H. Blood, Kaysville; Wm. J. Layton; H. J. Sheffield, Kaysville; E. P. Ellison, Layton. H. H. Blood, J. E. Willey and N. T. Porter will confer with the Utah Light & Power Company and the Telluride Power Company to obtain bids. The $30,000 stock with which the company will incorporate has nearly all been subscribed.

MORRISVILLE, VT. A. A. Niles, Village Clerk, writes that at the annual meeting in April, the question of constructing a new dam across Lamille River for the development of additional power will be acted upon.

ROCKFORD, WASH.—H. W. Collins is said to be interested in the construction of an electric light plant.

SEATTLE, WASH.—James A. Moore will ask the City Council for a franchise to construct an electric railway partly within city limits.

SUNNYSIDE, WASH.—The citizens have voted to issue $9,000 bonds, for water works and an electric light plant.

KINGSTON, WASH.—At a recent meeting of the citizens plans for the construction of a telephone line between Kingston and Port Gamble were discussed. It is probable that the work will be started within a very short time.

SPOKANE, WASH.—Franchises have been asked for from the Board of County Commissioners by the State Line Telephone Company, the Spokane Bridge & Liberty Lake Rural Telephone Company and the Valley Prairie Telephone Association.

PUYALLUP, WASH.—The Puyallup Board of Trade has taken steps to introduce an independent telephone system. The committee consists of George D. Spurr, Fred J. Chamberlain, W. D. Cotter and W. E. Hale and W. O. Westcott. Rates of the present company are considered exorbitant. The committee has received reports on the cost of installation of a central-energy system.

WENATCHEE, WASH.—Important changes are taking place in the central part of Washington in the telephone field. The town of Quincy and surrounding country, hitherto without service, is to have two lines. The Pacific States Company is almost ready to string wires between Wenatchee and Quincy, and W. H. Babcock will install a system in Quincy. The Babcock system will connect with the Farmers' line of Wenatchee at Cashmere, Melaga and Leavenworth. It is stated that a company has been formed at Conconnully to purchse the holdings of the Pacific States Company in that part of the State. The system under consideration extends from Pateros to Twisp, Bridgeport, Brewster and Oroville. These lines will be supplemented by several new branch lines. The Perry system will be taken over and a new line built to Wauconda from Riverside. The stockholders of the new company are said to be S. J. Dillabaugh, William Yeagin, Messrs. Stickles, Fairweather, Hormann and others.

ELM GROVE, W. VA.—The National Telephone Company, of Wheeling, is to establish an exchange at Elm Grove.

ENGLESIDE, W. VA.—W. N. Camp, Engleside, W. Va., has purchased recently one 150-kw Allis-Chalmers type "AH" generator and belted exciter.

CHARLESTON, W. VA.—A deal has been consummated whereby the water, natural and artifical gas, traction and other public utilities of Charleston pass into the hands of W. E. Chilton and associates. Mr. Chilton is supposed to represent the Chesapeake & Ohio Railroad. The deal involves more than $1,000,000.

OCONOMOWOC, WIS.—The capital of the Badger Telephone Company has been increased from $5,000 to $10,000.

GLENWOOD, WIS. The West Wisconsin Telephone Company has increased its capital stock from $7,000 to $15,000.

WEST MILWAUKEE, WIS.—The Chicago, Milwaukee & St. Paul Railway Company will install a 225-kw Allis-Chalmers generator at the West Milwaukee shops.

RACINE, WIS. The Milwaukee Electric Railway & Light Company is planning to extend its lines from this city to Horlicksville, Franksville, Thompsonville, Raymond, North Cape, Eagle Lake, Brown's Lake and Burlington.

SAUK RAPIDS, WIS. The Watab Pulp & Paper Company, of Sauk Rapids, Wis., has recently added to the electrical equipment already on order for the new pulp mill now in course of erection, in the shape of two 40-hp Allis-Chalmers type induction motors.

GREEN BAY, WIS.—Albert M. Murphy, W. P. Wagner and others, of Green Bay, owners of the Green Bay Traction Company, have purchased the plant of the Green Bay Gas & Electric Company. It is reported that the two plants will be consolidated and $200,000 expended in improvements.

CHEYENNE, WYO.—The Bell Telephone Company is planning to make extensive improvements in its system here this coming season.

CHEYENNE, WYO.—A syndicate of Denver, Col., capitalists, known as the Northern Colorado Power Company, is reported to have secured options on the electric plants of Cheyenne, Evans, Greeley, Fort Collins, Lafayette ,and other towns in Colorado. It is stated that a system of electric lines connecting these towns will be constructed. Mr. Henry, of the Denver (Col.) Gas & Electric Company, and F. E. Warren, of Cheyenne, are reported interested.

HAVANA, CUBA.—At the stockholders' meeting of the Havana Electric Company, held in Jersey City, N. J., the proposed issue of $300,000 bonds was ratified and directors re-elected. The bonds were issued to provide for proposed extensions of the system.

CHATHAM, N. B.—James Nichol, Mayor, writes that bids will be received until March 20 for an electric light and power station for Chatham.

ST. JOHN, N. B.—Ross & Holgate, Montreal, have submitted their report to this city on the cost of a municipal electric light plant. The report suggests the combination of a garbage destructor and electric light plant, and the estimated cost of constructing the combined plants is $80,000.

BRANDON, MAN.—The Brandon Electric Light Company is preparing to make large extensions to its plant in order to be able to supply the increasing applications for power. The company's city power station will also be extended in the near future.

Company Elections.

DENVER, COL.—At a recent meeting of the Colorado Telephone Company the present directors and officers were re-elected. It was also decided that in order to meet the demand for additional telephone service the company should offer at par to the stockholders $1,400,000 of treasury stock. Numerous improvements and extensions in Colorado and New Mexico are contemplated.

WATERBURY, CONN.—The Perkins Electric Company has elected the following officers. W. W. Mertz, president; E. A. Perkins, treasurer; S. A. Herman, secretary; other directors, J. F. Dewey and F. N. Holley.

WATERBURY, CONN.—The annual meeting of the stockholders of the Woodbury Electric Company was held recently and the following officers elected: F. F. Hitchcock, president; Samuel C. Tomlinson, vice-president; Edward S. Boyd, secretary and treasurer, the other directors being William L. Judson and Arthur D. Warner.

HARTFORD, CONN.—The stockholders of the Hartford Electric Light Company elected the following directors at the annual meeting: Austin C. Dunham, D. Newton Barney, Samuel G. Dunham, William F. Henney, Henry Roberts, Dr. E. K. Root, Willie O. Burr, Ralph W. Cutler, Atwood Collins, Morgan G. Bulkeley, Louis R. Cheney, George G. Williams.

ALPHA, IA.—At the recent business meeting of the Alpha Telephone Company the following officers were elected: C. Carr, president; J. T. Gager, vice-president; E. W. Paul, secretary; W. H. Stone, treasurer.

BALTIMORE, MD.—At the annual meeting of the Maryland Telephone Company and the Baltimore Electric Power Company recently the directors were re-elected as follows: Messrs. David E. Evans, George R. Webb, B. S. Josselyn, Bernard N. Baker, Frank A. Furst, Reuben Foster, Frank H. Callaway, John Waters and John Hubner, all of Baltimore, and Sydney L. Wright, W. Frederick Snyder and Hugh H. Harrison, of Philadelphia.

FRANKFORT, MICH.—The Benzie County Telephone Company held its annual meeting and elected the following officers: William A. Young, Benzonia, president; George C. Woodward, Frankfort, vice-president; Herbert B. Woodward, Benzonia, secretary and treasurer.

PENTWATER, MICH.—The Lake Shore Telephone Company held its annual meeting and elected the following officers: H. S. Newton, president; G. F. Sands, vice-president; J. K. Flood, secretary; L. P. Hyde, treasurer, E. A. Fuller, manager. The present number of telephones in the Oceana Division is 852.

MOUNTAIN LAKE, MINN.—The North Star Telephone Company at a recent meeting elected the following officers. S. Balzar, president, Frank Balzar, vice-president; J. H. Dickman, secretary and treasurer; T. Schroeder, manager.

PORT JERVIS, N. Y.—The Port Jervis Telephone Company has elected the following officers: Moses Dupuy, president; Dr. Cuddeback, vice-president, A. Parshall, secretary; E. F. Mapes, treasurer.

SARATOGA, N. Y.—At the annual meeting of the Hudson River Water Power Company recently in this city the following directors were elected for one year: Eugene L. Ashley, Glens Falls; E. H. Gay, of Boston; W. J. Jackson, Boston; Charles E. Parsons, Albany; Elmer J. West, Glens Falls.

COOPERSTOWN, N. Y.—The Otsego Home Telephone Company has elected the following officers and directors: George R. Fuller, president; George Whitman, vice-president; John Losee, secretary; H. P. McDonough, treasurer and manager. The company will spend $30,000 in new construction this year.

ALBANY, N. Y.—The Hudson River Telephone Company, at its recent annual meeting held in this city, elected the following board of directors: John F. Adriance, Union N. Bethell, Charles F. Cutler, Frederick P. Fish, Henry E. Hawley, D. Cady Herrick, Walter C. Humstone, George P. Ide, James H. Manning. During the present year new buildings will be erected at Kingston, Peekskill, Port Jervis, Fishkill Landing and Watervliet.

SCHENECTADY, N. Y.—At the stockholders meeting of the Schenectady Railway Company, held a few days ago, a new board of directors was elected, representing jointly the New York Central Railroad and the Delaware & Hudson Company. These two roads last year took over control of the Schenectady Railway from the General Electric Company. The directors elected are: E. V. W. Rossiter, John Carstensen, William K. Vanderbilt, Jr., Horace E. Andrews, F. A. Harrington, David Willcox, T. B. Dixey, A. Ekstrom, J. W. Burdick and A. I. Culver.

BROOKLYN, N. Y.—Annual meetings of the stockholders of the Kings County Electric Light & Power Company and of the Edison Electric Illuminating Company were held recently in Brooklyn, when the following board of directors was elected for both companies: Frank Bailey, William Berri, A. N. Brady, N. F. Brady, Horace C. Du Val, Walton Ferguson, W. W. Freeman, Bernard Gallagher, Hugh J. Grant, Seth L. Keeney, Thomas E. Murray, W. F. Sheehan and A. M. Young. Mr. Bailey, who was elected to fill a vacancy, was the only new member. The board subsequently organized by re-electing the retiring officers.

CLEVELAND, OHIO.—The annual meeting of the United States Telephone Company was held recently, and the following directors elected: H. A. Everett, E. W. Moore, C. W. Wason, B. Mahler, C. S. Dickson, Calvary Morris, H. R. Newcomb and C. Y. McVey.

GUTHRIE, OKLA.—At the annual meeting of the stockholders of the Pioneer Telephone Company, which now controls both Oklahoma and Indian Territory, the following officers were elected for the ensuing year: Eugene Nimms, president, John M. Noble, vice-president and general manager; E. E. Westervelt, secretary and treasurer, all of Oklahoma City.

CLARKSVILLE, TENN.—At a meeting of the board of directors of the Home Telephone Company the following officers were elected: Dancey Fort, president; B. F. Gill, vice-president; W. E. Beach, treasurer; H. M. Perry, general manager and secretary.

LEXINGTON, VA.—The Lexington Light & Power Company recently elected the following officers: President, L. H. Latham, vice-president, D. C. Humpreys; secretary and manager, R. E. Hutton.

NIGHTHAWK, WASH.—At the meeting of the Board of Trustees of the Similkameen Falls Power & Development Company, Monroe Harman was elected president of the company, Charles A. Andeus, vice-president; L. L. Work, treasurer, and H. W. Johnson, secretary and manager.

KINGSTON, ONT.—At the annual meeting of the Kingston & Pembroke Electric Railway Company the following officers were elected: President, W. D. Matthews, Toronto, vice-president, W. R. Baker, Montreal; secretary-treasurer, Archibald MacNaughton.

New Incorporations.

HARRISON, ARK.—J. A. Bush and others have been granted a franchise to build an electric railway from this place to Bergman.

DE QUEEN, ARK.—The plant of the De Queen Ice, Light & Power Company has been destroyed by fire. The loss is estimated at $10,000.

YELLVILLE, ARK.—The G. A. Ward Telephone Company has filed articles of incorporation for the purpose of constructing a telephone system through various counties. J. D. Simms is president of the company.

CALDWELL, ARK.—The Caldwell Telephone Company has filed its articles of incorporation. The main office of the new company will be at Forrest City. It is capitalized at $5,000. W. C. Beasley is president.

HARRISBURG, ARK.—The Harrisburg Electric Light & Power Company has filed articles of incorporation showing a capital stock of $25,000. The directors are A. A. Boon, Thomas Flourney, J. G. Gant, M. H. Frayser, Dr. J. C. Davis, Morris Huyuten, Thomas B. Steel, B. F. Coe, J. A. Darham and Lee Weeks. The company will construct and operate an electric light and power plant and water works and manufacture ice.

IMBODEN, ARK.—The Imboden Power Development Company, capitalized at $100,000, has been incorporated. The company now owns and operates the electric light plant, a sawmill and has a large steel water tower erected for the water works which will be put in operation this spring. The company has a bill before Congress which will authorize the company to construct a dam across Spring River at this point. It is estimated it will develop about 800 hp, thus affording sufficient power for a large number of factories and various other enterprises.

SAN FRANCISCO, CAL.—Articles of incorporation of the Battle Creek Power Company have been filed. The directors of the company are Henry W. Brown and Walter E. Carr, of Colma, Harold L. Wright, Dudley C. Bates and Joseph E. Barry, of San Francisco. The company is capitalized at $1,000,000 and its purpose is to furnish electric power and water.

EATON, COL.—The Eaton Water, Light & Power Company has been incorporated with a capital stock of $35,000, by John McCarthy and others.

SALEM, ILL.—The Farmers' Telephone Line has been incorporated with a capital of $1200. The incorporators are Manson Thurman, Charles Sherman and George S. Mathews.

EDWARDSVILLE, ILL.—The Madison County Light & Power Company, of Edwardsville, has been incorporated, with a capital of $100,000, by Chas. Zilly, B. E. Bramble and Geo. M. Matters.

ELM GROVE, ILL.—The Elm Grove Mutual Telephone Company has been incorporated with a capital stock of $2,450, by Lewis T. Lipkey, Michael N. Reinhart and Michael Ruch.

TOBINSPORT, IND.—The Robinsport Telephone Company, capitalized at $1000, has filed articles of incorporation.

BROOK, IND.—The Newton & Jasper Counties Telephone Company has been incorporated with a capital of $7500.

FISHER'S SWITCH, IND.—The Highland Telephone Company has been incorporated with a capital of $2,000 and the following directors: Claude Beaver, W. Beaver, C. Sachs and Thomas McCarty.

LEESBURG, IND.—J. E. Armstrong, W. R. Wood and W. H. Slatey are the principal promoters of a company to secure a franchise to construct and install an electric light, heat and power plant in this town.

CUTLER, IND.—The Co-Operative Telephone Company has filed articles of incorporation, with a capital stock of $4,000. William H. Draper, Noah Plank, William Smith, George Phillips, W. S. Hazlitt, George W. Shanklin and James D. Love are the incorporators.

WILLIAMS, IA.—The Mutual Telephone Company has been organized with a capital of $15,000, and will install a local exchange and telephone system.

ASSARIA, KAN.—The Assaria Mutual Telephone Company has been incorporated with a capital stock of $6,000.

BUNKER HILL, KAN.—The Bunker Hill Telephone Company has been incorporated with a capital stock of $12,000.

COLONY, KAN.—The Anderson County Light & Heat Company has been incorporated with a capital stock of $16,000.

BENTON, KAN.—The Benton Telephone Company has been incorporated with a capital stock of $1,000.

HUTCHINSON, KAN.—The People's Water, Light & Power Company has been incorporated with a capital of $150,000.

NEW ORLEANS, LA.—The charter of the New Orleans, Crowley & Western Railroad Company has been filed for incorporation. The capital stock is placed at $1,000,000, and authority is given the company to issue bonds to any amount necessary. It will be an electric road. The road will do a general freight, express and passenger business and will be especially equipped for handling oil, sugar and rice.

LOVELL, ME.—The Independent Telephone & Telegraph Company has been incorporated with a capital of $5,000. C. P. Hubbard is president.

PORTLAND, ME.—The Gas Construction Company has been organized for the purpose of operating gas plants and electric lighting and heating plants. The company has a capital stock of $5000, and the following officers: Fred Bogue, president, W. S. Lee, treasurer.

AUGUSTA, ME.—The American Utilities Company has been incorporated with a capital stock of $3,000,0000, and will build and operate electric railways, electric lighting plants, etc. The officers are M. W. Baldwin, Portland, president; James J. Hernan, of Portland, treasurer.

BOSTON, MASS.—The Old Colony Light Company has filed articles of incorporation, with a capital stock of $50,000. A. F. Chace, E. Bunker and William R. Kelley are among those interested.

JESSIE, MICH.—The Farmers' Telephone Company has been organized with a capital of $5000.

LAKE CITY, MICH.—The Missaukee Telephone Company has been incorporated with a capital of $20,000.

ST. JOHNS, MICH.—The Ovid Mutual Telephone Company has been incorporated with a capital stock of $5,000. E. B. Carpenter is president.

MUSKEGON, MICH.—The Fremont & Hesperia Construction Company has been organized to build an interurban railway to connect Grand Rapids and Ludington.

WALLED LAKE, MICH.—The Walled Lake Telephone Company has filed articles of incorporation in the office of the County Clerk, with $1,000 capital stock. Geo. Dickerson, E. Calhoun, L. S. Carnes and H. F. Andrews are the incorporators.

SANBORN, MINN.—A stock company with a capital stock of $15,000 has been organized here for the construction of three rural telephone lines. F. W. Stevens, G. A. Dreblow and Emil Gerth are the executive committee.

KALISPELL, MONT.—The Western Montana Electric Company has been incorporated, with a capital of $20,000, by L. H. Fauct, of Libby; H. A. Kendall, of Kalispell, and others.

HICKMAN, NEB. The Hickman Telephone Company has been incorporated with a capital stock of $6,000 by Adam Brendle and others.

PAGE, NEB.—The Page Telephone Company has been incorporated with a capital of $10,000 by C. A. Townsend and others.

LINCOLN, NEB.—The Farmers' Independent Telephone Company, of Wayne and Thurston Counties, has filed articles of incorporation with a capital stock of $7000.

TRENTON, N. J. The Prairie Telephone Company has secured a New Jersey charter permitting it to construct and operate telephone lines outside of the State. The capital stock is $200,000 and the incorporators are James A. Plotner and C. M. B. Chase, both of Kansas City, and Fred H. Brown, of Parsons, Kan.

CINCINNATUS, N. Y.—The Otselic Valley Telephone Company is to be incorporated with a capital stock of $10,000. The following are the directors of the company P. C. Wheeler, F. M. Davis, E. W. Terrill, William Edwards, A. Fowlson, J. M. Murray and J. M. Lotridge.

NORWAY, N. Y.—Crockett Ridge & Milletville Telephone & Telegraph Company has been incorporated to operate telephone lines, etc. The capital is $5,000. E. B. Tubb, Norway, president; H. G. Dinsmore, Norway, treasurer.

MARION, N. C. The Marion Light & Power Company has been incorporated with a capital of $25,000, by J. L. Morgan and others.

FARGO, N. D. The Pingree Telephone Company has been incorporated, with a capital of $50,000.

BURLINGTON, OHIO.—The North Kenova Telephone Company has been incorporated with a capital of $1800 by A. O'Neil and O. M. Elkins.

NEW PARIS, OHIO.—The New Paris Home Telephone Company has been incorporated by S. C. Richie, P. C. Dowler, A. C. Lindemuth, L. D. Lesh, W. D. Rush. The company's capital is $40,000.

SHELBY, OHIO.—The Shelby Traction Company has been incorporated with $10,000 capital stock by J. E. Will, H. K. Beck, J. W. Williams, A. H. Anderson and A. C. Morse to build a line from Plymouth to Crestline through Shelby with lines diverging from Shelby and Bucyrus in one direction and Ashland in the other. These lines would complete through routes from Cleveland to Columbus.

CLEVELAND, OHIO.—The Highland Telephone Company has been incorporated with a capital stock of $20,000. A. Caig, C. Beaver and A. H. Shaffer are the incorporators.

CRANDALL, OHIO.—The Excelsior Telephone Company has been incorporated to operate a telephone system in Harrison, Floyd, Ashington, Orange and Crawford Counties, Ind. The capital stock is $6,000. John W. Gresham, George E. Sims and A. W. Scheler are the incorporators.

MARTIN'S FERRY, OHIO.—The Dillonville & Ohio River Traction Company, with a capital of $10,000, has been incorporated by James T. Hedgens, Thomas J. Stringer, W. C. Fawcett, Louis Liphart and William B. Francis. The company proposes to build an electric railway connecting Dillonville and Rayland.

CUSHING, OKLA.—The Cushing Telephone Company has been incorporated, with a capital of $2,000, by W. W. Oder and others.

NORMAN, OKLA.—The Norman Telephone Company has been incorporated with a capital stock of $22,000.

CLARION, OKLA.—The Cleo, Cimarron Valley & Western Telephone Company has been incorporated, with a capital of $5,000, by James E. Ely and others.

GUTHRIE, OKLA.—The Pleasant Valley Telephone Company, with a capital of $1200, has been incorporated by H. O. Reeves, W. W. White and others.

LAWTON, OKLA.—The Canadian County Farmers' Telephone Company has been organized with a capital of $50,000, with El Reno as headquarters.

MOUNT HOOD, ORE.—Mount Hood Telephone Company has filed articles of incorporation, with a capital stock of $3,000. The incorporators are W. S. Gribble, C. M. Wishart and L. C. Lafferty.

GRESHAM, ORE.—The Farmers' Mutual Telephone Company has been incorporated by H. W. Shashall, Charles Clevelena, Archie Meyers and Timothy Brownhill. The line will probably be ready for operation in about three months.

EUGENE, ORE.—The Chambers Power Company has filed articles of incorporation, with a capital of $50,000. Frank L. Chambers, George Midgley and Darwin Bristow are the incorporators. The company will construct and operate plants for the production of power, either water, electric or steam, and will also operate mills for the production of lumber, etc.

ALLENTOWN, PA.—The Lehigh Electric Company has been incorporated, with a capital of $10,000, by J. H. Jacoby, A. S. Weibel and others.

ARMOUR, S. D.—Articles of incorporation have been filed and a charter granted to the Chester Telephone Company, of Chester township.

FEDORA, S. D. The Citizens' Economic Telephone Company has been incorporated with $25,000 capital, to build a county telephone system.

HENRY, S. D.—The Henry Union Telephone Company has been incorporated by J. T. Belk, E. Reinecke and others.

COURTLAND, VA.—The Courtland Waverly Telephone Company has been incorporated, with a capital stock of $5,000. J. N. Sebrell, Sr., president; J. P. Johnson, secretary; Dr. E. F. Reese, treasurer.

New Industrial Companies.

THE WELCH SAFETY THIRD RAIL SYSTEM, Spencerville, Ohio, with a capital of $50,000, has been incorporated by E. M. Welch, Jno. Whyman, J. A. Park and C. A. Wolford.

THE ELECTRIC ADVERTISING COMPANY, of Camden, N. J., has been organized with a capital of $250,000, by Charles Weinfeld, Samuel A. Ettelson and A. H. Heyman.

THE ELECTRIC CONSTRUCTION COMPANY, of St. Louis, Mo., has been incorporated, with a capital of $125,000. Arthur Lambert is one of the incorporators.

THE CENTRAL ELECTRIC COMPANY, of Greensboro, N. C., has filed articles of incorporation, with a capital stock of $25,000. The incorporators are W. C. Waddell, C. W. Petty and C. E. Leak.

THE TAYLOR-HERRICK ROTARY ENGINE COMPANY, of New York, has been incorporated, with the following directors: E. H. Herrick, J. E. Raymond and G. P. Herrick.

THE ELECTRIC SUPPLY & CONSTRUCTION COMPANY, of La Crosse, Wis., has filed articles of incorporation, with a capital stock of $10,000. Robert J. Nichols, Will D. Burford and E. D. Burford are the incorporators.

THE INTERNATIONAL ELECTRO-CHEMICAL COMPANY, of New York, N. Y., has been incorporated, with a capital of $10,000, and the following board of directors: W. F. McCarty, Rocky Ridge, Md.; C. E. Fisher and T. A. Darby, of New York.

FRANK D. COOK, Chicago, Ill., has filed articles of incorporation and will engage in the manufacture of telephones. The capital is placed at $100,000. Associated with him are Emma A. Olsen, Mary R. Rochford and Elizabeth R. King.

THE BROWNELL-TREBERT COMPANY, Rochester, N. Y., has been incorporated and will manufacture automobiles. The company is capitalized at $50,000, and the following are named as directors. F. A. Brownell, H. L. F. Trebert and Paul Le Hardy.

THE EDWARD E. CARY COMPANY, of New York, has been incorporated with a capital of $20,000. The company will manufacture electrical apparatus. P. C. Fredericks, Dean Emery, R. W. Crawford, of New York, are the incorporators.

THE J. G. BARR ELECTRICAL COMPANY, St. Louis, Mo., has made application for incorporation. The incorporators are Jesse G. Barr, Wade H. Bush, Frank J. Daugherty, Ernest C. Krauss and Marion E. Loftus. The object of the incorporation is to manufacture and deal in electrical appliances, fixtures, machinery, etc. The capital stock is $10,000, fully paid.

THE STARK SIGN COMPANY, of Canton, Ohio, has been incorporated with a capital stock of $10,000 by P. F. Dittenhaver, William Schohtz, Luther Day, Thomas St. John and others. The company will absorb the Dittenhaver Sign Company and will make electric and special signs of all descriptions.

Legal.

THEFT OF KEY SOCKETS.—In the Criminal Court of Chicago, Cook County, a jury on Thursday, March 1, brought in a verdict of guilty in the case of the People vs. Ralph Lipsey, indicted for receiving stolen property, the penalty for which is imprisonment in the penitentiary for not less than one year nor more than ten years. In this case the jury found that Lipsey, who was the president of the Great Northern Metal Company, 61 West Van Buren Street, Chicago, had received and again disposed of four cases of key sockets which had previously been stolen from one of the large jobbing houses of Chicago. Many of the jobbing houses have suffered more or less from petty thieving, as well as from graver acts of stealing, involving often goods of considerable value, and the electrical jobbers and manufacturers of standard supplies have taken much interest in this case. The disclosure of the fact of receiving stolen property is one of the most difficult capable of legal proof, and, in this case, the defense left no stone unturned to escape the jury and the verdict of guilty. The commission of this offense is one that is a constant menace to the legitimate trade, for, unless the thief can find a fence to dispose of the stolen goods, there would be few, if any serious cases of this nature. The evidence in this case was prepared by Frederic P. Vose, lawyer, Marquette Building, who assisted States Attorney James Barbour in the prosecution of the case.

TIME STAMP LITIGATION.—In the case of the Calculagraph Company of New York vs. Jno. C. Wilson, which was a suit brought under the patents of Hamilton & Abbott to enjoin the Automatic Time Stamp Company from making or selling an instrument known as the "Timeometer" used on telephone toll-line switchboards to record the time the toll-line was in use by a customer, the U. S. Circuit Court of Appeals in an opinion by Judge Colt has reversed the decision of Judge Hale, of the U. S. District Court, and has remanded the case to the Circuit Court with directions to dismiss the bill of the Calculagraph Company with costs in the Circuit Court and in the Court of Appeals. Judge Hale had also found the defendant in contempt for making another machine for the same purpose, known as the "Duragraph," and this decision of the Court of Appeals acts to void this finding also. J. S. Rusk and Fredk. L. Emery, counsel for appellant. E. J. Prindle for appellee.

Obituary.

WILLIAM ALFRED HOVEY, of the American Bell Telephone Company, well known in journalistic and literary circles, died in Boston on February 18, aged 64 years. He was at one time president of the Merchants' Electric Light & Power Company, and in 1884 he became editor of the *Electrical Review*. In 1885 he associated himself with the American Bell Telephone Company, with which he remained up to the time of his death.

MR. F. R. GILLINDER.—Mr. Frederick R. Gillinder, president and senior member of Gillinder & Son's Franklin Glass Works, Philadelphia, died at his home there, last week, of general debility. He was born in England in 1845 and succeeded his father, who founded the Franklin Flint Glass Company, and was president of the Glass Manufacturers' Association. He served as a volunteer in an emergency regiment during the Confederate raid into Pennsylvania, in 1863. He leaves a widow, two sons and a daughter.

MR. CHARLES H. KILGOUR, who was prominently connected with street railway and telephone systems in Cincinnati, died at his home in that city last week He built and operated many of the original horse lines in the city, entering the business in 1869. It was under his guidance that the street car lines were first equipped with cable, then electrified and finally merged into the present system. He left a fortune estimated at $5,000,000. For a number of years he had led a retired life, devoting his time largely to charities.

MR. FRANKLIN BROOKS.—We regret to note the death of Mr. Franklin Brooks, well known as vice-president of Eugene Munsell & Co. This sad event occurred at his home in Elizabeth, N. J., March 5. He had been ill for three months or more with rheumatism, and had lately gone to Summerville, S. C., for treatment. He grew rapidly worse and being brought home succumbed shortly afterwards. Mr. Brooks was born in San Francisco fifty-one years ago, and came East with his parents when but a child. The elder Brooks was interested in a mica mine in North Carolina, and there the son spent several years, acquiring knowledge of the mineral which made him widely known as an expert. He associated himself with his cousin, Eugene Munsell, in the firm of Munsell & Brooks and dealt in mica. Later Eugene Munsell, Franklin Brooks, Lewis W. Kingsley and William H. Rollo bought out the Munsell & Thompson Manufacturing Company, and this and the firm of Munsell & Brooks were consolidated into the firm of Munsell, Rollo & Company. This firm was later dissolved and the firm of Eugene Munsell & Company was formed, and of this firm Mr. Brooks was a member till his death. He was also vice-president of the Mica Insulator Company, and a director in two mica mining companies operating in North Carolina. The firm is also interested in the output of mica mines in India, and a few years ago Mr. Brooks visited there, while on a trip around the world. Mr. Brooks was president of the Mattano Club, a member of the Elizabeth Club and of the Elizabeth Town and Country Club, and a director of the Union County Trust Company. He was widely acquainted and was everywhere a great favorite, He was of a genial, generous disposition. Mr. Brooks married Miss Julia G. Van Horn, of one of the old Dutch families of Jersey City. Besides his wife, Mr. Brooks leaves one son, Eugene F. Brooks, and two daughters, Miss Marion and Miss Josephine Brooks.

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Personal.

H. C. THAXTER.

MR. H. C. THAXTER, of the Standard Electric Works, San Francisco, Cal., was born in Carson, Nev., March 24, 1872, where he received his earlier education until 1880, going in that year to Terre Haute, Ind., to enter the Rose Polytechnic Institute. He studied there for two years, leaving with Dr. Jordon and the Indiana contingent for Stanford University, Cal., in 1891, from which institution he graduated with the degree of B.S. in electrical and mechanical engineering in 1894. He entered the employ of the Los Angeles Railway in the winter of the same year, in whose service he was rapidly advanced through its several departments to the position of superintendent of motive power in 1896. At this time the West Side Lighting Co. of Los Angeles was negotiating to become an Edison licensee, and desiring to obtain the services of a thoroughly reliable engineer, offered special inducements to Mr. Thaxter to become their engineer and general suprintendent, which position he accepted in 1896. That the choice of the Edison Company was a wise one has been demonstrated by the rapid growth of their plant from a 200-hp high-frequency station to one of 5000-kw capacity with three steam stations, one hydro-electric sub-station, with an auxiliary storage battery for supplying a large underground area, during the seven years of Mr. Thaxter's incumbency. In 1903, he was offered and accepted a position as general manager of the Asphalt Paper Pipe Co., which later became the American Conduit Company of Los Angeles and Chicago. Desiring to return to the lines of his profession he resigned from this company in 1904 to take the position of engineer and general superintendent of the Standard Electric Company of California, where he remained until that company was absorbed by the California Gas & Electric Corporation, when he entered the employ of the Standard Electric Works of San Francisco, Cal., as engineer and assistant manager, which position he still holds at the present writing. This company is a member of the National Jobbers Association, and besides doing a general construction business represents as Pacific Coast agent numerous Eastern factories for various lines of electrical appliances. Mr. Thaxter has been largely instrumental in bringing the Standard Electric Works to the front as one of the leading electrical firms on the Pacific Coast. His services are also in frequent demand by a numerous clientele as a consulting electrical engineer.

H. E. NIESZ.

MR. HOMER E. NIESZ, whose efficient work as a director and in charge of publicity for the Chicago Electrical Show have resulted in his being made managing director of the show for next year, is assistant to the second vice-president of the Chicago Edison Company. He was born in Canton, O., in 1868 and educated at Mt. Union College, Alliance, O., from which he graduated in 1886. During his course he specialized in civil engineering with the idea of taking up that work. After graduation he engaged in electrical work, first with the Western Electric Company, of Chicago, and later with the United States Electric Lighting Company, and with Leonard and Izard. In 1888 he entered the employ of the Chicago Edison Company as wireman and rapidly rose from one grade of work to another until in 1889 he was made assistant superintendent of the construction department. This position he held for ten years. In 1889 he was made assistant to Mr. L. A. Ferguson, then general superintendent, in which position he continued when Mr. Ferguson became second vice-president. Mr. Niesz has written for the technical press, and in 1905 edited the National Electric Light Association Question Box. In the latter connection he did excellent work, appreciated by all central station men who have occasion to refer to the Question Box. He was one of the incorporators of the Chicago Electrical Show and took an active part in the management of this year's show, which, as said before in these columns, was a remarkable success, having an attendance of 101,000 in 12 days. In taking up this work Mr. Niesz does not in any way relinquish his duties as assistant to second vice-president of the Chicago Edison Company, from which office he will carry on the work of the exposition for the present.

MR. F. A. BERTRAND, formerly of the Springfield, Mo., Gas & Electric Company, has become interested in and will manage the Jefferson City, Mo., Light, Heat & Power Company.

MR. CHARLES J. GOLDMARK, consulting electrical and mechanical engineer, has removed his offices in New York to 7 West 38th Street, a district that bids fair, with the opening of the United Engineering Building, to become the great center in New York for professional men in the engineering fields.

PROF. W. HALLOCK, of the physics department of Columbia University, New York City, has been appointed dean of the faculty of science, in place of Prof. E. B. Wilson, resigned. Prof. Hallock is widely and favorably known in the scientific field and has a wide acquaintance among electrical engineers.

MR. N. McD. CRAWFORD, formerly general manager of the Hartford Street Railway Company, and more recently engaged in engineering work at Hartford, Conn., is making a trip to England and other parts of Europe, in connection with the municipal ownership investigation of the National Civic Federation. He will probably be occupied there for three or four months.

MR. HENRY FLOY.—Napier & Mitchell Mfg. Company, of Belleville, N. J., is enlarging its factory by the erection of two new buildings, contracts for which have already been let. All the power and lighting will be electrically distributed. Two-phase, 240-volt motors and a generator direct-connected to a high-speed engine, will be installed. Mr. Henry Floy is the consulting engineer.

MR. G. F. DINSMORE, treasurer of the Hatch Accumulator Company of Boston, has been visiting New York this week in the interests of his company. Mr. Dinsmore is a chemist and physicist, and during the past 15 or 20 years has done a great deal of original research, not only in chemistry, but in the deeper problems that touch the constitution of matter and the conservation of energy.

MR. GEORGE W. FOWLER, who has been actively engaged in the electrical engineering business for several years past, has established himself at 136 Liberty St., New York, as consulting electrical engineer and power expert. Mr. Fowler was formerly connected with the C. & C. Electric Company, and more recently has engaged in engineering construction. He will devote his attention especially to the application of electric power to industrial and manufacturing establishments.

MR. FRANCIS E. DONOHOE, who has had charge of the Chicago office of the American Electrical Works for the past twelve years, has been transferred to the position of sales agent at their New York office. His predecessor, Mr. W. J. Watson, resigned March 1 to engage in the real estate business on Long Island. Mr. Donohoe handed over the management of the Chicago office to Mr. E. H. Hammond, who has been assisting him there the 12 years Mr. Donohoe was in charge.

MR. HUBERT H. MACRAE.—The construction work of the Electrical Development Company and the Toronto & Niagara Power Company is now approaching completion and it has been considered necessary to appoint a general manager who will give undivided attention to the operation of the companies. Mr. Frederic Nichols has therefore retired from that position and is now first vice-president and managing director. Mr. Hubert H. Macrae, solicitor for the two companies, has been appointed general manager and will assume the duties as soon as the necessary arrangements can be completed.

MR. JOHN F. WALLACE, formerly chief engineer of the Panama Canal Commission, will in a few weeks take an important position in the Westinghouse Companies. This step was rumored when Mr. Wallace left the Commission, but the news was very indefinite then as, indeed, it is to-day. It is understood that a new Westinghouse company is being organized, of which Mr. Wallace will be the president, but the official announcement on the subject is not expected before the end of the present month. Mr. Wallace before serving on the Canal Commission was chief engineer of the Illinois Central Railroad, and has always enjoyed a high reputation in engineering circles for his technical ability and attainments.

Trade Publications.

SWITCHBOARDS.—The Worcester Electric Manufacturing Company, 42 Lagrange St., Worcester, Mass., has issued circular No. 4, dealing with standard switchboards for 250-volt circuits. The switchboard instruments are of any style selected by the purchaser.

MICHIGAN CEDAR POLES. A neat little brochure, letter size, has been issued on the subject of Michigan white cedar poles, by the Kellogg Switchboard & Supply Company, of Chicago, Ill. It gives a view of its large yard at Wilson, Mich., and includes a variety of data, specifications, etc.

HAZARD MANUFACTURING COMPANY, the well-known manufacturer of insulated wires and cables at Wilkesbarre, Pa., has issued a handsome, large, broadsheet calendar for 1906 that is useful for any office or plant where the day of the month should be plainly in evidence. Each date has a space about 2 by 3 inches.

CENTURY TELEPHONE CONSTRUCTION COMPANY, of Buffalo, N. Y., has got up an attractive long distance "ad," which it has been using to good advantage in advertising independent telephone service. These celluloid triangular discs are mounted on the transmitter, being held in place by the mouthpiece, and bear the "Independent" shield in colors.

WARD LEONARD ELECTRIC CO., Bronxville, N. Y., has issued a catalogue, No. 19,062, covering motor starters equipped with 20 steps of resistance for speed control by field regulation. It includes cuts, diagrams of connections showing internal connections, full descriptions, prices, etc., covering both the plain no-voltage release type and the interlocking overload circuit breaker and no-voltage release type. This catalogue will be sent upon request.

INTERURBAN RAILWAY JOURNAL.—Mr. J. T. Elliott, Jr., American Central Life Building, Indianapolis, gives notice that he has been appointed receiver for the *Interurban Railway Journal* of that city. Creditors can file claims until March 10. This was an attempt to issue a special paper to cover interurban railway work, but that department of technical journalism is already well filled, and it was soon shown that no necessity existed for this publication. Mr. E. H. Talbott was the editor.

McLEOD, WARD & COMPANY, 27 Thames Street, New York City, desk lamp specialists, have just issued a broad sheet of their fixtures and portables under the title: "Light Where Needed." It shows no fewer than twenty-three styles and varieties of desk lamps, pulpit lamps, bracket lamps, orchestra lamps, picture lamps and other useful specialties; and illustrates also the Ward "Double-joint," through which the flexible cord runs, and which gives free play to the movement of the lamp in any direction. These Ward and Kinsman specialties have been a great boon to the public, and to-day if they were more generally pushed by central station companies, or installed by isolated plants, there would be a much keener appreciation of the value and beauty of the electric light.

News of the Trade.

THE ELEKTRON MANUFACTURING COMPANY, of Springfield, Mass., has made arrangements to manufacture the "Sulton" car, a well-known French model, in connection with its other work at the factory in this city.

CHANGE OF STYLE.—The C. H. Wheeler Condenser & Pump Company, on account of the delay and confusion due to the similarity of its name to that of another concern, has changed its corporate name to C. H. Wheeler Manufacturing Company.

THE BASTIAN METER, a well-known British meter of the electrolytic type, is handled in this country by the Helios Manufacturing Company of Bridesburg, Philadelphia, Pa. Mr. Frank S. Marr, president, informs us that the Bastian Meter Company claim that 80 per cent. of all the meters used in Australia are of its type and make.

FREVERT MACHINERY COMPANY has opened salesroom and offices at 18 Dey Street, New York City, where it carries a complete line of new and second hand metal working tools and machinery of every description. It is also manufacturing a line of newly designed hand power traveling cranes, trolleys, hoists and overhead tracks, which are said to embody a number of improvements and new features. Mr. H. F. Frevert, the head of the concern, has had a large experience in the machine tool business.

VULCAN SOLDERING TOOLS. L. P. Brown & Co., 71 West Jackson Boulevard, Chicago, have recently enlarged their quarters and are catching up with orders for their Vulcan electric soldering tools. A number of improvements have lately been introduced into the goods, and Mr. F. J. Holmes, the manager, says: "The original No. 10 has been superseded by the No. 100, which is identical in size with the No. 10. In the No. 100 the parts are brazed together, the outside shell being brazed on after the winding is in place. We, therefore, have a completely closed winding chamber, the winding being, as it were, embedded in a solid metal body, and thus protected from the soldering flux fumes and the intense corrosive effect which always results from the action of these fumes. We have so changed the construction of the renewable copper tip as to do away with the possibility of the tip becoming stuck and immovable. The make-up of the tool has also been changed in such a manner that the copper core is located in the body of the appliance, enabling us to reduce the price of extra tips from 50 cents to 30 cents each. The No. 200 has been developed along lines similar to the No. 100, and the larger sizes which we are now preparing will have the same construction. We are confident that electrically heated soldering coppers will rapidly replace those heated by gas, gasolene or charcoal. As a matter of fact, we are now putting these tools into many manufacturing establishments in place of the obsolete devices which are being abandoned."

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED FEB. 27, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

813,403. THERMOSTAT: Arthur D. Colton, Chicago, Ill. App. filed Aug. 22, 1904. A rod of expansible material acts to move a multiplying lever between contact points for the alarm or control circuit. The contact point may be adjusted simultaneously by an index, for different temperatures.

813,410. MOTOR CONTROL; Charles A. Eck, Newark, N. J. App. filed May 16, 1905. The combination with a motor having poles and an armature, of an adjustable yoke-ring having a series of portions of large cross-sectional area, each somewhat longer than the distance between the poles, and having portions of small cross-sectional area connecting the portions of large cross-sectional area.

813,410. SELECTIVE SIGNALING SYSTEM: Charles G. Hawley and Herbert O. Holderness, Chicago, Ill. App. filed Dec. 15, 1903. A system of cabinets for train dispatchers and others in which dials along the route are moved synchronously by step by step magnets. The proper number of pulsations is transmitted from different levers by a sort of fire alarm arrangement.

813,426. SIGNALING SYSTEM; Herbert O. Holderness and Charles G. Hawley, Chicago, Ill. App. filed Feb. 17, 1904. Relates to modifications of the above and particularly to the details of the cabinets and indicating dials used at the various stations along the route.

813,472. ELECTRIC MACHINES; Edward J. Willis, Richmond, Va. App. filed Feb. 8, 1905. An element for induction electric machines provided with a plurality of rods extending longitudinally beyond the ends of the element and a plurality of bonds consisting of naked wires spaced apart and extending entirely around said element upon said extended ends and each bond electrically connected with each rod at each contact point.

813,512. CIRCUIT CLOSER FOR TELEGRAPH KEYS; Herbert R. Nevens, Portland, Me. App. filed June 14, 1905. In order to prevent accidental displacement of the circuit closing lever of a telegrapher's key, the patentee provides a spring which exerts a tension to close the lever at all except its extreme open position.

813,515. TROLLEY SUPPORTING DEVICE; Alexander Palmros, Columbus, O. App. filed Apr. 11, 1900. Adapted for mine locomotives in which the trolley pole swings in a horizontal plane against the conductor. A tension spring is connected to a short crank so as to press the pole against the wire whether the pole is in its forward or rearward relation.

813,523. BRUSH HOLDER FOR MOTORS OR GENERATORS; Frank L. Sessions, Columbus, O. App. filed May 20, 1903. The brush is guided longitudinally in a fixed casing or support, and has a supplemental spring-pressed lever engaging its outer end to press the brush against the commutator.

813,526. GROUND CONNECTION FOR ELECTRIC CIRCUITS; Joseph B. Simpson, Washington, D. C. App. filed Apr. 11, 1905. A two-part metallic ring has its adjoining ends arranged to interlock in a plurality of different relations so that the effective diameter of the ring is changed, and can be accorded to any size of pipe.

813,532. PROCESS FOR THE ELECTROLYTIC PRODUCTION OF METALS OF THE EARTHY ALKALIES; Carl Suter and Berthold Redlich, Ratibor, Germany. App. filed Jan. 2, 1904. A process for the electrolytic production of metals of the earthy alkalies consisting in melting the salt, effecting the electrolysis thereof, and causing a slow movement of the cathode from the surface of the electrolyte during the action.

813,538. CONNECTOR FOR ELECTRICAL CONDUCTORS; Frederick J. Troll, Baltimore, Md. App. filed Apr. 3, 1905. A connector for flexible wires designed to give them the characteristics of solid wires at the connection point. Soft copper sleeves or tubes surround the bared flexible cable, and portions of the sleeves extend over the insulation thereof.

813,546. INCLOSED SAFETY DEVICE FOR FUSES FOR ELECTRICAL INSTALLATIONS; Wilhelm Fellenberg, Charlottenburg, Germany. App. filed Apr. 28, 1904. The fuse receptacle has a zig zag channel therethrough in which the fuse wire is contained. The interior is closely packed with powdered emery, talc or absorbent substance to prevent damage by the hot gases.

813,560. TELEPHONE SYSTEM FOR CENTRAL STATIONS; Gustaf Lambert, Charlottenburg, Germany. App. filed Apr. 16, 1902. A telephone system comprising a loop conductor line connected to the central station, and a pair of electromagnets in the respective branches of the loop with selective means actuated by one to short circuit the other until the call is answered.

813,568. INCANDESCENT LAMP SOCKET; Robert R. Miller, Grand Rapids, Mich. App. filed Jan. 3, 1905. Instead of a turn button the patentee provides a short centrally pivoted lever with a knob at each end so that the lever can be thrown to its alternate position by a simple pressure on one or the other knob.

813,582. ELECTRIC STORAGE BATTERY; Harris H. Porter, Providence, R. I. App. filed Sept. 21, 1903. A porous separator for secondary battery plates having on its faces a series of flat surfaces and grooves, said surfaces being substantially wider than said grooves and the surfaces on one face being opposite the grooves on the other face.

813,610. CLOCKWORK ELECTRICITY METER; Hermann Aron, Charlottenburg, Germany. App. filed Jan. 13, 1904. Relates to a form of meter having two clock driven pendulums each carrying a shunt coil which is thereby vibrated in a series field so that the speed of movement is controlled. The present invention relates to a means for compensating for inexact leveling of the instrument, and includes a special form of suspension spring.

813,638. ELECTRICALLY OPERATED CONTROLLING MECHANISM; George H. Fretts, Springfield, Mass. App. filed May 13, 1905. The switch point is connected to the short arm of a double bell crank lever moved by two solenoids. Motion is normally arrested by two detents which are released by the induced magnetism of the solenoids cores.

813,660.—Lightning Conductor.

813,660. LIGHTNING CONDUCTOR; Thomas H. Miner, Winona, Mo. App. filed May 1, 1905. A construction of lightning arresters forming a frame adapted to follow the lines of the building to be protected.

813,662. ELECTRICAL RAILWAY SIGNAL; August W. Nelson, Spokane, Wash. App. filed May 11, 1905. Relates to details of construction of a tappet adjacent the track rail and adapted to be engaged by the wheel flanges. Has a roller supported by an upwardly spring-pressed plunger.

813,682. THERMOPILE; Meyer Wilderman and Robert L. Mond, London, Eng. App. filed Aug. 14, 1905. In order to secure a large number of perfectly connected elements, the patentee electroplates a platinum wire with an iron coating, and then etches the wire so as to remove the coating at spaced periods or sections along its length. The wire is then wound so as to expose corresponding section ends to the heat source.

813,685. ELECTRICITY METER; Hermann Aron, Charlottenburg, Germany. App. filed Jan. 13, 1904. Provides means for automatically exerting a retrograde movement to the recording mechanism when the flow of working current ceases and additional means for detaining the same against such retrograde movement.

813,688. APPARATUS FOR PREPARING BLEACHING LIQUORS; Friedrich L. Bartelt, Bristol, England. App. filed Oct. 7, 1904. An apparatus for preparing bleaching liquor comprising a solution tank, a float therein, an electrolyzer at a lower level than the tank, and a bleaching liquor tank below the electrolyzer in combination with a source of electricity in circuit with the electrolyzer, a bell circuit and a electrolizing circuit including a switch adapted to be closed by the float.

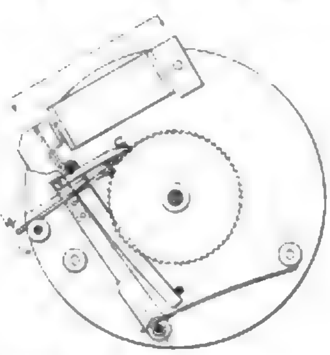
813,710. RELAY; Hemming Johansson, Stockholm, Sweden. App. filed July 21, 1904. An electro-magnet has its poles in proximity to a centrally pivoted lever of uniform polarity and moves the same for constant or pulsating current. The relay is, however, not responsive to alternating currents, which are too rapid to impart vibrations to the lever.

813,730. STORAGE BATTERY; Adolph Muller, Berlin, Germany. App. filed July 10, 1904. A battery plate support consisting of perforated covers provided with lateral loops and having pins inserted through the loops, the relation of the loops being such that the pins lock the covers together.

813,775. ELECTROMAGNETIC MOTOR; Murray Cheever, Boston, Mass. App. filed Feb. 20, 1905. A motor designed to secure a heavy torque at slow speed. A toothed wheel is intermittently stepped around by a pawl lever operated by an electromagnet.

813,840. INSULATED RAIL JOINT; McLeod W. Thomson, Altoona, Pa. App. filed Apr. 10, 1902. The fish plates have depending wings which converge toward one another beneath the base of the rail and serve to hold an insulating wooden block which serves as an insulating connection to strengthen the construction.

813,844. ELECTROLYTIC APPARATUS; Leroy Van Scoyoc, Gilbert Station, Iowa. App. filed May 15, 1905. An apparatus for decomposing water by electrolysis comprising a receiver, means including a valve actuated by variations in the water level in the receiver to supply water to the latter, a gas collector, electrodes in the receiver in suitable relationship to the gas collector and a valve actuated by variations in the water level in the receiver to control the discharge of gas to the collector.



813,775.—Electromagnetic Motor.

813,879. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Charles D. Gilpin, Cleveland, O. App. filed Oct. 6, 1905. An arrangement for securing multiple control through two conductors. Currents are sent through the two conductors alternately which serves to move the various contactors successively.

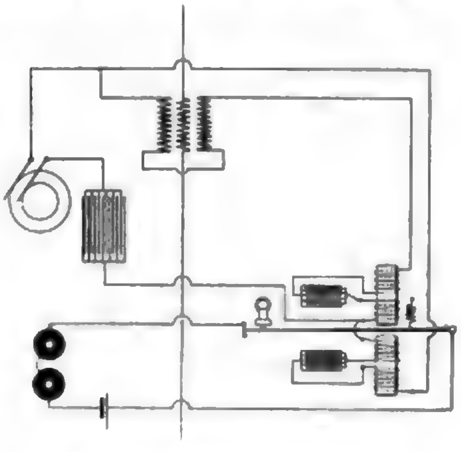
813,882. ELECTRIC SWITCH AND SIGNAL APPARATUS; Lawrence Griffith, Yonkers, N. Y. App. filed Nov. 5, 1904. A complete interlocking railway signal system so arranged that the various indicators cannot respond to a signal as long as electric energy is supplied to the signal "motion plates."

813,898. AUTOMATIC BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; Gray W. Johnston and Alex. H. Ackermann, New York, N. Y. App. filed Apr. 25, 1905. Secures an overlap system by spaced contact plates along the road which successively receive energy from the power circuit. Avoids the use of local batteries or track potentials or other factors of variable or uncertain value.

813,909. AUTOMATIC ELECTRIC BLOCK SYSTEM; Albert M. Mott, Hampton, Iowa. App. filed June 26, 1905. Details of a circuit-closing device adjacent the track rails comprising a bow-spring which is depressed by the train and which steps around a ratchet wheel to alternately make and break a signal circuit by its successive motions.

813,914. WIRELESS ELECTRIC SIGNALING SYSTEM; Ragnar H. Rendahl, Berlin, Germany. App. filed Aug. 19, 1905. A capacity is bridged across the coherer or detector for the purpose of improving the resonance of the detector circuit with the antennæ circuit.

813,931. ANNUNCIATOR; James A. Wotton, Atlanta, Ga. App. filed May 16, 1904. Adapted for telephone switchboards and comprises an electromagnet with a sector-shaped armature which vibrates before the pole pieces on an axis parallel with the magnet cores.



813,975.—Wireless Telegraphy.

813,975. WIRELESS TELEGRAPHY; James F. King, Washington, D. C. App. filed Jan. 8, 1903. Patentee impresses local generator currents on two branch circuits, and then causes the currents in said circuits to set up opposing magnetic fields, one of which is normally stronger than the other. The received oscillations act to vary the normal relation between said fields.

813,996. MEANS FOR ELECTRICALLY CONNECTING RAILWAY RAILS AND THE LIKE; John M. Atkinson, Chicago, Ill. App. filed Mar. 15, 1904. The fish plates have a V-recess to closely engage the rail web and a soft copper strip is embedded in the walls of said recess to contact with the rail.

813,998. INSULATED RAIL JOINT; Bancroft G. Braine, New York, N. Y. App. filed Oct. 11, 1903. Details of a bolt fastening for insulated rail joints. The bolt has a split insulating jacket and insulating caps with annular recesses which receive the ends of said jacket.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

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NEW YORK, SATURDAY, MARCH 17, 1906.

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THE INVERTED GAS-MANTLE BURNER.

In the report printed elsewhere in this issue of the very successful meeting last week of the Illuminating Engineering Society, there will be found an abstract of a paper on the inverted gas-mantle burner for interior service, which recently has been attracting much attention abroad and in this country. If we are to give credence to the gas engineer who presented the paper, the possibilities of this new type of gas burner have been grossly exaggerated, and electric lighting has nothing to fear from its competition. In printing, however, this destructive criticism—so surprising from a gas engineer—a word of caution to the electric lighting fraternity seems called for. The gas-mantle burner is only in the first stages of development, the patents on most of the forms now in the market having been issued within the past few years, and many inventors are hard at work on its perfection. In Europe this new type has been taken seriously and appears to have already established some foothold. In this country the advertising pages of one of our gas contemporaries are overflowing with enthusiastic announcements of various types of "The Light of the Future," and in New York City brilliant displays of the inverted burner can be seen in the show windows of some of its many exploiters. While the only specific advantage of the new over other gas burners with respect to competition with the incandescent electric lamp is that it admits of decorative bracket and ceiling pendant dispositions imitating those heretofore only associated with electric lighting, it is nevertheless well for central station men to keep an eye on its development. In the meantime, the thanks of central station managers are due to the author of the paper for the long catalogue he gives of the defects of a possible competitor, which information should prove useful where the inverted gas mantle may seek for public favor as a rival to the incandescent electric lamp.

DEFLECTION POTENTIOMETERS.

The potentiometer, which dates back to Poggendorff, is an invaluable piece of electrical laboratory apparatus for calibrating voltmeters and ammeters. It is distinctly a null-method instrument in its standard form. That is, it requires the use of a galvanometer, the deflection of which must be adjusted to zero in order to secure the balance on which the measurement depends. An article this week by Mr. H. B. Brooks, on page 564, describes a modification of the potentiometer as constructed at the Bureau of Standards, in which for certain purposes the null-method is partly replaced by a deflection method. That is, an approximate balance, or approach to zero, is first obtained in the ordinary way, and then the reading of the galvanometer, or its deflection, from the zero of correct balance, marks off the value that would otherwise have to be obtained from a careful resistance adjustment. This deflection type of potentiometer is thus in part a direct-reading instrument, and is somewhat swifter to work with than the ordinary balance potentiometer. Special arrangements and precautions have to be taken, however, in the deflection potentiometer, in order to maintain the uniformity of the galvanometer scale reading values at all parts of the range afforded with the instrument. It would seem from the description, that for portable use in central station instrument service, and for special types of laboratory work, the instrument might be very convenient. The standard balance form is, we think, likely to remain in favor for precision laboratory work.

REFRIGERATING CENTRAL STATION LOAD.

Elsewhere in this issue are given figures on the actual cost of artificial refrigeration in a meat market at Beloit, Wis. As will be seen, the electrically-driven refrigerating machine taking power at the central station company's regular rates makes a showing far below ice both as to operating expenses and total cost, including fixed charges on the refrigerating plant. It goes without saying that this class of work furnishes about as desirable a kind of load as a central station could ask for, as it can be kept entirely off the peak. Some time ago we printed an account of the excellent economy attained with the electrical refrigeration system in Philadelphia, where it has been introduced upon a considerable scale. The figures for Beloit indicate that the smaller central stations can also make refrigeration a source of income, and this demonstration should not be passed unheeded by the enterprising manager.

THE FLAMING ARC LAMP.

A paper presented last week before the Illuminating Engineering Society, an abstract of which is given elsewhere, brings out strongly the enormous light efficiency of the flaming or luminous arc lamp. Tests, of which data are given in the abstract, show that on the basis of spherical or total flux, a candlepower is produced on .353 watt, as compared with 1.78 watts for the enclosed arc light, 1.9 watts for the tantalum filament, and 3.9 watts for the ordinary (3.1 watts nominal) carbon filament. Other advantages of the lamp noted are the excellent quality of the light, both in color and steadiness, and its superior distribution. Aside from the present price of the lamp and electrodes, the main disadvantage is attendance due to the short life of carbons as compared with the enclosed arc and necessity for removing vapor deposits. Doubtless competition will take care of lamp cost, and we are informed that the composite electrodes used with the lamp are already manufactured in this country at a great reduction from the recent price of imported electrodes.

THE LIFE OF FROSTED LAMPS.

Elsewhere in this issue are given the results of some interesting tests made to determine the effect on the life of a lamp of the two common methods of securing diffusion of the light from the bare filament—namely, by frosting the lamp bulb and by enclosing it in a diffusing globe. This question is one which becomes of greater importance as more attention is given to the proper diffusing and softening of the light from incandescent lamps. That such diffusing is desirable where lights are placed in the ordinary line of vision is unquestionable. It is also desirable, although not so necessary, where close work, such as reading, writing and drawing, is done under the light of an incandescent lamp, for the reason that the light coming through a diffusing bulb or globe is more comfortable to work by than if from a clear bulb lamp, since it approaches more nearly the character of daylight, in that the glare of regular reflection from the paper and the shadows are less pronounced. Cases without number come up in practice where the engineer must decide whether to place lamps in diffusing globes or use simply a frosted bulb lamp, and the question of how much the frosting of a lamp bulb reduces its life or how much enclosing it in a globe reduces its life has received almost no consideration.

The tests cited by Messrs. Cravath and Lansingh in the article referred to show that the reduction of life of an ordinary 3.1-watt incandescent lamp by frosting is about 52 per cent. The loss by enclosing it in a globe is only about 5.5 per cent. It has been known in a general way for a long time that frosting of lamp bulbs materially reduces the life, but reliable tests seem heretofore to have been wanting. These results will probably cause the selection of enclosing globes rather than frosted bulbs for purposes of securing diffusion in the majority of cases where there are not good reasons why they cannot be used. If the enclosing globe is of frosted or sand-blasted glass with the smooth surface outside, and the neck of the globe is closed with an asbestos or mica cover as the authors recommend, the combination is much easier to keep clean than the frosted bulb. On the other hand, if the frosted bulb is in a location where it is burning a large number of hours per day it will probably burn out and be renewed before any great accumulation of dirt has been rubbed into its frosted surface by repeated cleanings. As far as the user of the light is concerned, even if he furnishes his own lamp renewals the extra cost of lamp renewals either with frosted bulbs or enclosing globes is so small as to be not worth considering in comparison with the advantages gained in the way of improved quality of illumination and artistic effect. There are many places where enclosing globes cannot be used but where diffusing glass is nevertheless desirable, and for such the frosted bulb still has the field to itself.

Up to date no very satisfactory combination of enclosing globe and reflector has been devised, although the results of these tests may set illuminating engineers to thinking along these lines. There would always be the inherent difficulty about any such arrangement that an enclosing globe must have a 3¼-in. holder and be of a size which interferes materially with efficient reflectors fitting closely around the lamp. Another interesting aspect of the situation is that presented to central station companies which furnish free renewals. Some companies furnish free renewals of frosted bulb lamps as well as of clear bulbs, while others make an extra charge for the frosted bulbs. The extra charge, if based on the difference in the initial cost of the lamp, will not begin to cover the actual expense involved in the use of the frosted bulb as against a clear bulb. However, since it is to the interest of central station companies to further any movement which is in the direction of improved and more artistic illuminating effects, the difference in the life of frosted and clear bulb lamps can well be left out of account.

MEASUREMENT OF POWER IN THREE-PHASE SYSTEMS.

The single-phase alternating-current system, when it first came into vogue, gave much trouble to electrical engineers in regard to the measurement of power delivered. The direct-current system, which was then familiar, permitted the power to be ascertained very readily. All that was necessary was to insert an ammeter in the circuit, and multiply the amperes by the main voltage of delivery. Direct-current recording watt-hour meters were also constructed and installed without great difficulty. All this was changed when the alternating-current system made its appearance. The power delivered was not proportional to the current strength. Only particular types of recording watt-hour meters would register correctly on alternating-current circuits. In time, however, these difficulties were overcome and forgotten. When the three-phase alternating-current system came into use electrical engineers were again perplexed by the problem of measuring the power. The voltages per phase were out of step with the currents in the wires even on the best balanced and most regular three-phase system. When the system was unbalanced, the conditions were still worse. Finally, the engineers adopted the two-wattmeter method for ordinary purposes, and this correctly indicated the power delivered on any three-phase system, whether balanced or not.

On page 563 this week Mr. E. R. Shepard describes a method of measuring the power in a balanced three-phase system, using two wattmeters, but only one voltage transformer. This method may be very convenient to fall back upon, when one of two regular switchboard voltmeter-transformers gets out of order. No change in the switchboard arrangement is required beyond shifting the secondary wires of the injured transformer to the uninjured one, which thereby has to supply a doubled secondary current. Even if the plan is liable to error, by reason of unbalancing in the system, it is better to have a pair of recording watt-hour meters which will give the energy delivered within a few per cent. than to have the record entirely lost by reason of a break down in one of the wattmeter transformers. The plan is easily remembered, and is a useful device to keep in the central station engineer's note-book.

SUBSTATION CONSTRUCTION.

The huge Toronto sub-station described in this issue is particularly worth consideration as being both the largest yet erected in point of capacity, and the most complete example of cellular construction ever attempted. Add to this example the long transmission at the maximum voltage in use and the importance of the plant commands instant attention. The most interesting feature to the engineer is the extremely intricate system of subdivision of units employed throughout. There have come to be two distinct lines of design in high-voltage work. The fundamental aim of the one is simplicity, of the other safeguards. The former regards, in dealing with extreme voltage, every switch, separate unit and concealing barrier as a more or less necessary evil and pins its faith in the best possible initial construction of apparatus and its installation where it can be watched; the latter regards each step of subdivision and each inerpolated device as a safeguard for possible trouble, in spite of any attainable excellence of construction. The Toronto station is a very perfect example of the pessimistic theory of design which provides for the n^{th} possible trouble an $(n \div 1)^{th}$ safety precaution. To begin with, there are to be four transmission circuits of the modest capacity of 7,500 kw each. Each of these is treated as an independent unit with its own full bank of three transformers, each of 2,400 kw output, and in addition there is provision for working in multiple to any desired extent. In each group every individual line, transformer and oil switch is in an individual cell, and to an extent never before realized, every part of the apparatus is isolated from every other part.

Of course, for this equipment the principle of remote control must be carried to the last refinement, and so in fact it is. It is difficult to see how with all these precautions the failure of any single piece of apparatus can by physical contact involve any other piece; and yet since all are in electrical connection, no amount of isolation can prevent the spread of trouble under certain conditions. In spite of the good points of cellular construction, we feel it necessary to press this warning. For instance, in that tremendous case of destructive surging a couple of years since in one of our metropolitan power houses, no amount of isolation of individual apparatus would have prevented a shut down. The burning out of a single unit from an electrical cause costs just as much whether it occurs in an open power house or in a locked masonry cell. In the last analysis, cellular construction is mainly a precaution against fire as such, rather than against electrical failures which, with standard apparatus, are equally likely or unlikely to happen irrespective of the location of the units. One of the most striking features of the Toronto plant is the remarkably good protection given to the high-tension wiring, which is far too often left to the last moment and inadequately provided for. High-voltage wires should be located either so that they can be easily inspected or so that they will not need inspection; and in a cellular station the latter arrangement is evidently the only one possible. We do not think the staff of the Toronto station will have to worry much about their 60,000-volt leads. In such a plant the lightning arresters and the cable connections are really the most vulnerable points. In the operation of the former we shall be much interested, since the lines are very long, and, from the high tower construction, somewhat exposed.

A transmission of 75 miles at 60,000 volts in a rather unfavorable climate is a daring undertaking even in the present state of high-voltage transmission, and its performance will be watched with great attention. Already engineers are getting ready to consider 75,000 volts and more, and if this fine Canadian line at 60,000 volts gives first-class service, the next step will be taken with more confidence in the results. The line is uniformly the weakest point when it comes to such voltages, since there is probably the lowest factor of safety in the insulation, and the greatest exposure to danger, both electrical and mechanical. If the present limit of 60,000 volts is to be raised, it will be by better line equipment, for the apparatus can be made safe enough for much greater pressures. We have no doubt, for instance, that the high-voltage switches of the Toronto plant would serve admirably at 75,000 volts, and transformers can surely be made reliable at that pressure, if line troubles can be kept away from them. Perhaps with the immunity from internal disturbances which should be secured in the Toronto plant, that system may readily be the scene of successful work at even higher pressure. The troubles to be feared are those from the outside. As regards the principles of design followed in this instance, there is no general consensus of opinion among engineers. There is a point at which any further increase of plant complication and multiplication of safety devices tends to defeat its own ends, since the complexity may entail more ultimate care than would be required by a simpler construction. A plant like the Toronto one is not at all an easy one to handle in a real emergency, since the very isolation of the parts renders a quick grasping of the situation and prompt action almost impossible. We cannot imagine a conflagration in such a station, but we can easily imagine a breakdown as complete as in the case of an open station, and perhaps less easy to reach and remedy. The extent of precaution really desirable is, as we said at the start, still a moot point among those most competent to judge. Carried to the limit as it is in this case, the extra cost entailed is a very considerable item in the total cost of transmission. We would much like to know the actual complete cost of the Toronto station finished and ready to operate. That it is large goes without saying, but it would be very interesting to figure the cost of the insurance measures that have here been carried out with so exceptional thoroughness. It certainly is a masterly embodiment of the extreme point of view which it represents.

Large Gifts to Institute Building Fund.

The chairman of the Land and Building Fund of the American Institute of Electrical Engineers announces this week some very large and important contributions to this fund, the object of which is to raise $200,000 for the land on which the United Engineering Building, given by Mr. Carnegie, is now being executed. The total cost of the land is $540,000, and the obligation is divided between the Electrical, Mechanical and Mining Engineers.

Mr. Clarence H. Mackay, president of the Postal Telegraph-Cable Company, has given $5,000 to the fund, accompanied by the expression of his interest in the building as a center whose facilities will be available to the various bodies of telegraphers. Mr. U. N. Bethell and Mr. J. J. Carty, members of the committee, have advised it, on behalf of the American Telephone & Telegraph Company, the Western Electric Company, the New York & New Jersey Telephone Company and the New York Telephone Company, that these corporations have jointly contributed $25,000 to the fund, in view of the great benefits that the existence of this new engineering center will confer upon the electrical arts and upon their employes in the widening field of telephone engineering.

Other notable gifts to the fund are $1,200, from Mr. E. W. Rice, Jr., and $500 from Mr. T. D. Lockwood. A number of subscriptions of lesser amounts have been received from the Institute membership at large and in this manner the fund has now reached the total of over $130,000 or two-thirds of the required amount. With the campaign it has already inaugurated, and the plans now maturing the committee is hopeful of having the entire sum pledged before the Institute moves into its new home.

Water Powers in France.

A very thorough study is being made in France of the condition of the water sources and water powers of the country. A decree dealing with the subject was put forth in December, by the president, adopting a report from the minister of agriculture, increasing the staff devoted to such works. The French minister of agriculture, in his report which drew forth the decree above mentioned, says: "We know the great degree of interest in the utilization of waterfalls for the production of electricity, not only of those great mountain torrents, but also of those of the secondary ranges, and in a certain measure the streams of flat countries. In France the rivers susceptible of being controlled with a view to industrial utilization are very numerous. However, before erecting hydro-electrical works of importance, it is of the highest interest to know the variations in the volume of the stream utilized at various periods of the year. For having neglected this primordial element of information several enterprises hastily realized have given rise to cruel deceptions. During periods more or less long certain concerns have had at their disposition an amount of power greatly inferior to that upon which they counted, and are, therefore, placed under the necessity of making costly transformations in their original installations, and in some cases have been obliged to abandon their plants.

"The factors to be investigated are the surface and direction of the watershed, the mode of culture, the extent of the forests, the geological nature of the soil and subsoil, the intensity and the division of the rains or snows received by the watershed, and in mountainous countries the surface of glaciers which sustain the summer discharge. Your minister of agriculture has instituted a bureau of hydraulogy and great hydraulic forces in our two principal mountain systems—the Alps and the Pyrenees—and he proposes to extend progressively the same studies to the secondary systems and then to the level regions. The two services which now operate have already gathered together a great number of useful elements; but it is of the highest interest in order that they may be utilized to determine the best methods of seeking these elements and to co-ordinate the results obtained. This is a new and important task, which is now confided to a committee of scientific studies."

The Famous Dalrymple Report.

It will be remembered that Mr. James Dalrymple, manager of the municipal street car system of Glasgow, was brought to this country by the advocates of municipal ownership in Chicago to make a report on the conditions there. Mayor Dunne, of Chicago, got a report, but in some way managed to suppress it immediately. A great deal of interest and curiosity has been aroused as to the document, and until now fruitless efforts have been made to secure a copy of it. Mayor Dunne asserted that Dalrymple went to Chicago as a personal guest and that the report was, therefore, personal property. The Chicago City Council finally obtained a copy of the report from Alexander Walker, Deputy Town Clerk of Glasgow. The report in effect is against the municipal operation of street car companies in Chicago unless it has become impossible to reach an agreement with the companies now operating lines in the city streets.

Mr. Dalrymple suggests that an effort be made to come to terms with the companies now operating street car lines in the city, and suggested that if that is not possible there is only one thing to do, which is to start a new line as fast as the franchises under which the companies are now operating, expire. The report then declares that most of the present equipment of the companies should be relegated to the scrap heap, and a time fixed within which the lines should be placed in perfect condition. Then a franchise should be granted for, say, twenty years, with the city having the right to take possession at the end of five-year periods. The report concludes as follows:

"I should be very sorry indeed if you were forced to take such a step as starting new lines when the franchises of the present companies expire, because, speaking generally, I should say from my knowledge and experience of what it means to operate a municipal street railway system, that the municipalities of the United States are not yet quite ready successfully to undertake this work."

Mr. Dalrymple strongly recommends the overhead trolley for motive power, saying that to "install the underground trolley in any extent would, for various reasons, be a scandalous waste of money."

Co-operative Electrical Development.

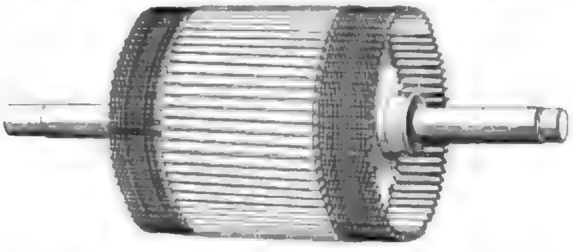
Mr. J. R. Crouse, of the Co-operative Electrical Development Association, announces that it is proposed to hold a meeting in New York City for the different electrical interests for a consideration of the work of the Association. This meeting will be held on Friday, March 23, at the Imperial Hotel. Substantially every well defined line in the industry will be represented, including the larger manufacturing companies, representatives of different groups of electrical manufacturers, such as incandescent lamp, rubber covered wire, etc., the president of the National Electric Light Association and a co-operating committee of three appointed at their last meeting, representatives of the trade papers, the counsel and committee of the Electrical Jobbers' Association East and West, the president of the National Electrical Contractors' Association, their co-operating committee, advertising agencies specializing in the electrical field, a committee of Electrical Salesmen's Association, etc. The session will conclude with a dinner in the early evening.

Cooking by Electricity.

With a view to introducing electricity for domestic purposes President Maritt, of the Kokomo, Marion & Western Traction Company, has secured Mrs. A. V. Sanborn, of St. Louis, to deliver lectures on cooking by electricity and to demonstrate to the farmers' and villagers' wives how successfully and economically electricity can be used in the home. The company believes that when people living along the line acquire a knowledge of the comfort, convenience and economy of electricity, a considerable demand for the current will be created, and incidentally quite a market for miscellaneous apparatus.

Rotor for Induction Motor.

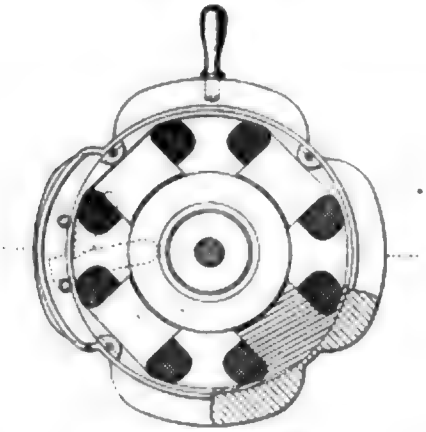
In order to provide improved facilities for cooling the secondary windings of an induction motor, Mr. E. J. Willis, according to a patent issued February 8, allows the rod conductors to extend longitudinally beyond the ends of the rotor core, and interconnects the ends of rods by means of naked wires placed circumferentially in notches cut in them. The construction is clearly indicated in the illustration.



ROTOR.

Variable Speed Direct-Current Motor.

The accompanying illustration shows a method of obtaining speed variation in a shunt-wound, direct-current motor as disclosed in a patent issued February 7, to Mr. C. A. Eck. The motor is provided with an adjustable yoke between the poles whose sectional area can be varied. When the yoke is adjusted to one position, the magnetic lines of force will flow through that portion of the yoke having a large cross-sectional area, and when adjusted to another position the lines will flow through that portion of the yoke whose cross-sectional area is smaller. It is seen, therefore, that there is a change in the reluctance of the magnetic circuit and a corresponding variation in the field flux with constant field current, but there is no change in the dimensions of the air-gap or of the cores of the poles.



VARIABLE SPEED MOTOR.

Canadian Electric Railways.

There are 793 miles of electric railways in the Dominion, a gain of only 36 miles over the preceding year. The capitalization is $61,033,321. The gross earnings for 1905 were $9,357,125, the operating expenses $5,918,194 and the net $3,438,931. The passengers carried were 203,67,317, or 2,777,319 more than in 1904-5. The freight handled was 510,350 tons, a gain of 110,189 tons. The total run was 45,959,101 car miles. The killings numbered 56, and 1,260 people were injured. In Montreal 67,297,268 passengers were carried; in Toronto 65,792,792; in Winnipeg 11,255,967, and in Ottawa 9,328,690. The Vancouver, Victoria and New Westminster system in British Columbia handled 10,352,410 passengers.

Meeting of the Illuminating Engineering Society.

The meeting in New York last week of the Illuminating Engineering Society scored a notable success, the attendance exceeding 150. At the meeting it was announced that although a systematic canvass for members has not been started, the membership to date is 192, of whom about a half reside distant from New York. The secretary stated that arrangements are being made for the organization of branches of the society at Boston and Chicago, and that the papers of the evening would be discussed in Boston and Chicago the following Friday. The New York meeting will be held on the second Friday of each month, unless there are special reasons for changing the date. The programme for next meeting, which will be held on Thursday, April 12 (the 13th of April being Good Friday), is a general discussion of the subject of interior illumination, which will be opened by several short introductory papers.

The surprise of the evening was the character of the paper by Mr. Victor A. Rettich, a gas engineer, on the inverted gas mantle lamp. It was expected that the paper would present the claims in favor of the inverted gas burner, which at present is attracting so much attention in this country and abroad. Instead it is as severe an arraignment of the new device as its most unrelenting antagonist could desire.

Below will be found abstracts of the several papers presented and of the discussion to which they gave rise:

ILLUMINATING ENGINEERING FROM THE ARCHITECT'S STANDPOINT.

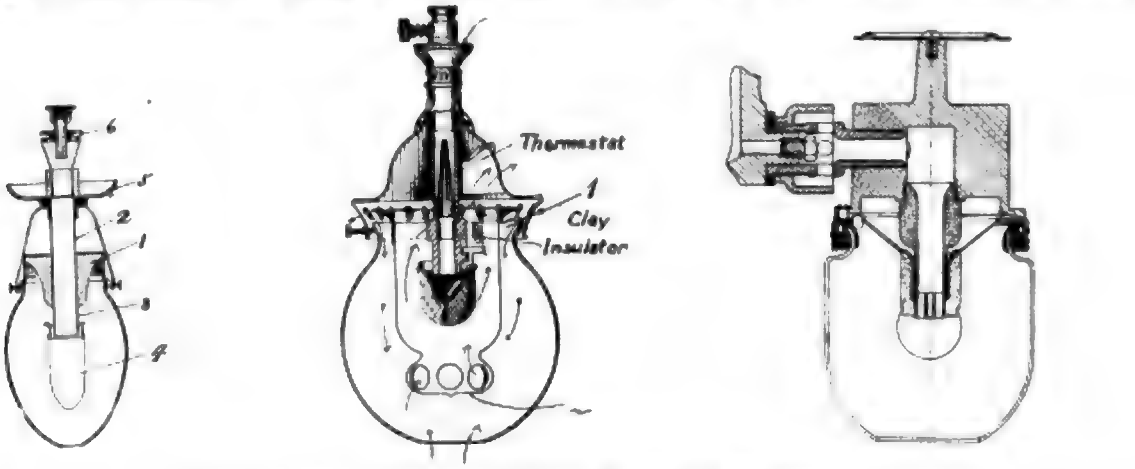
In a short paper with the above title, Mr. W. S. Kellogg gave a brief discussion of artificial illumination from the architect's standpoint. He expressed his belief that the intrinsic brilliancy of the commercial illuminants is too great and that globes must be employed to render the light less objectionable. The present trend of development in illuminants is towards greater brilliancy at the same or an increased consumption of electrical energy. It seems desirable from all points of view not to increase the illumination from the source of light at a given cost for energy, but rather to decrease the cost for electricity while maintaining or even decreasing the illumination. The author thought that the only logical method of rating lamps for illumination is by the mean spherical candle-power, and that other methods merely lead to confusion. It is desirable that both the lamp itself and the light obtained from it should harmonize with the surroundings. It is the duty of the architect to study the requirements of his customers and then to select the lamp which most nearly corresponds with those requirements. The position of the lamp, its color, and the color of the light produced, are of prime importance, while frequently efficiency is of secondary consideration.

THE INVERTED GAS MANTLE LAMP.

The paper on this subject, presented by Mr. Victor A. Rettich, enumerates the defects of, and objections to, the inverted gas lamp, as follows:

1. Dangers of falling particles. 2. Carbonization. 3. Flashing back. 4. Delicacy of mantle suspension. 5. Flickering light at low pressure. 6. Discoloration of chandelier arms. 7. In many cases a difficulty in attaching lamps so that they will be gas tight when set in the required direction. 8. Methods of gas regulation are too coarse. A much more delicate way is required. 9. Liability of breaking mantles when removing glassware. 10. Variations of diameters of globe rings, so that glassware is not interchangeable with different makes of burners. 11. Variations in means of affixing mantles to burners. Manufacturers should get together and adopt one standard type, though each is naturally trying to protect his future trade in renewals. Still the public ought to be considered if the lamp is to become popularized. 12. Too much heat thrown off in proportion to the amount of gas used.

Mr. Rettich stated that after a long discussion at a recent convention in England, the verdict was that the inverted lamp in its present form would not be a success, and no suggestions were put forward as to its improvement. Where a light gas of low candle-power is supplied at a high pressure, the inverted burner may give good results, but with New York gas the problem is a very difficult one to solve. During a recent visit to Europe he was told that the sale of the inverted lamp is something enormous, but he failed to see that even a small percentage of the burners in use were of the inverted type, and he cannot see that the burners in the present form are going to be a permanent addition to gas lighting appliances. It has been on sale in Europe for the last four or five years and yet to-day a tremendous majority of burners are of the upward type. While admitting that the inverted burner permits of graceful outlines and designs, he said that so far the public has not taken to the designs in which the mantle is so placed and the globe is so shaped as to present the appearance of an electric incandescent lamp. The inverted burner, he stated, has recently been condemned in New York City by the Board of Fire Underwriters on account of fires started from it, and many billiard tables, etc., have been charred by red-hot carbon falling through the open base of the globe. As to efficiency, he said that while there can be no doubt that with the inverted burner this is much greater than with the incandescent lamp, still the light is so brilliant and glaring that it has to be toned down by ground glass or opaque shades so that the actual candle-power that is utilized is small compared with that of the source.



Figs. 1, 2 and 3.—Details of Inverted Gas-Mantle Burners.

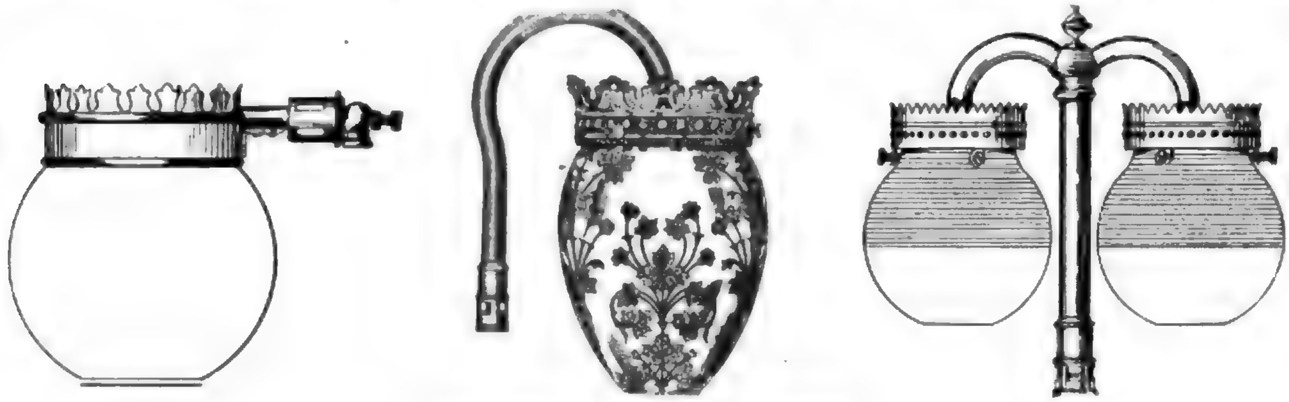


Fig. 4.—Inverted Gas-Mantle Fixtures.

The paper was illustrated by a large number of sketches showing different types of the lamp. The earliest patent cited on the inverted burner is dated 1895, but the patents on the forms now in use date from 1901 and later. Fig. 1 shows what is stated to be the pioneer of the present lamps, the inventor of which was an Austrian. The principal point is the porcelain cone, 1. The burner tube, 2, is of a poor conducting material, the burner head, 3, being made of metal. The mantle is shown at 4, and 5 is a deflector to keep the products of combustion from the air ports, 6. Fig. 2 represents what is stated to be the latest inverted burner to enter the field. The inner and outer globes may be used either together or singly. The air intake may be above the mantle as at 1, in which case an entirely enclosed outer globe may be used. The bottom (2) of the inner globe is closed in order to catch any falling particles. The particular feature of this type is the employment of a thermostat which is arranged in a direct line with the flow of gas. When the burner is cold the narrow ends of the thermostat will be bunched together, forming a solid cone

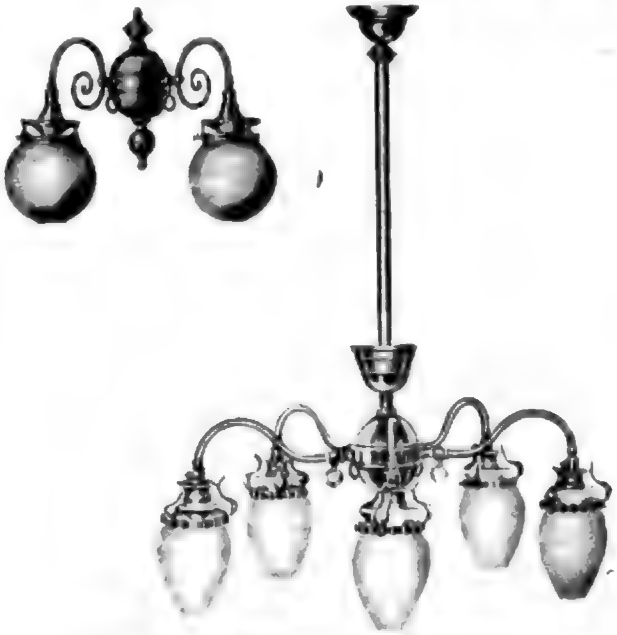


Fig. 5—Inverted Gas-Mantle Fixtures.

and offering resistance to the mixed air and gas, thus permitting of lighting without flashing back. As soon as the burner is thoroughly warmed up the action of the heat on the thermostat fingers will cause them to open and lie flat against the inner surface of the globe, thus offering no obstruction to the descending gas and permitting it to take a full complement of air. Fig. 3 shows the type of inverted burner that has been used with very satisfactory results in railway lighting. A peculiarity of this type is the way in which the mantle is attached; there is no opening between the mantle holder and the burner tip, the mantle being continuous with the tube, so that no products of combustion can escape. The combustion of the burner is stated to be absolutely perfect, and consequently no carbonization of the mantle follows. Mr. Rettich ascribed the great success of this burner to the fact that it is used with the Pintsch gas system, which employs the great pressure of about 28 in. of water.

THE LUMINOUS ARC LAMP.

In the first part of his paper with the above title, Mr. E. L. Elliott sketched the progress of electric arc lighting from the discovery of the electric arc by Sir Humphry Davy to the present time. In taking up the subject of the paper he criticised the use of the term "flaming arc" and advocated that for the sake of scientific accuracy it would be far better to use the term "luminous arc" since this word is exactly descriptive.

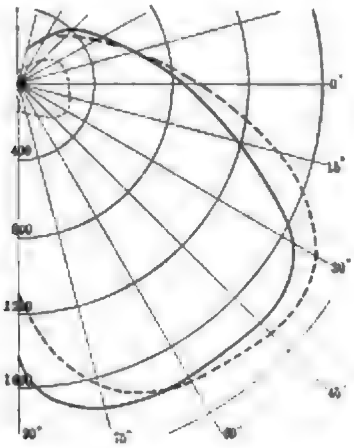


FIG. 6.—LIGHT CURVES OF LUMINOUS AND ENCLOSED ARC LAMPS.

By the introduction into electrodes of substances having a high light radiating power, such as salts of the calcium group of elements, the electric arc itself is rendered highly luminous and becomes the principal source of light, instead of the heated end of the positive carbon as in the case of the ordinary arc lamp. The hot gases generated by the volatilization of the salts in the carbon furnish a path of less resistance than air for the passage of the current and thus permit the electrodes being drawn much further apart, producing an arc 1½ in. to 2½ in. long. The light thus produced is, with the calcium salts, of a golden tint hardly distinguishable from the color of light of ordinary flames and incandescent electric lamps. This yellow color of light is for purposes of exterior illumination, a decided point in its favor, having a much greater penetrating power than the blue and violet light from the open arc. For lighting foundries, iron mills, railway yards or any other large enclosure where smoke abounds, this is of particular advantage.

While in the past electrodes to produce white light have been less efficient than those producing yellow light, at the present time carbons giving a white light of remarkably fine quality are made. It is claimed that the white light thus produced is the nearest approach to sunlight of any of the commercial light-sources.

In efficiency as a light producer, the luminous arc is revolutionary. Comparative measurements made by the Electrical Testing Laboratories with a luminous lamp producing the yellow light, and with an enclosed arc gave the following results:

	Luminous arc.	Enclosed arc.
Mean amperes	8.	5.1
Mean volts at arc	45.	91.
Mean watts at arc	360.	413.
Mean spherical c.p.	1020.	232.
Mean lower spherical c.p.	1560.	260.
Watts per m.s.c.p.	.353	1.78
Watts per m.h.s.c.p.	.265	1.59

In actual light production the luminous arc is, therefore, practically five times as efficient as the enclosed arc. The lamps tested were run on direct current, and were fitted with opaline globes of practically equal density.

While the price of luminous arc electrode is higher than the price of the best pure carbons, the cost per candle power hour figures out exactly the same. The smaller lamps run ten hours with one setting of carbons, and the larger lamps 15 hours.

Fusible matters introduced into arc electrodes have the tendency to form drops of slag, which interfere with the operation of the lamp if the carbons are placed one above the other. It was, therefore, found necessary to resort to an arrangement of the carbons side by side and inclined toward each other at a slight angle, thus reverting to the arrangement of the Jablachkoff candle, the earliest commercial form of arc lamp. This necessitates the use of an electromagnet placed above the arc to give a downward curve and prevent its running up the sides of the carbon. This arrangement has the advantage of giving a distribution entirely free from shadows underneath. In practical construction a concave porcelain plate or cup is placed immediately above the arc, which protects the mechanism, steadies the arc, and acts as a reflector of the upward rays.

The distribution of light from the lamps now on sale in this country is practically the same as from the enclosed arc when used with opaline globes. A comparison of the two curves from the tests above referred to is shown in Fig. 1. Both curves refer to vertical planes, one passing through both carbons and the other at right angles thereto. The dotted curve of small area represents the light flux of an enclosed arc. For exterior illumination a somewhat broader curve would be rather more desirable.

Owing to the much greater size of the light-source the intrinsic brilliancy, even with the lamps giving much higher total candle power, is far less than with the ordinary arc, except where the latter is diffused with very strong diffusing globes. With the carbons giving a white light the efficiency is said to be reduced about one-half; but even in this case the efficiency is more than twice that of the enclosed arc, and the quality of the light superior in being free from the excessive blue and purple rays.

On account of its greater length, the arc is naturally very sensitive to air currents, and it is therefore necessary to protect it from drafts. Since there is also some vapor generated, which must be allowed to escape, provision is made for a restricted access of air and the discharge of the vapors. This is accomplished by providing a small inlet at the bottom of the globe and a corresponding protected outlet at the top.

Lamps are made to run on either direct or alternating-current circuits, and on frequencies of 60 cycles and upward. As they require about 45 volts to the arc, they are run two in series on 110-volt circuits. The mechanical and electrical operation of the lamps now sold seem to be entirely satisfactory. Thus far only lamps of foreign manufacture have been introduced here, the general design of which is practically the same. One is manufactured in Germany and the other in England. The lamps sell for about $50 each.

As the real virtue of the lamp lies in the composition of the carbons, these are naturally claimed by the different manufacturers to be either protected by patents or are kept secret. As the fundamental patents have long since expired, it seems unlikely that any monopoly can be maintained in this respect. The most serious objection that can be urged against the lamp at present is the greater amount of attention required. It is in this line that efforts are at present mainly directed toward improvement, particularly toward combining the long life of the enclosed arc with the efficiency of the luminous arc. In view of the enormous increase of efficiency obtained, the improvement in the color of the light, its steadiness, and naturally advantageous distribution.

together with the rapid improvements that have been made within the last few years, it is safe to predict that the luminous arc lamp marks an epoch in electric illumination.

DISCUSSION.

The several papers of the evening were discussed together. Prof. Edward L. Nichols, of Cornell University, in opening the discussion, referred to the deep interest which the new society has aroused among the many classes of engineers, architects, builders, dealers, physicists and all persons in any way connected with illumination. He expressed his belief that the society will undoubtedly prove a success. Artificial light was used long before history began, but even at the present time very little is known as to the proper use of illumination. Many problems are yet in dispute. The society should insist on correct methods and satisfactory results will be obtained. It should educate the people to judge of illumination by the effect produced, and it should also educate the engineers and architects to a proper appreciation of the fundamental features of illumination. He thought that the organization of the Illuminating Engineering Society would mark an epoch in the art, by bringing together for the good of each all persons interested in illumination.

Mr. Geo. G. Ramsdel agreed with Mr. Rettich in regard to some of the minor defects of the inverted gas mantle lamp, and expressed the opinion that while the paper of Mr. Rettich contained much of truth, it contained much more of error. The inverted lamp is exceptionally free from defects, if its age be considered. It is not yet perfect, but even now it is in good form and is sure to be a success. To just the same extent as Mr. Rettich was pessimistic, he himself was optimistic. Mr. E. C. Brown remarked that about three year ago he obtained the first inverted gas mantle lamp to be brought to this country. Even at that date the lamp was extremely satisfactory; the mantle was not destroyed in the short time mentioned by Mr. Rettich, but it burned for eight months. He felt that the inverted mantle lamp has come to stay and that it is a success at the present time, while the few remaining defects can easily be overcome. In reply to a question by Mr. Rettich, he stated that the particular lamp to which he had referred is not now in use because the mantle had been destroyed. A second inverted mantle lamp is giving good service, but lamps of the older type are yet being used by him.

Dr. C. H. Sharp discussed the physical relations which exist between the incandescent-mantle lamp and the flaming-arc lamp. In each lamp the light comes largely from a substance which ordinarily is not luminous. Thus, in the flaming arc the vapor is rendered luminous by the passage of the electric current, while in the mantle lamp the substance of the mantle becomes luminous when placed in the gas flame. In the former lamp there is a consumption of the substance giving the illumination, while in the latter the luminous substance is permanent. The exact cause for the increase in illumination when a mantle is placed in the gas flame has never yet been determined. It is known, however, that only certain definite proportions of the elements forming the mantle will give the desired illumination. When each element is used singly, the desired effect is entirely lacking. Rubens, who studied the distribution throughout the spectrum of the energy radiated by the mantle, found that the radiation is confined largely to the visible portion of the spectrum, and is very low in the heat range, so that the efficiency of the luminous radiation is extremely high. The effect of combining the various components of the mantle seems to be to confine the radiation to the visible portion of the spectrum. He expressed the opinion that the flaming arc is too brilliant to be substituted directly for the older types of arc lamps. The lamps should be more widely separated and should be placed higher from the ground.

Prof. Nichols ventured what he termed a "guess" as to the high luminous efficiency of the gas mantle. Perhaps the increase in illumination is due to the luminescence of the mantle at the temperature produced by the gas flame. Each luminescent substance exhibits this property at a definite temperature; some at the low temperature of liquid air, others at ordinary temperatures, and yet others at much higher temperatures. The mantle may be considered as a solid in solution which is rendered luminescent at the particular temperature to which it is subjected. The energy curve of the radiation throughout the spectrum seems to show that this theory is correct. It is difficult to ascertain just how much of the illumination from the mantle is due to the luminescence of the substance, on account of the high temperature which simultaneously renders the mantle incandescent. It may be possible to discover materials other than those used in the mantles which are luminescent at certain temperatures, and thus to produce various color effects. This is an inviting field for investigators.

Mr. W. D'A. Ryan, of the General Electric Company, stated that the weakest features of the flaming arc lamp are the short life of the pencils, the high brilliancy and the poor distribution of illumination. Distribution curves which he displayed showed that only 16 per cent of the total illumination is given off in the range between 0 and 20 degrees below the horizontal, that is, within the useful range for street illumination. When globes are used the light is enormously decreased. For street illumination, distribution is of greater importance than efficiency, as is shown by the fact that the enclosed arc lamp has superseded the open arc, although its efficiency is much lower, merely because a large portion of the light is given off in the useful range. He considered that the very best arc lamp with reference to distribution is the G. E. "Magnetite" lamp, which gives 55 per cent of the light between 0 and 20 degrees below the horizontal.

CURRENT NEWS AND NOTES.

JERSEY TROLLEY FREIGHT.—The New Jersey Legislature has passed the bill permitting trolley companies to carry freight and a limited franchise measure granting certain leases to public utility companies for a period of 20 years.

N. E. L. A. TRANSPORTATION.—Mr. G. F. Porter, master of transportation of the National Electric Light Association, announces that the Trunk Line Association and the New England Passenger Association have authorized a rate of fare and one-third, on the certificate plan, from points in their respective territories to Atlantic City and return, for delegates and their friends attending the twenty-ninth convention of this association, to be held at Atlantic City, N. J., June 5 to 8, inclusive. Negotiations are under way with the other associations and it is hoped that the same rate will be obtained from them.

PERSONAL INJURY LITIGATION, so expensive to public service corporations, is one of the things municipal ownership advocates think about rarely. It is, therefore, interesting to note that such litigation that will cost the city millions of dollars every year under the municipal ownership of traction lines is predicted by City Attorney John F. Smulski, of Chicago. He sounds the warning in his annual report to the City Council, and recommends amendments to the Mueller law that will remove the impending danger. After calling atention to 700 lawsuits for personal damages filed against the city last year which were settled at a total cost of $400,000 to the city, Mr. Smulski expresses the belief that the damage suits would be increased more than twelve fold under municioal ownership. "The street railways of Chicago," said he, "have filed against them claims of every description, possibly to the number of 10,000 annually. I have it on good authority that these companies pay out in defraying expenses of their claim and law departments to charge of personal injury litigation, the settlement of claims and the payment of judgments recovered, upward of $2,000,000 annually. Knowing from past experience what success personal injury professionals have had against municipalities, I believe that the amount of claims and judgments recovered in the case of municipal ownership and operation of street car lines would far exceed the sums paid out by the present street railway corporation, which have reduced the system to a science."

CHICAGO SEEKS ADVICE.—The Chicago City Council Committee on Telephone Rates is advertising in New York papers for the opinions of the local telephone subscribers as to the measured rate system of service. The Western metropolis is proposing to adopt a new telephone rate ordinance and thus seeks information on the subject.

DESTRUCTIVE AUTO FIRE.—No fewer than 50 or 60 electric automobiles were destroyed in a fire that broke out on March 10 in the barns of the New York Transportation Company in this city. Several hundred machines were stored in these quarters, for the extensive public service system maintained by the corporation, whose vehicles are in constant demand and have been extraordinarily busy this winter.

BUYING A CATARACT.—It is announced from Spokane, Wash., that Mr. Jay P. Graves has paid $77,000 for the falls of the Columbia River at Kettle Falls, Wash., 75 miles north of Spokane. The river there can produce 100,000 hp at extreme low water and the falls are said to be the largest in the United States with the exception of Niagara and the Shoshone Falls in Southern Idaho. Mr. Graves is expected to install an electrical generating plant to supply his Inland Empire Electric Railway radiating out of Spokane, and also to supply the mines and smelters in the boundary district of British Columbia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The next regular meeting of the American Institute of Electrical Engineers will be held Friday evening, March 23, at 8.15 p.m., in the assembly room of the New York Edison Company, 44 West Twenty-seventh Street. The following papers will be read and discussed: (1) "Some Features Affecting the Parallel Operation of Synchronous Motor-Generator Sets," by J. B. Taylor, railway engineering department, General Electric Company, Schenectady, New York. (2) "Notes on the Design of Hydro-Electric Power Stations," by D. B. Rushmore, of the General Electric Company, Schenectady, N. Y.

BOUNDARY OF YOSEMITE PARK.—The California Congressional delegation at Washington has been unofficially advised that a favorable report will be made by the Secretary of the Interior on the plan to change the boundary of Yosemite National Park in order to permit the construction of electric railways on an even footing in competition for Yosemite Valley traffic. The southwestern boundary at present prevents Huntington's line from Fresno, Cal., from approaching as closely to the valley as does the Merced route. It has been demonstrated to the satisfaction of the Department that no scenic features or valuable forests would be excluded from the Park by changing the boundaries, while the public interest would be served by giving all railroads an equal chance to compete. Upon receipt of Secretary Hitchcock's report, an effort will be made to secure the passage of a bill making the proposed change in the boundary.

TROLLEY FREIGHT bids fair to assume considerable importance in New England. The Massachusetts Railroad Commissioners have given the Old Colony Street Railway system of the Massachusetts Electric Companies authority to carry freight and express matter over its lines between Boston and Fall River. The management has been preparing for this service and has secured the local rights to the south of Boston and ordered cars for this service. Mr. George Dumford, who built up a large freight and express business for the Utica Street Railway Company, has been appointed "superintendent of freight and express" with headquarters at Brockton. The new service will be opened inside of thirty days. Express cars of 20 tons capacity each and two coal cars have been secured for service on the Boston & Northern system. These cars will have running rights over the Boston Elevated lines, and terminals in Boston will be secured. Hereafter the Boston & Northern will transport all its coal from tidewater to Lawrence and Woburn and other inland points for the company's power needs at a considerable saving. Practically the only expense will be that of labor.

THE PROPOSED MONORAIL.—The Brooklyn Engineers' Club, of Brooklyn, N. Y., was entertained recently by F. B. Behr, the English engineer, who in an illustrated lecture explained the principles of the monorail system, which he is advocating as a means to relieve some of the congestion on the local street railways. With stereopticon pictures Mr. Behr showed interiors of the cars which would be run on his road, sections of the experimental track in Germany, and drawings giving the mechanical construction of the cars. Most of the lecture, which dealt with local conditions, had to do with the line Mr. Behr proposes to run down Fourth Avenue, Brooklyn, to Coney Island, starting from the Interborough terminus at Flatbush Avenue.

STATE METER EXAMINATION.—A bill said to have plenty of politics behind it has been introduced in the New York Legislature. It gives the State Gas and Electric Commission power to inspect all gas and electric meters and to affix the commission seal guaranteeing their efficiency. Lighting corporations may not install meters unless they have been inspected. The bill also provides that a testing apparatus shall be kept on the premises of the consumer. A consumer may demand a test in his presence at any time. If the test by the company be unsatisfactory in his opinion he may ask for a test by the State Commission. This is one newspaper comment: "Behind this bill is said to be a movement to take from Jastrow Alexander his power as State Inspector of Gasometers and transfer them to the State Commission. Alexander is Republican leader of the Twenty-sixth New York District, and, like many other Republican district leaders, he is waiting to see which way the wind blows before he ties himself to either State Chairman Odell or Chairman Parsons." What a pretty picture is presented!

LODGE AND THE MEDIUMS.—The deep interest taken by Prof. Lodge in mediumistic performances is well known and is brought to notice again in the following cable dispatch from London of March 10: "Sir Oliver Lodge and other prominent scientific men who are interested in the occult were to have held a series of experiments next week with Charles Eldred as a subject. Eldred for the last six months has been creating a great stir in spiritualistic circles as the most gifted medium in the country. He has now been exposed by fellow spiritualists, one of whom, a man named Braily, declares that the spirits informed him that Eldred was an impostor. After a séance Eldred left in Braily's house a chair which he had used in the cabinet from which the 'spirit forms' emerged. Braily's examination resulted in the discovery of a keyhole hidden in the plush covering a hollow seat, which contained spirit faces, masks, wigs, diaphanous drapery, an electric lamp, powder, etc. At the next séance Braily denounced Eldred as an impostor and the latter confessed. Sir Oliver Lodge and the other scientists are thus deprived of their experiment. The fact that Braily is also a medium suggests professional jealousy."

DISTINCTIVE LAMP POSTS.—In an article discussing art in the street, in the March *Century*, Mr. Sylvester Baxter says: "Street furnishings like lamp posts, in their numerous repetitions, perform an important decorative function. We know that in decorative design the repetition of ornament is an æsthetic principle, producing its impression by the reiteration of a pleasing figure. But long-continued uniformity produces monotony; fatigue follows visual restfulness. Therefore, even when manufacturers produce good designs, it is undesirable that these should be alike everywhere, in town after town, for the eye would tire of seeing the same thing in all places. Hence each municipality would do better to obtain something distinctive. Indeed, the same thing should not be repeated all over one city; the standard pattern ought to vary with different districts, and perhaps with different streets. Locally individual significance might well be imparted to these things by embodying in the ornament of such furnishings some device, like a municipal seal, or arms, that in design would symbolize a distinguishing character of the place, as in site, trade or staple industry." The practice or suggestion has been observed in some of the more conspicuous arc lighting posts and standards in Europe.

MUNICIPAL PLANT ASSOCIATION.—To protect the interests of municipal plants in Massachusetts, an association has been formed, with a membership drawn from the mayors and selectmen of towns and cities operating such plants, together with the managers or commissioners. This body has perfected its organization with Mayor N. P. Avery, of Holyoke, president; Col. Barrett, of Concord, vice-president; J. C. Norcross, manager of the Hudson City lighting plant, secretary and treasurer. The executive committee comprises these and Messrs. King, of Peabody, and Lyon, of Manfield. Meetings are to be held at the call of the executive committee, and legislation affecting municipal ownership is to be watched.

MUNICIPAL OWNERSHIP FAILURE.—At a meeting of the Commercial Club in Boston on February 28, an especially interesting address was delivered by Mr. Everett W. Burdett. He described in detail the conditions that have followed the introduction of municipal ownership in British cities, and held that muncipal ownership had few beneficial results to show. He brought out the point that the discussion of municipal ownership had developed a considerably widespread disposition among the voters to assent to any scheme, however extravagant, in the expectation that some good must result. This should serve to remind us of the warning of the exponents of the old Jeffersonian democratic view, that man's best benefits are those which he earns by his individual exertions and not through the factitious aid of government.

LONDON TRAFFIC.—Some very interesting figures are given in the report of the London Traffic Commission for 1905 just out. The total number of passengers carried on the underground and surface railways and omnibuses of London during the year was equal to three-quarters of the population of the whole world. The lumbering old omnibuses carried passengers equal to the whole population of the United Kingdom seven times over. At the busy time of the day 642 omnibuses pass the Bank of England in the heart of the city district in an hour, a procession two miles and a half long. There are in London 3,471 horse and already 307 motor 'buses. A passenger in Oxford Street, leading east and west, has the choice of twenty-seven omnibus routes to different parts of London. This is said to be a convenience unexampled in any other city.

A THOUSAND TELEPHONES ORDERED OUT.—More than 1,000 printed notices, signed by Seattle, Wash., business men and professional men, ordering the removal of the Sunset telephone from office or residence, and hundreds more of these notices sent to the committee in charge are the immediate results of a mass meeting held in the Grand Opera House February 21, according to a Seattle report. If the individual signers abide by their determination as expressed in the printed notice, nearly 2,000 Sunset telephones will be removed on or before the first day of August, and in their places will be installed telephones of the independent company. By adopting the report of the committee in charge, the mass meeting took the above action. This report embodying the results in brief of the committee's investigations of the local telephone situation, was presented by W. T. Dovell. Disclaiming any enmity or ill feeling against the Sunset system or its management, the report was a severe arraignment of the service the company has given to Seattle for years past. The independent system was credited with fair play and good management.

ELEVATORS AND ANTI-TRUST LAW.—The Department of Justice at Washington announces that an anti-trust suit has been brought in San Francisco by the Government against 31 elevator concerns, including the Otis Elevator Company. The department says: "The companies named as defendants comprise the principal elevator companies of the United States, but the operations specifically complained of have been carried on mainly in California and the States and Territories west of the Rocky Mountains. It is charged that these companies make and sell at least 80 per cent of all of the elevators used in that territory, and that they have entered into a combination among themselves to control and enhance the prices at which elevators are sold. That in order to make the combination effective the Otis Elevator Company has acquired the whole or a majority interest in the businesses of all the other defendants, although said defendants are still being operated as apparently separate and independent concerns. The bill prays that the defendants be perpetually enjoined from carrying out their illegal combination and from further agreeing and combining together to control the trade and commerce in elevators and to deprive the people of the several States in the United States of the benefit in rates and prices derived from free and unrestrained competition in said business."

NEW LONDON SUBWAY.—A special cable dispatch from London of March 10 says: "The Baker Street Waterloo "tube," one of the late Charles T. Yerkes's group of railroads, was opened to-day. This is the most important link in the solution of the city's traffic problem. The new artery, the length of which is five and one-quarter miles, runs north and south, traversing all the older lines, with which it is connected by subways, thus enabling passengers to reach within a short distance of any point in the metropolis. The construction of the road was begun in 1898 under the auspices of the late Whitaker Wright's group of roads, and subsequently was purchased by the Yerkes-Speyer interests. Speaking at the luncheon in celebration of the opening of the road, Edgar Speyer, the successor of Mr. Yerkes in the chairmanship of the system, said he hoped that by the spring of 1907 the entire underground system would be working satisfactorily. These lines, he believed, would supply a great want, do much to solve the great traffic problem and fully justify their existence. In some places the new tube is 155 ft. below the surface of the ground and 35 ft. below the bed of the River Thames." The time of the first public train over the route was twelve minutes. The new two-penny tube is superior to the other tubes in construction, is well ventilated and lighted and has stations with colored tiles of a distinctive tint, easily recognized. This crosscut line will become more important in the course of six months, when the extensions are finished to the Marylebone and Paddington stations and additional connection made with Southeastern London.

ELECTRICITY AT OIL WELLS.—In an interesting article by Mr. J. E. Walsh in *Mines and Minerals* for March, reference is made to the use of electricity around European oil wells as a preventive of fire as well as for oil drilling and pumping. He says: "The use of electric motors for driving oil drills and oil well pumps has extended rapidly in parts of Europe where German and French engineers have studied the problem. To a European engineer the waste of Americans seems often nothing less than a crime, and it is impossible to understand our point of view. When we consider that the world's demand for petroleum far exceeds the supply, any waste of the fuel appears all the more obnoxious. The extended use of internal combustion engines and the popularity of the automobile are factors that are working steadily toward a more general use of refined petroleum, and there is little doubt that within a decade the demand for the oil will be more than sufficient to exhaust the native supply. The suppression of the fire risks in the oil regions first led engineers in Russia to experiment with electric motors. The fires and explosions at the mouth of the wells were almost as great in that country as in this. The elimination of the fire risk in the oil regions was not the only consideration, however, which induced the engineers to adopt electric power. The wells in nearly every field are scattered over a wide area, necessitating the distribution of steam pipes over a great radius or the installation of separate generating units. This was a costly method of operating. In some cases the cost of power was so great as to make profitable oil mining impossible except in regions where the flow was abundant. For each paying well a dozen would be operated at a loss."

The Largest Sub-Station in the World.

TORONTO, CANADA, now has the largest sub-station, in point of capacity, in the world, and this sub-station is to receive 30,000 kw at about 60,000 volts from Niagara Falls. Energy for the electric light and power system at Toronto, and also for the street car lines in and about the city, is to be supplied by the Toronto & Niagara Power Company, which has built this sub-station and the 75-mile line from the Falls, of which it is the terminal. At present two of the four 60,000-volt, 10,000-hp circuits that are destined to enter this sub-station have been completed over a line of steel towers from the Falls, as previously described in the ELECTRICAL WORLD, and a large part of the transforming equipment for these two circuits has been erected in the sub-station. Each circuit is to receive 60,000-volt, three-phase, 60-cycle current and to deliver 10,000 electric hp with a line loss of 10 per cent. At this terminal or sub-station the 60,000-volt current is transformed to 12,000 volts, three-phase, for distribution to the several lighting and railway stations about Toronto.

Three transformers are provided for each transmission circuit at the Toronto terminal station, and each of these transformers is rated to step down 2,400 kw from 60,000 to 12,000 volts. For each transmission circuit the total transformer capacity at the terminal is thus 7,200 kw. As the terminal is designed for four of the transmission circuits, the combined rating of their connected transformers will thus be 28,800 kw, a capacity that is probably greater than that of any other sub-station in the world to-day. Though the four 60,000-volt circuits will be connected to only twelve of these 24,000-kw transformers at any one time, provision has been made at the Toronto terminal for 15 units of this capacity, so that there will always be one set not in use. Each group of three transformers is connected in delta at both the 60,000-volt and the 12,000-volt windings, so that each transformer has the full line pressure at its high-tension coils.

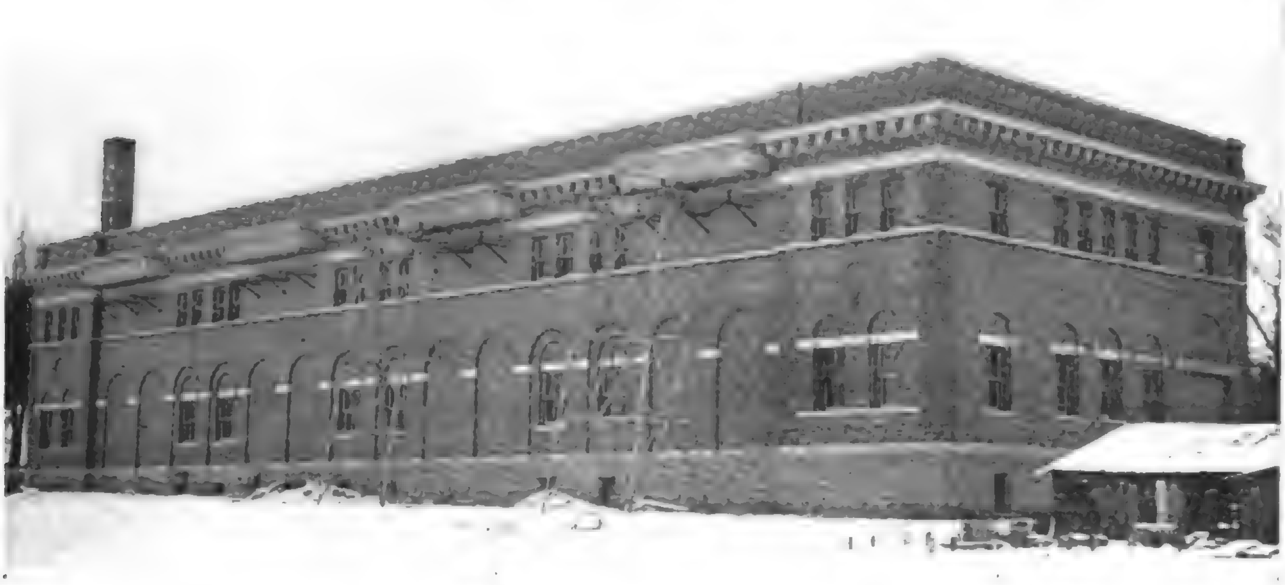


FIG. 1.—TORONTO TERMINAL STATION.

Current enters the sub-station at about 60,000 volts and leaves it at about 12,000 volts, passing through a choke coil, current transformer, two 60,000-volt oil switches, 60,000-volt bus-bars, a step-down transformer, two 12,000-volt oil switches and 12,000-volt bus-bars, on the way. On each side of each 12,000-volt oil switch and on each side of each 60,000-volt oil switch, except where a 60,000-volt oil switch leads directly to a transformer, there is a disconnecting switch in each conductor of each three-phase circuit, so that each conductor from the 60,000-volt entry to its transformer includes three connecting switches, and each conductor from its transformer to the 12,000-volt exit includes four such switches. From this arrangement of switches and bus-bars it results that each 60,000-volt transmission circuit may be directly connected with either group of three transformers alone, or may be connected to two or more groups of transformers in parallel.

On entering the sub-station each conductor of the 60,000-volt circuits passes into a tee connection that leads to a disconnecting switch and lightning arrester at one side, and through a disconnecting switch, choke coil, current transformer, oil switch and disconnecting switch to a short bus-bar from the other. Each of these 60,000-volt conductors, disconnecting switches and choke coils is mounted on three-part porcelain insulators, like those outside on the steel towers of the transmission line. Each insulator has three petticoats, the highest of which is 14 in. in diameter, and is 13¼ in. high and mounted on an iron pin. For a disconnecting switch two of these insulators are used with their centers 24 in. apart, and a metal cap cemented to the top of each carries the clips.

The lightning arrester to which each conductor of a 60,000-volt circuit is connected contains 240 air-gaps between brass cylinders and 60 carborundum rods in series between the conductor and the earth, and is mounted on insulators like the above. In the choke coil that follows the first disconnecting switch in each line conductor after it enters the sub-station, there are 19½ turns of copper wire with a diameter of 0.46 in. The current transformer, carried by each of two conductors in a 60,000-volt, three-phase circuit, is 6½ in. long and 6 in. in diameter, in the enclosed part, and has 16 in. between its high-voltage terminals.

Switches designed to open a circuit carrying 7,200 kw at 60,000 volts are not seen frequently enough to be commonplace, and those at the Toronto sub-station deserve detailed notice. Each brick and stone compartment, in which the two oil cylinders carrying the terminals of one three-phase conductor are located, is 4.5 by 3 ft. in floor area and 7.75 ft. high, and the partitions of fire brick between the compartments are 8½ in. thick. In front of each compartment there is an iron door hung at the top. Each compartment or cell contains two cylinders mounted vertically in a common frame, and an end of one conductor of a three-phase circuit enters the bottom of each cylinder. These two cylinders and the frame that carries them are made of wood, save as to four porcelain insulators that unite the legs of the frame with the part that holds the two cylinders together. Pine wood is apparently the material of which the many pieces that go to make up a cylinder are composed, and the outside is well served with shellac.

Heavy petroleum fills each of the wooden cylinders, and through a small central hole in its built-up cover plunges the vertical connecting rod that is electrically connected by a metallic cross

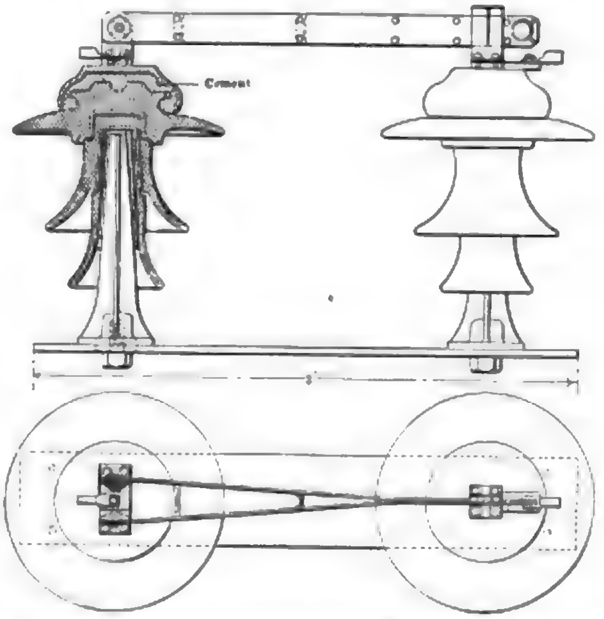


FIG. 2.—DISCONNECTING SWITCH FOR TORONTO TERMINAL STATION.

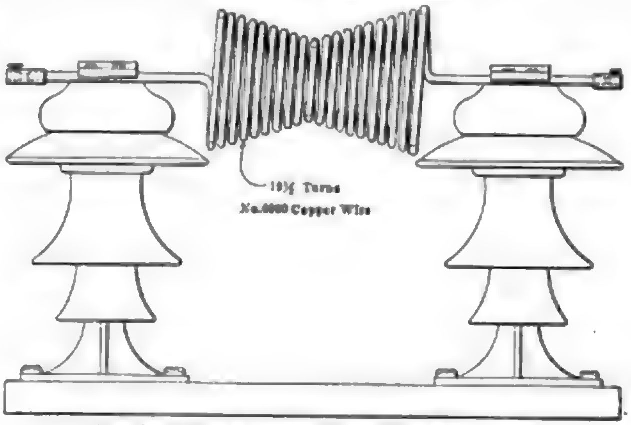
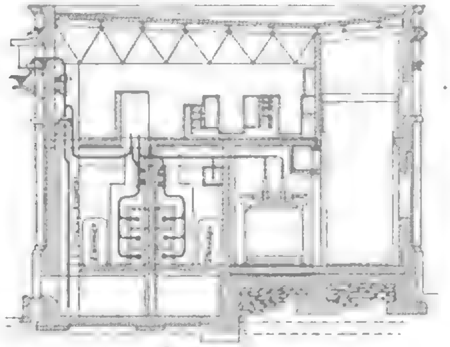
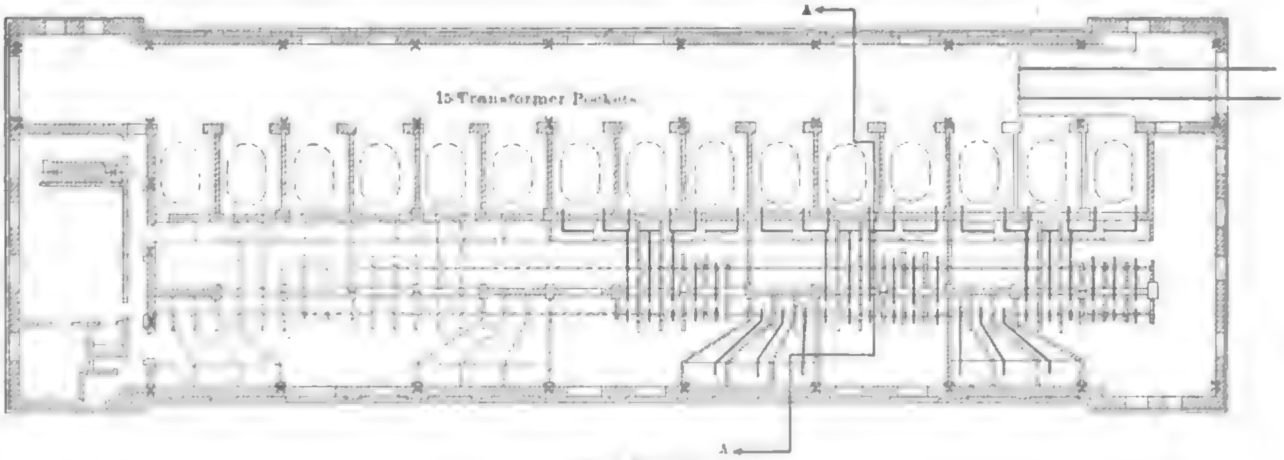


FIG. 3.—CHOKE COIL FOR LIGHTNING ARRESTER.

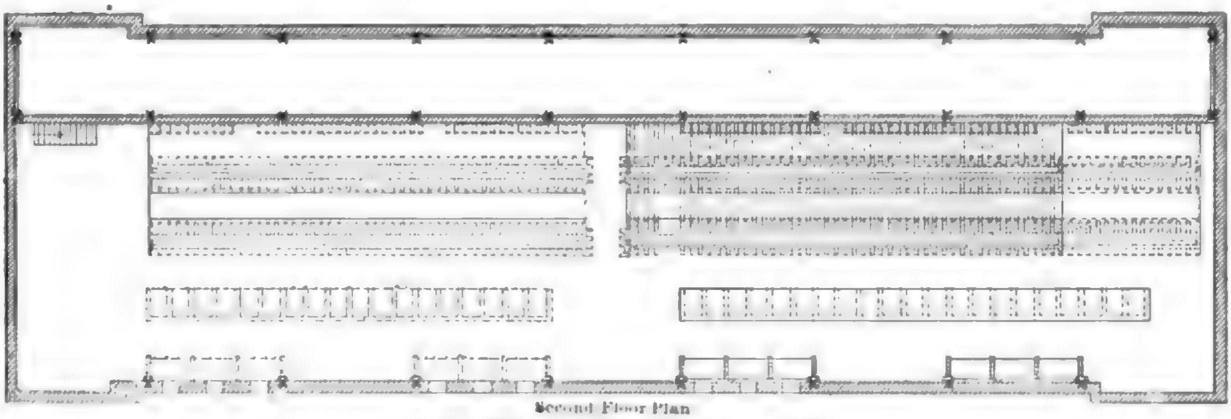


Section A-A

FIG. 4.—SECTIONAL VIEW OF TORONTO STATION.



First Floor Plan



Second Floor Plan

FIG. 5.—PLANS OF FIRST AND SECOND FLOORS.

THE LARGEST SUB-STATION IN THE WORLD.

piece with the corresponding rod of the twin cylinder. From this cross piece a vertical wooden rod rises through the stone top of each cell to the motor-driven operating mechanism above. In diameter each pine wood cylinder measures about 10 in., and its length is 32 in. It may be assumed that these wooden cylinders have been adopted in order to avoid the tendency of arcs to strike through the contained petroleum to the side of a metal cylinder, when the circuit is opened.

Each pair of connecting rods for a conductor of a three-phase circuit, in one of the 60,000-volt, 300-amp. oil switches, has a break or throw of 33 in., so that the conductor is opened by a total break of 66 in. From its oil switch each conductor of a 60,000-volt circuit passes to a connecting switch by which it is joined to a short, separate bus-bar, and this short bus-bar may be joined by other connecting switches either to another oil switch and then to the regular 60,000-volt bus-bars, or else to another oil switch and then to the primary coils of its transformer. By this combination of switches with the short and the regular 60,000-volt bus-bars, each conductor of a three-phase transmission circuit may be connected, through two oil switches in series, with the primary coils of its usual group of transformers, or through a series of two oil switches with the regular 60,000-volt bus-bars. Any group of three transformers may have its primary coils connected to the regular 60,000-volt bus-bars, through a series of two oil switches and one of the short bus-bars. The result is that any conductor of a 60,000-volt transmission circuit may be connected to either of the four groups of transformers, or all the circuits and transformers may operate in parallel.

Each of the 2,400-kw, 60,000 to 12,000-volt transformers is oil-insulated and water-cooled, and is located in a separate pocket, of which the walls are brick and the door steel. The fifteen pockets for as many transformers are ranged on the same level in a single row and a track for the transformers runs into each pocket. Water pipes from these transformers run to inlet and discharge points and the pipes carrying oil connect with a system of storage and emergency tanks, filters and an air compressor and exhauster. All of the oil piping is of brass.

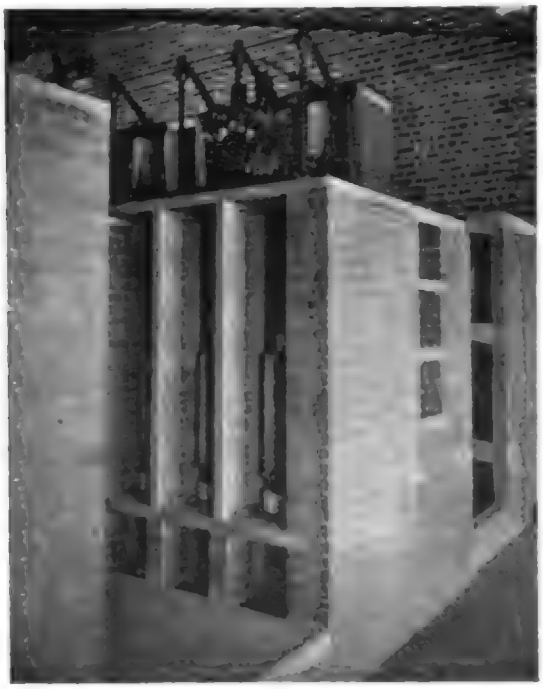


FIG. 6.—12,000-VOLT OIL SWITCHES.

The 12,000-volt leads from the transformers go to either of two sets of three-phase bus-bars, by way of either of two sets of oil switches. Similar oil switches connect with the 12,000-volt bus-bars the underground cables that run to the several sub-stations about Toronto. There are 31 of these 12,000-volt, motor-operated oil switches for three-phase circuits, 25 of which are rated at 300 amp. and the remaining six at 500 amp. Each 12,000-volt oil switch is located in three brick and stone cells, similar to those above described. The break or throw of each contact rod in the oil cylinders is 20 in.

Both the 12,000-volt and the 60,000-volt bus-bars are carried in cells of brick and stone and in the case of the 12,000-volt bus-bars, their cells adjoin those of the corresponding oil switches. The 60,000-volt bus-bars are located some feet distant from their switches, however, and between the rows of cells that contain the two sets of these bus-bars there is a 13½-in. brick wall.

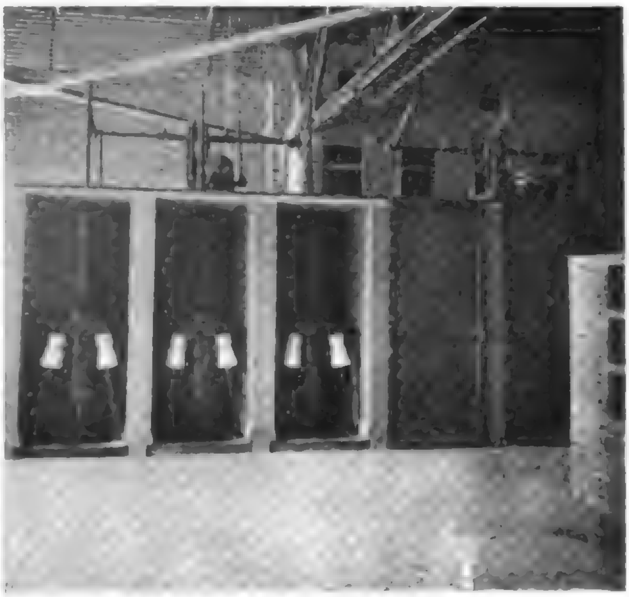


FIG. 7.—60,000-VOLT OIL SWITCHES.

Construction of the cell type is provided for the other parts of the 12,000-volt and 60,000-volt circuits as well as for the bus-bars, and each conductor of a 60,000-volt circuit is carried in a separate compartment from the time it enters the terminal station until it reaches the transformer pocket. For each conductor of a 60,000-volt circuit the compartment is about three feet square, and its partitions are at least four inches thick and built of hard burned shale brick or of concrete.

All of the oil switches are controlled from operating boards located some distance away, but on the same floor. There are two of these operating boards, one controlling the 60,000-volt, and the other the 12,000-volt circuits. Leads from these controlling boards to the motors that operate the oil switches are run through iron conduit pipes laid in the floor. Besides the controlling switches and dummy bus-bars, the switchboards carry switch operating relays, power factor indicators, and wattmeters and watt-hour meters. The watt-hour meters are located behind the operating panels. A motor generator in connection with a storage battery supplies current at 125 volts, for the operation of the motors of the oil switches, and for lighting the sub-station. For the operation of other motors about the sub-station, a bank of three 15-kw transformers step down the 12,000-volt, three-phase, 60-cycle current to 110-220 volts. If the above motor-generator fails to operate, the battery is automatically connected to the lighting circuits.

Steel, brick, stone, tile and concrete are used in the construction of the terminal or sub-station on Davenport Road, just outside of the Toronto city limits, and substantially no wood is to be found in any of its parts. The building measures about 61 by 202 ft. on the ground, and its height includes two stories and a basement. Architecturally the sub-station is of pleasing design, with high ashlar underpinning, brick walls pierced by numerous windows, and stone trimmings.

The sub-station is located near the main line of a steam railway, and a spur track enters one end of the building at the

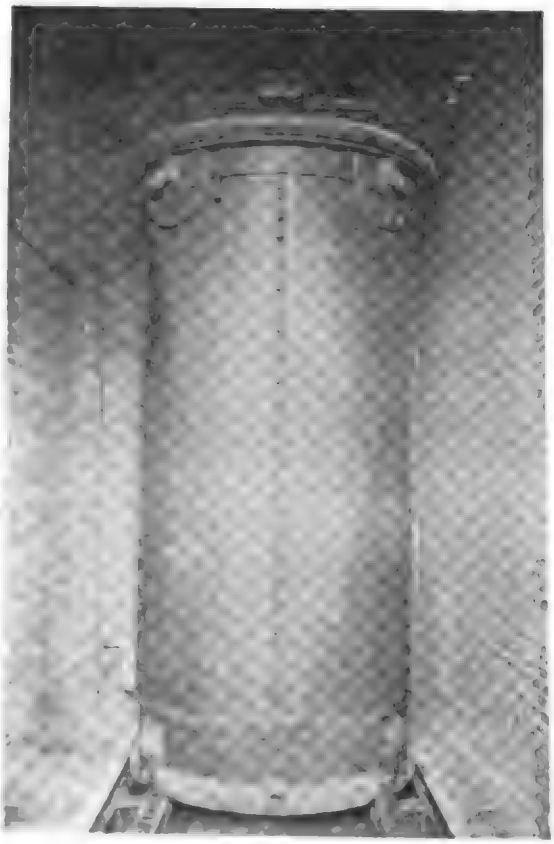


FIG. 8.—400-KW TRANSFORMER.

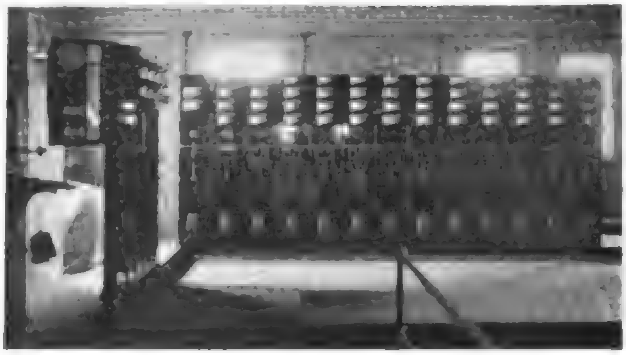


FIG. 9.—CONTROL SWITCHBOARD.

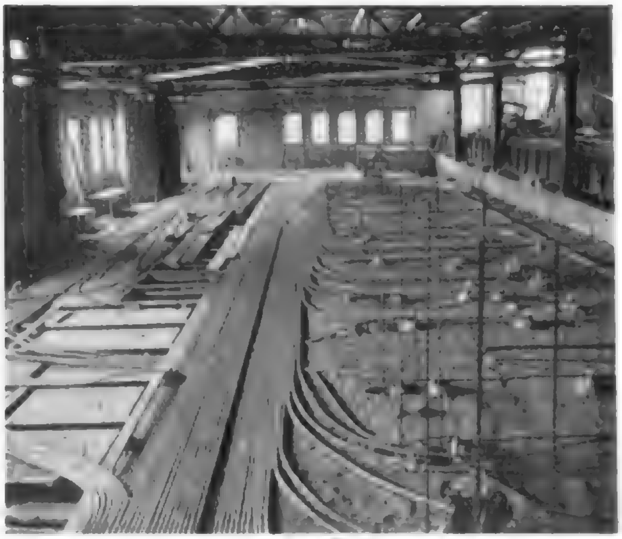


FIG. 10.—CONDUITS FOR CONTROL WIRES.

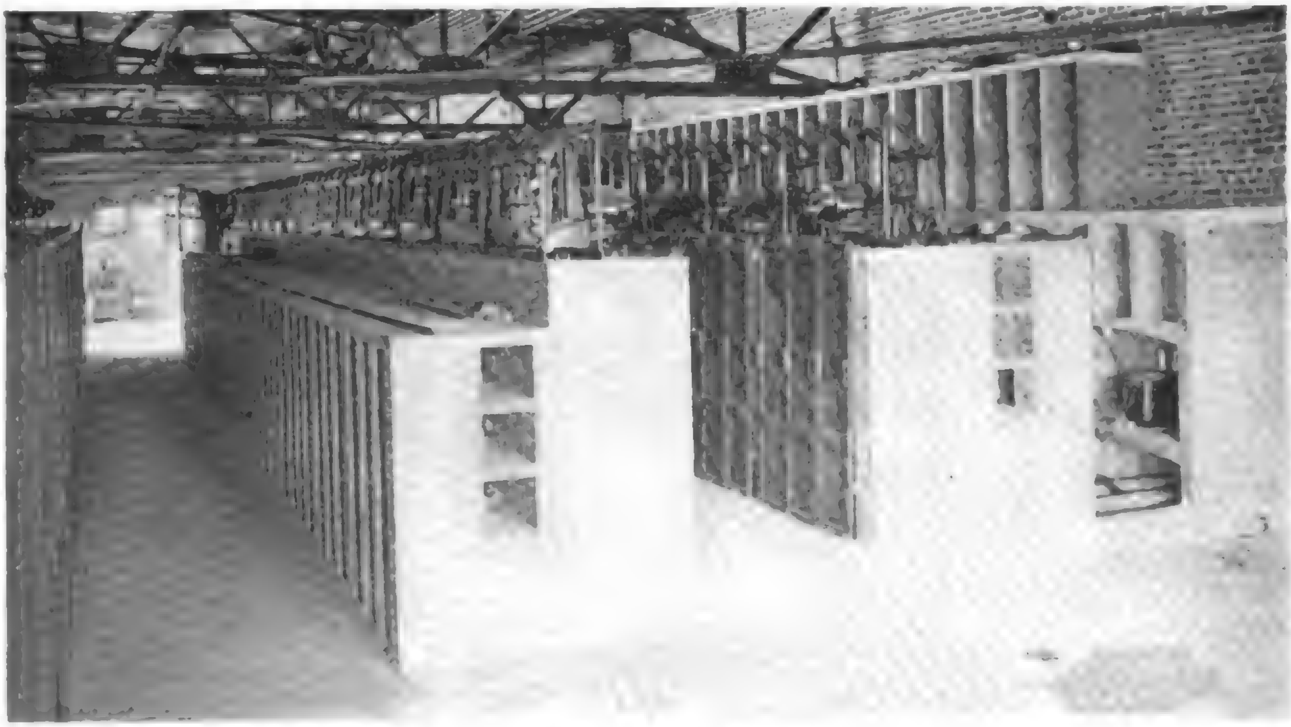


FIG. 11.—OIL SWITCHES AND BUS-BARS.

THE LARGEST SUB-STATION IN THE WORLD.

ground level, so that cars containing the transformers or other heavy apparatus may be unloaded directly on to the first floor. On the west side of the station, at an elevation of about 42 ft. above the ground, there are four entrance hoods for the four 60,000-volt, three-phase circuits from Niagara Falls. Each of these entrance hoods has three compartments, one for each conductor of its circuit, and is built up of concrete on a steel frame.

A terminal tower carrying one three-phase circuit sets close to each entrance hood, and before entering the underside of the hood each conductor is attached to a steel bracket that runs out from the station wall. In the interior of the terminal station, on its east side, a clear space about 12 ft. wide, and extending from the first floor to the roof, runs its entire length in front of the row of fifteen transformer pockets. Over this area moves a traveling crane for handling the transformers, and a brick wall separates the upper part of the space from the remainder of the second story of the station. Over this area in front of the transformer pockets the nearly flat tile roof is supported by I-beams, and the remainder of the roof is carried on steel trusses.

In addition to the two-story space in front of the transformer pockets, the first floor is taken up by these pockets, the bus-bar compartments and the lightning arrester passages, and the second-story contains the oil switches and the controlling boards, and also the upper parts of these same passages. On passing through the west wall of the sub-station, each conductor of a 60,000-volt circuit enters a vertical passage, enclosed by brick partitions, that leads to the basement. In the upper part of each of these passages are the connecting switches that lead respectively to the lightning arresters and to an oil switch. Just beneath these connecting switches is the current transformer, and then comes the long bank of lightning arresters.

After the 60,000-volt conductor passes below the level of the second floor, it turns into a horizontal passage and runs to a point directly beneath its oil switch. Between the first and second floor the space under the 60,000-volt oil switches is shut in by brick partitions, and is sub-divided by other partitions into separate passages for each conductor. Within this same space are the brick and stone compartments for one set of 60,000-volt, three-phase bus-bars, to which the conductors from the oil switches lead. These bus-bar compartments are built against a 13½-in. brick wall, and on the other side of this wall there is another set of 60,000-volt bus-bars and another space running from the first to the second floor, like that just described. On either side of the 13½-in. brick wall between these two vertical spaces there are connecting switches for each conductor.

As a result of the erection of the 60,000-volt circuits in the enclosed spaces and passages just mentioned, each conductor of these circuits is isolated from all others, and is completely surrounded with masonry, from the point where it enters the sub-station to the transformer pocket. In this way the isolation of the high-voltage conductors is, perhaps, more complete than has ever been attained before in a sub-station.

The row of transformer pockets is about 166 ft. long, and the enclosed space that contains the two sets of 60,000-volt bus-bars with their conductors and connecting switches is of equal length. Between the row of transformer pockets and the enclosed bus-bar space there is a foot passageway along the first floor, and a like passageway runs between the other side of this enclosed space and the vertical compartments where the lightning arresters are located. At intervals along the walls that enclose the lightning arrester and the bus-bar spaces there are hand holes and archways in the brickwork, so that the conductors and apparatus can be erected, and the connecting switches operated. On the second floor the oil switches are in three rows. Two of these rows are made up of the 12,000-volt switches with the 12,000-volt bus-bars in the same masonry structures, and the third row contains the 60,000-volt switches alone. Across and at one end of the second floor and in view of the oil switches are the control switchboards.

The basement extends under only about one-half of the sub-station, and this half is divided into two parts by a brick wall parallel with the row of transformer pockets. In that part of the basement that is nearer to the transformers, are located their oil and water pipes, and also the oil tanks. The other part of the basement contains the lower ends of the lightning arresters for the 60,000-volt circuits, and into this part of the basement come the 12,000-volt underground cables that connect the terminal sub-station with the several lighting and railway sub-stations in Toronto.

As described in former issues of the ELECTRICAL WORLD, there are two principal sub-stations in Toronto devoted to the general distribution of power for lamps and motors, and two main sub-stations for the street railway system. It is intended that these principal sub-stations and some minor ones, operating the entire electrical supply and traction systems of the city, shall distribute Niagara power to most of their loads.

The above terminal sub-station of the Toronto and Niagara Power Company has been erected and equipped under the direction of Mr. Robert C. Brown, chief electrical engineer of the company. Plans for the complete work were from the office of Dr. F. S. Pearson, consulting engineer.

The transformers, oil switches, and all of the above named electric equipment were made by the General Electric Co., or in some part by the Canadian General Electric Co.

Measurement of Power in Three-Phase Systems.

By E. RAY SHEPARD.

In high-voltage, three-phase systems where step-down transformers are employed for the wattmeters, it may occasionally be necessary to measure the power with only one transformer. One of the two may have been burned out or for some other reason only one may be available. This may be done by connecting the two wattmeters to the one transformer. In this case the power will no longer be the sum of the two readings, but it will be twice the reading of the normal one minus the reading of the other.

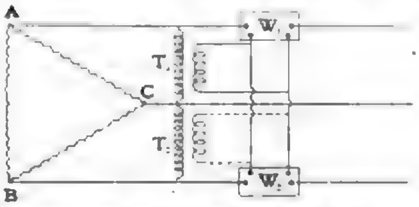


FIG. 1.—CONNECTIONS OF TRANSFORMERS AND WATTMETERS.

The dotted lines in Fig. 1 show the ordinary connections when two transformers are employed and in which case the sum of the two wattmeter readings is the power of the system. The full lines show how W_2 may be connected to T_1, where T_1 is the only transformer employed.

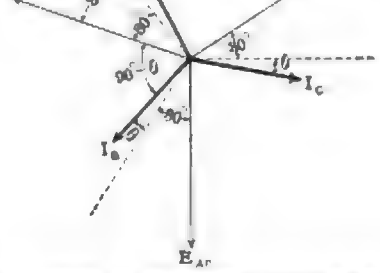


FIG. 2.—PHASE RELATION OF CURRENTS AND ELECTROMOTIVE FORCES.

Fig. 2 shows the relations of currents and pressures in the system, from which it is seen that the readings of the wattmeters will be:

$W_1 = E_{AC} I_A \cos(30^\circ + \theta)$, where θ = the angle of lag;

also $W_2 = E_{AC} I_B \cos(90^\circ - \theta)$. Expanding these we have

$$W_1 = E_{AC} I_A \{ \cos 30^\circ \cos\theta - \sin 30^\circ \sin\theta \}$$

$$= E_{AC} I_A \{ \tfrac{1}{2}\sqrt{3} \cos\theta - \tfrac{1}{2} \sin\theta \}$$

$$= \tfrac{1}{2} E_{AC} I_A \sqrt{3} \cos\theta - \tfrac{1}{2} E_{AC} I_A \sin\theta$$

$$2W_1 = \sqrt{3}\, E_{AC} I_A \cos\theta - E_{AC} I_A \sin\theta$$

$$W_2 = E_{AC} I_B \{\cos 90^\circ \cos\theta + \sin 90^\circ \sin\theta\}$$

$$= E_{AC} I_B \sin\theta;$$

and if the system be balanced,

$$2W_1 - W_2 = \sqrt{3}\, E\, I \cos\theta - E\, I \sin\theta + E\, I \sin\theta$$

$$= \sqrt{3}\, E\, I \cos\theta,$$ or power in a three-phase system.

Of course, this is true only for a balanced system and is of no help with a commercial polyphase watt-hour meter.

Deflection Potentiometers.

By H. B. Brooks.

*U. S. Bureau of Standards.**

INSTRUMENTS for the measurement of electromotive force and current may be divided into two main classes, which may be called deflection instruments and balance instruments, respectively. Each of these two classes, as is well known, has its advantages and disadvantages. An ideal instrument would be one combining as much as possible of the convenience of the deflection instrument and the accuracy and constancy of the potentiometer or balance instrument. With the above requirements in mind, it occurred to the writer that a satisfactory instrument might be realized by using the potentiometer method to measure the bulk of the electrical quantity, in conjunction with a suitable deflection instrument to measure the small remainder, which may be of the order of one per cent of the total. For example, if an e.m.f. is between 110 and 111 volts, the potentiometer method may be used to measure 110 volts, the other part being read by the deflection instrument.

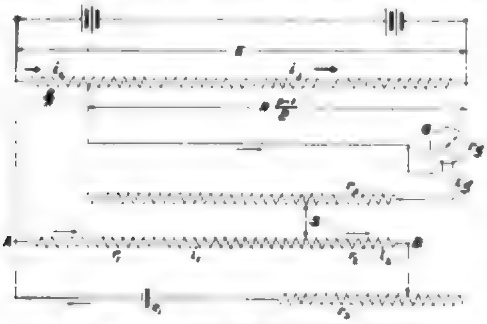


FIG. 1.—DIAGRAM OF "VOLT BOX" CIRCUITS.

The potentiometer is essentially a null instrument, and the function of the galvanometer ordinarily is to show, by the absence of a deflection, when the unknown e.m.f. is compensated by the known. In some cases, however, as in measuring low e.m.f's, it is desirable to read one more figure in addition to that given by the lowest dial; and in such a case, with some forms of potentiometer, it is possible to interpolate between adjacent settings on this dial. In the present case the problem is to determine the conditions to be met, first, in order that the deflection corresponding to a given unbalanced e.m.f. may always be the same, regardless of the setting of the potentiometer dials; and second, in order that the deflection should be strictly proportional to the unbalanced e.m.f. for a relatively large unbalancing, as it is ordinarily assumed to be for a small unbalancing.

Assuming that the instrument is to be used for measuring e.m.f's higher than those of a single cell, a "volt box" will be required, as shown in Fig. 1, in which *E* is the unknown e.m.f. to be measured, e_1 that of the auxiliary storage cell, *R* the total resistance of the volt box, the fall of potential around a fraction of this, *R/p*, being opposed to the fall of potential around a portion, r_1, of the potentiometer wire, *A B*. It was seen that to obtain the condition of constant sensibility a rheostat would be required in the galvanometer circuit, this rheostat being controlled by the motion of the main dial, represented by the slider, *S*. For simplicity the standard cell and connections for using it to check the working current in *A B* are not shown, as they do not affect the problem. Assuming that the condition of balance does not exist, and denoting the currents and resistances in the various branches by i_1, i_2...r_1, r_2..., and applying Kirchoff's laws, the following equations are obtained:

$$i_1 - i_3 + i_g = 0 \qquad (1)$$

$$i_4 - i_5 - i_g = 0 \qquad (2)$$

$$i_1 r_1 + i_3 (r_2 + r_3) = e_1 \qquad (3)$$

$$i_1 r_1 - i_g (r_4 + r_g) - i_4 \frac{R}{p} = 0 \qquad (4)$$

$$i_5 R \frac{p-1}{p} + i_4 \frac{R}{p} = E \qquad (5)$$

Solving these equations,

$$i_g = \frac{e_1 \left(\dfrac{r_1}{r_1 + r_2 + r_3} \right) - \dfrac{E}{p}}{r_4 + r_g + \dfrac{r_1 (r_2 + r_3)}{r_1 + (r_2 + r_3)} + R \dfrac{p-1}{p^2}} \qquad (6)$$

The first term in the numerator of this expression is the fall of potential in the portion r_1 of the potentiometer wire when the galvanometer circuit is open; it is therefore numerically equal to the setting of the potentiometer. The second term in the numerator is the fall of potential which would exist around the portion *R/p* of the volt-box if the galvanometer circuit were open. The denominator is the total resistance in the galvanometer circuit, the third term being the resultant resistance of the portion r_1 of the potentiometer wire shunted by the remainder of the battery circuit, and the fourth term the resistance of the portion *R/p* in parallel with the remainder of the volt-box. Equation (6) therefore shows that the current through the galvanometer is equal to the unbalanced portion of the e.m.f. divided by the total resistance of the galvanometer circuit; or

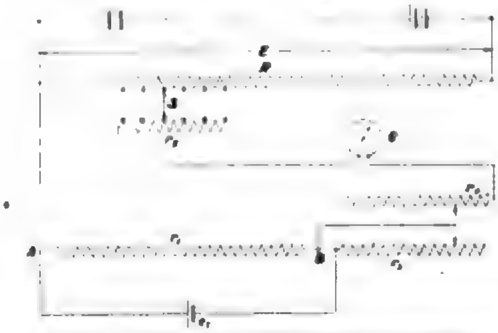


FIG. 2.—ANOTHER ARRANGEMENT OF CIRCUITS.

$$i_g = \frac{\Delta e}{\Sigma r}. \qquad (7)$$

Referring to equation (6) the first term in the numerator, which may be called the setting, may be denoted by *s*. Since the volt-box has a multiplying power of *p*, the equation may be written in the form

$$i_g = \frac{ps - E}{p\, \Sigma r} \qquad (8)$$

which shows that if Σr can be kept constant the galvanometer current will be directly proportional to $(ps - E)$, the difference between the e.m.f. corresponding to the setting and the e.m.f. to be measured. If Σr can be kept constant for all settings, it is only necessary to calibrate the scale of the galvanometer properly to make it read directly the unbalanced part of the e.m.f. under measurement. Referring to Fig. 1 and equation (6) it will be seen that the resistance, r_4, must have such values for different positions of the slider, *S*, that the sum of r_4 and $\dfrac{r_1 (r_2 + r_3)}{r_1 + (r_2 + r_3)}$ will be a constant. The latter has a maximum value at some point between *A* and *B*, and minimum values at *A* and *B*; so that r_4 must vary accordingly.

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* Abstract of a more detailed paper to be published in a forthcoming number of the *Bulletin* of the Bureau.

A difficulty in the way of using this particular arrangement of circuits lies in the fact that the value of e_1 depends on the condition of the storage cell, and as e_1 varies r_3 must be varied to keep the proper current through *A B*. This difficulty may be overcome by using the circuits shown in Fig. 2.

In this arrangement the setting is made on the volt-box instead of on the potentiometer wire. The rheostat, r_3, is set so as to give, by reference to a standard cell (not shown) a certain standard current through *A B* and therefore a constant fall of potential around it. This fall of potential is balanced as nearly as possible by setting the slider, *S*. The variable resistance, r_4, is arranged so that r_4 plus the resultant resistance of the potentiometer circuit is a constant; r_4 thus takes care of changes in resistance required by variations in the e.m.f. of the auxiliary cell, but is independent of the setting. The fraction $\frac{1}{p}$ being in this case a variable, the resistance in the galvanometer circuit must vary with it, as may be seen from equation (8). Since in this second arrangement the e.m.f. term, $e_1 \frac{r_1}{r_1 + r_2}$ is a constant, it may be denoted by *e*. Therefore,

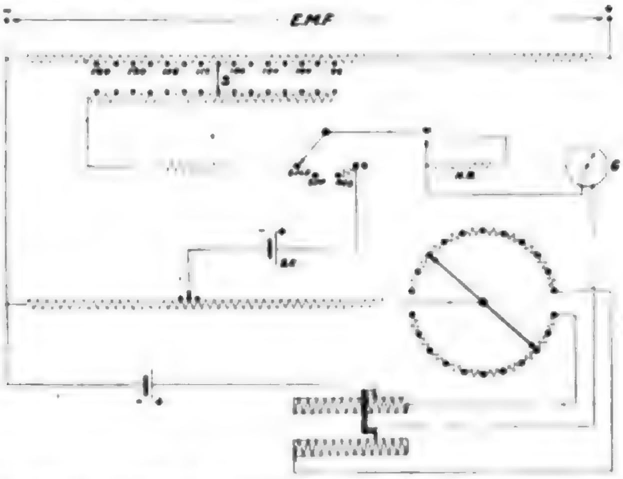


FIG. 3.—DIAGRAM OF CIRCUITS OF DEFLECTION POTENTIOMETER.

$$i_g = \frac{1}{p} \cdot \frac{pe - E}{\Sigma r}. \qquad (9)$$

For a difference of one volt between the setting p_e and the e.m.f. *E* under measurement the galvanometer is to give a deflection of *m* scale deflections. If *I* denote the current required to give a deflection of one scale division, the current *m I* must always flow when $pe - E = 1$. Substituting these values,

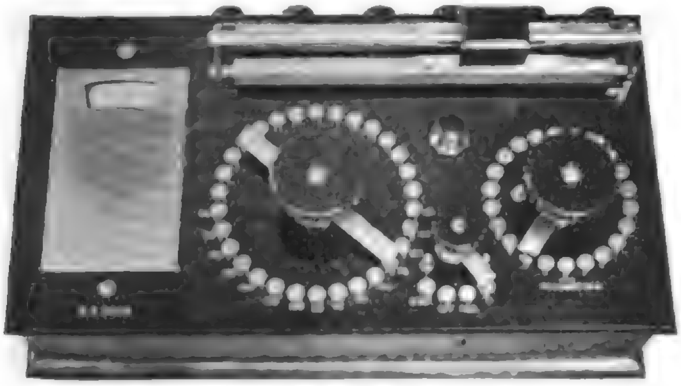


FIG. 4.—VIEW OF DEFLECTION POTENTIOMETER.

$$m\,I = \frac{1}{p} \cdot \frac{1}{\Sigma r} \qquad (10)$$

$$\Sigma r = \frac{1}{p\,m\,I} \qquad (11)$$

Equation (10) shows that the compensating resistance, r_4, in the galvanometer circuit, which is controlled by the movement of the slider, *S*, must vary so as to keep the product $p\Sigma r$ a constant. Equation (11) holds for the first arrangement also, shown in Fig. 1; in this case, *p* being a constant, Σr must be constant and equal to $\frac{1}{p\,m\,I}$.

The galvanometer to be used as a part of this instrument should be of the needle type, preferably one that is pivoted and does not require an arrestment. It should have a good zero, a short period and a calibrated scale. For laboratory use a reflecting galvanometer of short period may be used, but in many applications, as in checking switchboard instruments in position, the use of such a galvanometer would be a serious drawback.

A deflection potentiometer has recently been constructed in the instrument shop of the Bureau in accordance with the foregoing principles, and has been put into service for voltage measurements in photometric work. The range of this instrument is from 95 to 125 volts. Fig. 3 gives a diagrammatic plan of the circuits in the instrument. The main dial has fifteen steps, each of two volts, the galvanometer normally covering a range of two volts, although it may be used over a range of three volts; that is, one and a half volts on each side of the setting. To avoid errors in the photometric work the resistance, *R*, was made high, being 50,000 ohms. The resistance in the battery circuit is 2,000 ohms total when the e.m.f. of the storage cell is 2 volts. On account of these high resistances the galvanometer sensibility required is greater than would ordinarily be necessary. The galvanometer gives 1 mm. deflection for 1.6 microamperes. The internal resistance is 270 ohms and the period on open circuit 1.3 seconds. When in use, with its circuit closed through the potentiometer, the motion of the needle is very nearly aperiodic, and readings may be quickly made. The battery current is regulated by a rheostat of ten steps, in connection with a slide rheostat for fine adjustment. The e.m.f. of the storage cell may have any value between 1.9 and 2.1 volts.

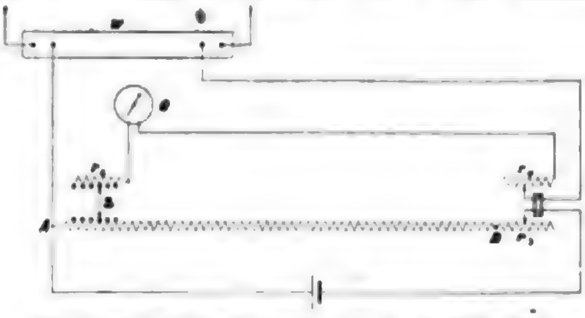


FIG. 5.—DIAGRAM OF CIRCUITS OF MILLIVOLTMETER.

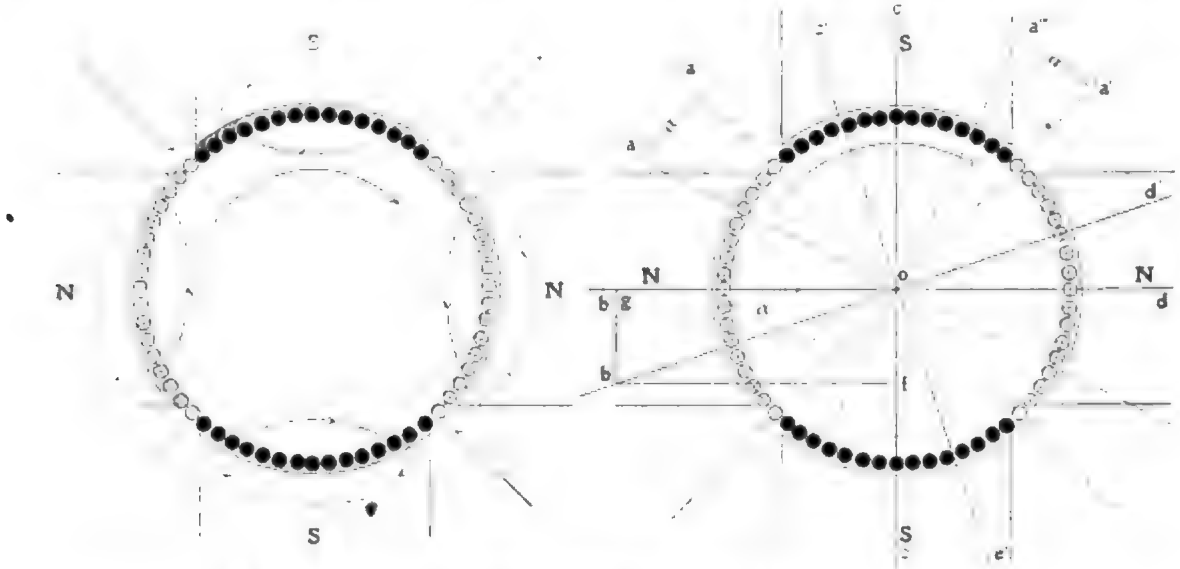
A view of this deflection potentiometer is given in Fig. 4, from which it is seen that the galvanometer is built into the apparatus so that it is self contained with the exception of the standard cell and storage cell.

It is interesting to note that while the plan of circuits shown in Fig. 1 is not convenient for use in measuring voltages higher than those of a single cell, it is the most suitable one to use in a deflection potentiometer for measuring currents. Any standard current shunt may be used, and it need not be an integral part of the potentiometer proper, which thus constitutes a precision millivoltmeter. The circuits for an instrument of this kind are shown in Fig. 5. A current shunt, *W*, replaces the portion *R/p* of the volt-box in Fig. 1, and only a limited portion of the potentiometer wire, *A B*, is used, corresponding to the drop in the shunt at full load, say 150 millivolts. Since only a small portion of the wire, *A B*, is used, the compensating resistance, r_4, may correct for the small changes in the resultant resistance as the battery rheostat, r_3, is altered, for the position of *S* corresponding to full load through the shunt. The compensation for smaller loads will not be theoretically exact, but the error may be made negligibly small. In an instrument for this purpose it is an advantage to use a smaller resistance in *A B*, in order to reduce the necessary sensibility of the galvanometer and to keep within limits the source of error just referred to. By proper design a high grade of portable galvanometer like the one before mentioned, if suitably wound, will be sensitive enough, and will be of advantage when the instrument is to be used, say, for checking ammeters in position on switchboards, and for use in laboratories when it is desired to have a portable precision ammeter which is independent of external disturbing forces.

A Graphic Method of Showing the Action of Auxiliary-Pole Variable-Speed Motors.

By Norman G. Meade.

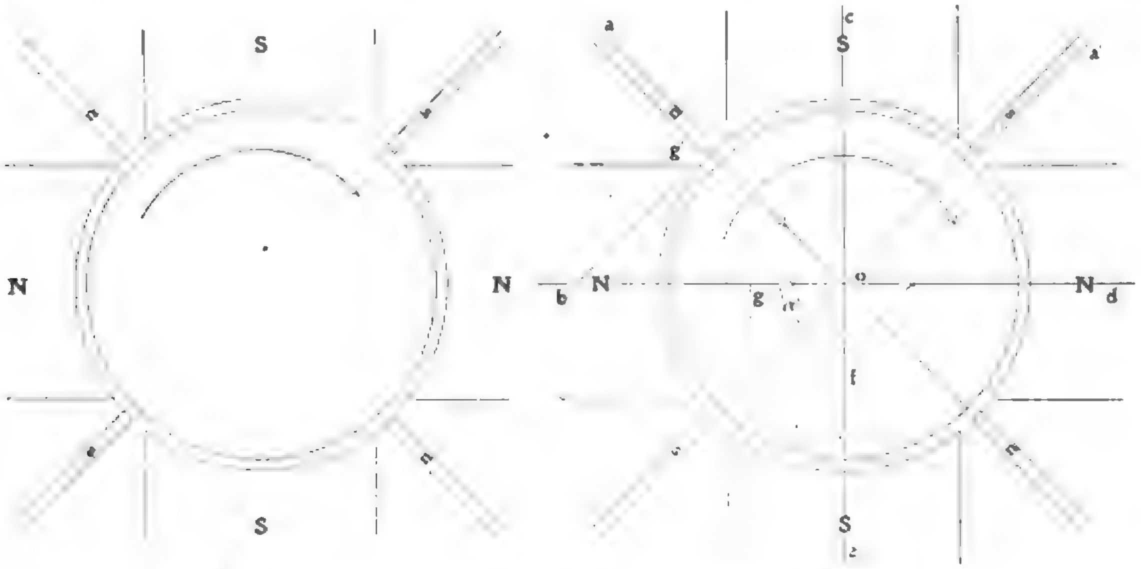
In Fig. 1, *N, S, N, S* are the four poles of an ordinary multipolar motor. The light and dark circles about the periphery of the armature represent the conductors. In the dark circles the current is supposed to be flowing away from the observer, and in the light circles toward the observer. Under these conditions, with the armature revolving in the direction of the curved arrow, the magnetic flux set up by the armature conductors travels in the paths shown by the dotted lines, producing the well known phenomenon of weakening the leading pole tips and shifting the neutral point.



Figs. 1 and 2—Diagrammatic Representation of Armature Currents.

In Fig. 2 this is shown in a somewhat different manner. The dotted lines, *a* and *a'*, represent neutral lines without armature current. From *b* and *d* to the origin, *O*, thence to *c* and *e*, illustrates graphically the path of the field flux. To show the effect of armature reaction, let *f-o* represent the flux set up by the cross-ampereturns of the armature, which acts at an angle with the field flux represented by *g-o*. Now, considering these two factors as forces, they resolve themselves into a parallelogram, and the diagonal, *b'-d'*, and the line at right angles, *c'-e'*, give the new path of the field flux, it having been shifted through the angle, α, by the effects of the armature reaction, causing the no-load neutral lines, *a* and *a'*, to shift through an equal angle to the positions *a''* and *a'''*.

As the factor *g-o* varies with the change of speed by field weakening and the factor, *f-o*, with the load, the position of the neutral point is dependent on the magnitude of both factors and the position for sparkless commutation varies accordingly.



Figs. 3 and 4.—Diagram Showing Addition of Auxiliary Poles

The addition of auxiliary poles, as shown in Fig. 3, introduces a new element, the effect of which is graphically illustrated in Fig. 4 in an exaggerated manner. In the example given it is assumed that the motor is operating at one of its higher speeds; consequently the field is considerably weakened by the introduction of resistance which reduces the factor *g-o*, shifting *b-d* and *c-e* to positions parallel with the theoretically neutral lines, *a* and *a'*. Let *g'-O* represent the auxiliary pole factor acting on the first diagonal at *O*; then the diagonal of the second parallelogram will be *b-d*, restoring the neutral points to their normal position.

The Effect of Acid Frosting and Enclosing Globes Upon the Life of Incandescent Electric Lamps.

By J. R. Cravath and V. R. Lansingh.

The last few years there has rightly been a tendency in incandescent lighting to lower the intensity of the source of light, either by using enclosed diffusing globes or else by frosting the lamp bulb itself. The diffusion obtained by these methods has not only resulted in more artistic effects, but has also made the light much easier on the eyes, and has undoubtedly aided in popularizing the use of the incandescent lamp. In this connection, the question has arisen as to the relative efficiency of the two available methods, which are:

1. Frosting the lamps themselves and using them without enclosing globes.

2. The use of the bare lamp with a diffusing enclosing globe either ground glass, opal, Holophane or other types.

It has generally been conceded that a frosted lamp, as far as efficiency is concerned, is more economical than a plain lamp with a diffusing globe. Generally speaking, the absorption by such frosting is in the neighborhood of 10 per cent, while with the use of ground glass, and other types of diffusing globes, the absorption runs from 12 per cent to 25 per cent or more. The question as to the effect on the life of the lamp has, as far as the authors know, never been satisfactorily answered to date.

The authors, in previous articles in this paper, have advocated the use of some sort of cover or gasket for the neck of an enclosing globe, such a cover being formed of asbestos, mica or some similar material which will keep out all dust and, in the case of white asbestos, increase the light below the horizontal. In order to determine the effect on the life of the lamp, with these various conditions, tests were made on the following at the Electrical Testing Laboratories:

1. Frosted lamp, bare.
2. Clear lamp and diffusing globe.
3. Clear lamp, diffusing globe and asbestos cover.

Thirty lamps were selected from among a large number which were purchased direct from the manufacturer. They were of 16-cp, 115-volt, 3.1 watts per candle, oval anchored filament type. These lamps were selected with a view to securing those free from perceptible defects. When received they were divided into three groups. In making this division the only consideration was the efficiency; an endeavor being made to have the same average candle power and watts consumed for each of the different groups. One of the three groups was then taken to the factory of the manufacturer and was there frosted by the usual acid process. The ten lamps after frosting were again photometered in order to determine the absorption and modification of the distribution of light, due to the frosting.

The enclosing globes used were of the "Holophane" type, being spheres, 6½ in. in diameter with 3¼-in. holders. Ten of these were used without any cover while ten others were protected with an asbestos disk or washer which practically prevented any dust from entering and at the same time had a tendency to throw down any light striking the white surface. This type of globe was selected for the reason that while the glass is heavier than the ordinary type of globe, the increased radiating surface, owing to its numerous prisms, would tend to increase the radiation.

The first tests made were to determine the absorption and modification of the distribution of light, due to the three methods given above. As will be seen from the data given later, the loss of light due to the frosting of the lamp itself was 9 per cent, while the loss due to the absorption of the globe was about 16½ per cent. The distribution of light, as thus obtained with the above combination, is shown in Fig. 1, where the photometric curve of the bare lamp is also given for the sake of comparison.

The effect of frosting a lamp is to decrease the candle power at all angles, with the exception of that directly underneath and directly above the lamp.

The type of globe used in this test is known as one which aims to diffuse the light in all directions below the horizontal rather than redirect it in any one direction. This is shown by Fig. 1. It will be noticed that the use of an asbestos disk slightly increases the useful light at all angles below the horizontal. Other things being equal, it would seem desirable to use asbestos disks with any form of enclosing globe, thereby preventing the accumulation of dust on the inside and increasing the useful illumination at the same time. In this connection it should be noted that the use of such a disk or washer prevents the dust from settling on the lamp itself as well as on the inside of the globe. The importance of keeping the inside of the globe, and the lamp itself perfectly clean has been well brought out in tests reported on by Messrs. Legg and Townsend at the Chicago Public Library, where in the case of clear lamps and porcelain reflectors, the average increase of light, due simply to wiping off the lamps and shades with a cloth, was nearly 30 per cent.

After the absorption test was finished the three groups of lamps were placed on life test. All were burned pendant upon the same racks and under the same conditions; a frosted lamp, a lamp in a Holophane globe, and a lamp in a diffusing globe with asbestos disk being placed in turn. All were operated on a 60-cycle, constant-potential, alternating-current system, in which the average pressure fluctuations did not exceed ¼ of 1 per cent above or below normal. The lamps were burned under such conditions throughout their useful lives. Neither the frosted lamps nor the globes were cleaned in any way.

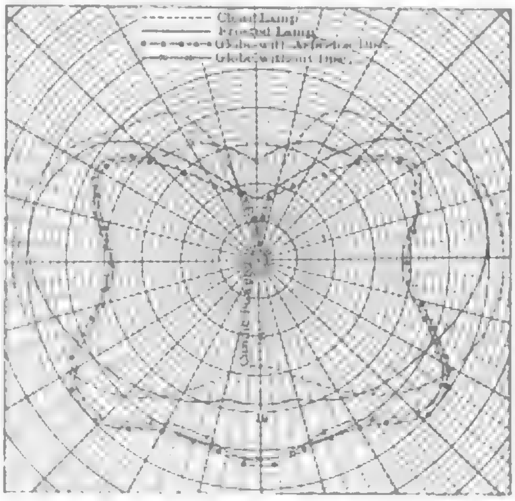


FIG. 1.—CURVES OF LIGHT DISTRIBUTION.

After the test had been in progress 144 hours and 336 hours respectively, the mean spherical candle power of each of the ten frosted lamps was determined. After the test of the lamps burned within the globes had been in progress 288 and 516 hours respectively, their mean spherical candle power values when used with the globes was determined. At more frequent intervals, the mean horizontal candle power of the lamps was determined in order to establish the rate of deterioration in candle power.

	Group No. 1 Frosted.	Group No. 2 in globes.	Group No. 3 in globes and disks.
Initial m. s. c. p. as modified	12.2	11.1	11.1
Watts per initial m. s. c. p.	4.15	4.55	4.55
Per cent. loss of light as compared to clear lamps	9.0	16.5	16.5
Mean zonular c.p.			
Lower 45 deg. zone	10.6	12.9	13.4
Lower 60 deg. zone	11.3	13.4	13.9
Lower 75 deg. zone	11.8	13.2	13.5
Lower hemisphere	12.4	12.4	12.6

Because of the nature of the light units tested the only practicable method of comparison is on the basis of mean spherical candle power. All candle power results shown in this report, are, therefore, reduced to this basis. The lamps were burned in every case to 80 per cent of their initial mean spherical candle power.

The net results of the tests made at the beginning are given in the following table:

LIFE TESTS OF LAMPS.

	Group No. 1 Frosted.	Group No. 2 in globes.	Group No. 3 in globes and disks.
Average life to 80 per cent of initial c.p.	216 hours	428 hours	423 hours
Corresponding candle-hours	2383 "	4401 "	4384 "

In studying the results we note that the loss of light, due to the frosting of the lamp is 9 per cent, while in the case of the type of globe used in this test the loss was 16½ per cent. When, however, the question of life is considered, we find that the life with a frosted lamp is only 216 hours, whereas the globe under test gives 428 hours or nearly twice the life. If we multiply the average mean spherical candle-power by the number of hours of useful life, we find, in the first case, we have 2,383 candle hours, while in the second place we have 4,401 candle hours; an increase of 85 per cent. Fig. 2 shows the life hours and the candle-power graphically. Care should be taken not to confuse this with horizontal candle hours commonly used in considering the life of incandescent lamps.

Coming now to the question of asbestos disks in the neck of enclosing globes, we find that the total flux of light is practically the same in either case, but that the light in the lower hemisphere is increased about 2 per cent, and that the loss of life, due to the same, is only about 1 per cent. Inasmuch as there is a great gain due to the fact that dust is prevented from falling on the inside of the globe, and also on the lamp itself, it is beyond question a desirable thing to equip all pendant enclosing globes with some form of cover to prevent the collection of dust or dirt. Dirt collecting in the bottom of a diffusing globe is not only a cause of loss of light, but is inartistic and slovenly. It shows much more plainly in a diffusing globe than in any other and should be avoided both on account of the efficiency and appearance.

The object of frosting lamps is to cut down the intense glare of the bare filament with the least possible loss of light, rendering the lamp more agreeable to the eye and giving a more artistic effect. In many instances, the same results can be obtained by the use of ground glass diffusing globes with a corresponding increase in the life of the lamp. Where a reflector is needed and at the same time diffusion of the light from the lamp filament is advisable, a frosted bulb lamp is still the most easily available device for securing diffusion. It is to be regretted that the tests did not include ground glass as well as diffusing globes, but judging from the tests given in previous articles in these columns by the authors on the absorption by ground glass globes, it is probable that a test on these would show very nearly the same results as here obtained.

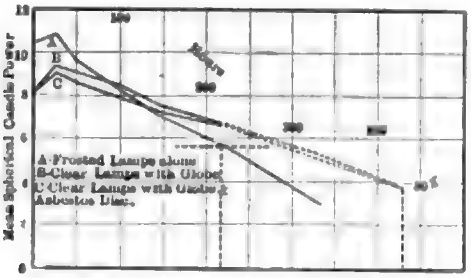


FIG. 2.—CURVES OF AVERAGE CANDLE-POWER PERFORMANCE.

The usual guaranteed life of bare lamps of this kind with clear glass bulbs is 450 hours. The loss of life by enclosing them in globes is, therefore, about 5.5 per cent, while the loss of life by frosting is about 52 per cent.

Consolidation of Electric Power Stations in Switzerland.

By W. Weissenbach-Griffin.

Up to the date of this writing there is only one instance of the consolidation of several independent central station companies, namely, two power stations, built in 1899 and 1900 and situated in Canton Berne, were united. The Kander station is located in the Berne highlands and the Hageneck station near Biel and their transmission lines meet near the city of Berne, one coming from the south and one from the west. The Kander station has a maximum capacity of 6,000 turbine horse-power under a head of 223 ft. and producing a normal power of 4,000 kw.

The Hageneck station has a maximum capacity of 4,000-5,000 turbine horse-power, under a head of from 23 to 32 ft., and giving a total power of 4,000 kw. The two stations together serve a population of 140,000 people contained in 40 or 50 towns, the longest transmission being about 37 miles. The polyphase transmission lines are operated at 4,000 volts and 16,000 volts respectively, while the distribution voltage is 2 × 125 volts for lighting, and for power 250 volts and 3,000 volts. The Kander station also supplies a standard gauge railway between Thun and Burgdorf with 1,500 kilowatts polyphase power.

The consolidation of these stations was made possible by the co-operation of the canton Berne—the Cantonal Bank took two-thirds of the stock. It remains to be seen whether the combination will result in an increase in the dividends or not. Both companies paid well before combining.

The general consolidation of electrical generating stations in Switzerland will become a necessity with time. At present there are 196 stations with the following capacities:

11	stations	50,000 kw
21	"	30,000 "
164	"	31,000 "
196	"	111,000 "

There are too many small stations. There is a lack of uniformity in the rates charged for power and light, as will be seen from the following:

Sixteen candle-power incandescent lamps burning 1,700 hours per year from 128 to 952 francs ($25.60—$190).

Sixteen candle-power incandescent lamps burning 500 hours pay from 550—2,616 francs ($110—$520) per year.

Three horse-power motors working 3,000 hours pay from 135—420 francs ($27—$84) per horse-power-year.

Fifty horse-power motors pay from 110—325 francs ($22—$65) per horse-power-year.

This non-uniformity will, in many cases, be the stumbling block to a readjustment of rates, especially where the arrangement does not result in an increase. Here it is interesting to note that some of the small stations show very good results, and by buying cheap power transmitted from a distance the building of the extension of existing plants is rendered unnecessary.

One of the hindrances to the consolidation of plants is the difficulty with the operating personnel of the small plants. This difficulty is sure to occur and have an influence upon the results. As a rule, small Swiss plants can be operated at a very low cost.

Among the Swiss cities with from 20,000 to 165,000 inhabitants, a dozen have municipal lighting plants, some of which buy power from stations situated at a distance, while others purchase from local companies to help out.

In Berne, Zurich, St. Gall, etc., the power is transmitted from a distance and added to that produced by the municipal plants, the original city plants, which were driven by steam engines or water turbines, not being large enough to take care of the growing business. Then a larger municipal plant was obtained nearby and finally power was taken from a private station which was built in the meantime. The purchase of power from private companies is often only a temporary arrangement to tide over to the time when the city will be in a position to build or assist in building an hydraulic station, or buy outright a station which has been built by a private company. The consolidation of municipal plants becomes more important as the cities acquire more central stations.

A new epoch for such mergers will follow as soon as large hydro-electric stations are built for the operation of the Swiss Bundesbahnen (United Railways). It will be good policy for these stations to sell electrical energy in connection with their regular load in order better to utilize the water power and give a cheaper power for traction. These new stations will do away with many of the small stations in their districts. In most cases it will prove advantageous to consolidate plants which are scattered along the banks of the same stream, and which utilize the water power for electric transmission and industrial purposes. By combining the plants and building one large central station, which will utilize the greatest head and be equipped with large and efficient machinery, a much more economical result will be obtained than was possible with the small stations.

From the above the situation in Switzerland can be stated as follows: Although many plants will best please their local customers as well as the owners, by working out their own development, there is an opportunity for both large and small plants, in building new stations for mixed loads, to reach out and supply current to many communities, which hitherto have had unsatisfactory service, due to high rates, poor service, bad regulation or faultily designed distribution system.

In the cities the electrical supply service, including central stations for lamp, motor and railway loads, is not a private but a municipal undertaking. The state has a few electric stations built as cantonal plants, but since the railroads belong to the Bund (Union), the state will build hydro-electric plants to supply power for traction. The general service to the public is supplied by private corporations and these will continue to exist so that there will be three sources of supply in the field at the same time; private plants, state plants, and the city plants, which fact should aid in promoting consolidation.

Laws which deal with water power concessions are now being drafted and will be laid before the next parliament. These laws concern the delivery of power outside the country as well as the construction of the plants. Complications due to canton borders and the non-uniformity of the cantonal laws, will be removed so that new plants can be built without infringing the right or sovereignty of the cantons over water powers.

Electrical Terminology.

By T. M. Roberts.

The following suggestions are offered, not to increase an already large vocabulary of electrical terms, but rather to do away with not a little confusion often present with the use of the words *alive* and *loaded* as applied to conductors. These two terms may be supplemented by a third term, or else a more careful distinction made in the use of them. The evidence is in favor of a third term, for the present ones, as often loosely used, do not convey to the average mind the true state of things electrical, as regards safety and danger.

For illustration: The three accompanying figures have been submitted to three prominent electrical engineers, A, B and C; and their use of the terms *dead, alive* and *loaded* are here given.

In the first case, they all agree that a conductor having zero voltage and no current traversing it is *dead*.

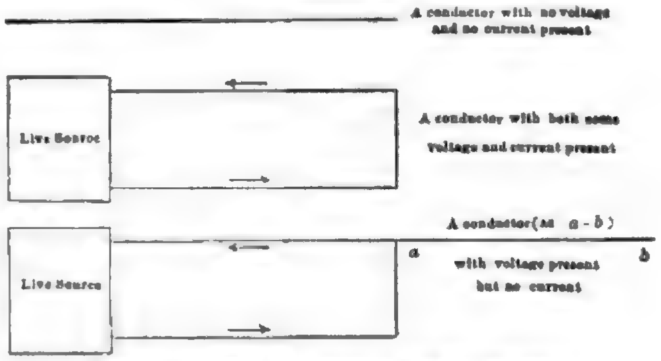
To the second case, they all apply the term *alive*, yet engineer A says it is *alive* and *loaded*.

In the third case A says the conductor is *alive* and *unloaded*, which is a nice distinction. B says the third conductor is *loaded* as distinguished from the second, which is *alive*. And C says both the second and third conductors are *alive*, and that the two terms *dead* and *alive* cover all three cases, and no third term is needed.

Several other terms have been loosely applied to both the second and third conditions, yet the above is sufficient to establish the fact that a *dangerous looseness* of the application of electrical terms is in common use; dangerous because, even to a technical person, an ambiguous term is misleading, and because the uninformed are deceived, which frequently leads to disaster. For who has not seen, or heard of someone receiving a shock—perhaps fatal—from some conductor that was supposed to be dead, but which proved to be *alive* in the *unloaded* sense of Engineer A—that is, having potential but no current. An experienced electrician knows and appreciates the difference between the second and third conditions, but to the inexperienced person, a conductor that carries no current is dead, and can be touched with impunity. It is the ambiguous terms and the use of misleading phrases that often give trouble.

The term *load* and its derivatives *loaded* and *unloaded* are already overloaded with several different meanings. And granting the desirability of the use of synonyms in giving flexibility to our language, does not the third condition deserve a third specific term? A thing is inherently what it is, irrespective of the name given it; and in matters where both public and private welfare as well as property are concerned, the term used to designate a thing should denote what the thing itself connotes.

An old Latin professor used to say to his students that when they were at a loss for a word to express the meaning of the context, "Call it *Tecumseh* and go on." But now when electrical science is spoken of as an exact science, it is both humiliating and confusing to be hampered with ambiguous terms. And even if such terms are in common use (words that need additional words to explain their meaning), it must be said in deference to the progressive spirit of electrical engineers, that they are, pre-eminently, inventive pioneers to adapt practical means to practical ends. And when the means are suggested, the general public is every ready to follow and glad to adopt a single, definite term for a particular thing, and not a clumsy, cumbersome, "Tecumseh" expression that says one thing and means another.


A conductor with no voltage and no current present
Live Source
A conductor with both some voltage and current present
A conductor (as a - b)
a
b
with voltage present but no current
Live Source

FIGS. 1, 2 AND 3.—ELECTRICAL TERMINOLOGY.

A term for the third case, which is readily self-suggestive, is the word *asleep*. I am not aware that this word has ever been used by others in this meaning, yet its kinship to the terms *dead* and *alive* is sufficiently close to give it a place in everyday use. It denotes a state of a conductor whose condition connotes electrical inactivity; that is, not alive in the active or loaded sense, but alive in the inactive or unloaded sense.

Briefly, then, the three terms *dead, alive* and *asleep* would be used thus:

A conductor having no voltage and carrying no current is *dead*.

A conductor bearing both voltage and current is *alive*.

A conductor having some voltage above or below the earth, or surrounding conductors, but carrying no current is *asleep*.

As regards safety and danger, a *sleeping* wire is just as unsafe to touch as a *live* wire, for it is connected to and is part of a live circuit.

As regard fire risk, it is beyond dispute that idle conductors, whether they are *dead* or *asleep*, may be a source of trouble. For it is a very easy step to resurrect a dead wire into a sleeping condition and then just a touch of another potential is sufficient to create the *cause* of fire or accident which it is desirable to eliminate.

If a thing of importance has no name, it goes without saying that it needs a definite tag. And if it creates confusion and trouble by being dubbed with appellations of doubtful import, a corrective effort should be applied to do away with whatever is objectionable. And this corrective effort is largely assisted by the adoption of a specific third term.

Central Station Work at Beloit, Wis.

Beloit, Wis. (population, 10,000), has a combined water power and steam plant, operated by the Beloit Electric Company. The manager of the company, Mr. John S. Allen, is one of those who believes there are great opportunities for increasing central station business, and considers the solicitor to be the most important man a central station company has. The general methods used by this company are similar to those used at Madison where a business-getting organization has been at work for a number of years. As a result of the new business campaign, the company's net earnings have been doubled in the past two years. A solicitor has been employed for a year, who devoted all of his time to following up clews and inquiries brought in by advertising. The first three months the solicitor worked, business adding $1,000 per year to the company's gross income was taken on.

The company is a liberal advertiser in the Beloit daily papers. Most of the advertising so far has been concentrated for the purpose of increasing the use of electric light for sign and display purposes among the stores in the down-town district.

RATES FOR SIGN LIGHTING.

Contracts for sign and decorative lighting are taken at flat rates and the lights turned off at midnight by the company's pattrolman. These rates are calculated to be equal to what the customer would have to pay if he were purchasing current on the Doherty system of charging in vogue in Beloit and described later, plus $12 per year to cover the cost of a patrolman's services. These rates are as follows:

2-cp lamp	$2.40	per	year
4 cp "	3.20	"	"
8-cp "	4.50	"	"
16-cp "	9.00	"	"
3 glower Nernst	41.33	"	"
6 glower Nernst	91.66	"	"

WORDING OF ADVERTISEMENTS

The advertising, as stated before, has been mainly directed towards securing more sign and display lighting, although some relate to power. In all this advertising, the idea is impressed on the merchant that an electrical display is to be looked upon as an advertisement and a method of getting business rather than as simply a lighting expense. One expression of which considerable use is made is: "A bunch of bright bulbs will boom your business better than a brass band." Another advertisement has a border around the headlines consisting of a number of plain black lines arranged in what appeared at first to be a rather haphazard manner. Within this border is a single line in bold-faced type: "Electric light talks." Underneath was the following: "These black lines represent the outline of a prominent building in the city. Guess what and where it is. No need to tell you about the enterprising firm that has foresight enough to see that their lights *stand out* and talk for their business." Another advertisement read: "An electric sign is not costly; its unattractive neighbor is the expensive sign." Another advertisement is worded as follows: "What makes a business center? Business. What draws business? Lots of light. You and your neighbors can be in the city if you want to be. Get together. We will furnish the light and the light will furnish the business." Another attempt to get the attention of the merchant was worded about as follows: "This man is a stranger in town. He wants to buy some shirts, collars and a few cigars, etc. He doesn't go up one side of the street and down another looking for a good store. The electric sign shows him where to go. It tells him which store is the most progressive and that he will find there a better choice of goods, more courteous clerks and a more congenial proprietor." Among the longer advertisements was the following: "The first 10 per cent of your gross business doesn't show much profit. The last 10 per cent should be all profit. With your present equipment and your knowledge of business it would be very easy to increase those profits enormously by spending a small amount of money on electrical display. Let us tell you about the small cost and big returns." Of course, all advertisements are signed Beloit Electric Company. Among the shorter advertisements and expressions used the following have been selected: "Get the habit of studying your windows. Is your store front as attractive as it might be?" "Electric light talks (for your business)." "Tonic for business depression. More light."

The company has no special place reserved for its advertisement in the paper and the matter of location is left to the newspaper itself. The space used is also varied. One advertisement last winter was headed: "How to keep frost from show windows," after which followed an article on the use of a fan motor for keeping the warm air in circulation against the inside of a show window so as to keep the merchant from losing the value of his window display in very cold weather. The company at one time sent out a little booklet published by the Westinghouse Electric & Manufacturing Company instructing the consumer to read his own meter. At the same time a short article appeared in the newspapers on this subject. In connection with advertising and securing power business a copy of the following advertisement is of interest as showing the importance of being prepared to take advantage of opportunities. The advertisement was as follows:

"Man kept his temper. Motor helped him out. Last night at 11 o'clock a steam engine broke down at the Beloit steam laundry. Bad time for a breakdown. We got a message to put in a motor. This morning the laundry is running same as ever. The proprietors kind of like the way we use them. They like the motor even better and the chances are good that Mr. Steam Engine hits the rubbish heap. Just a start, a trial, in electric motor use and you tie up to it right away. Send us the word now. Don't wait for a breakdown. You simply can't depend on steam. Beloit Electric Company."

FIGURES ON A REFRIGERATING OUTFIT.

The company has at present but one motor driving an artificial refrigerating plant, but this is a very interesting installation because of the fact that figures are available on its cost of operation as compared to the previous cost of ice. The plant is in the store of Rouse & Bibbins, a progressive meat market. The motor is of 7½ hp and is belted to a countershaft from which a meat chopper can also be driven. The ice box or cold storage room is 16 x 27 ft. The ice machine is a Larsen, made at Omaha, Neb., and costing about $1,400. Brine tanks are used for storage so that the refrigerating machine need not be operated continuously. The motor, which is of the three-phase induction type, cost about $300. The cost of the cold storage room motor and refrigerating machine complete was about $2,500. The bills for the operation of this motor, which of course also includes its operation for running the meat chopper, were as follows from April to December, 1905: April, $22.80; May, $23.22; June, $27.33; July, $33.62; August, $37.80; September, $32.24; October, $25.92; November, $10.50; December, $17.93. The average per day for 275 days is 87 cents.

The storage room formerly used in this meat market was kept cool by ice and had dimensions 8 x 18 ft., giving a floor area of 144 sq. ft., as against 432 for the new room. The owners state that this former storage room took about $2 worth of ice per day. In other words, it cost over twice as much to cool a room of one-third the capacity of the present room. This leaves a large margin in favor of the electric refrigerating outfit over and above the interest on the investment. As to maintenance and depreciation, this item is very low for the mechanical refrigeration and high for the ice box, as an ice box rots out in the course of a few years and has to be entirely rebuilt. Mechanical refrigeration produces a dry cold and has the further advantage that it is always on hand when wanted regardless of whether the ice dealers are overworked or not.

ELECTRIC HEATING.

The company put about 50 flatirons out on trial in August and got very few back. Of course this was rather late in the season to begin a flatiron campaign. These were all 6-lb. household irons. The company has about six tailors' irons in use on its lines, these irons weighing from 12 to 18 pounds. An overall factory in the town is also trying electric irons. Warming pads have been very successful, there being about three dozen of these out in the town. A novel application of electric heating has been made at the farm of F. W. Morgan, located about 2½ miles from Beloit. An American Electric Heater Company warming plate is used in an incubator and is found an ideal method of keeping a uniform heat. On this farm there is a 20-hp Wagner single-phase motor which is mounted on a wagon and used around the farm for various purposes where power is required. There is also a motor used for blowing a pipe organ at this house and numerous other applications of electricity.

NERNST LAMPS.

The company has about 50 Nernst lamps on its circuits. The three-glower size is the most popular. The cost of materials for glower renewals for 1905 was about 5 cents per glower per month. Some of these lamps are in saloons where they are run all night and others are in stores which close at 6 o'clock except two nights per week and on factory pay day nights, which come two nights per month. These Nernst lamps are inspected once a week by the men who trim commercial arc lamps.

RATES.

The company has two systems of charging, one of which is a readiness to serve or Doherty system. Under the Doherty contract the consumer agrees to pay the company a service charge of $1 per month, plus 10 cents per 16-cp lamp connected or its equivalent, plus 10 cent meter rent, plus a meter rate of 5 cents per kw-hour. From the total bill 25 per cent is deducted for payment on or before the tenth of the month following. The Beloit Electric Company agrees to test without charge any consumer's meter to determine its accuracy upon the request of such consumer, provided not more than two tests a year are requested. Additional tests will be made only at the expense of the consumer unless the meter should prove to be wrong and against the consumer. No additional lights or apparatus using current are to be connected to wires which are in at the time the meter was set, without first notifying the central station; otherwise the consumer will be held responsible for any damage done the meter.

As the Doherty contract is not attractive to some customers, they are given the option of the following contract: A minimum bill of $1.10 per month plus 15 cents per kw-hour for the first 25 kw-hours consumed, plus 12 cents per kw-hour for the second 25 kw-hours consumed, plus 9 cents per kw-hour for all over that. As a matter of fact, the rates on the contract are 18 cents and 15 cents for the first 50 hours, a discount of 3 cents per kw-hour being allowed for payment before the tenth of the following month.

The system of distribution is 2,300-volt, 60-cycle, three-phase primaries with 110-220-volt, three-wire, single-phase secondaries for lighting. Power and lighting are operated off the same primary feeders.

The company has about 500 hp in motors connected, the equivalent of 16,000 16-cp lamps and 64 10-amp. open series street arcs. It is hoped to do away with the latter in the near future. Inside wiring is turned over to a concern which is friendly to the company.

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New Telephone Patents.

PUSH-BUTTON MESSAGE COUNTER.

A manually-operated message counter adapted for location at the subscriber's premises, is the subject of a patent granted to Messrs. F. McBerty and E. B. Craft and assigned by them to the Western Electric Company. This apparatus is controlled jointly by a push button and by the operator. When a subscriber desires to call, he must push his button to signal the exchange. This act sets a switch so that it closes immediately upon the release of the button and not before. As soon as the button is released and the switch is closed it is impossible to offset the switch further without the assistance of the operator. When the switch finally closes it becomes locked by a catch under control of the armature of a polarized relay. This armature may be tilted either way according to the polarity of the impressed current. For a good call the operator works the armature to count one call and release. For a lost call a reverse current releases without affecting the counting mechanism.

LOCK-OUT SYSTEM.

Ralph Sherer, of Eaton, Ohio, has patented a lock-out party line system. This system while fairly simple in construction and operation, does not seem to be worked out upon a basis such as to meet the demands of practice.

◆

Recent Electrochemical Developments.

ELECTROMETALLURGY OF IRON AND STEEL.

Of all applications of the electric furnace, none has attracted more attention during the past year than its use in the metallurgy of iron and steel. While the dreams of some would-be inventors in the past were concerned with the big problem of reducing iron from ores in the electric furnace, the more practical engineers who are distinguishing themselves in the present industrial development early recognized that to make a success they had to set in at the weakest spot of the present art—that is, at the manufacture of high-class steels by the crucible method with its extraordinary expense.

In copper metallurgy all the first steps of the treatment of the ore up to the state where the product is already almost pure metallic copper, are purely metallurgical, and all attempts to reduce copper by electrochemical means directly from the ores—for instance, by using anodes made from copper ores—have been commercially unsuccessful. It is only at the last stage of the chain of metallurgical operations—for removing the last impurities—that electrolysis has proven the great success. Copper refinish has indeed proven so very successful in every respect that the capacity of the large refineries of this country is now double what it was six years ago.

By analogy we may conclude that electric furnace treatment will obtain prominence in iron and steel metallurgy for the refining of steel. The crucible process is by necessity very expensive, while electric furnace treatment promises not only to yield as good a product as the crucible process, but to yield it at a lower cost, mainly due to the reduced working costs.

In this respect a recent patent of P. L. T. Heroult is significant. The patent of Heroult to which we refer is a combination patent which is very broad in some of its claims. One of its claims covers the process of converting cast iron "or the like" into high-grade or crucible steel, by first treating the metal in a Bessemer converter and then transferring it to an electric furnace where it is finally treated to deoxidize and decarburize it. Since the metal is here received in fluid condition no electric power is required to melt it, and the power cost, which is often a most troublesome factor in the cost sheet of electrochemical processes, is comparatively small.

A second patent recently granted to Heroult is interesting on account of the huge scheme which it involves. The object is to provide a steel mixer of considerable capacity, in order to secure uniformity in the product of an entire works, to secure a certain desulphuration and decarburation and to conserve the oxidizable additions—such as silicon, manganese and the like—in order to reduce their quantities to a minimum. Dr. Heroult thinks of an electric steel mixer of a capacity of 300 or 400 tons to be fed by five or six Bessemer converters or open-hearth furnaces. Heat produced by the electric current has the advantage that it is non-oxidizing, while Heroult moreover provides a reducing atmosphere by the introduction of producer gas under pressure.

In the meanwhile reports have been published to the effect that the experiments carried out by Heroult with the assistance of the Canadian Government at Sault Ste. Marie, have been quite successful, according to a telegram of Dr. Haanel, superintendent of mines, to the Minister of the Interior in Ottawa. It should be emphasized here that these experiments relate not to steel manufacture, but to iron reduction from the ores—for which the prospects of using electric furnace methods are far less favorable. Two points in Dr. Haanel's telegram are interesting. It is stated that the results are better than given in Harbord's report. This was, of course, to be expected, and it should be remembered that according to Harbord's report, with electric energy at $10 per electric horse-power-year and coke at $7 per ton, the cost of production in the electric furnace is approximately the same as the cost of producing pig iron in a modern blast furnace. It is evident that the results must turn out very much better than that, if the electric furnace is to become a commercial competitor of the blast furnace under general conditions.

Of course, local conditions may be more favorable to the electric furnace, and in this respect a second point in Dr. Haanel's telegram is interesting. Mention is made there of the production of nickel pig. This would sell well and represents, of course, an opportunity with a nickeliferous ores available at Sault Ste. Marie. To judge accurately what has been accomplished the full report of Dr. Haanel should be awaited.

In the meanwhile the chief application of the electric furnace in iron and steel metallurgy continues to be for the production of ferro-alloys. Imports from Europe have been very large in recent years, especially in ferro-silicon. Here the power is the most important item of cost and in some European plants, originally intended for the manufacture of calcium carbide, water power is available at a very low cost. At the same time strong efforts are now being made to extend the commercial manufacture of ferro-alloys in this country at suitably located points.

In the pioneer American ferro-alloy plant—that of the Willson Aluminum Company—considerable experimental work is being done. An indication is a recent patent of F. von Kuegelgen and G. O. Seward. The object is to produce ferro-alloys low in carbon—which is the principal technical problem of the whole manufacture. If the charge of carbon for reduction is made small, the expensive carbon electrodes will be rapidly consumed. The inventors, therefore, conduct the process with a view of prolonging the life of the carbon electrodes. Under these conditions the ferro-alloy produced is rich in carbon. In order to remove the carbon the same inventors formerly proposed to apply metallic calcium. In the present patent they suggest another method; they cast the alloy in form of pencils and employ two such pencils in an electric refining furnace in which the carbon is eliminated by the decarburizing action of the slag or lining. A suitable slag for refining ferro-chrome is a mixture of lime and chrome ore with suitable fluxes.

In this connection attention may be called here to the increasing interest in metallic calcium, since its chief use will probably be in the steel industry. Two patents for producing metallic calcium by electrolysis have recently been issued. The one granted to O. Ruff and W. Plato recommends the addition of calcium fluoride to calcium chloride as electrolyte in order to lower the melting point of the chloride. A mixture having a melting point of 650° C. is used, while the melting point of metallic calcium is 780° C. The inventors carry out the electrolysis at 760° C., and separate the two electrodes by means of a partition.

A second calcium patent was granted to W. Borchers and L. Stochem, who electrolyze fused calcium chloride with a comparatively small artificially cooled cathode against a large anode. Under these conditions calcium is obtained in the shape of a soft sponge upon the cathode.

BATTERY INVENTION.

After several months had passed without a single battery patent having appeared—which was a most unusual phenomenon—the issue of patents of this class has recently again started. Details of construction of primary batteries have been patented by C. Jaeger, K. Tsukamoto, E. C. Henn and C. E. Lockwood and G. A. Lutz. The latter two inventors mix the depolarizer with a binder and enclose it in perforated retainers, like in the Edison cell. But when the depolarizer has been used up, they do not regenerate it by charging, but the old retainer is replaced by a new one with fresh depolarizer. The arrangement seems to be specially intended for cupric oxide as depolarizer in an alkaline cell, sugar being used as binder.

Details of storage battery construction are patented by W. Fennell and Wm. P. Perry and by D. P. Perry. An interesting patent referring to storage battery operation is that recently granted to L. Lyndon and assigned to the General Storage Battery Company. Its object is to make the operation of the end cell switch automatic. The end cell charging switch automatically sets the contact brush of the switch upon such a cell contact that all the cells on one side of the contact are fully charged while those on the other side are not. The device which actuates the switch is of an electrical nature and is controlled by one or more of the end cells.

LETTER TO THE EDITORS.

Compensating for Phase Differences.

To the Editors of Electrical World:

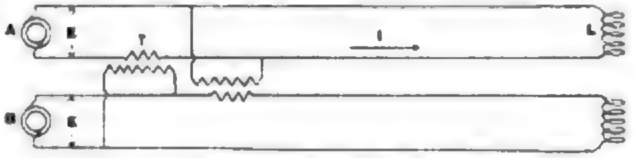
Sirs:—The accompanying diagram represents a suggestion as to a means of bringing the power factor back to unity in inductive, polyphase circuits.

A and *B* are the separate circuits of a two-phase generator, each working on an equivalent inductive circuit.

Let E = voltage at generator terminals.
L = inductance of load in henries.
I = the current in each phase.
$\omega = 2\pi f$; in which f = frequency.

Then the reactive e.m.f. of the inductive load will be equal to $\omega L I$.

T is a booster type of transformer having either a fixed ratio, $\frac{E}{\omega L I}$, or a variable and adjustable ratio. The secondary or series coil is to be so connected in that its e.m.f. is in opposite phase to the reactive e.m.f. of the inductive load. A similar transformer arrangement is provided to neutralize the inductive reaction in phase *B*. Under these conditions the generator e.m.f's and the currents should be practically in phase. There will of course be a small current circulating through the primary or high-potential coil of each balancing transformer, and this current will be at right angles to the load current, but its magnitude should be too small to sensibly affect the phase of the current passing through the generator.



ARRANGEMENT OF BALANCING TRANSFORMERS.

It is obvious that a similar pair of transformers could be applied directly at the inductive load, and in this case the pair shown in the diagram would only be required to correct the inductive reaction of the line alone.

Finally, as a three-phase system may be transformed into a two-phase system by well-known means, and the above correction applied, it is seen that the scheme is applicable to all commercial polyphase systems. It would also be possible to arrange transformers to produce a small corrective e.m.f. at right angles to the current in any wire of a three-phase system without transforming such system into the two-phase arrangement.

The advantages to be derived from the above method of unifying the power factor will be found in the increased generator capacity, and improved regulation, offset to some extent by the cost of transformers, which, however, will be of small capacity compared with the output of the circuits to be regulated by them.

Lincoln, Neb. George H. Morse.

[The scheme proposed by Mr. Morse possesses one vital defect. The current circulating through the high-potential coil of the balancing transformer is not "small." In fact, it possesses a value such that when combined with the current flowing through the inductive load circuit the resultant current is out of phase with the generator voltage by exactly the same angle which would have existed if the balancing transformers had not been used.—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Capacity of Transformers.—Dina.—An account of experiments with a 80-kw, 100,000-volt oil transformer. Some of the results obtained were quite peculiar, but may be easily explained if it is considered that a transformer in operation has not only a magnetic field but also an electric field. In the latter they are not only closed electric lines of force, but also open lines of force, which therefore have two terminals which are the seats of quantities of electricity. A change of these quantities is accompanied by a charging current. It is, therefore, possible to speak of the electrostatic capacity of the transformer. Some effects of this capacity are the more peculiar the higher the secondary voltage of the transformer. In the secondary winding of the transformer when not connected to an external circuit, a charging current is flowing which changes from element to element of this winding. In the same transformer the distribution and the mean value of this current depends on the connections of the high-tension circuits. On account of the reaction of the secondary charging current upon the primary circuit, the intensity of the primary current and its phase difference with the primary voltage may have very different values. The primary current may also consist only of a watt component. The distribution of potential in the secondary winding is not always represented by a straight line, but may approximate a sinusoidal form. It is, therefore, possible that in the interior of the transformer higher tensions exist than the tension at the terminals. The ratio of the secondary to the primary voltage may be different from the ratio of the windings. Under certain conditions this ratio becomes much larger than the normal value, since the increase of the secondary voltage is then only limited by the losses (case of resonance). Especially with transformers for very high voltages and high frequencies these phenomena must be taken into account.—*Elek. Zeit.*, February 22.

Single-Phase Commutator Motors.—Niethammer.—At starting the commutation is bad in all types of single-phase commutator motors. Since sparking during the starting period is due to a transformer e.m.f., there is theoretically a possibility of compensating it by a transformer e.m.f. which may be assumed to be produced by a double auxiliary pole. This represents, however, practical difficulties. The author discusses this remedy theoretically and shows that the use of a double auxiliary pole is necessarily connected with a number of essential disadvantages.—*Elek. u. Masch.*, February 18.

Lamps and Lighting.

Incandescent Lamps.—Gaster.—In a paper on progress in electric lighting the author gave the following table of the variations in candle-power and consumption of standard 3.1-watt lamps due to changes in voltage.

Percent of normal voltage.	Percent of normal c.p.	Consumption in watts per candle.
90	53	4.68
95	74	3.76
99	94½	3.22
100	100	3.1
101	106	2.90
105	131½	2.62

The extent to which the useful life (i. e., a life lasting until the candle-power has fallen by 20 per cent) of a 3.1-watt lamp is shortened by overrunning is shown by the following figures:

Percent of normal voltage.	Life factor.
100	1,000
101	.880
102	.681
103	.662
104	.452
105	.374
106	.310

A lamp of fairly high efficiency will give the best results, but it must be run on a constant voltage. He recommends free lamp renewals, or failing that, the supply of lamps by the station at less than cost. Also he would have station engineers make freer use of portable voltmeters over their networks. In the light of the information thus obtained the voltage of the actual supply to customers ought to be arranged to suit the lamps or the lamps to suit the voltage.—Lond. *Elec. Times*, February 15.

Mercury Vapor Lamps.—An article discussing several new arrangements for starting a mercury vapor lamp. The devices described are taken from patents granted to Recklinghausen, to the Cooper Hewitt Company, and to the Allgem. Elec. Ges., in Berlin. The arrangement of the latter company is shown in Fig. 1. The tube, 1, is filled at the bottom with mercury, 3, forming one electrode. In the upper part of the tube the other electrode, 5, is provided, which is an iron cylinder and is suspended by the spring, 6, which is in electrical connection with the magnet winding, 11, surrounding the upper part of the tube. From the electrode, 5, a rod, 8, of carbon is suspended passing through the guides, 9 and 10, and dipping into the mercury, 3. When current is started the electromagnet winding, 11, attracts the iron cylinder, 5, and the lower end of the carbon rod, 8, leaves the mercury, whereupon an arc is started between the terminal of the carbon and the mercury. On account of the very high vacuum within the tube, this arc does not remain stationary, but extends along the rod, 8, upwards until it reaches the electrode, 5. The current which then passes through the lamp is conducted largely, if not wholly, by the mercury vapor in the tube, so that the current passes through the rod, 8, practically only at starting.—*Zeit. f. Beleucht*, February 10.

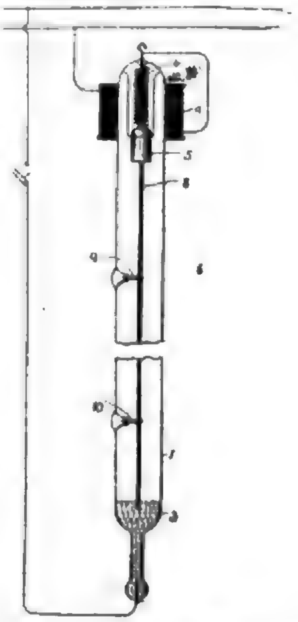


FIG. 1.—MERCURY VAPOR LAMP.

Train Lighting.—L'Hoest.—An illustrated description of the L'Hoest-Pieper system of electric train lighting.—*La Revue Elec.*, February 15.

Power.

Driving Rolling Mills.—Ortmann, Wild, Weideneder.—A discussion of the relative advantages of the steam engine for driving rolling mills and of electric driving. Ortmann and Wild conclude that only in the case of small mills is there any assurance of profit in electric driving, if a suitable power house is available, but that for larger units the charges for interest, etc., will eat up anything saved in other directions. Weideneder gives comparative costs of driving reversing mills electrically and by means of steam engines, both with and without the use of exhaust turbines. His results are much in favor of electric driving.—From *Stahl und Eisen*, in *Iron Age*, March 8.

Protection of Electric Motors in Mines.—Beyling.—The first parts of a full account of the experimental tests made in a German mine on the methods of preventing explosions in mines due to sparking of electric motors and apparatus.—*Glueckauf*, January 6, 13 and following. The article on the same subject by Goetze is continued in *Elek. Zeit.*, February 22.

Gas Engines.—Sargent.—A fully illustrated account of the development of large gas engines in recent years. "The experimental stage has passed, internal combustion engines have come to stay. Steam turbines, reciprocating steam engines and water wheels have their place, but the internal combustion engine is destined to be prime-mover of the future."—*Jour. West. Soc. Eng.*, February.

Traction.

Single-Phase Traction Experiments on Swedish Railroads.—An account of the programme of the tests which are being made on the Swedish State Railways with single-phase traction. Different kinds of trolley wire suspension are used on different parts of the line so as to test their relative merits. The tests will be made with two locomotives and two motor cars. One locomotive was supplied by the Westinghouse Company. It has two axles, each axle being driven by a 150-hp, single-phase, series motor. The locomotive carries a transformer which reduces the voltage supplied from the trolley line. The arrangement is so made that voltages of 3,000 or 6,000 or 12,000 or 15,000 or 18,000 may be taken from the line. The total weight of the locomotive is 25 tons and its dimensions are relatively small. The second locomotive was supplied by the Siemens-Schuckert Company and also carries a transformer for taking current from the trolley wire at voltages of 5,000 or 10,000 or 15,000 or 20,000, the secondary current being supplied to the motors at a voltage of from 115 to 300. The locomotive has three axles, each axle being driven by a 100-hp, single-phase series motor. The total weight of the locomotive is 35 tons. The two motor cars were supplied by the Allg. Elek. Ges. Each carries two 120-hp, single-phase Winter-Eichberg motors. The stator of the motors takes current directly from the trolley wire at 6,000 volts. There is no transformer inserted between trolley wire and motors. On the other hand, the dimensions of these high-tension motors are larger and they are heavier and more expensive; further there is the other disadvantage that they can be used only at the one voltage of 6,000. A complete list of the different problems which are to be solved by the test is given.—*Elek. Anz.*, February 15 and 18.

London Subway.—An illustrated description of the Baker Street & Waterloo Railway, which is one of the new tube railways in London; the total length when complete will be about 5¼ miles, with 12 stations. Down grades are provided on leaving the stations to help acceleration, and corresponding up grades to assist braking. A cross-section of the track is shown in Fig. 2. The negative conductor rail is placed in the center between the two running rails while the positive conductor rail is placed sideways of one rail. For the conductor rails a special quality of manganese steel is employed, of which the resistance is about 6.4 times that of pure copper. These rails weigh only 85 lb. per yard, as against the 100-lb. conductor rail employed on the London District Railway. The insulators for supporting the conductors are also entirely different from those hitherto employed. The positive rail outside the track has a clearance of only 2½ in. from the flanges of the segments of the tube, so that a special-shaped insulator is required for the outer conductor. All the insulators are of vitrified earthenware. Malleable-iron clips are used to hold them down and felt pads ⅛ in. thick are provided. The power for working the line is supplied through three substations from the underground electric railway company's power house. Three-phase currents are there generated at 11,000 volts and are converted to about 600 volts direct current in the substations. Careful attention is paid to good ventilation and the system differs entirely from that used in the older tube railways in London. Instead of the air being drawn out from one end by a huge single fan once a day, as is done at Shepherd's Bush, fans are provided at every station and work continuously all day long. By this means a column of air in each station is being continually renewed, and as by the movement of the trains these columns of fresh air are being constantly forced into the tunnels and replaced by columns of air requiring renewal from the tunnels, practically the whole of the underground air is frequently renewed. Each fan has been designed to exhaust 1,000,000 cu. ft. of air per hour, which is sufficient to renew all the air in the average length between the stations in both tunnels every 30 minutes. As the path of suction is relatively short and the cross-section of the duct varies between 12 and 16 sq. ft., no great pressure and velocity were required, so the efficiency is relatively high. One million cubic feet of air per hour requires 8.1 hp. The Westinghouse electropneumatic system of automatic signaling is used. There are three or four elevators at each station. The control of the trains is by the standard Sprague-Thomson-Houston multiple unit system.—Lond. *Elec.*, February 16 and 23.

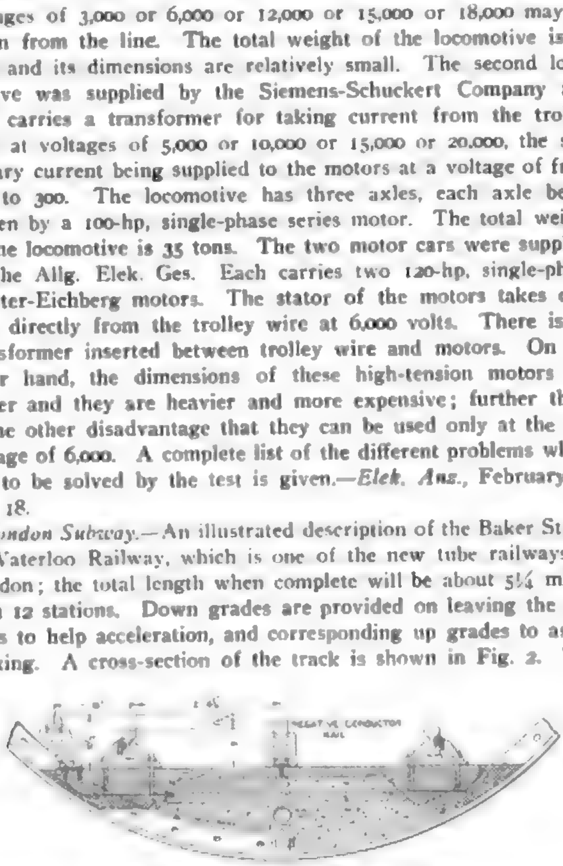


FIG. 2.—CROSS-SECTION OF TRACK.

Overhead Equipment.—Tweedy and Dudgeon.—The conclusion of their paper read before the Birmingham section of the British Inst. Elec. Eng., on the construction and maintenance of overhead equipment. The authors discussed the construction of the trolley wire and trolley wire ears and the causes of the wear of the trolley wire. The depreciation due to rolling friction is almost negligible. Sliding friction may be reduced to the same negligible quantity by attention to alignment and by the universal use of swivel trolley heads of the freest type. Arcing is the most serious trouble of all, and must be discounted by the use of modified trolley wire section and a complementary trolley wheel. The effect of an impure atmosphere requires further elucidation. The method of suspension does not affect the wear, while the effects of height of wire and pressure of trolley wheel require careful examination. A large number of tables give the results of the actual experience of the authors.—Lond. *Elec.*, February 23.

New Haven.—An illustrated description of the Grant Avenue Station of the Consolidated Railway Company at New Haven, Conn. Although the equipment of this station is made up of different types of machinery installed over a period of nearly 12 years, it possesses special interest on account of the low power costs secured. The total cost per kw-hour is given in the six months from July to December, 1905, as .75, .76, .68, .65, .65 and .58 cent, respectively.—*St. R'y Jour.*, March 3.

Electric Traction.—Koester.—An illustrated review of a quarter century of electric railway engineering, discussing the important steps leading up to heavy alternating-current service.—*Eng'ing Mag.*, March.

Electric Automobile.—Bary.—An illustrated description of the Vedrine electric automobile which carries a storage battery as the only source of power. The system of wiring, the controller, the methods of braking, etc., are described.—*L'Industrie Elec.*, Jan-

Installation, Systems and Appliances.

German Central Station Statistics.—The voluminous statistics of the central stations in Germany. In addition to an editorial review, it comprises almost 48 full pages. The statistics refer to the stations in operation on April 1, 1905. On that date there were working 1,175 plants and 540 plants were in course of construction. There are also some 80 plants from which no data could be obtained. Of the 540 plants in course of construction on April 1, 1905, about one-third are now in operation, so that the total number of working central stations in Germany is now almost 1,500. Only stations which supply cities with light or power are included, while private isolated plants are purposely omitted. The statistical tables contain for the first time data on the rates of charging, and these data are pretty full. It appears that the flat rate with discounts is used in a majority of cases. As a typical example the central station of Aix la Chapelle may be mentioned which charges for energy for lamps 13.75 cents per kw-hour for the first 250 hours and 6.25 cents for every further kw-hour. For energy for motors the following rates are used: During the day for the first 5,000 kw-hours 3.75 cents is charged per kw-hour, 3 cents for the next 5,000 kw-hours, 2.5 cents for the next 10,000, 2 cents for the next 20,000 and 1.5 cent for every kw-hour above that. For the evening hours the following motor rates are charged: If up to 10,000 kw-hours are used daily 7.5 cents are charged per kw-hour; 6.25 cents between 10,000 and 20,000, 5 cents between 20,000 and 40,000, 4 cents between 40,000 and 80,000, 3.5 cents between 80,000 and 150,000, 3.25 cents between 150,000 and 200,000, and 3 cents for every kw-hour above that. In addition to this rate of charging, which is most generally used in Germany, the double tariff and the maximum demand tariff are used in a large number of works, while quite a number of plants—and not only small ones—supply energy on a general flat rate. In 1905 there were 53 central stations with a capacity of more than 2,000 kw; their aggregate capacity being 330,203 kw. These 53 plants are located in 40 cities. The five largest are the Berlin Electricity Works (three-phase and direct current, with accumulators), 91,971 kw; Berlin-Moabit (three-phase and direct current, with accumulators), 30,078 kw; Berlin-Oberspree (three-phase and direct current, with accumulators), 27,570 kw; Hamburg (direct current, with accumulators), 27,131 kw, and Rheinfelden, which is the largest German hydro-electric station (three-phase and direct current, with accumulators), 14,491 kw. The development of German central stations during the last 10 years is shown in the following table:

	Number of plants.	Number of 50-watt incandescent lamps.	10-ampere arc lamps.	Motors h.p.
1894	148	493,801	12,357	5,635
1895	180	602,986	15,396	10,254
1897	265	1,025,785	25,024	21,800
1898	375	1,429,601	32,586	35,867
1899	489	1,940,744	41,172	68,629
1900	652	2,623,893	50,070	106,368
1901	768	3,403,205	64,278	141,414
1902	870	4,200,203	84,891	192,059
1903	939	5,050,584	93,413	218,953
1904	1,028	5,687,382	110,856	263,036
1905	1,175	6,301,718	121,912	310,428

Of the 1,175 stations in operation on April 1, 1905, there were 929 using direct current with accumulators with a total capacity of 313,058 kw. The direct-current system without accumulators was used by 44 plants; their total capacity was 2,960 kw. Single-phase and two-phase alternating-current systems were used in 43 stations of together 39,178 kw; three-phase current in 75 stations of together 89,306 kw; the monocyclic systems in two stations with 1,182 kw; the combined three-phase and direct-current system was used in 66 stations of 170,536 kw, while the combined single-phase or two-phase alternating-current and direct-current system was used in 16 stations of together 9,650 kw. The total capacity of the 1,175 stations was 625,870 kw; these plants were located in 1,133 different localities. More than one-half, namely, 630 stations, use steam and their capacity (411,716 kw) is four-fifths of the total capacity of all central stations if accumulators are not included in the capacity figure. There are 125 water power stations with a total capacity of 15,582 kw. Gas power is used in 124 stations with 11,120 kw. Both water and steam power is used in 219 stations of 61,692 kw; both water and gas power in 18 stations of 1,572 kw; both steam and gas in 20 stations of 5,167 kw. The number of incandescent lamps connected on April 1, 1905, and reduced to 50-watt lamps was 6,301,718; the number of 10-amp. arc lamps was 121,912, the capacity of all electromotors was 310,428 hp. The total connections reduced to 50-watt incandescent lamps represented 13,108,542 incandescent lamps, or 655,427 kw. The number of electricity meters in use was 269,722. The number of central stations opened to the end of 1888 was 15; there were opened 7 in '89, 8 in '00, 13 in '91, 22 in '92, 31 in '93, 36 in '94, 63 in '95, 74 in '96, 106 in '97, 152 in '98, 142 in '99, 144 in 1900, 94 in '01, 84 in '02, 82 in '03, 62 in '04, and 40 in '05.—*Elek. Zeit.*, February 15.

Zurich.—Wagner.—An account of the system of electric supply in Zurich. There is an absolute separation for the power employed for lamps from that employed for motors. The old single-phase network is reserved entirely for the lamp service, while the three-phase currents used for motors come from the Benznau station and are transmitted at 25,000 volts to transformer sub-stations at Guggach and Albishof, where the voltage is reduced to 6,000. From these sub-stations the current is led by means of cables to three sub-stations within the city, where the voltage is reduced to 500 for supplying current to the city network. In case of an accident at the Benznau station, the sub-stations can be supplied from the city plant, where a turbo-generator set of 1,500 kw has been installed for this purpose, giving three-phase currents at 2,000 volts, which can be transformed up to 6,000 volts and transmitted to the sub-stations at Guggach and Albishof. Two of the three sub-stations installed in the city are provided each with three converters of 600 and 900 kw for traction purposes and with batteries having a capacity of 1,000 amp.-hours.—From *Schweiz. Elek. Zeit.*; in *L'Industrie Elec.*, January 25.

British Central Station.—An analysis of last year's account of the Charing Cross, West End & City Electricity Supply Company. The company has two stations which supply each other to some extent in bulk at times of high load on one station. The total kw-hours sold to consumers were nearly 15,500,000. The total works cost per kw-hour sold to customers was 2.22 cents; the total costs, excluding capital charges, 3.18 cents.—Lond. *Elec.*, February 23.

Electrophysics and Magnetism.

Canal Rays.—J. J. Thomson.—An account of an investigation of the properties of canal rays obtained by means of a perforated cathode; the rays are allowed to impinge upon a charged metal plate mounted in an auxiliary tube at an angle to the path of the rays. When the canal rays strike against a solid they cause it to emit cathode rays moving with small velocities. This can easily be shown by charging the metal plate against which the canal rays impinge negatively to a potential of, say, 80 volts, then from the part of the plate struck by the canal rays a pencil of feebly-luminous rays can be seen. These rays are easily deflected by a magnet in the direction indicating a negative change. The canal rays ionize the gas they traverse, and the presence of electrons is proved by the deflection of a portion of the beam towards the plate when charged positively. When the canal rays, consisting as they do of positive ions, lose a certain portion of their velocity, they combine with electrons to form uncharged molecules or atoms. This critical velocity is about the order of 10 cm. per second, but is higher in the alpha rays of radium. The canal rays disintegrate a metal plate against which they strike, for after a long-continued bombardment of the metal plate the walls of the tube in the neighborhood of the plate are found to be covered with a deposit of the metal. When the canal rays impinge on a salt of sodium, the salt gives out yellow light, in which the D line is very bright. It is remarkable that this line is not given out when canal rays impinge on the metal sodium itself. A mirror of sodium with specks of oxide on it presents a beautiful appearance when struck by these rays. The spots of oxide shine out brightly with a greenish-yellow light, while the surface of the metal itself seems quite dull if no external light falls upon it.—Lond. *Elec.*, February 16; from *Proceedings Cambridge Phil. Soc.*, January 31, 1906.

Faraday and Kerr Effects in the Infra-Red Spectrum.—Ingersoll.—An account of a study of electromagnetic rotary dispersion, particularly in the infra-red spectrum. The chief results are summed up as follows: The electromagnetic rotatory dispersion of carbon bisulphide has been measured by infra-red methods over a range of spectrum extending from the sodium lines to $\lambda = 4.3\mu$, and found to be correctly represented by a formula which takes account of the absorption band beyond 8μ, showing that an infra-red absorption band may effect the rotary dispersion, much as it does ordinary dispersion, over a considerable range of spectrum. The magnetic metals and magnetite show, after wave length 1μ in the infra-red, a decrease of the Kerr rotation with increase of wave length. The complete rotatory dispersion curves, made by supplementing the results for the infra-red by existing observations for the visible spectrum, show a marked resemblance to a typical dispersion curve in the region of an absorption band, indicating the existence in metals of something analogous to a region of resonance absorption, extending over the visible spectrum. The particular cases of nickel and magnetite are notable, for the rotation appears to vanish for a particular wave length in each case, and then change in sign. The Kerr rotation for the magnetic alloy, Heusler's metal, if it exists at all, is less than one-tenth of that for iron or steel, although the magnetic properties of the metal are quite comparable.—*Phil. Mag.*, January.

Gravitational Energy.—Cremieu.—The radiation resulting from the acceleration of electrons implies a degradation of energy, and the author puts the question as to whether a corresponding degradation of energy can be traced in connection with the generation or destruction of gravitational energy. If it cannot, then gravitational energy is the only form of entirely reversible energy hitherto known. He has endeavored to approach this question experimentally along several different lines of investigation. One of them consists in determining the gravitational constant in liquids, where it should be the same as in air in accordance with hitherto accepted opinions. He succeeded in determining the constant in water under favorable conditions, but could not obtain any decided indication of an effect of the medium. He also endeavored to detect some effect of the abrupt acceleration by free fall of the attracting body, arguing that by Lenz's law the energy liberated would produce a motion in the attracted object tending to oppose the relative motion. He looked for an impulse of the attracted object in the direction of the fall, but failed to find it. In another experiment he formed in a bath of olive oil, several drops of a mixture of alcohol and water of the same specific gravity as the oil, and found that they were apparently attracted toward each other, although neither capillarity nor ordinary gravitational attraction could be alleged as the cause of the attraction.—Lond. *Elec.*, February 2; from *Jour. de Physique*, January, 1906.

Determining Dielectric Constants.—Veley.—A description of a modified form of apparatus for the determination of the dielectric constants of non-conducting liquids. The method consists essentially in producing a balance between two capacities and two capacity-free resistances. Both resistances are kept constant and one capacity is varied concomitantly with the other, the capacities being measured in terms of a length according to the principle that ceteris paribus the capacity of a condenser varies inversely with the distance between the metallic plates provided that such distance is small relatively to the area of the plates. The results obtained with the method are satisfactory.—*Phil. Mag.*, January.

Units, Measurements and Instruments.

D'Arsonval Galvanometer.—Wenner.—An abstract of an Am. Phys. Soc. paper in which the author describes the use of the D'Arsonval galvanometer with a particular adjustment for ballistic work which has some important advantages. The coil is stripped of its dampers, so that its motion is but little damped when on open circuit. The relation between the coil constant, the suspension constant, the strength of the field, the moment of inertia of the coil and the resistance of the coil is so adjusted that the coil comes to the zero position in the least time without swinging past it. It is also desirable to have the period of the coil as large as 15 or 20 seconds. To make the period as large as this often requires the use of a small suspension or an increase in the moment of inertia of the coil. Unless the coil has a very large moment of inertia in proportion to the copper in it or swings in a very weak field the adjustment may be completed by putting the proper resistance in series with the coil. This resistance may be determined by using different values and observing the swing of the coil past the zero when released from a certain deflection. If resistances are plotted as ordinates and the swings past the zero as abscissa, the point where the curve meets the "y" axis gives the resistance. With this adjustment the ballistic constant is *e* (base of Naperian log.) times as large with the coil on closed circuit as when on open circuit. The constant may be determined by the solenoid method, a condenser and standard cell. The galvanometer may be used either on closed or open circuit work with the same constant except the factor *e*. When used on condenser work the coil may be quickly brought to the zero by closing the coil circuit. When used on closed circuit work, such as iron testing and induction experiments, the coil returns to the zero position without attention about as fast as readings can be taken and recorded.—*Phys. Rev.*, March.

Localization of Faults.—Boehm-Raffay.—A mathematical article, illustrated by diagrams, on localization of faults by the Wheatstone bridge arrangement.—*Elek. Neu. Ans.*, February 15.

Telegraphy, Telephony and Signals.

Wave Length in Wireless Telegraphy.—Round.—The following factors determine the choice of the wave length: terminal conditions, interference from natural electrical discharges, interference from other stations, distance to be worked, and the nature of the surface to be worked over. The chief limiting terminal condition is the impossibility in certain circumstances of constructing a radiator which is properly efficient. The most serious trouble that practical wireless telegraphy has had to contend with up to the present time is natural electrical discharge. It is nearly always possible in practice to work even with faint signals with wave lengths under 500 ft. in length, the only exception being when a heavy thunderstorm is in proximity to either of the working stations, but the use of these short waves is limited to about 100 miles sea range. Wave lengths of the order of 1,000 ft. are more seriously interfered with, and when waves of 5,000 ft. are used electrical discharges can be heard practically at all times, and in the summer time would interfere seriously with the reception of all but the very strongest of signals.—Lond. *Elec.*, February 16.

E.M.F'S in Wireless Receivers.—Tissot.—When a receiving antenna is earthed and exposed to waves from a tuned sender, there is a stationary wave in the receiving antenna, exhibiting a node of current intensity at the summit and a ventral segment at the base. The potential, on the other hand, has a ventral segment at the summit and a node at the base. If 1 is the length of the antenna, *r* its radius, *V* the effective potential and *i* the effective current, as indicated by a bolometer or other thermal instrument, the equation holds $V = 2L\frac{21}{r}i$. Tissot succeeded in measuring the effective e.m.f. at the summit by a direct idiostatic electrometer method. It was 4.6 volts, the stations being 1 km. apart, the receiving antenna 70 meters long and the spark length 5 cm. The theoretical value was 4.4 volts. The author also measured the effective voltage in a "jigger," or secondary coil influenced by the induction of the receiving antenna, and found it to be of the same order of magnitude as in the antenna itself, viz.: from 4 to 5 volts, at a distance of 1 km.—Lond. *Elec.*, February 23; from *Bull. Franc. de Phys.*, January 19.

New Telephone Exchange.—An account of the recent change over of all the subscribers on the London Post Office "Central" exchange to the "City" exchange, the number of subscribers and junction lines transferred being about 14,000. The change over took place on a recent Saturday afternoon.—Lond. *Elec.*, February 23.

Tuning of Wireless Telegraph Apparatus.—A summary of the chief results of the last three papers of Slaby's serial on this subject, all of which have been noticed in the Digest from the original German publication.—Lond. *Elec.*, January 26.

Miscellaneous.

Removal of Salamander from a Blast Furnace.—Smith.—An illustrated discussion of various methods for this purpose. The author mentions drilling with the electric arc. If a carbon supplied with an electric current of proper voltage and in proper quantity be used as a burner on a metallic mass, the mass can be cut by melting, at a very rapid rate. In recent years advantage has been taken of this to bore holes through the walls and into the tapping hole of furnaces which have become partially chilled. The best results have been obtained with alternating current at 50 volts or less and with 1,000 amp. of current, the carbon rod being three inches in diameter by six feet long.—*Am. Machinist,* February 22.

Magneto Ignition.—A description of the Rankin Kennedy system of magneto ignition for internal combustion engines, the spark being obtained in the cylinder by means of a high-speed magneto machine working in conjunction with a tremble coil.—Lond. *Eng'ing,* February 16.

Electric Ignition.—Little.—A paper read before the Newcastle section of the (British) Inst. Elec. Eng., discussing the systems now in use of electric ignition for motor cars.—Lond. *Elec.,* February 16.

BOOK REVIEWS.

Die Elektrischen Bogenlampen. Deren Prinzip, Konstruktion und Anwendung. By J. Zeidler. Braunschweig: Friedrich Vieweg und Sohn. 140 pages, 130 illus. Price, 5.50 marks.

The arc-lamp exists in so many different forms, and is capable of being studied from so many different points of view, that no single text-book can cover the entire subject. This book is written from the standpoint of the electric lighting engineer, and devotes special attention to the distribution of illumination from arc lamps. The various types and constructions of lamps are considered, the duration of their carbons, and the distribution of their luminous intensity. The unit of illumination employed is the lux defined as a Hefner-metre. The unit flux of light is a Hefner-lumen. The description is clear, and the illustrations are excellent. The book will be valuable to students of the technology of electric illumination by arc-lamps.

Le Four Electrique. By Adolphe Minet. Paris: A. Hermann. 76 pages. illustrated. Price, 5 francs.

The electric furnace has only recently come into commercial use on a large scale, but its origin on an experimental scale goes back to the beginning of the nineteenth century, in researches on the then new voltaic arc. In the little treatise the author has given an outline of the history of the electric furnace, a brief account of its principal recent applications, and a brief collection of electrochemical tables and formulas. Photographically reproduced portraits are also appended of Minet (the author), Siemens, Huntington, Clerc, Borchers, Héroult, Cowles and C. M. Hall. This collection of portraits gives the book special interest for electrometallurgists. The text is clear and well illustrated by about fifty cuts. The book will be welcomed by students of electrochemistry and of the history of that art.

Theorie der Elektrizität. By M. Abraham. Vol. II. Leipzig: B. G. Teubner. 404 pages, 5 illus. Price, 10 marks.

This second volume of the author's "Theory of Electricity" is principally devoted to electrons and the electronic theory. The method of treatment is essentially mathematical, and vectorial analysis is largely employed. Starting with Maxwell's theory of the electromagnetic field, the experimental results of Hertz, Zeeman, Townsend, Thomson and Wilson are discussed and collated into a new theory of electricity which is in all main features an electron theory. The treatment is very skillful, and the author is to be congratulated upon the thoroughness of the work. The second section of the book deals with electric waves and their connection with optical phenomena. The mathematical treatment being somewhat abstruse will necessarily restrict the use of the book to advanced students. It will, however, well repay the study required for its comprehension.

The Telegraphist's Guide. By James Bell and S. Wilson. London: S. Rentell & Co. 227 pages, 197 ills. Price, 50 cents.

This is a very handy and very practical little manual intended for the use of telegraphers in Great Britain. Telegraphists in Great Britain, aspiring to superior appointments in the telegraph service, are required to pass a technical examination, and this manual is designed to meet the standard requirements of that test. The book now appears in its fifth edition. The first chapter is devoted to voltaic batteries, their nature, tests, grouping and maintenance. The second chapter deals with simplex signaling apparatus. The third covers duplex telegraphic working; the fourth, quadruplex; the fifth, Wheatstone; the sixth, repeaters; the next three, testing, and the last, wireless telegraphy. The treatment is simple in character and almost devoid of mathematics; but is clear, full, modern and comprehensive. There is a good glossary of technical terms and index of subjects. The book will be of much value to those who are interested in the practical telegraph apparatus of Great Britain.

Die Elektrochemie der Organischen Verbindungen. By Dr. Walther Löb. Halle: William Knapp. 320 pages, 10 illus. Price, 9 marks.

This is the third and enlarged edition of a very useful work. Organic chemistry has profited much by the short cuts and direct processes which electrochemistry offers, and is even beginning to count on quantitative outputs by the assistance of this new reagent. Dr. Löb has systematized and put in very accessible form the various items of scattered information which have so far appeared. He divides the subject into the necessary sections of electrolytic processes and electrothermic processes. The former are classed under six chapters; viz., theoretical, methods, electrolysis of aliphatic compounds, electrolysis of aromatic compounds, electrolysis by alternating current, and electrical endosmose. The latter is treated under the headings of theory and methods, spark discharge and arcs, utilization of electric heat from solid conductors, the silent discharge and action of Tesla currents. Electrochemical literature has been materially enriched by the work of Dr. Löb; and although an English translation is promised, yet anyone interested in the use of electricity in organic chemistry should certainly obtain and read this book without delay.

Leçons d'Electrotechnique Générale. Professées à l'Ecole Supérieure d'Electricité. Tome II. Courants Alternatifs Series oï daux et Non-Series oï daux Alternateurs. Transformateurs. Deuxiéme Edition. By Paul Janet. Paris: Gauthiers Villars. 309 pages, 156 figures.

That M. Paul Janet is an accomplished electrician is well known on both sides of the Atlantic. It is therefore no surprise to find that this second volume of his revised work on general electrotechnics fully sustains the reputation he has acquired for lucidity of expression and thoroughness of treatment. The phenomena of alternating currents form a branch of inquiry which demands a fair amount of mathematical knowledge at the very outset. Given such requisites as readiness in handling analytical formulæ and some familiarity with graphical methods, M. Janet's presentation of the subject will be found profitable and enjoyable reading. In successive chapters, he talks of harmonic functions, currents that follow the sine law and those that do not, polyphase currents and their applications, alternators and transformers.

Appended to four of the eight chapters is a lengthy bibliography including works and papers of the best known Americans and European contributors to our knowledge of the theory and applications of alternating currents.

Electric Wiring, Diagrams and Switchboards. By Newton Harrison, New York: The Norman W. Henley Co. 272 pages; 105 illus. Price, $1.50.

This work is a treatise on the subject of electric wiring in all its branches, beginning with the simple circuit and working up to practical every-day problems, all being presented in a simple and intelligent manner. Only arithmetic and simple algebraic formulas are used in the calculations and explanations. Some originality is shown by the author in the method of presentation of the matter, the liberal use of tables helping to a clear understanding of the subject. The diagrams, although on old subjects, are shown in a new form which will be found very helpful in the comprehension at a glance of facts that many persons might find difficult to understand if stated only in words.

While more than half of the work is devoted to wiring and related subjects, there is a good deal of other information that will be found generally useful. There is a chapter on incandescent lamps, which includes tabulated data on this topic. Switchboards of the various types, their design, etc., are considered in three chapters and the accompanying diagrams are clearly executed and easily understood. The three final chapters briefly review the nature and characteristics of alternating currents, and their practical applications are described.

Die Formelzeichen. By Olof Linders. Leipzig: Jäh & Schunke. 96 pages, tables. Price, 5 marks.

The author presents in these pages a table showing the various symbols which are in current use among technologists in different countries, for representing physical quantities in algebraic formulas. No less than 871 physical quantities appear in the table. To each is given its dimensional formula in the c.g.s. system, and also the symbol under which it is represented in 12 different sources of literature, as well as in the new system proposed by the author. Of the sources referred to, three are German pocketbooks, two are English and two are French. There are also five German or Austrian technical societies quoted.

The electromagnetic units are duly scheduled to the number of about 160. Unfortunately for electrical engineers, the symbols proposed by the author differ in a number of cases from those which he shows to be in general use among electrical writers. Of course, it needs no comment upon a table of nearly 900 symbols, that in order to avoid repetition, havoc must be created here and there in the existing usage of symbols and formulas. Only by mutual compromise between different scientific workers and technologists can a comprehensive uniform system of symbols be brought about.

The author has done good service in presenting this tabulated list of sybmbols, if only by paving the way towards uniform action in the future. The book will be of much interest and utility to great numbers of technologists, engineers and students in different departments of applied science.

La Théorie Moderne des Phénomènes Physiques. Radioactivité, Ions, Électrons. Par Augusto Righi. Traduit de la 2 iéme édition Italienne par Eugène Néculea. Paris: *Eclairage Electrique.* 126 pages, 19 illus. Price, 3 francs.

This pamphlet of 126 pages may be appropriately called an inquiry into the mechanism of physical phenomena or into the constitution of matter itself. Before stating any conclusion as to the probable nature of the simplest form of ponderable matter, Prof. Righi treats successively of electrolytic ions and electrons, cathode rays, radioactivity; mass, charge and velocity of ions and electrons.

It will be seen here that we have all the elements of an essay on contemporary physics to which must be added that the essay was written by a masterly hand, Prof. Righi himself being an ardent worker in the electronic field.

We note that he writes modestly, not emphatically, still less dogmatically, about the new views which constitute the electronic theory of matter; for, admitting the possible existence of an entity quite distinct both from matter and ether, he is careful to state that the new theory has only just made its *début* and that it would be premature to consider it as affording anything like a sure basis for a new system of natural philosophy.

No one knows what the intimate nature of the electron or electric atom is; but, according to the high priests of the new views, it is something very complex indeed, resembling a cosmic system of infinitesimal dimensions. The structural complexity of the postulated entity which is neither matter nor ether does not greatly encourage the hope that it will be able to reveal to us the supreme reason of things. But, failing that, it will serve a useful purpose, by co-ordinating and correlating the various branches into which we still divide the wide domain of physical research.

The work is translated from the Italian by M. Eugène Néculea of the research laboratory of the Sorbonne, and opens with a four-page introduction by Prof Lippman, of the University of Paris

General Electric Oscillograph.

The accompanying illustrations show a compact form of the oscillograph of the vibrating loop type, manufactured by the General Electric Company. This oscillograph is similar to a D'Arsonval galvanometer in that it has a current carrying circuit located in a powerful magnetic field. The part corresponding to the moving coil in the galvanometer is replaced by two small moving strips which also act as a suspension and carry the mirror. In a light tight box (See Figs. 1 and 2) is placed a three-element galvanometer of this design, combined with devices for viewing or photographically recording current and electromotive force waves. Each galvanometer element, or vibrator, consists of a single loop of very fine ribbon, *B*, suspended vertically in a powerful magnetic field. The terminals of the galvanometer are the ends of this loop, which is held at its lower extremity by an adjustable pulley.

With the exception of the magnetizing coils, each galvanometer element in the set of three is entirely complete and can, therefore, be easily insulated. Each set of vibrating strips is exposed on all sides when removed from the containing cells, so that any required adjustments or repairs are most conveniently made.

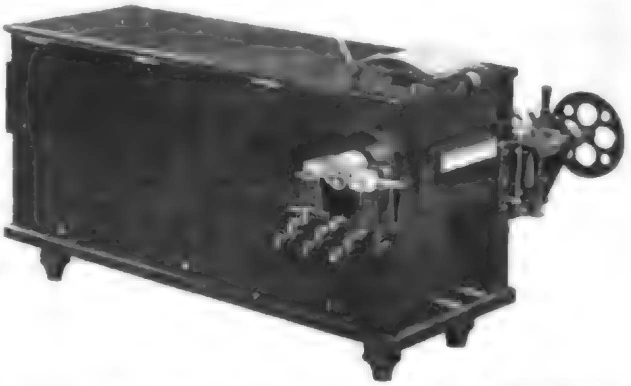


FIG. 1.—OSCILLOGRAPH, SHOWING PHOTOGRAPHIC AND TRACING ATTACHMENTS.

Light, usually from an arc lamp, is thrown by a lens upon prisms, and by them to the oscillatory mirrors of the galvanometers. From these mirrors the rays are reflected horizontally to the photographic drum at the opposite end or to a synchronous mirror from which they are reflected upward to a surface where they can be observed or traced.

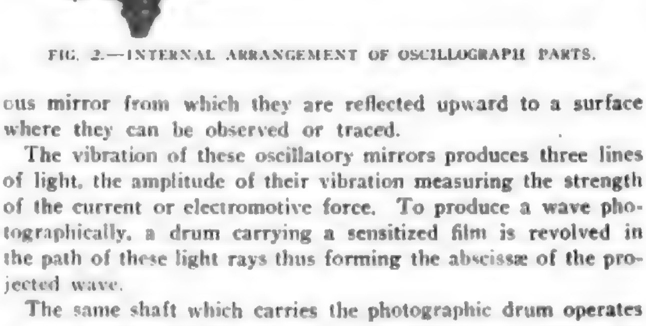


FIG. 2.—INTERNAL ARRANGEMENT OF OSCILLOGRAPH PARTS.

The vibration of these oscillatory mirrors produces three lines of light, the amplitude of their vibration measuring the strength of the current or electromotive force. To produce a wave photographically, a drum carrying a sensitized film is revolved in the path of these light rays thus forming the abscissæ of the projected wave.

The same shaft which carries the photographic drum operates a set of contacts which actuates a shutter interposed between the light source and the condensing lens. This shutter-operating mechanism is so arranged that the shutter is open during one revolution of the drum.

For viewing recurring waves, as has been stated, a so-called synchronous mirror is provided. This may be easily swung into position by a lever without removing the photographic recording device. The synchronous vibration of this mirror, which is oscillated by a cam driven by synchronous electric motor, provides the necessary range of action along the axis of abscissæ and thus gives an image of the wave form.

Such an apparatus is useful in studying the action of the various phenomena in electric circuits having not more than 5,000 or 6,000 complete vibrations per second. The accompanying oscillograms, Figs. 3 and 4, show the application of the General Electric oscillograph to various phases of engineering in which this method of ascertaining hidden electrical conditions has been found highly valuable. The enormous increase in the reversed voltage across the field winding of a shunt motor when the circuit was opened by a quick-break switch is indicated in Fig. 3. The curve, *E*, of Fig. 4, shows the instantaneous record of the electromotive force wave in a certain circuit. Curve *I* shows the almost sinusoidal current which the distorted e.m.f. sent through an inductance coil, while curve *C* indicates the current which the same e.m.f. sent into a condenser. The effects of the inductance in decreasing the distortion and of the condenser in increasing the distortions are strikingly shown by a comparison of curves *I* and *C*.

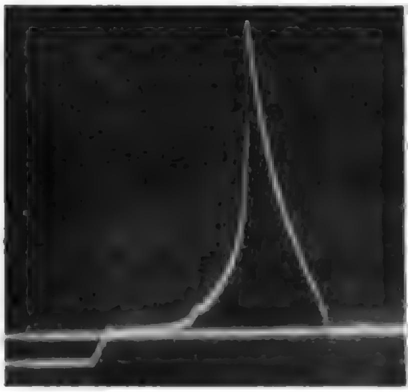


FIG. 3.—OSCILLOGRAM OF INDUCTIVE INCREASE IN VOLTAGE UPON OPENING CIRCUIT.

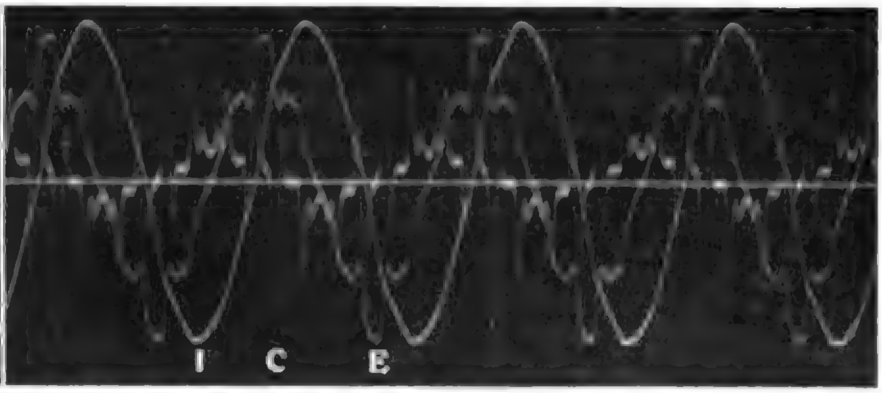


FIG. 4.—RECORDS OF E.M.F. AND OF CURRENTS THROUGH INDUCTIVE AND CONDENSIVE CIRCUITS.

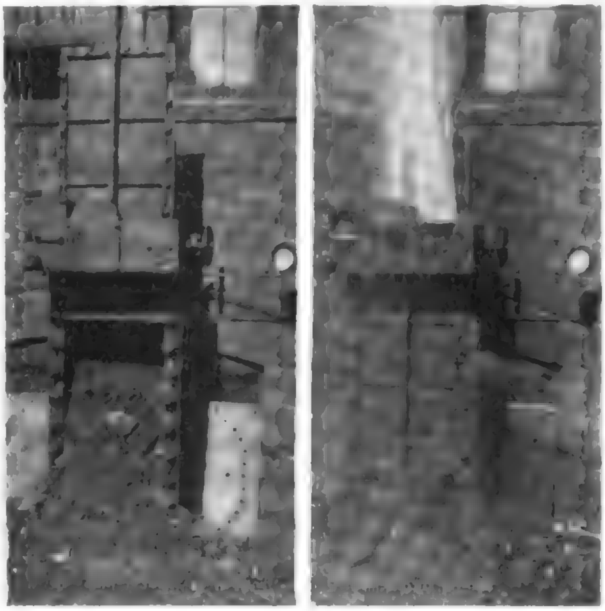
Tests of Electrically-Operated Bulkhead Doors.

The U. S. Navy Department, through the Bureau of Construction and Repair, lately conducted some elaborate tests of the "Long-Arm" power door, which type is installed on United States warships. In the tests the conditions were reproduced existing aboard ship when the coal bunkers are full and the doorways between the bunkers and the fireroom are open and choked with coal. The test included also a reproduction of the situation which would arise in the event of a hull puncture admitting water sufficient to sweep the coal through the doors.

Before proceeding with the coal and water tests the door was operated continuously for a period of several days, during which time it was opened and closed over 3,000 round trips, the equivalent of about ten years of actual service on a warship. During this trial all that was necessary to keep the door in perfect operative condition was to oil several of the bearings once a day (that is, about once for each 700 round trips). The controller received no attention whatever and the contact fingers were found in excellent condition at the end of the test; the motor also received no attention during the entire test. The worm and the wormwheel, by which power is immediately applied to the door, were lubricated before the test started and not at all during the test, and they were found in excellent condition at its completion. Immediately before making the trials for the Bureau of Construction and Repair, a duplicate of the prescribed tests was carried out by the "Long-Arm" System Company to make sure that everything would run properly, and thus the particular door passed through a series of openings and closings equivalent to twenty years actual service upon a warship without showing appreciable wear.

The box upon which the door was mounted was filled with coal, allowed to run out through the door opening in the same way that it would if the door were opened from a coal bunker. Large lumps of coal were mixed with the layer of all sizes. Before closing the door upon this mass of coal, fine coal dust was shovcled and thrown up all over the tighteners and the frame in order that the conditions of the test might be as severe as possible. To make the coal dust stick in sufficient quantity, the bulkhead frame and tighteners were covered with thin oil.

The door was then closed from the bridge emergency station; the door plate cut through nearly all the coal, and the clear opening was practically completely closed when the automatic cut-out opened the circuit and stopped the motor. After the door had closed into the coal and been stopped by an automatic cut-out, the water from an elevated tank was let in the box back of the door plate and a head of 35 ft. above the sill was maintained. A thin film of spray worked its way through the clearance space between the bulkhead frame and door plate, and in some places the water succeeded in washing out the fine coal dust which had collected. At this time the actual leakage measured less than 75 gallons per minute. The water back of the door plate soon worked its way down through the coal to the slight opening at the bottom and washed away the pile of coal in front, thus relieving the resistance to the thrust of the door plate, causing the automatic cut-out to throw in the current again, and allowing the door to complete its closure.



ELECTRICALLY-OPERATED BULKHEAD DOORS.

During another test the door was clean, as would be the case on a passage door, and the leakage under this condition was remarkably small. The tests described showed that one of the reasons why the door works so perfectly on a coal bunker is because the motor is protected by an automatic cut-out which opens the circuit as soon as the load upon the motor becomes greater than it can safely handle, and when the load decreases to a safe amount the circuit is automatically closed again by the same device. It was shown by the tests that the cut-out gives to the door an almost human intelligence in its action when operated from the emergency station. For instance, when the door closed into a mass of coal and struck a lump so large that it could not cut through it, the circuit to the motor was opened; but nevertheless the device was not inoperative, for when water got into the bunker back of the coal, it at once loosened the mass of coal beneath the door plate. As soon as this was done the pressure upon the plate was relieved, the circuit again closed, the motor again started and complete closure of the door effected, as if the work had not been interrupted.

The principle upon which the automatic cut-out is based and its mechanical construction are really very simple. The motor is directly connected to the worm engaging the wormwheel already referred to, which in turn transmits the load through its shaft and a pinion to a pin rack upon the door plate. In performing its work, the worm exerts a thrust in the direction of its axis, and this thrust is borne by a specially constructed bearing supported by a heavy helical spring. This spring has upon it an initial load equal to the greatest thrust which it is desired that the motor should deliver. As soon as the thrust actually exerted by the worm exceeds the initial compression upon the spring, the latter gives way slightly, allowing the wormshaft to move axially. This motion of the wormshaft is used to interrupt the circuit, and the same motion in the reverse direction (when the excess load is removed) will complete the circuit which it has previously broken.

Small Power Motors.

The Westinghouse Electric & Manufacturing Company has lately perfected a line of motors for light power service, such as operating sewing machines, dental apparatus, coffee grinders, small ice cream freezers, phonographs, sign flashers, moving window novelties and hundreds of other adaptations. The smaller sizes may be attached to an ordinary incandescent lamp circuit, furnishing a profitable day load for lighting companies.

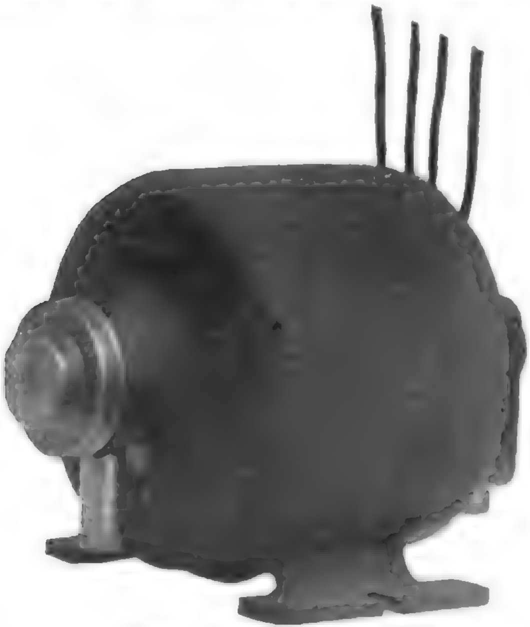


FIG. 1.—ENCLOSED MOTOR.

These motors, which follow very closely the design of the Westinghouse fan motors, are built for both alternating and direct-current circuits, either 115 or 230 volts. The direct-current motors are either shunt or series wound, and the alternating-current motors are wound for 25, 60 or 133 cycles. The efficiency of all machines is claimed to be exceedingly high.

The base of the motor consists of a separate casting, the frame being drilled and tapped so that the feet may be fastened in any one of four different positions. This construction adapts the motor for mounting in any position. The screw holes in the base are slotted to allow belt adjustment. A two-step grooved pulley, suitable for a cord or round belt, is supplied with each motor. The speed obtained by driving from the larger step is about twice that of the smaller.

The bearings are self-oiling and similar in construction to those of the fan motors. They are provided with vertical oil cups with a wick which effectually lubricates the shaft, and a suitable return channel prevents the dripping of oil from the bearings. The leads are brought out through hard rubber bushings and connection to the motor is easily made. An ordinary lamp cord and plug may be attached to the motor leads for connecting it to an incandescent socket or receptacle.

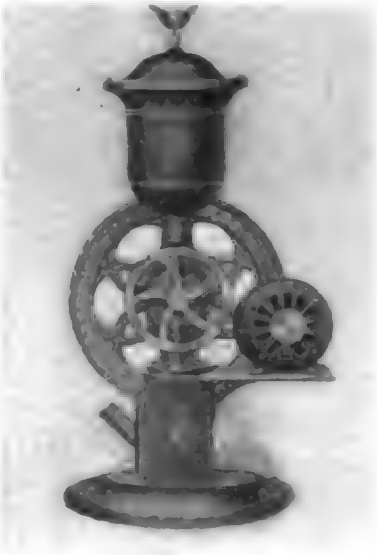


FIG. 2.—MOTOR-DRIVEN COFFEE GRINDER.

All motors are finished in black enamel with the trimmings of brass, allowing them to be installed where neat appearance is essential.

The alternating-current motors are of the single-phase induction type with open end frames and split-phase winding, the starting coil of which is automatically cut out as the motor comes up to speed. A self-acting friction clutch engages the load after partial speed has been attained. One of these, shown in Fig. 2, is driving a coffee grinder. The direct-current motors are enclosed and are made both series or shunt wound, and are so constructed that no starting device is necessary. One of this type is shown in Fig. 1.

Electrical Pumps for New York City.

The equipment for the two new fresh and salt water high pressure pumping stations for the Borough of Manhattan, which will consist of ten multi-stage, centrifugal pumps furnished by the Allis-Chalmers Company, of Milwaukee, will be driven by ten 800-hp "Bullock" induction motors, built in accordance with the specifications of the Department of Water Supply, Gas & Electricity and provided with a device by which resistance can be inserted at starting to limit the current taken from the supply lines. The ten pumps to which these motors are to be direct coupled, will each be constructed with six runners; i. e., the water will be handled in six stages, each stage raising the total required amount of water through one-sixth of the total required head. The pumps are designed to give their maximum efficiency when delivering 3,000 gal. of sea water each per minute, at a speed of approximately 735 r.p.m., and against a discharge pressure of 300 lbs. per square inch.

This equipment of motor driven pumping units, which is remarkable for the size of its motors and its water lifting capacity, will be installed in the new Gansevoort and Oliver Street stations which are identical in arrangement. Each station is designed to accommodate, in all, eight complete units, of which five will be installed at the present time.

◆

Electromagnetic Friction Clutch.

Friction clutches are often of great advantage on line shafts to drive counter-shafts, and especially on counter-shafts to drive individual machines to be started or stopped at the will of the operator. When such clutches are used on main shafts, the machinery of each department served by the shaft can be started or stopped independently of the others. Clutches have also found a useful application in the reverse motions for planers, automobiles, hoisting machines, printing presses, machine tools, etc. Experience has shown that friction clutches of the magnetic type possess advantages which cannot be embodied in other types. The accompanying illustrations show a self-demagnetizing electromagnetic friction clutch, which has recently been placed on the market by the Pick Electric Co., Yonkers, N. Y.

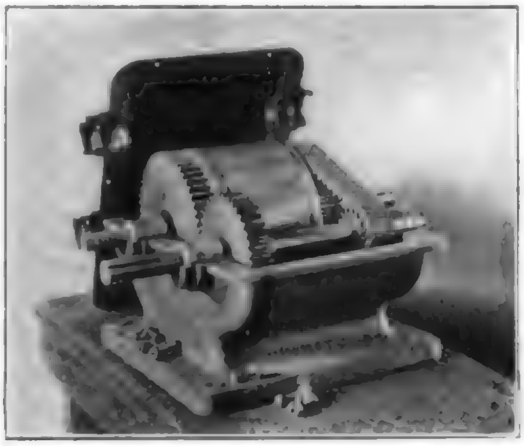


FIG. 1.—INTERIOR VIEW OF ELECTROMAGNETIC CLUTCH.

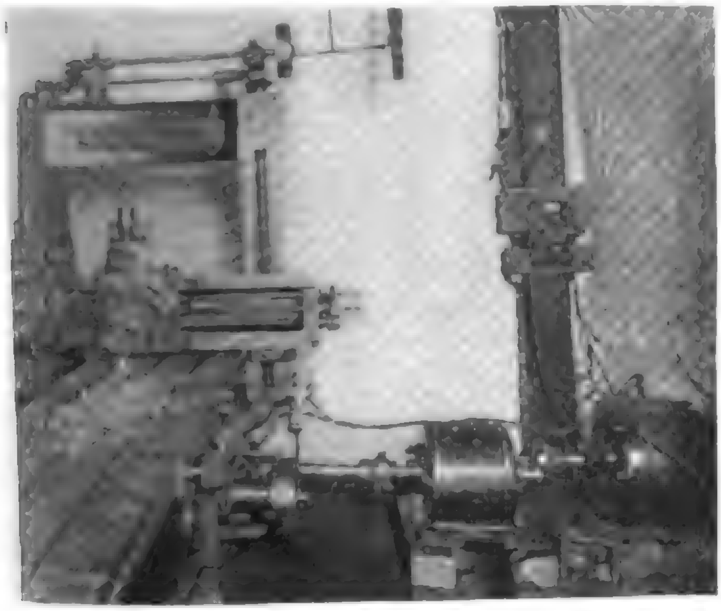


FIG. 2.—ELECTROMAGNETIC CLUTCH DRIVING PLANER.

The mechanical arrangement of the clutch is indicated in Fig. 1. There are two shafts, designated as the driving and the driven, respectively. On the driven shaft is directly keyed an electromagnet having two coils, one at either end, each of which is provided with a separate magnetic circuit. The magnetic circuit for one coil is completed through an armature which runs free on the driven shaft, but is directly geared to the driving shaft, and which runs constantly in one direction. The armature at the other end of the driven shaft is connected by silent chain to the driving shaft, and it runs constantly in the opposite direction. The driven shaft will run in one or the other direction, according to which coil of the electromagnet receives current.

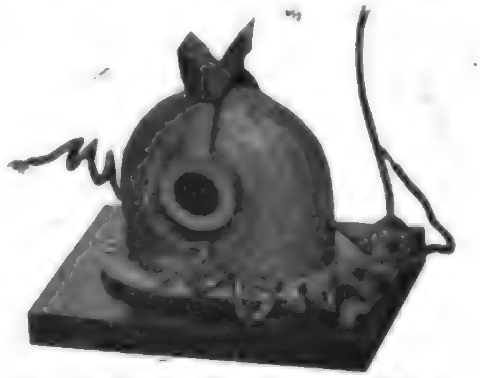


FIG. 3.—"LILIPUT" CLUTCH CONTROLLER.

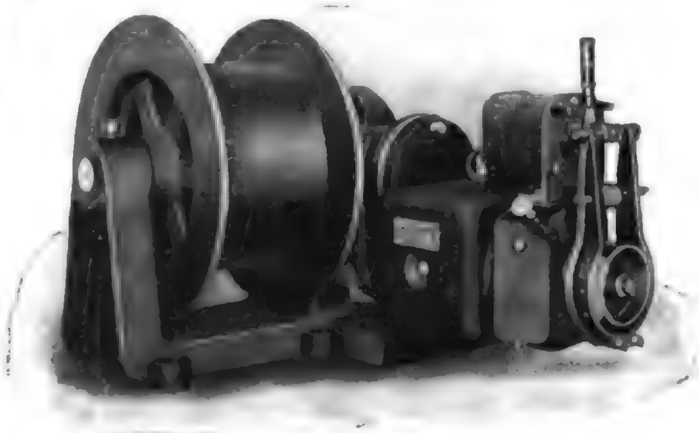
The clutch releases at once as soon as the current is interrupted, which is a leading feature of this type of clutches. The whole clutch mechanism is enclosed, and the moving parts are surrounded by oil.

Fig. 2 shows a Pick electromagnetic clutch, used to transmit power from an "Interpole" motor to a "Cincinnati" planer. In connection with this equipment there is used a "Liliput" clutch controller (shown in Fig. 3), which is operated by the moving table of the planer, and causes the current to flow through one or the other coils of the electromagnet, according to the desired direction of the motion of the planer.

◆

Winding Drum Hoists.

The Sprague Electric Company, New York, manufacture several styles of electric winding drum hoists, and one of the most recent types is shown in the accompanying illustration. Hoists of this style require to be fastened securely to a foundation when in use, but they can be mounted upon a movable platform, truck or car, and thus be made portable between hoisting operations. They are used on boom derricks for raising both the load and the boom, as whip hoists, to raise loads rapidly through a hatchway, or in the open, and on docks, on board ships or in buildings. They can be used out of doors without protection from the weather, as they are entirely enclosed and are dust and moisture-proof. The controller, shown on the hoist motor, can be located in any desired position regardless of the location of the hoist, thus affording the utmost convenience in operation. Standard winding drum hoists are rated for single rope with maximum pull of ½, 1½ and 2½ tons.



WINDING DRUM HOIST.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Spring jobbing was very active, exceeding last year's business at all markets. Some slight irregularities are noted in trade reports, but they are seasonable and are to be expected at his time of the year. A good indication of business conditions is the fact that mercantile collections are generally prompt. A little conservatism regarding forward business in some industries may be attributed to high prices, although the greatest strength appears in building materials, and preparations for structural work are beyond precedent. The few minor strikes do not seriously interfere with progress, and thus far the only noticeable effect of the coal controversy is the unusually large demand for this season of the year in all fuel markets and the disposition of small merchants in the immediate vicinity of the anthracite mines to allow stocks to become depleted. There is little idle machinery in any of the leading manufacturing industries, and contracts for distant delivery come forward freely, except at the textile mills, where purchases are chiefly for immediate requirements. Winter wheat crop reports are excellent; prices, except of some country produce, wheat and flour among breadstuffs and bleached cotton goods, show notable strength. Production of iron is enormous, probably more than was anticipated, but shipments are heavy and stocks are light Bar iron is still weak, while old material in general continues to decline. Demand for structural material is good, specifications are plentiful, and some large orders are in sight. Sales of steel rails are rather heavy, considering the recent activity in that department of the industry, orders from trolley lines being a feature. Bituminous coal is in better demand, especially in the West, and railroads in the producing districts of Indiana and Illinois are carrying large quantities. The undertone of the market for copper is firmer, but the buying movement is not especially heavy. Chinese holders of American copper are reported to have made sales to Europe at a concession in price. Prices are firm, with a disposition on the part of several producers to advance prices ¼c. a pound. Latest quotations for lake and electrolytic for future delivery are 18½c.; prime casting grades, 18¼c Business at copper and brass working plants in New England and the Middle States is active, the electrical trades being far in the lead in demands for high-grade copper. Machinery and machine tools are in good demand, and plants are well engaged ahead. *Bradstreet's* reports 177 business failures during the week ending March 8, as compared with 180 in the previous week and 190 in the corresponding week last year.

OFFICE FOR STONE & WEBSTER IN TACOMA.—Stone & Webster, of Boston, whose property and management interests in the far West include the Seattle Electric Company, the Puget Sound Electric Company, the Tacoma Railway & Power Company, the Puget Sound Power Company and the Whatcom County Railway & Lighting Company, all in Washington, have opened a suite of offices in the Pioneer Building, First Avenue and James Street, Tacoma, which will be in charge of Jacob Firth as resident manager. Mr. Firth now is president of the Seattle Electric Company and of the allied corporations and is also president of the Puget Sound National Bank. Mr. H. F. Grant, general manager of the Seattle Company, will have offices with Mr. Firth and will be considerably relieved of the details of the management of that property through the appointment of J. B Lukes to the position of general superintendent of the company. Heretofore Mr. Lukes has been superintendent of lighting and power of the company

ALLIS-CHALMERS ENGINES.—The North American Manufacturing Company, of East Liverpool, Ohio, is a recent purchaser of two Reynolds girder engines, 18 in by 42 in., built by the Allis-Chalmers Company, Milwaukee The Fonda Glove Lining Company, of Fonda, N. Y., recently purchased an 18-in. by 36-in. Reynolds girder engine. The Astoria Light, Heat & Power Company, of Lawrence Point, L. I., has recently purchased a Reynolds heavy-duty, cross-compound engine, 16 in. and 32 in. by 36 in. and a 32-in. by 12-in. Reynolds independent air pump and jet condenser. The George A. Fuller Company, contractor of the building of the New Plaza Hotel, New York City, has recently let contracts for the engines to be installed in the building power plant. Four Allis-Chalmers heavy duty, cross-compound Corliss engines will be installed, two 18-in. by 42-in. and the others 22 in. by 42 in. and 25 in. by 47 in., respectively.

GAS ENGINE ORDERS.—The Allis-Chalmers Company, of Milwaukee, has been placing before the purchasing public, for some months past, its gas engines of the Nurnberg type, in capacities ranging from 300 to 5,000 hp and for all power purposes. An 1,800 brake hp Allis-Chalmers unit was recently ordered for the Crystal City, Mo., plant of the Pittsburg Plate Glass Company It is of the well-known four-cycle, double-acting type, direct-coupled to a 1,000-kw Allis-Chalmers generator. The Illinois Steel Company, Chicago, at present using a large number of Allis-Chalmers steam units of various kinds, has very recently ordered two large gas engine generating units, twin tandem type, 1,000 kw each. These machines will be installed in the company's present power plant for lighting and power purposes.

AT THE STANLEY WORKS.—The extensive additions under way at the Stanley Works, Pittsfield, Mass., have necessitated a large increase in the power required by the company. A large cross-compound condensing engine was recently installed and the company is now erecting a thoroughly equipped boiler plant. The building will be of standard brick and steel construction throughout and is planned to provide for the installation of additional units as required. There will be four Babcock & Wilcox boilers of 340 hp each at 130 lb. pressure. They will be supplied with superheaters, Roney mechanical stokers and Green fuel economizers. The design and installation of the plant is in charge of the Westinghouse, Church, Kerr & Co.

ENLARGING POWER HOUSE.—Plans have been filed with Buildings Superintendent Murphy for the enlargement of the power station and carhouse of the New York City Street Railway Company in the block in Amsterdam Avenue, from One Hundred and Twenty-eighth Street to One Hundred and Twenty-ninth Street, which was the first street car cable power house erected in the city, and originally belonged to the old Third Avenue Railroad Company. Two stories are to be added to the building, making it a three-story and basement building, and the interior will be remodeled. The improvements are to cost $150,000, according to the estimate of A. V. Porter, the architect.

WELDING BY ELECTRICITY.—The New England Enameling Company, of Middletown, Conn., is installing new machines for welding the handles of the enamel ware into place. These will be operated by electricity supplied from the plant of the Middletown Electric Light Company. Heretofore the handles have been riveted on by hand, the process being a very slow one. It is expected that the new machines will do the work of forty hands

ROTARIES FOR LONG ISLAND.—The Pennsylvania Railroad Company has closed a contract with the Westinghouse Electric Manufacturing Company for four rotary converters aggregating 5,000 kw capacity for use in its Long Island electric railway development work. The contract amounts to about $100,000. The machines will be duplicates of eighteen machines purchased by the Pennsylvania two years ago.

WALKER FOUNDRY COMPANY.—It is announced that the Walker Foundry Company, incorporated in New Jersey with a capital stock of $100,000, divided into 1,000 shares, will manufacture electric motors, dynamos and other electrical machinery. The incorporators are Joseph Diehl Fackenthal, John J. Daly and Albert C. Wall, all of 1 Exchange Place, Jersey City, the registered office of the concern.

WESTERN ELECTRIC FACTORIES.—The big Western Electric factories at Hawthorne, a suburb of Chicago, are to be extended this year at a cost of $1,000,000, the chief increase being in the switchboard department; but the cable plant is also to be enlarged. There will also be a lumber yard for the hardwoods that enter into switchboard construction with a capacity of four million feet.

THE NATIONAL ELECTRIC COMPANY, of Milwaukee, Wis., reports having closed a contract with the Edison Illuminating Company, of Detroit, Mich., for four 500 kw motor-generator sets, to be used for railway service

SHAFTING.—Shafting manufacturers are to meet in Pittsburg March 26 to discuss prices and probably to advance them.

MASSENA POWER CO. SOLD.—It is announced that the Pittsburg Reduction Company, which is controlled by the Melons and other capitalists of Pittsburg, has taken over the St. Lawrence River Power Co., which owns the large water power plant at Massena, New York. The Reduction Company is the principal customer of the St. Lawrence River Power Company, which also serves five or six other industrial establishments in the same neighborhood. The Power Company has outstanding, in addition to $500,000 5 per cent. bonds, $3,500,000 of preferred stock and $3,000,000 of common stock. The company is taken over by the Pittsburg Reduction Company on the basis of an issue of $4,000,000 4 per cent. Pittsburg Reduction Company bonds in exchange for all the capital stock of the Power Company. The Reduction Company, moreover, guarantees the principal and interest of the $500,000 St. Lawrence River Power Company bonds.

NEW YORK, WESTCHESTER & BOSTON RAILWAY.—Bids will be received until March 24 by T. D. Rhodes, president of the City & County Contract Company, 30 Broad Street, New York City, for the power plant to be constructed in connection with the construction of the New York, Westchester & Boston Railway. The bids are for the construction and starting in actual operation of the following component parts of said plant: Three steam turbo-alternators with their dependent auxiliaries; twenty-four water-tube boilers with superheaters and their parts; three open exhaust feed-water heaters; six horizontal outside packed plunger boiler feed pumps; three surface condensers; twenty-four mechanical stokers; one 60-ton electric traveling crane. Information, plans, etc., may be had by applying to William A. Pratt, chief engineer, New York, Westchester & Boston Railway Company, 30 Broad Street.

AUTOMATIC REFRIGERATION.—We understand that the Automatic Refrigerating Company, of 22 Thames Street, New York, which company, it will be remembered, represents the merged interests of the Automatic Refrigerating Company, of Cleveland, Ohio; the Singer Automatic Ice Machine Company, of Bridgeport, Conn., and the Marshall Ice & Refrigerating Machine Company, of Boston, Mass., is about to remove their office, shop and refrigerating show plant to Hartford, Conn., where provision has been made for greatly increased manufacturing facilities. The Hartford address of the Automatic Refrigerating Company is to be 630 Capitol Avenue.

THE STROMBERG-CARLSON TELEPHONE MFG. CO., Rochester, N. Y. reports having closed contracts for switchboards in the following places: Holton, Kan.; Tonopah, Nev.; Nashville, Tenn.; Elkhart, Ill.; Grand Ridge, Ill.; Bryson City, N. C.; Brantford, Ont.; New York City, N. Y.; Sunset, La.; Mt. Upton, N. Y.; Carthage, Ill.; Central Square, N. Y.; Marcus, Ia.; Franklin, N. C.; Auburn, N. W.; Ladd, Ill.; Diagonal, Ia.; Lytton, Ia.; Woodstock, Ill.; Rochester, N. Y.; Seattle, Wash.; Fontana, Kan.; Clarksville, Tenn.; New Cambria, Mo.; Cambria, Mo.; Rupert, Idaho; Elkville, Ill.; Chio, Ill.

WIRING AT OGDEN, UTAH.—Mr. J. K. Taylor, supervising architect of the United States Treasury Department, notifies us that the time of opening proposals for conduit and electric wiring in the Post Office and Court House at Ogden, Utah, has been extended from March 14 to March 27.

SALE OF NATIONAL ELECTRIC PLANT.—A formal order has been entered directing the sale of the plant, real estate, patent rights and good will of the National Electric Company, of Milwaukee, at 10 a. m. March 26 in the referee's court.

Financial Intelligence.

THE WEEK IN WALL STREET.—Stock prices were weak the first two days, but later on a moderate bullish tone developed with general recoveries throughout the list. There was an easier feeling as to money conditions, based on the action of the Treasury Department in coming to the relief of the market. The news from abroad indicating a more favorable termination than had been anticipated in the Morocco conference was construed as opening the way for a revival of foreign interest in the American market. The most marked concessions early in the week were in the high-priced stocks and the issues which had been under pool manipulation. In the undecided market which ensued after the decline had been checked there was little in the way of features. The steel stocks developed a fair degree of strength on the renewed stories regarding the ore land negotiations between the United States Steel Corporation and Great Northern. The copper stocks were moderately active. At the close of the week the general market was strong and buoyant in spots. Electric and traction securities were strong and firm on moderate sales. Allis-Chalmers closed at 22 for common, a net gain of 1⅝, and at 59 for preferred, a gain of 3 points. General Electric closed at the highest figure—170¼—which represents a net gain of 2½ points, and Westinghouse advanced 1 point, closing at 160½. Among the tractions, Brooklyn Rapid Transit advanced to 83⅝ from 78⅝, but lost some of the gain and closed at 82⅜, which is a net gain of 2¼ points. Metropolitan Street Railway closed at the highest figure of the week—116—and Interborough Rapid Transit (on the curb) at 229½, the latter being an advance of 1 point. Interborough-Metropolitan was quoted at 52⅝ at the close of the curb market. Little business was done in the telegraph and telephone issues, Western Union closing at 93¼ and American Telephone & Telegraph at 138. American Telegraph & Cable closed at 93, and Mackay Companies at 60. The curb market was dull during most of the week with general declines during the first day or two, followed by a slow recovery later on. There was not much public demand for stocks. Following are the closing quotations of March 13:

NEW YORK

	Mar. 6	Mar. 13		Mar. 6	Mar. 13
Allis-Chalmers Co.	20⅝	22¼	General Electric	167	169½
Allis-Chalmers Co. pfd.	56	59¾	Hudson River Tel.	...	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	228½	229
American Locomotive	67¼	70⅝	Mackay Cos.	60	59¾
American Locomotive pfd.	115½	118½	Mackay Cos pfd.	73¾	74¾
American Tel. & Cable	93	92	Marconi Tel.	...	...
American Tel. & Tel.	137¾	138	Metropolitan St. Ry	115	116
Brooklyn Rapid Transit	79⅝	84¼	N. Y. & N. J. Tel.	...	...
Electric Boat	27	27	Western Union Tel	93⅝	94¼
Electric Boat pfd	65	66	Westinghouse com.	159	161
Electric Vehicle	17	17	Westinghouse pfd	...	..
Electric Vehicle pfd.	16	18			

BOSTON

	Mar. 6	Mar. 13		Mar. 6	Mar. 13
American Tel. & Tel.	138¼	139	Mass. Elec. Ry. pfd.	67	69¾
Cumberland Telephone	118½	..	Mexican Telephone	4½	...
Edison Elec. Illum.	246½	247	New England Telephone	138½	...
General Electric	167¾	...	Western Tel. & Tel.	..	..
Mass. Elec. Ry.	18½	20	Western Tel. & Tel pfd.	90	..

PHILADELPHIA

	Mar. 6	Mar. 13		Mar. 6	Mar. 13
American Railways	51	51¼	Phila. Electric	7⅜	...
Elec. Co. of America	11⅝	11¾	Phila. Rapid Trans.	30¾	30¾
Elec. Storage Battery	78	79	Phila. Traction	..	..
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Mar. 6	Mar. 13		Mar. 6	Mar. 13
Chicago City Ry.	193½	170	National Carbon	92	90
Chicago Edison	160	...	National Carbon pfd	120	120
Chicago Subway	..	60	Union Traction	...	...
Chicago Tel. Co.	130	.	Union Traction pfd.	...	...
Metropolitan Elev. com.	28	28¼			

* Asked.

DIVIDENDS.—General Electric directors have declared the regular $2 quarterly dividend payable April 16. The quarterly dividend of 1½ per cent on the preferred stock of J. G. White & Co. has been declared, payable April 2. The regular 1¼ per cent quarterly dividend on the capital stock of the United Traction & Electric Company of New Jersey is payable April 2. The regular quarterly dividend of the Cumberland Telegraph & Telephone Company of 1¾ per cent is payable April 2 to stockholders. The Havana Electric Railway Company has declared an initial dividend upon its $5,000,000 non-cumulative preferred 6 per cent stock, payable April 3. Directors of the Interborough Rapid Transit Company have declared the regular quarterly dividend of 2 per cent., payable April 2 to holders of the voting trust certificates of record. Directors of the Mackay Companies have declared the regular quarterly dividend of 1 per cent on the preferred stock, payable April 2 to stockholders of record March 17. The Massachusetts Lighting Company has declared a regular quarterly dividend of 1¼ per cent, payable April 15. Directors of the Otis Elevator Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock and the annual dividend of 2 per cent on the common stock. The dividends on both common and preferred are payable April 16. Directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable April 2. The Western Union Executive Committee has recommended the regular quarterly dividend of 1¼ per cent.

CAR CONSOLIDATION ABANDONED.—The project of merging the principal street car manufacturing companies in a $56,000,000 combination has been abandoned, according to an official statement made by Kean, Van Cortland & Co., of New York, one of the banking firms which was to have financed the consolidation. The chief difficulty is understood to have been the price asked by at least one of the companies in the proposed consolidation for its property. G. Martin Brill, of the J. G. Brill Co., was to have been the president of the consolidated organization.

GENERAL NEWS.

Construction News.

NORTH BIRMINGHAM, ALA.—The citizens have voted to issue $10,000 bonds for an electric light plant.

BIRMINGHAM, ALA.—A building permit has been issued to the Birmingham Railway, Light & Power Company to erect an addition to its power plant, to cost about $50,000.

PHOENIX, ARIZ.—Joseph Cox, chief electrician for the Arizona Copper Company, at Clifton, Ariz., is interested with a syndicate of capitalists in a project to utilize the waters of Black River to generate electric power for the big mining camps of Morenci and Clifton. A dam will be built across Black River, 52 miles from Clifton, and that point will be made the site for the power plant. The surveys have been completed and construction work will soon be started.

MARYSVILLE, CAL.—The franchise to construct and operate an electric railway over Eighth Street will be granted to the California Midland Railway Company by the City Council.

STOCKTON, CAL.—Newton Rutherford, city clerk, writes that the Central California Traction Company has secured a franchise for an electric railway, bids being opened February 19.

STOCKTON, CAL.—R. C. Tumelty, city engineer, writes that Prof. Cory, of Berkeley, will prepare estimates for the proposed electric light plant. The election to issue bonds for this improvement will be held later on.

WALNUT CREEK, CAL.—The officials of the Key Route System have promised to extend a branch line twelve miles in length over the hills to the proposed site of the State Farm, providing the Farm Commission will accept the site offered.

SACRAMENTO, CAL.—The Supervisors have agreed to grant a franchise to the California Traction Company for an electric railway on M Street between this city and Perkins Station, five miles from the eastern boundary of the station.

ALAMEDA, CAL.—The city trustees have decided to grant a franchise for an electric railway system, with ferry connections, provided the ordinance as introduced be first amended. W. J. Morgan and F. M. Greenwood are the parties named in the grant.

SAN FRANCISCO, CAL.—The Board of Supervisors has passed an ordinance providing for the sale on April 23 of a franchise for a telephone system to the highest bidder on the petition of the Home Telephone Company, which desires to bid for the privilege.

SAN FRANCISCO, CAL.—The Ocean Shore Railway Company, which is building a double-track electric railway from San Francisco to Santa Cruz, a distance of 81 miles, of which 10 miles is completed, is reported to have bought the Union Traction Company, of Santa Cruz, an 18-mile narrow-gauge city and suburban line.

SAN FRANCISCO, CAL.—The Board of Supervisors has formally re-adopted and re-approved the plans submitted by the city engineer for the reconstruction of the Geary Street, Park & Ocean Railroad as a city system, and upon which bids for the doing of the work are to be advertised for. Such bids, in accordance with the terms of the new resolution, are to be opened on the afternoon of Monday, April 9.

YREKA, CAL.—J. E. Turner, one of Yreka's City Trustees, has located large water rights on the Klamath River, near Keno, Ore. At the same time he located 100,000 miner's inches from the same river just over the boundary line in California. This water power will be used principally for electric power. This same water will also be diverted into a canal about 60 feet wide at top, 40 feet wide at bottom and 8 feet deep, and used for irrigation purposes.

SENECA, CAL.—Representatives of the Stanislaus Electric Power Company assumed control of the Tuolumne water system recently and are now directing its affairs. Extensive improvements will be made in the plant. The plans of the Stanislaus Electric Power Company contemplate the expenditure of $1,000,000 a year for the next two or three years, for labor alone, on its dams, flumes, ditches, etc., and a large part of this amount will be spent in Tuolumne County.

SAN FRANCISCO, CAL.—The Board of Supervisors' committee on public utilities has formally recommended the granting of the Home Telephone Company's petition for the passage of an ordinance putting up for public bidding a franchise for the establishing of a competing telephone company in San Francisco. The report of the committee was adopted by the board. The installing of the new system is to be finished within three years after it is begun, the company to have expended $4,000,000 by that time.

VISALIA, CAL.—The foundations of the building for the new steam plant to be constructed by the Mt. Whitney Power Company, just east of the city limits, are being laid and work on the building itself will be begun very shortly. The plant will have a generating capacity of 2000 hp, sufficient to produce all of the power necessary in case a break-down should occur at either of the water power plants or on any of the lines. The steam plant will be ready for operation by July. During the summer months when the water is low the plant will be used as an auxiliary.

RIVERSIDE, CAL.—The plant of the Riverside Power Company has been purchased by the Pacific Light & Power Company. It is understood that the power will be transmitted to San Bernardino and used there for lighting the city. The city was offered the plant at an annual rental of $6400, with the privilege of purchase at any time. The amount paid for power from the plant by the city amounted to $11,000. In addition, the city was offered 2000 acres of river bottom land and riparian rights appurtenant. While the city authorities were considering the question, the above deal was closed. It is understood that this land and these rights go to the Anaheim Union Water Company.

COLORADO SPRINGS, COL.—A resolution looking to the building by the city of its own gas and electric plant was introduced at a recent meeting of the Board of Aldermen, and has been taken under advisement.

BANTAM, CONN.—The Electric Light & Power Company has notified its customers that either meters must be installed or the cost of light hereafter will be 50 cents per month per lamp.

STAFFORD SPRINGS, CONN.—The Rockville Gas & Electric Company is constructing an electric light line from Rockville to Stafford Springs. When the line is finished a day and night electric light and power service will be established for both Rockville and Stafford Springs.

DOVER, DEL.—The Smyrna, Kent County & Delaware Bay Traction Company, in connection with its line from Smyrna, Del., to Woodland Beach and thence to Milford, Del., a distance of 35 miles, has decided to extend the line from Milford to Rehoboth.

WASHINGTON, D. C.—The actual work of construction has been begun on the Anacostia, Surrattsville & Brandywine Electric Railway in the District of Columbia. The road is planned to connect Anacostia, D. C., via Surrattsville, with Brandywine, Md., a distance of about 16½ miles.

ATLANTA, GA.—The Fairview Telephone Company, owning and operating telephone lines in Hamilton and Tipton Counties, has purchased the rights and property of the Atlanta Telephone Company in those places.

WASHINGTON, GA.—Engineers under direction of the Anthony Shoals Milling Company have completed the survey of Anthony Shoals in the northern part of Wilkes County, for the purpose of developing this property for electrical purposes, as proposed by J. H. and T. M. Fitzpatrick, of Washington.

STERLING, ILL.—The Green River Telephone Company is contemplating enlarging its territory and improving the service.

MORRIS, ILL.—The Gas & Electric Development Company, of Philadelphia and New York, reports the sale of the plant at Morris to Mr. Burdette L. Bowne.

DECATUR, ILL.—The McKinley syndicate has announced that interurban lines will be built this year as follows: Clinton to Bloomington. Springfield to Jacksonville, Springfield to Lincoln. The line from Decatur to Champaign depends on franchises now pending for entrance to the two cities mentioned.

CHICAGO, ILL.—The ordinance before the City Council to permit the Chicago, Milwaukee & St. Paul railroad to equip the Evanston branch from Wilson Avenue to the city limits for electrical operation is indorsed by the North Shore Improvement Associations, representing the residents of the suburbs through which the road passes.

OAKLAND CITY, IND.—A telephone franchise has been granted to Charles F. Stevens for 25 years.

COVINGTON, IND.—The Council has granted a franchise to the Fountain Warren Traction Company to construct its lines on Liberty and Second Streets.

LINTON, IND.—The City Council is considering the advisability of selling the Linton municipal lighting plant. The Linton Gas Company, of Lafayette, Ind., is said to be a bidder for the plant, and if the deal is consummated the plant will be enlarged and new machinery installed.

INDIANAPOLIS, IND.—Advocates of a new electric belt railway to encircle Indianapolis at a radius of 14 miles, held a meeting in this city March 10 and effected an organization, with B. V. Hubbard president, and T. J. Wright secretary. The proposed line will pass through 15 towns and will connect with 18 steam and electric railroads.

WABASH, IND.—Parties are here making arrangements for the building of an electric railway from this city to Warsaw by way of Urbana and North Manchester. The Fort Wayne & Wabash Valley Traction Company will furnish power for the line. It is understood that the Indiana Union Traction Company is back of the enterprise which will become a part of that great system.

INDIANAPOLIS, IND.—Charles N. Thompson, of this city, is president, and E. M. Coles, of New York, secretary of the newly organized and incorporated company capitalized at $3,000,000 to build a railroad between this city and Toledo, Ohio. President Thompson announces that arrangement has been made with the W. B. Strang Construction Company, of New York, to build the road. Steam will be used for moving freight and gasoline electric cars for passenger service.

SHENANDOAH, IA.—The Artificial Ice, Power, Heat & Light Company is contemplating the rebuilding of its electric light plant, at a cost of $25,000.

WINTERSET, IA.—At the special election held in this city February 27 the proposition to grant an exclusive franchise to the Des Moines-Winterset-Creston Railway Company, the franchise was defeated. The company will not ask another franchise, but will make use of another route which has already been surveyed, running southeast of the city and just outside the city limits.

DES MOINES, IA.—The question of granting a franchise to the Des Moines North & South Interurban Railway Company to construct interurban railways in the city of Des Moines will be submitted to the voters of the city at the regular election on March 26. It is proposed to construct, besides the street railway in the city, an interurban railway from Des Moines to Carlisle and Oskaloosa.

AMES, IA.—The purchase of the property and franchises of the Ames & College Railroad has recently been consummated by the Newton & Northwestern Railroad Company, which is building an extension from a point on its main line to Fort Dodge and another from Kelley to Des Moines, with a view to establishing electric interurban service between Fort Dodge and Des Moines. The conclusion of this deal indicates that the company intends to construct another extension from Kelley to Ames. It is also stated that this extension will later be run east to Nevada, Ia.

OBERLIN, KAN.—The citizens have voted to issue $10,000 bonds for an electric light plant.

HIGHLAND, KAN.—The Electric Company has secured a franchise for an electric light plant.

COVINGTON, KY.—The Council has adopted a resolution providing for the appointment of an engineer, to prepare plans and specifications for an electric light plant.

NORTH VASSALBORO, ME.—Agents of the Waterville & Fairfield Electric Light Company are canvassing the village for subscribers to the incandescent lights, with the intention of connecting the village by wire from Winslow should the number of lights subscribed warrant it.

SANFORD, ME.—At a meeting of the stockholders of the Atlantic Shore Line Railway was held March 2, the proposition for acquiring the property of the Portsmouth, Dover & York Street Railway Company was voted upon favorably. The capitalization of the Atlantic Shore Line will be changed and a new bond issue made, of which latter $1,900,000 will be issued at once to assist in acquiring the new property, to make immediate improvements, acquire rights of way and to begin work on a proposed new line. This new line comprises an 18-mile connecting link between Kennebunkport and York Beach and will make a continuous system of 97 miles of track, permitting direct connection between Lewiston, Me., and Boston.

WORCESTER, MASS.—It is possible that another electric light plant will be established here.

ATTLEBORO, MASS.—An appropriation of $12,000 has been voted by the Town Board for improvements in the street lighting system.

BOSTON, MASS.—The Edison Electric Illuminating Company, Boston, will start at once on a 2-story addition of brick, to cost $75,000.

FAIRHAVEN, MASS.—The lighting system in Fairhaven will be changed during the year to 3-phase, 60-cycle and a power service instituted.

WORCESTER, MASS.—A charter has been granted to the Worcester & Northern Street Railway Company, authorizing the construction of the road.

WORCESTER, MASS.—The Marlboro & Westboro Street Railway, which has been recently acquired by the Worcester Consolidated management, is to be thoroughly repaired.

TURNER'S FALLS, MASS.—It is understood that the Turner's Falls Company will build a steam plant this spring to provide for the increased demand for power during seasons of low water.

WESTMINSTER, MASS.—Municipal street lighting was decided on at the town meeting, when an appropriation was made for poles, wiring, lamps, etc. The power will be purchased from the street railway company.

TEMPLETON, MASS.—It is probable that Templeton will go into the business of municipal lighting as soon as the necessary steps can be taken to bring this about, although electrical power will be secured from the Gardner Electric Light Company instead of building a power house in Templeton.

SPRINGFIELD, MASS.—The contract for putting several miles of its electric light cables underground has been awarded by the United Electric Light Company to Fred T. Ley & Co. The amount contracted for is between two and three miles, and is located in almost every part of the city.

MARLBORO, MASS.—In about two weeks the Marlborough Electric Company will be prepared to furnish electric power to all parts of the City and Southboro. To insure continuous service the steam equipment at the station is being thoroughly overhauled and changes will be fully completed within a few days.

MANSFIELD, MASS.—The demand for more electricity for power and light has been so great that it became necessary to enlarge the city plant. The citizens at the recent election voted to expend $30,000 for the purpose. This money will be used in the purchase of another engine and in building an extension to the house.

FITCHBURG, MASS.—The directors of the Fitchburg Gas & Electric Light Company have voted to double the capacity of the electric power plant. When the new station was built provision was made for this extension. It will increase the output from 1000 kw to 2000 kw and will require the installation of another generating unit.

PEABODY, MASS.—At the last meeting of the Board of Trade, the sentiment expressed was strongly in favor of making such enlargements of the existing electric lighting plant as are necessary, and continuing the manufacture of electricity, rather than buying it from a foreign company. A report from Commissioner Wilson recommended an appropriation of $27,000 for overhauling the plant and putting in new machinery sufficient to meet the demands of the business.

ORANGE, MASS.—At a recent meeting of the directors of the Orange Electric Light Company it was decided to install two new generators and furnish a day service for power and lights; a new steam plant will also be put in at Wendell. The company has secured the loan of an arc light dynamo which will be put in at once to supply the street lamps until the new dynamos are installed when the inclosed arcs will be put in. It will be about four months before the improvements are completed.

SPRINGFIELD, MASS.—Officials of the Boston & Maine Railroad, the Hoosac Valley Street Railway Company, merchants of North Adams and men who recently purchased a large tract of lumber land in southern Vermont, have been in consultation in North Adams concerning the construction of an electric railway from the end of the Briggsville line of the Hoosac Valley Company to Hartwellville, Vt., a distance of about 10 miles. The main purpose of this line will be to furnish a means for rapid and cheap shipping of the immense amount of lumber which it is proposed to cut and ship to the market.

BOYNE CITY, MICH.—The Council is considering the proposition of W. J. Pearson to furnish the city with electric light.

PENTWATER, MICH.—It is reported that E. L. Brooke, of Hesperia, is interested in the construction of an electric railway from Grand Rapids to Pentwater.

SHEPHERD, MICH.—C. C. Field, of Shepherd, has decided to construct dams, power houses, etc., on Chippewa River, and will furnish light and power in Isabella, Gratiot, Midland and Clare Counties.

BERRIEN SPRINGS, MICH.—The Berrien Springs Water Power Company, of which F. A. Bryan is general manager, South Bend, Ind., proposes constructing a dam and power plant on St. Joseph River, to develop about 8,000 horse-power.

DETROIT, MICH.—Press reports state that the railroads of Detroit are planning to introduce the third-rail electric railway system for use in making short passenger and freight hauls in competition with the Detroit United Railway Company's lines. It is also planned to give the city a crosstown line from Milwaukee Junction to West Detroit.

TRAVERSE CITY, MICH.—Petitions for the construction of two dams on the Boardman River have been granted by the Supervisors of Grand Traverse County to the Queen City Light & Power Company. The company's petition for the privilege of setting lighting poles and stringing wires along the highway of the Traverse City and Houghton Road was also granted.

RIPPLE, MINN.—Chas. Swedback has been granted a franchise for a local telephone exchange.

FERGUS FALLS, MINN.—G. H. Gard, City Secretary, writes that there is some talk of constructing a concrete dam at the municipal electric light plant.

BIWABIK, MINN.—A movement is in progress on the range to establish an independent telephone line between range points and Duluth. Local men are interested in the enterprise.

CROOKSTON, MINN.—N. A. Hoffard, County Auditor, writes that the contract for a lighting plant for the county jail, including storage battery, has been awarded to Fairbanks, Morse & Co., of Chicago, Ill., for $3,240.

ST. LOUIS, MO.—The United Railways Company is preparing to build a new line on the Fee Fee road to connect the St. Louis, St. Charles & Western with its Creve Coeur divisions in St. Louis County.

HELENA, MONT.—The Helena Power Transmission Company has filed title to several tracts of land which will be flooded by its new dam. The transactions involve a total amount of $35,760.

BUTTE, MONT.—A petition to the Mayor and the City Council for a franchise for a new telephone and telegraph service has been filed in the office of the city clerk by Frank H. Stow, of the Home Telephone & Telegraph Company, of Portland, Ore.

LINCOLN, NEB.—The question of municipal ownership of the street railway system of Lincoln will be submitted to a vote of the people.

GIBBON, NEB.—J. H. Davis & Son will construct an electric light and power plant. They will probably do their own construction work.

RENO, NEV.—The Council has authorized N. E. Wilson, Mayor, to appoint a committee, of which he will be chairman, to investigate and report on the question of establishing a municipal electric light plant.

WADSWORTH, NEV.—The sale of the plant and the power rights of the Wadsworth Light & Power Company to the Green Hill Mining Company, which recently took over the big properties of E. Olinghouse in Olinghouse Canyon, has been consummated. N. E. Hummel, one of the attorneys who negotiated the sale, states that the Green Hill Company will at once proceed with the construction of the branch railway running from Wadsworth, where its mill is to be located, to Olinghouse.

MOUNT HOLLY, N. J. The Burlington County Railway Company, which operates between Moorestown and Burlington, passing through Mount Holly, has applied for a franchise to extend the line toward Smithville.

ORANGE, N. J.—Only one bid was received and opened on March 5th for street lighting, that having been submitted by the United Electric Company. The bid was for $83 per light on a 5-year contract and $90 for 3 years.

SERGEANTSVILLE, N. J.—Surveys are now being made for the proposed railway between Lambertville and Flemington, which it is expected will be built. The road ultimately will be operated by electricity, but there is some question as to the motive power to be used at first.

TRENTON, N. J.—General Manager Hurley, of the Trenton Street Railway, says that the Trenton Junction extension (Trenton, Hamilton & Ewing Traction) will be constructed at once and completed by July 1 at the latest. The Mercerville and Hamilton Square extension will also be constructed at an early date.

ALBUQUERQUE, N. M. Improvements are under way and contemplated by the Colorado Telephone Company in its local system, which will represent an outlay of about $100,000.

BURTONSVILLE, N. Y. The Hudson River Electric Power Company of Glens Falls is considering the constructing of a dam at Burtonsville.

AMSTERDAM, N. Y.—The Empire State Power Company, of which C. M. Knight, of Amsterdam, is superintendent, has completed plans for a sub-station to be erected on Church Street, this city.

GREENPORT, N. Y.—An application of the Fisher's Island Railroad Company for permission to construct and operate a street surface railroad has been made to Commissioner of Highways George H. Fleet of Southold.

LITTLE FALLS, N. Y.—The Common Council granted on March 6 a franchise to the Hudson River Electric Power Company of Glens Falls. The company will soon commence laying conduits in the business portion of the city.

TROY, N. Y.—The Forest Park Railway Company is considering the advisability of making an application to the city of Rensselaer for a franchise to operate a street railway in that city, but nothing will be done until the matter of the franchise from this city is settled.

RICHFIELD SPRINGS, N. Y. The interests behind the plan to build the proposed Ilion, Morris & Sidney electric railway estimate the cost of the line at $471,906 and the cost of the equipment about $159,000. The cost of the road from Morris to Sidney will be $321,230, making a total of the 56 miles fully equipped, $96[illegible],000. It is proposed to form a company with a capital of from $600,000 to $1,000,000.

BUFFALO, N. Y.—President Henry J. Pierce, of the International Railway Company, has confirmed the report that Joseph B. Mayor and William F. Sheehan have closed negotiations whereby the Traction, Gas & Electric Finance Company, recently incorporated at Albany, has secured possession of the electric light plants in Erie, Pa., and all the electric lines and franchises covering the territory between Erie, Pa., and Buffalo. The transaction involves upwards of $7,000,000.

GREENSBORO, N. C.—E. J. Justice has been granted a franchise to construct an electric railway from Greensboro to High Point.

LEXINGTON, N. C.—The city authorities are installing about $3000 worth of machinery in the municipal electric light plant, for the purpose of increasing its capacity.

ALBEMARLE, N. C.—The Albemarle Ice Company has been granted a franchise to operate electric and water plants and will establish such plants for the purpose of supplying light and water to the city.

REIDSVILLE, N. C.—A committee has been appointed to secure an engineer to estimate the cost of building an electric railway from this city to some point in Caswell County to connect with the Norfolk & Western Railroad.

GASTONIA, N. C.—The Spencer Mountain Power Company has been awarded the contract for supplying lighting current at the rate of $20 per hp-year for day use and $14 per hp-year for night use. It is estimated that about $3000 per annum will be saved by the city at these rates.

WINSTON-SALEM, N. C.—The Board of Aldermen has adopted a resolution providing for the purchase of the plant of the Winston-Salem Gas & Lighting Company, and if the same cannot be purchased at a reasonable figure, to establish a municipal gas or electric light plant.

COLUMBUS, OHIO. The House has passed the bill appropriating $25,000 to install an electric light and power plant in the State House.

SHELBY, OHIO.—The Shelby Telephone Company has increased its capital stock from $60,000 to $75,000, and will make improvements to its exchange.

ADA, OHIO. The Ada Telephone Company has increased its capital stock from $100,000 to $125,000. The increase is made for the purpose of providing for contemplated improvements to the system.

CLEVELAND, OHIO. Mr. C. F. F. Alkin, Williamson Building, this city, has been requested to prepare plans and specifications for the proposed municipal electric lighting plant for South Brooklyn, Cleveland.

CLEVELAND, OHIO.—The Cleveland, Painesville & Eastern Railway Company is negotiating for the sale of $500,000 5 per cent. bonds, the proceeds of which will provide for various improvements contemplated by the company.

TOLEDO, OHIO.—The Vulcan Iron Works are preparing to erect a new manufacturing plant consisting of eight large buildings. There will be a central power station for lighting and heating all the buildings and supplying power for the motors driving various machinery. A. Mills, a Toledo architect and engineer, is preparing the plans.

CLEVELAND, OHIO.—It is probable that the proposed Cleveland, Ashland & Mansfield Railway will be built this spring. It is being backed by the Cleveland & Southwestern interests and the engineering work is in charge of the Roberts & Abbott Company. The company will be a separate corporation with a capital stock of $1,000,000.

STEUBENVILLE, OHIO.—The Dillonvale & Ohio River Traction Company has secured a charter from the Secretary of State to construct an electric railway from Rayland to Dillonvale, a distance of 6½ miles. J. T. Hodgens is president; E. E. Erskine and T. J. Stringer, vice-presidents; W. B. Francis, secretary; W. C. Fawcett, chief engineer; Louis Lipphardt, treasurer and general manager.

CLEVELAND, OHIO.—The Baltimore & Ohio Railroad Company is preparing to install considerable electrical apparatus in the new repair shops being erected at Lorain, Ohio. There will be a very complete power plant of about 1000-hp boiler capacity and generators will be installed to furnish lighting current and to supply motors for operating machine tools and a number of devices for handling fuel and ashes. Plans are being prepared at the Baltimore offices of the company.

CINCINNATI, OHIO.—The Executive Committee of the Cincinnati & Suburban Bell Telephone Company authorized the construction of a large number of conduits, which will take every telephone wire and pole down across the canal, the cost of the new conduits will be $88,000, and the new cable to be used in them $77,000, making a total of $165,000. Bids will be called for at once. As soon as the contract is let the work will be rushed to completion. Address Bayard L. Kilgour, general manager.

MYRTLE CREEK, ORE.—C. C. White has petitioned for a franchise for an electric light plant.

McMINNVILLE, ORE.—H. S. Maloney, City Recorder, writes that the improvements contemplated to the electric light plant have not yet been decided upon.

BANDON, ORE.—The City Council has granted a twenty-year electric-light franchise to the Bandon Electric Light Company, work to be commenced by May 1.

IONE, ORE.—The City Council is holding open meetings with a view to rushing the installation of the municipal electric light plant. The money has been raised and the Council is now open for bids for furnishing material. It is intended to install a 500-light generator and to put in about 300 lamps at once.

HAWLEY, PA.—V. A. Decker, F. C. White and Lewis P. Cooke have purchased the plant of the Hawley Electric Light Company and will expend about $20,000 in improving it.

JOHNSTOWN, PA.—A syndicate of capitalists headed by C. S. Jennings, of Maryland, has obtained the charter rights and franchises of the Somerset County Electric Railway Company.

COATESVILLE, PA.—It is stated that the West Chester Street Railway Company has been granted right of way by Joseph and John Beale, between Coatesville and Gallagherville, a distance of four miles.

PHILADELPHIA, PA.—The plant of the Chester Traction Company at Penrose Ferry bridge was wrecked by the bursting of a flywheel a few days ago. It is estimated that it will cost $25,000 to repair the damage to building and equipment.

WILKESBARRE, PA.—Both the Wilkesbarre & Hazleton and the Wilkesbarre & Wyoming Valley Electric Railway Companies are preparing to make important improvements shortly. The former will extend its tracks from Ashley directly into this city.

ALTOONA, PA. Improvement bonds in the sum of $1,200,000 will be issued to cover a mortgage for a like sum given to the Standard Trust Company, of New York, for the purpose of building the 40-mile electric railway between this city and Bedford.

PHILADELPHIA, PA.—Only one bid was received and opened on March 9 for the electric lighting contract for 1907, which was submitted by the Philadelphia Electric Company. It agreed to do the work at the same price it is getting this year, which is about $99 per lamp per year; the contract for this year amounts to $1,017,303.

PITTSBURG, PA.—Bids will be received until April 2 by Major Wm. L. Sibert, Corps Engrs., U. S. A., Pittsburg, for furnishing and erecting eight 65-hp gas engines, and eight belt-driven, 2-stage air compressors, two each of the following places on the Ohio River: Dam 2, near foot of Neville Island; Dam 3, Glenosborne; Dam 4, Legionville, and Dam 5, near Freedom, Pa., about 9, 11, 18, and 25 miles, respectively, below Pittsburg, Pa.

BELTON, S. C.—The survey for an interurban electric railway from Anderson to Belton has been completed by Engineer J. E. Sirrine, of Greenville, S. C., and the work of construction has been commenced.

CHESTER, S. C.—The Southern Power Company has made a proposition to supply the town with electricity at the rate of $20 per hp-year for not less than 2000 hp. This is about half the price being paid by the city at present and it is probable that the offer will be accepted.

HIGHMORE, S. D.—O. C. Kippenbrock, City Auditor, writes that J. L. White, of Clear Lake, has secured a franchise for water works and an electric light plant here.

YORKTOWN, TEX.—An electric light and power plant is to be installed here shortly by Koenig & Son, at a cost of $16,000.

BRYAN, TEX.—Grupe & Harold, of College Station, have decided to petition the Council for a franchise for an electric light plant.

BROWNSVILLE, TEX.—F. J. Combe and S. C. Tucker, of this city, are preparing to install an electric light and power plant here. The service will probably also be extended to Matamoros, Mex., situated opposite Brownsville.

AUSTIN, TEX.—W. F. Robinson, an attorney of New York, has arrived at Austin for the purpose of submitting a proposition to the City Council to rebuild the dam across the Colorado River and install an electric light and power plant for the city. Mr Robertson says he represents a strong syndicate of capitalists who stand ready to undertake and carry out the work if the city will accept the proposition.

ALEXANDRIA, VA.—It is rumored here that local promoters are endeavoring to interest New York capitalists in a proposition to construct an electric railway between Washington and Mt. Vernon, via Alexandria, in opposition to the Washington, Alexandria & Mount Vernon Railway Company. It is said that the plans call for a bond issue of $1,500,000, $500,000 to be used in the construction of eighteen miles of road and two power houses, $250,000 for the equipment in this city, $250,000 to install the line in the District of Columbia, and $75,000 for the condemnation of right of way.

TACOMA, WASH.—Application has been made by the Sunset Telephone Company for a permit to lay underground conduits in different sections of the city. If granted the work will commence at once.

SEATTLE, WASH.—E. M. Day, of Bellingham, representing the Seattle Vancouver Electric Railway Company, is said to have secured for that company the old route of the Great Northern Railroad from Bellville to Bellingham, a distance of 30 miles.

SEDRO WOOLEY, WASH.—The Skagit Improvement Company has leased a tract of ground and will shortly install a 250-hp steam plant to furnish power for lighting the city. The intention is to put in an auxiliary plant for use when the present water-power plant on Gillian Creek is disabled.

MORGANTOWN, W. VA.—Secretary W. W. Smith, of the Dunkard Valley Railway Company, writes that bids for constructing the proposed railway will be received in the spring, and that the cost is estimated at $600,000.

MARINETTE, WIS.—F. H. Rosslyn, of Oshkosh, writes that the proposed power plant in which he and associates are interested, is to be constructed on High Falls, Peshtigo River, Marinette County. Engineer, Daniel W. Mead, of Chicago, Ill.

FORT D. A. RUSSELL, WYO.—Bids will be received by Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, until April 14 for furnishing and installing electric light fixtures in certain buildings, and for extending the lighting system at Fort D. A. Russell.

CALGARY, ALB.—The City Council is making arrangements for making improvements to the extent of $30,000 in the electric light system. Address Alderman Jones.

EDMONTON, ALB.—The City Council is considering plans for an electric railway through the city, with an extension to Kinistino. Address the mayor or city engineer, J. H. Hargreaves.

KAMLOOPS, B. C.—Extensions to the electric lighting plant are being considered by the City Council. Address Alderman McLean.

MACLEOD, CAN.—The town council is applying to the legislature for permission to build, own and operate an electric light plant. Address C. H. Baker.

CARBERRY, CAN.—The ratepayers voted almost unanimously in favor of the town building a civic electric light plant. Address Mayor Eaton.

VIRDEN, MAN.—New York parties have made a proposition to the town to install an electric light plant here. Address J. G. Rattray.

BRANDON, MAN.—C. B. McAllister, representing the Great Western Power & Machinery Company, has presented a proposition to the Council for the installation of a plant to cost $300,000. Address G. F. Sykes, secretary and treasurer.

TORREON, MEX.—More than $150,000 has been subscribed by local capitalists towards capitalizing a company for the purpose of erecting a new electric light and power plant here.

CHIHUAHUA, MEX.—Governor Enrique Creel and others of this city are interested in the project of establishing a large hydro-electric power plant on the San Pedro River, about 45 miles south of here. It is planned that electric power shall be transmitted to Chihuahua and other towns in this vicinity.

HAMILTON, ONT.—The Western Counties Power Company will build a pole line from here to Brantford, Ont., a distance of 30 miles.

BRANTFORD, ONT.—The Grand Valley Radial Company, of Brantford, has purchased the Thames Valley road running from Ingersoll to Woodstock and assumes control at once.

QUEBEC, QUE.—It is said that the North Shore Power, Railway & Navigation Company will shortly be in the market for eight 100-kw generators for the pulp mill at Seven Islands.

MONTREAL, QUE.—Senator Domville, St. Johns, N. B., cabled from England that he has interested sufficient capital for the building of the proposed electric road from Montreal to the Great Lakes, a distance of about 600 miles. The line will be known as the Canada Central.

SWIFT CURRENT, SASK.—J. T. Booker, Houston, Tex., is preparing to install a local telephone system here which will be conducted by an independent company.

Company Elections.

MONTEREY, CAL.—At the recent annual meeting in Los Angeles of the stockholders of the Monterey County Gas & Electric Company the following officers were elected: C. W. Allen, president and general manager; Mrs. Cora E. Hubbell, vice-president; R. C. P. Smith, secretary-treasurer.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has elected officers for the next fiscal year as follows: President John A. Britton; vice-president, Frank G. Drum; treasurer, Cyrus Peirce; secretary, C. W. Conlisk. The board consists of N. W. Halsey, chairman; E. J. de Sabla, Jr., John Martin, Frank G. Drum, William H. Crocker, N. D. Rideout, Frank B. Anderson, Joseph S. Tobin, John A. Britton, Henry E. Bothin, Louis F. Monteagle, Garret W. McInerny, Cyrus Peirce, Carl Taylor and F. W. McCutcheon, the latter of New York City.

MATTOON, ILL.—At the meeting of the Mattoon, Shelbyville, Pana & Hillsboro Traction Company, the following officers were elected: W. R. Patton, Charleston, president; Robert Johns, Pana, vice-president; I. B. Craig, Mattoon, secretary; J. W. Yantis, Shelbyville, treasurer.

HUNTINGBURG, IND.—At the annual meeting of the Dubois County Telephone Company the present directors were re-elected as follows: H. Landgrebe, Phil. Dilly, Chas. Moenkhaus, C. R. Ramsbrok, E. C. Dufendach, Hugo C. Rothert. The latter was also re-elected secretary.

IOWA FALLS, IA.—At the annual meeting of the Central Iowa Telephone Company the following board of directors was elected by the stockholders: Wm. Mayse, W. D. Wagoner, Jos. Husman and J. H. Huneman of La Porte, Ia.; W. V. Shipley and J. H. Funk of Iowa Falls, Geo. Wright, Chas. Hawkole, of Eagle Grove, and Otto Wettstein, of La Porte. The board elected the following officers: President, W. D. Wagoner, of La Porte; vice-president, J. H. Funk, of Iowa Falls; secretary and treasurer, W. V. Shipley, of Iowa Falls.

LOUISVILLE, KY.—At the annual meeting of the Independent Long Distance Telephone & Telegraph Company held in Wilmington, Del., in February, the following directors were elected: John A. Armstrong, J. D. Powers, Chas. J. Doherty, Donald McDonald, S. S. Adams, Jr., C. C. Bickel, J. W. Irwin, E. M. Coleman, C. L. Hughes, George W. Lewman, C. D. Knoefel, Matt O'Doherty, Ed. L. Barber.

LOUISVILLE, KY.—At the annual meeting of the stockholders of the Louisville Home Telephone Company held at Wilmington, Del., in February, the following directors were elected: John A. Armstrong, Charles J. Doherty, E. M. Coleman, C. C. Bickel, J. D. Powers, George W. Lewman, C. L. Hughes, W. C. Garland, J. G. Gray, C. D. Knoefel, Donald McDonald, Matt O'Doherty, Ed. L. Barber.

SAGINAW, MICH.—The annual meetings of the Bartlett Illuminating Company, the Saginaw Valley Traction Company and the Saginaw City Gas Company were held here recently. The Bartlett Illuminating Company directors were chosen as follows: George B. Morley, H. T. Wickes, Otto Schupp, H. D. Walbridge, S. E. Wolff. The officers are: President, H. D. Walbridge, New York; vice-president, S. Edwin Wolff; secretary-treasurer, Chas. E. Mershon; assistant secretary-treasurer, George E. Hardy, New York. The directorate of the Traction Company includes the following: George B. Morley, Thos. A. Harvey, G. M. Stark, H. T. Wickes, C. M. Clark, Philadelphia; H. D. Walbridge, New York; S. E. Wolff. The officers are: President, H. D. Walbridge; vice-president, S. E. Wolff; secretary-treasurer, Chas. E. Mershon; assistant secretary-treasurer, George E. Hardy. The Gas Company directors are the following: George B. Morley, Jas. B. Peter, T. E. Dorr; Fred H. Potter, H. D. Walbridge, T. A. Harvey, S. E. Wolff, B. C. Cobb. The officers are: President, H. D. Walbridge; vice-president, Geo. B. Morley; secretary-treasurer, Chas. E. Mershon; assistant secretary-treasurer, George E. Hardy.

COLFAX, MINN.—At a meeting of the local telephone company the following officers were elected: G. Krenz, president; Bert Hilygus, secretary; F. Henze, treasurer; B. Bouskhol and G. Poppen, directors.

ST. LOUIS, MO.—The annual meeting of the stockholders of the United Railways Company for the election of directors was held March 5. The following directors were re-elected: John I. Beggs, of Milwaukee; James Campbell, Murray Carleton, Robert McCulloch, Henry S. Priset, W. V. N. Powelson, Festus J. Wade, of St. Louis; C. W. Wetmore, George R. Sheldon, of New York. Charles H. Huttig and C. D. Smithers were elected to fill vacancies.

TOLEDO, OHIO.—The Toledo Talk-O-Phone Company has elected the following directors: George Metzger, A. L. Irish, Will Tyler, O. C. Reed, Frank Thompson, W. R. Edgar, Jacob Gerrold, Harry M. Ensign, Lawrence Lucker of Minneapolis, George Chase of San Francisco, J. C. Gurney of Cincinnati and C. O. Bevel of Pittsburg. The capital stock has been increased to $1,000,000 and the company is preparing plans to greatly enlarge the plant and add several new buildings.

SPOKANE, WASH.—At the annual meeting of the Washington Water Power Company the trustees elected were H. M. Richards, J. P. M. Richards, Thomas G. Thomson, A. B. Campbell, J. D. Sherwood, J. N. Glover, Huber Rasher, D. L. Huntington and W. A. White, Frank Lyman and George Southard, of New York. The officers elected were: H. M. Richards, president; A. B. Campbell, first vice-president; D. L. Huntington, second vice-president and general manager; H. E. Perks, treasurer, and H. L. Bleecker, secretary. The company plans several extensions and new lines during the coming year, and will greatly increase its electrical power, developed at Spokane and in Post Falls, Idaho.

New Incorporations.

LITTLE ROCK, ARK.—Articles of incorporation have been filed by the Spring River, Ashflat & Franklin Electric Railway, Light & Power Company. The company is capitalized at $100,000. The incorporators are S. L. Guthrie, T. W. Simpson, W. O. Wadley, J. W. Bryant, R. L. Hastings, L. D. Phillis, W. F. Brawley, I. G. Ritchie, R. E. Sample, J. H. Franklin, S. P. Turner, W. Clayton, C. D. Ritchie, E. C. Hotchkiss and J. N. Roberts.

SAN FRANCISCO, CAL.—The Redding & Red Bluff Railway Company has been incorporated, with a capital stock of $800,000, by L. R. Notbohm, C. G. H. MacBride, George J. Reiner, John B. Rogers and H. H. Sanborn. The company proposes to construct a railway from Red Bluff to Redding, an estimated distance of 33 miles.

LAKEPORT, CAL.—Articles of incorporation have been filed here by the Lake County Power Company, with a capitalization of $10,000,000. Lakeport will be the principal place of business of the corporation, which has been formed for the purpose of carrying on in Lake and other counties of California the generation and selling of electricity for lighting purposes, the acquisition of real and personal property and water rights, and for the manufacture and sale of ice. The directors of the new company are Wilbert T. Mariner, Herbert V. Keeling, M. S. Sayre, B. H. Henderson and A. H. Spurr, all of Lakeport.

SAN FRANCISCO, CAL.—The Coast Counties Light & Power Company has been incorporated by the California Gas & Electric Corporation interests, with a capital stock of $1,500,000. The directors are L. H. Sussman, W. J. McLean, L. W. Pryor, H. Mallock, H. Bostwick, W. B. Bosley and R. A. Morgan. These interests have been acquiring electric power and lighting plants along the cost south of San Francisco, including those in Santa Cruz and Watsonville. Negotiations have been under way for some time for the acquirement of the Monterey County Gas & Electric Company's light and power plants and electric railway at Monterey, Cal. Should this deal be consummated the new company would be able to handle all of the properties above mentioned, together with others that may be acquired in future.

VANDALIA, ILL.—The Vandalia Telephone Company has been incorporated with a capital of $6000. The incorporators are George C. Morris, Chris Bussee and Fred P. Kinder.

CHAMPAIGN, ILL.—The Madison County Light & Power Company, with a capital of $100,000, has been incorporated by Charles Zillick, B. E. Bramble and George M. Mattis.

WHITE WALNUT, ILL.—The White Walnut Telephone Company has been organized. The officers are: E. F. Logan, president; Chris. Schmalriede, secretary; Herman Pulke, treasurer.

MOUNT TABOR, ILL.—Mount Tabor Mutual Telephone Company has been incorporated with a capital of $2,500, to operate a telephone system. Incorporators are Albert Stewardson, J. W. Fleming and Levi Moorts.

VALMEYER, ILL.—An Independent telephone company has been formed at Valmeyer with the following officers: Henry Volhardt, president; E. J. Lee, Jr., secretary. The lines of the company will connect with the Farmers' Fountain Telephone Company of New Hanover.

MURPHYSBORO, ILL.—Papers have been filed asking for the incorporation of the Murphysboro & Benton Railway Company. John G. Hardy, William Wall, Charles L. Ritter, John M. Herbert and J. N. Craine are the incorporators. The capital stock is $25,000.

PEORIA, ILL.—The Peoria, Streator & Ottawa Railway Company, with principal office at Champaign, has been incorporated with a capital stock of $100,000. The incorporators and first board of directors are: W. J. Ferris, B. E. Bramble, Charles Zillick, George M. Mattis and W. B. McKinley.

HORTONVILLE, IND.—Fletcher Jessup is organizing a new telephone company.

SHIRLEY, IND.—A company has been organized here with C. W. Bouslog, president, and J. C. Wink, secretary, to construct water works and an electric light plant.

ANDREWS, IND.—The Andrews Light & Water Company has filed articles of incorporation, capitalized at $10,000. John H. Moore, W. E. Nichols and Henry B. Thornton are the directors.

INDIANAPOLIS, IND.—The Indiana Contracting Company has filed articles of incorporation with the Secretary of State. The capital stock is $50,000. The object of the company is to promote, finance and equip street and interurban railways. William C. Schoemaker, John A. Shoemaker and George P. Lyon are the incorporators.

MALLARD, IA.—The Mallard Mutual Telephone Company has been incorporated with $12,000 capital stock.

WATERLOO, IA.—The Wenkel Telephone Company has been organized vice-president.

MEDIAPOLIS, IA.—The Square Deal Mutual Telephone Company has been organized with the following officers: President, J. B. McCray; vice-president, Robert Eland; secretary, J. L. Siscoe; treasurer, Lewis Wogner.

HONEY CREEK, IA.—The Honey Creek & Southwest Telephone Company has been formed. G. W. Crombaugh, president; Wm. Schraeder, secretary. The company will build lines from Kosata to the adjoining country.

FORT ATKINSON, IA.—The Farmers' Mutual Telephone Company, Fort Atkinson, Ia., has been incorporated with a capital stock of $2,500. President, C. D. Horton; vice-president, L. T. Huber; secretary and treasurer, J. A. Huber.

OSCAR, MINN.—The Oscar-Trondhjem Farmers' Telephone Company has been formally organized. The following directors were elected for one year: Ole K. Aaberg, president; E. Stras, vice-president; Swend Larson, secretary and treasurer, and G. T. Braatellen.

LAKE BENTON, MINN.—The Lincoln County Telephone Company has been incorporated with a capital stock of $50,000. The incorporators are K. G. Skartum, John H. Hanson, Charles E. Lavesson, Hans Lavesson, F. E. Tucker and John McKenzie, all of Lake Benton.

ST. CLOUD, MINN.—The Mississippi River Power Company has been incorporated, with a capital of $50,000, by E. F. Moore, D. H. Freeman and others of St. Cloud, to build a dam near Clearwater, manufacture electric light, heat and power, and operate a pulp and paper mill.

CORINTH, MISS.—The Corinth & Shiloh Electric Railway Company has been incorporated, with a capital stock of $250,000. Abe Rubel, president; W. J. Lamb, vice-president and manager; M. T. Bynum, secretary.

PERU, NEB.—The Peru Electric Light & Power Company has been incorporated, with a capital of $4,000, by O. N. Good, A. N. Borst and others.

TONOPAH, NEV.—Articles of incorporation have been filed by the Austin-Manhattan Telephone Company with the County Clerk of Lander County.

OKOLONA, OHIO.—The Farmers' Mutual Telephone Company has been organized by T. F. Durham, Henry Schumacher and Martin Brobst.

CINCINNATI, OHIO.—The Cincinnati Light, Heat & Power Company has been incorporated, with a capital of $100,000 by Guy W. Mallon, H. H. Bechtel and others. The company will apply for a franchise to furnish electricity for commercial use in this city.

MILLERSPORT, OHIO.—The Buckeye Lake Home Telephone Company has been incorporated with $10,000 capital stock. W. G. Palmer, W. G. Ogarag, W. R. Nutt and H. J. Brown are among the incorporators.

TOLEDO, OHIO.—The Erie Construction Company has been incorporated, with a capital of $10,000, by James E. Bradley, H. P. Yeager, A. F. Hanson, W. E. Cordill, J. C. Newton and others, of Toledo. The company will finance and construct telephone exchanges and expects to build a number of small independent plants throughout the Middle West.

BURLINGTON, OHIO.—The North Kenova Telephone Company has been incorporated by A. O'Neill, Oscar M. Elkins, Francis M. Fullerton, and others. The company proposes to establish a community exchange at Burlington.

DELTA OHIO.—The Citizens' Mutual Telephone Company has been incorporatedby William T. McQuillan, O. R. George, Claude L. Sturtevant, C. D. Eberly, Frank Terwilliger and others. The company will build an independent exchange in Delta.

GUTHRIE, OKLA.—The Kansas Union Traction Company, a Kansas company, which proposes to build an electric railway between Parsons and Coffeyville, a distance of 40 miles, has taken out an Oklahoma charter. It is capitalized at $1,000,000 and has its Oklahoma headquarters at Newkirk. The incorporators are William J. Jones and C. N. Petty, of Altamont, Kan.; S. T. Bisbee and Ralph J. Ramer, of Oklahoma City.

HARRISBURG, PA.—Newly chartered electric railway companies are the West Pittsburg & Ellwood City, with a capital of $42,000; the West Pittsburg Electric Railway Company, with a capital of $6000; and the Crescent Avenue Electric Railway Company, having a capital of $6000. The presidents of these companies are C. P. Dushane, E. G. Dunham and Frank S. Hoyt, respectively. The first company contemplates building about 7 miles of line and the other two will construct one mile of road each.

WHITE LAKE, S. D.—The Northwestern Telephone Company has filed articles of incorparation, with a capital stock of $3,000. L. G. Sale, J. E. Ellis and Charles Gobler are the incorporators.

ETHAN, S. D.—The Ethan Telephone Company has been incorporated, with a capital stock of $1,500, by J. A. Howard, W. G. Snyder, Philip Germscheid, Joseph Friedel, and others, all of Ethan.

HERMOSA, S. D.—The Hermosa Telephone Company has been incorporated, with a capital of $10,000. S. M. Booth is president; H. C. Closson, vice-president; Paul D. McClelland, secretary; Edward Stenger, treasurer, all of Hermosa.

NOBLE, TEX.—The South Canadian Telephone Company has been incorporated with a capital of $1000, by C. M. Hebaugh and others.

TARPLEY, TEX.—A. M. Stigler and J. O. Bintner have filed articles of incorporation for the Bandera Telephone Company, with a capital of $4000.

HUBBARD, TEX.—The Hubbard Light & Power Company has been incorporated, with a capital of $10,000, by Wm. Burr, J. N. DuBois and W. A. Atkinson, of Dallas.

PECKHAM, TEX.—The Peckham & Northwestern Mutual Telephone Company, with a capital stock of $4000, has been incorporated by B. H. Fisher, J. W. Stewart and others.

THOMAS, TEX.—The Home Telephone Company has filed articles of incorporation, having a capital stock of $20,000. J. F. Gully, W. L. McClung and A. H. Donnell are among the incorporators.

EMPIRE, WIS.—The Empire Telephone Company has been incorporated by William C. Ray, H. Keys and H. D. Vinton. The capital is $1800.

WONEWOC, WIS.—The Wisconsin Home Telephone Company has filed articles of incorporation, with a capital of $25,000. The incorporators are A. E. Hazlik, M. E. Hutchins and F. A. Serrurier.

OSCEOLA, WIS.—Farmers and business men of this city have organized a new telephone company and articles of incorporation have been filed with the Secretary of State. The directors are: George A. Taylor, president; Geo. F. Clark, vice-president; Charles H. Oakley, treasurer.

MEDICINE HAT, ALB.—The Alberta Southeastern Telephone Company has been formed here with the following directors: W. C. Harris, S. T. Fawcett, William Rutherford, George Henry and W. Nicholls. Sufficient subscribers have been obtained to build a line to Cypress Hills, a distance of 50 miles, and construction will be commenced at once.

VANCOUVER, B. C.—The Vancouver, Fraser Valley & Southern Railroad Company has been incorporated to build an electric railway from Vancouver to Blaine, Wash., via New Westminster, also through the Fraser Valley to Chilliwac and Delta municipalities.

VANCOUVER, B. C.—The Burrard Power Company, Ltd., has been organized to develop the water power of Lilloeb Lakes and tributaries, for the purpose of generating electricity for light, heat, manufacturing and industrial purpose. The power plant will probably be located on Fraser River, in the vicinity of Port Haney.

CARTWRIGHT, MAN.—The Mather Co-operative Telephone Company has been formed here with the following officers: President, T. E. Elliott; vice-president, H. McLean; secretary-treasurer, D. B. McKinnon, trustees, Joseph Bere, George Mayo, James Melvin, John Burrows, D. Fulford.

New Industrial Companies.

THE VIRDEN ELECTRIC COMPANY, Virden, Okla., has filed articles of incorporation, with a capital of $10,000. The incorporators are Samuel Black, of Leal; E. C. Englehart, of Virden, and Roy Black, of Minco.

TYPEWRITING TELEGRAPH COMPANY, New York, N. Y., has been incorporated with a capital of $250,000. The directors are W. W. Crehore, Elizabeth, N. J.; W. C. Sherwood, Jersey City, and A. F. Garbe, of New York.

THE NILES ELECTRICAL CONSTRUCTION COMPANY, of Niles, Ohio, has been incorporated. The company is capitalized at $10,000 and will do electrical repair and construction work. Among those interested are W. M. Kerr, William Stephens, Edward Lyon and H. Wilson.

THE CAMDEN & ATLANTIC AUTOMOBILE COMPANY, of Camden, N. J., has been incorporated with a capital of $25,000. The company will manufacture, buy and sell automobiles and will also operate automobiles between Camden and Atlantic City for the purpose of carrying passengers and freight.

THE THOMPSON ELECTRICAL COMPANY, of Evansville, Ind., has been incorporated to do a general electrical supply and construction business. The new firm will open a factory and supply house at 329 Upper Third Street. J. E. Thompson and Henry Koehler are among those interested in the concern.

THE WALKER FOUNDRY COMPANY has been incorporated in New Jersey with a capital stock of $100,000, to manufacture electric motors, dynamos and other electrical machinery. The incorporators are Joseph Diehl Fackenthal, John J. Duly and Albert C. Wall, all of 1 Exchange Place, Jersey City, the registered office of the concern.

Legal.

LARGE INJURY AWARD.—At Syracuse, N. Y., on February 24, the jury in the case of Florence Ryan against the Central New York Telephone & Telegraph Company returned a verdict of $20,000 for the plaintiff. Miss Ryan is nineteen years old. She fell in a trench dug for the subway of the telephone company and for eight months lay in a state of coma. The defence alleged that her condition was due to hysteria as the result of suggestion.

ST. CLAIR, MICH., INJUNCTION.—The citizens of this city have manifested their opposition to the installation of a system to secure electric power from the St. Clair water works and current for lighting purposes from a Port Huron concern, by the commencement of an injunction suit in the Circuit Court to restrain the mayor, F. W. Moore and city clerk, W. H. Brown, from carrying out the contract. It is claimed that it will cost the city $10,000 for the necessary machinery and will wrongfully divert money voted for the purpose of obtaining new municipal electrical equipment.

CHICAGO DRAINAGE CANAL.—The famous case of the State of Missouri vs. the State of Illinois involving the right of the City of Chicago to divert its sewage into the Mississippi River through the Chicago sanitary canal and the Illinois River has just been decided by the Supreme Court of the United States in favor of Illinois. This decision leaves the way clear for the power development project which is well in hand for using the 40,000 hp in water power at Lockport, Ill., the lower end of the Sanitary and Ship Canal. At this point will be installed four 4000-kw, three-phase, 60-cycle, 6600-volt alternating-current generators now under construction in the shops of the Crocker-Wheeler Company, Ampere, N. J.

LIGHTING IN BAY CITY.—The suit of the Bay City Traction & Electric Company of Bay City, Mich., against the city to determine the right of the city to engage in commercial lighting on the east side of the river has been filed in the Circuit Court. The company asserts that it is impelled in its action by the fact that as a taxpayer it is entitled to rights possessed by anyone else, and that aside from any injustice to its business the city has no authority to engage in further commercial lighting. The company says that it is not subject to taxes for improper purposes, the explanation being that if the city spent money for commercial lighting it would do so by incurring indebtedness for the cost thereof, and as the action would be improper the consequent taxation would be improper.

WIRELESS LITIGATION.—The Gesellschaft fur Drahtlose Telegraphie of Berlin writes us as follows as to recent litigation in this country on the Fessenden liquid barretter: "In reference to your article in No. 5 of February 3, 1906, page 302 under "Legal," and headed "Fessenden Liquid Barretter," we beg respectfully to bring the following to your notice: The article in question appears to us to be somewhat indistinct. The writer appears entirely to overlook the fact that, firstly, a temporary injunction only has been issued and this merely as regards specific claims. It would, however, appear from the item that our company were forbidden to manufacture, use or sell in the U. S., any apparatus whatsoever on the "System Telefunken," a system, to use the words of your English contemporary, of great prominence and world-wide reputation, whereas the injunction on the basis of an opinion by Judge Wheeler, refers only to claims 11, 23 and 25 of Mr. Fessenden's patent No. 12,115, the said claim covering only a cell with an extremely fine terminal, i. e., a terminal with a diameter of less than 0.0004 of an inch. In conclusion we beg particularly again to emphasize the point that the action is not yet definitely decided."

RATES AT LOS ANGELES, CAL.—For failure and refusal to comply with a city law, seven of the representative officials of the Home Telephone & Telegraph Company have been arrested with a view to testing the validity of this law. They are J. M. C. Marble, president; A. B. Cass, vice-president; J. H. Torrance, secretary; H. W. Hellman, treasurer, and W. C. Patterson, W. S. Bartlett and Thomas W. Phillips, directors. The complaint was issued under the penalty clause of an ordinance which measure provides for the fixing and regulating by the City Council of rates to be charged for telephone and light service. To enable the council to fix the charges advisedly, the ordinance provides that the various public service companies shall during the month of January of each year file reports of receipts and expenditures and valuation of their respective properties. With this ordinance the Home Telephone & Telegraph Company refuses to comply, and the attention of the district attorney was directed to the case. The penalty clause of the ordinance provides that "any person, firm or corporation violating any of the provisions of this ordinance shall be deemed guilty of a misdemeanor, and upon conviction theref shall be punished by a fine not exceeding $500, or by imprisonment in the city jail for a period not exceeding 100 days, or by both fine and imprisonment."

PAYMENT FOR PAVING.—A decision holding that the city of Trenton, N. J., has an action against the Trenton Street Railway Company to compel that company to pay its share of the cost of paving South Broad Street, North Broad Street and East State Street, has been given in the Supreme Court by Chief Justice Gummere. This decision is in the case which was instituted by the city through city solicitor Charles E. Bird, and in which the city seeks to recover from the Trenton Street Railway Company about $40,000 of the cost of repaving the streets named above. When the Trenton Street Railway Company changed its motive power from horses to electricity, the city of Trenton gave it permission to place electric tracks, to string wires and to erect poles, and in return for this privilege the company was to pay for the paving of streets occupied by its tracks for the distance inside the rails and for a specified distance beyond the outer rails. The ordinance granting the franchise and providing that the company should pay for its share of the paving was accepted in writing. The question raised in the suit was whether the ordinance and the acceptance of it in writing constituted a valid contract. The Supreme Court holds that the contract is valid and that because of the refusal of the company to perform its part of the contract the city has an action for damages.

Educational.

UNIVERSITY OF WISCONSIN.—The College of Engineering of the University of Wisconsin has just received a Curtis steam turbine which is being installed in the mechanical laboratory of the engineering building. The new machine, which is in part the gift of the General Electric Co., will be used for the instruction of students and for experimental work. It is of 35-hp capacity. Owing to the increasing importance of this kind of machine in electrical plants, as well as its successful application recently for ship propulsion, the college of engineering considers itself very fortunate in securing this valuable addition to its laboratory equipment.

Personal.

MR. C. M. CALDWELL has been appointed City Electrician of Kansas City, Mo., to succeed J. A. Burns.

MR. LELIO BORNO has assumed the direction of the telephone service of Port au Prince, the capital of the Island of Hayti, West Indies.

MR. ALBERT SPIES has retired from the editorship of the *Electrical Age*, with the completion of the February issue. He will continue in editorial charge of *Cassier's Magazine*.

MR. WARREN D. KING, manager of the municipal electric light plant, of Peabody, Mass., has been elected a member of the executive committee of the Municipal Light Association.

MR. ALBERT UHL has severed his connection with the firm of Uhl & Elliott, electrical engineers and contractors of Shreveport, La., and has joined the staff of the Woods Electric Company, of Houston, Tex.

MR. HARRY G. McCULLY, superintendent of the New Jersey division of the New York & New Jersey Telephone Company, on March 1 retired from that position to assume other duties in the service of the same company.

MR. EUGENE W. GODFREY, of Boston, Mass., has been engaged as general superintendent for the Marlboro Electric Light Company, to succeed Herbert E. Ryder, who resigned recently to accept a similar position at Fall River.

MR. CLAUDE L. CLARY, who has been connected with the sales department of the Western Electric Company, has resigned to accept the general management of the Sikeston Ice, Light & Power Company at Sikeston, Missouri.

MR. WESLEY WENTWORTH has been appointed general manager of the Houston Electric Company, of Houston, Tex. Mr. Wentworth comes from Dallas, where for the last nine months he has been superintendent of the Dallas Consolidated Street Railway Company.

MR. LELAND HUME has been promoted from the office of assistant general manager to that of general manager of the Cumberland Telephone Company, Nashville, Tenn. Mr. Hume was also elected president of the Nashville Board of Trade.

MR. C. L. KNIGHT, who for a number of years has been superintendent of the Sacramento Electric, Gas & Railway Company's power plant at Folsom, Cal., has been transferred to a position with the California Gas & Electric Corporation at Alta. F. O. Hutton of Sacramento will succeed Mr. Knight as superintendent of the Folsom plant.

MR. FRANK H. BETHEL, who has been associated with the Chesapeake & Potomac Telephone Company as its general manager since May 1, 1904, has been appointed vice-president of that company as well as vice president of the Bell Telephone Company and of the Delaware & Atlantic Telephone Company.

MR. G. A. DURKEE, who for the past year has been chief engineer at the municipal electric light plant of Clifton Springs, N. Y., has been advanced to the position of superintendent of the electric lighting system to succeed Mr. A. J. Short, who expects to take a position in the northern part of the State in the near future.

MR. F. B. HUNTINGTON, vice-president and secretary of the Fond du Lac Street Railway & Light Company, the Fond du Lac & Oshkosh Street Railway Company, and the Eastern Wisconsin Street Railway & Light Company, of Fond du Lac, Wis., has resigned from these companies to become comptroller of the Chicago Terminal & Transfer Company.

MR. HORACE E. ANDREWS, president of the Cleveland Electric Railway Company, will sail on March 10 for a two months' automobile trip through Europe. Mr. Andrews will pay some attention to the street and interurban railway situation in Europe and will inspect the subway in London built by the late Charles T. Yerkes.

MR. E. J. BEARD. Mr. E. J. Beard, chief assistant engineer of the Chicago, Rock Island & Pacific Railway, will resign to become engineer of steam railways in the Philippines with J. G. White & Co. He will have complete charge of the $11,000,000 work which that company has undertaken. The construction corps will be organized in New York in the near future.

MR. FRANK B. GREENWOOD has been appointed superintendent of the Home Lighting, Power & Heating Company of Springfield, Ohio, to fill the vacancy caused by the resignation of W. N. Zurflub, who has resigned. Mr. Greenwood has recently been chief inspector of the Central Union Telephone Company at Springfield, but was formerly in central station work.

COL. I. S. DICKSON, of Cleveland, Ohio, has announced his intention to resign the presidency of the various Federal telephone properties, and of his acceptance of the management of the local offices of A. O. Brown & Co. Mr. Dickson's successor has not been announced and he will remain at the head of the various companies until such time as he can be relieved.

MR. A. F. WINCHESTER, superintendent of the municipal electric light plant of South Norwalk, Conn., has been granted leave of absence by [illegible] to enable him as member of the special committee of the National Civic Federation on municipal ownership to visit Europe and report on some of the plants there. He sails on the Cunarder "Caronia" on March [illegible] for [illegible] to join the other members of the special committee, whose work is expected to last until August 1.

MR. LEE H. NEWBERT, manager of the Marysville Gas & Electric Company, Marysville, Cal., has been appointed to the position of superintendent of the Peninsular Division of the California Gas & Electric Corporation. He will enter upon his new duties about March 10. The Peninsular Division is that territory between San Bruno or South San Francisco and the town of Lawrence, near Santa Clara. It embraces San Mateo, Redwood City, Palo Alto, and a number of smaller places. Mr. Newbert will reside at San Mateo.

MR. DANA PIERCE has been engaged by the Underwriters' Laboratories as engineer in charge of electrical work. He begins his duties this month, spending a few days at the New York office of the Laboratories, going to Pittsburg to attend the annual conference between experts in the employ of insurance interests and those of the Westinghouse Companies, and takes up his active duties at the executive offices and testing station of the Laboratories in Chicago about the 15th. Mr. Pierce graduated from Amherst College with the class of 1892, and since that time has devoted himself to physical laboratory practice and electrical engineering, taking a post-graduate course at Johns Hopkins, and afterwards doing a variety of work at Harvard and Cornell laboratories, conducting experiments in high-tension electrical measurements at Worcester Polytechnic Institute and acting as instructor in laboratory work at Pratt Institute.

Trade Publications.

LUBRICATING OILS.—A catalogue recently received from the A. W. Harris Oil Company, Providence, R. I., deals with lubricating oils for general engineering work and for all special conditions and requirements.

F. T. PAISTE COMPANY, Philadelphia, Pa., has issued for February a folder, Bulletin No. 29, illustrated, and devoted to its latest types of fusible hanger boards, taplets, panel cut-outs, entrance switches, and panel-boxes. The last page has a racy talk on "Holoshades."

AMERICAN ELECTRICAL WORKS, Phillipsdale, R. I., have issued under date of February 15 a price schedule, in envelope form and size for bare copper wire, office and annunciator wire, and weatherproof iron wire. It includes also a freight schedule for car loads and less.

GASOLINE ENGINES.—The R. M. Cornwell Company, Syracuse, N. Y., has issued an illustrated booklet describing the Wonder gasoline engines. These engines are of the two-cycle type and are characterized by simplicity of design and operation. The outfits are compact and very light.

WIRE & TELEPHONE COMPANY OF AMERICA has issued a very neat binder in lavender cloth, quarto, for its trade literature. Bulletin 100 is the "Foreword" and is devoted to general matters on its bare and insulated wire, telephone apparatus and telephone supplies. Later bulletins will take up these and other subjects in detail.

STEAM ENGINES.—Bulletin No. 17 of the Ridgway Dynamo & Engine Company, Ridgway, Penn., describes and illustrates McEwen engines of the simple and of the tandem compound types. The illustrations represent the various constructional features of the engines and show belted-type engines, and engines direct connected to Thompson-Ryan dynamos.

TOLL TELEPHONES.—The Gray Telephone Pay Station Company, Hartford, Conn., has issued a well illustrated catalogue dealing with toll equipments for public and measured telephone service, and describing specifically Gray public pay stations for the automatic collection of telephone charges and Gray registers for measured service on private or party line.

FIRE PUMPS.—A neatly executed publication describing pumps for fire service has recently been issued by the Goulds Manufacturing Company, Seneca Falls, N. Y. An interesting description is given of the high-pressure fire protection plant installed at Coney Island, New York. In the pumping station there are three triple-acting pumps, direct-connected to three Nash vertical three-cylinder gas engines.

VARIABLE SPEED MOTORS.—The Electro-Dynamic Company, Bayonne, N. J., has issued circular No. 23, dealing with inter-pole motors of the open and semi-enclosed types. A view is given of a motor with extended shaft and without feet, which is adapted for electric hoist or crane work, where it is desired to set the motor in a shell or cradle. Circular No. 22 of the same company points out in a convincing manner the advantageous features of the inter-pole construction.

WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued a catalogue No. [illegible], covering Ward Leonard motor starters equipped with 20 steps of resistance for speed control by field regulation. The catalogue includes cuts, diagrams of connections showing internal connections, descriptions, prices, etc., covering both the plain no-voltage release type and the interlocking overload circuit breaker and no-voltage release type. This catalogue will be sent upon request.

TELEPHONES.—Bulletin No. 38 of the Sumter Telephone Manufacturing Company describes in detail the Mason multi-discharge lightning arrester in which the grounding medium is completely encircled by the conductor and exposed to it four times within each convolution, thus securing a multiplicity of discharge points and an effective dissipation of the lightning. Bulletin No. 39 of the same company contains 44 pages dealing with "New Beauty" telephones and accessories.

HOLOPHANE LITERATURE.—The Holophane Glass Company, 227-9 Fulton Street, New York City, has just issued two handsome pamphlets, one entitled "Lighting of Churches, Schools, Libraries and Hospitals," and the other "The Lighting of Theatres and Public Halls." Both are illustrated, and with the aid of the descriptive text, an excellent idea is afforded of the manner in which the Holophane prism globes have been able to improve to a remarkable degree the illumination of these places of public resort.

CIRCUIT BREAKERS.—The Ward Leonard Electric Company has issued a new catalogue covering circuit breakers, catalogue No. 19061. This catalogue differs from the last circuit breaker catalogue, No. 19043, in that the "DKE" type no-voltage and overload and the "PEL" type no-voltage release circuit breakers are described and listed. Both of these circuit breakers are catalogued for use in the protection of motors. The no-voltage and overload circuit breaker is a single pole breaker, which cannot be closed upon short circuit or overload.

THE POWER AND MINING MACHINERY COMPANY, Cudahy, Wis. (suburb of Milwaukee), will shortly have off the press the following publication, Catalogue No. 4, Rock-Crushing Plants. This is the second edition of the P. & M. M. Co.'s Catalogue No. 4. All of the matter contained in the first edition has been thoroughly revised to conform with the latest and best engineering practice. This catalogue will contain 72 pages, fully illustrated, and will be sent upon request to those interested in modern crushing plants and equipments.

STEAM ENGINES.—The 1906 catalogue of the Harrisburg Foundry & Machine Works, Harrisburg, Pa., contains a well prepared description of Fleming engines. Illustrations are given of simple engines for direct connection to electric generators and for belt driving; also of side-crank tandem compound engines, of the self-lubricating four-valve Corliss engines of the simple and compound types and the long-stroke Corliss engines; while mention is made of the fact that the company is prepared to construct the "Fleming" steam turbine.

MATTHEWS CATALOGUE.—The new catalogue of the W. N. Matthews & Brother, 227 North Second Street, St. Louis, is a handsome piece of work, containing 32 pages of text descriptive of the Stombaugh guy anchor and the Kearney cable clamp, and illustrated by numerous halftones. The cover is richly and tastefully printed in three colors. This catalogue should prove very interesting and valuable to electric light, telephone, telegraph and street railway companies, as it embodies much useful data as to the construction of pole lines. A copy will be mailed on request.

SOME ROEBLING PRODUCTS is the suggestive title of a pamphlet, oblong form, envelope size, 36 pages and cover, issued by John A. Roebling's Sons Co., Trenton, N. J. It shows the cable bridges across the East River, New York; the tall buildings with wire rope for their elevators, cup winners with wire rigging; tugs with wire hawsers, wire rope transmission cables, the electric power cables of 4427 feet span across the Cargainez Straits, wire rope fastenings, alligator wrenches, steel core bell cord, double galvanized telephone wire, copper telephone wire, coppr trolley wire and insulated wires.

STATIONARY TRANSFORMERS.—Bulletin No. D of the Electrical Manufacturing Company, Lafayette, Ind., is a neat publication dealing at length and in detail with the constructional features and operating characteristics of Hornberger. An interesting and instructive feature of the bulletin is a table showing the general and the electrical charactristics of a complete line of 60-cycle transformers. This table gives the weight of coils, weight of core, weight of case, weight of oil, total external surface, maximum temperature rise, core loss, copper loss, regulation and efficiency. These transformers have been designed for exceptionally high efficiency, and low temperature rise. The bulletin closes with the statement that "Quality is remembered long after price is forgotten."

THE SPRAGUE ELECTRIC COMPANY, New York, is sending out a unique and forcible advertisement emphasizing the idea that the popularity of the electric drive is largely due to the perfection of design and construction of that company's round type motor. The card shows a supposed niche in the Hall of Fame containing a round type motor, and the tablet underneath bears this inscription: "The Motor that Made the Electric Drive Popular." That the round type motor was one of the most prominently successful among the earliest electric motors is a fact generally known to those familiar with electrical progress, and the care uniformly exercised in the design and manufacture of these motors has greatly extended their use and firmly established their popularity in the field of mechanical drive.

News of the Trade.

THE UNION TWIST DRILL COMPANY, of Athol, Mass., is installing an electric power plant, which will have sufficient capacity to run the present plant with its recently completed addition and an addition which it is proposed to make this spring. The plant is now run by steam and water power, which will be discarded. The General Electric Company is installing the new equipment.

THE AMERICAN ENDOSCOPIC COMPANY, Providence, R. I., manufacturer of miniature lamps, pocket flash lights and other electrical specialties, has found its old plant entirely inadequate for its rapidly increasing business and has consequently been compelled to seek larger quarters. It is now located at 23 to 33 Brood Street in that city, where it has one of the most completely equipped plants in the country for turning out its line of specialties.

THE BROWN HOISTING MACHINERY COMPANY, of Cleveland, Ohio, is erecting a large electrically-operated ore-handling outfit at Toledo for the Toledo & Ohio Central Railroad. It consists of three legs of fast clam-shell plants each capable of unloading about 200 tons of ore an hour. Each leg is operated by two 235-hp motors. Two larger motors drive the entire plant, and it has a travel of about 700 feet. The outfit will have a capacity of unloading the largest vessels on the lakes in 18 hours.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, O., has just placed an order with the Electric Cable Company, 42 Broadway, New York, for the new insulating compound, Voltax, for impregnating field and armature coils. This material, which is rapidly being adopted by many of the large railway and manufacturing companies, has only recently been placed on the general market. It is cheaper than rubber insulation and with the increase in the price of pure rubber this new material is coming into very general use. The tests which have recently been made of this compound by the Electrical Testing Laboratories of New York have shown that Voltax possesses all of the insulating properties of rubber and in many cases has withstood tests far more severe than rubber. As Voltax has no injurious effects upon copper it does not require thinning before applying the compound, as there is no corrosive action whatever. Further, it is not subject to chemical change. Tests have also proven that Voltax wire and cables can be handled at all temperatures and the insulation will not crack or harden at 20 degrees Fah.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 6, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

814,021. RAILWAY TRAFFIC CONTROLLING APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Apr. 13, 1905. In order to avoid variable and indefinite movements of the semaphore arm by reason of expansion, loose joints, etc., in the connection rods, the patentee operates a fluid compression device by the rod connection, and utilizes the compressed fluid to move the semaphore arm.

814,049. METHOD OF TREATING MATTE; Woolsey M. Johnsen, Hartford, Conn. App. filed May 27, 1903. The method of treating material containing nickel and copper sulphides, which consists in roasting the same, dissolving the roasted residue in sulphuric acid, electrolizing the solution with suitable anodes, while passing into the electrolyte the gases derived from the roasting operation, and returning the acid electrolyte to the roasted material.

814,050. ELECTRICAL SMELTING PROCESS, Woolsey M. Johnson, Iola, Kan. App. filed May 24, 1904. A smelting process which consists in interposing between a charge containing low grade ore and a furnace wall, a charge containing high grade ore, thereby protecting said wall from the action of the low grade ore.

814,064. STORAGE BATTERY; Francois Mouterde, Lyon, France, App. filed July 24, 1905. A storage battery comprising a lead vessel having columns integral with its bottom and provided with flanges, a plurality of other electrodes disposed in the vessel, and a spider supporting said electrodes and terminating in a central pole, and said electrodes and said vessel being provided with Y shaped projections adapted to receive lead fibers between them.

814,075. TROLLEY CATCHER; Simeon F. Pierce, St. Paul, Minn. App. filed June 5, 1905. A fluid pressure retrieving cylinder is connected to the trolley pole, and has a piston valve which is moved to admit air to the cylinder in case of a sudden compression therein, as when the pole moves upward in leaving the wire. The admission of air serves to depress a piston and retrieve the pole.

814,083. GENERATOR OF INTERMITTENT ELECTRIC CURRENTS; Malcolm P. Ryder, White Plains, N. Y. App. filed Aug. 12, 1904. A permanent magnet has soft iron pole pieces upon which are wound bobbins forming part of the generator circuit. Two soft iron armatures are arranged to complete the magnetic circuit, either through or outside the bobbins so that a sudden e.m.f. is generated as the charge is made.

814,118. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed June 15, 1903. In combination with a telephone line, a line signaling device therefor, a testing plug, suitable connections from said plug and a suitable source of current to test the condition of the line signalling device when desired, and an operator's outfit connected with said plug whereby the said plug may be used for conversational purposes when desired.

814,123. ATOMATIC FIRE ALARM; Napoleon H. Ferland, Manchester, N. H. App. filed June 3, 1905. Patentee provides two contacts which are spring pressed toward one another but normally held apart by a strip of celluloid. The mechanism is contained in a box having a celluloid window and in case of fire the celluloid window and strip are consumed so as to give the alarm.

814,146. PANEL BOARD; Ernest R. Le Manquais, New York, N. Y. App. filed June 9, 1904. Secured to the marble panel board by the same bolt connections are two metallic clips or fixtures, one of which constitutes a rigid fork to receive the end of the fuse tube and the other a spring clip to establish electrical connection therewith.

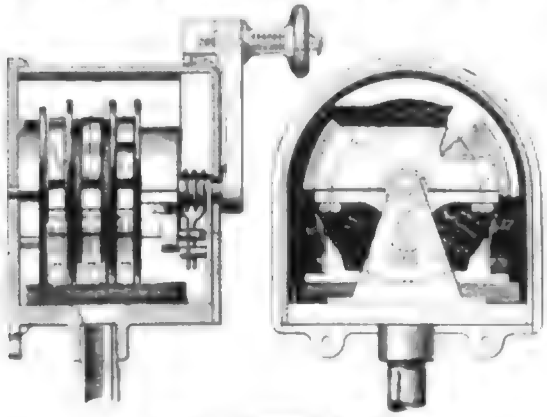
814,155. APPARATUS FOR DECOMPOSING WATER BY ELECTROLYSIS; William T. M. McCarty, Rocky Ridge, Md. App. filed Nov. 8, 1904. In combination with a tank, a partition mounted therein and dividing the tank into two chambers, said partition being provided with a line of apertures, and an electrode mounted in each compartment and connected with a suitable source of current supply and having a terminal discharge portion extending at right angles to the body of the electrode located opposite and in line with all the apertures in said partition.

814,162. ELECTRIC INCANDESCENT LAMP; William J. Phelps, Detroit, Mich. App. filed Dec. 22, 1902. A form of Hylo lamp in which the long and short filaments are connected in series between the shell and stud of the lamp. When the lamp is screwed firmly into its socket, however, an additional contact is made which cuts out the short filament.

814,217. CONDUIT OR CASING FOR ELECTRICAL CONDUCTORS; Richard H. W. Knight and Ludwig Nagel, London, Eng. App. filed Mar. 1, 1904. Sheet metal strips of C-shaped section are capable of being nested together in pairs so as to form a complete tube. Elbows and T's of corresponding construction are also provided.

814,219. AUTOMATIC TELEPHONIC INSTALLATION; Bernhard Kugelmann, Bad Kissingen, Germany. App. filed Sept. 15, 1903. In an automatic telephone system, the combination with the lines of the subscribers, of a number of switch apparatuses, each including one common speaking way, and a series of relay devices, one of such devices in each series being attached to each subscriber's line for control by the subscriber, each relay device adapted to join the corresponding line of the subscriber to the said common speaking way, and each apparatus when occupied bringing the next unoccupied switch apparatus into the sphere of control of the subscribers.

814,259. RECIPROCATING ELECTRIC MACHINE; Truman H. Aldrich, Birmingham, Ala. App. filed Apr. 5, 1905. A hollow wire coil or bobbin is slidably supported on a rod which constitutes the pole of a pair of opposed iron clad magnets. Connections are provided for reversing the polarity at the limit of forward and back movement of the movable coil.



814.324.—Controller Switch.

814,277. SWITCH KEY; Edward B. Craft, Chicago, Ill. App. filed Dec. 7, 1904. Relates to specific details of switch key for telephonic exchange switchboards.

814,302. ELECTRICAL SIGNAL SYSTEM; Fred Lacroix, San Antonio, Tex. App. filed Aug. 29, 1904. The track is divided into sections and one rail is continuously energized to a fixed potential throughout its length. The other rail is connected to a return wire through resistances of varying magnitude. The purpose is to have the strength of current in the return wire indicate the position of the train along the track.

814,303. ELECTRICAL SIGNAL SYSTEM; Fred Lacroix, San Antonio, Tex. App. filed Jan. 31, 1905. Relates to additional features of the above. In this case a special trolley is arranged to complete an indicator circuit in the engine cab, so that the engineer can ascertain the condition of switches ahead and receive train despatches.

814,314. WINDOW STOP AND BURGLAR ALARM; George H. Parker, New York, N. Y. App. filed Apr. 23, 1904. In order to permit a window to be partly opened and yet secure against the entrance of thieves, the patentee provides a stop which limits the raising movement of the window and which is designed to complete an alarm circuit in case an attempt is made to raise the window.

814,322. REVERSING SWITCH FOR ELECTRICAL CIRCUITS; Thomas S. Perkins, Wilkinsburg, Pa. App. filed June 6, 1904. Motor reversing switch operable by a pilot circuit; has two opposed solenoids acting on an intermediate plunger in the manner of a donkey pump. The plunger has various metallic rings which establish the power circuits through suitable contracting fingers.

814,323. SYSTEM OF REMOTE CONTROL FOR ELECTRIC MOTORS; Thomas S. Perkins and Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. A complete multiple control system in which the various controllers are stepped around by ratchet mechanism operable by the pilot circuit. A feature lies in an arrangement by which the controllers must all be stepped around to zero position in case an overload on the motors operates a cut-out on any car.

804,324. CONTROLLER SWITCH; Thomas S. Perkins and Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. The controller segments are spaced apart on the usual square shaft and have flat coils axially supported between them, the influence of which is to blow out the arc in whichever direction the segments are moved.

814,325. CONTROLLER OPERATING MEANS; Thomas S. Perkins and Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. The controller shaft is spring impelled in one direction and movable by a ratchet to throw on the current. The ratchet acts as an escapement to permit step by step return. A release lever is operable as a cut-out to secure quick return.

814,364. LAMP REGULATOR; Alphonsus L. Drum, Lake Forest, Ill. App. filed Mar. 28, 1905. The various lamps of a train are grouped in a single series multiple circuit receiving current from the trolley. A solenoid automatically cuts out some of the lamps in case the voltage falls below a predetermined value.

814,380. SYSTEM FOR VARIABLE SPEED OPERATION OF ALTERNATING CURRENT MOTORS; Ben. G. Lamme, Pittsburg, Pa. App. filed Oct. 8, 1904. The combination with a source of alternating current electrical energy of approximately constant frequency and a translating device, of means for varying the voltage from said source and separate means for automatically varying the frequency of current alternations supplied by said device in accordance with the voltage variations.

814,386. TELEPHONIC EXCHANGE, William M. Marean, Belvidere, Ill. App, filed June 6, 1904. In a telephone exchange, the combination of a telephone circuit, a main signal circuit leading to the central exchange, a visual indicator device located at central exchange and comprising a plurality of movable indicators, and means under the control of the subscriber for sending impulses over said signal circuit to any one of said indicators, comprising means for subsequently and automatically controlling the telephone circuit.

814,411. TELEPHONIC RELAY; John Trowbridge, Cambridge, Mass. App. filed July 14, 1903. A telephone relay comprising a receiver, its diphragm, a vibrator opposed to the receiver diaphragm and spaced therefrom, a transmitter in connection with the vibrator, and a close metallic connection between the vibrator and the diaphragm.

814,417. DYNAMO ELECTRIC MACHINE; William L. Waters, Milwaukee, Wis. App. filed June 3, 1904. In order to obtain a dynamo electric machine having the characteristics of the ordinary magnet pole type, and also those of the continuous field type as in induction motors, the patentee bridges the pole pieces with small iron rings fastened to their outer edges.

814,461. ELECTRIC DOOR RELEASING DEVICE; Libermond A. Leon, Montreal, Canada. App. filed May 8, 1905. The latch contains a weight or hammer which is raised by the act of closing the door. A magnet controlled detent releases the hammer which falls on the bolt lever and withdraws the bolt.

814,478. TELEPHONE OR TELEGRAPH SYSTEM; George Ritter, Stuttgart, Germany. App. filed June 16, 1904. The combination, with a main line circuit, and a plurality of sub-station instruments connected to said main line circuit, of a controlling device at each sub-station operating directly to render its sub-station instrument operative, an electric circuit including controlling devices, mechanism at each sub-station arranged to regulate the admission of electric current to the circuit connecting said electric devices, and to render its own disconnecting device inoperative, and means at each substation arranged to prevent the operation of its own controlling device.

814,482. LIGHTNING ARRESTER; Frank K. Singer, Wheeling, W. Va. App. filed Apr. 27, 1905. Fuse wire is contained in a tube upon the outside of which is wound a choke coil. The fuse tube is supported by fixtures which constitute part of a lightning arrester and the choke coil insures the lightning discharge taking place across the carbon blocks instead of through the fuse wire.

814,498. CAR-HANDLING APPARATUS; Frank E. Woodford, Chicago, Ill. App. Mar. 2, 1905. An apparatus for handling small ore and coal cars. The track is divided into sections, and each section has a pair of trolleys separately energized from a controlling station and which are in circuit with the motors and brake respectively of the particular car which happens to be on that section. Thus an operator for each section is able to perfectly control the movements of each car as it passes his point of the line.

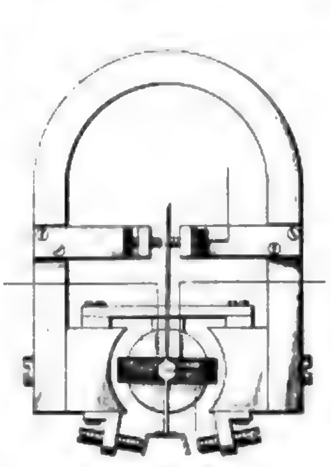
814,501. RELAY; James Allen, U. S. Army. App. filed July 31, 1905. A polarized relay constructed on the lines of an H armature magneto machine, the armature of which lies in the relay circuit.

814,537. SAFETY DEVICE FOR RAILWAY SWITCH AND SIGNAL APPARATUS; Lawrence Griffith, Yonkers, N. Y. App. filed Sept. 20, 1905. The switches are operable by electric means supplied from a power circuit, and the indicators for the switches are not operable until the power current for the switches ceases.

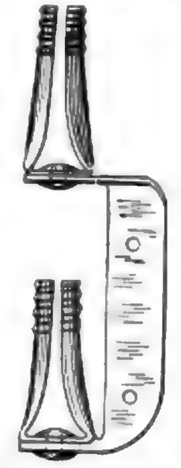
814,535. ELECTRIC SIGNAL APPARATUS; Lawrence Griffith, Yonkers, N. Y. App. filed Oct. 28, 1904. Relates to modifications of the above.

814,571. TELEPHONIC SYSTEM; Elmer A. Terpening, Geneseo, Ill. App. filed Sept. 6, 1904. In a telephone system, the combination of a party line circuit connecting a plurality of subscriber's stations and a central station, means at each subscriber's station for producing direct and alternating current in the lines and a signaling device responsive to alternating current only and at the central station a relay comprising a coil supported for oscillation in a magnetic field, and means for retarding the oscillation of said coil.

814,613. INSULATOR PIN; Frank MacKean, Chicago, Ill. App. filed Feb. 20, 1905. The patentee stamps a piece of sheet metal with two projecting opposed ears which form elements or sections of a resilient pin, having threads stamped thereon to engage the usual threads of the glass insulator.



814,501. Relay.



814,613.—Insulator pin.

814,632. SUPPORT FOR OSMIUM FILAMENTS; Carl A. von Welsbach, Vienna, Austria-Hungary. App. filed May 31, 1901. The combination of an osmium filament and a support for the same, said support composed of cintered or fritted refractory oxide, non-adherent to incandescent osmium and chemically indifferent thereto.

814,643. PLURAL SPEED ELECTRICAL CONTROLLER; George N. Eastman, Chicago, Ill. App. filed May 5, 1904. A pair of cut-out magnets are provided, one of which acts slowly on the exciter circuit of the generator and the other of which acts quickly on the main line circuit.

814,658. SAFETY DEVICE FOR RAILWAY SWITCH AND SIGNAL APPARATUS; Lawrence Griffith, Yonkers, N. Y. App. filed Nov. 5, 1904. A signal system in which the signals are operated by compressed air and in which the indicators are not operable until the air pressure is removed.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the Electrical World 16,000 *copies are printed. Total circulation for* 1906 *to date,* 216,000, *an average of* 19,636 *per week. The total circulation of the* Electrical World and Engineer *for* 1905 *was* 712,500 *copies, an average of* 13,702 *copies per issue.*

NEW YORK, SATURDAY, MARCH 24, 1906.

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The Fan Motor.

The fan motor is now as staple a part of the electrical industry as insulated wire or the incandescent lamp, but is still susceptible of improvement periodically, so that some variation in style or construction may be expected from season to season. Of such changes in this mechanism, for the year 1906, a general view is presented in our pages this week; and it is encouraging to note how many possibilities of perfection are still recognized to exist in this useful little adjunct of the light and power circuit. For several years past a large number of fan motors have been turned out, until hundreds and hundreds of thousands are to be found in daily use through the summer months. A yearly production worth, say, $1,500,000 would represent not less than 150,000 to 200,000 a year, at net prices, and the annual value seems to be somewhere around those figures. We think the product might easily be increased in bulk and amount, and that there is probably not a single central station system that has its fan motor business taken care of or developed up to the "saturation point." Hardly any one who reads this cannot mention some home or office or factory that he visits between May and October where fans could not be installed—and where perhaps the suggestion to put them in has never been made by the central station interested.

Electroplating.

The article elsewhere by Mr. A. J. Tizley illustrates the prevailing lack of knowledge of the technical principles of electroplating by those engaged in the art. The conservatism which is also a characteristic of this industry is illustrated in an old established electroplating plant recently visited, where a battery of Smee cells is still used, the reason being that this has been the practice since the works were started and it has always proven satisfactory. According to the recent Census, there are more than 1,300 electroplating plants in this country, and the annual loss of money through the conditions above indicated must aggregate a pretty sum. Electroplating appears to be generally carried on by rule of the thumb, and it is only recently that the importance of exact measurements in the practice of this art has come to be understood, and ammeters, voltmeters and precision balances introduced. Saving of power, however, is only one item, and probably less important than others relating to the purely chemical side of the art. With respect to solutions, the practice in the past appears to have been to add a spoonful of some "dope" if the deposit did not look good, and then if the appearance did not improve to add a pinch of some other "dope." Of course, none knew what the final solution really consisted of. It is not only necessary for the electroplater to measure the volts and amperes and regulate them according to the specific requirements of a given work, but he should also know the exact composition of the solutions and anodes, and should weigh with precision every material he adds to the bath. Only in this way can he properly control the operations.

But the practical electroplater is not the only one at fault, for those who should guide him have too largely devoted their attention to the more interesting—because relatively simple—phenomena of "indefinitely dilute" solutions, instead of to the actual phenomena of the electroplating bath. Fortunately a reaction is here also in evidence, though at present there is a surprising disagreement among electrochemical authorities when it comes to the consideration of the scientific side of electroplating. Taking the fact expressed in the language of the electroplater that the metallic coating will adhere to the base metal only if the two metals are such that they will "stick" together, Prof. Kahlenberg expresses this in the statement that they must alloy. Prof. Burgess thinks that the "alloying" phenomenon is not universal, and that in many cases there is "direct cohesion." However we may express this requirement, we know that if we want to plate nickel on copper, which metals alloy, there is no difficulty; on the other hand, if we want to plate nickel on lead, the lead is first plated with copper and then the copper with nickel, as the latter metal, which does not alloy with lead, would not stick if directly plated thereon. Burgess and Hambuechen's method of plating aluminum articles with gold is a further illustration, the aluminum being first plated with zinc, then with copper and finally with gold.

Another general principle that should not be lost sight of is that the electric current passing necessarily changes the electrolyte, at least in concentration. In copper plating the cathodic effect of the current is to remove copper ions from the layer of solution in intimate contact with the cathode. If a low cathodic current density is used, there is time for diffusion to bring fresh metallic copper ions into this critical change; but as the current density is increased the less will be the effects of diffusion and the more the impoverishment of the layer. Hence the well-known deleterious effects of high current density, sometimes expressed by electroplaters as the "burning effect" of the current. When the cause is understood the remedy is self-evident, it being necessary to bring continually fresh metal ions into the layer next to the cathode, which may be done by stirring the electrolyte, by the use of revolving electrodes, by heating, etc. It is most sincerely to be hoped that in the future more than in the past men of theory and practical electroplaters will work together in a co-operative spirit. The present very unsatisfactory condition of the art would, under this condition, soon be changed to the benefit of the practical man, while the electrochemist would have his knowledge of many interesting electrolytic actions largely clarified and even extended.

Fluxmeters for the Measurement of Electromagnetic Fields.

A very interesting and novel type of instrument has recently been taken up by the Cambridge Scientific Instrument Company of England. It is called the Grassot fluxmeter. It consists essentially of a D'Arsonval galvanometer in which the horizontal forces on the coil are made so small as to be insignificant in view of the powerful electromagnetic damping of the moving system. An exploring coil is used with the instrument just as in the ordinary measurement of a magnetic field with a ballistic galvanometer. In the latter case, as is well known, the period of time during which the exploration of the field is effected by the coil must be short compared with the period of oscillation of the galvanometer needle. If the needle's period be, say, thirty seconds, the motion of the exploring coil through the magnetic field ought to be completed in about three seconds, in order that the first swing of the galvanometer needle may measure the flux cut by the exploring coil. But the period of the fluxmeter coil is made enormously great by the use of a delicate suspension fibre, so that the motion of the exploring coil can be made in the most leisurely way. The deflection of the coil is also semi-permanent, instead of being a mere evanescent swing; so that the coil assumes a new position, and its displacement measures the maxwells or total flux, that has been introduced into the exploring coil. An advantage of the instrument is that it reads off maxwells directly on its scale for an exploring coil of suitable dimensions, and enables the intensity of the field in gausses to be very readily deduced. A galvanometer needle that has to be pushed back to zero, and that stays where it is put by the maxwells, is a curiosity.

Heat from Sparking Coils.

We are glad to publish a brief report of a research on this subject by Prof. Perkins. Some time since we raised the question as to the conditions of efficiency in the ignition of the charge in gasoline engines, and this paper is the first fruit of the discussion. It is directed primarily to the heat actually developed by a spark and not to the relation of this quantity to the conditions of ignition, serving therefore as a useful reconnoisance upon which to base further investigations. The measurement of the fluctuating currents and voltages involved in the operation of an induction coil is not altogether an easy matter in general, but for the limits of precision attainable in this class of investigation, Prof. Perkins' method is both simple and sufficiently precise. It could easily have been converted into a null method had occasion required further refinements. The measurement of the primary watts is on the whole the most troublesome feature of the experiment. The voltameter method gives, however, at least an approximate idea of the magnitude in question, and as might be expected the efficiencies found for the heat of the spark were low. The maximum figure was 42 per cent, and we are disposed to think that even this is higher than a more rigorous investigation would have found, and very far in excess of the efficiencies generally realized in automobile spark coils in use. This particular value was obtained with a long spark, about 0.225 inch, for which the relative efficiency of the secondary coil may be taken as much higher than for a spark across a short gap of lower virtual resistance.

The relation between different lengths of spark is an interesting and somewhat complicated one. As the spark is lengthened, both the total output of energy in the secondary coil and its distribution as between exterior and spark and interior resistance, in all its items, change. The change due to frequency can hardly be regarded as of any further significance than as a natural result of the change in the relations existing between the electrical constants of the secondary. Capacity cuts considerable figure in these high voltage spark coils and cannot be left out of account. No very simple relations between frequency, spark-length, input and efficiency can therefore be expected. For the purpose in hand it is sufficient to realize that the efficiencies are all low, in practice probably all under 20 to 25 per cent and generally much under. This point cleared up, one can more intelligently go about improving the efficiency. Now we do not quite agree that the best way to do this is to lengthen the spark-gap unless it is shown that with a long gap a given input in energy will produce a higher spark temperature than with a short gap, the coil being in each case designed for maximum efficiency. Speaking broadly, the temperature depends upon the concentration of energy, and Mr. Perkins' long gap of 0.225 in. developed only a little more than three times the heat concentrated in the shortest gap of 0.025 inch. So if the temperature at the spark is the important thing there is a reason to believe that a short gap will meet the requirement of a given temperature with less expenditure of primary energy than in the case of the long gap. A properly proportioned condenser would undoubtedly still further enable one to concentrate energy in a short spark, and with a suitable designed secondary this could probably be done with fair efficiency.

The upshot of the matter is that the final solution of the problem in hand may best be reached by working backwards, i. e., from the result of the explosion to the method of ignition. Prof. Perkins' results are most useful data to serve as guide posts on the way, and we hope he will follow up the line already laid out. The practical question to be settled is how best to obtain efficient sparking in an engine. The first point to be determined is the relation of spark length and intensity to the explosion produced. In other words, what is the maximum energy required to give first class ignition, and is it better to have this energy so distributed as to give a long spark or a short one? There is no doubt that a very weak spark will fire the explosive mixture, but will it do it as effectively as a stronger or a longer one? Probably not, and indeed there is reason to think that ignition would be more effective could it take place over a considerable area. Granted this, what if any is the difference produced by lengthening the spark and by shortening it, by using condensers, or omitting them? And beyond this, what is the comparative effect of sparks from an induction coil and the flash from a wiping contact? There is thus plenty of work ahead, and room for many workers. The end is to find out the very best way of arranging the ignition of the engine, which is an extremely important matter. If the ignition can be secured from simple dry batteries at two or three times the efficiency now usual, a long step will have been made in advance. If, on the other hand, dynamo ignition is practically needful on account of the input demanded, then the sooner the conditions to be met are put on record the better. In any case, sparking apparatus, source of energy, and spark plugs must be co-ordinated as a whole in order to get first-class results. It may be taken for granted, for instance, that the coil best suited, with a given plug, for use with dry batteries, will not be the best to use with storage batteries or dynamo. There are some thousands of automobilists daily putting up prayers or imprecations *in re* ignition, and the best that can be offered them at present is the choice between one unknown quantity and another. With the general use of four and six-cylinder engines the demands on the source of power have been greatly increased and improvements are necessary.

CIRCLE DIAGRAM OF THE COMPENSATED SERIES SINGLE-PHASE MOTOR.

Judging the motor solely by the theory connected with its operating characteristics, one of the simplest machines of the alternating-current type which has yet been produced is the compensated series motor. If one neglects the modifying effects of the short-circuit by the brush of a coil in which there exists an active e.m.f., and assumes that the cores are devoid of hysteresis, then the circuits of the motor may be treated as equivalent to a constant inductive reactance in series with which is a resistance, the value of which varies with the speed. This fact will be appreciated at once when it is remembered that the field flux is in time phase with the current through the machine; that the e.m.f. which is counter-generated in the armature by the cutting of the field flux by the armature conductors under speed conditions, is in time phase with this flux and in phase opposition to the armature current, and therefore acts as an apparent resistance in the armature circuit. Moreover, this speed-generated e.m.f. is proportional directly to the product of the speed and the current taken by the motor, and hence the apparent resistance varies directly with the speed.

The impedance diagram of such an ideal motor possesses two vectors in quadrature; one represents the constant reactance of the field and armature circuits, and the other indicates the apparent resistance of the circuits. The tangent of the angle of lag of the current behind the e.m.f. of the circuit is the ratio of the former to the latter vector. These statements apply to either the compensated or the uncompensated series motor. In the latter machine the ratio of the torque to the square of the current is the same as that in the former, but the operating power factor of the compensated motor is considerably better than that of the uncompensated machine on account of the smaller reactance of its circuits, and the torque varies more rapidly with a change in the speed when subjected to a constant impressed e.m.f. If in series with a constant reactance there be inserted a variable resistance and the combination be subjected to a constant impressed e.m.f., the current which passes through the circuit will, as is well known, have a value and phase position with reference to the e.m.f. such that it may be represented by a vector whose extremity describes the arc of a circle.

It is upon this latter fact that the construction of the circle diagram of the compensated series single-phase motor depends, as is outlined in an article by Mr. E. C. Stone, on page 610 of this issue. In the formation of the diagram the author has included the modifying effects which were neglected in the outline given above, and hence the results which are obtained are more nearly accurate than the simpler diagram would show. The assumption is made that the speed-generated e.m.f. is out of phase with the line current by an angle which depends upon the core loss and upon the losses in the short-circuited armature coil; so that the increase in the impedance of the armature under speed conditions is not wholly equivalent to the addition of resistance. Since the phase angle between the speed e.m.f. and the line current is practically constant, however, the increase in the apparent impedance is proportional to the speed, and the speed may be represented on the diagram by taking account of this fact. The input to the motor varies directly with that component of the current which is in phase with the e.m.f., while the output depends upon the losses. The author assumes that the torque varies with the square of the current, and that the output is the product of the torque and the speed. A diagram based on these assumptions could correctly represent the facts if the losses varied directly with the square of the current. The torque indicated in the diagram represents the turning moment on the armature structure, neglecting the friction and certain core losses, and, in respect to this torque, the diagram is sufficiently accurate for all practical purposes.

Arrangements for the National Electric Light Convention.

As chairman of the committee on arrangements, Mr. Arthur Williams has just issued convention circular No. 1 as to the arrangements for the convention of the National Electric Light Association, at Atlantic City, N. J., June 5, 6, 7 and 8. It is stated that no single hotel will be made headquarters, but that the association has leased Young's Pier for the week and will there hold its meetings, the secretary having his office for registration, badges and general information at the land end of the pier. The meetings will be held in the small auditorium at the middle of the pier, and the trade exhibition of apparatus will be made in the large room at the end of the pier. There will also be an exhibit of the material and methods employed for advertising purposes by central station companies. The trade exhibition space available will be over 10,000 sq. ft., and a charge not exceeding 20 cents per foot will be made for the entire week, inclusive of everything except the booth erection and any special lighting. Plans of the pier are now being distributed to the associate membership. The front of the pier with a thousand comfortable chairs is available as a music hall and sun parlor.

Special rates have been obtained from 35 hotels, of which 13 are on the ocean front. The inclusive rates for one person, American plan, range from $2 to $4 daily, without bath, and $3 to $6 daily, with bath; for two persons, from $4 to $8, without bath, and from $6 to $10, or slightly higher, with bath.

It is expected that the exhibit will include all the new and striking developments in light and power, and many important reservations of space have already been made. Some of the papers will deal with such developments. The entertainment features also will not be overlooked, but will include a reception at the new Marlborough-Blenheim on June 5, a convention banquet and a whole day excursion for the ladies to Philadelphia, with lunch at the Bellevue-Stratford. It is hoped to have in operation part of the new electrified railroad system between Philadelphia and Atlantic City.

Blending Steam and Trolley Service.

President C. S. Mellen, of the New York, New Haven & Hartford Railroad, has outlined this week his plans for a very interesting and comprehensive blending of the steam and trolley services of that great system. In a speech before the Get Together Club at Hartford Mr. Mellen said, in explanation of the scheme: "We would like to make the experiment on a large scale to determine whether the two systems of traction—steam and electric—may not be worked in common, each supplementing the other, and we would like to electrify our steam tracks between here and Waterbury, and on the Central New England Railway between here, New Hartford and Springfield, and on the east side between here and Rockville, Melrose and Springfield, and upon the Valley line between here and Middletown.

"Instead of running to and from our stations through our yards, with all the switching and delays incident thereto, we want to connect at convenient points with the street railway tracks, and for interurban service make a circuit of the principal streets, collecting and delivering suburban shoppers at the store doors, and we believe both the city and the railroad will be greatly the gainers thereby.

"No city on our lines is so favorably situated as is Hartford for the development of this idea." In order to carry it out Mr. Mellen explained that it would be necessary to substitute T-rails for the usual grooved trolley tracks. "Now, what we want," he continued, "is that you shall permit us to use on the streets where this suburban service will naturally go, the T-rails we use in other cities, New Haven, for instance, and, waiving none of your rights under your contracts, see how it will work, ascertain if the objections are real or imaginary, and if you find there are more objections than advantages after a two-years' trial, we will take up the T-rails, restore the grooved rails and go back to the old order of things.

"I am not afraid of your decision—I will trust you, and if you are afraid to trust me, I will secure the performance of my part of the contract by a good and sufficient bond to your satisfaction. Let me suggest right here that I am advised the contract requiring the use of the grooved rail is not binding in law, but I have none the less required its observance on the part of our company, and shall continue to until we can agree amicably upon its modification.

"I shall be most seriously disappointed if you force me to go elsewhere to try the experiment. The proposition is knocking at your doors—such an opportunity as no other city has to-day."

The Commercial Future of Wireless Telegraphy.

In a recent address before the Beacon Society of Boston Mr. John Stone Stone considered at length the commercial future of wireless telegraphy. Before entering on the main subject of his address he noted some recent important improvements in details. One of these is a means devised by his principal assistant, Mr. Sewell Cabot, whereby the receiving operator in wireless telegraphy can "break in" just as he does in wire telegraphy, and correct any error or ask any question of the transmitting operator that he pleases. At first it was only possible in wireless telegraphy to send about 12 words a minute with any precision whatever, while at present it is possible to send and receive as fast as on a wire line, a speed of about 40 words a minute having been attained. The invention of Mr. Cabot is of great commercial importance, for it obviates repetition to a very great extent, and one may almost say that by means of this invention twice the amount of matter can be transmitted in a given time than would otherwise be possible. In referring to the transmitting and receiving range of wireless telegraphy, he stated that at the Stone station at Portsmouth Navy Yard the dry dock *Dewey* was communicated with from a distance of 1,800 miles.

Mr. Stone said that the future of wireless telegraphy depended upon the solution of the problem of selectivity—a problem which he considered had been solved by his system. He did not believe that the wireless telegraph is going to have its greatest field in competing with transatlantic cables. The great field for a selective system of wireless telegraphy is that where the most people live and where most people wish to communicate, and that place is right on land. The opinion expressed by Marconi and Edison that the field of wireless telegraphy is in the transmission of messages over water was probably due to the fact that they spoke and wrote at a time when it was believed the matter of interference between wireless stations could not be overcome. No considerable competition would, he believed, arise between wire lines and wireless telegraph interests, but rather one will help the other. He drew a distinction between the trunk line service of wireless telegraph companies and the lines, enormously in the majority, which feed this service. The maintenance of the latter costs from 30 to 33 per cent per annum, and they do not yield enough business to pay for this maintenance, money being lost on every message practically that goes over one of the subsidiary lines. The trunk lines, however, are extremely profitable, and more than make up the deficiency. There is a great future for wireless in supplanting these feeders to telegraphic trunk lines—in doing the service now done by one and two-wire lines, and even up to the 10-wire lines. In this there would be a very handsome profit, not a mere manufacturer's profit, but a profit on the patents involved as well as on the apparatus. The selective system of wireless telegraphy will not, however, remain long on a par with wire lines in the matter of operation, but will later open up fields of its own in which wire telegraphy cannot compete because of the excessive cost of pole lines and their maintenance. As an example of new applications, Mr. Stone stated that within the next year it will be possible for a ship more than 100 miles away from the coast to obtain exactly the bearing of any light on the coast within 150 or 250 miles of the vessel; and not only of one light, but of two or more, and thereby be enabled to determine exactly her position.

Utilization of Electricity in Coast Defense.

The report of the National Coast Defense Board recently submitted to Congress by the President contains the interesting and significant statement that "Electricity has become of vital importance to an efficient system of gun defense." The total estimates of the National Coast Defense Board for the completion of the defense of the United States and Insular possessions amount to seventy-four million dollars, and of this sum twenty-seven million dollars is the estimate for apparatus and equipment more or less dependent upon electricity, divided as follows: Power plants, $6,250,000; submarine mine material, $5,650,000; searchlights, $3,486,000, and fire control apparatus, $11,793,000. The estimate for power plants includes the necessary buildings, but aside from this the balance is for electrical apparatus; the $5,650,000 for submarine mine material is largely made up of cable and kindred appliances. Searchlights are entirely an electrical output, and the fire control apparatus includes cable for base lines, lines of information, telephones, and so on.

The committee of the National Coast Defense Board having in charge this question, made the following recommendations:

1. That the electrical power for fortification and defense purposes be furnished by an adequate steam-driven, direct-current producing central power plant, all machinery to conform in type to approved commercial standards.

2. That each battery, or group of batteries, depending upon local conditions, be equipped with direct-current generators, gas or oil-engine driven, installed as a reserve to the central plant.

3. That searchlights, except such as are in close proximity to the central plant, be provided with and operated by self-contained units.

4. That the torpedo casemates be equipped as heretofore with independent power for submarine mine purposes, as an integral part of the submarine mine defense.

5. That when alternating currents are essential, they should be obtained, if practicable, from direct current by means of a suitable converter; or, if more economical, by a separate alternating unit.

6. That the current from the fortification central plants, when not needed for fortification service, may be used for garrison purposes when such distribution does not require too large an increase in the size and number of units.

7. That if garrison service requires alternating current, this should be supplied by the central plant, either through a suitable converter or from alternating-current units specially installed for the purpose in the central station; such increase, however, and all additional cost due to post lighting being a charge against the proper appropriation.

8. That uniformity of types and accessories is desirable.

9. That all electrical power plants for the use of fortifications shall be operated by the artillery.

The decision to employ the direct current was only reached after extended discussion and consideration of many of the peculiar needs of fortification service, as was the recommendation for a central power plant. This central plant will be protected as well as possible from the enemy's fire, but the reserve plants in each battery are provided in case a stray shot should put either the central plant or its communicating cables out of commission. All cables are either subterranean or submarine to protect them as far as may be from accidental injury. The recommendation that all power plants for use of fortifications shall be operated by the artillery means that they will be operated by the enlisted personnel, civilians not being employed therein.

The system of fire control and direction depends largely upon electrical communication, and the Board lays considerable emphasis on the adopted system as adding largely to the effectiveness of the armament; in fact, the statement is made that much of the reduction from the number of guns heretofore considered necessary is due to the advantages of an efficient fire control system.

At each end of a base line, about 2,000 yards long, is placed a powerful telescope—a vertical base range finder, as a matter of fact, for use in emergencies. Electrically-connected clocks at regular intervals sound a bell in each base-end station, when an observation of the angle of the target is made and transmitted by telephone from the secondary to the primary station where the information is plotted and the range and direction of the target from the gun are determined. This information is then corrected for the various ballistic incidents affecting the flight of the projectile, such as temperature, humidity, wind and so on, and the corrected data are sent to the gun. The rapidity with which this is done is remarkable, as observations are made every twenty seconds and the gunner is as often informed of the exact range, so that the gun is kept constantly trained in such position that the projectile will reach a given spot at the same instant as the target. The flight of the projectile varies from 15 to 50 seconds, depending on the range and gun, so that it may be seen that something more is necessary than merely aiming the gun at the target, for the speed of modern war vessels would carry them beyond the danger zone while the projectile was in flight if this were done.

Some idea of the magnitude of the installation for range finding and fire control may be had from the fact that in one of the fortifications near New York City there is to be installed 26,000 ft. of lead cable, 30,000 conductor-ft. inside wire, 262,500 conductor-ft. (about 50 miles) of submarine cable, and 810,000 conductor-ft. (153 miles) of subterranean cable.

As submarine cables enter so largely in the system of range finding and fire control, the proper installation and maintenance of these cables require special appliances and boats, and the Board recommends the purchase of seven such boats, to be stationed at various harbors about the coast. Much has also been learned about the use of searchlights during the various combined army and navy manœuvres.

Right of Appeal from Interlocutory Decrees.

An interesting opinion was handed down by the United States Supreme Court on the 19th inst. in the case of National Enameling & Stamping Company vs. New England Enameling Company, and in the case of Automatic Switch Company vs. Cutler-Hammer Manufacturing Company, which settled a somewhat uncertain point of practice in patent cases, affecting the rights of the different parties to appeal from interlocutory orders or decrees. It is generally recognized that either aggrieved party, or both aggrieved parties, may appeal from a final decree of one of the United States Circuit Courts to the Court of Appeals of the same circuit. It is also recognized that an appeal may be taken by the aggrieved party from an interlocutory decree granting an injunction or appointing a receiver. The question as to whether or not the party in whose favor an injunction is granted by an interlocutory decree, may appeal, on some other point, from such decree, has been involved in some doubt, and this is the question which was settled by the Supreme Court in its opinion. The statute giving the right of appeal from interlocutory decrees is to the effect that such an appeal may be taken when the decree grants an injunction or appoints a receiver. It is silent, however, as to which party has the right to this appeal.

In one of the two above cases it was held in the Circuit Court that three of the claims of the patent sued upon were invalid, that four were valid but were not infringed by the defendant, that five of said claims were valid and infringed, and that as to said five claims, an injunction should issue. The question of damages sustained by the complainant was referred to a master. A final decree could not be entered in the case until the master's report had been made and approved, but an interlocutory decree was entered granting an injunction against the defendant. From this latter decree there was no question as to the defandant's right to appeal, but the complainant also claimed the right to appeal from the finding of the court that three of his claims were invalid and four were not infringed. The Court of Appeals dismissed the complainant's appeal and the matter was then taken to the Supreme Court on mandamus proceedings to have the complainant's appeal reinstated and heard by the Court of Appeals. The argument was made by the complainant that as the interlocutory decree of the Circuit Court granted an injunction, either party had the right to appeal. The mandamus was refused by the Supreme Court, however, on the ground that the complainant could appeal only from a final decree. This settled the heretofore doubtful point as to the right of either party to appeal from an interlocutory decree which granted an injunction.

Electrical Club of New York.

The Electrical Club of New York has been organized as a down-town luncheon club, and in about two weeks will occupy quarters now being fitted up at 16 Park Place. A large space has been secured on the third floor of the handsome modern office building at this address, and about $4,000 are being expended in fitting it up for the purposes of the club. There will be a large dining-room, a small dining-room, a billiard room and a lounging-room. An arrangement has been made for catering service with Kalil's restaurant, which is one of the best in New York City, and occupies all of the ground floor of the building, together with the basement, which is also very handsomely fitted up as a rathskeller. This arrangement insures an extremely satisfactory bill of fare and table service. One hundred and ten members have already been enrolled and it is expected that the club will be opened with a membership of 150. The present enrollment is well distributed among manufacturers, contractors, jobbers and electric lighting and telephone men. The initiation fee for resident members is $30 and for non-resident members $25, the annual dues being $25 and $15, respectively. Following is a list of the board of managers: G. J. P. Hall, president; H. L. Shippy, vice-president; R. B. Corey, secretary; C. P. Scott, treasurer; Messrs. E. B. Latham, H. T. Johnson, C. I. Hills, C. W. Price and E. F. Keefer.

Another Bidder for a New Subway in New York City.

In a letter to the chairman of the Rapid Transit Subway Commission, Mr. Frank J. Sprague stated that without offering any argument on the question of the advisability of separating, on future subways, contracts for equipment and operation from those of construction, if such a separation be made either by virtue of a decision on the part of the Rapid Transit Commission with plenary power, or because of any mandatory provision of new laws, he will be prepared to bid for the equipment and operation of any subway not operated as a branch of the existing one, but in competition therewith, on plans which will insure a maximum carrying capacity and a greater measure of safety in operation. Mr. Sprague also offered to lay before the commission certain essential facts and conclusions relating to existing equipment and operation as viewed in the light of contract requirements and results accomplished, to the end that there may be incorporated certain essential requirements beneficial to the city and equally binding upon all bidders. We understand that this latter statement has been placed before the commission.

Alternating-Current Railway Systems.

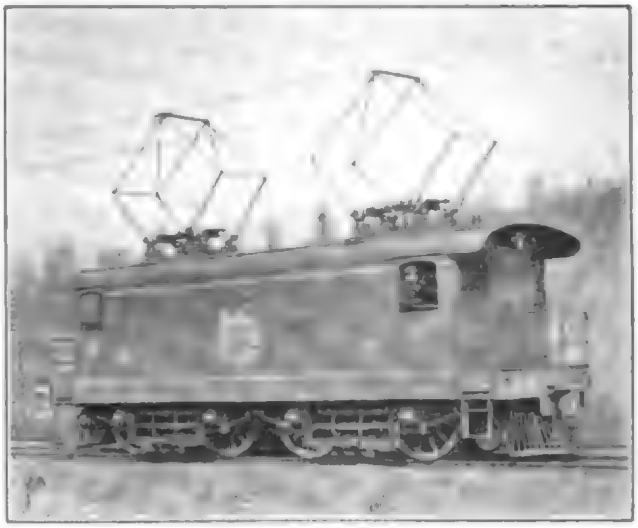
At a meeting of the New York Railway Club, held on March 16, Mr. B. G. Lamme presented a paper dealing with alternating-current systems for heavy railway service, and which dwelt in considerable detail on the equipment designed for the New York, New Haven & Hartford Railroad. A brief abstract of the paper and discussion is given below, more extended notice being reserved for another issue.

The main power house will contain 5,500-kw, three-phase generators driven by steam turbines. Only one phase of each generator will be used at present, so that each machine is rated at 3,750 kw. The 25-cycle currents are fed directly into the catenary trolley system at 11,000 volts.

A view of one of the New Haven locomotives is shown herewith. The running gear consists of two trucks on each of which are mounted two 250-hp, single-phase compensated series motors. The motors are of the gearless type, having a full-load speed of about 225 r.p.m. The armature is not placed directly on the shaft, but is built up on a quill through which the car axle passes. The torque from the armature is transmitted to the wheels through springs which also serve to keep the axis of the armature parallel to the axle of the locomotive. The motors are cooled by air from the blower used for cooling the lowering transformers during alternating-current operation, and the starting resistances during direct-current operation.

The windings of the machines are connected permanently in parallel and require about 450 volts at the terminals on alternating current and from 550 to 600 volts on direct current. On the direct-current part of the line, current is taken from the third rail system, the motors being controlled according to the usual series parallel method. On alternating current the supply voltage is varied, there being no change in the motor connections. No resistance is used in regular running, although a slight amount is used in passing from one working step to the next. There are two transformers for decreasing the potential from 11,000 volts to the value used at the motors.

The controller system is arranged for multiple-unit operation, so that two or more locomotives may be coupled to the same load. The main controllers are of the electro-pneumatic unit switch type, and are operated through low-potential relays by means of master controllers, one of which is placed at each end of the cab. Each locomotive is provided with two pantagraph-type, high-tension bow trolleys for collecting alternating current, and with eight shoes for making contact with the low-potential, direct-current third rail. A low-tension overhead direct-current pantagraph trolley is also used in order to conform with certain New York Central requirements.



ALTERNATING-CURRENT LOCOMOTIVE.

Each locomotive is expected to handle a 200-ton train in local service on a schedule of 26 miles per hour, the maximum speed being 45 m.p.h. A single locomotive will be able to haul a 250-ton train on through service. For heavier trains it is intended to couple two locomotives together and operate them in multiple.

Mr. W. J. Wilgus said that the motives that guided the New York Central in electrifying the Grand Central division were the elimination of smoke in the tunnel and the improvement of the passenger service. He stated that where a steam railroad finds it desirable to change its motive power it should adopt the system which has been found best by the interurban railways, namely, the multiple unit system, with trains of any desired length and at convenient intervals.

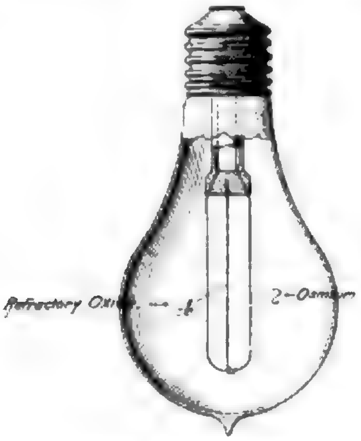
Mr. Calvert Townley, of the New York, New Haven & Hartford Railroad, showed why it was necessary for this road to be electrified. In discussing the selection of alternating-current, high-potential circuits in preference to low-potential, direct-current, Mr. Townley stated that in the former system there is only one link between the bus-bar and the locomotive, namely, the trolley wire. This one link is less liable to cause trouble than if there were used a high-voltage transmission system, a high-tension switchboard, step-down transformers, rotary converters, a direct-current switchboard, a storage battery, a system of direct-current feeders and a 600-volt trolley wire. Investigation seems not to warrant the assumption that the additional risk in using a 11,000-volt trolley wire would afford the possibilities for trouble which would be introduced by the seven or eight links between the power house and the locomotives.

Frank J. Sprague stated that the direct-current railway work had advanced to the stage where it is possible to use 1,500-volt motors. The existence of electrolysis is undeniable, but it would make little difference on a trunk line which, unlike tracks laid in city streets, is not in proximity to water or gas pipes for considerable distances. It appeared that with an 11,000-volt circuit the combined resistance of the trolley wire and rails would give a drop so large that the difference of potential between the rails and the ground would be about 5 per cent of the total potential, or about 500 volts. The effect of such a difference of potential on the telegraph and telephone wires adjoining can be easily imagined. He also asserted that the draw-bar pull of a single-phase locomotive is inferior to that of a direct-current locomotive under similar conditions.

Mr. Lamme, in closing the discussion, took up first the question of flexibility. He said that the alternating-current system had been arranged to make use of the multiple unit control just as well as the direct current. As regards the rail losses, Mr. Sprague's specific figures are correct, but comparing the 11,000-volt New Haven system with the 600-volt New York Central system he thought that the losses in power would turn out to be the other way. As to draw-bar pull, repeated experiments had demonstrated that there are no essential differences between alternating and direct-current locomotives of the same power.

Support for Osmium Filaments.

Osmium filaments for incandescent electric lamps when brought to a dazzling white heat are quite flexible, so that if brought into a horizontal or inclined position they tend to droop or sag by their own weight. Moreover, owing to the relatively high specific gravity of osmium and a certain degree of brittleness inherent in the filaments, the latter are particularly liable to be broken during transportation, the lamps being of necessity frequently exposed to more or less violent shocks and jars. To obviate these disadvantages and dangers, it is desirable to provide the osmium filament with a suitable support or supports, suitably disposed within the lamp bulb, so as to maintain the filament against excessive flexure or vibration under the varying conditions of use of the lamp and the vicissitudes of shipment and of handling. In a patent issued March 6 to C. A. von Welsbach it is stated that a satisfactory material for the support of osmium filaments is found in an intimate mixture of about ten parts, by weight, of pure thor oxide and about one part by weight, of magnesia. These oxids are mixed in a powdered form and used with a viscous binding material consisting of a solution of sugar. The paste thus produced is shaped into filaments which are dried and subsequently burned in free air until all the organic substance is consumed. Finally they are subjected to a very high temperature until the particles are sintered together. The support is non-adherent to incandescent osmium and is chemically indifferent thereto.



OSMIUM FILAMENT LAMP.

CURRENT NEWS AND NOTES.

MAYOR DUNNE ON ANOTHER TACK.—A dispatch from Chicago states that action was taken by Mayor Dunne on March 14 to get temporary revenue from the street railway companies through car licenses, pending the final settlement of the traction question. An ordinance is being drafted for the licensing of every car.

LARGE CANADIAN PROJECT.—Advices from Montreal state that President Domville, of the Canada Central Electric Railway, says London capitalists have subscribed $20,000,000 for stocks, and that work will be started at once on an electric line from Montreal to Ottawa, thence westward to Toronto. The line will be 670 miles in length. It will invade the territory held between the Canadian Pacific and Grand Trunk Railways.

CONTROL OF WIRELESS.—A special dispatch from Washington of March 17 says: "Legislation for government control of commercial wireless telegraph stations, in accordance with the recommendations of the interdepartmental board appointed by the President two years ago, will be urged on Congress by Secretary Bonaparte. Under the terms of a bill drafted by the board commercial wireless stations would be subject to regulation by the Department of Commerce and Labor, and no station could be established until a license had been obtained. This bill has been pigeonholed until now, but the interests of the navy are said to make it imperative that private stations be regulated because of their interference with the Government service. The bill proposing to enact the desired legislation will probably be introduced in the House and Senate at this session."

MUNICIPAL OWNERSHIP INQUIRY.—In regard to the municipal ownership inquiry now being conducted here and abroad, a cable dispatch from London of March 17 says: "The American commission representing the National Civic Federation has opened a London office and settled down to an exhaustive investigation of municipal ownership, gas, tramways, electricity and supplies. It has selected half a dozen towns conspicuous for excellence of gas, tramway and electric plants, operated either by local authorities or by private corporations, and will make a close examination of the mechanism. The reports of engineering experts will be supplemented by critical analysis of financial results by accountants. The inquiry will be extended to other towns, and the mechanical resources and economic results of municipal and private management will be carefully compared. Incidentally, the relations of municipal trading and local taxation will be brought out. Milo R. Maltbie is conducting the work of the central office with skill and efficiency. J. W. Sullivan has visited Birmingham, Leicester, Sheffield and Manchester, and has started the work of investigation. John B. Klumpp is examining gas and electric plants, and R. C. James is studying municipal accounts. N. M. Crawford, the Hartford street railway engineer, and Albert E. Winchester, superintendent of the South Norwalk electric works, are expected in London within a fortnight. A staff of two accountants from the tramway, gas and electric engineers has been organized for carrying on the work under the six American commissioners, and Birmingham, Manchester, Sheffield, Liverpool, Glasgow and Newcastle will be the towns chosen for thorough investigation. Bristol, Leeds, Dublin and other towns may be included in this practical survey of municipal activities in the United Kingdom."

BRITISH TELEPHONY.—The National Telephone Company, of England, reports that 1,053,000,000 messages were sent over its system in 1905. The increase in the use of the telephone is shown by the fact that 1905 calls were 53,000,000 in excess of 1904.

AUTOMOBILE IGNITION.—At the meeting of the Automobile Club of America on March 27, at the clubhouse, 753 Fifth Avenue, New York City, Mr. Clarence B. Brokaw will lecture on "Various Methods of Ignition: Dry and Storage Batteries, Dynamos, High and Low-Tension Magnetos."

POWER IN MEXICO.—The Mexican Light & Power Company announces that it has two units in operation from its electrical plant at Necaxa, and has closed its steam plant in the City of Mexico; 13,000 hp is being delivered into Mexico City and 4,500 into the El Oro mining district. The Necaxa system was illustrated and described in these pages last year.

N. E. L. A. TRANSPORTATION.—Mr. G. F. Porter, master of transportation of the National Electric Light Association, informs us that the Southeastern Passenger Association and Western Passenger Association have authorized a rate of a fare and one-third, on the certificate plan, from points in their respective territories to Atlantic City and return, for delegates and their friends attending the twenty-ninth convention of this association, to be held at Atlantic City, N. J., June 5 to 8, inclusive.

LONG ISLAND THIRD RAIL.—The electrification of the Long Island Railroad system is going forward steadily and already comprises 96 miles of single track over which 172 scheduled trains run daily. A host of summer residents on Long Island are looking forward anxiously and eagerly to the months when they will have to test the improvement in the train service effected by electricity, as compared with last summer, when the conditions of the period of transition were frequently intolerable.

SALT LAKE ELECTRICAL SHOW.—The electrical show fever is becoming epidemic, and will probably have to run its course. Salt Lake City is now to have a show and a number of people connected with electrical interests there and with the Utah Light & Railway Company have organized such an affair to be held for ten days beginning April 2. It is the first of the kind in that part of the country and ought to prove atractive. The announcement from Mr. B. W. Mendenhall, chairman of the publicity committee, says that the show is already an assured success.

A PRIZE ESSAY.—To encourage local interest in, and appreciation of, the benefits of electric current supply for the household, the Janesville, Wis., Electric Company offered three prizes for essays on the subject by students in the high school, the prizes being $10, $5 and $2.50. Some excellent work was turned in and the first prize was won by Wallace Mills, son of Dr. J. Mills, secretary of the Palmer Memorial Hospital. The essay is printed by the local *Gazette*, and its succinct enumeration of the things that electricity can do for the family and the home cannot fail to be productive of inquiry and increased consumption of power and introduction of apparatus.

UNVEILING STATUES is a performance that is not always gone through gracefully or without hitches. Mr. J. S. Hill, an electrical engineer connected with the Interior Department, has invented a new apparatus for use in the unveiling of statues. The invention consists of a series of magnets and electrical apparatus placed at different points in the drapery concealing the statue to be unveiled. By its use the covering falls gracefully from the figure, and the hitches which so frequently occur in the removal of the drapery from statues to be unveiled are avoided. Mr. Hill has not secured a patent on his device and will give it to the French Government if it is desired for the approaching ceremony in connection with the presentation of the Franklin statue in Paris.

HARMONIC SIGNALING.—At Pittsburg, on March 13, 235 electrical engineers gathered at the Carnegie Technical School at a meeting of the Pittsburg branch of the American Institute of Electrical Engineers, Chairman S. P. Grase presiding. Telephony was the subject discussed. Harmonic signaling party line telephone systems was the most prominent point brought out by the discussion. The following were the speakers and topics: A. D. T. Libby, power engineer Dean Electric Company, "Power Apparatus for Harmonic System"; R. L. A. Snyder, construction engineer Central District & Printing Telephone Company, "Telephone Cables"; L. Millheizer, superintendent of maintenance Pittsburg & Allegheny Telephone Company, "Advantages of Harmonic System"; M. C. Rorty, traffic superintendent Central District & Printing Telephone Company, "Telephone Traffic"; S. P. Grace, chief engineer Central District & Printing Telephone Company, "The Telephone Line."

TELEPHONE BEGINNINGS.—At the annual banquet of the Brantford (Ontario) Board of Trade, interest centered largely in the presence of Prof. Alexander Graham Bell, inventor of the telephone, whose name and fame Brantford will shortly perpetuate by the erection of a suitable memorial in that city, which is the birthplace of the telephone. Prof. Bell told the story of his work at Brantford, where the first actual transmission of speech took place, in the summer of 1876. "It took place," said Dr. Bell, "over the telegraph wires of the Dominion Company, extending from Brantford to Mount Pleasant, a distance of five miles." Mr. Bell was at the Mount Pleasant, or receiving, end of the wire, the messages being transmitted only one way, as the instruments would not permit of reciprocal service. A given time was fixed when his uncle should speak into the transmitter at Brantford. At the receiving end Bell waited patiently, and when the time came he heard quite distinctly his uncle's voice five miles distant, the first words being "To be or not to be." "It was a case of to be," the speaker remarked, amid applause. Other similar tests followed in various parts and the inventor then gave his attention to perfecting the invention. On March 10, 1876, the first telephone message was sent by Dr. Bell, in Boston, to his co-worker, Mr. Thomas A. Watson, at a boarding house in Exeter Place, and in June the apparatus was shown at the Philadelphia Centennial Exposition.

INTRODUCING ELECTRIC FLATIRONS.—A great many central stations, especially in smaller towns, have experienced somewhat indifferent success in attempts to induce customers to try electric flatirons. This is largely because proper methods have not been followed or because the work has been carried on in a half-hearted manner. Many managers of central stations have considered that they have given such devices a fair introduction when they sent manufacturer's circulars and literature enclosed with monthly statements or have given to manufacturers lists of their most likely customers, so that they do the circularizing themselves. Other managers have fitted up irons in their offices and have given practical demonstrations of the advantages of the devices whenever good customers have happened in the office. Some have assisted local supply houses in introducing the devices, while a comparatively few have had sufficient faith to buy a few and give demonstrations in homes of prospective customers. The W. J. Barr Manufacturing Company, of Cleveland, Ohio, manufacturer of a line of irons, is carrying on an interesting campaign of missionary work. The company has a number of representatives constantly in the field, who go to lighting plants, secure the names of possible customers, and place irons in the hands of such people on two weeks' trial. They make personal demonstrations and give thorough instructions as to how the devices should be used, indicate the best sizes for certain service, and otherwise convince customers that this is a practical, convenient and economical innovation. Then the company either closes up the orders or gets the lighting company to do it. In the latter case the lighting company is given a trade discount and allowed 30 days' time in which to collect from customers.

JAPANESE WIRELESS TELEPHONE.—A dispatch from Tokio, Japan, March 15 states that the Admiralty has announced the invention of a wireless telephone by an engineer named Kimura. Great as the Japanese are in the practice of the arts, their inventions still seem to be few and far between.

LYNN ENGINEERING SOCIETY.—The Lynn General Electric Engineering Society has had its annual election, and the new officers are as follows: President, Mr. R. Fleming; vice-president, Mr. G. E. Sanford; secretary, Mr. J. A. Howe; treasurer, Mr E M. E. Humphries, and assistant treasurer, Mr. F. M. Shaw.

APPARATUS FOR BRAZIL.—The government budget estimates of expenditure of Brazil for 1906 make provision for the disbursement of certain sums on meteorological apparatus, light houses, life-saving apparatus, submarine construction, telegraph and telephone lines. Provision is also made for the free importation of hydro-electric plants.

POLES AT LOS ANGELES, CAL.—All poles and overhead wires owned by telephone and electric lighting companies in Los Angeles have been ordered down by the municipal authorities in an extended district in the business section of the city, as defined by a conduit ordinance just passed. Seventeen corporations have been notified that they must comply with this regulation.

TANNING BY ELECTRICITY.—United States Vice-Consul-General Hill, of Halifax, Nova Scotia, reports that the demonstration plant there for the tanning of leather by electricity has proven a success, and a company will now start a regular tannery. The rights for Canada have been purchased from the Boston inventor. This process is said to take only thirty days to manufacture against the three to four months of the old methods, and produces better leather.

USE OF MEANS OF COMMUNICATION.—It is stated that in 1904 the number of letters and postal cards in the United States per 1,000 population were 65,406; of telegrams, 1,125, of telephone talks, 40,600. In Europe the number of letters and postals per 1,000 were 29,717; of telegrams, 738, and of telephone talks, 6,904. The ratio of letters and telegrams appears to be diminishing rapidly on account of telephonic growth. The use of the picture postal must distort the figures somewhat, but it may be some time before that craze dies out.

THE DUTCH POINT STATION.—In the hurried preparation of descriptive material, the name of the designing engineer is often divorced from his work; and if the latter be especially distinguished by extraordinary skill in overcoming almost insuperable obstacles or is an example of particularly good engineering, this chance omission works an injustice. It is with pleasure, therefore, that we accord this belated recognition of work well done at the Dutch Point Station of the Hartford Electric Light Company, lately described in our pages, to Westinghouse, Church, Kerr & Co., who designed and constructed this property from the bottom of its difficult foundations to its last detail of refinement.

TELEGRAPH RIGHTS IN CHICAGO.—According to a dispatch from Chicago Assistant Corporation Counsel Maclay Hoyne declares it as his opinion that the Western Union Telegraph Company and the Postal Telegraph Company have no rights in that city. Mr. Hoyne holds that under the decision of the United States Supreme Court on the Ninety-nine-Year act, the City Council may pass a general ordinance compelling the telegraph companies to pay for the right to occupy streets with their poles and wires, and also on their interstate business passing through Chicago. Mr. Hoyne declares that any rights the telegraph companies may have had in the past are done away with by this decision, and that the city, if the companies refuse to pay compensation, can take steps to oust them from the city.

HAMILTON (OHIO) MUNICIPALISM.—The *Ohio State Journal* of March 11 says: "Gross mismanagement of the municipal electric light plant, the gas plant and the water works are the features of the criticism by the Bureau of Uniform Accounting Examiners in their report upon the affairs of Hamilton, Butler County, filed yesterday. It is stated that ex-officials, present officials and prominent business men of political influence have been furnished free light and fuel service for months, while private enterprises have been allowed thousands of dollars' worth of similar service. The delinquent list of patrons of all three plants is surprisingly large and altogether the report indicates a gross laxness in the management of all three plants. All of the accounts of the three plants are badly muddled and poorly kept."

ALUMINUM PRODUCTION.—It is estimated by the *Wall Street Journal* that the output of aluminum during the year 1905 amounted to 10,000,000 pounds, and as the Pittsburg Reduction Company, the sole manufacturer of the metal in the United States, is increasing the capacity of its plants with expectations that by the end of the current year production will be doubled, it can be readily approximated what the 1907 output will be The aluminum industry in this country began in 1883 with an output of but 83 lb.; this had nearly doubled in the next year and in 1885 amounted to 283 lb. In 1890 it had grown to 61,281 lb.; to 920,000 five years later and to 7,150,000 lb. in 1900. Some few years before the manufacture of the metal in the United States was commenced the first recorded importation of aluminum was made when an amount, not given, but valued at $98, was brought into this country, in 1870.

FLOW AT NIAGARA.—In a recent editorial on the alleged impending destruction of the American Falls, the New York *Times* says: "That Senator Teller has spoken hastily and inadvisedly the following facts show: Dr. John M. Clarke, the New York State Geologist, says that the sill or edge of the falls is ten feet higher on the American than on the Canadian side; the waters at the crest of the American side are ten feet shallower. Let the entire flow be reduced by 80,000 cubic feet a second and the American Falls will have vanished, leaving a precipice of dry rock. The charters of the two American and three Canadian companies already allow an abstraction of 48,000 cubic feet a second, and developments on the Canadian side have been planned that will require the use of an additional 70,000 cubic feet a second for power purposes. Engineering difficulties, park restrictions and legislative prohibitions have effectually discouraged efforts on this side to further deplete the falls. Yet an increased allowance by the Canadian authorities of 32,000 cubic feet a second would sound the death knell of the American Niagara."

THE METRIC SYSTEM IN CANADA.—United States Consul Seyfert, of Stratford, reports an active movement in Canada that has for its object the adoption of the metric system of weights and measures. Active propaganda is at work to have the question properly presented to the Canadian people. The consul writes: "With a view of adopting the metric system in weights and measures at an early day the Canadian Government is preparing and educating the people for the change. Prof. J. C. McLennan, of the University of Toronto, has been engaged by the Dominion Government to devote the next year to explaining the system in a series of lectures in all the leading cities from Halifax to Vancouver. The professor delivered his first lecture on the subject at Stratford February 7, before the Board of Trade. According to his explanation it is the object of the Canadian Government to secure a uniform standard of weights and measures throughout the entire British Empire, and thus to advance trade relations among the different colonies of the empire. The Board of Trade at Stratford unanimously adopted resolutions, urging adoption of the system."

OHIO ELECTRIC LIGHT CONVENTION.—The place and date of the next convention of the Ohio Electric Light Association have been arranged. It will be at Hotel Victory, Put-in-Bay Island, August 21, 22 and 23. The first session will probably be held Tuesday evening, August 21.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.—The date of the meeting of the Southwestern Electrical and Gas Association has been changed from the second Tuesday in May to May 16, 17 and 18. It will be held at Galveston, Tex. Frank J. Duffy, of Beaumont, Tex., is secretary of the association.

POWER OF THE RHINE.—United States Consul Brittain, of Kehl, writes that the German manufacturers of upper Alsace and upper Baden are perfecting plans to develop the water power of the Rhine. The fall of the river between Basle and Neuenburg is 267 ft. and between Neuenburg and Breisach 77 ft. It is proposed to erect three power houses, the first at Rheinweiler, with 60,000 hp. to supply the city of Mulhausen. The power house to be constructed at Breisach will develop 24,000 hp.

FOREIGN TRADE.—The Bureau of Statistics of the Department of Commerce and Labor reports a splendid foreign trade for February. The imports were $104,201,884, as compared with $103,057,052 last year; but the exports were $141,710,650 as compared with $109,024,019. The eight months, including February, shows imports of $799,926,525 and exports of $1,198,346,309, a merchandise trade balance of $398,419,784, or over one hundred millions more than for the same period last year, and about five millions more than 1904.

WESTERN UNION JUBILEE.—An interesting telegraph jubilee is near at hand. The Western Union Telegraph Company on April 4 will have rounded out 50 years of corporate existence. A charter was granted to the company on April 4, 1856. Its immediate predecessor was the New York and Mississippi Valley Printing & Telegraph Company, which was merged with the Western Union Company. The company now has a network of wires and cables under the North Atlantic and throughout the North American Continent. Up to the time of the foundation of the company the telegraph development of the country had been almost as chaotic as that which has been witnessed during the last five years in independent telephony.

SINGLE-PHASE FOR ENGLAND.—The London, Brighton & South Coast Railroad Company, of England, has decided to operate part of its lines by the Winter-Eichberg single-phase alternating-current electric traction system, the British patents for which are controlled by General Electric interests. There will be about 75 miles of track from London to Brighton, etc., electrified at a cost of about $3,000,000. All trains entering both the London terminals will be handled by electric locomotives. Thirteen tracks are operated at Victoria and eleven at London Bridge. Each train will consist of three cars, two being motor cars, each with four motors developing 600 hp. This is the largest conversion contract so far in England, but others are said to be coming.

ELECTRIC POWER IN INDIA.—Plans are now being perfected for the generation of electric power on a large scale in the Punjab for transmission to Lahore and Amritsar, the Punjab Power Association of London having been formed for the purpose. The power is to be generated on the Dari Canal and transmitted over a distance of 70 miles to Lahore and 100 miles to Amritsar. Coal at the points of delivery of the power now costs from $5 to $6 a ton, and it is expected that the low price at which electric power will be supplied will give a general interest to industrial undertakings at both cities. The United Provinces Power Association of London has also been formed to develop water power on the Jumna River and to transmit electric power to Delhi, 140 miles distant, and possibly to Simla, 95 miles distant in the opposite direction.

POWER FOR OGDENSBURG, N. Y.—A special telegram from Potsdam, N. Y., of March 17 says: "The longest electrical power transmission line in the East, with the exception of lines running from Niagara Falls, was successfully put in operation here at midnight last night. It is the transmission line of the Northern Power Company, of Potsdam. The power is developed at the plant of the Hannawa Falls Water Power Company, at Hannawa Falls, on the Raquete River, near here, and runs across the country 35 miles to the city of Ogdensburg, where the power is delivered to the Ogdensburg Street Railway Company, which uses it to operate the street railway and lighting systems of that city. A number of engineers were present to witness the tests, which showed the line to be completely successful. The current is sent over aluminum circuits. W. C. Johnson, of Niagara Falls, is the consulting engineer and W. T. Cogswell and E. J. Page, of Syracuse, are the president and vice-president, respectively, of the Northern Power Company."

TUNNEL RECOMMENDATIONS IN NEW YORK.—The Rapid Transit Commission, in a formal communication to the Board of Estimate and Apportionment, has recommended a four-track electric subway branching from the Fourth Avenue-Hamilton line at Thirty-sixth Street, Brooklyn, and running as a subway to Eighty-sixth Street and Bay Thirty-fifth Street, in Unionville, and then as an elevated system across the low-lying ground at the edge of Gravesend into Stillwell Avenue, in the heart of the amusement district in the West End. The subway will cost about $8,000,000. In effect the new section will be an extension of the Fourth Avenue and Fort Hamilton subway, the plans for which were approved by the Rapid Transit Commission on July 14 last and by the Mayor on July 28. This last section is so planned that connections can be made with the subway now under construction, and with the Prospect Park extension heretofore authorized, and also with the Brooklyn and Manhattan loop lines approved by the commission on July 14.

OWNERSHIP IN SEATTLE.—A special telegram from Seattle, Wash., of March 7 announces a very narrow victory there for city ownership. Mr. William Hickman Moore, municipal ownership candidate for mayor, was elected on a platform pledged to municipal ownership of public utilities, by a majority of 15. The vote was: Moore, 8,490; Riplinger, 8,475. Seattle is nominally Republican by 3,500, and has always, since its foundation, had a Republican mayor. Moore proposes to build in outlying sections of the city a street car system to compete with the present system operated by Stone & Webster, of Boston. The charter amendment submitted to the voters providing that no franchise for street car purposes shall be granted in the future that does not contain a clause providing that the city have joint use of the tracks on payment of half the cost of construction and maintenance, and also containing a provision for acquisition of the line in entirety by the city at any time it sees fit, was carried by a large majority. The cost is to be fixed by arbitration.

SOURCES OF RUBBER.—The high price of rubber makes new sources more welcome than ever by electrical manufacturers. United States Consul-General Guenther, of Frankfort, quotes the report of the well-known African explorer, Harry Johnston, to the effect that the Republic of Liberia, in West Africa, possesses an almost unlimited supply of rubber trees. This news, he writes, is all the more remarkable, as heretofore Liberia exported hardly any caoutchouc. Johnston stated in a lecture before a company which has received a concession for the production of rubber in Liberia, that an extraordinary amount of that article is to be found there, that it only awaits collection, and that he did not hesitate to say that within six years 2,500,000 of cultivated rubber trees, furnishing an excellent quality of rubber, will be yielding sap. Another report states that at least 20,000 English square miles are covered with dense rubber tree forests. It is also stated that various creepers are found there containing rubber which heretofore have been unknown. Should these reports be based on facts the rubber industry will be greatly benefited.

The Houston, Tex., Lighting and Power Company.

HOUSTON, the second largest city in Texas, a prosperous, go-ahead community with about 60,000 population, was one of the first cities in the South to have a central station, and although the lighting business in Houston has passed through more than the ordinary run of financial and physical vicissitudes, the plant by recent additions and improvements has been put into first-class shape and the property gives promise of a thoroughly successful and prosperous future. All of the public electric lighting and power facilities of the city are now operated by a company whose corporate title is "Houston Lighting & Power Company—1905."

The present company is doing business under privileges and franchises originally granted by city ordinance in February, 1888, to the Fort Wayne-Jenney Electric Light Company, of Fort Wayne, Ind. These franchises together with the plant were later assigned by the Jenney Company to the Citizens' Electric Light & Power Company. In January, 1898, this latter company went into the hands of a receiver. In March, 1898, the original plant was partially destroyed by boiler explosion and the day following was totally destroyed by fire. For two years the company filled its lighting and power contracts by buying power wherever available from private isolated power plants in different parts of the city.

During this period subsequent to the fire the company built a new plant which was placed in operation in the spring of 1900. In December, 1901, the property was sold at receiver's sale and was purchased by a new company known as the Houston Lighting & Power Company, in which the General Electric Company, of Schenectady, was largely interested. Last year Isidore Newman & Son, of New Orleans and New York, became financially interested in the enterprise and the present company was organized to take over the property. The plant and lines are being overhauled and rearranged under the direction of Ford, Bacon & Davis, of New York, consulting and constructing engineers.

The plant erected in 1900 contained two 300-kw generating units and three 350-hp boilers. In the summer of 1901 there were added a 600-kw unit and an additional 350-hp boiler. In the summer of 1902 another 600-kw generating unit and an additional 350-hp boiler were installed, and in 1905 the station was increased to its present capacity by installing a 1,500-kw Curtis vertical turbo-generating unit and three 500-hp boilers.

During this period there has been going on an entire reconstruction of poles and lines; mains have been extended and new lines built. The company now has about 600 miles of distribution lines, all overhead, carried on some 5,000 poles ranging from 35 ft. to 50 ft. in height. The present connected load includes an aggregate of over 1,600 hp in small motors varying from ¼ to 100 hp each; about 50,000 16-cp equivalents in incandescent lights; 1,600 street and commercial arc lamps, and 600 city arc lights.

The city is primarily a railroad town and a considerable portion of the motor and lighting load comes from the railroads entering the city, most of which have extensive shops at this point and all of which are required to light the locations where they cross city streets. The railroads pay $100 per lamp per year for lights at these locations. The other motor load comes from machine shops, grain elevators, public and private

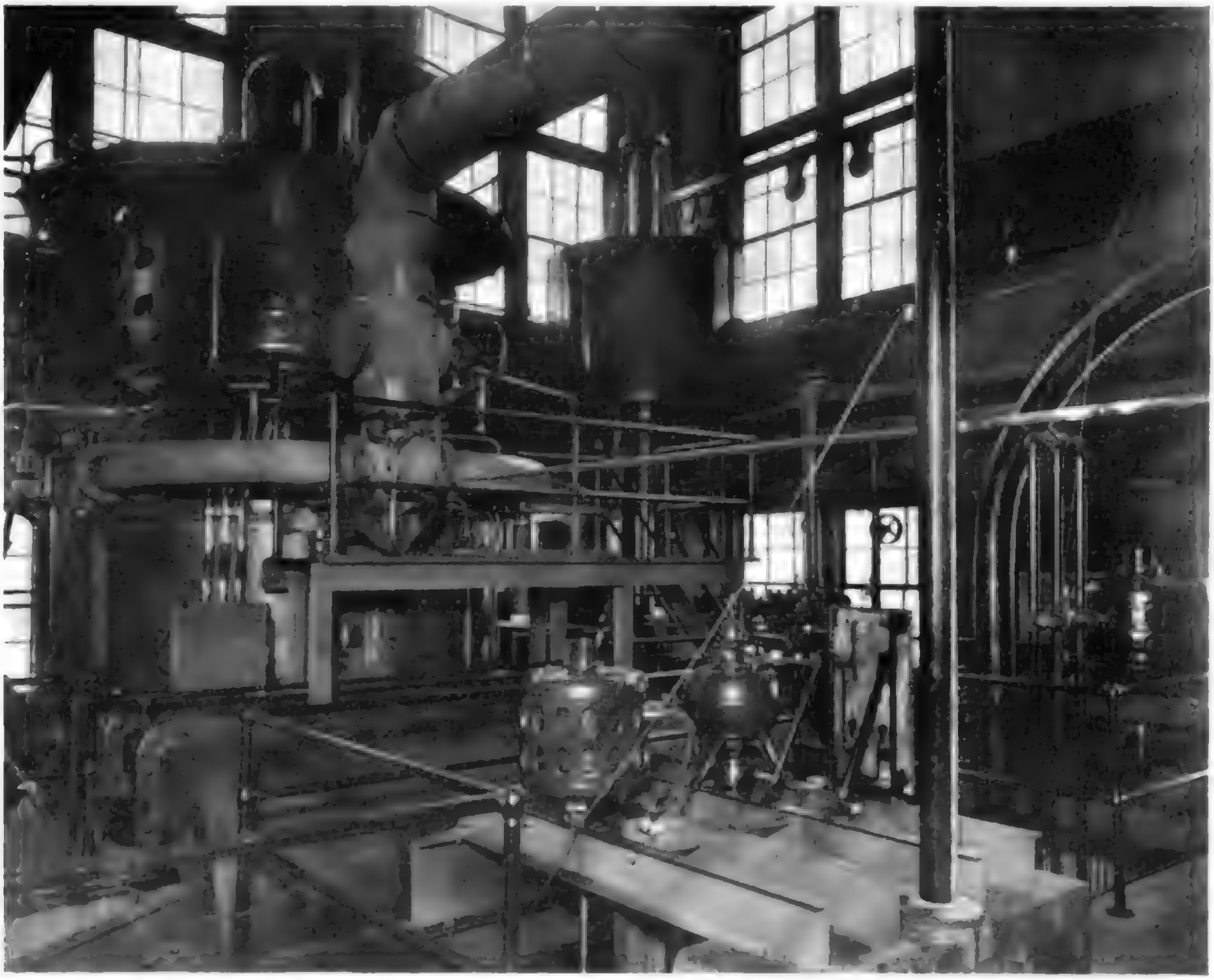


Fig. 1.—View of Turbine Auxiliaries, Showing Particularly Application of Induction Motors.

buildings and factories of various kinds. Many of the industrial and manufacturing plants in the city, including an entire newspaper establishment, are operated exclusively by electric power supplied from the lighting station.

Aside from the physical property of the Houston Company, not the least noteworthy phase of the enterprise is the remarkable growth in the company's activities, despite the many vicissitudes and setbacks. During the past four or five years the connected load has been largely increased, and this has come about not so much by strenuous activity on the part of an elaborate contract department, as through the advertising secured by means of an excellent service at fair rates. It has been the business policy of the management to keep the capacity of the plant in advance of the needs of the city, and not so much to make the patronage justify the plant as to make the plant justify the patronage. Up to the present time comparatively little systematic soliciting has been done, and but little advertising other than an effort to have it known generally among the citizens of the city that the company's service was good and its rates reasonable. As a result of the recent enlargement of the power facilities, however, the company is now organizing a contract department for the purpose of more carefully and systematically handling the new business with reference to the rapidly growing city.

The company has a contract with the City of Houston, dated March 3, 1903, for furnishing street lights for a period of six years therefrom. Under this contract the company is required to furnish 425-watt, enclosed arc lamps, running 4,000 hours per year, for the sum of $85 per lamp per year for a period of four years for all lamps up to the number of 450. If, during this time, the city shall order enough lamps installed to exceed 450, then the price per lamp for all in excess of 450 shall be at the rate of $80 per year per lamp. At the end of four years all lamps furnished to the city are to be charged for at the rate of $80 per lamp per year, less 2½ per cent if paid before the 15th day of the month. The contract provides that if at the end of four years the city has built and is operating its own electric light plant, or at any time thereafter, the contract can be canceled by the city giving 60 days written notice. The rate for lighting in the buildings owned or rented by the city is to be charged for at the rate of 5 cents per kw-hour. The cost of changing the location of street lights is to be paid for by the city.

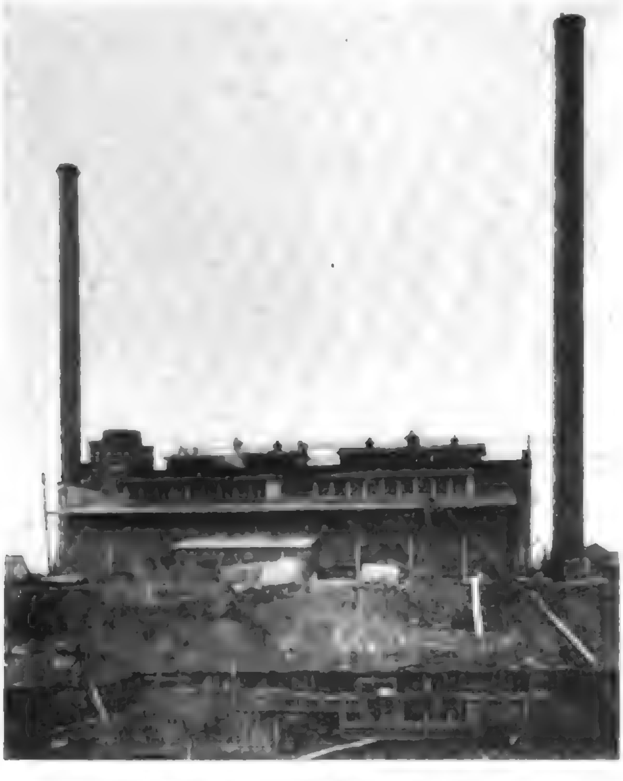


FIG. 2.—VIEW OF POWER HOUSE FROM REAR.

GENERATING STATION.

The generating station is located on the Buffalo Bayou, the latter a Southern term derived from the French for a sluggish inlet from a lake or bay, and is applied more particularly to the many narrow arms, often resembling rivers, that extend from the Gulf of Mexico back into the land, often for a hundred miles or more. At the particular point on the Buffalo Bayou where the Houston plant is located, the bayou takes the form of a deep ravine, and the floor of the engine room is about 50 ft. above normal water level. This situation admitted of an interesting treatment of the condensing layout which will be described later. At Houston, which is about 50 miles from the Gulf, the water in the bayou is normally fresh, although it becomes brackish a little further down toward the sea.

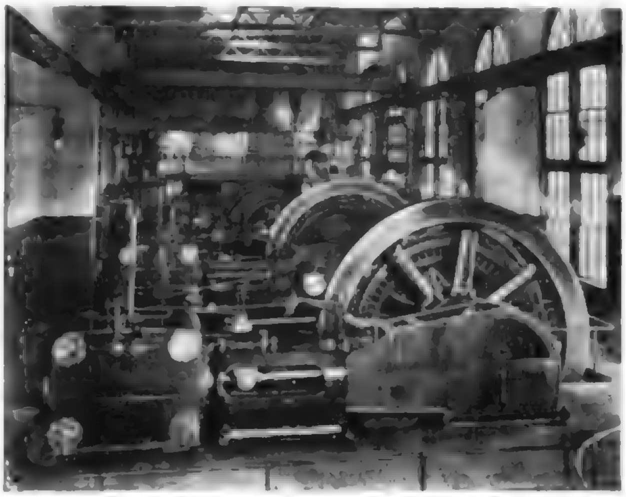


FIG. 3.—GENERAL VIEW OF POWER HOUSE INTERIOR.

The present power house is a two-story brick building 172 ft. x 42 ft. with boiler room extension 155 ft. x 44 ft. The engine room is two stories high with tower three stories and attic. The boiler room is one-story high with open loft. The engine room floor and roof are structural steel frame work, the roof being covered with porous tile and composition. The roof of the boiler room is corrugated iron. All walls except partition wall between engine and boiler room are 17 ins. thick. The partition wall is 13 ins. thick. The entire front of the building is faced with buff brick with stone window-sills and belt courses and terra cotta coping.

There are two 300-kw General Electric alternators each direct-connected to a McIntosh-Seymour horizontal cross-compound condensing engine with cylinders 14x28x32 ins., each rated at 500 hp; and two 600-kw General Electric alternators each direct-connected to a Rice & Sargent horizontal cross-compound condensing engine having cylinders 18x36x42 ins., and rated at 1,000 hp each. These four units are located in the older portion of the station, and up to a year ago were sufficient to carry the load satisfactorily. As previously stated, however, during 1905 the engine and boiler rooms were extended and the generating apparatus was increased by the addition of a 1,500-kw Curtis vertical turbo-alternator; a 1,500-kw, 900 r.p.m., 2,300-volts, 377 amps., 8-pole unit, and is said to be the first Curtis turbine turned out at the Lynn plant of the General Electric Company. The addition of this unit at the Houston power station required a complete new installation of condensers, condenser pit and auxiliary apparatus, the work involving a number of unusual and noteworthy features. The turbine installation includes a counter-weight accumulator for feeding water supply to the step bearings of the turbine; two 7½x2x6-in. duplex plunger pattern Worthington pumps for pumping the water used in the step bearings; and one oil pump set consisting of two 2x1⅛x2¾ in. duplex pumps and tanks for furnishing lubricating oil to the turbine.

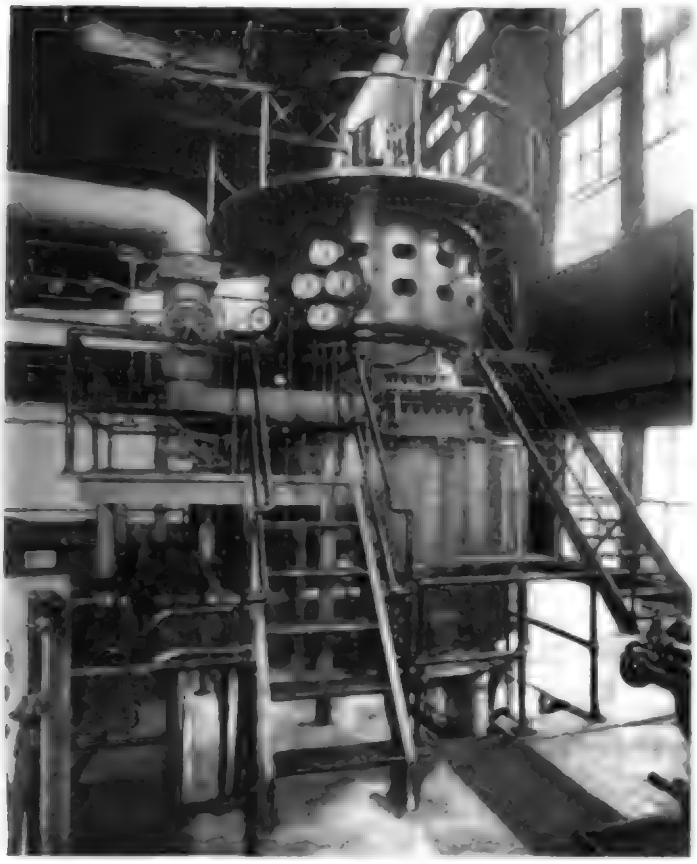


FIG. 4.—VIEW OF CURTIS TURBINE.

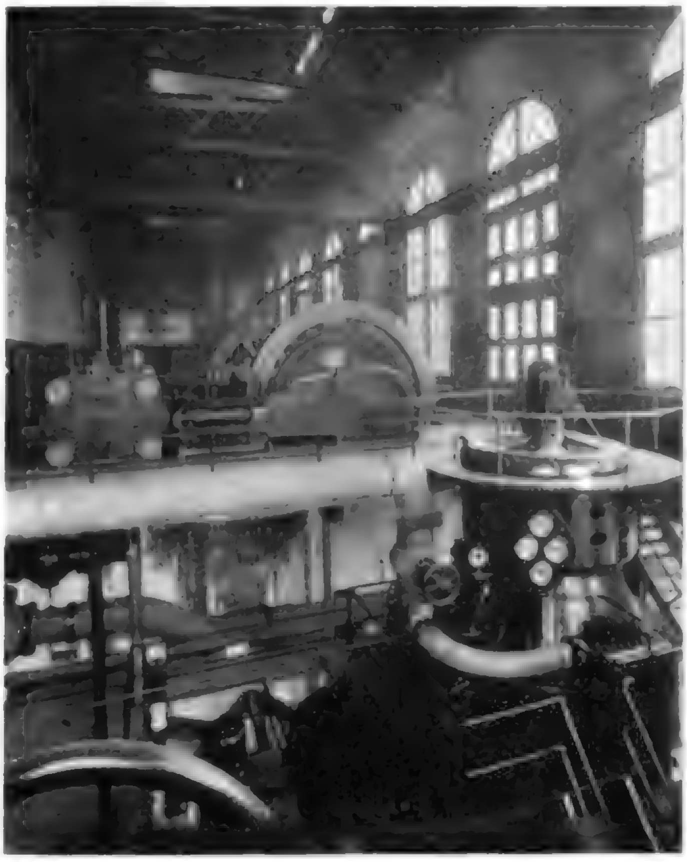


FIG. 5.—TURBINE AND ENGINE-DRIVEN ALTERNATORS.

FIG. 6.—END VIEW OF CONDENSER.

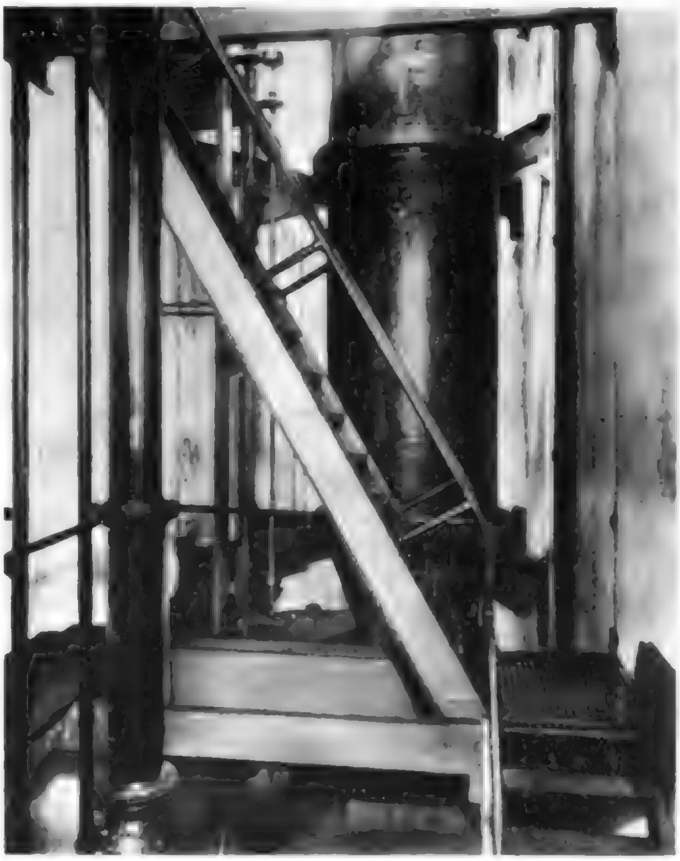


FIG. 7.—NEW CONDENSER PIT.

All of the generating units at this plant generate three-phase, 60-cycle currents at 2,300 volts. The current is sent at this voltage throughout the city and delivered to customers through local transformers placed at convenient locations. From these mains is carried the alternating-current commercial lighting load and also a considerable number of induction motors of various sizes for various purposes.

For supplying direct current for commercial incandescent lighting and the direct-current motor load, there are located at the main power plant two 100-kw and two 300-kw General Electric rotary converter sets with their transformers. The converters making up the first-mentioned group are 6-pole, 100-kw, 1,200-r.p.m., 182-amp. machines. They receive the initial current through one transformer set consisting of three air blast transformers rated at 75 kw, which receive current at the primaries at 2,300 volts and deliver it at the secondaries at 375 volts. The converters deliver 550-volt direct-current. For delivering the air blast to the transformers there is a Buffalo Forge Company 9-in. steel blower direct connected to a General Electric 3-hp induction motor.

The converters comprising the second group are 8-pole, 300-kw, 900-r.p.m. machines. They receive current through two transformers rated at 330 kw, which deliver at the secondaries 430-410-volt alternating-current. These transformers are also of the air-blast type, air being supplied by two 35-in. blower sets driven by induction motors. The blower outfits for the transformers are suspended from the ceiling in the sub-basement beneath the transformers and deliver the air up through the floor in sheet metal air ducts.

For supplying the city arc circuits there are six 100-light "tub" transformers located in a separate fireproof vault at one side of the engine room.

The auxiliary electrical apparatus at the station includes three motor-driven exciter sets, each consisting of a 25 kw generator coupled direct to a 37-hp, 220-volt induction motor. These exciter sets are used for starting the generating units when current is available. For starting after a complete shut down, there is an auxiliary exciter set consisting of a 30-kw generator driven by an 11x8 in. vertical marine type engine.

The switchboard is arranged on a steel frame platform at one end of the building. It comprises 16 alternating-current panels and 8 direct-current panels of blue Italian marble on which are mounted a full equipment of standard instruments and appliances.

The engine room is spanned by a 15-ton hand power overhead traveling crane having 37 ft. 6-in. span and a lift of 17 ft. The crane was furnished by the Wellman-Seaver Engineering Company of Cleveland.

The boiler room equipment consists of three 350-hp Cahall boilers, two 350-hp and three 500-hp Babcock & Wilcox boilers. All of these are fitted to burn oil as fuel. The three boiler units last mentioned were installed to serve the turbo set. They are fitted with internal superheaters and deliver steam at 200 lbs. pressure. The other boiler units supply the reciprocating engines and deliver steam at 140 lbs.

Water from a 1,200-ft. natural flow artesian well is used for boiler feeding. The feed water is forced to the boilers by one 10x6x10-in. horizontal duplex pressure pattern feed pump made by Worthington, three 10x7x10-in. duplex feed pumps made by George F. Blake Manufacturing Company, and one 5½x3x6-in. duplex feed pump made by George F. Blake Manufacturing Company. There is a Webster vacuum feed water purifier and filter and a 1,000-hp vertical open heater made by Stillwell-Bierce & Company.

CONDENSER ARRANGEMENT.

As the base of the turbine is approximately 50 ft. above the average water level in the Buffalo Bayou, from which condensing water is taken, it was thought best to place the condenser at the bottom of a deep pit rather than attempt to lift the circulating water so high. Accordingly all the apparatus pertaining directly to the condensing system is located at the bottom of a pit, which is approximately 10 ft. square and 43 ft. deep measured from the base of the turbine. The pit was constructed of steel I-beams and concrete reinforced with expanded metal in the sides. The turbine condenser, which is of the Worthington surface type rated at about 6,000 sq. ft. capacity, is supported near the bottom of the pit, and the exhaust from the turbine reaches the condenser through a 48-in. cast iron pipe. Immediately below the condenser and forming part thereof is a hot well comprising a square cast-iron box which receives the condensed water. This hot well in addition to supplying a portion of the feed water required by the boilers, serves also as a reservoir from which is drawn the water used in the step bearing under the revolving part of the turbine.

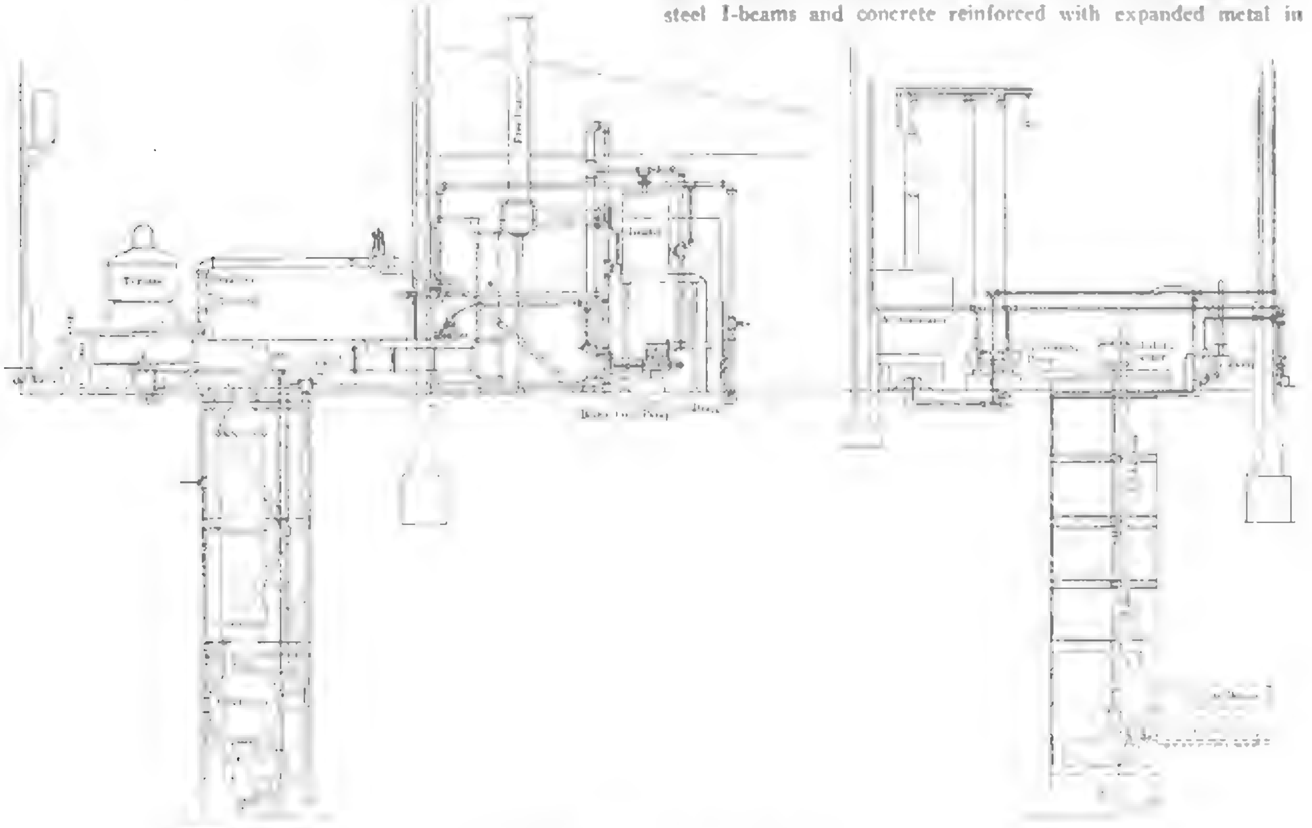


Fig. 8.—Piping Sections, Houston Plant.

The circulating water for the condenser is taken from the bayou through a 16-in. suction pipe, passes through an air cooler located on the end of the condenser, into the bottom of the condenser, through the condenser and back to the bayou through a 24 in. discharge pipe. The intake and discharge mains are carried on cradles inside a brick tunnel about 100 ft. long, extending from the power station building to the bank of the bayou. The water is circulated by a 16-in. vertical centrifugal circulating Worthington pump driven by a 50-hp, 220-volt, three-phase induction motor. In order to keep the motor dry, it is located at the level of the top of the condenser pit and drives the pump through a vertical shaft. This shaft, as shown in the accompanying drawings, is supported at intervals by side bearings attached to the framework of the pit.

The vapor is drawn from the top of the condenser by a steam driven 8x16x12-in. single horizontal rotative dry vacuum pump of the center crank pattern made by Worthington. The course of the vapor is from condenser, through an air cooler at end of condenser, through pump to atmosphere.

For lifting the water from the hot well there is a 3-in. two-stage centrifugal hot-well pump located at the bottom of the pit and driven through a vertical shaft by a 7½-hp induction motor located at the top of the pit. This pump lifts the water from the well and delivers it to the feed-water heater, but at a point near the top of the condenser a portion of this water is diverted to the step-bearing pumps, by which it is forced to the turbine bearing.

In order to prevent the possibility of seepage water accumulating in the condenser pit, a 2½-in. vertical volute Worthington pump is provided at the bottom of the pit. This pump is driven through a vertical shaft by a 5-hp induction motor located at the top of the pit.

The station log at this plant shows the following averages: Vacuum, 27.6 in.; temperature of hot well, 84° F.; temperature of condenser injection water, 76° F.; temperature of discharge water 70° F.; temperature of feed water, 138° F.

The condensing apparatus for the reciprocating engine units is located in a separate compartment, 34 ft. deep, under the old portion of the plant. The apparatus comprises two 9x20x12-in. jet condensers with vertical twin vacuum air-pump; one 12x28x18-in. jet condenser with similar pump; and one 16x40x21-in. jet condenser also served by the same type of air pump. These condensers and pumps were furnished by the George F. Blake Manufacturing Company. Circulating water for this group of condensers is taken from, and discharged into, the bayou through mains laid in a tunnel in about the same way as described for the turbine condensers.

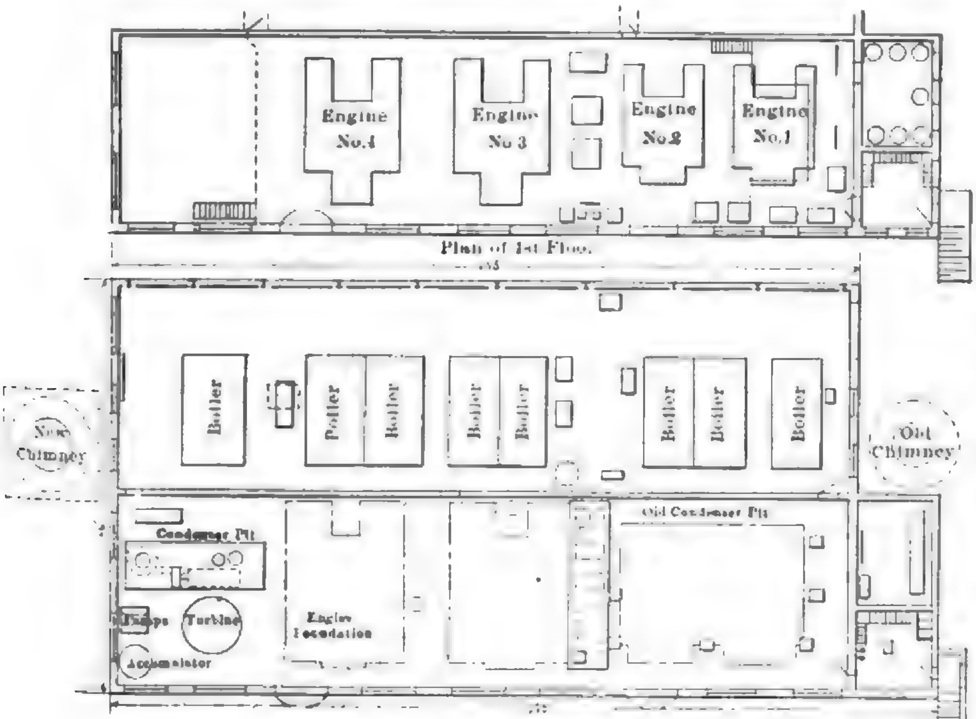


FIG. 10.—PLAN OF BASEMENT AND BOILER ROOM.

FUEL OIL.

The station is now burning exclusively a good grade of Texas oil as fuel under the boilers. The oil is received in oil tank cars from which it is unloaded by gravity into storage tanks, of which there are three, each with 1,200-gal. capacity. These tanks are housed in a brick vault outside the station. From the tanks the oil is forced directly to the burners at 40 lbs. pressure. For this purpose there are two complete oil-pumping systems, one consisting of two 3x2x3-in. Snow duplex pumps and receiving tank, and the other consisting of two 4x2x4-in. Snow duplex pumps and receiving tank. Both of these oil pumping outfits were furnished by the National Supply Company, of Chicago.

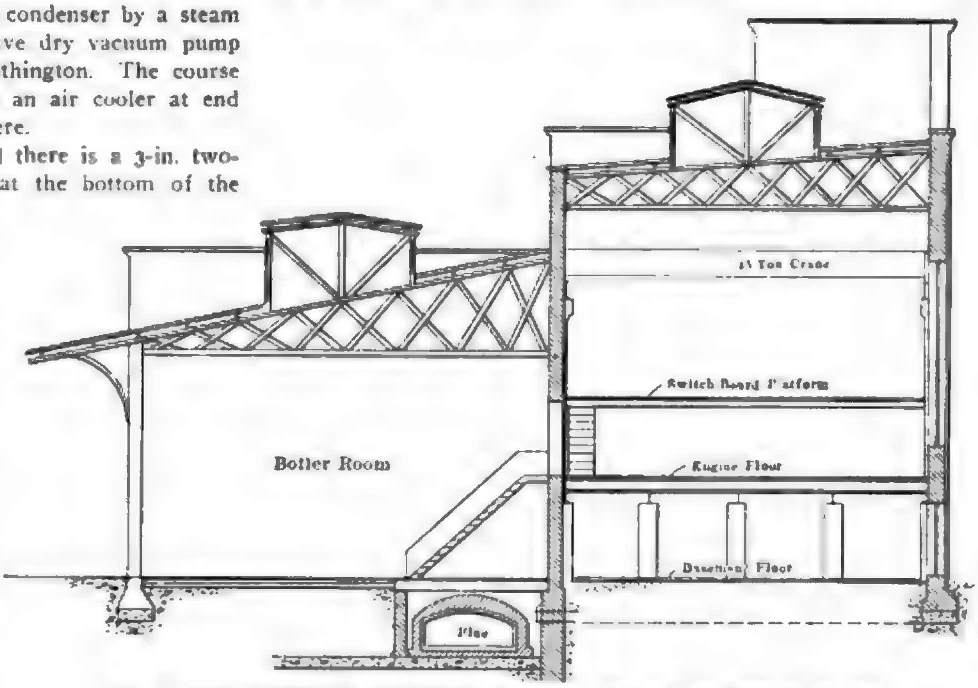


FIG. 9.—CROSS-SECTIONAL ELEVATION THROUGH ENGINE AND BOILER ROOMS

The oil burners under the boilers consist of double nozzles in which the oil as it comes through, drop by drop, is caught up by a jet of live steam which serves to thoroughly atomize the particles of oil and force them to the burners in a fine spray. The flame shoots from the end of the nozzles in a fine white flame. In this particular station provision is made for supplying the burners with superheated steam taken from a separate superheater.

The station is now using about 150 barrels of oil per day, there being 42 gal. of oil to a barrel. The total daily electrical output of the station averages about 45,000 kw-hours measured at the switchboard so that the plant is getting from 2 to 2½ kw-hours per gallon of oil. This is considered an exceptionally good showing. As a basis of comparison, it is usual to figure about 3.6 barrels of Texas oil as the equivalent in thermal units contained to one ton of Indian Territory run-of-mine coal. This is not a particularly good grade of coal. A more convenient comparison might be to say that 4 barrels of oil will equal a ton of ordinary Pittsburg coal.

The local affairs of the Houston Lighting & Power Company are directly in charge of Mr. William H. Chapman, who has been general manager of the property for a number of years, and to whose energetic management is due in large measure the present satisfactory and efficient condition of the company. Mr. W. W. Reed is superintendent of the plant. The executive officers are Mr. A. H. Ford, of New York, president; Mr. W. H. Chapman, vice-president and general manager, and Mr. Robert Duerer, secretary and treasurer.

The Heating Effect of the Electric Spark.

By Henry A. Perkins.

Following a suggestion of the Electrical World and Engineer made last summer, the following series of determinations on the heating produced by the electric spark has been conducted. In view of the fact that the spark method of ignition is much the most common in all forms of gas engines, it seemed desirable to find the exact quantity of heat developed under different conditions, as well as the efficiency of an average sparking apparatus as a whole, considering the heat developed by the spark as the output and the total power consumed by the coil as the input. Three series of tests were made: One set in which the spark length was varied, another in which the primary current was varied with constant spark length, and a third in which the frequency of interruption was considered the variable quantity.

The method employed was one that is readily adaptable to all similar measurements, and should be capable of a high degree of precision, in fact, much higher than was necessary considering the somewhat irregular character of an ordinary mechanical interruption.

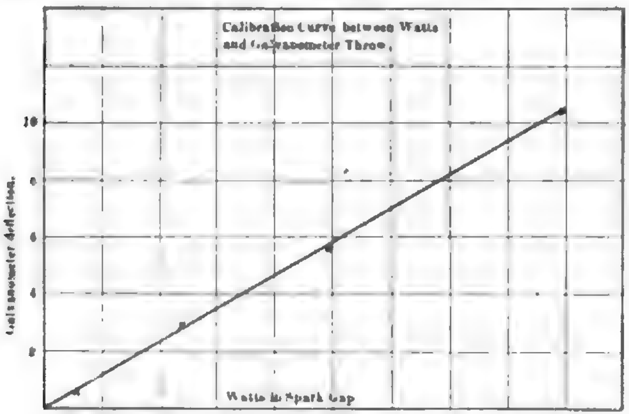


FIG. 1.—CALIBRATION CURVE.

The current from a battery of 30 storage cells was sent through an ordinary volume voltameter, and the primary of a Splitdorf automobile induction coil. The sparking took place inside a glass tube about half an inch inside diameter and two inches and a quarter long; the ends were stopped with corks through which passed the terminals of the secondary, ending in platinum points. The distance between these points could be varied by a micrometer whose head was outside the tube; it was thus not necessary to open the tube after the test had begun. Surrounding the spark-gap was a small, thin coil of No. 33 copper wire whose resistance was about 23 ohms. It lay close to the glass, thus leaving nearly a quarter of an inch between itself and the platinum terminals. The coil was nearly three-quarters of an inch long; it might thus be supposed to absorb a large percentage of heat from a spark that did not exceed a length of one-quarter of an inch. This test coil formed one of the arms of a Wheatstone bridge, the galvanometer being of the D'Arsonval type with a large period and damping factor.

In order to interpret the deflections of the galvanometer in terms of joules given off by the spark as heat, and absorbed by the surrounding coil, it was necessary to calibrate the whole arrangement. This was done by substituting for the spark-gap a minute spiral of bare German silver wire that could be heated by a current from some dry cells. The number of joules given out by this coil were determined by taking the time the circuit was closed and measuring the volts across the coil with a standard voltmeter, and the current with a Kelvin balance. The deflections of the galvanometer were then plotted as a function of the watts given off in the form of heat, as in Fig. 1. The time of heating in this as in all succeeding determinations was invariably ten seconds. By this method of calibration it was not necessary to make any assumptions as to the proportion of heat absorbed by the coil, or the influence of time on the transfer of heat by conduction or convection, for the conditions were exactly identical in the case of calibration and actual test, except that the small heated spiral was replaced by a spark occupying practically the same position.

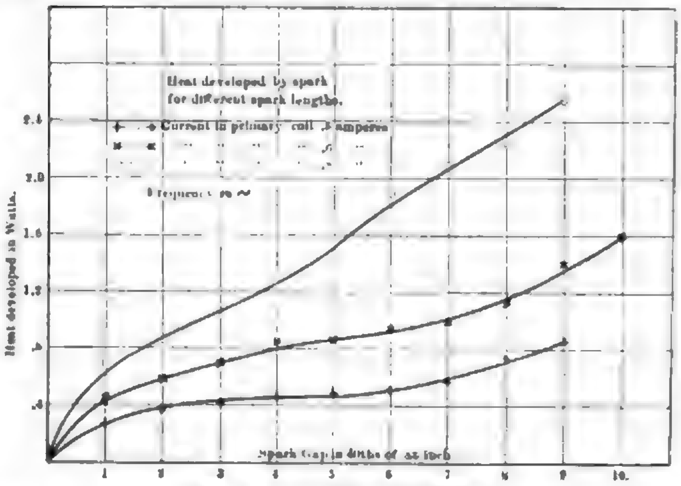


FIG. 2.—SPARK HEAT CURVES.

In making a determination of the heat developed by the spark the method was as follows: The bridge was balanced, and allowed to stand for a while until the heating of the test coil due to the current flowing in it was balanced by the rate of radiation. The bridge was then rebalanced and no observation was made when the cross hair of the telescope was as much as two small scale divisions from the zero of the scale and was practically in equilibrium. Next the length of the hydrogen column in the voltameter was taken, and finally the circuit closed and kept closed for ten seconds by a stop watch. For perhaps a second and a half after closing the circuit, the galvanometer remained stationary, then it began to swing, and continued for nearly the same time after the circuit had been opened again. This lag was probably due to the time required for the radiated heat to be conducted through the insulation of the test coil. The maximum deflection was then read, also the length of the hydrogen column, and the voltage of the main storage battery during the observation. The deflection could be readily reduced to joules or watts by the calibration curve, and the effective primary current calculated from the amount of hydrogen liberated.

In order to calculate the power input I made use of a set of observations with a variable number of dry cells connected directly to the primary without interposing the voltameter. The current sent through by a number of cells was estimated by comparing the heat developed with that produced by a known current under exactly the same conditions. Then taking the product of this current and the known voltage of the dry battery, a rough estimate of the power input as a function of the current was obtained. This curve was practically a straight line and was produced to give values beyond the range of the dry cells used.

Such a method is far from satisfactory as it takes no account of the undoubted lagging of this intermittent current, and there are other obvious sources of error. But no simple method for quantitative measurement of this pulsating but inharmonic power occurred to the author, that was not open to serious objection. The efficiencies quoted below must then be regarded as only suggestive of the true values.

The first set of curves, Fig. 2, show the influence of varying the length of the spark for three different primary currents

The currents in this case being .52, .60 and .76 amp., respectively. It is evident that the heating increases with the length of the spark, but not as a simple linear function. To test the reliability of the method, one of the curves was repeated in inverse order, and the points thus obtained agreed very well with those of the first set. As an illustration of the complete series of readings, the following table may be interesting. The time in every case was 10 seconds, the hydrogen liberated .6 c.c., the frequency about 96 cycles, and the impressed e.m.f. 57 volts.

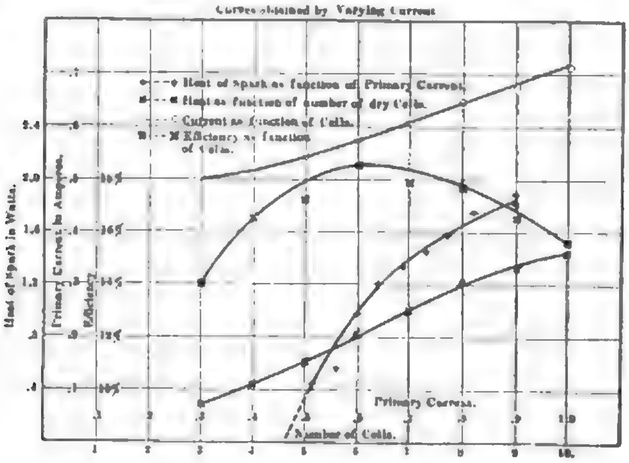


FIG. 3.—CURVES SHOWING EFFECT OF VARYING CURRENT.

Length of gap.	Deflection of galvanometer, ascending	Deflection of galvanometer, descending.	Heat developed in watts.	Primary watts (net).
1/40 in	.76	.8	.26	2.
2/40	1.02	1.15	.36	2.
3/40	1.25	1.25	.41	2.
4/40	1.3	1.4	.45	2.
5/40	1.47	1.46	.49	2.
6/40	1.5	1.48	.5	2.
7/40	1.7	1.7	.57	2.
8/40	2.22	2.1	.73	2.
9/40	2.48	2.43	.83	2.

The efficiency, since the input is constant, increases with the output, and the maximum value for this particular curve is .84 ÷ 2. = 42%. The maximum efficiencies of the other two curves were about 32 per cent and 23 per cent, respectively.

Referring to Fig 3, we see how the heating depends upon the primary current. Two series of tests were made in this connection. In the first the current from the storage battery was varied by an interposed resistance drum and the currents determined as usual with the voltameter; in the second series a varying number of dry cells was used, from three to ten (less than three failed to produce a spark) and the current was estimated by comparing the deflections obtained with the previous curve, for the voltameter could not be used with so low an e.m.f.

It will be seen that the current varies almost directly as the number of cells (and therefore with the e.m.f.), the heat developed increases with greatest rapidity at about six cells and there is consequently a maximum of efficiency at this point of nearly 18 per cent. In all these curves the spark gap was 5/40 in.; hence the efficiency is not as high as the values for longer sparks.

The curve of heat developed as a function of primary current is interesting as it clearly intersects the X axis at a point well to the right of the origin. This is to be expected, as it takes a current somewhere between that supplied by two and three cells to produce a spark at all.

The fourth plate is less reliable than the others, as it was very difficult to measure the frequency and keep it constant during a run, moreover the primary current varies to a very marked degree with the frequency. The method used was a rough one, simply comparing the note emitted by the vibrator with a standard tuning fork and the interval estimated. It will be seen that the points do not lie on the curves at all satisfactorily; still a rough estimate of the influence of frequency can be obtained and shows an increase of heat with decrease of period, while the power input increases much less rapidly, showing a great gain in efficiency for high notes. This conclusion is most important for the maximum efficiency obtained in this series was for a frequency of 128, the value being 16 per cent with a spark-gap only 5/40 in. long.

A few obvious conclusions may be drawn from these tests. It is evident that the heat developed by the spark increases with its length in such a manner as to suggest an actual rise in temperature as the spark length increases. The efficiency increases in the same proportion, and it would thus appear that in a gas engine the gap between the points of the spark plug should be as long as possible and still permit the spark to jump during the highest pressure used in the compression stroke. The same is true of frequency, high frequencies being both more effective and more efficient than low ones. In considering the voltage, or number of cells that should be used, we are confronted with a slightly different problem; here there appears to be a point of maximum efficiency corresponding to an e.m.f. of about 8 volts (6 cells). This, of course, depends upon the coil used, but in principle it would be the same for all coils; that is, that there is a certain critical voltage that should give the highest efficiency.

Perhaps the most important result obtained is the proof of the wastefulness of the whole process. When we consider that the process of converting electricity into heat is 100 per cent efficient, it seems extraordinary that an attempt to localize this process in a particular place means a sacrifice of perhaps 75 per cent which is lost in heating the other parts of the circuit. Of course the temperature necessary for ignition is very high and it may be that no better way can be devised for securing this temperature quickly and surely, and that the process is subject to the same kind of limitation that restricts the use of the inverted refrigerating machine, where higher temperatures are produced with lower and lower efficiency.

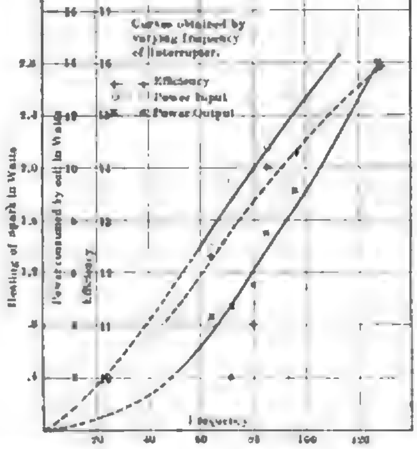


FIG. 4.—CURVES SHOWING EFFECT OF VARYING FREQUENCY.

Those who are familiar with the gas engine in the automobile are aware of the surprising rapidity with which even large dry cells are exhausted, and any adjustment that will even double their life should be a welcome one, but it seems doubtful if much more than that can be secured when the secondary spark is the device used for ignition.

* * *

Applied Science at Harvard.

As a preliminary measure in the utilization of the McKay millions left to Harvard for the advancement of the study of applied sciences, the governing bodies of Harvard have established a Graduate School of Applied Sciences and a new general degree of bachelor of sciences. For admission to the new school a bachelor's degree will be required. The course of study will be ordinarily two years. Degrees in applied science from Harvard will in future be of the same standard as degrees from the Harvard law, medical and divinity schools.

Circle Diagram of Compensated Series Single-Phase Motor.

By E. C. Stone.

If an alternating current be passed through an ordinary direct-current series motor, rotation is produced, for the flux and current reverse at the same time, thus maintaining torque in the same direction. This torque, however, instead of being steady, as in the direct-current case, is pulsating on account of the alternations of current and flux.

Now if an armature of the ordinary direct-current type be rotated in an alternating field (see Fig. 1) two e.m.f's will be generated in the conductors. Let us assume that the brushes are at the neutral points, *a a'* (Fig. 1).

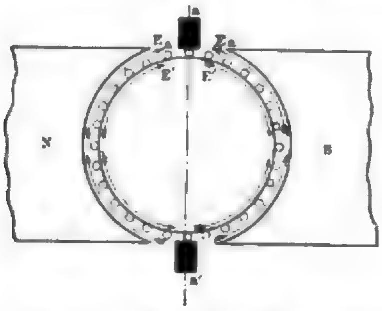


FIG. 1.—SIMPLE TWO-POLE MODEL OF SERIES MOTOR.

1. The ordinary e.m.f. of rotation, Ea, familiar in the direct-current motor. Its direction is shown by the arrows *outside* the armature,

$$Ea = \frac{\phi m}{\sqrt{2}} Na\, n \times 10^{-8}, \qquad (1)$$

where ϕm = maximum flux crossing air-gap,
Na = conductors on armature,
n = speed, in revolutions per second.
Ea = r.m.s. value of voltage..

2. An e.m.f., E', which is caused by the alternating flux, and is exactly analogous to that produced in the secondary of a transformer. It is represented by the arrows inside the armature, Fig. 1. Its equation is the same as the transformer equation:

$$E' = 2\pi f \,.\, \frac{\phi m}{\sqrt{2}} \,.\, \frac{2}{\pi} \,.\, \frac{Na}{2} \,.\, 10^{-8},$$

$$= 4.44 \,.\, \frac{2}{\pi} \,.\, \phi m \,.\, \frac{Na}{2} \,.\, f \,.\, 10^{-8}, \qquad (2)$$

where f = frequency cycles per second.

N_a being the number of conductors on the armature, $\frac{Na}{2}$ = the number of turns. The factor, $\frac{2}{\pi}$, comes in because the number of lines of force linked with a single turn depends upon the position of the coil, and is proportional to *sin* a (Fig. 2). The flux linked with any one turn = $\phi m \sin a$, and the total flux linked with the armature turns $= \phi m \int_0^\pi \sin a\, d\, a = 2\phi m$. Therefore, the average value of the maximum flux linked with a conductor $= \frac{2}{\pi} \phi m$.

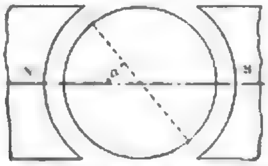


FIG. 2.—DIAGRAM FOR DETERMINING THE INTERLINKAGE OF FLUX AND TURNS.

In this type of motor the brushes are placed at the neutral points (*a a'*, Fig. 1) with respect to Ea, so that E', consisting at these points of two equal and opposite components, does not manifest itself at the terminals of the motor. It does, however, appear in the coils short-circuited by the brushes. With the brushes thus placed the coil under the brush being at right angles to the field links with practically all the main flux, which causes a considerable e.m.f., E_S, to be set up therein.

$$E_S = 2\pi f \,.\, \frac{\phi m}{\sqrt{2}} \,.\, N_S \,.\, 10^{-8}. \qquad (3)$$

N_S = number of *turns* short-circuited by each brush.

This e.m.f. produces a short-circuit current which causes trouble in two ways:

1. Sparking at the commutator, due to breaking of current when brush leaves short-circuited coil.

2. I^2R losses and attendant heating.

Hence, the number of turns, N_S, that are short-circuited should be kept as small as possible, in order to keep down the induced voltage and consequent short-circuited current. Also, resistance is introduced into the commutator leads to keep down the short-circuit current.

Now, suppose a current I to flow through the motor. As field coils and armature are in series, the current is identical throughout the motor. This alternating current, I, in the field winding produces the main flux, ϕf, which is somewhat larger than ϕ, the flux across the gap, on account of the leakage directly from pole to pole. This alternating flux sets up a back e.m.f., Ef', 90° behind it in phase.

$$Ef' = 2\pi f \,.\, \frac{\phi fm}{\sqrt{2}} \,.\, Nf \,.\, 10^{-8}. \qquad (4)$$

where ϕfm = maximum field flux.
Nf = number of field turns.

If current I were a pure magnetizing current, it would be in phase with ϕf. But it must also supply a power component at right angles to ϕf, sufficient to cover not only the core loss in the field structure, which is laminated, but also the copper losses in the short-circuited coil.

To understand that the latter loss is supplied in this way, simply consider the short-circuited coil as the secondary of a transformer, whose primary is the main field coil. The e.m.f. set up in the short-circuited coil is of course 90 electrical time degrees from ϕf and the power component, I_S, of the short-circuit current is in phase with the e.m.f. Hence I_S is at right angles to ϕf, and consequently to the magnetizing current.

If I_p = power component and I_m the magnetizing component,

$$I = \sqrt{I_m^2 + I_p^2}. \qquad (5)$$

The angle of phase difference $\beta = \tan^{-1} \frac{I_p}{I_m}$.

Due to the rotation through the flux, the counter e.m.f. of the motor is set up according to (1). This is in time phase with the main flux, since it arises from cutting that flux. With alternating current the armature winding becomes a choke coil, the flux set up being parallel to a line joining the brushes. A back e.m.f. is thus produced, displaced 90 time degrees from the armature current, such that

$$Ea' = 2\pi f \,.\, \frac{\phi am}{\sqrt{2}} \,.\, \frac{2}{\pi} \,.\, \frac{Na}{2} \,.\, 10^{-8}, \qquad (6)$$

where ϕam = maximum armature flux. $\frac{2}{\pi}$ comes in here for the same reason as in (2), save that here the flux linkage is proportional to *cos* a.

This flux, whose direction is 90 electrical space degrees from the main flux, serves no useful purpose; it merely lowers the power factor of the motor, since Ea is displaced nearly 90° in phase from the main current. This flux is, therefore, counteracted by current in a compensating coil which is wound in slots in the poles, and is given a number of turns such that the current will set up a field as nearly as possible equal to ϕa, but opposite in direction, thus neutralizing the armature inductance, and making it practically $= 0$. The compensating winding is in series with armature and field coils, as shown in Fig. 3.

There will be, however, still some local flux around the armature conductors, which will not link with the flux of the compensating winding and vice versa. This gives rise to some leakage reactance in these windings which is quite analogous to the leakage reactance of induction motors.

The equation for torque in the single-phase motor is the same as in the direct-current case, save that the angle β between current and flux, due to the losses mentioned above, must be taken into consideration. The torque in dynes may be expressed as

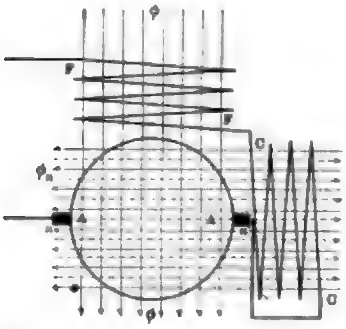


FIG. 3.—DIAGRAM SHOWING COMPONENT FLUXES IN COMPENSATED SERIES MOTOR.

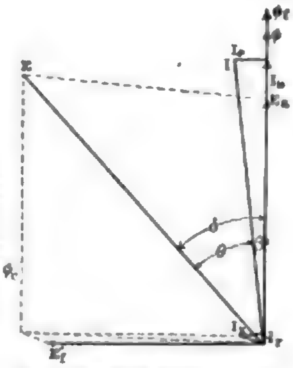


FIG. 4.—VECTOR DIAGRAM FOR FULL LOAD.

$$Td = \frac{\frac{I}{10} \cdot \frac{\phi m}{\sqrt{2}} \cdot Na}{2\pi} \cos\beta, \qquad (7)$$

where I = effective value of the current in amperes,

ϕm = maximum flux across the gap.

Na = conductors on armature.

Reduced to lbs.-ft.,

$$T = \frac{I\,\phi m\,Na}{2\pi\sqrt{2}} \cos\beta \times .737 \times 10^{-8}. \qquad (8)$$

This is, of course, the formula for electrical torque, from which the torque demanded by armature core losses due to rotation, and also by friction, must be supplied.

Cos β is determined by the core losses in the field structure and by the I^2R losses in the short-circuited coils. These losses are proportional to I^2—hysteresis only approximately, of course—if the main flux is proportional to the main current, which is true so long as the saturation curve is a straight line. This is nearly true here, since low flux densities must be used; and the angle β is practically constant.

The following table gives an analysis of the power consumed by the motor:

Power Input	Electrical Losses	Core losses in field structure, due to alternating current. I^2R losses in windings. I^2R losses in short-circuited coils.
	Mechanical Power	Core losses in armature, due to rotation. Useful mechanical work. Friction.

The vector diagram for full load is given in Fig. 4. Let ϕ = flux across the gap. Then ϕf = flux that must be set up in the field coils in order to allow for leakage. To produce this flux, a magnetizing current, I_m, is necessary, while I_p at 90 electrical time degrees to I_m is consumed in losses. The main current, $I = \sqrt{I_m^2 + I_p^2}$. To overcome the back e.m.f. due to the alternating flux, ϕf, a component, Ef, at 90 electrical time degrees to ϕf must be supplied. The back e.m.f. of rotation is nearly in opposition to the current, I—since it must be in phase with ϕ, but opposed to the current—and a component of e.m.f. of opposite direction must be supplied to overcome it—Ea. I_r in phase with I, and I_x in quadrature to I, represent the components of voltage supplying, respectively, the resistance and reactance drops of the motor. x = leakage reactance of armature and compensating windings; r = total resistance of the motor. The vectorial sum of Ef', Ea, I_r and I_x gives E, the terminal e.m.f. of the motor. The cosine of angle θ is the power factor. Angle β = angle between I and ϕ, produced by the power component of I supplying losses in field and short-circuited coils.

An excellent circle diagram for this type of motor was given by Mr. F. Creedy, in the London *Electrician* for April 21, 1905. This diagram assumes that the machine has a straight line saturation curve, which is very nearly true within the working range of most motors of this kind, since the flux densities must be low to keep down the iron losses. If this is the case, the angle β will be constant, as mentioned previously.

A constant e.m.f., $O\,E_0$ (Fig. 5) is impressed. At standstill the motor is merely a choke coil, and the current flowing, $O\,S$, will be such that the vectorial sum of resistance and reactance drops equals the impressed e.m.f. As the motor starts a counter e.m.f., $O\,E'$, is set up in phase with the flux and at the angle $\pi - \beta$ to the main current, $O\,I$, which produces a current $O\,I'$, lagging behind it at a constant angle, $I'O\,E'$, which represents the impedance of the motor. The main current, $O\,I$, is equal to the vector difference between the short-circuit current, $O\,S$, and this current, $O\,I' = S\,I$. Since the angle $I'O\,E'$ is constant, and therefore angle $S\,I\,O$ is constant, and $O\,S = O\,I + S\,I$ vectorially, the extremity of $O\,I$ must be the locus of a circle passing through O.

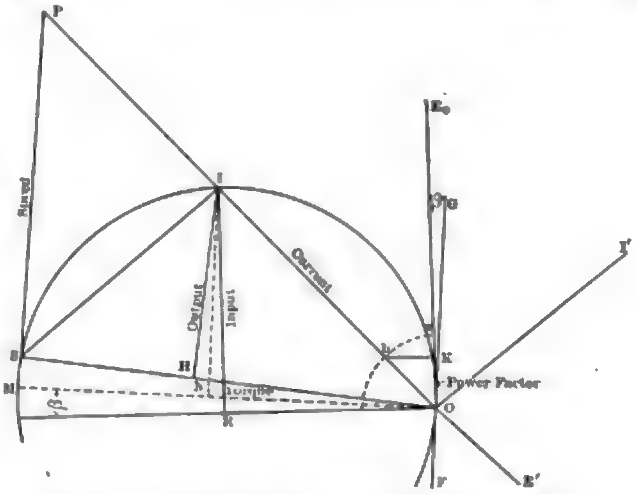


FIG. 5.—CIRCLE DIAGRAM OF COMPENSATED SERIES MOTOR.

Now, $O\,I'$ is parallel to $S\,I$ by construction.

$\therefore\ < S\,I\,O = < I\,O\,I'$.

Also $< S\,O\,E_0 = < E'O\,I'$, both being the angle of impedance of the motor.

$< \beta$ = angle between ϕ and I, the main current.

$< E'O\,I = \pi - \beta$.

$< I\,O\,I' = \pi - \beta - S\,O\,E_0$.

$< S\,I\,O = \pi - (\beta + S\,O\,E_0) = < S\,O\,F$,

where the line $F\,G$ makes $< \beta$ with $O\,E_0$.

$\therefore$ $F\,G$ touches the circle at O.

$\therefore$ The diameter $O\,M$ of the circle makes the angle β with the line $O\,R$ of zero power factor.

Speed: $S\,I$ is proportional to the counter e.m.f., $O\,E'$.

$\therefore$ $S\,I$ " " " flux × speed.

But the flux " " " the main current, $O\,I$.

$\therefore$ $S\,I$ " " " $O\,I$ × speed.

$$\text{and speed} = \frac{SI}{OI} \times \text{a constant.}$$

Make the angle $OSP = SIO$. Produce OI to P. Then the triangles SIO and OSP are similar

$$\text{and } \frac{SI}{OI} = \frac{SP}{SO}. \text{ But } SO \text{ is constant.}$$

$\therefore$ SP is proportional to speed.

Torque: Torque is proportional to OI^2 (since Φ is proportional to I).

$$IN^2 = ON \cdot NM.$$

Add ON^2 to both sides

$$IN^2 + ON^2 = OI^2 = ON\ (ON + MN) = ON \times OM.$$

But OM is constant.

$\therefore$ OI^2 is proportional to ON,
and torque " " " ON.

Output: Output = torque × speed $= OI^2 \times \frac{SI}{OI} = SI \times OI$.

But angle SIO is constant.

$\therefore$ $SI \cdot OI$ is proportional to area of triangle SIO.

The base of SIO is constant.

$\therefore$ $SI \times OI$ is proportional to the altitude IH of triangle SIO.

$\therefore$ **Output is proportional to IH.**

Power Factor: With center O and radius = 1, draw a circle cutting OE_k and OI at a and b, respectively.

Then, obviously, OK = power factor.

Efficiency: Output is proportional to IH.

Input " " " IR, since IR = component of current, OI, in phase with e.m.f., OE_k.

$$\textit{Efficiency} = \frac{IH}{IR}.$$

Iron Losses in Single-Phase Commutator Motors.

By Prof. Dr. F. Niethammer.

It is a well-known fact that the iron losses of a direct-current armature or of a three-phase armature are considerably larger than those in the core of a transformer, induction periodicity and volume being the same in the two cases. In the first case the magnetization is produced by rotation of an iron body in a magnetic field, and in the second case there exists a local periodical variation of the field. In a single-phase series motor both kinds of magnetizations are combined; at standstill there is only a transformer action, but after being started the armature of such a motor rotates in an alternating field. There are two widely different periodicities which have a bearing on the iron losses of a single-phase commutator motor, viz.: the periodicity, n_r, of rotation, equal to the number of revolutions per minute multiplied by the number of the poles of the motor and divided by 120. From a theoretical standpoint it is difficult to decide in which way the total iron losses depend upon these two periodicities. Steinmetz states that up to synchronous speed the iron losses of series motors depend upon n, and that above synchronism they vary with n_r, which seems entirely logical.

In order to ascertain in just what manner the iron loss varies with the speed, a simple experiment was performed using the circuits shown in Fig. 1. The field, F, of the single-phase commutator motor, K, is excited by an alternating current, A_c, and the open circuited armature, K, is driven by an auxiliary direct-current motor, H. The watts, A_e, input to the field and the watts input to the auxiliary motor were measured once when F was not excited (A_1) and then when F had a definite alternating-current excitation (A_2). The test conditions corresponded to those found in compensated series motors. The difference, $A_m = A_2 - A_1$, of the last two values gives the watts iron loss supplied to K by the auxiliary motor, H (if all necessary precautions are taken), and the first-mentioned watts are the iron losses supplied by the alternating current in the field coils. The sum of the two values, $A_e + A_m$, gives the total iron losses.

The motor tested was a four-pole machine with an output of 7 hp at 1,500 r.p.m. It is constructed with an equally distributed series winding in stator and rotor covering the whole circumference (no definite poles). The measurements were made at speeds from zero up to 1,800 r.p.m. for two periodicities, 35 and 50, and for two magnetic fields equal to about the full-load field and about half of this value. The value of the armature field, F_a, was determined from the open e.m.f., E, of the armature, R, and that of the primary field, F_f, from the field voltage, E. All necessary corrections were made on the measured results of the commutator motor, K, as well as on those of the auxiliary motor, H.

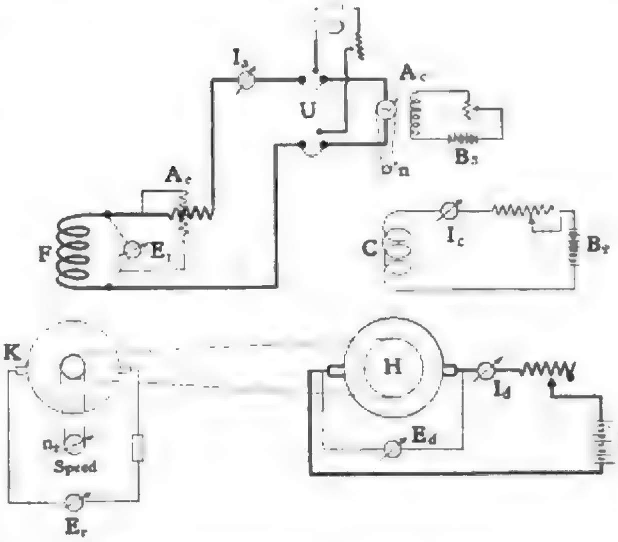


FIG. 1.—ARRANGEMENT OF TESTING CIRCUITS.

For purpose of comparison the iron losses with direct-current excitation were also measured by changing the position of the reversing switch, U, on D. The results are shown in Figs. 2 and 3; Fig. 2 for the larger flux and Fig. 3 for the smaller flux. The curves in full line refer to the total losses, which are made up of the two dotted curves which represent singly the losses measured by the wattmeter, A_c, and by the auxiliary motor, A_m. The dot-and-dash curve refers to direct current. For small

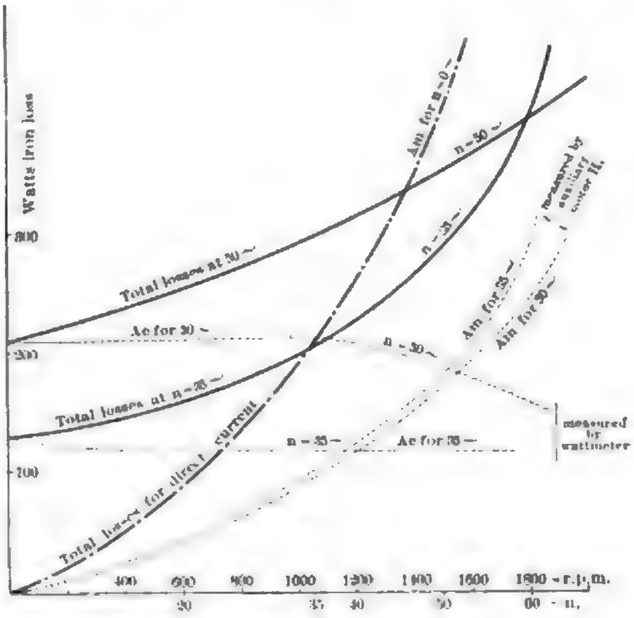


FIG. 2.—IRON LOSSES OF SINGLE-PHASE MOTOR.

speeds the total iron losses are the smallest for low periodicities, but for high speeds the ratio is reversed and the losses are largest for low periodicities. In fact, the curves for 35 periods crosses the curve for 50 periods, and the curve representing the direct-current losses crosses, first, the curve for 35 periods, and later on the curve for 50 periods, the flux remaining constant.

A knowledge of the character of these curves should be of value in connection with single-phase motors used for intermittent work where starting and stopping occur frequently, for example, for traction purposes on urban lines. It may be noticed that in this special case the intersection of the direct-current curve with the alternating-current curves takes place in the neighborhood of the synchronous speed; that is, at a point where n_r is nearly equal to n.

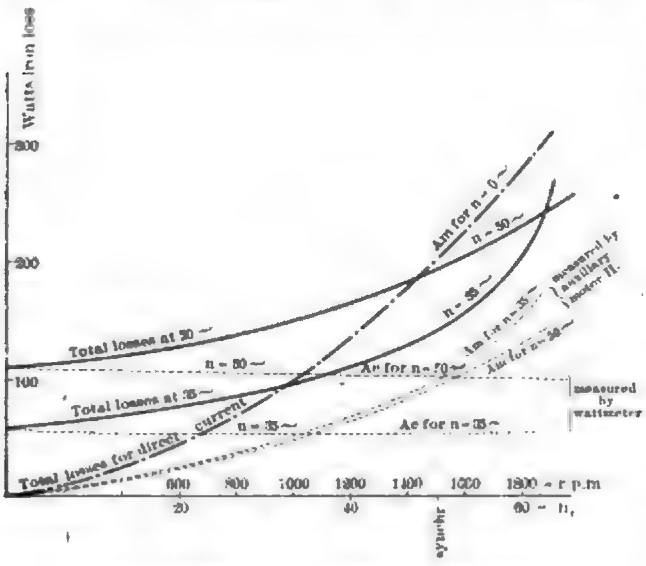


FIG. 3.—IRON LOSSES OF SINGLE-PHASE MOTOR.

The curves may be expressed approximately in formulas similar to those used for the iron losses in transformers and dynamos, as follows:

Hysteresis in the field (stator):

$$\sigma\left(\frac{n}{100}\right)\left[\left(\frac{\mathfrak{B}_1}{1{,}000}\right)^{1.6} V_s + \left(\frac{\mathfrak{B}_{z_1}}{1{,}000}\right)^{1.6} V_{zs}\right] \qquad (1)$$

Eddy currents in the field (stator):

$$c\,d^2\left(\frac{n}{100}\right)^2\left[\left(\frac{\mathfrak{B}_1}{1{,}000}\right)^2 V_s + \left(\frac{\mathfrak{B}_{z_1}}{1{,}000}\right)^2 V_{zs}\right] \qquad (2)$$

Hysteresis in the armature (rotor):

$$\left[\sigma\left(\frac{n}{100}\right) + \sigma^1\left(\frac{n_r}{100}\right)(1 - b\,n)\right]\left[\left(\frac{\mathfrak{B}_2}{1{,}000}\right)^{1.6} V_r + \left(\frac{\mathfrak{B}_{z_2}}{1{,}000}\right)^{1.6} V_{zr}\right] \qquad (3)$$

Eddy current in the armature (rotor):

$$d^2\left[c\left(\frac{n}{100}\right)^2 + c^1\left(\frac{n_r}{100}\right)^2\left(1 - b\,n\right)^2\right]\left[\left(\frac{\mathfrak{B}_2}{1{,}000}\right)^2 V_r + \left(\frac{\mathfrak{B}_{z_2}}{1{,}000}\right)^2 V_{zr}\right] \qquad (4)$$

In the above formulas, n = periodicity of impressed e.m.f., n_r = periodicity of rotation. $\mathfrak{B}_1$ (magnetic density) in stator core per square centimeter, $\mathfrak{B}_2$ magnetic density in rotor core, $\mathfrak{B}_{z_1}$ = flux density in stator teeth, $\mathfrak{B}_{z_2}$ = flux density in rotor teeth, V_s = volume of stator core iron in cubic decimeter, V_r = volume of iron of rotor core, V_{zs} and V_{zr} = volume of teeth in stator and rotor, d = thickness of iron sheets in millimeters. For the motor under test the coefficients are approximately $\sigma = \sigma' = 1$; $c = 2$; $c' = 20$; $b = .011$. The high value of c' proves the well-known fact that in an armature rotating in magnetic fields large additional eddy currents occur.

Unfortunately, there is no similar experimental method for determining the iron losses of the repulsion motor or of the series motor with transverse (short-circuited) brushes. So far as theory goes, one may conclude that the stator iron losses of repulsion motors will be the same as for the simple series motor with damping coil, given in (1) and (2), but for the rotor the losses are different, viz.:

Hysteresis in the armature (rotor):

$$\left[\sigma\left(\frac{n_s}{100}\right) + \sigma^1\left(\frac{n_r}{100}\right)\right]\left[\left(\frac{\mathfrak{B}_2}{1{,}000}\right)^{1.6} V_r + \left(\frac{\mathfrak{B}_{z_2}}{1{,}000}\right)^{1.6} V_{zr}\right] \qquad (5)$$

Eddy currents in the armature (rotor):

$$d^2\left[c\left(\frac{n_s}{100}\right)^2 + c^1\left(\frac{n_r}{100}\right)\right]\left[\left(\frac{\mathfrak{B}_2}{1{,}000}\right)^2 V_r + \left(\frac{\mathfrak{B}_{z_2}}{1{,}000}\right)^2 V_{zr}\right] \qquad (6)$$

All denominations remain the same as for the expressions (1) to (4), n_s = slip = $n - n_r$ (always to be used as a positive value). In this equation the parts containing n represent the additional eddy-current losses.

Economy of Power in the Electroplating Room.

By A. J. Tizley.

It is unfortunately true that less attention is given to the electrical equipment in the majority of electroplating rooms attached to manufacturing plants than to the apparatus employed in other departments of no greater importance. Upon looking over an electroplating room recently installed in a large plant, the following conditions were noted:

Four large tanks for acid copper plating were connected to a 1,500-amp., 3½-volt dynamo, driven by a 25-hp motor through a series of three short, heavy, tight belts. Now, to commence with, an acid copper bath designed to produce a heavy, pliable coating of copper does not require, and in fact cannot be run at, a greater pressure than 2 volts. This fact every plater should know. Investigation showed that this difficulty had been overcome by introducing a heavy rheostat into the main line cutting the voltage from 3½ volts down to 2 volts, thereby lessening the available energy distributed to the tanks in direct proportion to the reduction in pressure, the difference being lost in the resistance.

Furthermore, it was found that the conducting rods leading from the main rods to the tanks were too small in diameter; this was readily shown by the rods being so hot as to blister one's fingers. This meant a further loss of electrical energy, due to the resistance of the inadequate conducting rods.

Taking up the matter of motive power, it is evident that whereas a 25-hp motor was used to drive this 5.2-kw generator, a 7-hp motor properly installed was all that was necessary. The variation in the speed of motive power and consequent drop in voltage of the generator is compensated by the field rheostat of the modern plating dynamo.

Further examination showed that as much power was lost in transmission, between the motor and dynamo, as was consumed by the dynamo itself, due to the three belts referred to. Still further, it developed that the local Edison Company supplied this plant with about 100 hp to run its various motors and the question arose, why was it necessary to transmit power through three belts from motor to dynamo when a direct-connected machine might have been installed at a less cost, thus eliminating the initial expense of shafting, hangers, pulleys, belts, etc.?

It has been demonstrated that under average conditions there is a loss of about 25 per cent of power in shops belt-driven from a common center, aside from the cost of maintenance, which for belting alone amounts to 37 per cent per year of the initial cost, besides other expenses; whereas with a direct-connected machine the loss of efficiency is not over 15 per cent.

In consequence of the above, the owners were advised to discard these machines and to put in a dynamo, direct-connected to a 5-hp motor; that the dynamo should have a voltage of 2½ instead of 3½ volts, and to put up conducting rods heavy enough to carry the electric current without undue heating, and consequent loss of energy. This suggestion was followed, the results being that more metal was deposited in the tanks in a given time, and the bill for electric power was reduced by nearly 65 per cent.

In another shop visited was a dynamo with an outfit of 2,500 amp. and 6 volts connected to a number of large tanks; each tank had a heavy rheostat to reduce the pressure down to from 6 volts to between 1½ and 2½ volts pressure. The power supplied was, therefore, $2{,}500 \times 6 \div 746 = 20.1$ hp. The remedy in this case was simple: the speed of the dynamo was reduced to such an extent that it registered a pressure of 2½ volts, the current remained the same, and the saving in power is readily seen if we figure as before thus: $2{,}500 \times 2\tfrac{1}{2} \div 746 = 8.3$ hp, being a saving of nearly 12 hp.

The above illustrations are but two of the many instances noted by the writer within the past year, and serve to illustrate how a very little forethought may appreciably lessen the expense of power in an electroplating plant.

International Conference on Electrical Units.

As was noted in our columns at the time, an international conference on the subject of the fundamental electrical units was held in Charlottenberg (Berlin), Germany in October, 1905. The conference, whose membership is noted below, was convened upon invitation of Dr. Warburg, president of the Physikalisch-Technischen Reichsanstalt, whose action was supported by Dr. Stratton, Director of the Bureau of Standards at Washington. Such a conference had been recommended by the Chamber of Delegates of the International Electrical Congress of St. Louis, and had also been advocated by the American Institute of Electrical Engineers.

At the Charlottenberg conference there were present Prof. H. S. Carhart, from the United States; Prof. E. Gerard and M. P. Clement, from Belgium; Dr. Th. Lewald, Prof. Dr. F. Kohlrausch, Prof. Dr. E. Warburg, Prof. Dr. E. Hagen, Prof. Dr. W. Jaeger, and Prof. Dr. St. Lindeck, from Germany; Dr. R. T. Glazebrook, from England; M. E. Mascart, from France, Mr. V. von Lang and Dr. L. Kusminsky, from Austria. The conference held five meetings, during which the following problems were discussed: Shall the three units: ohm, ampere and volt, be independent of each other; or, shall only two be defined, and which two? The determination of the electrochemical equivalent of silver with reference to the definition of the ampere. Selection of a standard cell. The determination of the ohm. The method of the precipitation in the silver voltmeter. The production of the standard cell. International specifications of the standard cell.

At the first meeting, which was held on October 23, a sub-committee consisting of Gerard, Glazebrook, Jaeger and Lindeck, was appointed to submit a specification of the standard ohm. The members then entered into a discussion concerning the selection of the fundamental units. Glazebrook stated that the Electrical Standards Committee of the British Association, consisting of Lord Rayleigh, Carey Foster, Ayrton, Trotter and himself, had come to the conclusion that there should be selected only two units, the ohm and the ampere, independently defined. Mascart remarked that it was unnecessary to give a theoretical definition to the units. The ohm can be defined by the column of mercury and the ampere by the deposit of silver, and from these the volt can be derived. Kohlrausch held that it was not important whether the theoretical definition was given or not. Carhart presented a paper (reprinted below) showing why the ohm and the volt should be selected as the independent units. A similar position was also taken by the Bureau of Standards in a communication, an abstract of which is printed below. The selection finally rested on the ohm and the ampere as independently defined units.

The electrochemical equivalent of silver was discussed by Glazebrook, Mascart, Warburg, Kohlrausch and Gerard. Glazebrook expressed the wish that the value 1.118 might be chosen, for this is in use in England and America. The further discussion of this point was postponed until after the silver voltameter had been dealt with. The subsequent meetings were devoted to a detailed discussion of the deposit in the silver voltameter, the specification of the ohm, the methods of eliminating the difficulties in using a column of mercury, the practical operation of the silver voltameter and the characteristic features of the cadmium cell. The final decisions of the conference were as follows:

FORMAL DECISIONS.

Fundamental Units.

That only two electrical units shall be chosen as fundamental units.

The international ohm, defined by the resistance of a column of mercury, and the international ampere, defined by the deposition of silver, are to be taken as the fundamental electrical units.

The international volt is that electromotive force which produces an electric current of one international ampere in a conductor whose resistance is one international ohm.

Standard Cell.

The Weston cadmium cell shall be adopted as the standard cell.

Determination of the Ohm.

The conference recommended the following procedure for the establishment of the ohm:

The method which omits the end correction (Ausbreitungswiderstand) should not be employed.

The Reichsanstalt will put itself in communication with Messrs. Schott & Co., of Jena, in order to determine whether tubes of glass 59 of sufficiently uniform section can be produced.

The glass tubes used in setting up mercury resistances are to be carefully annealed.

The tubes are to be filled in vacuum without heating.

In determining the weight, the mercury column is to be bounded by planes at the terminal cross-sections of the tube and to be at a temperature of 0° C.

The length measurements are to be made as far as possible at 0° C. with the aid of contact pieces.

The electrical measurements are to be carried out at 0° C. and a method is to be employed which avoids the use of thick connecting wires. Among such methods the Kohlrausch differential galvanometer method, the Thomson double-bridge method and the compensation method are recommended. The current employed in measurement shall be limited by the condition that the mercury shall not be warmed sufficiently to produce appreciable error.

The mean of at least three fillings shall be taken as the value of the resistance of a tube.

The mean of at least five tubes must be taken to determine the value of the mercury unit.

The mercury standards shall have a resistance of approximately one ohm.

For the value of the wire standard, the mean of at least five resistances of one ohm shall be taken.

A comparison of the wire standard with the mercury units shall be carried out at appropriate intervals of time.

Specification of Standard Cell.

The Weston standard cell shall contain solid hydrated cadmium sulphate; the strength of the cadmium amalgam shall be 12 to 13 per cent of cadmium.

In the form of standard cell to be finally specified, sources of disturbance at the negative pole are to be avoided.

Determination of Ampere.

The conference further expressed the following opinions:

That the information before it is not sufficient to enable it to propose any alternation in the formerly accepted value for the ampere.

That the information before it is not sufficient to enable it to lay down exact directions in respect to the silver voltameter and the standard cell.

That if a proposal for a change in the accepted value of the ampere is to be brought from any source before a formal congress to be held later, an agreement in writing on the point should be arrived at previously between the parties interested. If differences of opinion in the matter cannot be removed, another preliminary conference should be held.

The same procedure should be observed in regard to the specification for the silver voltameter and the standard cell, in the event of such specifications being submitted to a formal conference from any quarter.

International Convention.

The conference expressed the wish that an International Convention should be summoned in order to arrive at agreement in the electric standards which are in use in the different countries, and the following resolution was further adopted:

"In view of the fact that the laws of the different countries in relation to electrical units are not in complete agreement, the conference should be summoned in the course of a year with the object of bringing about this agreement."

AMPERE OF VOLT.

Following is the communication presented by Prof. H. S. Carhart:

The most important question to be discussed at this conference is the following: Shall the ohm and the ampere, or the ohm and the volt be defined for practical purposes by *concrete* standards? It will be assumed in these remarks that the usual c.g.s. definitions of the ohm, the ampere and the volt are accepted by all. We are thus in possession of ideal values, and all concrete or material standards must be critically examined with respect to these ideal values.

It will be assumed, further, that the ohm as defined by the resistance of a specific thread of mercury under standard conditions is acceptable to all as the material standard of that unit. There remains the decision between the ampere as defined by the silver voltameter and the volt as defined by means of a standard cell.

Material Standards.

The ampere cannot be represented in a concrete or material form in the sense in which the ohm and the volt can be so represented. A standard ohm can be preserved, transported and compared with other standard ohms by well-known methods. An almost identical statement may be made respecting the volt as determined by a standard cell. When one is in possession of these two standards, one is fully prepared, by means of the appropriate apparatus, to measure resistances, electromotive forces and currents, and not merely average values of the last but instantaneous values. On the other hand, an ampere, with which to compare currents and measure volts, cannot be carried about and set up as a concrete standard of comparison. The very nature of the volt, therefore, as a static electric pressure, gives it a very important advantage over the ampere from the point of view of concrete material representation. Amperes cannot be compared; volts can readily be compared.

The Voltameter not an Ammeter.

The silver voltameter is not an ammeter but a *coulometer*. It does not measure the value of a current at any instant; but it measures more or less perfectly the quantity of electricity that has passed in an observed period of time. The value of the current derived from it is only the mean arithmetical value of a current which varies more or less throughout the period included in the observation. It has its scientific uses, but it is an imperfect device to employ for the legal definition of an ampere.

The Chemistry of the Silver Coulometer not Understood.

It has been shown within the last few years that the electrochemical equivalent of silver may apparently be made to vary as much as two-tenths per cent. The variation appears to be due in large part to the formation at the anode of some modification of silver nitrate, in which the silver has a larger electrochemical equivalent than the silver of the normal nitrate. If this compound reaches the cathode, the deposit of silver is greater than for a normal solution. The best suggestion made thus far in this connection is to adopt some means of keeping the unknown compound away from the cathode; but such a solution of the difficulty may or may not be a perfect one. This serious objection is sufficient in itself to decide in favor of the abandonment of the silver coulometer for the purpose of legally and scientifically defining the ampere.

Its Limitations.

The silver coulometer hitherto has been restricted to currents not much in excess of one ampere. Hence for practical purposes in calibrations it is nearly worthless. If it were not imperfect otherwise, the only service it can perform is to integrate the record of an ampere balance and to transfer this record imperfectly to a potentiometer for the purpose of determining the electromotive force of a standard cell. But the standard cell itself is capable of recording, in connection with a standard resistance, the instantaneous indication of an ampere balance. This cannot be done by the silver coulometer.

Currents Measured Practically by Standard Cell.

Even though the ampere should be legally defined by means of the silver coulometer, practical calibrations for both legal and scientific purposes would not be made by the silver coulometer, but by a standard resistance and a standard cell. This practice would lead to two values of the ampere, which might or might not agree. It is eminently wiser and more scientific to preserve the indications of an absolute ampere balance by means of a standard cell and a standard resistance than to, endeavor to preserve them by a silver coulometer.

Relation of the Ampere Balance to the Question.

In the last analysis the ampere, in whatever way it may be defined for practical purposes, must be determined by means of an absolute electrodynamometer or ampere balance. Such a piece of mechanism cannot itself be employed to *define* the ampere for general practical purposes. It cannot be precisely duplicated; its indications may involve the constant of gravity; and no one instrument should be relied upon in the final decision. The real question now is whether the results obtained by such instruments shall be given to the world in the form of the electrochemical equivalent of silver, or in the form of the electromotive force of a standard cell.

The advocates of the silver voltameter urge that the ampere should be legally defined by means of it, and that the volt should follow from the ohm and the ampere by Ohm's law. This can mean only that the electromotive force adopted for any standard cell must be determined by means of a standard resistance and the silver coulometer; *otherwise* the definition of the ampere by the silver coulometer would have little or no significance. But the electromotive force of a standard cell can be determined more easily and more reliably, with higher precision, and therefore more scientifically by the use of a standard resistance and the ampere balance, than by a standard resistance and a silver coulometer. In both methods the electromotive force of a standard cell in the last analysis involves a standard resistance and the ampere balance; but if the silver coulometer is used, the indications of the absolute ampere balance are carried over to the standard cell through the imperfect agency of the silver coulometer. It is certainly more reliable and more accurate to determine the electromotive force of a standard cell directly by the use of the ampere balance and a known resistance than indirectly and circuitously through the intermediate agency of the silver coulometer. Why take so much pains to preserve consistency with the past when obviously the direct method is better?

Ohm in Ampere Twice.

The proposal to define the ampere by means of Ohm's law has been objected to on the ground that the ampere would involve the ohm twice; for the only practicable method of determining the electromotive force of a standard cell is by comparing it with the fall of potential of a known current over a known resistance. But it should be pointed out that the electromotive force of a cell is directly proportional to a resistance, while a current by Ohm's law is *inversely* proportional to a resistance. Hence the resistance disappears and is not involved at all in the current. Thus

$$Amperes = \frac{Volts}{Ohms} = \frac{R\,I}{R} = I$$

is an equation expressing the operations by which the ampere for practical purposes is derived from the ampere balance. Any error in the ohm will, therefore, not affect the ampere in the least. The value of the volt will in any event be proportional to the ohm, and any correction that time may show the need of making in the legal ohm will mean the same percentage correction in the volt, but the ampere will remain unaffected.

The Weston Normal Cell.

Standard cells, and especially the Weston normal cell, have now reached such an approach to perfection that their reproducibility may be relied upon to about one hundredth per cent. Their electromotive force can be determined with all the accuracy with which the ampere can be determined by an absolute ampere balance. The Weston normal cell as now constructed leaves little to be desired as an instrument of precision; and the definition of the legal volt in connection with it, and of the ampere by Ohm's law, will bring the legal values of these quantities into agreement with those in practical use.

MEMORANDA FROM THE U. S. BUREAU OF STANDARDS.

The United States Bureau of Standards submitted three memoranda to the conference. One of these gave an outline of investigations that should be carried out in order to make it possible for an international congress to redefine the electrical units. The opinion was expressed that there is too much uncertainty attending the values of the standard cell and the electrochemical equivalent of silver to warrant any change at present in their legal values; and that it would be better to conduct investigations, if necessary, for three or four years, and then to select values that will stand for a generation, rather than adopt values hastily that may require modification in a few years. If possible the ohm should be redetermined by several different methods in a very thorough way, to make sure whether any change is needed in its present definition; this is the more needed as its value enters into the determination of the volt and of other electrical units.

A second memorandum submitted a proposal for new legal definitions of electrical units, intended to harmonize the two different views advocated regarding the definition of the units. The proposal is that while the definition should state that the ohm, volt and ampere are intended to have certain values in the c.g.s. system, their actual legal values will be defined by certain concrete standards, prepared in certain definite ways to be officially specified. There will thus be no ambiguity or uncertainty regarding the legal units, there will be international agreement as to their values, and yet they may be redefined and their values slightly modified (say a generation hence) if the differences between the legal values and true values prove to be sufficient to warrant it. If, on the other hand, the definition should be made in terms of the c.g.s. units, any country is at liberty at any time, independently of other countries, to order its standards and to bring them more nearly in accord with what it feels to be the true values of these units, unless concrete standards are legalized apart from the units (as has been done in England), which the memoranda states to be undesirable.

Of the three units to be defined, only two—the ohm and the volt—should be independent. If further research shall demonstrate that the silver coulometer is more reliable for precision measurements than the cadmium cell, the Bureau of Standards will be willing to reconsider this choice. A decided preference was expressed for the cadmium cell over the present standard or Clark cell.

A sub-commission to carry along the investigations indicated above should consist of representatives of Physikalischen Technische Reichsanstalt, the National Physical Laboratory of England, one of the government laboratories of France, and the United States National Bureau of Standards, not more than two members of each to be appointed by the president or director of each institution, in addition to the said president or director, and 12 other members to be selected by the present conference—in all not more than 24 members. This commission should be authorized to issue a call for an international congress when the results of investigations shall warrant it, and to make a report and recommendations to such congress concerning the subject of electrical units.

A third memorandum submitted consisted of a discussion by Dr. K. E. Guthe on the electrochemical equivalent of silver, and called attention to the need of further research to determine the value of such equivalent.

A recommendation was also made with respect to an international committee consisting of representatives from such government institutions as support well-equipped laboratories for the maintenance and study of electrical standards, which should supervise the intercomparison of standards and designate the values to be assigned to the standards of each institution as a result of such intercomparison. These intercomparisons of standards or of copies of standards would be made at the several government laboratories, and would not necessitate the establishment of a new institution. Such an international committee might also take cognizance of the standards of inductance, of capacity, of photometry and of such other standards as might seem desirable.

LETTER TO THE EDITORS.

Efficiency of Lighting Balancers.

To the Editors of Electrical World:

SIRS:—In your issue of January 13, page 115, Mr. C. T. W kinson shows the over-all efficiency of a balancer set to be:

$$\eta = \frac{1}{2} + \frac{I_g}{2\,I_m}$$

I_g and I_m being the generator and motor current, respectively.

In calculating this over-all efficiency, however, no consideration was given to the fact that the balancer set supplies its power under only half the voltage which the main generator uses, and that, therefore, the transmission efficiency of the power furnished by the balancer set must be lower than the transmission efficiency of the power furnished directly by the main generator. The over-all efficiency of the balancer set is, therefore, in fact lower than the above equation determines, because the balancer set in addition to the loss represented by $(1 - \eta)$ produces the reduction of potential for which it is intended.

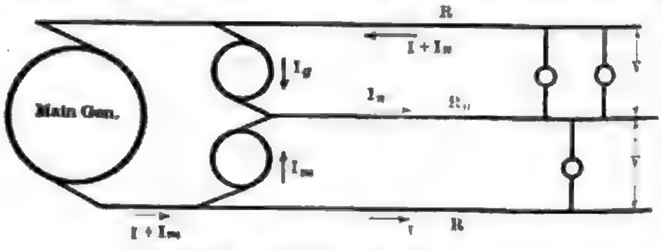


DIAGRAM OF BALANCER CIRCUITS.

Referring to the accompanying sketch wherein

R = resistance in positive and negative leads,

R_n = resistance in neutral,

the transmission efficiency of the power furnished directly by the main generator is:

$$\eta_m = \frac{2V \times I - 2R \times I}{2V \times I} = 1 - \frac{R}{V}.$$

and the transmission efficiency of the power furnished through the balancer set:

$$\eta_B = \frac{I_n \times V - I_n\,(R + R_n)}{I_n \times V} = 1 - \frac{R}{V} - \frac{R_n}{V} = \eta_m - \frac{R_n}{V}.$$

The last member of this equation represents the decrease of the transmission efficiency of the balancer set as compared with that of the main generator. The over-all efficiency of the balancer set is therefore:

$$\eta_B' = \left(\frac{1}{2} + \frac{I_g}{2\,I_m}\right)\left(\eta_m - \frac{R_n}{V}\right)$$

PITTSBURG, PA. B. F. JAKOBSEN.

DIGEST OF CURRENT ELECTRICAL LITERATURE

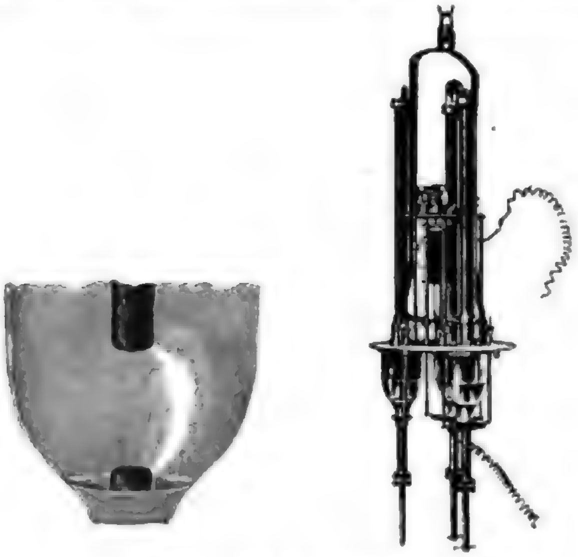
Dynamos, Motors and Transformers.

Magnetic Induction in Dynamo Armatures.—RUEDENBERG.—In designing electric machines it is important to know the path which the lines of magnetic induction take in the air-gap and in the iron, in order to determine the excitation and also because the iron losses in the moving parts depend on the density and the distribution of the lines of induction. With respect to the latter point the path taken in the armature iron is especially important and has recently been the subject of extended experiments by Thornton and Studniarski. The main point which has been established is that in the neutral zone of the armature the induction is a maximum not at the outside—as might be expected from a first approximate calculation—but further towards the center of the iron. The reason for this particular phenomenon is considered by Studniarski to be the self-demagnetizing reaction of the armature. The present author gives a mathematical theory of the subject.—*Elek. Zeit.*, February 8.

Commutation Poles.—OELSCHLAEGER, DERI AND DETTMAR.—Three letters referring to the recent article of Dettmar. They concern the history of commutation poles and some special applications like the use of commutation poles for shunt motors with adjustable speed.—*Elek. Zeit.*, February 22.

Lamps and Lighting.

Arc Lamp.—CORSEPIUS.—At the Exposition in Liege, the Vogel lamp of the Phoenix Electrical Co. was shown which represents a combination of an enclosed arc and a mercury-vapor lamp. Of the two carbons, the lower one is placed in mercury amalgam and the arc has the appearance shown in Fig. 1. The lamp shown in Liege was a triple lamp with common regulation; it is shown in Fig. 2. It furnished "considerable quantities of light" and the carbons are said to have a life of 1,600 hours. The lamps are used in connection with a starting resistance. According to the composition of the amalgam, white or colored light may be obtained.—*Elek. Zeit.*, February 8.



FIGS. 1 AND 2.—ARC LAMP.

Waste in Incandescent Electric Lighting.—WILKINSON.—A paper read before the Leeds section of the (Brit.) Inst. Elec. Eng. The author gives some glaring instances of the use of wasteful lamps and then suggests remedies. He first suggests a law according to which the electricity undertaker would be authorized to refuse to supply a consumer who uses wasteful lamps. A second remedy which he applies in practice is to issue a lamp specification of not too exact a nature and to test lamps for contractors at a cent a piece to see that the lamps come up to their nominal candle-power and wattage. Tested lamps are stamped and consumers are advised to use only lamps so certified. (In an editorial note the objection is made that the lamp maker will soon find that he can avoid the rejection of lamps by supplying lamps of high initial efficiency and short effective life, since life tests are out of question under these conditions.) The author finally points out that the present low average efficiency of lamps is at least in some measure the result of bad-pressure regulation on the supply network which is destructive to high-efficiency lamps.—Lond. *Elec.*, February 16.

Power.

Gas Engines.—ATKINSON.—A paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng., on the applications of gas engines to electric driving. Different methods of governing are discussed. The simplicity of "hit-and-miss" governing, together with the economical results thereby attained, make such an arrangement thoroughly satisfactory in many instances. There are cases, however, where automatic regulation has been introduced with a view to eliminating the governing variation. Broadly speaking, four methods have been adopted for this purpose, namely, throttle governing; cut-off governing; varying the richness of the charge by throttling the gas; varying the richness of the charge by admitting the gas earlier or later during the suction stroke, but cutting it off always at the same period at the end of the suction stroke. The relative merits and demerits of these different systems were dealt with. For alternating machine driving a multiple cylinder will be used. Engines giving two impulses per revolution will be mainly adopted for moderate powers, and for larger powers two such engines would be combined having their cranks at right angles.—Lond. *Elec.*, February 16.

Utilization of Blast Furnace Gases.—FREYN.—A paper giving a full and detailed estimate of the available power and of the cost of operation of a gas-engine power station operated with the waste gases from a blast furnace plant.—*Jour. Western Soc. Engineers*, February.

Steam Turbines.—A note stating that Mather and Platt are now taking up in England the manufacture of the Zoelly steam turbine of Escher, Wyss & Co. The Zoelly turbine is a multi-stage impulse turbine, with horizontal shaft, and its chief feature lies in the construction of the wheels. The same issue contains a description and results of tests of two 1,500-kw Curtis steam turbines built for a London station.—Lond. *Elec.*, March 2.

Steam Turbines.—STEVENS AND HOBART.—The first part of an article on the effect of admission pressure on the economy of steam turbines. The article is fully illustrated by diagrams and contains extended tables.—Lond. *Eng'ing*, March 2.

Crane Motors.—HILL.—The conclusion of his paper the first part of which was recently abstracted in the Digest. The author deals with the effect of the load factor, and discusses the design of controllers for crane motors.—Lond. *Elec.*, February 23.

Traction.

Self Induction in Steel Rails.—WILSON.—The author has experimented with two bull-headed rails of iron having a specific resistance of 21.5 × 10^{6} ohms per cubic centimeter at about 9°

C. The object of his tests was to discover how the ohmic resistance of the rails is varied when alternate-currents of different magnitudes traverse them at different frequencies; how much the potential difference (impedance volts) between the ends of a given length of rail is increased over the direct-current value under the action of alternating currents of different magnitudes and frequencies, when the return circuit consists of a copper conductor suspended parallel with the rails at different distances from them; how, when two rails are used in parallel, the potential difference between their ends varies for a given height of the suspended conductor as the distance between the rails is varied; and finally to find the self-induction of circuits consisting of a rail or rails and a parallel overhead conductor. The results are given in tables and diagrams. The author first found that for a given frequency the ratio of the ohmic resistance to alternating and direct-currents is greater the higher the current. The next experiments were made with one rail and the return overhead conductor, and then with two rails in parallel using the same overhead conductor as a return. The height of the conductor over the rail was changed. The results for the frequency of 100 are given in Fig. 3. The circuit formed of one rail and the conductor had a self-induction of 29×10^{-4} henries at frequency 50 when 150 amperes traversed the rail, and 36×10^{-4} henries at frequency 23 with the same current value. Comparing these with the self-induction obtained when the overhead conductor was 12 ft. above the rail at corresponding frequencies and current, we see that the 12-ft. air space only about doubles the self-induction of the circuit. And yet there is evidence to show that the frequencies dealt with are enormous as compared with the frequencies which would be required to produce an approximately uniform distribution of current over the section of the rail. That is to say, at the frequencies dealt with the outer layers of the rail are carrying most of the current. The greater penetration at the lower frequencies is shown by the increased self-induction.—Lond. *Elec.*, February 23.

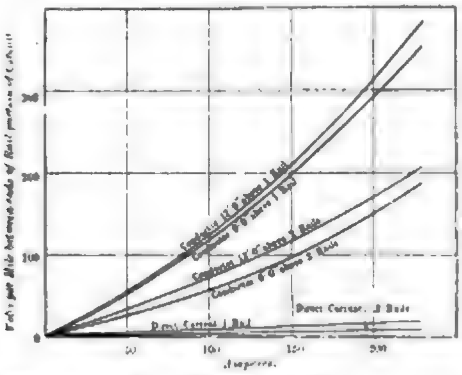


FIG. 3.—CURVES SHOWING RESULTS OF TESTS.

Three-Phase Traction in Simplon Tunnel.—The Simplon tunnel is to be opened early this summer. At the end of last year Brown-Boveri & Co. offered to install electric traction and to finish the equipment before the opening of the tunnel. This offer was made in order to enable a comparison between steam and electric traction on a line suitable to show the special advantages of electric traction. Mainly on account of the difficulties of ventilation this offer was accepted by the Swiss State Railways. In view of the short time available it was impossible to devise a new system, but since Brown-Boveri & Co. are building for the Italian Valtellina Railroad two three-phase locomotives each of from 900 to 1,000 hp, and since it appeared possible to use these locomotives for the Simplon tunnel, the three-phase system was selected. Its choice was therefore due mainly to incidental causes. At each of the two terminals of the tunnel, which is 20 km. (12 miles) long, there exist water power stations, each of which furnished up to the present time the power for the many motors used in the construction of the tunnel. The plants will now be used for traction purposes, three-phase currents being generated at 3,300 volts and 15 periods. For the present, only the tunnel proper is to be operated electrically; the current will, therefore, be supplied immediately without transformation to the trolley wires, the rails being used for the return current. When a train arrives at one terminal the steam locomotive is replaced by an electric locomotive which is again taken off when the train has passed the tunnel. The locomotives have three driving axles besides two running axles. The motors are built for two speeds, namely 34 and 68 km. (20 and 41 miles) per hour, the speed being changed by changing the whole connections. The draw-bar pull of the locomotive is six tons at the lower speed, and 3.5 tons at the higher speed. All switches are operated by compressed air; there are two electrically-driven air-pumps operating independently of each other.—*Elek. Zeit.*, February 22.

Single-Phase Railway in Switzerland.—The Oerlikon Company will equip the Valle-Maggia Railroad from Locarno to Bignasco. The road has a length of 27½ km. (about 17 miles). The steepest grade is about 3.3 per cent. The gauge will be one meter, and the trains will weigh up to 55 tons. Single-phase current will be used at 5,000 volts. The motor cars have four axles with four 40-hp single-phase motors; trailers will also be used for passengers and freight. An available water power will be used, and the power house, which will not be very far from the center of the road, will contain two 350-kw generating sets. This railroad will be the second one in Switzerland to use single-phase current. The first one is an experimental road from Seebach to Wettingen, which was also equipped by the Oerlikon Company, and operates at 15,000 volts. The results of this first road have been so satisfactory that the railway department of the Swiss government permitted at once the use of 5,000 volts on the trolley wire. This is the highest voltage used so far in Switzerland, with the only exception of the experimental road mentioned above.—*Elek. Zeit.*, February 22.

British Traction System.—The first part of an illustrated description of the Greenwich power house of the London County Council Tramways. Its total capacity will be 34,000 kw., but this has been divided into two parts, of which the first only is being proceeded with at present. This part contains four machines of 3,500 kw capacity each, so that the total is 14,000 kw. The second part will have four machines of 5,000 kw each. Three-phase currents are generated at 6,600 volts and 25 periods (the center of generators being earthed), and are transmitted to motor-generator sub-stations, where they are converted to direct current at 550 volts.—Lond. *Elec.*, February 23.

Installations, Systems and Appliances.

Operating Switches from a Distance Without Auxiliary Wires.—Multhauf.—In order to disconnect distant transformers for the purpose of avoiding no-load losses, or in order to change the connections of double-tariff meters a simple and cheap method is valuable for central stations. For cheapness it is important that no auxiliary wires should be used. The author accomplishes this result by sending currents of special frequencies over the supply network to relays which operate the switches and which are tuned to certain frequencies. If the system is to be used in direct-current stations, a small machine is to be installed in the power plant for generating alternating-current or pulsating direct-current of variable frequency, this current being then superposed on the direct-current of the power plant. The

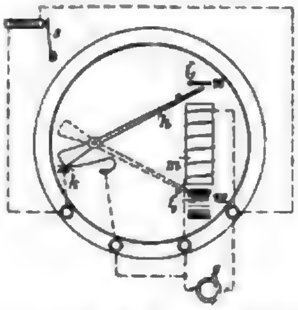


FIG. 4.—DIAGRAM OF SWITCH CONNECTIONS.

most important device of the system is the receiving relay. Its principle may be seen from Fig. 4. It consists essentially of steel tongues tuned to certain frequencies. If currents of the proper frequencies are transmitted over the supply wire, the tongue tuned to this frequency begins to vibrate and produces the desired connection either by a mechanical push or by closing a special auxiliary circuit. *m* is an alternating-current magnet which is able to set into resonance vibrations at least two steel tongues showing in cross-section in Fig. 4 at f_1 and f_2. The normal frequency in the power plant may be 100 periods per second and the largest change in this number above or below the normal value may be 1.5 per cent in ordinary service. In this case one tongue is tuned to 98 (the upper one in the illustration) and the second to 102 alternations. If the number of alternations is intentionally raised in the station to 102 or if a special current of this frequency is sent over the wire, the tongue, f_2, begins to vibrate rapidly and closes a contact, *k*, for instance, by means of the lever, *h*, which is movable between two positions of equilibrium. The vibrating tongue pushes the free end of the lever out of one position of equilibrium (shown by dotted lines in the illustration) so that the lever is thrown over to the other position of equilibrium (shown in drawn-out lines). In this new position the lever closes a circuit which may be used in a well-known manner, for instance, to produce attraction of the armature of the switch, *s*. This situation will remain unchanged until intentionally a current of 98 alternations per second is sent over the wire. Then the tongue, f_1, will be set in rapid vibrations and will throw the lever back into the position shown in dotted lines so that the contact, *k*, is now broken. Several modifications are described, together with the application of the author in central stations.—*Elek. Zeit.*, February 8.

Charging Batteries in Groups.—EDLER.—The first part of an article on charging batteries in groups. Since the charging voltage of a storage battery is much higher than the discharge voltage, a battery can be charged at the supply voltage; i. e., without the use of boosters, etc., only when it is divided into groups which are connected in series during discharge, but are connected differently during charge. For a long time it was usual to divide the batteries into two groups which were connected in parallel during charging with the aid of proper series resistances, while the two groups were connected in series for discharge, the resistances being then disconnected. More recently methods have been devised by which the battery is divided into three groups whereby the loss in the charging resistances may be considerably reduced. The author gives the formulas for the different arrangements possible.—*Elek. und Polyt. Rundschau*, February 1.

Wires, Wiring and Conduits.

Paper Versus Rubber for Cable Insulation.—TAMLYN.—A comparison of paper and rubber used for insulating cables for three-phase distribution to sub-stations in cities, using, say, a frequency of 25 cycles and potentials of from 6,000 to 12,000. Neither kind of insulation is perfect; in a given case the success or failure of a cable depends upon the care used in the design and manufacture and upon the service conditions. Since paper cables are cheaper in first cost than rubber, and will last as long as the sheath remains intact, they are undoubtedly better in places where there are no grounded direct-current trolley systems, or where the electrolysis caused by such systems can be eliminated. It still remains to be shown that the life of rubber cables, installed where ordinary city conditions obtain, is independent of the life of the sheath. This is especially true in view of the well-known action of even dry air on rubber. Vulcanized rubber, while it will last longer than pure rubber, is by no means free from deterioration. Paper will stand a temperature of 90° C. for a time without any bad effect, although the regular working temperature should not be allowed to rise as high as this. Rubber cannot stand more than 65° or 70° C. for even a short time without softening. The specific inductive capacity of paper is less than half that of rubber. This is an important item, because the loss due to the capacity of the line is directly proportional to the specific inductive capacity of the insulation between the conductors. The following results of a test of the New York Edison Company are quoted:

DIELECTRIC LOSSES IN TRIPLEX CABLES OPERATING AT 6,400 VOLTS, 25 CYCLES.

	Paper cable.	Rubber cable.
Length, feet	10,935	24,756
Copper, cir. mils	250,000	250,000
Insulation	10/32-in.	10/32-in.
Temperature (about)	80° F.	80° F.
Charging current in amperes, working conditions.	0.47	2.16
Total watts lost	312.6	4266
Watts lost per ft	0.02859	0.1723

These figures show a decided advantage in favor of the paper-insulated cable.—*Eng'ing News*, March 15.

Electric Wiring of Small Buildings.—ROBSON.—An abstract of a paper read before the New Castle section of the British Inst. Elec. Eng., on the electric wiring of small buildings during course of erection. The aim should be to compete with gas in cheapness, and to do this some cheap method must be adopted, such as the American split insulator system, though that requires that the wires to switches be carried in insulating tubes. The author commends the bituminized tubing and in reply to the objection that it is liable to be pierced by nails, says that the same thing applies to light steel tubing. His special abhorrence is close-joint tubing. —Lond. *Elec. Times*, February 15.

Determination of Feeder Drop.—WALLACE.—With reference to a former article in ELECTRICAL WORLD the author gives an analysis of the economics of feeder transmission and a formula for calculating it, together with a curve-chart for estimating feeder drop. —*St. R'y Jour.*, March 3.

Electrophysics and Magnetism.

Hysteresis Loss.—SUMPNER.—A communication pointing out that Steinmetz's hysteresis law is purely empirical and is not exact over the whole range of induction. Steinmetz's law contains the 1.6th power of *B*. As noticed in the Digest, Wild recently found that for very low values of *B* the exponent should be 2.7 instead of 1.6. The writer points out that there is nothing surprising in that. He has investigated the behavior of electromagnets for instrument purposes and has proved that the phase difference between the magnetizing current and the magnetism is dependent upon the ratio of *E* to B^2, where *E* is the energy loss in hysteresis for a cycle of maximum flux density, *B*. Now, if in the equation $E = B^x$, the exponent, *x*, is less than 2, the ratio of *E* to B^2 must decrease as *B* increases. This is true for values of *B* over 1,000. The curve connecting the value of E/B^2 with *B* has a maximum value for some value of *B* generally lying between 600 and 1,000, and as *B* is diminished below these values the value of E/B^2 falls very rapidly, showing that if $E = B^x$ the value of *x* must be greater than 2 for these low values.—Lond. *Elec.*, February 23.

Non-Metallic Condenser.—RUDGE.—An account of an investigation in which the author found that an ordinary vacuum tube or incandescent lamp may be made into a condenser by coating it with tinfoil on the outside only, the exhausted air acting as the inner coating. And, further, the outside coating may be replaced by a second vacuum surrounding the first, thus obtaining a condenser without any metallic coatings. Such a condenser is shown in Fig. 5. Exhaustion need not be carried beyond 1 cm. of mercury. Charging may precede exhaustion without greatly altering it, and the air may be renewed between charge and discharge without greatly reducing the effect.—Lond *Elec.*, February 23; from *Proc. Cambridge Phil. Soc.*, January 31.

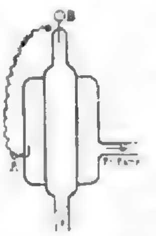


FIG. 5.—NON-METALLIC CONDENSER.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—WITT.—A lecture on the practical results obtained with the Birkeland-Eyde process used in Norway for the fixation of atmospheric nitrogen. The principal trouble was to work up into acid of merchantible strength the very weak acids and highly diluted acid vapors issuing from the apparatus. It is stated that water power may be obtained at the place where the process is in use in Norway at a price of not more than $3 per hp-year. This makes it possible to produce the nitric acid so cheap as to compete with Chili saltpeter. Calcium nitrate is the product sold. The immediate future for the synthetical product appears to lie in those branches of applied chemistry and agriculture where absence of chlorine and sodium compounds is desirable in the nitrogen compounds produced.—Lond. *Elec. Rev.*, March 2.

Accumulators.—Schoop and Liagre.—The first part of an illustrated article on containers for alkaline and lead accumulators. In the present installment the authors discuss the construction of hard rubber containers. Data are given as to the impurities which may be permitted in hard rubber for such purposes. The method for making a hard rubber container is described together with a test of determining the soundness of the walls by means of an induction coil.—*Electrochem. and Met. Ind.*, March.

Zinc.—Meyer.—A review of the zinc industry in the year 1905. After a sketch of the commercial situation, the author discusses the ores now available, and new developments in roasting and smelting. The same issue contains a very full description of the new Hazard zinc works of the New Jersey Zinc Company, both of the spelter and of the zinc oxide plants.—*Electrochem. and Met. Ind.*, March.

Hypochlorite.—Digby.—An illustrated account of two tests of electrolytic hypochlorite plants in England.—*Electrochem. and Met. Ind.*, March.

Electrochemical Progress.—Spiers.—The first part of a review of electrochemical and electrometallurgical progress in 1905.—Lond. *Elec. Rev.*, February 16.

Units, Measurements and Instruments.

Three-Phase Leakage Indicator.—An illustrated description of a leakage indicator devised by Ferranti for use on three-phase circuits when the middle point is not earthed. Fig. 6 shows the connections. The apparatus consists of a milliamperemeter of the long-scale type working on the induction principle, a four-way switch provided with an automatic spring back arrangement to keep it normally on the first contact, and three incandescent lamps all mounted on one board. The lamps are connected in star fashion to the three phases, and the neutral point thus formed is connected to the first contact of the switch. When the switch is on the first position the milliamperemeter will indicate the current passing to earth from the neutral point. In the other positions of the switch one of the three phases is put to earth through the milliamperemeter and a resistance. If, when the switch is on position 1, the instrument reads a full scale deflection; it shows a dead earth on either phase 2 or 3. If the same result is obtained on position 2 it proves that the earth is on phase 3. If, instead of a full deflection, the instrument reads D milliamperes, the insulation resistance, R, of phase 3 can be calculated from the formula $\frac{V}{R'+R} = \frac{D}{1{,}000}$, where V is the voltage between phases, and R' is the resistance of the instrument. It is intended that on each day readings should be taken with the switch in all four positions. If there be no leakage, the milliamperemeter will not read at all and the lamps will glow with equal dullness. A bad earth will put out the lamp on the earthed phase and cause the other two to light up more brightly, at the same time causing a large deflection on the milliamperemeter.—Lond. *Elec.*, March 2.

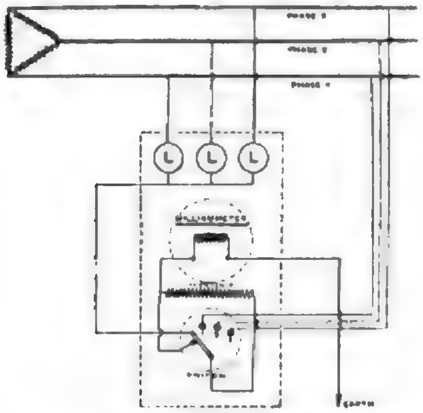


FIG. 6.—LEAKAGE INDICATOR CONNECTIONS.

Electric Waves.—Fleming.—The conclusion of the reprint of his Cantor lectures on the measurement of high-frequency currents and electric waves. The lecture given in the present installment deals with stationary electric waves on wires.—Lond. *Elec.*, February 23.

Phasemeters.—Sumpner.—An article, illustrated by diagrams, discussing the constructon and operaton of phasemeters and their calibration.—Lond. *Elec.*, February 23.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—Pierce.—This fourth paper on experiments on resonance in wireless telegraph circuits. The first discusses the direct-coupled type of sending circuit and gives resonance curves with this type of sender and various forms of receiver. He finally discusses the image theory of the action of the ground of a grounded circuit. According to this theory the action in the grounded circuit with the receiving instrument near the ground is the same as it would be if instead of being grounded it should be symmetrically duplicated below the surface of the earth. The author describes experiments which show a good agreement between the observations and the predictions from the image theory of the action of the ground. They also show that it is a simple matter to balance the aerial at the receiving station with an artificial ground that will increase the reception of energy (current square) by twenty per cent or twenty-five per cent over a good actual ground.—*Phys. Rev.*, March.

Miscellaneous.

Equipment of British Manufacturing Plant.—The first part of a well-illustrated description of the works of Veritys, Ltd., at Aston, manufacturing motors and fans, switches and controllers, arc lamps and fittings.—Lond. *Elec. Rev.*, March 2.

Liege.—Corsepius.—Some supplementary notes on various electrical exhibits at last year's International Exhibition in Liege.—*Elek. Zeit.*, February 8.

BOOK REVIEW.

Les Enroulements Modernes. By A. Meynier and H. Nobiron. Paris: Ch. Beranger. 53 pages, 41 illustrations.

The authors have set themselves the task of investigating and expressing a general theory of direct-current armature winding capable of embracing all the many varieties of windings which have been used or which are used to-day. This pamphlet is, therefore, a useful little text-book on the arithmetic of armature windings, a very practical, and at the same time a very complete, subject. Many of the theorems have already appeared in books devoted to armature winding; but the collection of the material in this form has distinct merit. The pamphlet will be of interest and use to students of direct-current machinery and to dynamo designers.

Single-Phase Equipment for Central Illinois.

The Central Illinois Construction Company has adopted single-phase, alternating-current trolley supply, catenary construction for the additional 80 miles of track being constructed, and its use is anticipated on later extensions. The portion of track to be so equipped consists of two 40-mile lines, one connecting Bloomington and Peoria, the other lying between Springfield and Lincoln. The present equipment of the Central Illinois Construction Company is direct current, consisting of heavy suburban type cars equipped with four General Electric 75-hp motors, and their local demand for power is considerable when accelerating or when operating on grade. The cars contemplated for the new extensions are still heavier and it is evident that the question of secondary distribution is one of great importance when such large equipments are used over a system so extensive. There is now high-tension distribution from the Riverton station at 13,200 volts, but this line is being changed to 33,000 volts, and the latter station will be supplemented by a second power house located in Peoria with a common 33,000-volt transmission line connecting the two stations.

The equipment includes ten 75-hp compensated motor car equipments, together with necessary sub-stations, overhead line material, generating station equipment, etc. Each car equipment consists of four 75-hp motors with Sprague-General Electric system of multiple unit control adapted for use on alternating-current circuits. These are so arranged that they will permit tap control when running on alternating current, and series-parallel resistance control when running on direct current. In addition to the motors and control apparatus, complete alternating-current-direct-current General Electric air compressors and straight air brake equipments will be installed, as well as arc headlights adapted for use on 25-cycle alternating current. The trolley will be of the pantagraph type with rolling contact, raised and lowered by compressed air.

The equipment just outlined will take care of the passenger service, but for hauling freight the operating company will employ a single-phase locomotive equipped for service on the same roads as the regular motor cars. This locomotive will be of the eight-wheel type, equipped with four General Electric 125-hp compensated alternating-current motors. The total weight of the locomotive complete will be 50 tons with a draw-bar pull of 20,000 lb. It will haul its train at a speed of 20 miles per hour with the current supply at 3,300 volts and 25 cycles. In common with the motor cars for passenger service the locomotive will be equipped with the Sprague-General Electric multiple unit control for operation on both direct and alternating currents. It will also be supplied with complete air brake equipment of the General Electric type, comprising an alternating-current-direct-current motor-driven air compressor with the straight air brake apparatus.

To furnish additional power for this new rolling stock, the present generating station at Riverton will be supplemented by a 2,000-kw Curtis steam turbine furnishing current at 25 cycles, and the new power house at Peoria will be equipped with two 2,000-kw Curtis turbines. The generator and high-tension distribution system will be three-phase and will feed the present rotary converter sub-stations, and also the 80-mile section of track operating with alternating current.

Dayton Fans.

The Dayton Fan & Motor Company, Dayton, Ohio, has revived the Dayton ceiling fan as originally placed on the market in 1892, but with an ornamental basket armature carrier instead of a plain one. The manufacturers state that many thousands of these motors have been in use constantly without repairs for from ten to twelve years. The fan is supplied with or without a switch for three speeds, and either two or four blades are furnished. The speed is 215 r.p.m. and the shipping weight of the motor is 50 lb. The motors are wound for 110, 170, 220, 250 and 500 volts.

Tuerk Alternating-Current Ceiling Fans.

The Hunter Fan & Motor Company, Fulton, N. Y., has added to its line of alternating-current ceiling fans two new types, both employing induction motors. The motors are designed for 40, 50 and 60 cycles and for voltages from 50 to 250 volts. With one type, when two blades are used, these are of 56-in. sweep, and 52-in. sweep with four blades. The speed is 225 r.p.m. All bearings run in oil. The second fan type is more moderate in price than that described above. It is equipped with either two or four blades of 60-in. sweep, the width of the blades being 8 in. The current consumption is 110 watts at full speed of 175 r.p.m. and 80 watts at a second speed of 150 r.p.m. The motor is equipped with a pull switch, the first pull starting the motor, the second pull on the chain securing the second speed. An indicator tells at a glance the speed and also when the current is off. The case is well ventilated and all bearings run in oil.

The Wireless Lamp Cluster.

The accompanying illustrations show some of the applications of the Benjamin wireless cluster, made by the Benjamin Electric Company, Chicago. The clusters are now made for from two lights to seven, in all of which the same principle is employed. A brass punching screwed on a porcelain base is connected with one terminal of the line and serves as the center contact for all of the lamps in a cluster. Lamp sockets are soldered into a hemispherical cap fitting over the base, this cap forming the other terminal of the line. There is approximately one-fourth of an inch of space between the cap and the center contact, thus removing all possibility of short-circuits. An outer hemispherical covering, which is highly polished and lacquered, is held in place by the lamp socket porcelain rings, and is lined with a heavy fibre insulation. On that style of cluster not provided with a socket in the center this insulation is secured in place by an insulating bushing inserted through the cap. The bushing is provided with a knockout center which, when removed, permits a cord to be run through for the attachment of a pendant switch, an extension light or a fan.

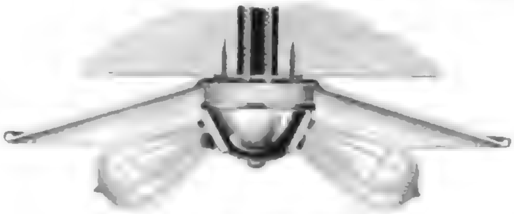


FIG. 1.—TWO-LIGHT CLUSTER.

The wireless cluster is particularly adapted for street car lighting, not only adding to the interior appearance of the car, but obviating trouble from short-circuits frequently encountered with the ordinary type of wired cluster, through the constant vibration of the car loosening a screw. The two-light cluster, shown in Fig. 1, is that most frequently used in electric cars. Three, four and five clusters are also made especially for this use. A reflector may be placed above the lamps close up against the ceiling, and a special porcelain enameled reflector for this purpose removes the chief objection to the use of reflectors on cars, as it is of steel and is not easily broken.

The "arc burst," which for some uses is replacing arc lamps, is a development of the wireless cluster. Immediately below a broad porcelain shade are arranged incandescent lamps, the center one being usually of 50 cp and sometimes provided with a separate reflector. By adding the "turn-down" feature, an advantage through reduction in electric light bills may be obtained over the arc lamp. This attachment permits the bottom lamp to be lighted independently of the others. In residence lighting a very small lamp may be employed in the center and then this alone may be kept burning at night. In store lighting also the attachment is used to considerable advantage. "Arc bursts" and in fact all the Benjamin wireless clusters, are made with long or short stems for rigid attachment to ceilings. In such cases a copper-plated

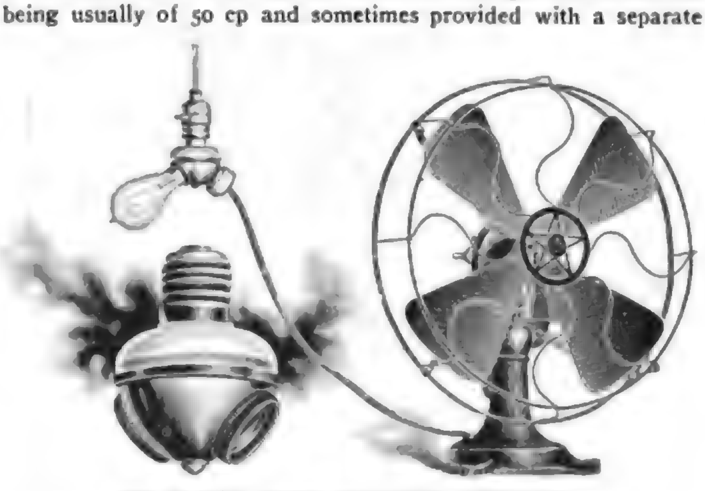


FIG. 2.—FAN MOTOR EXTENSION CONNECTION.

steel flange is screwed to the top of the porcelain base of the cluster proper, and into the threaded center of this the stem is inserted.

For large halls, churches and other places, where a desired effect can be produced only by the installation of an unusually large cluster of incandescent lamps, a wired cluster is made to hold as high as 20 lamps, and larger sizes are made on special order. This cluster contains a minimum amount of wire, and consists essentially of a metal shell with porcelain receptacles of special design fastened into properly spaced openings. As the body of the receptacles is in the interior of the shell and not visible, the cluster when filled with lamps has a very attractive appearance. The wires inside connecting the receptacles are approximately one inch from the shell or other metallic part of the cluster and there is consequently no danger of short-circuits.

The wireless idea has been well applied to a twin socket with a plug attachment, shown in Fig. 2. By removing a lamp and inserting the plug, two lamps may be employed or a lamp and a fan or other electrical device may be attached as desired. A receptacle plug by which one light pendant may be converted into a cluster is made up to four-light capacity. The two-light receptacle plug is often employed to connect a fan in circuit as shown in one of the illustrations. For use in factories and shops the "can't-break" guard, shown in Fig. 3, has been developed. The guard is in two halves pressed from sheet steel. A spring in each half bears on the lamp at four points, thus not only keeping it centered, but removing a portion of the strain from the socket. As this guard follows the shape of the globe closely, it is especially adapted for use in shops and factories where it is sometimes necessary to put the lamp up close to the work or into a small aperture.

FIG. 3.—VIEW OF "CAN'T-BREAK" GUARD.

The development of the wireless cluster necessitated the design of special shades, shade holders and lighting fixtures of various kinds. The attractive appearance of the wireless cluster when studded with several lamps with lighted globes has led to the development of a device called the candelabra plug, intended to be inserted in a socket instead of a single lamp when rooms are to be decorated temporarily. In it can be put seven candelabra lamps, which may have bulbs of two or more colors.

Emerson Fans.

The Emerson Electric Manufacturing Company, of St. Louis, embodies in its fans for the coming season a number of improvements. The line consists of desk and ceiling fans for alternating current and desk fans for direct current, which are marketed under the trade names "Emerson" and "Trojan." Each of the 1906 type of desk fan is equipped with a new convertible bracket base, by means of which any desk fan may be changed into a substantial bracket fan in a few seconds without extra parts. The new bracket adjustment is positive and secure, not dependent on thumb screws. As the faces have swivel and trunnion arrangements it is expected that a large number of these new types will be installed as bracket fans.

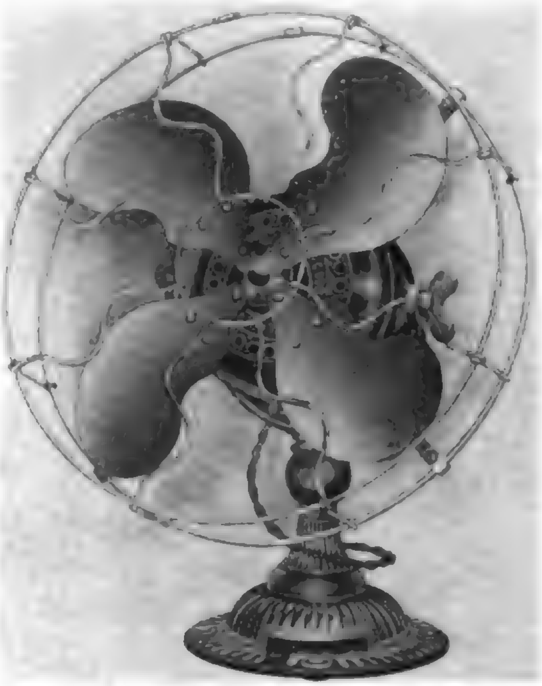


FIG. 1.—EMERSON DESK FAN.

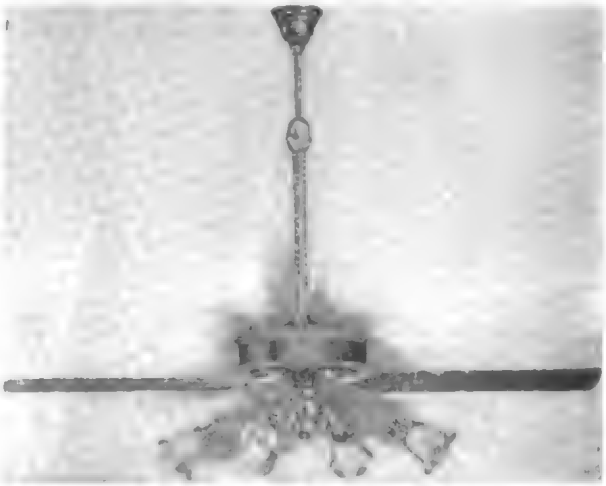


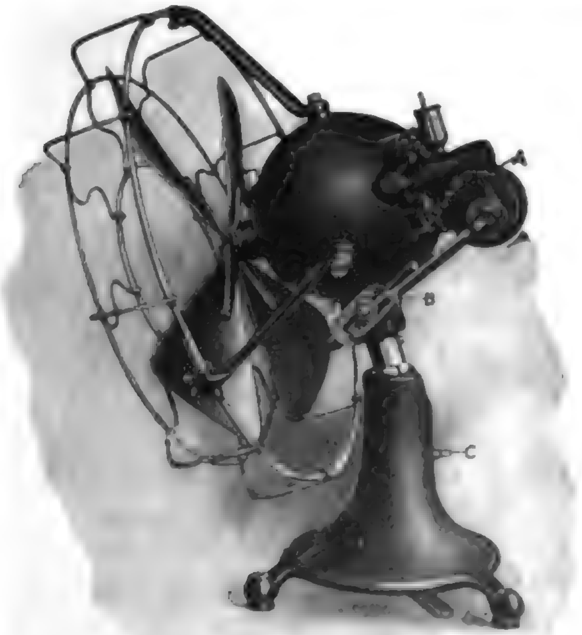
FIG. 2.—EMERSON CEILING FAN.

The desk fans for 60 cycles have two speeds and start promptly on either speed, being equipped with special automatic starting device and the power motor form of field winding introduced by the Emerson Company several years ago. In addition to 12 and 16-in. standard medium speed fans for store and office, a special slow-speed, quiet residence type is made. Each of these fans is equipped with six blades.

The 1906 Emerson ceiling fans for 60 cycles are equipped with a three-speed indicating snap switch and have much more satisfactory speed regulation than it has been possible to secure heretofore. New style decorative electrolier arms with wide spread can be used on these new fans, which are furnished with the familiar Emerson adjustable hanger. Trojan 1906 types of ceiling fans have two speeds. Two and four-blade styles, as well as column fans, are made in both "Emerson" and "Trojan" lines and all types are direct-connected to motors with automatically-oiled ball bearings. All alternating fans are of the induction type without brushes or commutator.

Eck Oscillating Fan.

The accompanying illustration shows the "Hurricane" oscillating fan made by the Eck Dynamo & Motor Works, Belleville, N. J. As will be seen, the oscillating motion does not depend upon air action, but is controlled by a positive direct drive, which admits of ready changes and adjustment without the use of a screwdriver or wrench, when it is desired to regulate the arc or speed of oscillation. The trunnion or ball-and-socket joint between the motor stem and the base permits a quick adjustment to regulate the general direction of the breeze. By means of this joint the desk pattern shown in the illustration may be changed at once into a wall or bracket fan. To overcome the objectionable humming noise of motors, some makers use fans of a very small pitch, thereby greatly reducing the efficiency. In the Eck fan the blades are of full pitch and yet in running at high speed give rise to a minimum of noise. The fan is supplied with an automatic grease cup, which gives just enough lubrication to insure easy and cool running, and one filling is enough for an entire season. The brush holder is so designed that new carbons, if necessary, can be fitted without disconnecting any wires. When the carbon wears too short, the fan stops and the holder can never come into contact with the commutator.



ECK OSCILLATING FAN.

Western Electric Universal Fan Motor.

Among the 1906 types of fans made by the Western Electric Company is a new design of alternating-current fan shown in the accompanying illustration. This fan is manufactured in one type and one size only, but the design is such that it can be easily converted into a desk or bracket type without the use of an adapter, a loose part which may easily be lost. A thorough consideration of the construction of blades led to the adoption of the 15-in. fan and of a pitch which insures a maximum efficiency. The motor is spherical and entirely enclosed, thus insuring against trouble from the collection of dirt and dust. The armature is of the slotted type and has a commutator designed to withstand long and continuous service. The field coils are elliptical in shape, machine-wound and especially insulated for the severe service of a fan. The brush holders, which are of the cartridge type, are designed to avoid the possibility of excessive brush pressure on the commutator and are fitted with carbon brushes. The brushes may be adjusted, inspected or renewed without removing the bearing and bracket. By means of a switch in the base there is a choice of speeds of 1,480, 1,100 and 750 r.p.m., re-

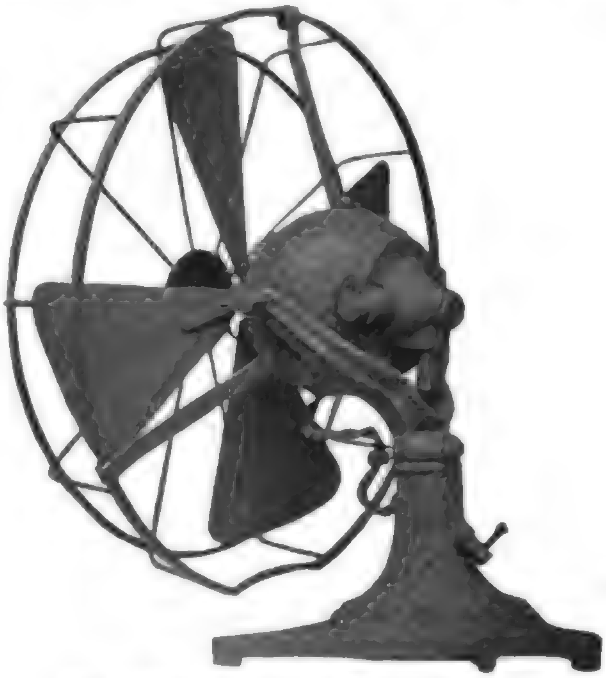


FIG. 1.—WESTERN ELECTRIC UNIVERSAL FAN.

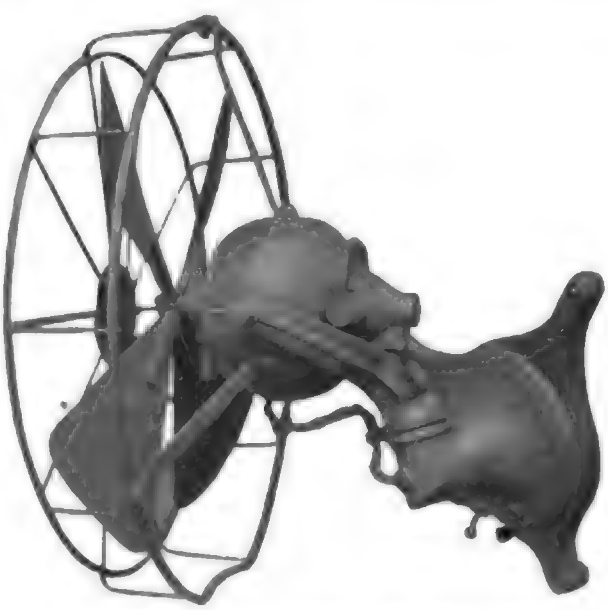


FIG. 2.—WESTERN ELECTRIC UNIVERSAL FAN.

spectively. The speed rheostat consists of an iron spool, heavily coated with porcelain, and a winding of German silver wire imbedded in and completely protected by a coating of white enamel. As will be seen from the illustration, the motor is mounted on trunnions, which admit of 30° depression and 15° elevation, and the base construction allows the fan to be rotated horizontally through 120°. The oiling is by means of a felt wick fed from an oil cup attached to the bearing bracket.

Westinghouse 1906 Electric Fans.

For the season of 1906 the Westinghouse Electric & Manufacturing Company has placed a largely increased assortment of electric fans on the market, made for both direct and alternating-current service in the forms known as desk type, bracket type, ceiling type, floor column type and counter type. One of the notable features of the desk and bracket types are the blades, which are a departure from the design in ordinary use. They are constructed upon exact mathematical principles, the angles being theoretically correct, with the result that the fan will give an even air pressure across its entire front, as there is an absence of the tendency to project a hollow cone of air which is found in the usual fan. The breeze is sent out in the shape of a solid cylinder of air, there being little tendency to set up eddying currents with their attendant losses. It is stated that the design of these blades has resulted in an extremely high air delivery, while the total watt consumption has been decreased. The motor is mounted upon trunnions, the line of support of which passes through its center of gravity, and is, therefore, balanced at any angle; the fan is secured in any position by two thumb screws, one holding it in any horizontal position and the other in any vertical. The thumb screw which retains the fan at any angle in a horizontal plane is a recent modification, superior to former methods in which friction washers were employed, and holds the fan securely in any position to which adjustment has been made.

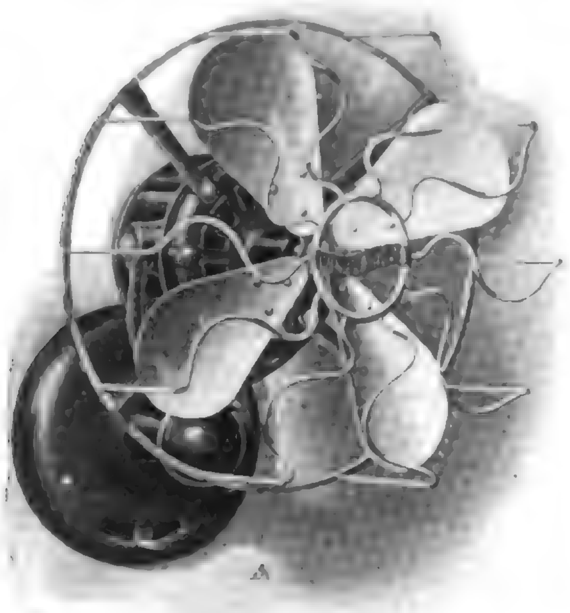


FIG. 1.—WESTINGHOUSE DESK OR BRACKET FAN.

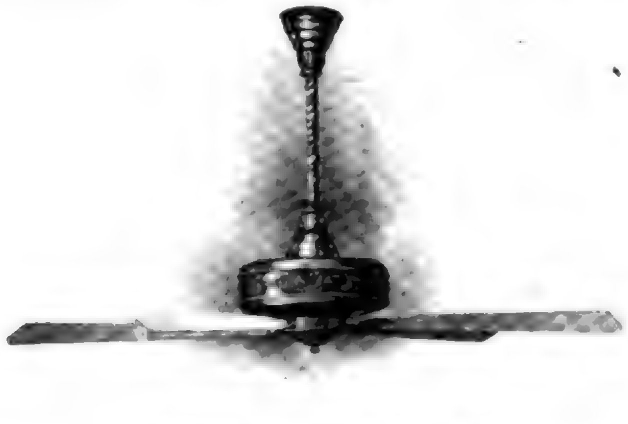


FIG. 2.—WESTINGHOUSE CEILING FAN.

By means of a simple adapter the desk and bracket types are interchangeable, making it possible for the user to attach the fan in the most convenient location without disconnecting lead wires, thus giving him all the advantages of two styles of mounting.

The ceiling and floor types, which are all in mottled copper as standard, have three speeds and four blades, which are set at angles calculated to give the highest possible movement of air with the least possible consumption of power. The blades are securely attached to the moving element by screws, which effectually prevent them from turning from their normal position.

Sprague Fans.

The Sprague Electric Company's fans for 1906 maintain the high grade in design and construction which have characterized them in the past, and the high efficiency of the motor, which is of the well-known single-field coil type. These fan motors run quietly without making a distressing noise and are, therefore, suitable for all localities; they consume a small amount of power, and require oiling only once a season; they are constructed on scientific principles and their graceful form blends harmoniously with any style of decoration.

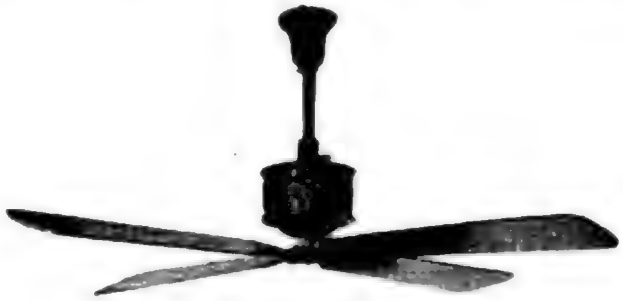


FIG. 1.—SPRAGUE CEILING FAN.

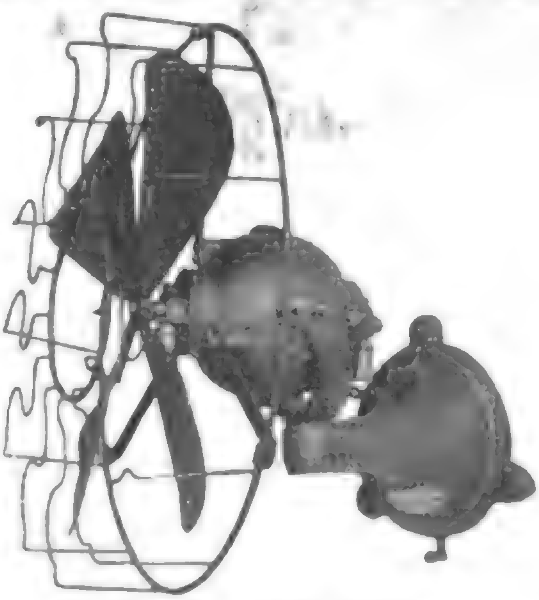


FIG. 2.—SPRAGUE BRACKET FAN.

The Sprague fans include 12 and 16-in. sizes of desk and bracket types, the desk types being either swivel and trunnion or solid base. In addition a ceiling fan has been designed to meet a popular demand. It is of excellent appearance, and while it is moderate in price is efficient and powerful in service. It has four wooden blades of 58-in. sweep, and the motor is furnished in black japan, or an ornamental finish which may be polished brass or oxidized copper.

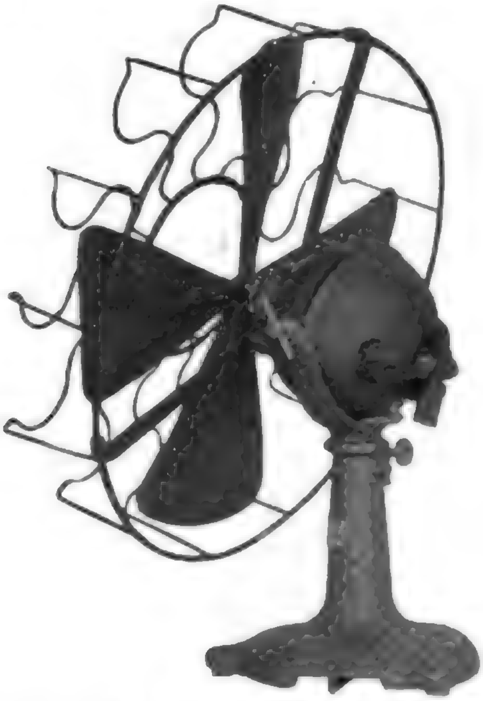
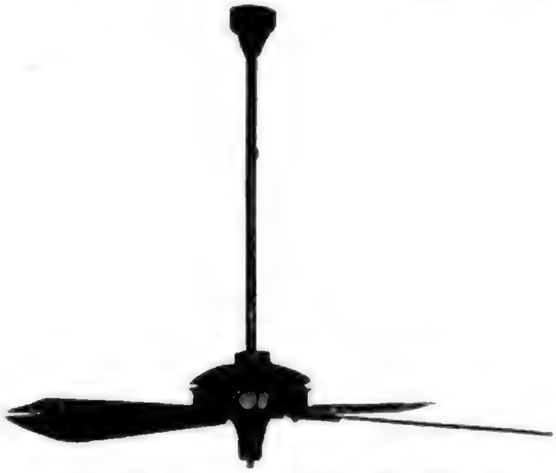


FIG. 3.—SPRAGUE DESK FAN.

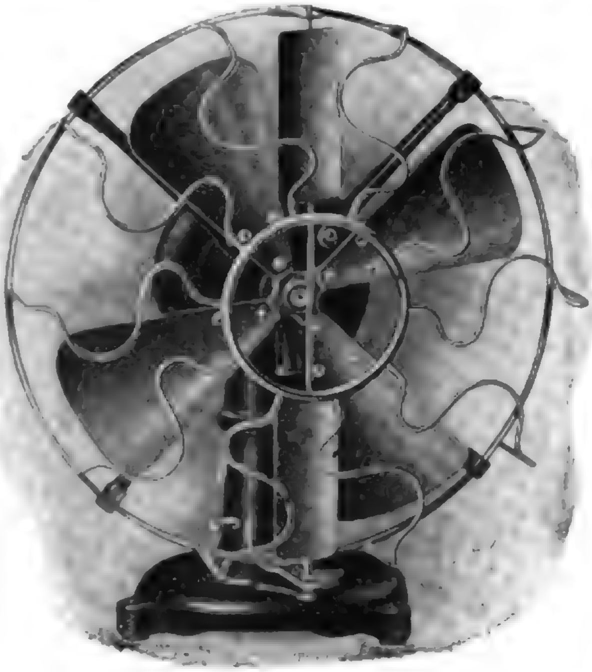
Pillsbury Alternating-Current Ceiling Fan.

The Century Electric Company, St. Louis, Mo., has introduced a number of improvements in its 1906 type of Pillsbury alternating-current ceiling fan. The manufacturers state that there is no moving wire in the fan and that it can be taken apart for cleaning or inspection without having to disconnect a single wire. Fans for 60-cycle circuits have two speeds, namely, 235 and 180 r.p.m. The speed will vary, of course, with the frequency of the circuit, and the fans are made for frequencies between 50 and 67 cycles. While the standard fan is wound for 104 to 110 volts, fans are also made in voltages as low as 100 and as high as 120. The accompanying illustration gives a view of the standard Pillsbury fan.


PILLSBURY ALTERNATING-CURRENT CEILING FAN.

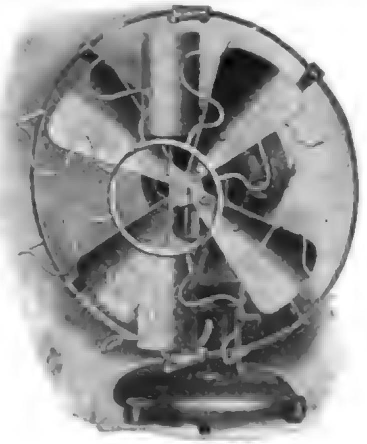
Peerless Direct-Current Fans.

The 1906 type of direct-current desk fan made by the Peerless Electric Company, Warren, Ohio, is shown in the accompanying illustration. This fan has a swivel and trunnion mounting and three speeds. The fan can be turned in any direction and tilted up or down within an angle of 45° from the horizontal. The 12-in. fan on a 110-volt circuit takes .5 amp., the maximum speed being 1,650 r.p.m. The 16-in. fan on the same circuit takes .8 amp., its highest speed being 1,350 r.p.m. The Peerless oscillating fan has been redesigned for the 1906 season, and in its present form oscillates upon a single ball bearing upon a hardened steel plate.


PEERLESS FAN.

Star Fans.

The Star Electric Company, Niles, Ohio, enters the fan motor field the present year with a line of direct-current fans. These include a swivel type, a swivel and trunnion type and an oscillating type, which latter is illustrated herewith. The swivel and trunnion fan has provision whereby it may be attached to a wall. The bearings of all the fans are of the self-aligning type, made of phosphor-bronze. They are lubricated by means of wick oil cups of extra large size, which hold sufficient oil to last the entire


STAR FAN.

season under ordinary conditions; the cups are adapted for the use of heavy cylinder oil, and all fans are provided with a sufficient oil-catching device. Carbon pencil brushes are used, which are controlled by compression springs holding the brushes firmly against the commutator with an even pressure, and the brushes can be used up to almost their entire length. The speed-regulating device is made up of German silver wire wound on a porcelain spool, and enables three speeds to be obtained.

Ventilating Fans.

The accompanying illustrations show two types of ventilating electric fans made by the American Blower Company, Detroit, Mich. That shown in Fig. 1 is designed especially for building into a brick wall, the motor being supported on the enclosing case.

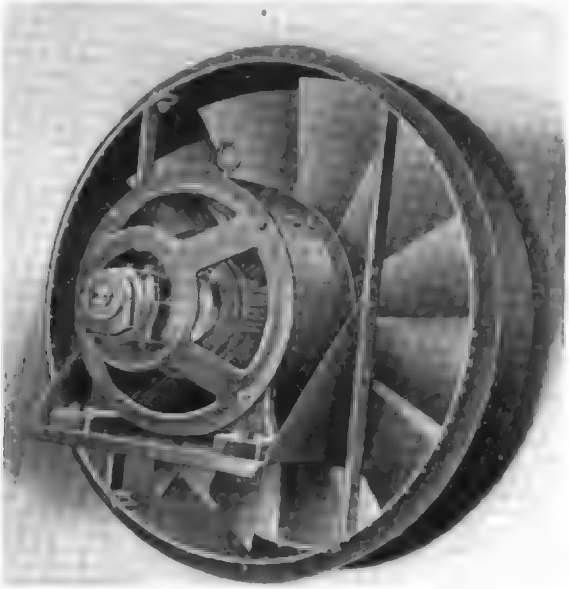


FIG. 1.—AMERICAN BLOWER VENTILATING FAN.

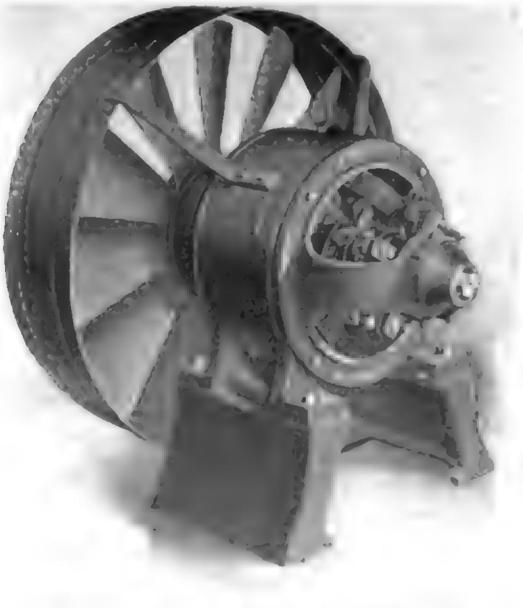
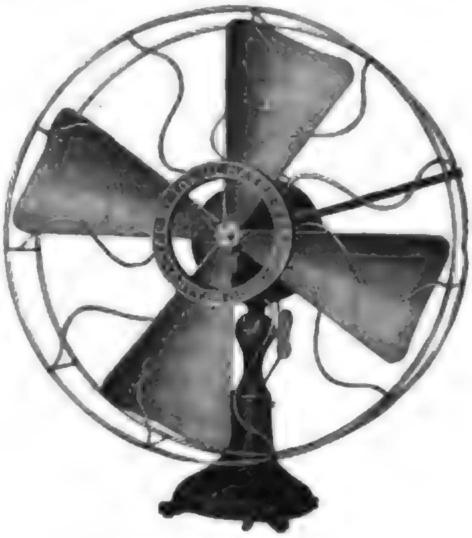


FIG. 2.—AMERICAN BLOWER PEDESTAL FAN.

In Fig. 2, as will be seen, the motor is mounted on pedestals. In each case a fan with 12 broad blades and wide central discs is used.

Bates "Universal" Fan.

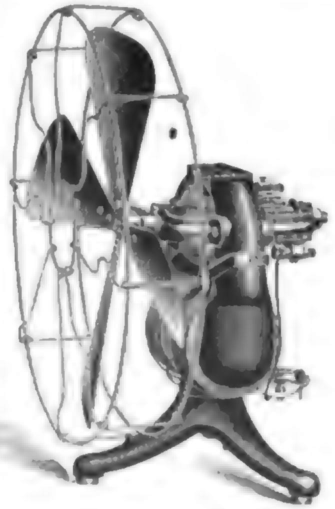
The 1906 type of "Universal" fan made by the D. L. Bates & Brother Company, Dayton, Ohio, is shown in the accompanying illustration. By means of a socket joint the fan can be inclined at any angle of the horizontal and it can also be installed as a bracket fan. The blades are of unusual size, being 20 in. in diameter. This fan, as well as the other lines of desk, wall, bracket and ceiling fans manufactured by the same company, are all for direct-current service.



BATES "UNIVERSAL" FAN.

Kenco Battery Fan.

The accompanying illustration shows the Kenco battery fan, made by the Knapp Electrical Novelty Company, of New York. The armature is of the drum type with windings in six slots. The brushes, which are of the radial gauze type, can be removed by a turn of the screw; they have a long spring adjustable tension, thus giving a positive contact. The motor is wound for from 2 to 4 volts and from 8 to 10 volts, in the former case taking 1.5 to 2 amp., and in the latter case 1 to 1.5 amp. The weight of the motor is 7 pounds and its height 7¼ in. Twenty good dry cells, 6 by 2½ in., connected in multiple series, will, it is stated, run the fan three hours per day for at least 200 hours.



KENCO BATTERY FAN.

Jandus Fans.

The accompanying illustrations show the 1906 types of the Jandus desk fan and "Gyrofan," both of which are made for direct and alternating currents. As will be noticed in the illustration of the latter (Fig. 1), two fans are mounted on either end of a horizontal arm which is mounted to rotate about a vertical axis. The two fans can be set to blow horizontally or at any downward angle, and either fan can be set at a different angle from the other. The arm can be set rigid, but otherwise rotates at a speed which can be varied by a simple adjustment; in the former case the two fans can be arranged to direct their current in any desired direction. When forming part of a ceiling electrolier, there is a switch with four contacts, by means of which the fans can be operated alone, the lights alone, or the fans and lights simultaneously. The manufacturers claim that although the "Gyrofan" requires two motors, it consumes 25 per cent less power than the ordinary ceiling fan.

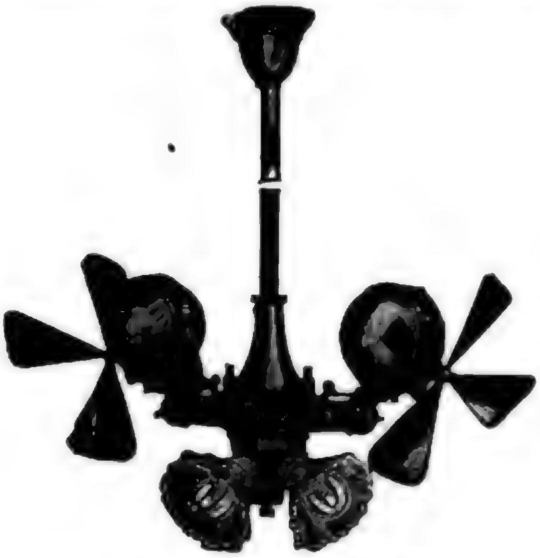


FIG. 1.—JANDUS "GYROFAN."

The Jandus desk fan, which is shown in Fig. 2, is made both for direct and alternating currents. The armature and field cores are of soft laminated iron and the fields are flexibly supported so as to withstand shocks or jars. The bearings are self-aligning, and while the speed is slow the velocity of air blast is high. The "Gyrofan" is a specialty of the Jandus Company, and has been the subject of several patents covering its novel features; the alternating-current "Gyrofans" are fitted this season for the first time with specially designed induction motors.

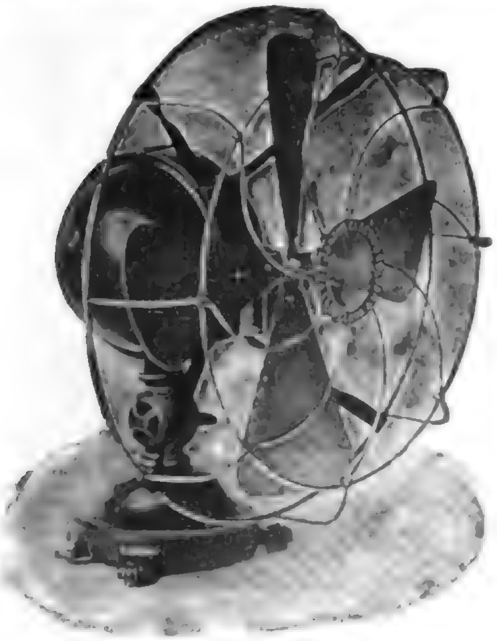


FIG. 2.—JANDUS DESK FAN.

◆

Diehl Fans.

For the coming season the Diehl Manufacturing Company offers a line of fans including nine styles of ceiling fans, two styles of column fans and a universal fan. The latter can be changed from a bracket to a desk fan or vice versa by simply loosening the screw holding the two halves of the ball on the standard. The position of these pieces is located by a pin on one part engaging a hole in the other. By loosening the screw sufficiently to disengage the pin from the hole the two halves may be rotated on themselves for a quarter turn. When the proper point is reached the pin engages another hole and the change is complete, when the screw is tightened.

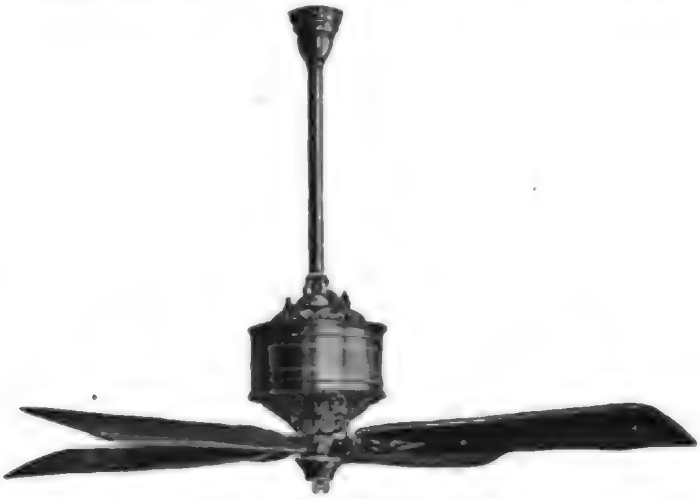


FIG. 1.—DIEHL CEILING FAN.

The Diehl fan regulators, which give a variation of three speeds, can be installed on all 110 and 220-volt ceiling fans. These regulators are made of mica plate wound with high-grade resistance wire of ample capacity to carry the maximum possible current without undue heating. The plates carrying the wire are separate units and are combined in proper numbers to give the required resistance for the style of fan and voltage.

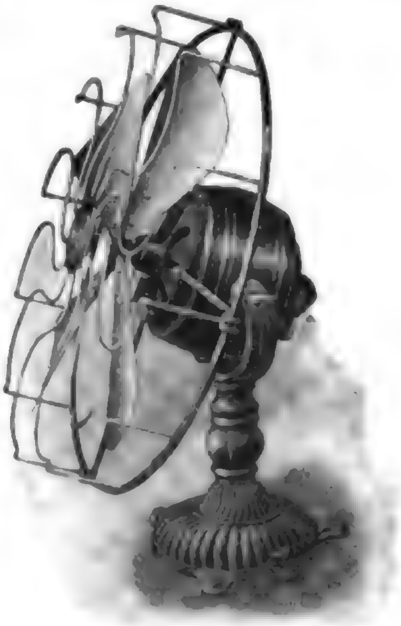


FIG. 2.—DIEHL "UNIVERSAL" FAN.

Robbins & Myers' 1906 Fans.

We illustrate herewith several of the 1906 models of fans made by the Robbins & Myers Company, Springfield, Ohio. Fig. 1 shows a 12-in. desk fan with swivel and trunnion mounting. This model was first brought out in 1904, but has been improved for the present season. A somewhat similar fan is made in the oscillating type, the propellor swinging slowly from side to side while running. Fig. 2 shows the latest "Universal" type of fan, which is made in 12 and 16-in. sizes with a three-speed switch. By means of a double knuckle with serrated edges and thumbscrews the fan can be adjusted for direction of breeze and for desk or bracket use. The latest type of ceiling fan is shown in Fig. 3 with an electrolier attachment. The blades are of polished mahogany with a 58-in. sweep and run at 200 r.p.m. The fan has two speeds controlled by a switch. The motor is of a spherical shape of the usual bi-polar type with a deep slot armature. The bearings are of babbitt metal and are lubricated by means of an oil well carrying a year's supply of oil and revolving with the shaft. The spherical form of motor admits of the finish being directly electroplated on the castings forming the field rings and end plates.

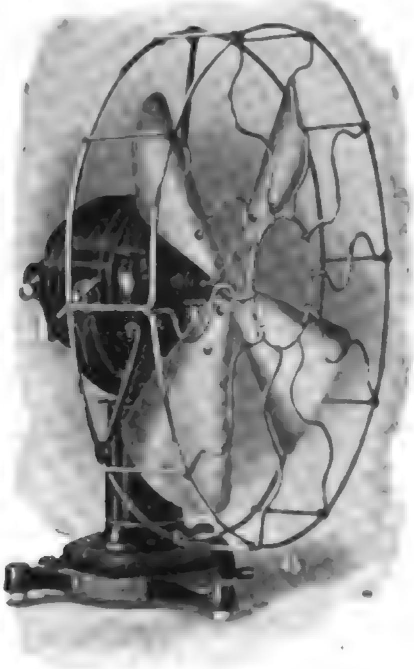


FIG. 1.—ROBBINS & MYERS DESK FAN.

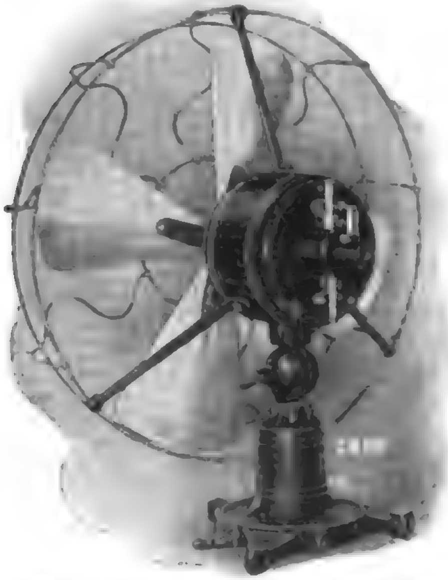
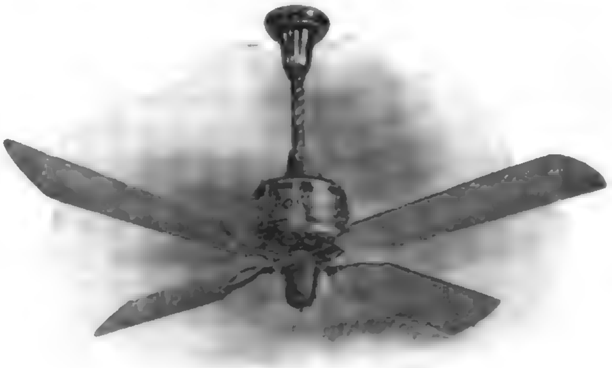


FIG. 2.—ROBBINS & MYERS "UNIVERSAL" FAN.

Fidelity Direct Current Ceiling Fan.

The Fidelity Electric Company, Lancaster, Pa., has added to its line of fans a new type of ceiling fan shown in the accompanying illustration. The motor has a multipolar field cast in one piece, and the design of the laminated armature is such as to admit of a very thorough ventilation by the provision of air ducts. The lower bearing of the motor runs constantly in oil, which is contained in a cup on the lower side of the fan. By unscrewing this cup the armature can be withdrawn without disturbing any of the other parts. The speed is 200 r.p.m. with four blades. The body of the motor is covered, as will be seen, with a metal band of handsome design. The top of the motor above is finished above the band in black Japan; on the lower side the oil reservoir and switch are covered with an ornamental iron cap finished in oxidized copper. The commutator is on the upper side of the motor, which obviates any chance of oil getting to it.



FIDELITY CEILING FAN.

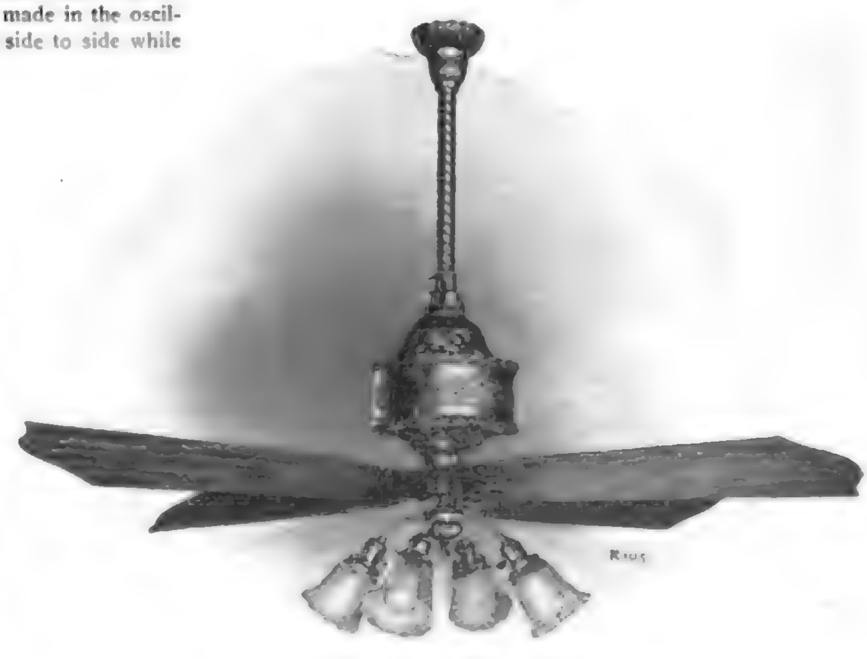


FIG. 3.—ROBBINS & MYERS CEILING FAN.

Beaver Battery Fan.

A battery fan motor outfit made by the Electric Motor & Equipment Co., Newark, N. J., is designed to meet the demand for an electric fan in places where electric current is not available. The fan motor weighs about 5 pounds and is equipped with a three-blade brass fan 7 in. in diameter. The four dry batteries for running the fan are contained in a neat wood box, the motor being placed on top of this and connection made by a flexible cord. The motor is provided with a switch for turning current on and off. It is stated that the batteries will run the fan continuously from 15 to 20 hours, or about 100 hours if used intermittently.

Fort Wayne "Wood" Fan Motors.

The line of fan motors manufactured by the Fort Wayne Electric Works last year consisted of four types: the desk, suspended revolving, bracket and telephone booth. These were all made with 8-in., four-blade fans. To these have been added this year a new line of 10-in., four-blade fans in the desk and bracket types. The same general construction has been followed in the new line of motors as in the old.

Both the direct and alternating-current motors have a spherical contour which gives the machine a very graceful appearance. The motor proper of this machine is exactly the same as that of the suspended revolving and bracket types. The field magnet is built up of stamped laminations which are individually japanned before being assembled. The field magnet coils are shellaced, baked and taped. The armature is of the familiar drum type with the discs twisted on the shaft so as to give the slots a slightly spiral course from end to end of the core. This is done to prevent humming. The commutator is separate from the armature, being assembled complete with its insulations and thoroughly baked before being finally finished and mounted on the armature shaft. The brushes are rectangular in cross-section and located in a brass tube in which they are fed toward the commutator by means of helical springs. Adjustment of the spring tension is provided by a screw set in the outer end of each brush tube. The bearings are self-oiling and are equipped with felt oil retainers.

FORT WAYNE REVOLVING FAN.

The 8-in. motors run at a speed of 2,200 r.p.m. when subjected to the normal voltage. The direct-current motors require 17 watts; the low-frequency, alternating-current machines, 20 watts, and the high-frequency motor, 40 watts. The telephone booth type fan has a speed of 1,200 r.p.m. The 10-in. motors run at a speed of 1,700 r.p.m. and take approximately 32 watts.

General Electric Fan Motors for 1906.

As fan motor practice has become more or less fixed, the General Electric Company has concentrated attention on increasing the efficiency of the motors by embodying every electrical and mechanical improvement suggested by past experience.

Both direct and alternating-current fans have a special blade design, a positive trunnion adjustment, and perfect lubrication. In the design of the blades the end attained was that of distributing the air over a wide angle, not of delivering a straight column of air covering a limited area, and a sure and positive trunnion adjustment permits the quick change of the breeze for either horizontal or vertical circulation, the position of the motor being always positively fixed by a notched clamp and thumbscrew. Wick oilers are provided which require no attention beyond the annual renewal of oil. The blades of the fans are carefully balanced and hung, thus insuring the elimination of disagreeable humming.

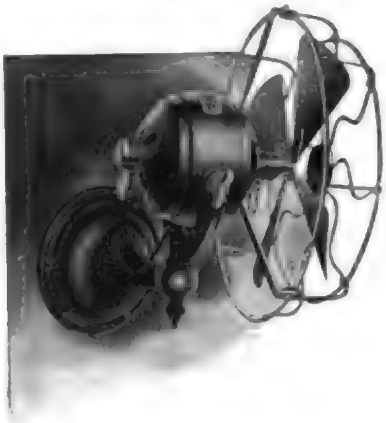


FIG. 1.—DIRECT-CURRENT WALL BRACKET FAN.

For frequencies of 60, 125 and 140 cycles the alternating-current type of fan consists of a single moving element without contacts, revolving in a ventilated cast iron field frame of compact design. Speed changes in the alternating-current motors are obtained by a six-point reactive coil and switch. The variation in speed so obtained makes the desk or wall bracket type of fan motor of universal application, as it may be operated on slow speeds for the office desk and home or on the higher speeds for stores and halls.

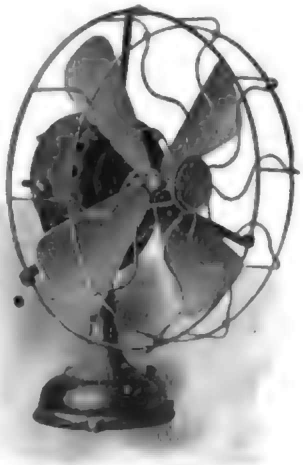


FIG. 2.—ALTERNATING-CURRENT DESK FAN.

The direct-current fans have cast iron frame of elliptical form, with ventilated removable shields rendering the brushes, commutator and armature easily accessible. Rectangular brushes are used, giving the largest area of contact on the commutator and an ingenious brush holder insures constant brush pressure on the commutator, keeping it polished and practically free from wear. Speed regulation is provided in the direct-current desk and wall bracket types by a self-contained four-point regulating switch and indestructible resistance, giving three speeds.

In addition to the regular desk and wall bracket types of direct and alternating-current fan motors, the General Electric Company also furnishes direct-current ceiling fans for either one or three speeds. These fans are ordinarily equipped with wooden blades, but are also furnished with aluminum blades for use in damp locations. In the three-speed fan the regulating device is entirely self-contained and operated by a button at the bottom of the fan.

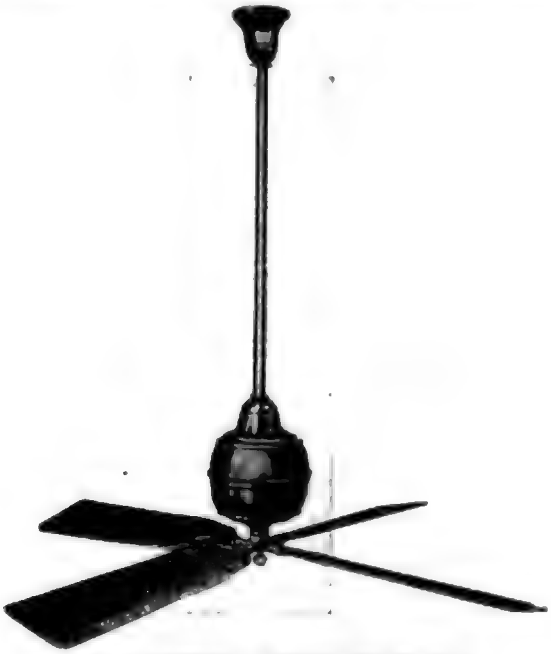


FIG. 3.—GENERAL ELECTRIC CEILING FAN.

For special ventilating purposes such as kitchens, hotels and restaurants this company supplies an exhaust type of fan motor for use on both alternating and direct current. These comprise the body of the swivel and trunnion type of the respective direct and alternating-current fans, mounted in a special bracket, as shown in Fig. 2, and adapted for suspension in windows, ventilating shafts, etc. Complete motor blower fans are made for ventilation purposes in mines and factories. Another type for both alternating and direct-current circuits is a compact little telephone booth fan motor.

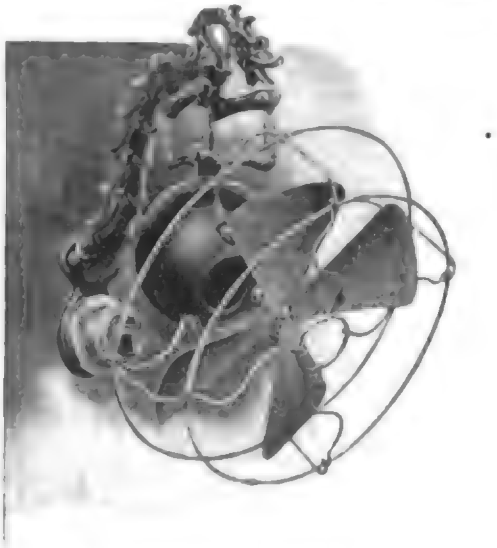


FIG. 4.—TELEPHONE BOOTH FAN.

Sterling Fans.

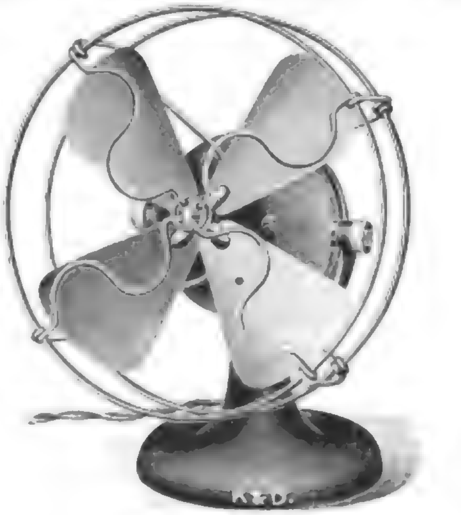
The Sterling Electrical Machinery Company, of Warren, Ohio, has put upon the market a new desk and bracket fan which embodies all the latest improvements in fan design. Since a well-ventilated fan, both as to armature and field coils, has a great advantage over an enclosed type, as it necessarily runs cooler and as a result will run longer, the Sterling fan is of the open field type. The armature is unusually well ventilated by means of open type hoods. The fans have three distinct speeds and a cut-out operated by means of a resistance in the base of the fan. The fan is made in two forms, both being of the swivel type adjusted by means of a thumb screw in the base. In addition one has a trunnion mounting.

Colonial Fan.

The direct-current type of oscillating fan made by the Colonial Fan & Motor Company, Warren, Ohio, has been entirely redesigned for the present fan season. The shifting vane, which actuates the simple rotating mechanism, is located inside the guard, thus removing possibility of injury from external causes. The fan body rotates on ball bearings. The switch, which is located in the base of the fan, affords two speeds, the higher of which is 1,350 r.p.m. for a 16-in. fan. Current from the main circuit is transmitted through brush holders to collector rings mounted on the bearing spindles, and leads to the motor are carried from these rings. By their use there is no possibility of lead wires wearing off in consequence of the oscillating movement. Switch, brush holders and collector rings are entirely contained within the base of the fan, being thus protected from dirt and injury. Brackets supporting the actuating vane are rigidly fastened to the guard, and these also carry the throwing lever. Among other 1906 Colonial fans are a swivel and trunnion type, and a new finish for ceiling fans.

Kendrick & Davis Battery Fans.

The accompanying illustration shows a battery fan made by Kendrick & Davis, Lebanon, N. H. As will be seen, the motor is practically of the enclosed type, the moving parts and windings thus being protected. The brushes and commutator, however, are exposed to inspection, so that any irregularity of performance due to worn-out brushes or dirt on the commutator, or any other cause, may be at once noticed and corrected. The bearings are of bronze. By means of a trunnion adjustment the fan can be tilted at any convenient angle. A switch is contained in the base. The diameter of the fan is 6 in. and the speed is 2,400 r.p.m. at 7 volts and ½ amp., the weight being 3½ lb. For operation 20 cells in multiples of 5 will give 200 hours or more of service.



KENDRICK & DAVIS FAN.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Few signs of slackening trade were in evidence in wholesale trade and industry despite the wintry weather of the past week. The opening retail spring trade was somewhat affected by the weather conditions, but on the other hand crops have been benefited by the snow and rain. The coal strike situation is still in an unsettled state, although the belief is that a general suspension of all work will not occur. Jobbing trade at leading centers is large, and reorders for spring goods are already reported at western centers; collections are classed as fair to good; export trade is of a large midwinter volume, and there are signs that lower prices of cereals have found response in improved foreign buying. The iron and steel mills are busily employed, and while new business is smaller in volume, there is a marked undertone of strength to this as to other metals, such as copper. Altogether, there is everything to indicate that the spring trade, present and prospective, will break all past years' records. Railway earnings were never better. January was deemed a record month, an increase of 19.4 per cent being reported, but February produced a heavier ratio of gain—25.6 per cent—and February's aggregate was only 4.7 per cent below that of January. The nearest approach to such a ratio of gain was recorded in November, 1897, the increase then being 21 per cent over November, 1896, when a decrease of 10 per cent was recorded. Comparing February, 1896, with the same month in 1906, shows that earnings have increased 50 per cent in the interval. Traffic has been heavy, and there seems to be an abundance in sight. Quietness still prevails in the market for pig iron. Consumption is heavy and production is slightly lower. The Bessemer market is in good condition, very little iron being available for early shipment. The tonnage on the book of some merchant steel interests is being reduced, and deliveries on plates are better. The steel-rail trade is in good condition; new orders are constantly coming out, while additional business is pending. Orders from trolley lines are a conspicuous feature. Large inquiries for structural material continue, and the prospects are for a further increase of business. Better deliveries are being made by eastern mills. Copper is firmer, but there is no general buying movement, though some business has been done for May shipment, and perhaps a little for June. Prices for lake and electrolytic were advanced another ⅛-cent during the week, which puts lake on the basis of 18⅝ and casting at 18⅜c. It is claimed that market conditions do not warrant the advance, but producers seem to be able to hold the gains as they are established. Demand for machinery and machine tools is good. *Bradstreet's* reports 187 business failures during the week ending March 15, as compared with 177 the week previous and 186 the corresponding week in 1905.

ROBERTS & ABBOTT'S NEW DEPARTMENTS.—The Roberts & Abbott Company, of Cleveland, Ohio, which for a number of years has been prominently identified with the electric railway industry as consulting electrical, mechanical and civil engineer, announces two other departments in addition to the recently-added hydraulic engineering department, giving a very wide range of operation. One is for industrial and architectural engineering, while the other is for fire prevention and protection. The first-mentioned department will be devoted to designing manufacturing plants and improving, altering and enlarging plants of that type already in operation. Herbert F. Stimpson, who has been placed in charge of the department, has had 24 years' experience in the designing of manufacturing buildings and has been connected with several large manufacturing establishments. The department of fire prevention and protection will devote its attention to designing buildings and installing special apparatus to provide adequate protection from fire. Mr. Houston Dunn, for ten years an inspector and adjuster of special hazards for one of the oldest fire insurance companies in the country, and for three years superintendent of the Philadelphia Fire Inspection & Protection Bureau, will be in charge of the department for fire protection. The Roberts & Abbott Company now has branch offices in the Maryland Trust Building, Baltimore, and 202 Walnut Place, Philadelphia, Pa.

COPPER REFINING PLANTS.—It is stated by the *Wall Street Journal* that the United Metals Selling Co., at its Raritan plant, is refining between 12,000,000 and 13,000,000 lb. of copper per month, but it is increasing its capacity 100 per cent, and by September 1 expects to be able to treat 25,000,000 lb. per month. A good share of the copper refining for the United Metals Selling Co. is done in Baltimore. The United States Smelting, Refining & Mining Co., which owns the Delamar plant at Cataract, N. J., will increase the capacity of its plant from 8,000,000 to 12,000,000 lb. per month by April 1. The American Smelting & Refining Co. recently increased the capacity of its eastern refining plant from 9,000,000 to 12,000,000 lb., and plans a further enlargement. The Nichols Chemical Co., owned by the American Metal interests, has a monthly refining capacity of 24,000,000 lbs. With the extension of these refining plants, there will be an excess refining capacity in the country. The copper production of this country, including Mexico and British Columbia, is at the rate of about 100,000,000 pounds per month, of which nearly 20,000,000 lb. is Lake copper which does not require electrolytic refining. With the enlargement of these plants the total copper refining capacity of the country will not be far from 100,000,000 lb.

SPOKANE POWER.—Mr. Jay P. Graves, of Spokane, has effected a consolidation of properties in which he was mainly interested. Among the roads which have been consolidated into one system are the Spokane & Inland, the Spokane & Coeur d'Alene, the Spokane Traction Co., and the Spokane Terminal Co. The Spokane & Coeur d'Alene was backed originally by Mr. Blackwell, of Spokane, who is president of the Howard Lumber Co., and controls large timber tracts in Idaho. It is about 100 miles long. The Spokane & Inland is under construction and runs down southeast from Spokane into the Palouse country. It is projected for a distance of about 140 miles, part of which is under construction. It will serve territory in which the Potatch Lumber Co. operates extensively. The Spokane & Inland will use electricity for its day traffic and expects to haul timber and lumber at night with steam power. It has a contract with the Washington Water Power Co. for electric power. The Spokane Traction Co. has about 13 miles of street railroad in Spokane. It receives its power also from the Washington Water Power Co.

POWER IN MEXICO.—Another power enterprise is reported from Mexico City; and it is stated that a syndicate of Chicago capitalists, represented by R. H. Springer, is having a survey made for an electric railway from the Cuernavaca line of the Mexican Central to the city of Chilpancingo. The syndicate has options on more than two million acres in the valley of the Rio Balsas. If these lands are purchased they will be colonized with American farmers. The current for operating the railway will be furnished from water powers in the region.

BERRIEN SPRINGS POWER.—A contract has just been executed between the council and the Berrien Springs, Mich., Power & Electric Company, of which C. A. Capin, of Chicago, is president, which means the erection in the village of a dam costing $1,000,000 in the St. Joseph River and an immense power house. The company gives the village 50,000 gal. of water daily and pays its indebtedness amounting to several thousand dollars. The dam will create a lake fourteen miles long.

THE DIEHL MANUFACTURING COMPANY has just completed the installation of an electrical equipment for a large manufacturing plant at St. Johns, P. Q., Canada. The plant consists of four 250-kw engine type generators running at 150 r.p.m., and one 100 kw at 260 r.pm. It includes also a 100-kw motor-generator set, and about 30 motors varying in size from 75 hp to 7½ hp.

CINCINNATI & COVINGTON TRACTION.—At its annual meeting held recently the Cincinnati, Newport & Covington Light & Traction Company decided to spend $175,000 in improvements, the greater portion of which will consist of additions to the electric light plant. A large turbine generator, a battery of 2,000 hp boilers, stokers and fuel-handling apparatus and a switchboard will be installed. Ten new cars will be purchased.

BAHIA, BRAZIL, TO BE ELECTRIFIED.—Guinle & Co., of Rio de Janeiro, Brazil, representatives of the General Electric Company, have closed a contract for the electrification of the tramway lines in Bahia, Brazil, and T. Guinle, of the firm, is now in the United States in connection with the project. The contract to the General Electric Company includes the machinery for the initial change-over. A new power house will be erected to contain a steam plant made up of Babcock & Wilcox boilers with Worthington condensers, furnishing steam to one 500-kw, 2,300-volt, three-phase, 60-cycle Curtis turbine of standard construction, and one 300-kw, 2,300-volt, 60-cycle Curtis turbine self-excited generator. Other station apparatus will include three 200-kw, 600-volt, direct-current generators driven by 300-hp, 2,080-volt induction motors, and three motor-generator sets, each consisting of a 150-kw, 600-volt generator driven by a 220-hp, 2,080-volt induction motor. The equipment contract also includes 40 miles of trolley line material, track bonding, etc., and motor equipments for thirty-six cars on each of which will be installed two-motor 40-hp equipments. The 300-kw Curtis turbine-generator is the first one to be shipped, built after the design of the self-exciting generator described in Mr. Alexanderson's paper before the recent meeting of the A. I. E. E.

WESTINGHOUSE RAILWAY ORDERS.—The railway department at the East Pittsburg works of the Westinghouse Electric & Manufacturing Company has received within the last few days some very extensive orders for electric railroad machinery. The Metropolitan West Side Elevated Railway Company, of Chicago, has ordered an equipment of 100 160-hp motors and 50 equipments of unit switch control. The same company ordered 52 motors of the same type only a month ago. The Bluffton & Marion Construction Company, of Bluffton, Ind., has contracted for a complete installation of electrical apparatus for a power house to operate an entire railroad, along with 32 50-hp motors. The Denver City Tramway Company has ordered 60 No. 101-F railway motors and the Pacific Electric Company has ordered 80 75-hp motors for an electric railway in Los Angeles, Cal. The largest order came from the Public Service Corporation of New Jersey for 378 motors, varying in capacity from 40 to 75 hp. These will be used to equip a number of new cars on the surface lines outside of Camden. This makes altogether contracts calling for 702 motors, and with the additional machinery included in these orders these contracts represent more than $1,000,000.

SHAWINIGAN POWER.—The statement is made in Boston that the Shawinigan Water & Power Co., whose securities are largely held in New England, will increase its income during the present year to the extent of over $100,000 by sales of additional power. The company was organized in 1898 to develop water power at Shawinigan Falls, Quebec, on the St. Maurice River, about 85 miles from Montreal. It is now selling 36,145 hp, and contracts coming in during 1906 will aggregate 9,300 hp additional, making a total of 45,445 hp, or approximately one-half the 100,000 hp capacity of the plant. Contracts in force show gross earnings of $324,333 per annum, and the additional power sold in 1905 will bring this total up to $433,783. It is estimated that the company will be able to show receipts at the rate of $500,000 before the close of the year. The company operates on the basis of about 13 per cent of gross, so that earnings of $500,000 should leave a balance of nearly $430,000 to meet the $200,000 interest on the $4,000,000 5 per cent bonds outstanding. The largest customer is the Montreal Light, Heat & Power Co., which has recently contracted to take 2,000 additional hp, making a total of 13,000 hp.

LARGE ADDITION TO SHOP.—In order to keep pace with its rapidly increasing business, the Power & Mining Machinery Co., Milwaukee, Wis., has awarded contracts for the erection of additions to their shops at Cudahy that will, when completed, more than double the present capacity. These improvements will cost upwards of $300,000, and will include a 200-ft. extension to their foundry, the installation of a considerable number of machine tools of special design, and an increase in its shop force of nearly 300 men, which will make the total number employed about 1,000. The present capacity of the plant is practically double what it was when the company acquired it, by purchase, from the Holthoff Machinery Company in 1903, but the business of the company has been increasing at such a rapid rate that its existing facilities have been found entirely inadequate, as it has been necessary for some months past to rely upon outside foundries for many of its castings. Excavating work has already commenced, and it is expected that the extension to the foundry will be completed early in June, at which time the new machinery will be installed.

STEAM TURBINE BUSINESS.—During the month of January, 1906, the Westinghouse Machine Company, East Pittsburg, Pa., entered orders for 22 steam turbines aggregating 56,500 brake hp in rated capacity, or an average of over 2,500 brake hp per turbine. Some of the largest orders were received from the United Electric Light & Power Company, New York, N. Y., 15,000 kw; New York, New Haven & Hartford Railroad Company, New York, N. Y., 11,250 kw; Louisville Lighting Company, Louisville, Ky., 3,000 kw; Oliver Iron & Steel Company, Pittsburg, Pa., 1,000 kw; West Virginia Pulp & Paper Company, New York, N. Y., 1,200 kw, and the Washington, Alexandria & Mt. Vernon Railway, 1,000 kw. The largest machines, going to the United Electric Light & Power Company, New York, N. Y., and will be 7,500 kw or 11,000 brake hp rated capacity. A 3,000-kw turbo-unit goes to Louisville, Ky., and three 4,500 brake hp units to the New York, New Haven & Hartford Railroad. The West Virginia Pulp & Paper Company already has two 1,000-kw units in service, and the recent order has resulted from the satisfaction given by the first installation.

ORDERS FOR ENGINES.—Appreciation of the Sturtevant engine has been shown by recent orders received by the B. F. Sturtevant Co., of Boston, Mass., from the Draper Company, Hopedale, Mass.; Illinois Central Railroad Co., Burnside, Ill.; Saginaw & Manistee Lumber Co., Williams, Arizona; Landers, Frary & Clark, New Britain, Conn.; Standard Ideal Sanitary Co., Port Hope, Ont.; San Diego Ice & Cold Storage Co., San Diego, Cal.; Continental Iron & Steel Co., Rahway, N. J.; Jones & Emmke, Sioux Fall, So. Dakota. Orders for economizers have recently been received from the Trimon Manufacturing Co., Roxbury, Mass.; Hamilton Powder Co., Beloeil, Montreal, P. Q.; Oliver Machinery Co., Grand Rapids, Mich.; Raritan Copper Works, Perth Amboy, N. J. The last named plant changed to the Sturtevant after experience with another type of economizer.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was extremely dull owing to the continuance of a firm money market and the uncertainty about the outcome of the coal labor situation. There was, however, a strong undertone, and breaks in certain stocks had little effect on the general list. The industrial group was also quiet, although the Steel stocks were firm, and a good impression was created by the corporation's annual report. There was some irregularity in Amalgamated Copper and other copper shares, which continued favorable reports about developments at the copper mines at Butte did not control. The market for electric stocks was devoid of any features and there was little activity. Allis-Chalmers common closed at 21⅞ and preferred at 59¼, these quotations being a net decline of ⅛ in the former and a net gain of ¾ in the latter. General Electric closed at 169, ex-dividend, a net gain of ¼ point, and Westinghouse at 161, an advance of ½ point. Among the tractions Brooklyn Rapid Transit made a net gain of 2 points, closing at 84¾, while Metropolitan Street Railway

NEW YORK

	Mar. 13	Mar. 20		Mar. 13	Mar. 20
Allis-Chalmers Co.	22¼	21	General Electric	168½	167
Allis-Chalmers Co. pfd.	58¾	57¾	Hudson River Tel.	...	...
American Dist. Tel.	37	30	Interborough Rap. Tran.	230	227½
American Locomotive	70⅝	69¼	Mackay Cos.	58¾	58¾
American Locomotive pfd.	116¾	116¼	Mackay Cos. pfd.	74¼	74
American Tel. & Cable	92	92	Marconi Tel.	...	...
American Tel. & Tel.	138	136	Metropolitan St. Ry.	115	113
Brooklyn Rapid Transit	84¼	83¾	N. Y. & N. J. Tel.	...	...
Electric Boat	27	27	Western Union Tel.	94½	91
Electric Boat pfd.	65	65	Westinghouse com.	161	161
Electric Vehicle	17	17	Westinghouse pfd.	...	...
Electric Vehicle pfd.	16	16			

BOSTON

	Mar. 13	Mar. 20		Mar. 13	Mar. 20
American Tel. & Tel.	138	137	Mass. Elec. Ry. pfd.	69½	69½
Cumberland Telephone	...	117½	Mexican Telephone	...	...
Edison Elec. Illum.	247	...	New England Telephone	...	140
General Electric	...	...	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	20	Western Tel. & Tel. pfd.	..	..

PHILADELPHIA

	Mar. 13	Mar. 20		Mar. 13	Mar. 20
American Railways	51½	51	Phila. Electric	...	7⅝
Elec. Co. of America	11⅝	11⅝	Phila. Rapid Trans.	30½	29½
Elec. Storage Battery	79	78	Phila. Traction	...	99¾
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Mar. 13	Mar. 20		Mar. 13	Mar. 20
Chicago City Ry.	170	180	National Carbon	90	91
Chicago Edison	...	155	National Carbon pfd.	120	118
Chicago Subway	50	49	Union Traction	...	...
Chicago Tel. Co.	...	115	Union Traction pfd.	...	...
Metropolitan Elev. com.	24½	25½			

* Asked.

lost 2⅛, the last quotation being 113⅛. Interborough Rapid Transit (on the curb) closed at 226, which is an advance of 1 point. The closing quotation of Western Union was 93, a net loss of ¼ point; American Telephone & Telegraph 138½, a gain of 2 points; American Telegraph & Cable 92, a net loss of 1 point, and Mackay companies (on the curb) 59¼, a decline of ¾. The curb market was irregular and devoid of feature. Most issues were a little lower. Some of the copper stocks sold off one or more points on efforts to get out of long holdings. Herewith are the closing quotations on the Stock Exchange on March 20.

WESTFIELD, MASS., LIGHTING PLANT.—The annual report of the municipal lighting works department shows that the value of the gas plant is now $120,225 and of the electric light plant, deducting the depreciation required by statute, is $143,910. The depreciation deducted since the town began the experiment amounts to $47,725. The receipts, amounting to $60,883, are divided as follows: Sales of gas, $30,390; electric street lights, $12,079; commercial electric lights, $9,756; sales of lamps and materials, $1,606; electric power, $1,067. The expenditures, amounting to $49,963, included: operating expenses, gas, $19,948; electric, $14,485; interest, $3,150; bonds, $4,000; construction, gas, $3,309; electric, $5,011. The excess of receipts over expenditures was $10,919. The total gross profits are figured at $28,323, divided as follows: Gas department, $16,146; electric light, $12,067. Deducted from this amount are bills due and interest amounting to $7,606, leaving a net profit for the year of $20,717. The net profit, leaving out the depreciation required by the State, would be 10.81 per cent, but including the depreciation the profit is 6.91 per cent. The total number of gas consumers is now 1,019, an increase of 91. The electric light consumers, 136, an increase of 30. The output of gas for the year was 22,017,200 cubic feet. The electric power plant was conducted at a loss of $1,733, but more motors are now installed and a better showing the coming year is a certainty. The growth of the use of the prepayment meters is mentioned. The number is now about 100. The recommendations include a new lift at the large holder to cost $5,500, new meters to cost $1,000, new mains, $1,000.

BOILER COMBINATION.—It is now definitely understood, and may be authoritatively stated, that the Babcock & Wilcox Company has acquired the Stirling Consolidated Boiler Company. The officers of the controlling corporation decline to make public any statement on the subject, either in affirmation or denial, as the company is a private enterprise, and is not making any appeal to the public for capital in carrying out its plans. The chief interest in the Stirling Company hitherto has been, it is said, that of Mr. O. C. Barber, president of the Diamond Match Company, while the Singer Sewing Machine interests are prominent in the Babcock & Wilcox Company, whose New York Offices are in the Singer Building on Broadway, with factories at Bayonne, N. J. The Babcock & Wilcox Company's capital has hitherto been $3,000,000 with no bonded debt. It is more than likely that the two companies will be conducted under separate management, as distinct concerns, as hitherto, but with the underlying unified control. The Babcock & Wilcox Company has now had a prosperous existence of a quarter of a century, and has made American water tube boilers standard throughout the world. The production of the company was never so large as it is at present. Mr. J. Hollis Wells is the president of the corporation.

DIVIDENDS.—Directors of the Detroit United Railway Company have declared the regular quarterly dividend of 1¼ per cent on the capital stock, payable May 1. The directors of the Electric Storage Battery Company have declared a dividend of 1½ per cent each on the common and preferred stocks, payable April 2 to stock of record March 27. The directors of the Western Union Telegraph Company have declared the regular quarterly dividend of 1¼ per cent, payable April 16. The Southern New England Telephone Company's directors have declared the regular quarterly dividend of 1½ per cent, payable April 16. The Union Switch & Signal Company's directors have declared the regular quarterly dividends of 2½ per cent on the preferred stock and 2 per cent on the common stock, both payable April 10. Directors of the Westinghouse Air Brake Company have declared the regular quarterly dividend of 2½ per cent; also the usual extra dividend of 2½ per cent, payable April 10. The regular quarterly dividend of 1½ per cent has been declared by the Cincinnati Street Railway Company, payable April 1. The regular quarterly dividend of 1⅛ per cent has been declared by the Cincinnati Gas & Electric Company, payable April 1.

BARNEY & SMITH CAPITAL.—One of the largest builders of trolley cars, etc., is the Barney & Smith Company, of Dayton, Ohio, who since the abandonment of the proposed street car builders' consolidation have proposed to reincorporate and increase their capital. The new company, which is to be incorporated under the laws of West Virginia or Ohio, will issue, it is said, $2,000,000 of 5 per cent bonds, half to be used to retire the existing 6 per cent bonds and the balance as required for improvements and extensions. In addition to the $2,500,000 8 per cent preferred stock and $1,000,000 common stock issued by the existing company, $2,000,000 common stock will be put out and will be paid to the preferred stockholders in lieu of 36 per cent of deferred dividends. The reincorporated company will thus have a capitalization of $7,500,000, as follows: $2,000,000 5 per cent bonds, $2,500,000 8 per cent preferred stock, $3,000,000 common stock.

LIGHTING IN LOS ANGELES.—The Los Angeles Gas & Electric Company, in its annual statement, shows receipts from the sale of gas and gas products of $1,055,222.36, and from the sale of electric light and power, $577,740.55. The expenditures in the gas department were $1,202,383.78, and in the electrical department $461,617.95. The actual cost of its gas works is given at $4,751,892.52, with a present value of $4,731,359.95. The cost of the electrical power plant and the wiring system is placed at $2,019,296.52, with a present cash value of $1,930,914.94. The Pacific Light & Power Company, of Los Angeles, Cal., in its annual statement, places a valuation on its property of $5,088,647.08, the actual cost of which was $5,426,966.85. The total revenue of the company is given as $1,053,594.84. The cost for supplying heat, light and power outside of Los Angeles is $70,790.74, and that within the city is $459,997.30.

OTIS ELEVATOR showed for the year 1905 net earnings of $912,938, with preferred dividends of $339,697; common dividends, $127,006; depreciation, $246,235, and a total surplus at the end of the year of $1,600,000. President W. D. Baldwin, of the Otis Elevator Company, in his report to the stockholders, says: "If your company's business continues as prosperous as now indicated it is the intention of the directors to place the common stock on a 3 per cent basis, payable 1½ per cent semi-annually, the first payment to be made on October 15, 1906." The directors of the Otis Elevator Company anticipate that it may be wise in the near future to issue $772,000 preferred stock now in the company's treasury, to be offered to the stockholders pro rata at par. The company has purchased new property at Yonkers, Buffalo and Chicago and new buildings and extensions in several other places will be made.

WESTERN UNION TELEGRAPH earnings appear to be holding up this year in spite of the loss of the racing news business. The net revenue, partly estimated, for the March quarter is $1,500,000, and for the nine months $5,360,790. The surplus of the company last year, after the payment of the regular 5 per cent dividend, amounted to $1,092,000. This brought the total surplus up to $15,974,209. In spite of competition from different sources, the company is able to show earnings well in excess of its interest and dividend requirements. For the past three years reported in full, the net earnings showed a tendency to decrease, but in the present year the decrease has apparently been checked.

KENTUCKY TELEPHONE DEAL.—The Central Telephone Company has been organized to take over the Louisville Independent Long-Distance and all smaller companies in Owensboro, Lexington, Maysville, Paris, Eminence and sections near these points in Kentucky. Southern Indiana will also be included. The Central Telephone Company was recently incorporated in the State of Delaware with a capital stock of $10,000,000. E. L. Barber, who was identified with the building of the Louisville Home Telephone Company, is president of the new concern.

U. S. LIGHT & HEATING.—The control of the United States Light & Heating has been obtained by interests connected with the New York Air Brake Company. While the new management of the United States Light & Heating Company is practically the same as that of the New York Air Brake Company, the latter has no interests, as a company, with the Light & Heating Company.

MUTUAL ELECTRIC LIGHT PLANT SOLD.—It is reported that negotiations have been practically completed for the purchase of the Mutual Electric Light Company, of San Francisco, Cal., by the Pacific Gas & Electric Company. The terms of the deal have not been announced, but Mutual stock has advanced to $19.25.

GENERAL NEWS.

Construction News.

OPELIKA, ALA.—The Opelika Railway, Light & Power Company has, after a lapse of some time, again started work on an electric line from Opelika to Auburn, Ala. The franchise includes besides the street railway a light and power plant.

BIRMINGHAM, ALA.—The City Council of Avondale has granted the Birmingham Railway, Light & Power Company the franchise on Third Avenue from the eastern city limits to the western limits for its new line. The new 3000-kw turbine of the company has been placed in service.

GADSDEN, ALA.—The Independent Telephone Company, which secured a franchise in this city several months ago, has commenced work upon the construction of its system. The Southern Bell Telephone Company also has a large force of men here at work putting in improvements to the extent of about $30,000.

DOTHEN, ALA.—Contracts for the municipal electric light plant, to cost about $10,000, have been awarded as follows: To the Crocker-Wheeler Company, of Ampere, N. J., for dynamos; the Harrisburg Machine & Foundry Company, Harrisburg, Pa., for the engines, and the Adams-Bagnall Electric Company, of Cleveland, Ohio, for the alternating-current arc lamps.

BISBEE, ARIZ.—In all probability the Consolidated Telephone & Telegraph Company will extend its system which will place Bisbee in position to communicate with Los Angeles and Denver.

STUTTGART, ARK.—The Stuttgart Water & Electric Light Company has been overhauling its plant. La Salle Stoops is manager.

SILOAM SPRINGS, ARK.—The Municipal Electric Light & Water Company is contemplating putting in larger engines and dynamos. R. L. Neely is superintendent.

SUSANVILLE, CAL.—James Branham has secured a franchise for an electric light plant.

SAN DIEGO, CAL.—The Pacific Mutual Light & Power Company has decided to construct a gas and electric light plant. I. C. Woodward, of Los Angeles, is one of the directors.

SAN FRANCISCO, CAL.—The Northern California Power Company has decided to construct a new power line from Volta to Chico and Hamilton. Address E. V. D. Johnson, of Redding, Cal., for further information.

LOS ANGELES, CAL.—It is understood that the Tia Juana and Cuyamaca dummy lines are to be rebuilt and electrified in connection with the work of the recently incorporated Los Angeles & San Diego Beach Electric Railway Company.

LOS ANGELES, CAL.—J. A. Kurtz, chief engineer of the Los Angeles Railway Company, has made a formal proposition to the citizens of Glendale and Verdugo to run an electric line from this city to Verdugo Park, a distance of more than 10 miles.

SAN DIEGO, CAL.—San Diego Consolidated Gas & Electric Company is installing a 1500-kw Curtis turbine, 1000 hp additional in Babcock & Wilcox boilers, and a 24-inch conduit to the bay, 1800 feet in length, for salt water for condensing purposes.

POMONA, CAL.—The directors of the local Home Telephone Company have re-elected Dr. F. W. Thomas president; J. Albert Dole, vice-president; Arthur M. Dole, secretary; Charles E. Walker, treasurer, and D. S. Parker, manager for the ensuing year.

MONROVIA, CAL.—An addition to its building on Myrtle Avenue, the most improved switchboard, cables to replace open wires and general improvements of the Monrovia branch are contemplated by the Home Telephone Company at cost of $10,500.

PASADENA, CAL.—Heman Dyer, City Clerk, writes that the City Council has passed a resolution, providing for the issue of $125,000 bonds for the construction of an electric light plant. An election will probably soon be held to vote on the question.

LAKEPORT, CAL.—The Lake County Power Company has been incorporated, with a capital of $10,000,000 to generate and sell electricity in Lake and other counties in California. The company will also manufacture and sell ice. The directors are Wilber T. Mariner, Herbert V. Keeling, M. S. Sayre and others, all of Lakeport.

FIELDS LANDING, CAL.—The North Mountain Power Company has applied to the Board of Supervisors at Eureka for a 50-year franchise to erect and maintain poles, masts and superstructures on which to suspend wires and other appliances for transmitting and conducting electricity for heat and light and power purposes along the streets, alleys and roads of the town of Fields Landing. Bids for said franchise will be received by the Board of Supervisors April 9. J. S. Brown, Chairman.

SAN FRANCISCO, CAL.—Under a contract made for twenty years with the United Railroads about thirteen months ago, the California Gas & Electric Corporation has begun to supply electric power to the street railway company. About 3000 hp is now being supplied daily, and in a couple of months when the power house just over the line in San Mateo County is finished, the California Gas & Electric Company will be able to supply a maximum of 12,000 hp. The latter will only be required during the hours of the day when the travel is heaviest. The average power will be about 6,000 a day.

COLUSA, CAL.—It is stated that it is the purpose of the California Gas & Electric Company in the future to depend upon Butte County as its most reliable and principal source of electric power. This is due to the fact that within this county the water supply has been unfailing, a condition which did not exist in other sections where the company has extensive plants. The company is now arranging to establish two additional generators of 8,000 hp each in Butte County—one each at Centerville and Da Sabla—and will also install two more in Nevada County, at Colgate and Deer Creek. The work which is now being done in the neighborhood of Centerville is toward this end. In addition to the water-power plants where the company is arranging to install several gasoline engines of 5,500 hp in the large cities, to be held for emergencies such as failure of water supply or breakages on the transmission lines. The company is now engaged in putting in a transmission line in one of the coast counties which is to furnish under a twenty-year contract 7,000 hp for a large cement works.

COLORADO SPRINGS, COL.—Henry Jameson, of Indianapolis, Ind., is said to have been elected president of the Animas Power & Water Company which proposes constructing a power plant on the Las Animas River, to cost about $1,000,000.

MONTROSE, COL.—The United Lighting & Traction Company has bought control of the Montrose Electric Light & Power Company, Montrose, Col. The officers are: President, W. S. Iliff; vice-president, C. K. Durbin, Denver; manager, S. B. Richey, Montrose.

JEWETT CITY, CONN.—It is understood that plans are being discussed for making improvements to the local electric light plant.

WILLIMANTIC, CONN.—Superintendent Moulton, of the water works, has recommended that an electric light plant be installed at the pumping station for lighting the station.

STAFFORD SPRINGS, CONN.—The Stafford Springs Electric Light & Gas Company's plant was sold by the receiver for $10 above the amount of the mortgage or bonds, to W. T. Hincks, of Bridgeport. The plant will be improved and put in condition to render satisfactory service.

BRANFORD, CONN.—Superintendent Baldwin of the Branford division of the Consolidated Light & Water Company has been notified by General Superintendent Calvert that on and after April 1 the price of electricity for Branford will be reduced from 18 cents per kw-hour to 15 cents. It is expected that this reduction will greatly increase the number of consumers.

WILMINGTON, DEL.—Bids will probably soon be asked by the Wilmington Heat, Light & Power Company, for a power plant on the Brandywine River, in the 9th ward.

WASHINGTON, D. C.—Bids will be received until April 20 by the Department of Agriculture, of which James Wilson is secretary, for furnishing electrical supplies, etc.

WASHINGTON, D. C.—Bids will be received until April 10 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards at Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies, as follows: Schedule 116, iron bolts; circuit breakers, voltmeters, ammeters, dry battery cells, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. A.

TAMPA, FLA.—A project is on foot to construct an electric railway across the peninsula from this city to Santa Lucia.

HAWKINSVILLE, GA.—The Hawkinsville Cotton Mill will install a 150-kw generator some time this summer; also about a 200-hp engine. W. N. Parsons is president.

ATLANTA, GA.—The Georgia Railway & Electric Company has petitioned the Board of County Commissioners for permission to lay either a single or double track along Stewart Avenue to Dill Avenue.

ROME, GA.—Work on the new power plant of the City Electric Railway Company in New Rome has been commenced. The plant will be in operation about August 1 and will cost $60,000. The old power plant will be sold.

CARTERSVILLE, GA.—Joseph B. McCrary, Empire Building, Atlanta, will prepare estimates for the construction of an electric light plant. The question of issuing bonds for same will probably be submitted to the citizens in sixty days. George S. Cobb is chairman of the Lighting Committee.

ALBANY, GA.—The town having been successful with municipal ownership of the electric light and water systems, it is now said to be negotiating for the electric railway system. A committee has been appointed to gather data in regard to the matter. It is believed that the city will not sell a franchise, but will proceed with the work itself as it did in the case of the other plants.

COLUMBUS, GA.—The newly organized Columbus Power Company, with a capital of $5,000,000, is perfecting its plans for the construction of a 3,000-hp plant on the Chattahoochee River between Columbus and West Point. The plans include a further development next year of an additional 4,000 hp. Later the company expects to develop 15,000 hp more at Clapp's factory, two miles north of the city, where the Chattahoochee River falls over 40 ft.

MAUI, HAWAII.—At a meeting of the Maui stockholders, Superintendent E. B. Carley's report for the expenditure of $2000 for improvements was adopted. Among other things this includes the building of two new lines to Hamakuapoke and Makawao and general line work.

CULDESAC, IDA.—The Culdesac Milling Company is preparing to make a test of the water power site which it owns, with a view to establishing an electric lighting plant.

POST FALLS, IDAHO.—The residents of the south side of the river are about to construct a telephone line. A company will be formed and will probably be incorporated.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company has doubled its output in two years. It will soon be enlarged, the present equipment being doubled throughout. D. C. Van Buren is manager.

DEKALB, ILL.—The electric power plant of the Haish Manufacturing Company of this city was destroyed by fire. Loss, $15,000.

CAMERON, ILL.—The Rock Island-Southern Railway Company has commenced work on the construction of its new power house.

UPPER ALTON, ILL.—At a meeting of the Star Telephone Company the capital stock was increased from $10,000 up to $25,000.

ALTON, ILL.—The Alton Gas & Electric Company has decided to expend $50,000 in making extensions in Alton and Upper Alton.

MT. CARROLL, ILL.—The Mt. Carroll Telephone Company has applied for a franchise to construct telephone lines in and around Mt. Carmel.

PEORIA, ILL.—Plans for the big power plant to be erected by the McKinley syndicate in this city have been prepared. The estimated cost is $400,000.

CARROLLTON, ILL.—The Carrollton Heat, Light & Power Company contemplates installing a 150-kw, direct-connected, two-phase, 60-cycle unit. F. M. Sinsabaugh is manager.

QUINCY, ILL.—Representatives of the Pittsfield (Ill.) Electric Light Company are said to be considering plans for establishing an electric light plant somewhere in the natural gas district of this city.

SULLIVAN, ILL.—The City Light & Water Works is making an estimate preparatory to enlarging its lighting plant, the improvements to include a Corliss engine and two alternators. The estimated cost is $35,000.

EAST ST. LOUIS, ILL.—It is stated that a number of improvements are contemplated in the rolling stock and power houses of the East St. Louis & Suburban Railway and the St. Louis, Alton & Granite City Railroad.

ATLANTA, ILL.—The Atlanta Electric Light & Power Company is enlarging its power house and installing another 100-hp boiler and replacing all the old open arcs with enclosed arc lamps. J. C. Robinson is secretary and manager.

CADIZ, IND.—Plans are being made to construct an electric light plant for Cadiz.

MUNCIE, IND.—The Delaware Hotel Company is preparing to install an electric light plant in its new hotel now nearing completion.

CANNELTON, IND.—The City Council and the electric light board concluded to rebuild the electric light plant recently destroyed by fire.

OAKLAND CITY, IND.—A 25-year franchise has been granted to Charles F. Stevens to operate a telephone exchange at Oakland City in competition with the Cumberland Company.

INDIANAPOLIS, IND.—Bids will be received by the Board of Park Commissioners on March 30 for incandescent lighting in the parks of the city. There are a large number of lights in the parks.

FAIRMOUNT, IND.—The Fairmount Light & Power Company proposes to install meters for all consumers and to give a continuous service, using an American Diesel engine. Paul La Rue is superintendent.

LINTON, IND.—The City Lighting Company is likely to pass to private ownership. It is possible that the city may retain a certain amount of stock. There are three purchasers in the field. J. J. Powell is superintendent and manager.

FORT WAYNE, IND.—It has been decided by the directors of the Fort Wayne & Wabash Valley Traction Company to build a line through Delphi, connecting Lafayette and Logansport and also to extend the Battle Ground line to Monticello.

LIBERTY, IND.—Charles L. Henry, of Indianapolis, president of the Indianapolis & Cincinnati Traction Company, in company with his chief engineer, was in Liberty recently looking over the line for the extension of the road from Connersville to Cincinnati.

RICHMOND, IND.—E. C. Meade & Co., consulting engineers of Dayton, O., have completed plans for the improvement of the municipal electric light and power plant for the city of Richmond. Bids for the new equipment will be asked for as soon as the plans are accepted.

NOBLESVILLE, IND.—The S. M. Smith Company has sold its plant to the Noblesville Heat, Light & Power Company, which intends to rebuild the plant and put it in first class condition. The new company, which is capitalized for $50,000, is composed of Kokomo and Indianapolis capitalists.

INDIANAPOLIS, IND.—The Indianapolis & Ohio Valley Traction Company desires to let contracts, if possible, by April 1. Contractors wishing to bid on this construction can correspond directly with the Indianapolis & Ohio Valley Traction Company, 403-406 State Life Building, Indianapolis, Ind., where plans, profiles, etc., are on file.

NAPPANEE, IND.—An election will be held in Turkey Creek township on April 20. Petitioners are asking that subsidies of $10,000 from Turkey Creek, $7000 from Van Buren and $4,000 from Jefferson townships be voted to the new traction line, which will be known as the Fort Wayne & South Bend Air Line Traction Company.

TERRE HAUTE, IND.—It is said that the board of public works has signed a five-year contract with the electric company to light the streets of the city. This act surprised the Council and the Mayor, who had planned to secure a one-year contract and then go ahead with the plans for a municipal plant in compliance with the popular vote of the people last fall. The Council is inclined to let the contract stand, although a majority is favorable to a municipal plant.

CHICKASHA, I. T.—The City Council has granted the City Street Railway Company, a franchise for an electric light plant.

COLGATE, I. T.—Frank V. Archer, of Muskogee, is reported to have secured a franchise for an electric light plant and street railway.

NOWATA, I. T.—The town is considering a grant to Mr. W. A. Davis of a franchise for a lighting plant. If the franchise is granted work on the plant will commence at once.

DAVIS, I. T.—The Commonwealth Trust Company, of St. Louis, Mo., is said to have acquired a controlling interest in the Oklahoma City, Lexington & S. S. Electric Railway and has arranged to carry out the plans as originally proposed by the former promotors.

AFTON, IA.—The city of Afton has bought an electric light plant for $2,950.

ALBIA, IA.—A. R. Jackson has been voted a franchise for a heat, light and power plant.

OTTUMWA, IA.—At the recent public meeting it was voted to accept the proposition of the Indiana syndicate regarding the building of an interurban line from Ottumwa to Des Moines.

TAMA, IA.—The Toledo Commercial Telephone Company is making improvements in the local system, which include a new switchboard and the erection of 5,000 ft. of new cable.

CLINTON, IA.—The Clinton Street Railway Company has been organized to succeed the State Electric Company, and the capital stock has been increased to $600,000 and the funded debt to $400,000. The company has changed the name of its park from Joyce Park to Eagle Point Park.

FAIRFIELD, IA.—The Fairfield Brick & Tile Company is asking a franchise for an electric power, light and heat plant, which will be voted upon on March 26. The town now has a municipal plant. William L. Long is superintendent.

ACKLEY, IA.—The Ackley Electric Light, Heat & Water Works proposes to install a 125-hp engine, direct-connected to two 110-volt generators of about 50-kw each. Also one or two 66-in. x 16-ft. high-pressure boilers in the near future. H. H. Nazett is superintendent.

OSAGE CITY, KAN.—W. C. White, city clerk, writes that the citizens voted March 16 to issue $15,000 bonds for improving the electric light plant.

OSKALOOSA, KAN.—The Oskaloosa Electric Light Company, which is now entering the fourth year of a successful career, is completing a circuit for street lights. A 50-hp Ideal engine and 30-kw Westinghouse alternator, 1,000-110 volts, are now loaded to full capacity. The rate charged is 15 cents per kw, with a monthly minimum of $1.50. Jay S. Buck is manager.

MONTICELLO, KY.—An electric light plant is being installed here and will be equipped with direct-current apparatus.

CLOVERPORT, KY.—The City Council has granted to H. Stewart Miller, Jr., of Owensboro, a franchise for an electric light plant here.

OWENSBORO, KY.—The plant of the Kentucky Electrical Company on Lewis Street is reported to have been destroyed by fire on March 8.

FULTON, KY.—The Fulton Electric Light & Power Company has been reorganized with the following officers: President, L. W. Graham; secretary, E. C. Robinson; treasurer, J. V. Hefley.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company is installing new machinery in its plant in order to provide for the supply of new lines which it will build at once.

SOMERSET, KY.—The Somerset Water, Light & Traction Company has commenced grading for its street railway, and will also reconstruct its wiring system for furnishing electric light and power.

HICKMAN, KY.—The Hickman Coal & Ice Company has leased the municipal water and light plant for twenty years and will run it in connection with its ice plant. A new outfit of machinery will be installed. A. B. Hughes is superintendent.

MORGANFIELD, KY.—The Morganfield Light & Power Company recently installed a 200-hp engine, 120-kw alternator with switchboard, 100-hp boiler, and has closed a contract for 30 arc lamps, to run all night every night. The plant has been in operation 12 years, but these will be the first street lights.

NEW ORLEANS, LA.—An ordinance has been introduced into the City Council, granting to Charles B. Stark the privilege of constructing and maintaining a telephone system in this city. The system must be completed within three years and have a sufficient capacity to serve 3,500 subscribers.

NEW ORLEANS, LA.—E. L. Powell, superintendent of the Cumberland Telephone & Telegraph Company, has presented in writing to the City Council an offer from the company to pay the city 3 per cent of its gross earnings so long as it has no competition. It is estimated that this will amount to not less than $12,000 per annum.

DONALDSONVILLE, LA.—At a special meeting of the City Council the Westinghouse Electric Company, of Pittsburg, Pa., was awarded the contract to furnish fifteen Westinghouse copper-case, inclosed arc lamps, with a 50-light transformer, etc., for $795. This equipment is to be used in illuminating Mississippi Street and Railroad Avenue. Other bidders were the General Electric Company, of New Orleans, and the Fort Wayne Electric Company of Fort Wayne, Ind.

PITTSFIELD, ME.—The citizens of Pittsfield are agitating the question of establishing a municipal electric light plant.

PORTLAND, ME.—The Portland Electric Lighting & Power Company has decided to construct a new brick power house here this spring.

LIVERMORE FALLS, ME.—The Maine Telephone & Telegraph Company has filed articles of incorporation, with a capital stock of $25,000.

BATH, ME.—The City Council has completed a contract with the Sagadahoc Light & Power Company for lighting the city for a term of five years.

LEWISTON, ME.—At the recent town meeting it was voted to make a contract for five years with the electric light company for lights not to exceed $75 per arc light.

ELLSWORTH, ME.—The Bar Harbor Union River Power Company suffered considerably during the late storm, which was the severest of the winter. Power and lighting service were both seriously interrupted for a few hours.

BANGOR, ME.—Jesse G. Waters, Danvers Cram and Arthur D. Mansell were appointed a committee to make a contract with the Newport Light & Power Company for street lights for the ensuing year. It is said that some of the arcs are to be removed and incandescent lights substituted.

BRUNSWICK, ME.—Superintendent Hopkins, of the Brunswick Electric Light & Power Company, states that after the recent storm the wires were in a worse condition than at any time during the fifteen years he has been employed by the company. One night the plant was practically shut down.

BALTIMORE, MD.—The County Commissioners have been asked to furnish a dozen or fifteen additional arc lamps in Violetsville in the Thirteenth District..

ARLINVILLE, MD.—The City Council has agreed to grant Senator W. L. Mounts an incandescent light franchise, and with it the gas franchise is also to be renewed.

TOWSON, MD.—The County Commissioners have awarded to the Mt. Washington Electric Light & Power Company the contract for lighting Roland Park, Evergreen Park and Tuxedo Park. T. W. Offutt is president.

RICHPORT, MASS.—A committee has been appointed to investigate the feasibility of establishing a municipal lighting plant.

HOPKINTON, MASS.—At a recent town meeting a committee was appointed to investigate the question of an electric light plant.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company is expecting to install a 2,000 kw engine and generator, direct-connected, and two B. & W. boilers of 400-hp each.

WHITMAN, MASS.—It was voted at a recent town meeting to either purchase or construct an electric light plant and a committee was appointed to investigate and report upon the matter.

BROCKTON, MASS.—The question of municipal ownership of the gas and electric lighting plants is being considered by the City Council, and it is considered probable that the systems will be taken over by the city.

MIDDLETON, MASS.—The following committee was chosen to investigate the matter of installing electric incandescent lights for street lighting, etc.; S. S. Merrill, M. J. Emerson, L. G. Esty, B. T. McGlauflin, H. K. Richardson.

ABINGTON, MASS.—There seems to be but little doubt that the stockholders of the Abington & Rockland Electric Light & Power Company will sell its interests to Stone & Webster, who control the Edison Electric Illuminating Company

FALL RIVER, MASS.—The contract for constructing the foundations for the new power house of the Fall River Electric Light Company, to be erected on the wharf at the foot of Hathaway Street, has been awarded to Beattie & Wilcox.

MANSFIELD, MASS.—The demands for business at the electric light plant have increased so rapidly that it has been found necessary to increase its capacity. The Council has been asked for an appropriation to install another 225 hp unit.

ORANGE, MASS.—The Orange Electric Light Company during the summer months will put in two new three-phase generators, enclosed arcs and a new steam plant in the building with its water plant, located at Wendell Depot, Mass. E. O. Horton is manager.

BEVERLY, MASS.—The Beverly Gas & Electric Company is installing a 500-kw Curtis turbine, 300-hp B. & W. boiler and Wheeler condensing apparatus; will put in new storerooms, and is starting an energetic canvass for new business. A. Macaulay is superintendent.

MILFORD, MASS.—At the adjourned town meeting recently the vote was taken authorizing the selectmen to contract for street lighting for one year with the Milford Electric Light & Power Company for 58 arc electric lights, the cost not to exceed $90 each, and for 150 gas mantle lamps at $24 each.

FITCHBURG, MASS.—At the offices of the Fitchburg Gas & Electric Light Company, contracts were signed which mean the doubling of the present electric plant of the company. The increase in production of power will be from 1,000 kw to 2,000 kw. The contracts are for Mackintosh & Seymour engines of 1,500 hp, and a General Electric Company alternating-current generator of 1,000 kw, all of which is to be installed before January 1, 1907.

WORCESTER, MASS.—The statement is made here that John Farson, of New York, representing a western syndicate, has been inspecting street railway propositions beginning with the Worcester & Holden and including those in the vicinity of Gardner, Westminster, Fitchburg and Leominster, besides prospective connections with Lowell. The suggestion is made that the syndicate is looking for a route into Boston by way of Lowell, although a new route between Fitchburg and Boston has been talked of by promoters for some months.

MONROE, MICH.—Improvement to the amount of $50,000 are planned for the power plant at this city.

HOMER, MICH.—The Homer Telephone Company has completed arrangements for increasing its capital stock from $15,000 to $30,000.

SHEPHERD, MICH.—The Michigan State Telephone Company has authorized the expenditure of $1,000 for improvements to the local system.

IRON RIVER, MICH.—Charles A. Otto, village clerk, writes that the citizens voted March 12 to issue bonds for the construction of an electric light plant.

LINDEN, MICH.—Warren S. Rundell, of Flint, has made a proposition to the Village Council to light this village from the electric plant at Fenton.

HARBOR SPRINGS, MICH.—The municipal plant will put in a 100-kw alternator to replace the present 37½-kw machine. Harry L. Metz is superintendent.

NORWAY, MICH.—Extensive improvements are contemplated by the Bell Telephone Company in its telephone system here. The company will spend about $10,000.

MOUNT PLEASANT, MICH.—Improvements and extensions in the local telephone system to the amount of $3,000 are planned by the Michigan State Telephone Company.

SAGINAW, MICH.—The Council on request of the Central Labor Union decided to submit to the voters April 2 a proposition to issue bonds for a $150,000 municipal light plant.

DETROIT, MICH.—H. W. Noble & Co. have sold the Dunkirk & Predonia Electric Railway to a strong syndicate of Eastern capitalists, who have also bought up the Buffalo, Dunkirk & Western.

LANSING, MICH.—The Capital Electric Engineering Company has purchased the stock and interests of the Van Gorder Electric Company, and F. E. Van Gorder has accepted a position as superintendent.

BLISSFIELD, MICH.—The annual report of the municipal electric light plant shows an expenditure for 1905 of $4,678.83, and a profit of $213.85, excluding 34 arc lamps and some incandescents on the streets, for which no charge is entered.

BATTLE CREEK, MICH.—The Battle Creek & Southeastern Electric Railway Company, which proposes to build from Battle Creek to Cold Water, announces that it has secured a 66-foot right of way for the entire distance. The company proposes to buy its power.

ANN ARBOR, MICH.—There will be a direct railway between Ann Arbor and Adrian by the extension of the Saline branch to Tecumseh. Ten miles of this road will be built as soon as spring opens. The power for the new line will be furnished by the Ypsilanti power house.

HART, MICH.—The Village Council has voted to submit to the people the question of issuing bonds for $20,000 for the purpose of putting in an electric light plant. Hart has been considering the municipal lighting question for some time. A proposition from the Pere Marquette Company has been under advisement.

BERRIEN SPRINGS, MICH.—The village has made a contract with the Berrien Springs Power & Electric Company, which will commence building a dam in the spring. The company will give the village power free forever to light 25 arc lights, pump 50,000 gallons of water free daily for the use of the village and sell electric current to commercial users at a rate of 20 per cent. lower than the price in South Bend.

SAGINAW, MICH.—The Detroit, Flint River & Saginaw Valley Railway Company has been granted a franchise in Flint and will construct an electric railway from Saginaw to Fenton via Flint. The road will be built by two companies—the Fenton, Long Lake & Flint line and the Saginaw-Flint line. W. F. Davidson, of Port Huron, is the president of both; D. D. Aitken, vice-president; E. D. Black, secretary, and Arthur Bishop, treasurer.

COTTONWOOD, MINN.—The Home Telephone Company will extend its rural lines.

AUDUBON, MINN.—A local telephone exchange is projected. A. O. Netland is interested.

LAMBERTON, MINN.—A company will be formed to install a local telephone exchange. Albert H. Enerson is interested.

NEW ULM, MINN.—The New Ulm Rural Telephone Company will build 50 miles of pole lines. The switchboard will also be enlarged.

MARSHALL, MINN.—The city will install new machinery in its lighting plant this summer, having outgrown its old equipment. E. Simmons is superintendent of the plant.

DAWSON, MINN.—The electric light plant will install a 125-hp engine this summer and an 80-kw direct-current machine, and will extend its pole line. The cost will be about $8,000 in all.

DULUTH, MINN.—The Mesaba Telephone Company will immediately begin the construction of a building for a telephone exchange and offices. The company expects to have the building ready for occupany by Fall.

NORTHFIELD, MINN.—Charles E. Church is arranging to install a new telephone exchange in this city to be known as the Northfield Rural Telephone exchange. It is to be operated in connection with the new Faribault rural lines and the Tri-State long-distance lines.

LEXINGTON, MISS.—The Board of Mayor and Aldermen are considering the question of issuing $25,000 bonds for an electric light plant.

WEATHERSBY, MISS.—The Board of Aldermen has granted a franchise to Ware & McInnis, of Simpson County, to erect a telephone system here.

SENATOBIA, MISS.—The municipal electric light and water works will add some street lights to its circuits. F. G. Godfrey is superintendent.

BROOKHAVEN, MISS.—The Brookhaven Light & Water Works expects to double its capacity soon and to change from 125 to 60 cycles. R. S. Purser is superintendent.

SARDIS, MISS.—The Board of Mayor and Aldermen on March 7 awarded to the Panola Electric Light Company the contract for installing a system of street lighting

FORREST, MISS.—At a meeting of the Mayor and Board of Aldermen a franchise was granted to Frank H. Harrison to construct and maintain an electric lighting plant in Forrest, to be in operation before fall.

YAZOO CITY, MISS.—The Board of Aldermen has ordered the Mayor to appoint a committee of three aldermen and citizens to prepare plans and specifications and ascertain the cost of building an electric street railway. The power will be furnished by the city lighting plant.

GRANITE CITY, MO.—The Kinloch Telephone Company has been granted a building permit for the erection of a $7,000 office and exchange building here.

MARYVILLE, MO.—The Council is reported to have under consideration an ordinance providing for the issue of $30,000 bonds for a municipal lighting plant.

FULTON, MO.—The Buffum Telephone Company is to spend $15,000 in improving its service in Fulton. It will put in a new switchboard and new cables all over the city.

KANSAS CITY, MO.—The Metropolitan Street Railway Company has ordered a new 7,500 h.-p. generator, which is to be installed at the Second Street and Grand Avenue power house.

CAPE GIRARDEAU, MO.—M. E. Leming, of this city, is having petitions circulated among property holders asking the City Council to give him a franchise for an electric street railway.

HUNTSVILLE, MO.—The Huntsville Gas & Electric Light Company expects to install an equipment of boiler, engine and dynamo this spring for power service. Chas. W. Hazell is president.

NORBORNE, MO.—The Norborne Fuel, Ice & Light Company has recently changed its name from the Norborne Electric Light & Power Company, and added to the equipment a 4-ton De La Vergne ice plant. F. S. Cunningham is secretary and treasurer.

WELLSVILLE, MO.—The Wellsville electric plant is offering inducements for the location of a factory for the manufacture of any kind of electrical apparatus in its large three-story station building alongside the Wabash tracks at that place. E. F. McBroom is the owner.

BUNCETON, MO.—The electric railway meeting, held March 14, was attended by 200 citizens who reside along the proposed route from Jefferson City to Sedalia, both the terminal points being represented by prominent business men. The road is to be known as the Missouri Interurban Railway Company. An executive committee was named to proceed at once and raise sufficient funds to pay for making the preliminary survey, and to report at the next meeting to be held at California, March 26.

ST. LOUIS, MO.—The St Louis Electric Terminal Company, better known as the McKinley system, which on March 8 obtained a charter, is the opening wedge which is to spread and give the electric system which is to connect Chicago with St. Louis, an entrance into St. Louis. It is the purpose of the incorporation to establish express and passenger stations at points not far from the river front, and to make the system a competitor for traffic between the two great cities and their connecting links of the middle west. The capital stock is given now at $100,000. Charles Zilly is credited with 900 shares; B. E. Bramble wih 30; W. L. Ferris, 30; George M. Mafts, 30, all of Champaign, Ill., and George L. Edwards, Jay Herndon Smith and Charles W. Moreys, all of St. Louis, one share each.

BUTTE, MONT.—A company, in which Charles R. Leonard, Charles J. Kelly, Harry Gallwey, Henry Mueller, F. Augustus Heinze, Elmer B. Jones and Herbert B. Brown are interested, has asked for a franchise to establish an independent telephone exchange in Butte.

MINDEN, NEB.—This city is to have a new lighting plant.

GENEVA, NEB.—The Fillmore County Telephone Company contemplates many improvements to its system.

HAVELOCK, NEB.—P. T. McGere has petitioned the Council for a franchise for an electric light plant.

GIBBON, NEB.—J. H. Davis & Son have been granted a franchise to install an electric lighting plant at this city.

FREMONT, NEB.—Plans are being discussed for building an electric railway here. E. N. Morse is mentioned as being interested.

GRAND ISLAND, NEB.—At an election $35,000 in bonds were voted for the construction of a lighting plant in connection with the municipal water works plant.

CENTRE HARBOR, N. H.—It is probable that a system of electric lighting for the streets of the town will be established here shortly.

LANCASTER, N. H.—The Lancaster & Jefferson Electric Company is considering extensive changes in its plant. W. U. Colby is superintendent.

NEWMARKET, N. H.—The Newmarket Electric Light, Power & Heat Company is planning to install an additional dynamo in the power house, so that in case of an accident to the present machinery there will be no suspension of service.

HIGHLAND PARK, N. J.—The Borough Council has signed a one-year contract with the Public Service Corporation for lighting the streets of the Borough.

CAMDEN, N. J.—The City Council has adopted the report of the joint committee of Streets and Finance, recommending that legislation be secured looking to the city acquiring municipal ownership of underground conduits.

ORANGE, N. J.—Officers representing Orange, West Orange, East Orange, Bloomfield and Montclair met recently in Orange and discussed plans for establishing a joint municipal electric lighting plant which will furnish light to streets of the different communities and to private consumers in competition with the Public Service Corporation of New Jersey. The combination will appoint a commission under the provisions of a bill now pending before the legislature, will build its own power station and lay its own conduits. The plan has been formulated because of the extortionate rates charged by the local electric lighting concern.

ITHACA, N. Y.—The Ithaca Telephone Company is to lay about 7000 feet of conduit.

WADHAMS MILLS, N. Y.—D. F. Payne has established two water-power plants developing 800 hp.

ELIZABETHTOWN, N. Y.—Mr. C. M. Wood is now manager of the Elizabethtown Electric Light Company.

WELLSBORO, N. Y.—Mr. F. W. Barker is now secretary of the Wellsboro Light, Heat & Power Company.

ELMDALE, N. Y.—The Farmers Telephone Company, with an exchange at Gouverneur is building lines to Elmdale. It will also build lines to Pierce's Corners.

ONEONTA, N. Y.—The Oneonta Light & Power Company will add 180-hp of McCormick-Rodney Hunt wheels to its plant this spring. G. A. Lane is manager and superintendent.

SYRACUSE, N. Y.—The management of the Central New York Telephone & Telegraph Company has been authorized to expend the sum of $200,000 for improvements in the system and service.

GROTON, N. Y.—The village lighting plant will install a separator on one engine and possibly on two the coming summer. Catalogues are requested. M. E. Yates is chief engineer and electrician.

LOCKPORT, N. Y.—The Common Council has granted the petition of the Lockport Gas & Electric Light Company to change the lighting system of the city from the present one to the enclosed-arc light system.

BUFFALO, N. Y.—A committee has been appointed to investigate the application of the Electrical Transmission Company for a franchise to furnish 60,000 hp of electricity for heating, lighting and power purposes in Buffalo.

MORAVIA, N. Y.—The Moravia Electric Company has recently finished a new station and dam. The station is 25 x 25 ft. equipped with a 1,200-hp McCormick turbine direct-connected to a General Electric alternator. Leslie L. Luther is the engineer.

NEW YORK, N. Y.—Plans have been filed for the enlargement of the power station and car house of the New York City Street Railway Company in the block in Amsterdam Avenue from 128th to 129th Street. The improvements will cost $150,000.

MIDDLETOWN, N. Y.—Superintendent Smith states that the Orange & Rockland Electric Lighting Company has been granted a franchise for lighting the village of Washingtonville. A sub-station is to be built by the company at Chester and that town will also be lighted by electricity.

COOPERSTOWN, N. Y.—At the foreclosure sale in Cooperstown on March 13 the property of the Oneonta, Cooperstown & Richfield Springs Electric Railroad was bid in for $960,000 by Henry W. Bean, chairman of the reorganization committee, subject to $250,000 or more receivers' certificates.

TROY, N. Y.—The bids for lighting the streets and public buildings with electricity and gas, opened on March 16 by the Board of Contract, are stated to have been rejected, being considered too high, and Corporation Counsel Wellington was instructed to draw up a bill to be introduced in the State Legislature, providing for the construction of a municipal lighting plant.

CLYDE, N. Y.—The Village Board of Trustees has made a contract with the Wayne County Electric Company, to run five years from the first of next June. Under the present contract the village pays $60 per light for fifty lights, but the new contract only provides for forty-five lights, as the village is not allowed to pay for more than the forty-five lamps without a special vote. At the coming village meeting the question of paying for five extra lamps will be voted upon.

HIGH POINT, N. C.—E. J. Justice has been granted a franchise by the board of County Commissioners for the construction of an electric railway from High Point to Greensboro.

STATESVILLE, N. C.—Bids will be received until April 2 by Eugene Morrison, City Clerk and Treasurer, for $20,000 bonds for extending the water and sewerage lines and improving the electric light plant.

SALISBURY, N. C.—The Salisbury Gas & Electric Light Company suffered a severe fire recently. This company has been making numerous extensions and improvements and the loss falls heavily. The whole structure in which the gas machinery was placed was burned out. Simultaneously with the destruction of the plant, began the tearing away for the new structure. The adjoining electric light plant was not hurt.

COURTENAY, N. D.—L. C. Lane will construct a telephone system in this vicinity.

GARRISON, N. D.—The Hughes Electric Company, of Bismarck, N. D., will install a local telephone exchange here.

ANAMOOSE, N. D.—William Baille, of Valley City, N. D., has been granted a franchise for a local telephone exchange.

FARGO, N. D.—I. H. Richardson, of Minneapolis, manager of the Tri-State Company, is authority for the statement that his company will build a long-distance line into Thief River Falls just as soon as the weather permits.

BURTON, OHIO.—The Burton Electric Light Plant is contemplating the installation of a 50-hp boiler.

NEWTON FALLS, OHIO.—The Newton Falls Telephone Company contemplates further extensions to its system.

CLEVELAND, OHIO.—The Cleveland Telephone Company (Bell) has absorbed the Warrensville Telephone Company and will enlarge the plant.

CANTON, OHIO.—The Street Railway Company has voted to issue $200,000 additional bonds to provide for extensive improvements of the system.

NEWARK, OHIO.—M. L. Gilette, president of the Newark Light & Power Company, states that the company will spend $100,000 for its new power station.

EATON, OHIO.—The Eaton Telephone Company has increased its capital stock from $50,000 to $120,000. It is the intention to make improvements to the system.

CANTON, OHIO.—Property owners of Dalton and East Greenville have petitioned the Canton-Akron Railway Company to extend its West Brookfield spur line to these places.

EAST LIVERPOOL, OHIO.—The North American Manufacturing Company has had plans prepared for the mammoth power house to be erected at Newell, W. Va.

RAGERSVILLE, OHIO.—The Ragersville-Fiat Telephone Company is planning to build new lines to connect with the independent long-distance system at Stone Creek and Yorktown.

CINCINNATI, OHIO.—The water works commissioners have awarded a contract for electric generating equipment for the new pumping station to Dravo, Doyle & Co., of Cincinnati, at $28,692.

OXFORD, OHIO.—The Board of Public Works has made a recommendation to the Council that an appropriation of $5,000 be made at once to install new boilers in the municipal lighting station.

CYGNET, OHIO.—The owners of the local lighting plant have shut off the power in the village because the Council thinks the bills are too large and refuses to pay. The village is contemplating buying a plant.

MEDINA, OHIO.—F. Oatman has sold his interest in the Medina Electric Light Company to local parties for $14,000. The new owners will make important improvements to the plant and the street lighting system.

MASSILLON, OHIO.—The Massillon Light Heat & Power Company has obtained a franchise from the County Commissioners to extend its lines to Canal Fulton and to install a lighting system in that village.

LIMA, OHIO.—Chief Engineer Walker of the Straford Construction Company, a subsidiary company of the Schoepf-Morgan syndicate, has completed four surveys between Lima and Bellefontaine. It is announced that the line will be built this year.

CLEVELAND, OHIO.—The village of Newburg has granted franchises to the Cleveland Electric Railway Company for lines in Kinsman Street, South Woodland Avenue, North Woodland Avenue, Union Street and Rice Avenue. The grants are for twenty years.

TOLEDO, OHIO.—Dr. H. E. Bucklen, of Elkhart, Ind., is negotiating with the Toledo & Western Railway Company to induce it to extend its line from Pioneer, Ohio, to Angola, Ind., to connect with the line which he is promoting between Angola and South Bend.

CLEVELAND, OHIO.—The Cuyahoga County Commissioners are investigating the cost of illuminating the court house and county jail. Gas and electric light bills amount to about $16,000 a year. Estimates for a lighting plant to light the buildings are to be secured.

NILES, OHIO.—The City Electric Light & Water Works proposes to install this summer, a direct-connected 300-kw alternator and a jet condenser. The street lights will be changed from series direct-current to series alternating-current. B. Holoway is superintendent.

SCHOEPF, OHIO.—It is announced that work on the Frey Electric Railway to Wilmington will be started by the middle of April. C. T. Clendenin, president of the New York Construction Company, has been spending several days in this city making arrangements for beginning the work.

CLEVELAND, OHIO.—The Garrett-Cromwell Engineering Company has completed plans for a large open-hearth furnace and bar mill for the Follansbee Bros. Company, Pittsburg, Pa. The plant will be erected at Follansbee, W. Va. A power plant, electric cranes and conveying outfits will be installed.

NORWALK, OHIO.—C. N. Wilcoxson, manager of the Norwalk Gas & Electric Company, states that the company is spending about $15,000 in erecting new mains and street lamps. In the near future all the power will be furnished by the Cleveland & Southwestern Traction Company, to which the lighting company is subsidiary, and the local plant will be changed into a sub-station.

DAYTON, OHIO.—The City Council on March 12 granted a franchise to the Dayton Citizens' Electric Company. Cyrus E. Mead & Co., of Dayton, consulting engineers, writes that the proposed plant contemplated by this company will cost $1,500,000. Valentine Winters is president, and S. W. Davies is secretary.

PAINESVILLE, OHIO.—A company headed by J. R. Curtiss, manager of the Cleveland, Painesville & Ashtabula Railway, is endeavoring to secure a franchise in order to compete with the municipal plant. Power will probably be furnished from the large railway station located on the outskirts of Painesville. Very low rates are offered.

SPRINGFIELD, OHIO.—The Peoples Railway Company, which a short time ago acquired the plant and business of the Springfield Light & Power Company, has completed a large number of improvements to the lighting system. Two large generators have been installed and the street lamps are being replaced with those of the latest type.

COLUMBUS, OHIO.—Announcement was made at the annual meeting of the Columbus Citizens' Telephone Company that the company had perfected a lease of the plants, exchanges and rights of the Franklin Telephone Company. The combined companies have a list of 10,000 subscribers in Franklin County on the city, village and rural lines.

LANCASTER, OHIO.—A syndicate is being formed to take over the Lancaster Telephone Company, which is controlled by the Federal Telephone Company, of Cleveland. The company is making a fine showing and is paying 4 per cent. on $100,000 capital stock. In 1905 the earnings were $20,475, as compared with $17,781 in 1904 and $15,527 in 1903.

ARLINGTON, OHIO.—A new Mutual Telephone Company is being formed in this vicinity. P. J. Baker has been elected president and manager. A number of farmers have joined the mutual agreement, and at the next meeting a committee will be appointed to correspond with supply houses to ascertain the cost of materials and to place contracts.

FOSTORIA, OHIO.—It is announced that the Western Ohio Railway Company interests have decided to build a line from this city to Fremont, Ohio, and that work will commence this spring. This is one of the most important links uncovered in Ohio. The Toledo, Fostoria & Findlay Railway, operating between Fostoria and Findlay, is preparing practically to rebuild this portion.

CINCINNATI, OHIO.—The Cincinnati & Suburban Bell Telephone Company will install a large amount of conduit system. The cost of new conduits will be about $88,000 and the new cables used in them $77,000, making a total expenditure of $165,000, which appropriation has been made by the company. Bids will be called for at once and as soon as the contracts are let the work will be pushed to completion

TIFFIN, OHIO.—It is stated that Detroit people are negotiating for the purchase of the Electric Railway & Power Company and the Tiffin Edison Electric Illuminating Company. The railway property includes five miles of city lines and a right of way and considerable grading for a line from Tiffin to Fremont. If the deal is consummated, this line will be completed. C. D. Loomis and F. J. Bunn are at the head of the Tiffin companies.

TOLEDO, OHIO.—Toledo people who control the stock of the Toledo, Ann Arbor & Detroit Railway are arranging to refinance the project. It will be remembered that the road became embarrassed through the failure of the Patrick Hirsch Company, which undertook to finance and build it. It is said that about $50,000 has already been invested in the property and the local stockholders hope soon to perfect plans whereby the road can be completed.

CINCINNATI, OHIO.—In his annual report, President James C. Ernst, of the Cincinnati, Newport & Covington Light & Traction Company, announced that the company will spend $175,000 in improvements the coming year. The money will be expended in the installation of a 2500-hp turbine and generator, a new switchboard, 2000 hp. of boilers and auxiliary equipment, largely for the lighting department of the plant. New cars will be purchased and about two miles of extension laid in Newport and vicinity.

COLUMBUS, OHIO.—The Board of Public Service has made overtures to the Columbus Railway & Light Company and to the Public Service Corporation, both of which do lighting in this city to ascertain whether arrangements can be made for supplying the municipal system with power in case the municipal power plant gives out as it did recently.

The board wishes to prevent the possibility of the city's being left in darkness again. New equipment is to be purchased for the municipal plant if an ordinance now pending passes the council.

CAREY, OHIO.—The municipal lighting plant at Carey, Ohio, is said to be proving a success. Six years ago the city was levying five mills annually for the support of the electric light and water works plants and the fund was $600 overdrawn. During the past two years since the municipal plant was improved no levy has been necessary. In the mean time two new boilers, two engines and one dynamo have been installed and paid for, about $800 worth of repairing has been done and $900 paid for new piping, and there is about $1,800 now in the treasury.

CLEVELAND, OHIO.—The Lake Shore Electric Railway has placed orders for four 500-hp Sterling boilers and stokers and to the Wheeler Conder & Engineering Company for a 2000-hp Wheeler condenser. These will be used in connection with the 2000-kw Westinghouse-Parsons turbine ordered a short time ago for the Beach Park power station. A sub-station equipment will be placed in the station. This additional equipment will give the Lake Shore Electric alternating-current transmission throughout its entire system, the old direct-current generating apparatus at Beach Park being used only for auxiliary purposes.

FINDLAY, OHIO.—The Findlay-Marion Railway & Light Company has increased its capital stock from $25,000 to $250,000. The project has been under way for some time and the company has secured a greater portion of the required right of way from Marion to Findlay by way of upper Sandusky. This is one of several lines which proposes to form a connecting link between Toledo and Columbus. The officers of the company are: R. P. Hankey, of Detroit, president; M. H. Neil, of Columbus, vice-president; G. W. Meeker, of Columbus, secretary, treasurer and manager, and Emmet Tompkins, of Columbus, general counsel. It is stated that work on the Findlay-Marion line will start this summer.

EL RENO, OKLA.—The Canadian Valley Farmers' Telephone Company, in case it cannot effect an arrangement with one or the other of the companies in the city for an interchange of business, will ask for a franchise to construct a line into the city and establish an exchange here.

LAWTON, OKLA.—The Washita Valley Electric Railway Company, which has material on the ground for constructing its line into Chickasha, has applied to the City Council of that place for a franchise granting it the right to construct, maintain and operate an electric light plant.

SEASIDE, ORE.—Rhodes & Welch have secured a franchise for an electric light plant.

PORTLAND, ORE.—The Portland General Electric Company will extend its lighting system to the Mount Scott district, embracing the settlements along the Mount Scott Railway, when 125 people sign agreements to take the service.

EUGENE, ORE.—F. L. Chambers, of the Chambers Power Company, of Eugene, writes that it is proposed to add to the present power plant a water-driven electric plant of about 100-hp, with plans for three other units of same size.

PENDLETON, ORE.—The Pendleton Water Board has entered into a ten-year contract with the Northwestern Gas & Electric Company to furnish power for the city water works at the rate of $4000 for the first year and $3,500 for each succeeding year. In return for this amount of money the power company agrees to furnish and install a 75-hp motor and a pump capable of pumping 1,200,000 gallons of water a day into the city reservoir. If before the end of the ten years the Water Commission desires to sell the plant, the contract will be void.

NEW CASTLE, PA.—A trolley line is to be erected to connect New Castle and New Wilmington.

BUTLER, PA.—A trolley line is to be constructed from Keister to Slippery Rock, Butler County.

DUNBAR, PA.—The question of establishing a municipal electric light plant is reported to be under consideration.

WILMERDING, PA.—The United Electric Company of this city has decided to increase its capital from $50,000 to $75,000.

LEWISBURG, PA.—The Lewisburg Light, Heat & Power Company proposes to change power from steam to gas (American Crossley engines) during the spring.

CONSHOHOCKEN, PA.—The Conshohocken Electric Light & Power Company intends to extend its lines to Harmonville and Plymouth. W. M. Bell is manager and superintendent.

PITTSBURG, PA.—The corporation committee of councils has approved the ordinance granting the Pittsburg Railway Company a franchise for a new line to Highland Park.

WILKESBARRE, PA.—The dam in the Susquehanna River at Nanticoke, owned by the Pennsylvania Railroad, has been sold to the Nanticoke Electric Power Company for $30,000.

POTTSTOWN, PA.—From present indications the projected trolley road from this city to Swamp will be built during the coming summer by the Schuylkill Valley Traction Company.

HAZLETON, PA.—The Mayor has signed the ordinance granting the People's Consumer Company a franchise for an electric light plant. Harry Mohr, of Hazleton, is reported interested.

SOMERSET, PA.—The Somerset Electric Light, Heat & Power Company has decided to erect a large central station here, to supply light and power to all nearby towns. J. M. Bricker is manager.

CONESTOGA, PA.—The Conestoga Telephone & Telegraph Company has elected the following officers: Henry Hertzler, president; Jacob Heartz, superintendent and manager; Stephen Mast, treasurer.

EBENSBURG, PA.—The Ebensburg & Blacklick Electric Railway Company will be incorporated to build an electric railway from Ebensburg to Blacklick. Captain Thomas Davis will be president.

CANONSBURG, PA.—The Pittsburg Railways Company, which is about to begin the work of building a line from this city to Castle Shannon, has purchased another tract of land in the Chartiers Valley.

BEDFORD, PA.—Plans have been completed by the Bedford County Telephone Company for constructing a copper wire circuit to Altoona to connect with the United Telephone & Telegraph Company at that point.

WELLSBORO, PA.—The Wellsboro Electric Company is about to move in a new building equipped with an Erie engine belted to a 60-cycle, 150-kw General Electric rotating field alternator. W. S. Culver is superintendent.

SCRANTON, PA.—One of the most important business transactions that has taken place in Wayne County in some months was the purchase of the Hawley Electric Light Company by V. A. Decker, Fred C. White and Lewis P. Cooke.

SCRANTON, PA.—Application for a charter for a new electric railway between West Pittston and Luzerne Borough has been made by a number of Scranton capitalists. Postmaster E. Ripple and Attorney N. C. Reynolds are among the prominent promoters.

SOMERSET, PA.—The Somerset Electric Heat, Light & Power Company, composed of Charles Fisher, A. W. Knepper and Joseph M. Bricker, held a conference with a number of citizens of Listle, preparatory to building a line from the company's plant in this city to Listle.

PHILADELPHIA, PA.—Bids will be received until April 7 by Mordecai T. Endicott, Chief Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing underground electric lighting cables at the Navy Yard, League Island, Pa. Estimated cost, $10,700.

SCRANTON, PA.—A large number of improvements are shortly to be made by the Scranton Railway Company. Among the most important of these will be additions to the power house and car barn, which will double the capacity of each. The equipment will also be increased proportionately.

PITTSBURG, PA.—Application has been renewed at Harrisburg by the Pittsburg Subway Company for a charter to build an underground railroad in the business section of the city. Horace P. Baker, of Pittsburg, is named as president of the subway corporation, which is capitalized at $50,000.

YORK, PA.—The York Haven Water & Power Company is installing five new generators at its big plant at York Haven, which, when completed, will bring the capacity of the plant up to 10,000 hp. The work on the sub-station at Steelton is nearing completion and the company hopes that in a short time the injunctions against extending its lines in that section will be dissolved by the courts, whereupon power will immediately be transmitted into Steelton. Propositions are pending by which the York Haven Company will supply electricity to many of the manufactories at Steelton, as well as to the Pennsylvania Steel Company. At Middletown, where the York Haven people also have a sub-station, all is said to be working smoothly. The car works are being supplied with power from York Haven, and the Raymond Company, the tube works, and other plants will soon be operated with power from the river plant.

SHAMOKIN, PA.—The consolidation of the various companies situated in Tamaqua, Mahanoy City, Mahanoy Plane, Frackville, Shenandoah, Ashland, Girardville, Mt. Carmel and Shamokin is being arranged, it is said. The New York firm, which so successfully consolidated the lighting and street railway companies in St. Louis and other large cities, is planning to capitalize the new company at from $5,000,000 to $7,500,000 and exchange the stock of the new corporation for that of the various companies interested. The companies directly concerned in the deal are the two in Tamaqua, Shenadoah, the two local companies and those in Mahanoy Plane, Frackville, Girardville, Ashland and Mt. Carmel. With these companies will also be made the purchase of the various trolley companies which obtain their power from the electric light plants to be bought in the deal. Following the consolidation of the various companies the stock will either be increased or bonds will be issued and a large plant will be erected in the center of the district covered by the companies. From this plant power will be furnished for lighting the towns in which the companies are located and for running the trolley lines in the entire region.

PROVIDENCE, R. I.—A bill has been introduced in the lower branch of the General Assembly to amend an act to incorporate the New England Shaver Telephone Company, passed July 23, 1891. The proposed act changes the name to the "Home Telephone Company," and allows the capital stock to be increased to $2,500,000 and permits of a bond issue of $1,500,000. This has been referred to the committee on corporations.

CHERAW, S. C.—The Cheraw Electric Light Plant has just finished putting in larger primary lines and a new and larger transformer.

DUE WEST, S. C.—R. S. Galloway is a member of a committee interested in securing an extension of the Anderson-Belton trolley line on to Due West.

CHARLESTON, S. C.—Bids will be received until April 3 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yard, Charleston, a quantity of naval supplies as follows: Arc lamps, lightning arresters; poles, etc. Applications for proposals should refer to Schedule 420. H. T. B. Harris, Paymaster-General, U. S. N.

FRANKLIN, TENN.—The Harpeth Electric Light & Power Company will soon install an engine of about 125 hp. Milton Lillie is electrician.

MEMPHIS, TENN.—Thos. H. Tutwiler, president of the Memphis Street Railway Company, announces that a large power house is to be erected at a cost of $200,000.

ATHENS, TENN.—The Athens Light & Power Company will this summer build a new concrete boiler and engine house and add a Greenwald-Brown engine and new boiler. T. J. Long is president and general manager.

CHATTANOOGA, TENN.—It is understood that negotiations for the consolidation of the Chattanooga Electric Railway and the Rapid Transit Company of Chattanooga will be consummated in a short time. As soon as the transaction is completed steps will be taken to improve the system and $1,000,000 will be expended for that purpose.

MOULTON, TEX.—Frank Koenig is reported to have secured a franchise for an electric light plant here.

BRYAN, TEX.—Messrs. Grupe and Harold, of College, are in the city with a view to establishing an electric light plant in this city.

GORMAN, TEX.—The City Council has granted W. A. Waldrop and F. B. Winters a franchise for water works and an electric light plant.

EL CAMPO, TEX.—The Town Council has granted E. Correll, W. J. Hefner and others a franchise for water works, an electric light plant and ice factory.

DALLAS, TEX.—The Southwestern Telephone & Telegraph Company proposes to build five miles of underground conduit for its wires at an estimated cost of $150,000.

WICHITA FALLS, TEX.—The Wichita Falls Water & Light Company intends to install meter all over town in April and start a day circuit this summer. G. S. Landman is electrician.

MINERAL WELLS, TEX.—The City Council has granted a franchise for a street railway and lighting plant to J. D. Beardsley and associates. Mr. Beardsley's associates are J. L. Bradford, of Shreveport, La., and Frank L. Deal, of Mineral Wells.

AUSTIN, TEX.—The Austin Electric Company has begun taking levels from the Federal Building to a point one mile and a half from the Colorado River bridge straight down South Congress Avenue, preparatory to extending the present straight railway into South Austin.

HOUSTON, TEX.—A newly-incorporated company proposes to build a line from Kansas City to a point at Matagordo Bay on the Gulf of Mexico, and a branch line from the junction near Fort Worth via Waxahachie and Corsicana, and a direct line to this city and Galveston. The capital is $10,000,000.

GREEN RIVER, UTAH.—E. T. Merritt is reported to be interested in the construction of an electric light plant here.

HUNTINGTON, UTAH.—The Electric Light & Milling Company, of which O. J. Harmon is president, is reported to have petitioned for a franchise for a lighting plant.

OGDEN, UTAH.—Bids will be received until March 27 by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for conduit and electric wiring system in the post office and court house at Ogden.

OGDEN, UTAH.—The executive committee of the Ogden Rapid Transit Company has decided to build five miles of extension during the present year, and will, in addition, electrify the line from Five Points to Hot Springs. The extension of the line to Bingham City also has been discussed.

SALT LAKE CITY, UTAH.—Bids will be received until May 2 at the office of the U. S. Reclamation Service, Salt Lake City, Utah, for installing in connection with the Strawberry Valley Reclamation project, a telephone system having four telephone stations and about 35 miles of pole line. Geo. L. Swendsen, Engr., Salt Lake City.

OGDEN, UTAH.—The Ogden Rapid Transit Company has made application to the City Council for a new franchise for a term of 50 years, similar to the one it has now. The present power house owned by the company will be enlarged and more machinery installed. These improvements will mean an expenditure of from $150,000 to $200,000.

AMERICAN FORK, UTAH.—The Utah Light & Power Company has decided upon the construction of two plants instead of the one as originally considered. One, a steam plant of 200 hp, will be located here in the town, and a water power plant located in American Fork Canyon, one and a half miles above the other plant. John H. Wootton is manager.

SALT LAKE CITY, UTAH.—T. S. Manley and L. H. Curtis, of Salt Lake City, have asked for a franchise for 50 years to use the streets and alleys of the city for the purpose of building and maintaining an electric lighting, power and heating system. The company will be known as the Salt Lake Public Service Company, with a capitalization of $100,000. The financing of the project has already been provided for by W. H. Schutt, of Chicago.

SOUTH RYEGATE, VT.—It is reported that an electric light plant will be established here, but none of the details have been given out as yet.

BELLOWS FALLS, VT.—The Fall Mountain Electric Light & Power Company, of which J. B. Crandon, of Bellows Falls, is chief engineer, has purchased a mill site at Gageville, and will probably construct a dam and power station there. Wm. A. Russell, of Boston, is president.

BRADFORD, VT.—The Bradford Electric Lighting Company began to operate its new station and to run the entire 24 hours, February 1. This company lights the villages of Bradford and Newbury. There ought to be a good field for motors to pump water in private houses, there being no water system in the village. B. W. Hutchins is manager.

VIRGINIA BEACH, VA.—The Virginia Beach Development Company, of which A. R. Law is president, is reported to be considering the construction of water works, a sewerage system and electric light plant.

LYNCHBURG, VA.—The Lynchburg Traction & Light Company is installing two new units, an alternator of 300-kw and a direct-current machine of 450-kw at its Roanoke plant, and will install two 500-kw units at Lynchburg. R. D. Apperson is president and manager.

NORFOLK, VA.—The Norfolk Railway & Light Company has just authorized the Southern Contracting Company to put down 180,000 feet of additional conduit, adding a third district to the two on which the company is at work now. The additional conduit makes 600,000 running feet for its extensive underground wire system in Norfolk. The entire installation will cost upwards of $200,000. With the completion of the third district the entire city, between the water front and Queen Street, and between Church and Granby Streets, will be interwoven with a solid network of conduits. The first district comprises the business section west of City Hall avenue. The second district lies between City Hall Avenue and Freemason Street. The third district will extend from Freemason Street to Queen Street. The Norfolk Railway & Light Company will at once remove all of its trolley poles in the fire district and will substitute for them ornamental iron poles, which will carry brackets for arc lights. The new poles will require an outlay of something like $50,000. It was stated several weeks ago that the Norfolk Railway & Light Company contemplated improvements involving an outlay of between $1,000,000 and $1,500,000. The conduit system and improved pole equipment are the first steps in the direction of the proposed improvements, the principal feature of which will be a new power house.

CENTRALIA, WASH.—The Centralia Electric Power Company is reported to have decided to install new dynamos.

EVERETT, WASH.—The Farmers' Mutual Independent Telephone Company will erect a $20,000 brick building.

SEATTLE, WASH.—The Independent Telephone Company will build an exchange building in West Seattle at a cost of $10,000.

PASCO, WASH.—C. A. Cochran, of Kennewick, is reported to have secured a franchise for water works and an electric light plant.

TACOMA, WASH.—We are informed that the Tacoma Gas & Electric Light Company proposes expending $65,000 for general extensions and improvements.

SPOKANE, WASH.—Plans for burying all high-voltage power lines in the city are being made by the Washington Water Power Company. The lines carry a pressure of 60,000 volts.

GOLDENDALE, WASH.—The White Salmon, Trout Lake & Glenwood Telegraph & Telephone Company has applied for a franchise to erect and maintain a telephone system in Klickitat County.

GOLDENDALE, WASH.—The Klickitat Valley Light & Power Company has a transmission line 10 miles long, 6600 volts, stepping down from line transformers to 220/100. H. W. Fellows is owner.

SEATTLE, WASH.—The citizens have voted to issue $600,000 bonds for extending the present municipal electric light plant. As soon as the bonds are sold the work of extending the system will commence.

OLYMPIA, WASH.—Articles of incorporation have been filed for the New World Electric Company, of Seattle. The capital stock is $3,000,000 and the incorporators are: G. L. Tanzer, N. L. Smith and W. R. Williams.

SPOKANE, WASH.—Jay P. Graves is reported to have purchased the franchise and water right held by the Spokane Light & Power Company, and it is stated that an electric light and power plant will soon be constructed.

NEWPORT, WASH.—The plant of the Newport Electric Company, at Bonners Ferry, Idaho, has been in successful operation for several months. It is intended to change from steam to water power in the near future, in which case a 5-mile transmission line will have to be built. J. F. Reynand is superintendent.

KETTLE FALLS, WASH.—Jay P. Graves, of Spokane, of the Inland Empire Electric Railway, is reported to have purchased the falls of Columbia River at Kettle Falls, and will construct an electric generating plant to supply this railway, and also the mines and smelters in the boundary district of British Columbia.

EVERETT, WASH.—The Seattle-Tacoma Power Company has entered upon its three-year contract to light the streets of Everett. The temporary plant in the old nail works building on the water front will furnish the power until such time as the Snoqualmie line is completed to this city, which will be a month or six weeks yet.

GOLDENDALE, WASH.—The parties who recently put in operation the electric light plant on the Klickatat River, seven miles from here, are planning to extend their line to Centerville for the purpose of supplying that town with electricity for lighting and power purposes. The service may also be extended to other towns in that vicinity. J. H. Tilsley, of Spokane; H. W. Fellows, of Goldendale, and Frank Lehr, of Crescent, are interested.

WALLA WALLA, WASH.—Manager J. E. McGilvery, of the Pacific States Telephone Company, who recently came here from Lewiston to take charge, is getting things in readiness for the installation of the new central energy plant. The business here has long since outgrown the present facilities, and in order to take care of the present demand and provide for growth, the new system and a larger switchboard will be installed as soon as the material can be procured. When this is done, the management expects to take on about 500 new subscribers. This will necessitate the construction of about four miles of cable line and three miles of pole line.

CHARLESTON, W. VA.—The Kanawha Valley Telephone Company will petition the council for a franchise to extend its lines on certain streets of the city.

WHEELING, W. VA.—The Wheeling Traction Company has closed two deals for property that gives it a clear right of way from Martins Ferry to Rayland for the new line.

MARTINSBURG, W. VA.—Application has been made by S. W. Walker and J. F. Thompson, representing a syndicate of capitalists, for a franchise for a street railway in this city.

NEW LONDON, WIS.—The New London municipal plant expects to obtain the consent of the City Council this summer to install a 60-kw alternator and high-speed engine.

SHAWANO, WIS.—The City Water & Electric Light Plant expects to change its street lighting system this spring from direct to alternating current. Chas. McCarter is superintendent.

RACINE, WIS.—The Chicago & Milwaukee Electric Railway Company will ask for a franchise into this city. The company's main line runs through the county some distance from Racine.

RACINE, WIS.—The Town Board of Caledonia has granted the application of Manager John I. Beggs, of the Milwaukee Electric Railway & Light Company, for an additional franchise through that township.

VIOLA, WIS.—The Union Telephone Exchange at Viola has been sold to the La Crosse Interurban Telephone Company. The La Crosse Company is to rebuild the exchange and put in a complete new system.

WATERTOWN, WIS.—By a vote of ten to one the special committee of the City Council decided to grant J. I. Beggs, president of the Milwaukee Electric Railway Company, a franchise for a term of fifty years to operate an interurban electric road in and through this city.

MILWAUKEE, WIS.—An underground cable between Milwaukee and Chicago to accommodate all the toll line business between these two points and costing $1,000,000, is one of the projects in the line of improvements contemplated by the Wisconsin Telephone Company for the coming year. Work on the new underground line will be started this summer and it is expected that by January 1 the cable will be ready for use.

MARINETTE, WIS.—The construction of the farmers' telephone line on the Hall Avenue road, according to Manager Bornheimer, will start in the spring as soon as the frost is out of the ground. There is a big demand for the service among the farmers on that road. The line will be extended from the city limits out about four miles, and later will be further extended. A large amount of new cable is to be strung in the city and many of the telephone leads are to be changed to the alleys. Hereafter lines will be put through alleys wherever possible. Thousands of dollars will be spent in the improvement work.

WHEATLAND, WYO.—M. N. Boggs will ask for a franchise to furnish this city with electric lights and pump the city water.

ENDERBY, B. C.—The Hinton Electric Light & Power Company, Victoria, B. C., is negotiating with the town to install an electric light and power plant. Address W. and H. Fraser.

VANCOUVER, B. C.—The British Columbia Electric Railway Company has been solicited by the people of Port Moody and those between that town and the city of New Westminster to build a line between Port Moody and Sapperton.

NEW WESTMINSTER, B. C.—The Canadian Pacific Railway Company has obtained control of the majority of the shares of the Fraser Electric Tramway projected between Chilliwack and New Westminster, and plans to build the line this summer.

ROSTHERN, CAN.—The Town Council is considering rough plans for an electric light and power plant. Address John Hamm.

FARNHAM, P. Q., CAN.—The Farnham Electric Company, during the coming summer, will thoroughly overhaul its plant. W. C. Girard is manager and chief electrician.

CARBERRY, MAN., CAN.—Robert A. Garland, city clerk, writes that the citizens have voted to construct an electric light plant. No engineer has been selected as yet.

PARRY SOUND, ONT., CAN.—The municipal plant is about to install a 425-kw, three-phase, 60-cycle, 2000-volt alternator, an exciter switchboard and a pair of turbines to develop 750 hp under 25-ft. head. G. Croves is electrical superintendent.

BLIND RIVER, ONT., CAN.—The Blind River Light, Heat & Power Company, Ltd., has recently acquired the interest of Lowe & Gray at Blind River, including the electric lighting plant and water works. The former had been built as a competing plant.

OWEN SOUND, CAN.—The Electric Light Department intends to increase the lighting plant from 300 to 800 hp by the addition of a compound condensing Corliss engine, direct-connected to a revolving field generator. J. McLinden is superintendent and chief engineer.

REGINA, SASK., CAN.—The Municipal Electric Lighting Plant has been in operation a year. Its equipment consists of a 300-kw Westinghouse three-phase, 60-cycle machine generating set, 2200 volts, direct connected to an Inglis-Corliss engine running at 150 r.p.m. E. W. Bull is manager.

WINNIPEG, MAN.—The shareholders of the Winnipeg, Selkirk & Lake Winnipeg Railway have transferred the road to the Winnipeg Street Railway Company. A new board of directors was elected, which were virtually those in control of the Winnipeg Street Railway Company.

KENTVILLE, N. S.—The Kentville Light & Power Company, Ltd., expects to change from alternating to direct-current soon. C. L. Baird is superintendent.

FORT WILLIAM, ONT.—The rate payers have passed a by-law to provide $12,000 for improvements to the municipal telephone system. Address Mayor Whalen.

GODERICH, ONT.—J. L. Goldthorpe, of the Maitland River Power Company, writes that bids will be received about June 1 for the construction of a power plant on Maitland River, to cost about $250,000.

BRANTWOOD, ONT.—At the meeting of the fire and light committee it was decided to recommend to the Council that the request of the A. X. Lyons Company for a franchise to supply electric lighting in the mercantile portions of the city should be granted.

TORONTO, ONT.—D. O. Cameron, solicitor of Toronto, is making application to the Ontario Legislature for an act to incorporate the company with power to construct, maintain and operate an electric railway from some point in or near the village of East Toronto, in the county of York, to Yonge Street, Toronto, a distance of 40 miles.

TORONTO, ONT.—W. C. Chilsholm, city solicitor of Toronto, is making application to the Ontario Legislature for an act to enable the city to construct electric railway lines upon independent routes within the limits of the city for the use of the Radial Electric Railways, and to empower the city to make agreements with any electric railway company for the use of the said lines.

HAMILTON, ONT.—The Toronto & Hamilton Railway has given notice that application will be made to Parliament for an act changing the name of the company to the Toronto, Niagara & Western Railway Company, authorizing the company to extend its line from some point on the main line to the International boundary at or near the City of Windsor, increasing the capital stock of the company and authorizing it to enter into arrangements with power companies for the transmission of electric power over its right of way for the purpose of electrifying the road.

TORONTO, ONT.—Controller S. Alfred Jones offered a resolution at the civic reception and legislation committee, calling upon the Ontario Government to establish a power development plant at Niagara Falls in competition with the existing companies. The resolution urged the necessity of the Government themselves at once proceeding to establish a plant at Niagara Falls for the purpose of development of electric power for distribution to Ontario municipalities, and further, that the co-operation of other Ontario municipalities in the matter be requested. The committee voted unanimously to send the resolution on to council.

KINGSTON, ONT.—Sixty thousand dollars will be expended between now and the first of June by the Central New York Telephone & Telegraph Company in extending the scope and increasing the efficiency of its service in the Thousand Island territory and between St. Lawrence River points in general. One of the new cables will connect Cape Vincent with Kingston, via Wolfe Island, and the other will extend from Massena Point to Cornwall on the Canadian shore. The short cable service between Thousand Island Park, Frontenac and the adjacent shore points of Clayton and Alexandria Bay will be made more efficient.

MONTREAL, QUE.—Senator Domville, of St. John, N. B., is said to have secured the aid of a powerful English syndicate for the construction of an electric railway from Montreal to Ottawa and the Great Lakes.

Company Elections.

COLUMBUS, IND.—The Columbus & Seymour Traction Company has elected the following officers: Frank P. Smith, president; Robert O. Beyer, vice-president; Ira E. Gutherie, secretary; H. P. Hughes, treasurer. The company is building a line from Columbus to Seymour to be taken over by the Indianapolis, Columbus & Southern as soon as completed.

DANVERS, MASS.—The Boston Incandescent Lamp Company, of Danvers, at its annual meeting elected the following officers: C. E. Pierce, president; M. M. Merritt, secretary and treasurer, and these with O. E. Jackson are directors.

WARE, MASS.—The Ware Electric Light Company, at its annual meeting, re-elected the directors as follows: Andrew Bryson, Charles C. Hitchcock, Henry K. Hyde, Edward H. Gilbert and Frank M. Sibley. Dr. G. M. C. Barnard was again chosen as clerk and treasurer and William C. Eaton as auditor. F. M. Sibley has been chosen president, and Andrew Bryson and Frank K. Southworth as vice-presidents.

SOUTH HAVEN, MICH.—The Kibbie Telephone Company held its annual meeting in this city and the following named officers were elected: President, S. M. Trowbridge; vice-president, Robert Adkin; secretary-treasurer and general manager, John H. Tripp; assistant general manager, Mrs. J. H. Tripp.

SAGINAW, MICH.—The Bartlett Illuminating Company and the Saginaw Valley Traction Company held their annual meetings in this city, but no change of importance in either directors or officers were made with the exception of Edwin S. Wolff, director and vice-president, succeeding B. C. Cobb. The Bartlett Illuminating Company directors were chosen as follows: George B. Morley, H. T. Wickes, Otto Schupp, H. D. Walbridge, S. E. Wolff. Officers: President, H. D. Walbridge, New York; vice-president, S. Edwin Wolff; secretary-treasurer, Chas. E. Mershon; assistant secretary-treasurer, George E. Hardy, New York. The directorate of the Traction Company includes the following: George B. Borley, Thomas A. Harvey, G. M. Stark, W. T. Wickes; C. M. Clark, of Philadelphia; H. D. Walbridge, of New York; S. E. Wolff. Officers: President, H. D. Walbridge; vice-president, S. E. Wolff; secretary-treasurer, Charles E. Mershon; assistant secretary-treasurer, George E. Hardy.

HUMBOLDT, NEB.—The Speiser Rural Telephone Company has elected the following board of directors and officers: C. Lionberger, president; R. F. Conrad, secretary; Simon Huffman, J. C. Luiginbill, Ed Uhri, Arnold Shuetz, John R. Hunzeker.

HOLDREDGE, NEB.—The Scandinavian Telephone Company has elected the following officers: Ben McArthur, president; Owen B. Wingerd, vice-president; L. P. Christenson, secretary; Walter O. Hopkins, treasurer; Hess, McArthur, Wm. Christenson, trustees.

CLINTON, N. Y.—The board of directors of the Clinton Home Telephone Company have elected the following officers: President, G. J. Caldwell, Clinton; vice-president, George R. Fuller, Rochester; treasurer, Charles H. Poole, Utica; secretary, G. A. Jackson, Utica; engineer, D. A. Cline, Utica.

TOLEDO, OHIO.—At the annual meeting of the Toledo Home Telephone Company the present officers were re-elected as follows: James S. Brailey, Jr., president; R. E. Hamblin, vice-president and secretary; Thomas H. Walbridge, treasurer. The annual report of President Brailey showed that 2,000 telephones were installed the past year.

NEWTOWN, PA.—The Newtown Electric Light Company held its annual meeting and elected the following directors: A. W. Watson, George C. Worstall, T. S. Kenderdine, William M. Watson, George C. Blackfan, Robert Kenderdine, Edward H. Cuckman. The following officers to serve the ensuing year are: A. W. Watson, president; T. S. Kenderdine, vice-president; William M. Watson, secretary; Robert Kenderdine, treasurer.

WESTERLY, R. I.—The following officers were elected at Westerly at the adjourned annual meeting of the Westerly Railway & Lighting Company: President, F. P. Sheldon; first vice-president, G. W. Mansfield; second vice-president, James O. Sweet; secretary, N. B. Lewis; treasurer, Harry B. Ivers; counsellor, Judge N. B. Lewis.

OAKFIELD, WIS.—The Oakfield Telephone Company has elected the following officers: President, A. J. Zielke; vice-president, George Day; secretary, W. E. Bristol; treasurer, C. H. Moore; superintendent, T. E. Worthing.

MILWAUKEE, WIS.—Three new directors were elected at the annual meeting of the Wisconsin Telephone Company. They are: Edward A. Uhrig, president of the Milwaukee-Western Field Company; Julius O. Frank, of the Goll & Frank Company, and Oliver C. Fuller, president of the Wisconsin Trust Company. The other members are Alonzo Burt, Ira B. Smith and Henry F. Whitcomb of Milwaukee; John Balch, Philip Dexter, Frederick P. Fish, Winfield S. Hutchinson and Thomas Sherwin of Boston. The list of officers elected at a subsequent meeting follows: President, Alonzo Burt; vice-president, John D. McLeod; treasurer, C. J. Lins; secretary, Charles A. Grant; general manager, E. B. Cottroll; auditor, O. B. Koepke; engineer, C. W. Burkette.

New Industrial Companies.

THE ELECTRIC SUPPLY COMPANY, of Charleston, S. C., has been incorporated with a capital of $10,000.

THE EVANS PHONOGRAPH RECORD COMPANY, of Jersey City, N. J., has been incorporated by James M. Evans, Jarvis C. Buxton and Charles A. Rainers.

THE ELECTRIC NOVELTY COMPANY, of Memphis, Tenn., capitalized at $10,000, has been chartered by C. T. Kelley, J. J. Peters, G. Benham, F. E. Beardman and S. Mosby.

THE ELECTRO METAL RECOVERY COMPANY, of Jersey City, N. J., has filed articles of incorporation, showing a capital stock of $100,000. The incorporators are John L. De Saulles, George F. Norton and George M. Clarke.

COLUMBIA ELECTRIC METER COMPANY, of Chicago, Ill., has been incorporated, with a capital of $50,000. The incorporators are L. W. Noveander, John Stahr and George F. Higham. The company will manufacture electrical supplies.

H. AND M. AUTOMATIC REGULATOR COMPANY, of Rochester, N. Y., has filed articles of incorporation, having a capital stock of $50,000. The directors are Willard Wadsworth, of New York, and J. M. Taylor and G. E. Taylor, of Rochester.

RECTOR LIGHT SUPPLY COMPANY, of Jersey City, N. J., has filed articles of incorporation. The company is capitalized at $25,000 and will manufacture gas and electric lamps. C. H. Opdyke, L. A. Opdyke and D. M. Collins are the incorporators.

THE U. S. ELECTRIC PORCELAIN COMPANY, of Findlay, Ohio, has been incorporated with $25,000 capital stock. The incorporators are J. S. Milligan, C. E. Wilhar, J. K. Henry, R. H. Sharp and C. E. Myers. The company will manufacture porcelain insulators and electrical specialties.

ASSOCIATED GAS & ELECTRIC COMPANY, of Penn Yan, N. Y., has been incorporated and will engage in the manufacture of engines, boilers and dynamos. The company has a capital of $1,500,000, and E. M. Treman, T. W. Summers and D. D. Norton are named as directors.

THE OVINGTON MANUFACTURING COMPANY has been organized in Portland, Me., for the purpose of manufacturing and dealing in electrical therapeutic apparatus, motors, dynamos, etc. The company's capital stock is placed at $250,000, and the officers are: Millard W. Baldwin, president; Clarence E. Eaton, treasurer, both of Portland.

THE DE FORD AUTOMATIC SWITCH COMPANY, of Logansport, Ind., has filed articles for incorporation with the Secretary of State. The company proposes to establish a plant to manufacture automatic switches and devices for steam and electric railroads. The incorporators are Joseph H. De Ford, Joseph C. Heyworth, William H. Porter and W. D. Pittman.

New Incorporations.

LOS ANGELES, CAL.—Articles of incorporation of the Los Angeles & San Diego Beach Electric Railway Company have been filed with the County Clerk. The company is capitalized at $6,000,000 and the following directors have been elected for the ensuing year: E. S. Babcock, A. E. Babcock, R. B. Talbot, A. E. Lillicrap and James Strout.

RINARD, ILL.—The People's Telephone Company of Southern Illinois has been incorporated, with a capital of $10,000.

FLORA, ILL.—The Flora Telephone Company has been incorporated with a capital stock of $20,000. The incorporators are: E. G. Myers, J. B. McFarland and W. A. Karr.

ELGIN, ILL.—Incorporation papers for the Elgin & Du Page Electric Railroad Company, which will spend $700,000 in building a line from River Forest to this city, have been filed with the Secretary of State.

ROCK GROVE, ILL.—The Rock Grove Farmers Mutual Telephone Company was incorporated recently with a capital stock of $6,000. The incorporators are: Lewis E. Rote, William Fisher and Martin Brobst.

CENTRALIA, ILL.—The Secretary of State has issued a license to incorporate the Ohio & Mississippi Electric Railway Company, with a capital stock of $5000, the incorporators being C. D. Tutts, F. P. Pullen and John J. Bundy.

LOCKMAN, IND.—The South Side Telephone Company, with a capital stock of $2000, has been incorporated by James C. McKinney, Charles W. Spurgeon and others.

BROOK, IND.—The Newton-Jasper County Telephone Company has been incorporated with a capital stock of $7,500. John A. Sell, T. L. Davis and J. W. Saye are the directors.

FORMOSA, KAN.—The Formosa Mutual Telephone Company has been incorporated with a capital stock of $7500.

STANFORD, KY.—The Interstate Traction Company has been organized with W. G. Schanberger president. The company has a capital of $130,000.

ADAIRVILLE, KY.—A new corporation to be known as the Red River Telephone Company has been organized by T. H. Baird and others, and proposes to operate under the franchise recently sold to W. K. Smith.

LOUISVILLE, KY.—The General Telephone Company has been organized to take over the Independent Long Distance and all smaller companies in Owensboro, Lexington, Maysville, Paris, Eminence and other points.

PEMBROKE, ME.—The Pembroke Power Company has been organized for the purpose of generating gas and electricity for heating, lighting and power purposes in the towns of Pembroke and Perry in Washington County, with $50,000 capital stock, of which $300 is paid in. Officers: President, H. L. Cram, of Portland; treasurer, A. F. Pine, of Portland.

UNADILLA, NEB.—The Unadilla Telephone Company, an independent company organized at Unadilla, Otoe County, has filed articles of incorporation with the Secretary of State. The company has a capital stock of $30,000. The incorporators include many of the farmers residing in the vicinity of Unadilla.

ATLANTIC CITY, N. J.—The Atlantic City Light & Equipment Company has been incorporated, with a capital stock of $50,000, by James J. Farmer, Harry R. Harris and G. B. Clemmer.

JERSEY CITY, N. J.—The American Wave Power Company has filed articles of incorporation and is capitalized at $100,000. Greenville Stevens, Timothy Walsh and A. A. Kelley are the incorporators. The company will utilize the power of water waves in the generation of electricity.

JERSEY CITY, N. J.—The Guatemala Tramway, Light & Power Company has been incorporated at Jersey City for the purpose of establishing plants, etc., in Guatemala. The capital is $4,000,000, and the incorporators R. D. Chipp, K. K. McLaren, H. S. Gould, Jersey City.

TAOS, N. M.—The Taos Valley Telephone Company, with headquarters at Taos, has been incorporated with a capital stock of $5,000. The incorporated by S. M. Stevens and others of Tedrow.
Dorney, Juan A. Vigil and others.

STERLING STATION, N. Y.—Red Creek & Fair Haven Telephone Company has been incorporated, with a capital of $930, by W. Bailey, N. Cuyler and V. Hersey.

HUNTS CORNERS, N. Y.—The Lapeer Telephone Company has been organized with the following officers: President, Lester Parker; vice-president, Wallace B. Lusk; secretary, E. E. Hults; treasurer, W. R. Pease.

NORWAY, N. Y.—The Crockett Ridge and Millettville Telephone Company has been incorporated with a capital stock of $5,000. President, E. B. Tubbs; treasurer, H. G. Dinsmore; clerk, A. T. Crooker, all of Norway.

EAST SPRINGFIELD, N. Y.—The East Springfield Telephone Company has been incorporated by Henry Rathbun, of Cooperstown; S. A. Young, H. W. Young and O. R. Young, of East Springfield. The company has a capital stock of $10,000.

EVANS MILLS, N. Y.—The North County Telephone & Telegraph Company has been incorporated with a capital stock of $15,000. The directors are: F. E. Rosbrook, M. J. Matty, C. E. Pail, Stephen Gould, F. G. Rosbrook and E. E. Ward, of Evans Mills, and A. I. Rosbrook, of Carthage.

PINGREE, N. D.—The Pingree Telephone Company, having a capital of $50,000, has been incorporated by James Price, Thomas Price, Oscar Boyd, O. H. Dahl, H. M. Dahl, of Pingree.

TEDROW, OHIO.—The Tedrow Telephone Company has been incorporated by S. M. Stevens and others of Tedrow.

CANON CITY, OHIO.—Organization of the Canon City, Florence & Royal Gorge Interurban Railroad Company has been effected here with a capital of $1,500,000.

CLEVELAND, OHIO.—The Lake Erie Terminal Southern Railway Company has been incorporated with $125,000 capital stock, by H. B. Camp, of Akron; R. J. Wood, Fred W. Green, J. R. Zunt and H. McIntyre, of Cleveland. The company proposes to build a line of railway from Cleveland to Akron and Massillon down the Cuyahoga River.

NEW LEXINGTON, OHIO.—The Citizens' Independent Telephone Company was recently incorporated with a capital stock of $50,000. The following are the officers: W. L. Cary, Jr., president; S. M. Granger, vice-president; T. J. Smith, secretary and general manager; J. B. Rhodes, treasurer. Arrangements are to be made immediately for establishing at New Lexington a modern telephone exchange which will be capable of serving the whole of Perry County. The many towns and rural districts will be connected with the New Lexington exchange.

CINCINNATI, OHIO.—The Cincinnati Light, Heat & Power Company has been incorporated with $100,000 capital stock by Guy Mallon, H. J. Bechtel, E. R. Stearns, C. W. Cole, of Cincinnati, and Cyrus E. Meade, of Dayton. The company proposes to apply for a franchise for supplying electricity for commercial purposes in Cincinnati. According to a statement made by Mr. Mallon, the capital stipulated is merely nominal and it will be increased from $6,000,000 to $8,000,000, when a franchise is secured. The company will offer to supply current for light and power purposes at a maximum rate of 8 cents per kw-hour. It will offer to pay the city 1 per cent. of the gross receipts. Another feature of the proposed franchise will be a clause agreeing to turn the plant over to the city at the expiration of the 25 years at its value as a physical property. The company is willing to place a large proportion of its mains underground.

HITCHCOCK, S. D.—The Pioneer Telephone Company has been incorporated with $5,000 capital. Chas. McFarland, secretary.

HOT SPRINGS, S. D.—The Sheep Canyon Telephone Company has been incorporated with $5,000 capital to build a line to Oelrichs. C. E. McClelland, secretary.

COLUMBIA, S. C.—The North Columbia Land Company has been organized here, its charter rights including the installation of electric light and sewerage systems.

LADONIA, TEX.—The Ladonia Light & Water Company has been incorporated with a capital of $30,000.

GALVESTON, TEX.—The Galveston Electric Park & Amusement Company has been chartered here with a capital stock of $15,000. The incorporators are Dave A. Weis, Elias Makeowitz and Lewis Fisher, all of Galveston.

GEORGETOWN, TEX.—The Georgetown Water, Light & Power Company has been incorporated with a capital of $100,000, by W. N. Coler, Jr., of Newark, N. J.; C. S. Hole, of Georgetown; Benj. B. Cain, of Tyler, Tex., and others.

OLYMPIA, WASH.—The Olympia Light & Power Company has announced to its patrons that all electricity furnished by it will be placed on a meter basis from May 20. Flat rate service will be discontinued.

PORT TOWNSEND, WASH. Articles of incorporation have been filed by John Siebenbaum and others looking to the consummation of the plans of the organization for the establishment in the city of an up-to-date electric plant. The name of the corporation is the Citizens' Electric Company, capital $30,000.

Legal.

WATER POWER RIGHTS.—Judge J. W. Hughes has handed down a decision in favor of the State against the Sacramento Electric, Gas & Railway Company, in which he holds that the State has the right to all the water at the first fall in the canal at Folsom Prison, and that the company has no right to place a shutter on the gate at the head of the canal to conserve the water at the dam for its own use. The decision is an important one, and is the outcome of years of litigation.

BOILER LITIGATION.—We are informed by the Babcock & Wilcox Company that a decree has been entered in the case of the Babcock & Wilcox Company against the Aultman & Taylor Machinery Company for infringement of trade-mark, in the United States Circuit Court for the Eastern Division of the Northern District of Ohio, in which the trademark of The Babcock & Wilcox Company is sustained as good and valid. It consists of the word "Steam," accompanied by a representation of the type of engine known as the "Aeolipile of Hero," which consists in part of a sphere.

WESTINGHOUSE LEGAL DECISIONS.—We are advised by the Westinghouse Electric & Manufacturing Company that several legal decisions have recently been recorded in its favor. In the United States Circuit Court of Appeals for the Third Judicial Circuit in Philadelphia a decision has been handed down in an appeal from the Circuit Court for the Eastern District of Pennsylvania in the case of the Westinghouse Electric & Manufacturing Company against the Cutter Manufacturing Company. This suit involves the Wright and Aalberg patent on automatic circuit breakers of the edgewise shunt carbon type, in which the shunt carbons are at the top of the device and the movable contacts are carried by a long swinging arm equipped with toggle mechanism for giving it a wide throw in opening the circuit. The Court in its decision enjoined the Cutter Company from the manufacture of circuit breakers which come within the claims of the Wright and Aalberg patent. In the United States Circuit Court for the Southern District of Ohio, sitting at Cincinnati, the case of the General Electric Company against the Bullock Electric Manufacturing Company was decided in favor of the former. This suit involved the Reist patent on armatures for dynamo-electric machines ventilated by having certain forms of space-blocks inserted between the different groups of laminæ forming the core or magnetic circuit of said armatures. Judge Thompson held that two forms of ventilators being involved in this suit were infringements. In the case of the Westinghouse Electric & Manufacturing Company against the Diamond Meter Company, of Chicago, an interlocutory decree has been filed by Judge Humphrey in the United States Circuit Court for the Southern District of Illinois, sitting at Peoria. In this decree the Diamond Meter Company is permanently enjoined from manufacturing, using or selling induction wattmeters under the Tesla patents Nos. 511559 and 511560.

Obituary.

MR. JAMES PARTRIDGE.—Announcement is made of the death of Mr. James Partridge, manager of the Sandusky, Ohio, plant of the National Carbon Company. Mr. Partridge was born in Birmingham, England, in 1854. With Mr. John Spear he organized and conducted the Partridge Carbon Company in Sandusky, which concern was purchased by the National Carbon Company in 1899. He was retained by the National Carbon Company as manager of the Sandusky works. Deceased is survived by his wife and two sisters. He was well and widely known in the electric lighting field.

Educational.

OKLAHOMA COLLEGE.—Morrill Hall, Oklahoma Agricultural & Mechanical College, Stillwater, Oklahoma, is to be equipped throughout with a fan blower system, utilizing the fans, motor, heater and tempering coil built by the B. F. Sturtevant Co., of Boston, Mass. The blacksmith shop of the same college is also to be fitted with a complete equipment of forges from the same source.

Personal.

MR. C. H. JUDSON has recently taken charge of the engineering work of the Seattle (Wash.) Independent Telephone Company as chief engineer.

MR. RALPH D. MERSHON, consulting electrical engineer, has removed his New York offices to 60 Wall Street. His Montreal office is in the Street Railway Chambers.

MR. LOUIS J. MAGEE, resident director in this country for the Allgemeine Elektricitaets Gesellschaft, of Germany, has just returned home to New York from a trip of several weeks to Europe.

MR. HAMILTON BALUSS, general manager of the Marquette City & Presque Isle Railway Company, Marquette, Mich., has resigned his position with that company to accept a similar one with the Susquehanna Traction Company, of Lock Haven, Pa.

MR. C. A. COFFIN, president of the General Electric Company, who has been touring in the Mediterranean and in Egypt since the beginning of the year, has just returned home in excellent health, by the "Celtic," having greatly enjoyed the rest and the trip.

MR. CHARLES H. COAR has resigned his position with the Northwestern Telephone Company to accept a position with the Twin City Telephone Company in its engineering department. Mr. Coar was recently appointed a member of the Minnesota State Board of Electrical Examiners by Governor Johnson.

MR. MAX LOEWENTHAL, who for some years has given special attention to electric heating problems, and has developed the heating departments of central station companies, has established himself at 150 Nassau Street, New York City, as a consulting engineer in that new and progressive field. His unique and extensive experience render his services of great value to any client.

MR. YOSHIO KINOSHITA, delegate of the Imperial Japanese Government to the International Railway Congress held at Washington last May, has since that time been investigating railroad conditions in this country, with special reference to the finances and economics of the electrification of steam systems. He proceeds this week by "Celtic" to England, where he will pursue his studies of the subject for some months.

MR. F. B. HUNTINGTON, vice-president and secretary of the Fond du Lac Street Railway & Light Company, Fond du Lac & Oshkosh Street Railway Company and the Eastern Wisconsin Street Railway & Light Company, has resigned and has gone to Chicago where he has accepted a position as comptroller of the Chicago Terminal & Transfer Company. Mr. Huntington went to Fond du Lac June 1, 1903, accepting a position with the Fond du Lac Street Railway company as secretary. He was there but a short time when he was elected secretary of the Eastern Wisconsin Street Railway & Light Company and soon after he was elected secretary of the Fond du Lac & Oshkosh Railway Company. Upon the death of F. B. Hoskins recently Mr. Huntington was elected secretary and vice-president of all three companies.

MR. F. A. STRATTON, president of the Westchester Lighting Company since its formation, tendered his resignation at the annual meeting of the company held on Tuesday, March 13. At the request of the directors and owners of the property, Mr. Stratton will remain as a director and will probably become chairman of the board of directors, a position heretofore held by H. E. Gawtry, formerly president of the Consolidated Gas Company of New York City. It is not known as yet who will succeed Mr. Stratton, but it is understood that it will be a Westchester County man. The new directors of the company are W. R. Addicks, J. C. Brady, H. E. Gawtry, T. E. Murray, J. W. Sterling, F. A. Stratton, W. W. Scrugham, H. Brown, R. A. Carter, W. F. Hall and I. L. Benedict, and the choice will likely fall on one of them. Mr. Stratton has worked incessantly for nearly seven years in developing the Westchester Lighting Company and its territory, and it is said that his object in declining to accept re-election was to relieve himself of the detail work which has grown to a large extent. As chairman of the board of directors, it is understood that he will have an active part in outlining the policy of the company, which has been of a highly progressive nature. The change will not affect Mr. Stratton's interests in the Northern Westchester Lighting Company of which he is president.

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Trade Publications.

CEILING FANS.—The Century Electric Company, 404 North Fourth Street, St. Louis, Mo., has issued an illustrated booklet describing "Pillsbury" alternating-current ceiling fans, and incidentally calling attention to "Century" self-starting single-phase motors.

FAN MOTORS FOR DIRECT CURRENT.—In a welll prepared bulletin, designated as No. 20, the Peerless Electric Company, Warren, Ohio, deals with direct-current fan motors and with oscillating fans, desk fans, ceiling and column fans driven by these machines.

DIRECT-CURRENT FANS. Catalogue No. 18, of the Fidelity Electric Company, Lancaster, Pa., gives an interesting discussion on the constructional features of electric fan motors for direct-current circuits. The company has also issued a folder devoted to "Eclipse" sockets fans for both alternating and direct current.

ALTERNATING-CURRENT FANS.—Catalogue No. 4200, of the Emerson Electric Manufacturing Company, St. Louis, Mo., is a neat publication describing in detail fans for alternating current. Much valuable information is given concerning the construction and operation of desk fans, ceiling fans, column fans and exhaust ventilating fans.

DESK FANS.—Bulletin No. 10 of the Colonial Fan and Motor Company, Warren, Ohio, is devoted to direct-current desk and ceiling fan motors. Views are given of swivel desk fans, plain and ornamental ceiling fans, and oscillating fans. The oscillating fan is provided with a shifting vane which causes the body of the fan to rotate on ball bearings.

BATTERY FANS. The Edison Manufacturing Company, Orange, N. J., is distributing a neat booklet devoted to battery fan motor outfits. These outfits have been designed for service where electric current cannot be obtained directly from a supply system. Thus they can be used in summer homes, yachts, private cars, etc.

FAN MOTORS.—The Western Electric Company, Chicago, Ill., has issued an elaborate publication dealing with desk, bracket and ceiling fans, and a recently developed universal fan which can be changed from the desk to the bracket model without the necessity for a separate part. The motors are built for either direct or alternating current circuits.

VENTILATING APPARATUS.—Bulletin No. 24 of the Jandus Electric Company, Cleveland, Ohio, describes combination desk and bracket fans for alternating and direct current, and gives much information concerning ceiling and column "Groofans" which are claimed to be the best and handsomest of all breeze makers.

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News of the Trade.

THE COAL AND IRON NATIONAL BANK, of the City of New York, has been designated a depository of the United States, as well as of the city of New York and State of New York.

THE GARFORD COMPANY, of Cleveland, Ohio, manufacturer of automobile parts, has decided to consolidate its plants at Elyria, Ohio, and will spend $300,000 in improvements. A power plant will be erected and all the machinery will be driven in groups by motors.

THE SYRACUSE SUPPLY CO., Syracuse, N. Y., which is a large dealer in steam fittings, material, supplies, etc., has opened an electrical department and is carrying a full stock of electrical supplies. The department has been placed in charge of Mr. F. S. Baldwin, late of the R. M. Cornwell Company. It is in the market for electrical supplies of all kinds.

THE BENJAMIN ELECTRIC COMPANY, Chicago, started in the basement of a flat building in Chicago about four years ago. Not long afterwards large downtown quarters were obtained. The business soon outgrew these and another change was made to the present quarters at the corner of Jackson Boulevard and Canal Street, Chicago, in the heart of the manufacturing district of that city. At the present time the factory occupies 9,600 square feet of floor space, but by May 1 additional space will be acquired which will give a total of 16,900 square feet.

FOSDICK LATHE. The Cincinnati Lathe & Tool Company, 2730 Spring Grove Avenue, Cincinnati, has purchased the lathe business of the Fosdick Machine Tool Company, the latter concern making a 16-inch lathe with the T. T. Emmes patent feed device. The plant is situated at the heart of the machine tool district, and will be in running order by April 1. The company is now receiving orders for future delivery. Mr. W. C. Heindel, long in the milling machine trade, is president of the company, and Mr. A. B. Sowden, who has been building lathes for twenty years, is the superintendent, and who proposes to maintain the high reputation already gained.

STEAM TRAPS.—The improved Sturtevant steam traps, although especially designed to use with Sturtevant heaters, is said to be equally well fitted for operation with steam heaters or radiators of any construction. The body of the trap contains a pot, which floats and closes the connection between the interior and exterior, until sufficient water accumulates in this space to overflow into the pot and sink it. Free passage for the water is thus afforded from the pot up to the outer air, which continues until the levity of the pot becomes sufficient to cause it to rise and close the outlet. The periodic delivery continues as long as there is water to discharge or sufficient steam pressure to cause the trap to act.

THE CHICAGO PNEUMATIC TOOL COMPANY has closed its Norfolk, Va., office, and will, in the near future, open an office in Richmond, Va. The office at 602 Empire Building, Pittsburg, Pa., will be closed April 1, and moved to 10 and 12 Wood Street, at which point a store building has been secured for the purpose of making a general display of air compressors, tools, etc., a large stock of which will be carried as soon as the factories are in position to furnish same. An up-to-date repair department will also be maintained at that point for the benefit of the large number of customers in the Pittsburg district. The office has been closed at Seattle, Wash., and a new office opened at No. 64 Sixth Street North, Portland, Oregon. The Company reports business entirely satisfactory both at home and abroad and all factories working double time.

LARGE FAN PROPULSION.—With the advent of electricity as a motive power the adaptability of the electric motor for fan driving led the B. F. Sturtevant Company, of Boston, Mass., to design a special line of motors adapted for direct connection to fans. In the smaller sizes of the cast-iron fans, the substantial side plate furnished a suitable base to which the motor could be attached. But in fans of larger capacity, operating at low rotative speed, motors were designed to be attached to the steel plate and angle construction as to form a most subsantial and easily portable electric fans. The latter type of motor readily adapted itself to use as a generator, to be driven by a direct-connected Sturtevant engine, and the Sturtevant generating set soon became an established feature of the business.

WAGNER ELECTRIC AGENCY CHANGES.—The Wagner Electric Manufacturing Company, St. Louis, Mo., desires to announce that it has recently completed arrangements by which sales of its apparatus in Texas, Indian Territory and Oklahoma will be taken care of by the Woods Electric Company of Houston, Tex., successor to D. F. Woods & Company. The sales department will be under the immediate supervision and management of Mr. William F. Sullivan, who for a number of years has been intimately connected with the Crocker Wheeler Company, and for the last two years in its St. Louis office. The Wagner Company also announces that its Atlanta territory, which was formerly handled by Mr. G. C. Henry, who has been devoting only a part of his time to Wagner interests, will now be handled exclusively by him.

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Co-operative Publicity.

The scope and plan of the Co-operative Electrical Development Association should receive the serious attention of our readers, as its underlying aim or motive is the greatest good of the greatest number in the electrical field. Mr. J. Robert Crouse, Jr., who has fostered and fomented this idea, is entitled to the utmost credit for the manner in which he has stuck to his campaign, and brought it from the nebulosity of a visionary scheme up to the basis of practical action. He has indeed proved himself a vitalizing force in giving novelty and attractiveness to that which was otherwise somewhat shopworn. There is after all nothing new in the idea of electrical publicity. So far as this journal is concerned, it might be said to have stood for nothing else during the past 30 or 40 years, and it is natural therefore that it should welcome the endorsement which thus comes for all that it has preached and practiced during so long a period. In the past two years, moreover, it has laid particular and special emphasis on the necessity of developing the commercial side of the central station industry, and here again the work of the new Association does but corroborate all that it has been trying to preach. When all is said and done, the central station manager is the objective point of this campaign, and the message to him is that he should reduce the price of his current and wake up to the great opportunities that exist for him to do business. It is possible that his rejoinder might be that his current is already at as low a price as he can afford and that the manufacturers themselves might play an important part by reducing the price of their apparatus. The doctrine that Mr. Crouse preaches, however, and that is embodied in the new Association, is that of co-operation; and it is only by getting together in this way that the best means of promoting electrical welfare will be found. At the present minute there is no fear of publicity in the central station field being overdone, and the new Association has therefore our heartiest good wishes. It can do little harm and may do infinite good.

The Bell Telephone Report.

Elsewhere in this issue is presented an abstract of the remarkable annual report just issued by President Fish of the American Telephone & Telegraph Company for the year 1905. This document is in many respects the most important of its kind that has been issued by a Bell president in many years. It is an extraordinary exhibit of vitality, growth and prosperity, the more remarkable when it is considered that this growth has been made in spite of the persistent and even astounding development of the "Independent" telephone field. Incidentally, there are signs that in spite of centrifugal tendencies, the two systems are drawing together, for while in 1904 the number of independent stations connected into the Bell organization were 167,213, the number reported for last year was no less than 246,337. This is 10 per cent of the total Bell system, but it is not quite certain how large a percentage it is of the independent system. In 1902 the independents reported 998,119 stations, but the last three years has, of course, seen a very rapid growth over that number.

The business done by the Bell system is remarkably large, so that whereas three years ago, in 1902, the number of conversations was slightly over three thousand millions, last year it was nearly four thousand, five hundred millions. The amount expended during the year for new construction and real estate was over $50,000,000, and the total income of the business was slightly over $100,000,000. In our first issue of the year the total income of the local telephone companies of the country was estimated at $140,000,000. This figure was thought to be large by some persons, but it will be seen that according to this basis only $40,000,000 was allowed for the entire independent system. There can be no question that the growth of the whole telephone industry continues to be extremely rapid with no perceptible possibility of diminution for many years to come. In fact, the demand for new capital to make the extensions is among the problems of the industry, and one of the notable financial events of last year was the authorization secured by the Bell system to issue convertible bonds in the aggregate amount of $150,000,000, to be applied to construction. That such money is after all well invested would appear from the fact that the securities held by the parent company being the stocks and bonds of its sub-organizations, carried at a value of $177,000,000, have an actual valuation at the present time of over $221,000,000. In fact, the interest receipts of the parent company show a gain in the past six years of 1,044 per cent, due to the large amounts of money loaned to the sub-companies for their development, but the other advances have been equally noteworthy. Dividend receipts in the past six years have shown a gain of 131 per cent, rentals of 60 per cent and long-distance business a gain of 115 per cent. It is to be borne in mind that the increase in income has been achieved in spite of the competition that has been at once wonderfully efficient in many places and in other places has given service far below cost. The Bell system has itself also in the last five or six years reduced its rates steadily, and it is certain that the minimum is not by any means yet in sight, although as the rates go down the business develops again out of all apparent proportion. It is perhaps no exaggeration to say that the telephone field is the most active one to-day within the range of electrical development, and it might indeed be wished that corresponding gains could be exhibited generally within the central station field.

ECONOMY IN SELECTION OF CANDLE-POWER.

The introduction of high candle-power high efficiency lighting units has developed a tendency both on the part of the central station man and of the customer to select larger sizes of these units than will give the best results. For example, both the merchant and the central station solicitor in a desire to put up something which will look big and imposing, are apt to select for the lighting of a store a few lamps of high candle-power rather than a greater number of lower candle-power. Now where a store or other interior is to be so flooded with light that there will be no points between lamps being insufficiently lighted, it is proper to use high candle-power units. It must be remembered, however, that the maximum illuminating efficiency is obtained with small units at frequent intervals rather than by units of an equal total capacity placed at infrequent intervals. For example, a row of 125-watt units placed 8 ft. apart will give better results than 250-watt units placed 16 ft. apart. It is better for the central station man to talk lamps of a low candle-power at frequent intervals to begin with, and then if the customer is not satisfied, it is an easy matter to increase the candle-power; whereas it is usually difficult to reverse the process and install more lamps of low candle-power after the merchant has had high candle-power lamps before him. High candle-power units placed in a store certainly have an advertising value, as they create the impression on the passerby or the casual observer that the merchant is not afraid to spend money on light. When they are used, however, there should be enough of them to provide ample illumination midway between lamps. What is said here is intended merely as a caution to central station men who are thinking of recommending to customers, whose light is now unsatisfactory, the substitution of higher candle-power units taking in the aggregate the same amount of energy as a number of well scattered low candle-power lights already in use. Efforts might better be directed toward equipping the existing low candle-power units with proper reflectors and placing them at the right height. On the other hand, where the low candle-power units are grouped on chandeliers or clusters, the substitutes of single high efficiency high candle-power units will in many cases make a decided improvement.

AUXILIARY POLES IN COMMUTATOR MOTORS.

Of the numerous improvements made in recent years in the commutator type of electric machinery, perhaps none is more general in its application than the "auxiliary" pole for preventing sparking. On account of the fact that machines which refused to operate at full load with the brushes at the neutral point would commutate satisfactorily at any load when the brushes were shifted, the cause of the sparking has frequently been attributed to the shifting of the field by the armature current. In explanation of the phenomena it was shown that the magnetomotive force of the field current and that of the armature current were electrically in space quadrature, and that the resultant magnetic field shifted in mechanical position with the change in the armature current as the load varied, or with the change in the field strength as the speed was varied. In the issue for March 17 Mr. Norman G. Meade gave a graphical method for representing the resultant field and armature magnetomotive forces, and for indicating the effect of the magnetomotive force of the auxiliary pole in counteracting the distortion of the magnetic field. Although the diagram proposed is accurately appliable only to machines which have uniform core material and are provided with stationary coils completely surrounding the armature, it serves to show in what way a compensating magnetomotive force may be applied to the machines.

It is worthy of note that successful commutation in direct-current machines does not depend upon the existence or lack of an undistorted magnetic field, although a complete compensation of the armature magnetomotive force, both locally and as a whole, is desirable and more or less necessary in alternating-current series motors. In the latter type of machine any uncompensated magnetomotive force of the armature produces a field, which alternates with the circuit frequency and generates a detrimental "wattless" e.m.f. In order that the inductive reactance of the armature circuit may be as small as possible, so that the machine may operate at a high power factor, the compensation in these motors is made approximately complete. In the alternating-current machines the sparking may be attributed largely to the e.m.f. generated in the coil under the brush by transformer action. In the direct current machine, the transformer action is absent, and the sparking is due largely to the e.m.f. generated in the coil under the brush by speed action. Thus the determining factor for commutation in the alternating-current machine is the magnetism passing perpendicularly through the coil, while in the direct-current machine the determining factor is the magnetism through which the coil passes perpendicularly. By the use of a small magnetomotive force applied locally at the coil under the brush, it is possible to nullify the field magnetism at this point, and thus to produce an effect equivalent in all respects to preventing the magnetic distortion by the armature current. An additional magnetomotive force is desirable at this same place in order to cause the generation in the coil of a reversed e.m.f. which assists the rapid reversal of the current in this coil. It is evident, therefore, that for direct-current machines it is advantageous to employ a concentrated magnetomotive force at the coil under the brush, while for alternating-current machines the compensating magnetomotive force should be distributed over the surface of the armature.

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On the Condition for Sparking at the Break of the Inductive Circuit.

The March number of the *Physical Review* contains a paper by Mr. J. C. Hubbard on the above topic. The whole question of sparking and spark coils is relatively old, having first been discovered by Faraday, but it is so extremely complex, and contains so many factors, that but little headway has yet been made towards placing the subject on an arithmetical or engineering basis. The research detailed in the paper relates to determining the velocity which must be given to the contact breaker in the primary circuit of a coil in order that there may be no sparking at that contact. It is well known that the loss of energy occurring in the spark at the vibrating contact of an induction coil is not only a waste in itself, but also that it prevents the full transfer of energy from the primary to the secondary circuit. In other words, it taxes the circuit that gives, and the circuit that takes. Rayleigh has shown that when a primary circuit was opened sparklessly at the velocity of a rifle bullet, a greater potential could be produced in the secondary winding of an induction coil than when using lower contact-breaking speeds, and the best spark-shunting condenser. The experiments made seem to show that the sparkless speed of separating primary contact increases in a straight-line law with the primary current strength. Diminishing the capacity in the primary circuit increased the non-sparking velocity, and increasing the inductance also increased this velocity. The two latter effects are in conformity with the general theory of the subject. The velocities required in the experiments to produce sparkless breaking were of the order of one meter per second. The effect of inserting iron-wire cores into the induction coil was marked, and was in the direction of diminishing the critical velocity. Very much more experimental and theoretical work seems necessary before a spark coil for gasoline automobiles can be completely predetermined by design.

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Starting Conditions of Induction Motors.

One of the difficulties connected with the design of induction motors is found in the fact that a machine which is constructed to exert a large torque at starting gives poor speed regulation under load conditions and possesses an unsatisfactory efficiency at full load. As is mentioned in an article by Mr. R. E. Hellmund on page 666 of this issue, the starting torque of a polyphase motor is equal in synchronous watts to the power dissipated in the secondary windings when the rotor is stationary. A large starting torque requires a large secondary resistance, and if the machine retains the simplicity of the squirrel-cage rotor, it follows that the slip under full load will be large and the efficiency low. The maximum torque which the machine can exert at starting is obtained when the secondary copper loss is at its highest value, which condition exists when a proper balance is made between the secondary resistance and the local leakage reactance of the windings. It is found in practice that better general results are obtained when the secondary has a resistance much below the value required for maximum starting torque, so that where efficiency and speed regulation are of prime importance and the torque must be large at starting, it is necessary to be able to vary the resistance in the secondary circuit.

The article by Mr. Hellmund draws attention to the fact that with constant resistance, the effect of varying the reactance is the same with reference to the value of the current, as varying the resistance when the reactance is constant. In either case, if the constant quantity is small in comparison with the variable one, the effect of the variation is much more pronounced than when the reverse is true. Thus, when the resistance is small, a change in the reactance produces a proportionate change in the current, while, when the resistance is large, a similar change has a negligible effect on the current. It is evident that when a change in the current is due to change in the value of the reactance, the copper loss varies directly with the square of the current, while if a similar change in the current is produced by altering the resistance, the copper loss may remain constant or may even be varied in the opposite direction. Mr. Hellmund shows that, since the leakage reactance depends upon the mechanical position of the secondary with respect to the primary, the starting torque varies considerably according to the position of the rotor. In extreme cases the commercial torque at starting may be much less than the average as obtained by the methods of calculation ordinarily employed.

The above statements relates particularly to polyphase induction motors. The torque of a single-phase induction motor is approximately equal to that of the equivalent polyphase motor multiplied by the speed with synchronism as unity, and hence the starting torque in any case is zero. On page 667 of this issue is given a description of a single-phase motor in which the starting difficulties have been overcome and the operating characteristics have been improved. The machine is used as a repulsion motor when starting and as a single-phase induction motor when full speed is reached, just as is done at the present time in a well-known American type of motor. The improvements introduced include means for gradually converting the machine from a repulsion to an induction motor, and for supplying the exciting magnetomotive force to the revolving secondary instead of to the stationary primary. By removing from the primary coil the wattless component of the exciting current and substituting therefor a power component of current necessary to overcome the added losses, the power-factor of the machine is rendered quite high, the output is increased, and, except in the case of small motors, the efficiency is improved.

Hydro-Electric Power Stations.

Mr. Rushmore's Institute paper, abstracted elsewhere in this issue, is a very good running summary of current practice in design. We are glad to see the stress he lays on reliability of service and commercial considerations, which actually are the controlling factors in power transmission. Plants are installed to earn money, not to demonstrate theses on dynamo and line construction, and the plant that does not pay is, speaking broadly, a badly engineered plant. Reliability, however, is a subject upon which there may be wide and well founded differences of opinion. It is a curious fact that people generally require from electrical apparatus a degree of immunity from trouble that they would not dream of applying to an engine, for instance. This, in a sense, is very complimentary, but it is sometimes also inconvenient. The moment one transmits power from a hydro-electric plant there is a howl for drastic guarantees, based not on any proper danger from interruption of service, but upon a popular delusion that steam plants, which the public in a measure understands, are reliable, while this sending of high-voltage current over a long line is a bit uncanny, and a proper subject of suspicion. A year or so ago a huge engine in the plant of an electric railway system broke down and for several months the cars could not be heated at the rush hours. The matter, serious though it was, passed almost without comment, but it is safe to say that had the cause of trouble been a failure in a transmission plant, a veritable hornet's nest of agitation would have been aroused.

It is a fact that most interruptions of service in electric transmission systems are due not to any failure in the main transmission lines, but to the general distribution system, which generally has a greater absolute mileage of wire, installed under less favorable conditions. Of course, any transmission plant should be installed with due safety precautions, but there is a limit beyond which safety devices cause more troubles than they prevent. The first point that makes for safety is in the hydraulic plant itself. It is very desirable that this should be so arranged that no casual break can put the plant out of service. Proper storage facilities and duplicate pipe lines where necessary are very valuable in getting clear of hydraulic troubles. The station apparatus should have reasonable reserve, but the main point is the line. The tendency toward duplicate pole lines instead of merely duplicate circuits is a very healthy one. Two circuits on the same supporting system are a little better than a single circuit, but not very much, for any really serious failure in a high-voltage line is likely either to involve both circuits or to force a shut down before repairs can be made. It is very difficult to get a clear idea as to the degree of reliability reached in good modern transmission plants. As Mr. Rushmore says, the nature of the service makes a difference in the requirements, but we know of no system, steam or hydraulic, on the lines of which trouble does not occur, to an amount not perhaps compelling a complete shutdown, but still not far missing it. Automatic safety devices prevent some failures of service and precipitate others, and a veracious report of cut outs tied up and held in on some large systems would make very interesting reading.

Another subject to which Mr. Rushmore gives deserved prominence is the rating of wheels and generators. Hydro-electric plants differ in this respect very radically from steam plants. If a water wheel be designed for good efficiency at its rated load, it will not be efficient on overloads of any considerable amount, and in fact is unlikely to be able to carry them. If designed for a stiff overload it will do badly on normal load. So the water-wheel really determines the whole matter, being the factor which varies most in efficiency with change of load. Mr. Rushmore's suggestion of rating the wheel at 80 per cent gate, is in accord with good practice. It implies a maximum overload capacity of 25 per cent in the generator, which is enough in plants of fair size. This overload means, however, that if less than five units are installed, one of them must be a spare, since with four machines the loss of one could not be fully repaired by overload on the others. It is therefore not uncommon to rate wheels a little lower so as to give an overload capacity of about one-third. As this change may cost several per cent in wheel efficiency, it should be considered in all its bearings. In this respect one can deal more freely with impulse wheels than with ordinary turbines. There is, of course, no need of generator capacity greater than the wheel capacity unless the generator regulation calls for a design that permits more overload as an incidental. With provision for one-third overload in the wheels Mr Rushmore's suggestion of 40° C. rise and 8 per cent regulation at full load would be running rather close to the line.

Mr. Rushmore passes rather lightly over one subject which is of increasing importance—the installation of auxiliary plants, generally steam. There is no doubt that the average plant can make good and profitable use of an auxiliary, which should be at the main receiving point in order to get inside of line troubles and save energy. The desirable size for such a plant is, however, a much mooted point. A complete full powered reserve is a very expensive affair, for it should be able to take care even of a peak. And auxiliaries may range all the way between this and a mere emergency plant capable of handling in case of need only the most vital parts of the load. In dealing with rather variable streams, of course, a liberal auxiliary can be used to help out, but it is important to remember that this office detracts from the emergency value of the auxiliary. In cases where several hydro-electric plants supply a network, as is now often the custom, the emergency auxiliary need not be planned for the aggregate capacity of the plants, but only for the capacity that may be lost by a single breakdown. Generally the auxiliary will be used both for emergencies and for occasional help at times of heavy load. There are sometimes very severe requisitions made in the matter of continuity of service, and it is probably sometimes desirable to decline the business rather than to be forced into a heavy expense for an auxiliary much larger than is necessary, particularly as the most strenuous customers are likely to be those who expect to pay the minimum price for power. Considering the extent to which hydraulic companies have sold surplus and non-permanent power, electric power companies should not neglect the same opportunity when it can be found. All in all, transmitted power has proved to be reliable and should not be subjected to guarantees which no one thinks of demanding of an ordinary steam plant

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The Berlin International Conference on Electrical Units.

It will be remembered that the Chamber of Delegates of the International Electrical Congress at St. Louis in 1904 recommended that an international commission should be appointed to consider the discrepancies between the laws relating to electric units in different countries, or between their interpretations, with a view to securing practical uniformity. This resolution was happily put into effect last October by the invitation of the Physikalische Technischer Reichsanstalt at Berlin, addressed to the Bureaus of the various governments, suggesting a conference at Berlin. It appears that the invitation was suggested by the United States Bureau of Standards, and was supported by the National Physical Laboratory of England, as well as by the Bureau Central Météorologique of France. The conference was held at Charlottenburg October 23-25, 1905, and was attended by six delegates from Germany, two from Austria, two from Belgium, one from England and one from America—Professor Carhart. Although these delegates were not officially appointed to represent their respective governments, yet the results of the conference are in many ways as valuable and important as though the governments had been formally represented therein. In fact, the informal nature of the proceedings perhaps facilitated their conduct to a definite conclusion. The fact that such a conference was called, brought into effect and conducted to a formulated series of resolutions published in English, French and German, is a matter for international congratulation. The proceedings of the conference have been published in a pamphlet of 67 pages, mainly in German, by the Reichsdruckerei, of Berlin. An abstract of this publication appeared on page 614 of our last issue.

Six definite questions were taken up by the conference for consideration, relating to the fundamental standards of electric measurement. These, however, centered about one main question, namely, whether the fundamental concrete standard units should be the ohm and the volt or the ohm and the ampere. The Chicago Congress left the matter in some indefiniteness, because the international ohm, ampere and volt were all three defined as concrete standard units—the ohm as the resistance of a certain mercury wire, the ampere as the current that would deposit silver at a definite rate in a definite form of coulometer, and the volt as a certain fraction of the e.m.f. of a certain form and preparation of Clark standard cell. Any two of these three fundamental standards must, however, determine the third by implication, under Ohm's law; so that only two of these units need to be defined in concrete form, and only two should be so defined, in order to avoid errors and misunderstandings. It transpired in fact that the Charlottenburg Bureau of Standards, working on the basis of the concrete ohm and ampere, came to alter the value of the e.m.f. legally attributed to the Clark cell, by a small but appreciable extent, and thus introduced a discernible discrepancy between the voltage of incandescent lamps as determined in Germany and in America.

Two American briefs were filed on behalf of the ohm-and-volt selection, and they are published as appendices to the text of the proceedings. On the other hand, the British physicists took sides with the French and the Germans in favor of the ohm-and-ampere selection, so that the latter view was held by the majority of the conference. Our opinion remains distinctly in favor of that advanced in the American briefs. Nevertheless, the question is only of minor concern from a physical point of view, and either is, or need be, of no concern whatever from an engineering point of view. All that the engineer calls for is that the units he employs shall be the same all over the world, and that his measuring instruments shall not have to be recalibrated, or subjected to a correction factor, when carried from one country to another. No devout Mahommedan was ever more zealous in monotheism than the electrical engineer for one and only one volt. He does not care whether it is derived fundamentally as a fraction of the e.m.f. of a standard cell, or from the drop of potential of an electrolytically determined ampere in a standard ohm. The agreement of the conference in favor of the ohm and ampere as fundamental concrete standards is, therefore, a matter for universal satisfaction, whatever opinions may be held as to the merits of the selection.

On examining the formal decisions of the conference, we have only one criticism to offer, of a technical rather than a fundamental character. These decisions amend the resolutions of the Chicago Congress, from which they have been evolved both historically and essentially. A person adequately acquainted wtih the history of these units would, no doubt, carry the decisions of the Chicago Congress forward in his mind and apply these amendments and additions thereto. But the decisions of the conference should have made reference to the Chicago Congress resolutions, in order clearly to indicate their scope. Thus, the conference decisions define the international ohm as a fundamental electric unit, in terms of the resistance of a certain mercury wire, and also the international ampere as a fundamental unit in terms of the deposition of silver. These are proper decisions concerning concrete standards. They are, we submit, improper decisions concerning fundamental units, unless interpreted as specific amendments to the decisions of the Chicago Congress. The international ohm, as defined by the Chicago Congress, was 10^9 units of resistance of the c.g.s. system of units, or a member of a large and comprehensive system of unit magnitudes. The legalized embodiment of this ohm or its concrete conventional representation, is the particular mercury wire. Consequently, the formal decisions should either have been defined as relating to concrete standards and not to units, or as amendments to the decisions of the Chicago Congress. In course of time, as the history of the subject absorbs the new decisions, the basis for this criticism will doubtless disappear. It will be evident that, theoretically, our ohms and volts are decimally related to the great scientific absolute system of units; but that practically and legally they are given international embodiment in terms of a certain mercury wire, and of the rate of deposition of silver.

It is important to observe that the Weston cadmium cell was formally adopted as the standard cell, thereby changing the decision of the Chicago Congress, which adopted the Clark cell. A practical point in this connection is that the cadmium cell is the subject of a patent or patents, and thus not open to free use Otherwise this amendment is doubly important. In the first place, the temperature coefficient of the cadmium cell, with free solid hydrated cadmium sulphate, is markedly less than that of the Clark cell. In the second place, the Weston cell can now be calibrated by the various national laboratories in complete uniformity, without affecting national legislation upon the e.m.f. of the Clark cell. In other words, the adoption of a uniform international value for the e.m.f. of the Weston cell will not apparently call for any amendment to the existing legislation of the United States or Canada. Our international volt will not, we think, be illegal. Taken as a whole, the conference of Charlottenburg has earned the thanks of electrical workers all over the world, and will lead, let us hope, to complete uniformity of calibration in future, between the national laboratories of Europe and America.

A. I. E. E. Nominations.

At the meeting of the Council of the American Institute of Electrical Engineers on Friday of last week the report of the scrutiny of ballots for nominations of Institute officers was presented and official nominations made for the offices to become vacant at the end of the present Institute year. For president a total vote of 1,074 was cast, of which Mr. E. W. Rice, Jr., received 551 and Dr. Samuel Sheldon 408. In acting upon the names for president on the proposed list, the Board of Directors departed from the past custom of placing in nomination for president only the member receiving the highest number of votes, and directed that the official ticket shall bear the names of both Mr. Rice and Dr. Sheldon.

Following are the other official nominees: For vice-presidents, Mr A. H Armstrong, of Schenectady; Mr. H H. Humphrey, of St Louis, and Mr F G. Baum, of San Francisco. For managers, Mr Paul Spencer, of Philadelphia; Mr. Paul M. Lincoln, of Pittsburg; Mr. J. J. Carty, of New York, and Mr. A. M. Schoen, of Atlanta, Ga. Treasurer, Mr George A. Hamilton. Secretary, Mr. Ralph W. Pope.

The balloting list indicates that the circular sent out fraudulently, purporting to represent the Philadelphia branch of the Institute, produced about 180 votes for the ticket in the interest of which it was issued. It will be recalled that the postal card authorized by the Institute repudiating this circular was not received by members until after the date when the balloting for nominations had closed If it had been received prior to that date, in all probability very few members would have voted the ballot accompanying the bogus circular, and the distribution of this large vote would have resulted in quite different totals for the guidance of the Board of Directors in making up its official ticket

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Annual Meeting of the Association of Electric Lighting Engineers of New England.

The fourth annual meeting of the Association of Electric Lighting Engineers of New England was held at the Parker House, Boston, on March 21. A large number of central station experts were present, and the following officers were elected for the ensuing year: President, W. C. Woodward, Providence; vice-president, N. T. Wilcox, Lowell; secretary and treasurer, Welles E. Holmes, Newton. Executive Committee—H. Bottomley, Fall River; S. Fred Smith, Salem; W. L. Mulligan, Springfield; G. R. Stetson, New Bedford; W. R. Eaton, Cambridge, and G. L. Sadler, Nashua. It was voted to hold at least three meetings per year hereafter.

The meeting was divided into morning and afternoon sessions, at which the following papers were presented: "Line and Station Protection Against High Potentials," by Mr. G. E. Palmer; "Discrimination in Rates," by J. S. Codman; "Progress in Methods of Electric Lighting," by Dr. Louis Bell; "Best Methods in Advertising," by Mr. Converse D. Marsh; "Alternating-Current Motors," by Mr. W. A. Layman; "Recent Progress in Arc Lighting," by Mr Richard Fleming. Abstracts of these papers and of their discussion will appear in our next issue.

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Electric Smelting at Sault Ste. Marie.

The experimental trials of the Héroult electric furnace carried out at Sault Ste. Marie under the supervision of the Canadian Government, have been concluded. While the official report has not yet been issued, Dr. Haanel, who represented the Canadian Government at the trials, has recently lectured on the results and stated them to be entirely successful From Dr. Haanel's remarks it would seem that there are good prospects for introducing the electric furnace for pig iron production in Canada. The electric smelting of pig iron containing some four per cent of nickel is stated to be demonstrated a commercial success, and it is reported that the experimental plant at Sault Ste. Marie has been taken over by the Lake Superior Corporation and is now being conducted as a commercial plant. The nickel pig thus produced commands about double the price of ordinary cast iron.

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Annual Report of the Bell Telephone System.

The annual report of President F. P. Fish, of the American Telephone & Telegraph Company has just been issued. It is a more voluminous document than usual, Mr. Fish discussing various problems and aspects of telephonic development with unusual freedom and frankness. From the technical standpoint the most interesting figures are those given in the subjoined table for the company and all its licensees:

	1905.	1904.	1903.	1902.
Exchanges January 1	....	....	1,609	1,514
	4,532	4,080	....	
Branch offices	....	....	2,131	1,861
Total miles wire	4,778,281	3,549,810	2,983,189	2,443,750
Total stations	2,241,367	1,799,633	1,525,167	1,277,983
Miles of pole lines	145,535	136,347	130,178	122,409

Mr. Fish says: "Since January, 1900, the number of telephones in the hands of our companies increased from 1,580,101 to 5,698,258; the total number of stations using Bell telephones, from 675,761 to 2,528,715; the miles of wire in toll and exchange use from 1,518,609 to 6,043,518; the number of officers and employes of all classes, from 29,599 to 87,212, and the number of yearly conversations, from 1,708,800,000 to 4,479,500,000. The American Bell system of the United States now exceeds, in the number of subscribers, mileage of wire and extent of traffic, the telephone systems of Great Britain and all of Continental Europe combined."

The growth in traffic as well as in necessary investment is enormous. The amount added to construction and real estate by all the companies, excluding sub-licensees, constituting the system in the United States during the year 1905, was:

For exchanges	$36,771,312
For toll lines	9,832,204
For land and buildings	4,177,390
Total	$50,780,906

"The amount added in 1900 was $31,619,100; in 1901, $31,005,400; in 1902, $37,336,500; in 1903, $35,368,700, and in 1904, $33,436,700, making the grand total of expenditure upon these properties during the six years $219,547,306.

"The plant is to a large extent stable and standard. Fifty-four and one-tenth per cent, in miles, of all the exchange wire in the country is now in cables under ground. At the end of the year 1905 all except about 20 per cent of the exchange wire in the Bell system was in cables, overhead or underground.

"At the present time the companies making up the Bell system have in use not less than 320,000,000 lb. of copper wire, much of it in cable of a permanent type, the value of which, as copper, if removed and sold, it is easy to estimate; not less than 8,000,000 poles and 95,000,000 duct feet of underground conduit are installed and in use to support or contain this wire."

The income account for 1905 shows dividend receipts from sub-companies of $8,897,879; rental of instruments, $3,896,151; telephone traffic, $6,529,556; real estate, $82,384; interest, $2,596,858; a grand total of $21,712,831. The expenses of administration were $1,220,460; legal expenses, $93,126; interest and taxes, $3,578,681; telephone traffic, $3,786,524; a total of $8,678,792. This left a net revenue of $13,034,038, out of which dividends were declared amounting to $9,866,355, leaving a balance of $3,167,683. Of this there was carried to reserve $1,743,295 and to surplus $1,424,388. Mr. Fish supplies the subjoined interesting table as to the total Bell telephone capitalization in the United States:

Entire capitalization (stock, bonds and all obligations as above) of all the companies including this company	$334,524,583
Number of stations (excluding sub-licensee and private line stations)	2,241,367
Average capitalization per station	$149
Deducting cost toll lines	$99,293,987
Balance, cost of exchanges	$235,230,596
Average capitalization per station (excluding toll line investment)	$105
Miles of toll wire	1,265,236
Average investment per mile of toll wire	$78

Elsewhere in the report Mr. Fish states that the total income of the whole Bell system was $100,440,264; and the total expenses were $74,110,795; the ratio of expense to gross income being 74 per cent, or for strictly telephone operation about 73 per cent.

President Fish discusses with fullness the independent telephone competition, and takes occasion to emphasize all the familiar arguments against the undesirability of having two or more competitive telephone services in any given place. He states that already 246,337 exchange and toll stations operated by independent systems are connected into the Bell network. This is probably somewhat more than 10 per cent.

The report closes with a reference to the successful placing of $100,000,000 convertible bonds for extension purposes, out of the $150,000,000 voted last December. This new capital will, it is estimated, carry the development of the business well into 1908.

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March Meeting of the American Institute of Electrical Engineers.

At the meeting last week of the American Institute of Electrical Engineers, Mr. T. Commerford Martin, as chairman of the building fund committee, announced that there has been subscribed a total amount of $132,389, or more than two-thirds of the sum needed for the land upon which the United Engineering building will stand. Of this amount $87,000 has been collected.

During the month the committee received from the American Telephone & Telegraph Company, the Western Electric Company, the New York Telephone Company, and the New York & New Jersey Telephone Company a joint subscription of $25,000, and from Mr. Clarence H. Mackay, president of the Postal Telegraph & Cable Company, the generous personal subscription of $5,000, both of which have been collected. On the day of the meeting there was received from the Edison Electric Illuminating Company of Brooklyn a subscription of $1,000.

The secretary read a report from the Board of Directors giving the results of balloting for nominees for the coming election, and submitting the ticket compiled by the Board. Annual election to be held on May 15. This ticket will be found in another column of this issue.

The following papers were presented: "Some Features Affecting the Parallel Operation of Synchronous Motor Generator Sets,' by Mr. J. B. Taylor; "Notes on the Design of Hydroelectric Power Stations," by Mr. D. B. Rushmore, and "The Relation of Load-Factor to the Evaluation of Hydroelectric Plants," by Mr. S. B. Storer. The paper by Mr. Storer is reprinted on page 669, while abstracts of the papers by Mr. Taylor and by Mr. Rushmore are given on pages 668 and 670, respectively.

In discussing Mr. Taylor's paper, Mr. W. L. Waters stated that personal experience tended to show that the results from the parallel operation of synchronous motor-generator sets are not quite so simple as one would expect from a perusal of the paper. He was inclined to attribute the erratic behavior of the sets to changes in the power factor of the different phases, especially when polyphase generators are used for single phase distribution. As regards the starting, he thought the method which employs two pointers on a single synchronism indicator dial is much superior to the method of reversing the poles, because the latter method places an unnecessary strain on the machine. He expressed his appreciation of the very simple and lucid explanation of the operation of synchronous motor-generator sets as given by Mr. Taylor. He thought, however, that the problem is one in which practice is more valuable than theory.

In reply to the criticism by Mr. Waters, Mr. Taylor said that the objection is not valid, because every motor must at some time go through with the process of slipping one pole and it must be designed to withstand the strain. Moreover, in practical operation, the slipping is done on low voltage, so that the increase in the current and the strain on the machine is not great. Any well built set will withstand this treatment indefinitely.

The papers by Mr. Storer and by Mr. Rushmore were not discussed.

Test of a 1500-Kw. Curtis Turbine.

The following data are from a test of a 1,500-kw Curtis turbine, made by Mr. C. P. Sparks, chief engineer of the County of London Supply Company. This company has recently installed two turbines of this capacity, one in its City Road and the other in its Wendsworth Station. The turbines are of the four-stage type and are mounted on sub-base condensers. The alternators are two-phase, generating 2,200 volts at 50 cycles and 1,000 r.p.m. When running continuously at full load, the guarantees were for a temperature rise of 40° C. and a further rise of 15° C. when the machine is run for three hours at 2,250 kw. The units can be loaded as high as 3,000 kw for short periods when condensing.

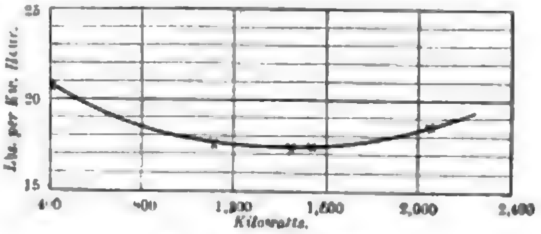

FIG. 1.—TEST READINGS.

In commenting on these tests, our London contemporary, *The Electrician*, refers to the great value of independent tests of this nature, and points out that Mr. Sparks has included among the data the amount of energy absorbed by the auxiliaries, figures which are often passed over in silence by experimenters. As more interesting than the low steam consumption at full load (17.25 lb. per kw-hour excluding auxiliary, and 17.6 lb. including auxiliaries), he notes that the consumption increases very little down to ⅓ full load. While the tests were favored by an extraordinarily high vacuum, on the other hand, the steam was superheated by 60° F. only. Reference is made to a test of a 1,200-kw Brown-Boveri-Parsons three-phase turbo-unit installed about two years ago at Rheinfelden, the steam consumption of which ranged from 15.9 lb. per kw-hour at 1,440 kw to 21 lb. at 378 kw. The vacuum was approximately the same as in the test by Mr. Sparks, but the steam was superheated to no less than 250° C. on an average, which our contemporary considers quite accounts for the difference in performance.

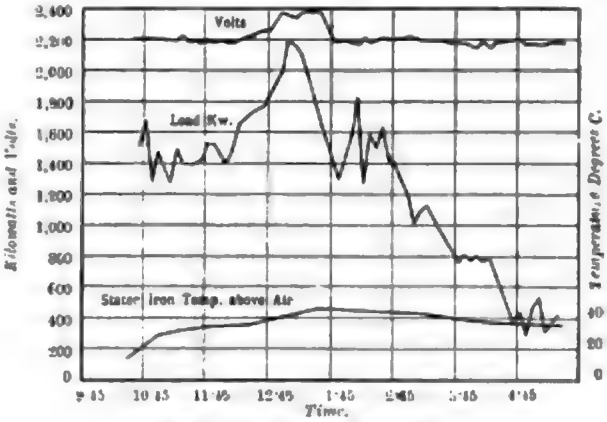

FIG. 2.—TEMPERATURE TEST.

During the tests the power taken by the auxiliaries amounted to 33 kw at one-quarter load (circulating water 21.5, excitation 5.7, air and foot-step pumps 5.75, total = 32.95); and 50 kw at full load (circulating water 36, excitation 7.25, air and foot-step pumps 6.75 = 50), resulting in a total steam consumption of 17.8 lb. per kw-hour when the set was delivering 1,500 kw.

Steam consumption tests were made during January at loads varying from 400 to 2,050 kw, the maximum load carried during the test being 2,200 kw. During the test the steam consumption was measured by weighing the hot-well discharge continuously in duplicate tanks holding six minutes discharge at full load. The test readings at each load, plotted in Fig. 1, were taken over 30 minutes, the reading at full load covering two hours

The output was measured by integrating wattmeters checked by ammeter and voltmeter readings (the whole of the instruments being calibrated at the Board of Trade laboratory after the trial). The artificial load was obtained by passing the current between iron plates immersed in running water. During the test the superheat at the turbine varied from 48° F., to 62° F., the steam pressure from 146 lb. to 154 lb. per sq. in., and the temperature of the circulating water was 43° F.

In order to shorten the temperature test (Fig. 2), after running two hours at full load normal pressure the load was increased to a maximum 2,200 kw at 2,370 volts; the increased iron losses under these conditions gave a temperature rise of 44° C. for the stator iron at the end of four hours' run. The load and pressure were then reduced to normal full load, giving a temperature rise of 42° C. at the end of the fifth hour; at this time the corresponding temperature rise of the end windings of the armature was 34° C., while the field coils rose 12° C. measured by increase of resistance.

Report on Chicago Lighting Rates.

Mr. Bion J. Arnold and Mr. William Carroll, city electrician of Chicago, acting as experts to advise the Chicago Council Committee on Oil, Gas and Electric Light, have submitted a report on the rates of the Chicago Edison and Commonwealth electric companies. The report gives the results of the investigation of the affairs of these two companies so far as relates to rates, and makes recommendations as to what constitutes a reasonable maximum rate of charge for incandescent lighting. The report is divided into two parts, one of which discusses the question of a reasonable maximum rate on the assumption that the companies cannot be compelled to accept less than cost for its service; and the question of a reasonable rate on the assumption that the companies can be required to serve a portion of their customers at less than cost, provided the returns from the total lighting business are reasonably profitable. A valuable feature of the report is a discussion of the subject of rates, with particular relation to the use of the Wright demand system of metering. Next week this section of the report will be printed in full.

In the discussion of the first question, it is stated that the maximum rate of the Chicago companies at present is 20 cents per kw-hour with a 20 per cent discount for prompt payment, giving a net maximum rate of 16 cents per kw-hour. With the present maximum rate there is no doubt some customers are served at a loss, and the company has compiled figures showing that this is true of a large percentage of customers, numbering no less than 10,000. The report places at 25 per cent the proportion of customers that at present are not giving a profit. Although the number of customers served at a loss may appear large, the total actual loss to the company in dollars, as compared to the total income from all customers, is small for the reason that only those using a small amount of current are supplied at a loss. It is stated that though theoretically each customer should pay for his own service, on the same theory, however, every merchant should charge proportionately more for the delivery of small purchases than for large ones; that is to say, if a single pound of coffee or a yard of silk is delivered, a higher charge per pound or yard should be made than if such small purchases were delivered with a larger bill of goods. This policy would not be considered good business, and as other merchants consider it to their interest to do a considerable amount of small business at a loss, it is not surprising to find that public sentiment is in favor of reducing the maximum rate for lighting, even if the supply company must make up this loss by slightly greater charge on larger sales than would otherwise be demanded. The problem, therefore, resolves itself into establishing a fair balance, and involves the relative rights of the "short hour" and of the "long hour" consumer, of the wholesale customer and of the producer, and should not be settled entirely in favor of any one and at the expense of the others. If it is maintained that the companies should not do any business whatever at a loss, then the present maximum rate cannot be reduced. It is only, however, by taking a broad view of the entire business that a conclusion can be arrived at as to whether the maximum rates can be reasonably reduced.

In the discussion of the second question, namely, as to what constitutes a reasonable rate on the assumption that the companies can be required to serve a portion of their customers at less than cost, provided the returns on the total lighting business are reasonably profitable, a number of combinations of maximum and minimum rates are made and discussed, and an analysis is given of the financial situation of the company.

The final conclusions of Messrs. Arnold and Carroll are that the Edison and Commonwealth companies can afford to reduce their lighting rates; and that their offer to reduce their rates to 14 cents for the maximum rate and 9 cents for the secondary rate for two years from the present time, and to 12 and 8 cents for the next following three years, may be considered reasonable and fair. A thorough investigation of the affairs of the company might show that they could offer to reduce the rates to 10 cents and 5 cents (equivalent to a flat rate of 6⅔ cents), but from all the figures submitted this rate at the present time would be a hardship and would probably seriously embarrass the companies; it can, however, reasonably be expected that eventually the companies can afford and probably will accord this latter rate.

Boston Meeting of Illuminating Engineers.

About seventy-five representatives of the electric light, gas and kindred industries were present at an informal meeting, held in Boston, March 20, preliminary to the organization of a New England Chapter of the Illuminating Engineering Society. The meeting was called to order by Mr. J. S. Codman, and Mr. John Campbell was chosen to fill the position of chairman. Mr. L. B. Marks, of New York, president of the parent society, said this was the first meeting to form a branch society, and that a movement was on foot to form the second in Chicago. He laid stress on the fact that men engaged in all kinds of business concerned with illumination were wanted in the organization, including architects, contractors and fixture dealers. While any antagonism with existing organizations was to be avoided, it was considered distinctly desirable to have a new and independent organization rather than to become a wing of any already established. Such a society could do a valuable work in impressing the public with improved devices and methods of illumination.

The illustrated paper on the inverted gas mantle lamp, presented by Victor A. Rettich before the New York society, was read by J. S. Codman, of Boston. The discussion that followed the reading of the paper in New York was read by W. W. Cummings, of the Boston Consolidated Gas Company, and there was further discussion by persons present. Mr. E. L. Elliott read his paper, presented in New York, on the flaming arc lamp, or, as he preferred to call it, the luminous arc. Dr. Louis Bell, Mr. W. D'A. Ryan and others discussed the papers of the evening. Mr. Ryan illustrated his remarks by a series of curves showing the distribution of light in the different forms of arc lamps.

Twenty-six of those present signed applications for membership and a committee, consisting of Dr. Louis Bell and Messrs. J. S. Codman, W. W. Cummings, Charles B. Burleigh, H. B. Brown, and Mr. John Campbell, was appointed to perfect and present plans for organization at a meeting to be held in April. At present there are nearly fifty members of the society in New England and the work of the local chapter is expected to bring the membership up to the hundred in a short time.

Wireless Telegraph Litigation.

On March 19 Chief Justice Fuller issued an injunction, on the representation of the U. S. Circuit Court of New York, commanding the De Forest Wireless Telegraph Company to "forever desist from, directly or indirectly, making or causing to be made, using or causing to be used, or vending to others to be used, disposing of in any way, or advertising or offering for sale, any system of wireless telegraphy, or apparatus used therefor, by which electrical signals are transmitted and received, containing, embodying or employing" the inventions and improvements or discoveries granted in claims 3 and 5 of the reissued Marconi patent No. 11,913, dated June 4, 1901.

As was noted at the time in these columns, the above claims were upheld by Judge Townsend in an opinion dated April 11, 1905. The text of the two claims is as follows:

"3. The combination, in an apparatus for communicating electrical signals, of a spark-producer at the transmitting station, an earth connection to one end of the spark-producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an end connection to one end of the contact, an insulated conductor connected to the other end, and a circuit through the contact, substantially as and for the purpose described.

"5. The combination, in an apparatus for communicating electrical signals, of a spark-producer at the transmitting station, an earth connection to one end of the spark-producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, choking-coils connected to each end of the contact, an earth connection to one end of the imperfect contact, an insulated conductor connected to the other end, and a circuit through the coils and contact, substantially as and for the purpose described."

On March 20 Judge Lacombe of the above-mentioned court issued an attachment against Mr. Abraham White, president of the De Forest Company, for failure to obey a writ directing him to appear on February 26 before a Master of the Court, to give evidence in a certain suit and pending accounting between the Marconi and De Forest companies.

Co-operative Electrical Development Association.

A joint meeting of the different electrical interests, affected by the public consumption of electrical current and electrical apparatus, was held on Friday, March 23, at the Imperial Hotel, New York, upon call of the Co-operative Electrical Development Association, organized by Mr. J. Robert Crouse, Jr. The object of the meeting was to review the work already done along the lines made familiar to the readers of this journal, to examine the plans proposed for the future and to discuss a suggested basis of organization. This meeting, which was held at 3 p.m. on the day in question, was well attended and was called to order by Mr. E. E. Jackson, Jr., who outlined the work to be done in the way of cultivating public interest in electricity, and who spoke particularly from the standpoint of his connection with the incandescent lamp industry. Mr. J. R. Crouse, Jr., then presented an admirable paper, in printed form, occupying some 45 printed pages, in which he went over the ground of the proposed united action and advocated the plan of profitable co-operation with which his name has become connected. He stated that 45 electrical manufacturers who have seen the plans develop during a year and a half past have given effective expression to their confidence in them by the appropriation of $60,000 for the partial execution of the scheme during the next three years. The paper called attention to the great market represented in the electrical field by the two charts, which were shown on the walls, illustrative of the extent to which electricity has been pushed and the manner in which many of the central stations had not lived up to their opportunities. It was stated that for the purpose of putting the entire industry in touch with the co-operative work under way, and of enlisting general co-operation, a mailing list of 4700 individuals identified with the electrical business had been prepared and duly circularized, while the central stations of the country were also included in the propaganda. The paper was in many respects an amplification of the one presented by Mr. Crouse at Denver last year, but embodied a great deal of additional information and argument. It was accompanied by several exhibits, which were distributed to each person in attendance.

The subject of publicity and advertising, etc., was then taken up from various standpoints, and was discussed in papers or in impromptu remarks, as follows: "Possibilities of Newspaper Commercial Publicity," Mr. Ivy L. Lee; "Possibilities of Magazine and Periodical Advertising," Mr. E. E. Calkins; "Possibilities of Co-operative Work," Mr. Paul Spencer; "The Co-operative Movement from the Central Station Standpoint," Mr. W. H. Blood, Jr., President of the National Electric Light Association; "The Co-operative Movement from the Jobber's Standpoint," Mr. F. Bissell; "The Co-operative Movement from the Contractor's Standpoint," Mr. J. H. Strong, President of the National Electrical Contractors' Association; "The Co-operative Movement from the Trade Paper's Standpoint," Mr. J. M. Wakeman, of the Electrical World; "The Co-operative Movement from the Manufacturer's Standpoint," Mr. A. W. Burchard. A number of very interesting points were presented and at the close of the meeting resolutions were passed as representative of the sense of the conference.

It was moved by Mr. Anson W. Burchard, assistant to the president of the General Electric Company, and seconded by Mr. W. H. Blood, Jr., President National Electric Light Association, that "It is the sense of this meeting that the Co-operative Commercial Campaign for the purpose of increasing the use of electric current by the public for light, heat and power, as both an end and a means to the increased demand for electrical apparatus and supplies as presented and discussed, gives good promise of highly profitable returns to all concerned, and that the general plans for its prosecution through the Co-operative Electrical Development Association can be undertaken along equitable and practical lines."

It was moved by Mr. Anson W. Burchard and seconded by Mr. W. M. MacFarland, Acting Vice-President of the Westinghouse Electric & Manufacturing Company, that a committee of eleven or more representatives of electrical interests be appointed by the chair for the purpose of considering the plans submitted for the organization of the Co-operative Electrical Development Association, and to complete and agree on a practical form of organization with a view of putting the same into operation. It was

"Resolved further, that this Committee be authorized to confer on the subject with co-operating committees already appointed, or other representatives which may be appointed from other well defined lines of the trade, so that adequate provision may be made in the plans of organization for immediate moral co-operation, as well as possibly financial co-operation at a later date.

"Resolved further, that the plans of organization when completed by this Committee be submitted to the representatives of the interests present, so that the entire proposition may be passed upon by their respective bodies or companies.

"When, in the opinion of this Committee, a sufficient number of the interests have agreed to co-operate in the work it shall be authorized to perfect the organization and to supervise its initiatory work."

The Chairman of the meeting appointed the following Committee as covered by the foregoing resolutions: Mr. W. M. MacFarland, Acting Vice-President of the Westinghouse Electric & Manufacturing Company, Chairman; Mr. J. R. Lovejoy, General Electric Company; Mr. Walter Cary, Sawyer-Mann Electric Company; Mr. A. D. Page, General Electric Company; Mr. F. S. Terry, National Electric Lamp Company; Mr. W. H. Swope, Western Electric Company; Mr. W. C. Bryant, The Bryant Electric Company; Mr. F. J. Newbury, John A. Roebling's Sons Company; Mr. A. T. Clark, American Circular Loom Company; Mr. W. H. Blood, Jr., President The National Electric Light Association; Mr. F. Bissell, The F. Bissell Company, representing the electrical jobbers; Mr. James R. Strong, representing the electrical contractors. It is probable that other members will be added to this committee from other interests which it was expected would be present and whose representatives were unavoidably absent.

The serious business of the afternoon was supplemented by a banquet in the evening at the Imperial, when the general subject was returned to by numerous speakers, but with lighter touch. Among those who spoke were Messrs. C. B. Humphrey, W. H. Blood, Jr., J. C. Fish, Paul Spencer, M. K. Eyre, A. W. Burchard, A. D. Page, C. A. Parker, Converse D. Marsh, S. O. Richardson, Jr., and J. R. Crouse. Mr. W. M. MacFarland was a most efficient and facetious toastmaster, and the proceedings were also enlivened by the performance of a mandolin band. During the evening the badge of the new organization was distributed in the shape of a neat little enameled pin carrying the initials of the Association, the magnet which is its emblem and the legend which is its war-cry "All together all the time for everything electrical."

A document of interest and value that was distributed was the legal form of certificate of incorporation and the tentative by-laws for the Association, prepared by the legal department of Mr. H. L. Doherty, the main point being that active members of the Association would be eligible upon payment to the body of a fixed percentage on all or a portion of their sales covering a period of three years.

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Vapor Electric Lamps.

Two patents issued March 13 to Peter Cooper Hewitt describe means whereby the light from a mercury vapor lamp may be much improved in quality. Mercury or other suitable material is used, as heretofore, for the negative electrode, and associated with the vapors therefrom is some other gas, the presence of which will modify the light given off by the mercury vapor. This added gas or vapor will act as a conductor in the tube and give out its characterized color or spectrum under the influence of electric current, if means are provided for condensing the vapor volatilized at the negative or mercury electrode in the vicinity of said electrode, thus preventing the vapors developed there from acting as the sole conductor through the entire body of the container. This condensation is provided for by a suitable cooling chamber at or near the negative electrode, consisting of a spherical enlargement of the base of the tube. The lamp will then operate with a dual light, the current leaving the upper or positive electrode within the fixed gas or vapor and then transferring itself to the vapor developed at the lower or negative electrode, which it will enter and traverse in the usual manner. Various gases may be used for the purpose indicated, but neon or one of the recently discovered inert gases, or a gas that is not chemically active, is preferred; nitrogen and argon are also named in this connection.

A patent granted on the same date to Mr. D. McFarlan Moore relates to a method of manufacture whereby a vacuum tube may be produced having a contained material of such character that it shall form a source of supply to the gas which forms the source of light within the tubes. The object of the invention is to secure the presence in a vacuum tube in order to affect the quality of light, a material comprising an electrolytically treated organic substance, preferably one of which nitrogen is a constituent. Vacuum tubes containing only gas and vapor are of comparatively short life, but this objection may be obviated by introducing chemicals into the tube as a source for supplying fresh gas as rapidly as there is deterioration of contained gas under the action of current. A difficulty in doing this, however, is that all chemicals of suitable quantity for the purpose have acted to change the necessary degree of air refraction in the tube through giving forth their gases too fast. The patent relates to the manner of overcoming this latter difficulty, which is by the introduction into the tube of an organic substance which previously to the sealing off of the lamp has been subjected to electrolytic action. The materials from which best results have been secured are stated to be obtained by subjecting an organic compound, preferably an aromatic hydrocarbon, such as benzine, or a derivative thereof, such as benzoic (with nitrogen) to electrolytic action. This substance is uniformly distributed over the interior wall of the tube by rotating the same, heat being applied externally when necessary to cause the substance to adhere to the tube. The tube is then sealed, connected with a suitable source of electricity and exhausted. The tube with the coating of material described by this process may then be used entirely as a complete manufactured device, but ordinarily only a section of tubing of this kind is used, forming the end portion of a commercial tube.

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CURRENT NEWS AND NOTES.

NEW YORK CENTRAL FARES are likely soon to be reduced by the electrification. Announcement of lower fares between New York City and suburban towns reached by the lines of the New York Central, as soon as the electrification of the road is completed, has been made in a letter by the company to the state railroad commission. The letter said that the electrification of the road would be completed within a few months.

N. E. L. A. TRANSPORTATION.—Mr. G. F. Porter, master of transportation of the National Electric Light Association, states that the Central Traffic Association and the Southwestern Excursion Bureau have authorized a rate of a fare and one-third from all points in their respective territories to Atlantic City and return for delegates and their friends attending the twenty-ninth convention of the Association, to be held June 5 to 8, 1906.

CHICAGO ELECTRICAL MEETINGS.—Mr. J. L. McQuarrie read a paper on "Telephone Engineering as a Profession" before the Chicago branch of the American Institute of Electrical Engineers, March 20, which excited considerable interest and discussion. A meeting of the electrical section of the Western Society of Engineers was held March 16, at which Prof. P. B. Woodworth, of Lewis Institute, led a discussion on "Schools, Engineers and Employes."

NATURAL GAS ILLUMINATION.—The village of Columbiana, O., is bringing suit against the West Virginia Natural Gas Company to compel it to cease supplying local residents with natural gas for illuminating purposes. The gas company was given a franchise for heating purposes some time ago, with the express stipulation that it should not enter the lighting field, as the village owns a municipal lighting plant, and it is feared that the plant will prove a failure if the lighting load is reduced. A number of citizens who have been using gas avow their intention of testing the Council's right to restrict them to the use of electricity as it is contended that the electric light is poor, more expensive than gas, and there is no day service.

TELHARMONY.—On March 24, a score of electrical engineers, journalists, bankers and others interested in the remarkable new invention "Telharmony," of Dr. Thaddeus Cahill, went to Holyoke, Mass., by special car, to see the apparatus and hear a concert of instrumental music rendered by the machine. Among the party were Gen. Eugene Griffin, Prof. Richards, of Columbia University; Mr. E. F. Higgins, publisher of *Success*; Mr. H. S. Collette, secretary J. G. White Co.; Mr. J. W. Middendorf, of the Baltimore banking house; and Messrs. Oscar T. Crosby, F. C. Todd, T. C. Martin, G. H. Guy. The apparatus was first inspected at the water-power factory and the music heard there. An elaborate concert was then given at the Hamilton Hotel, two miles away, where the receiving telephone was installed in the ball room, a chamber capable of accommodating three or four hundred people. The keyboard at the factory was played by three performers in succession; and one or two duets were given, the music being classical, operatic, popular and ragtime. The machine furnishing the currents has been built for New York, and is to be set up in this city in May. An interesting feature of this notable performance was the fact that about 400 telephones were in circuit at the same time, to illustrate the facility of distribution, but were "choked" in sand, as the one receiver, consuming three watts, was all the auditors needed to deliver to them sweet sounds from the distant "music distillery."

THURY SYSTEM IN GREAT BRITAIN.—Messrs. Dick, Kerr & Co., of London, have obtained a license for the Thury series direct-current power transmission system for Great Britain and its colonies.

WIRELESS STATIONS SOLD.—The De Forest Wireless Telegraph Company turned over to the Navy Department last week stations at Pensacola, Key West, San Juan, Porto Rico; Guantanamo, Cuba, and Colon, which the company had operated. The total paid by the Government was $65,000, or $13,000 for each station.

NEW PACIFIC CABLE.—It is announced from Manila, P. I., that the cable laying steamer *Silvertown* landed the shore end of the Commercial Pacific Company's cable there on March 24 and began paying the cable out across Admiral Dewey's former battle line toward Shanghai.

RAILROAD TELEPHONY.—A special dispatch from the West states that an independent long-distance telephone line will be equipped by the Union and Southern Pacific roads between Omaha and San Francisco for use by trainmen and officials. Commercial business may be accepted over the line.

PHILADELPHIA TRAVEL.—Large plans are in view for increasing traffic facilities in Philadelphia. By an agreement reached by Mayor Weaver with the Philadelphia Rapid Transit Company, that company undertakes to complete, within three years, subways under several streets in the business center of the city and an elevated railway from the southern section of the city to Frankford.

BLOCK SIGNALS.—Mr. E. H. Harriman has instructed Mr. Julius Kruttschnitt, director of maintenance and operation of his roads, to begin work immediately with a view to installing 2,342 miles of automatic electric block signals, which will cost nearly $3,000,000. The signals are to be placed over the entire line of the Union Pacific and Southern Pacific roads between Omaha and San Francisco, a distance of 1,800 miles, and also between San Francisco and Los Angeles, on the Southern Pacific, a distance of 542 miles. This is believed to be the most extensive piece of electrical work of the kind ever undertaken.

PUSH BUTTON VOTING.—Preparations are making to convene the Douma, the first Russian national parliament. The seats to be occupied by members of the National Assembly in the Tauride Palace there have been equipped with electrical apparatus similar to the system proposed several years ago for use in the House of Representatives at Washington, by which members press buttons and register their votes at the clerk's desk, thus avoiding the delays of roll calls. It will perhaps be remembered that Mr. Edison's first invention was an electric voting system for legislatures. The absence of enthusiasm in its reception rather discouraged him at the time.

GEOPHYSICAL RESEARCH.—The Carnegie Institution of Washington has acquired five acres of ground alongside of Rock Creek Park, on which to construct a laboratory for geophysical research. The investigations will be in charge of Prof. Arthur L. Day, of the United States Geological Survey. The undertaking is the most important of its kind. A study will be made of the minerals composing the earth's crust, with a view to determining scientific facts relative to the earth's formation that heretofore have baffled geophysicists because of the lack of facilities for obtaining accurate information. The apparatus with which the experiments will be conducted is new of its kind, and through the assistance of the Carnegie Institution scientists will obtain data of great value. A good deal of electrical work will be involved.

ELECTRICITY ON SHIPBOARD.—The more modern the steamship the larger her electrical equipment. The largest and most complete electric installation ever fitted on board ship is that for the new Cunarder, the *Mauritania*, now building at Wallsend, England. The vessel will be lighted by about 5,000 lamps of 16 cp, which is more than double the number fitted on the *Cedric*. The electric passenger elevators are to be erected for conveying the passengers between the six decks, two elevators for luggage and six smaller elevators for the mails, etc. There will be a telephone exchange on board, which will connect the chief passenger sections of the ship with the officers', and there are also to be special telephones from the bridge. There will also be various electric heaters and electric curling tong heaters for the women passengers.

SHADOWS WE ARE, but whether we are all the kind of shadows suggested in the subjoined dispatch will require a good deal of proof. A special cable message from London of March 24 says: "In the course of a lecture before the Psycho-therapeutic Society Dr. Ward announced that Prof. Elmer Gates, of Washington, D. C., who has been experimenting with light rays, has found about five octaves above violet a form of waves similar to X-rays. Under these rays living objects throw a shadow which exists only as long as there is life in the object. A live rat was placed in a hermetically sealed tube and held in the path of the rays in front of a sensitized screen. So long as the rat was alive it threw a shadow. When it was killed it became suddenly transparent. 'Here,' said the lecturer, 'there was a strange phenomenon. At the very instant the rat became transparent a shadow of exactly the same shape was noticed to pass, as it were, out of and beyond the glass tube and vanished as it passed upward on the sensitized screen.'"

AUTOMOBILE CLUB BUILDING.—The cornerstone of the new house of the Automobile Club of America, in New York City, was laid on March 21, on West Fifty-fourth Street, by Dr. S. S. Wheeler, who in addition to being president this year of the American Institute of Electrical Engineers, is chairman of the building committee of the club. Past-President Shattuck made a prophetic speech, a copy of which went into the stone with other records. Quoting a verse from the Bible to the effect that "the chariots shall jostle one against another in the broad ways," he spoke of the wonders of electricity and steam in the last century, and concluded with the prediction that in view of the success of ballooning, the automobile will in turn be superseded by the flying machine. It is hoped that the members may occupy the new house early next winter. The building will be eight stories in height, absolutely fire-proof. The top floor will be lighted by skylights, and will be divided into a number of rooms for members of the club, who are interested in experimenting in problems of automobile construction and engineering. The main clubrooms, assembly hall and library will be on the second floor. Special provision will be made for the charging of electric automobiles.

POWER IN IDAHO.—In April, 1902, Mr. L. L. Nunn, of the Telluride Power Company, made an appropriation of the flood waters of Bear River for power purposes. Later the Government intervened and a long delay occurred, pending the investigation as to the feasibility of the project as an irrigation scheme, the object of the Government being to furnish water to settlers. At that time the Government's engineers thought there were about 150,000 acres that might be reclaimed. Meanwhile, private companies built canals to supply so much land that only 60,000 acres remained, and the Government finally permitted its claim to lapse on the theory that it could not afford to go to such an expense for so small an area. It is now Mr. Nunn's intention to divert this water, which comes in a flood in the spring, by canals to North and Bear Lakes, using these lakes as reservoirs. Thence the water is conducted down the channel of Bear River to the point of the proposed power station, insuring a permanent flow all the year round. The water appropriated is estimated to generate 50,000 hp under a head of 500 ft. and 20,000 hp will be utilized this year. The generating station will be located about 45 miles north of Logan, Utah, and the equipment for the first two units has already been ordered. It is the intention of the company to transmit power to southern Idaho and northern Utah.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.—The next convention of the National-Interstate Telephone Association will be held at the Auditorium Hotel, Chicago, Ill., June 26, 27 and 28, next. Mr. A. L. Têtu, Nashville, Tenn., is secretary of the Association.

AN ELECTRIC RAILWAY FOR CHINA.—Lim Dat, a wealthy Chinese merchant of Victoria, B. C., is interested with a number of his associates in a plan to build an interurban electric railway from Canton to Sanwu, China. The city of Canton has a population of 2,000,000 and Sanwu has 500,000 residents. At the present time the service between the cities is an antiquated junk line on the River Sanwu, a distance of about 90 miles. These junks are towed by a launch and carry both passengers and freight. The trip takes about 14 hours. Each of the junks, however, carries about 200 passengers. The electric service to be initiated will make the trip a matter of only three hours, and will reduce the cost very considerably. Lim Dat intends to utilize a stream from the Quaitongshun Mountains for hydro-electric power.

MADISON BRANCH, A. I. E. E.—The March meeting of the Madison, Wis., branch of the Institute was held on Thursday evening, March 15, at the hall of the H. L. Doherty Club and the subjects of "Telephone Engineering" and "Aereal Cable Construction for Telephone Exchanges" were discussed by the members present. Mr. J. B. Kommers abstracted Mr. Carty's paper on "Telephone Engineering," and Mr. C. W. Burkett presented a very excellent paper on "Aerial Cable Construction for Telephone Exchanges." At the conclusion of his paper, Mr. Burkett showed a series of lantern slides comparing the old methods of open wiring previously employed with the much neater and more permanent construction with the use of cables. The meeting was very well attended and the subjects were extensively discussed. A short social meeting followed the reading and discussion of the papers.

HIGH-VOLTAGE EXPERIMENTS.—Some important experiments are being made at the Thury Works in Geneva, Switzerland, on high-voltage transmission by direct current. The experiments indicate that the use of 100,000 volts direct current is entirely practicable, and that by connecting the neutral point of the generating machine to earth at the station a voltage of 200,000 between the wires of a transmission circuit is practicable. The experiments have also shown that in underground cables a direct-current voltage may be employed more than twice as large as with alternating currents. For example, a cable pierced at a voltage of 30,000 alternating current was found to withstand between 70,000 and 80,000 volts direct current. In the experiment alternating currents of perfect sine wave form were used and there were no resonance effects, which latter would still further militate against the alternating current.

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Dr. Thaddeus Cahill.

Thaddeus Cahill, the inventor of the beautiful electric-music system, described in the Electrical World of March 10, 1906, was born in the State of Iowa in 1867, the son of a physician, and was educated at Oberlin in the Western Reserve of Ohio, a village noted for its happy blending of Puritan earnestness and modern culture, and the seat of an endowed conservatory of music that is one of the best in the United States. He acquired the rudiments of an English education and of Latin and Greek under private tutors, entered the Oberlin High School in 1883, and graduated in 1884, the youngest member in his class and at the head of it. The next year he studied in the Oberlin Academy, but an active spirit and the desire to perfect certain inventions in which he was interested led him to break away from the routine of college to have more time for inventive work. He was then interested in certain musical experiments and inventions, from which the electric-music system has grown, and also in certain plans to increase the output of the typewriter and to reduce the labor and fatigue of operating it.

From 1885 to 1888 he divided his time between inventive work, in which his father and brothers generously encouraged and assisted him, and college studies under private tutors. To find leisure and means for his studies, he obtained a clerkship at Washington in 1889, with a member of Congress, the late Amos J. Cummings. First as private secretary to Mr. Cummings, then as clerk of the Committee on the Library of Congress, and later as stationery clerk of the House of Representatives, the young inventor found leisure both for legal studies and for inventive work, which during this period consisted partly in the making of models and experiments, but chiefly in the making and remaking of one elaborate set of drawings after another.

On going to Washington, in 1889, Mr. Cahill began to read law, and in 1892 he graduated from the Columbian (now George Washington) University Law School, where he stood third in a class of more than 100, and was one of five to receive honorable mention from the law school faculty, of which Judges Harlan and Brewer, of the United States Supreme Court, and Judge Cox, of the Supreme Court of the District, were members. In 1893 he received the degree of LL.M. In 1894 he was admitted to the bar. In 1900 he received the degree of D.C.L. for legal studies from the Columbian University.

DR. THADDEUS CAHILL.

During his school days in Ohio the physics of music and the defects of existing musical instruments had engaged his attention. He made many experiments with a view to the production of music electrically, but without achieving entirely satisfactory results. In Washington, as noted, he gathered together the tangled threads of the electric-music plans, which had occupied him in boyhood, and became convinced that music by electricity, to be generated with the most beautiful chords and perfect expression, by living performers at a central station, and distributed therefrom to the homes of the people, over a wide area, was a practicable thing, which he could carry out. Another invention upon which he worked was the electrical typewriter, bearing his name. For several years he carried on both lines of investigation in parallel.

His first "telharmonium," submitted to Lord Kelvin in 1902, though less perfect than subsequent ones, and from the number of generators limited to music of a simple character, produced such beautiful effects as to impress every one who heard it. In 1902 Dr. Cahill established a larger laboratory at Holyoke on the Connecticut River, under the superintendency of his brother, Arthur T. Cahill, where his work has since been carried on. In 1903 he removed his Washington laboratory to Holyoke, and commenced the construction of a large commercial plant, for lease to the New England Electric Music Company, of which Mr. F. C. Todd is president. This plant is substantially complete, while a second large plant is well under way for installation by Mr. Oscar T. Crosby in New York City.

Electrical Equipment of Wanamaker's New York Store.

THE new building erected by John Wanamaker in New York to accommodate some of the departments of his store already established at Broadway, Fourth Avenue, Ninth and Tenth Streets, is a fourteen-story steel-cage structure of the most modern type and occupies the square block south of the older building. The new store embodies in its design the highest development of mechanical and electrical equipment as applied to the requirements of department-store service. The installation provides for the generation of electricity upon a large scale for lighting and for motors, and also for the heating, ventilating and mechanical service of both the old and new buildings.

GENERATING EQUIPMENT.

The power plant occupies the sub-basement which is divided into four sections; one section is devoted to the boilers and boiler auxiliaries, another section is given over to the electrical generating apparatus and hydraulic elevator pumps, a third section is occupied by ventilating equipment, and the fourth section contains the house pumps, air compressors, refrigerating equipment, filters and auxiliary apparatus.

Steam is generated in eight 300-hp Babcock & Wilcox boilers arranged in four batteries. Passageways are provided between the batteries, and an 8-ft. area in the rear contains the blow-off tank and piping together with the bilge pumps and other auxiliaries. A large firing space is provided in front of the boilers with two industrial railway tracks for coal and ash cars. Coal is stored in a 300-ton pocket beneath the Fourth Avenue sidewalk, from which direct delivery is made to the narrow-gauge cars. Feed-water piping and pumps are in duplicate, city water being used and preheated in Webster open feed-water heaters.

Fig. 1 is a view of the engine room showing some of the generator units. The equipment consists of six 300-kw generators each of which is direct-connected to a horizontal cross-compound Buckeye engine operating non-condensing under a steam pressure of 150 lbs. The engines are provided with a gravity oiling system, a force-feed cylinder lubrication, a combined telescopic crosshead oiler and indicator reducing motion; but owing to the lack of space the tail rods usual in this type of en-

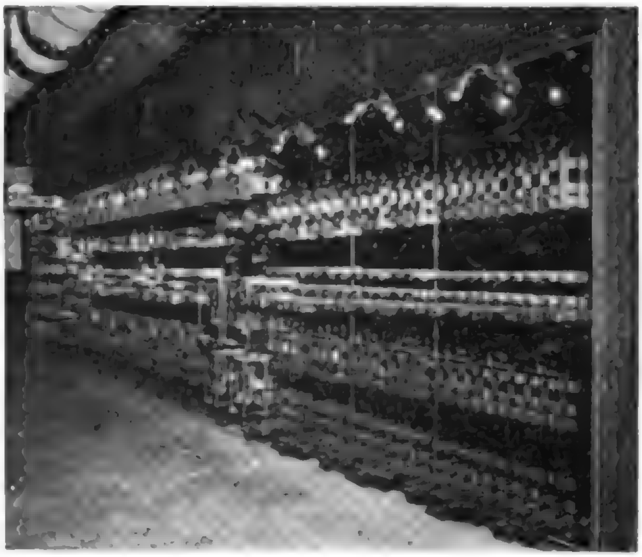

FIG. 2.—SWITCHBOARD, NEW YORK WANAMAKER STORE.

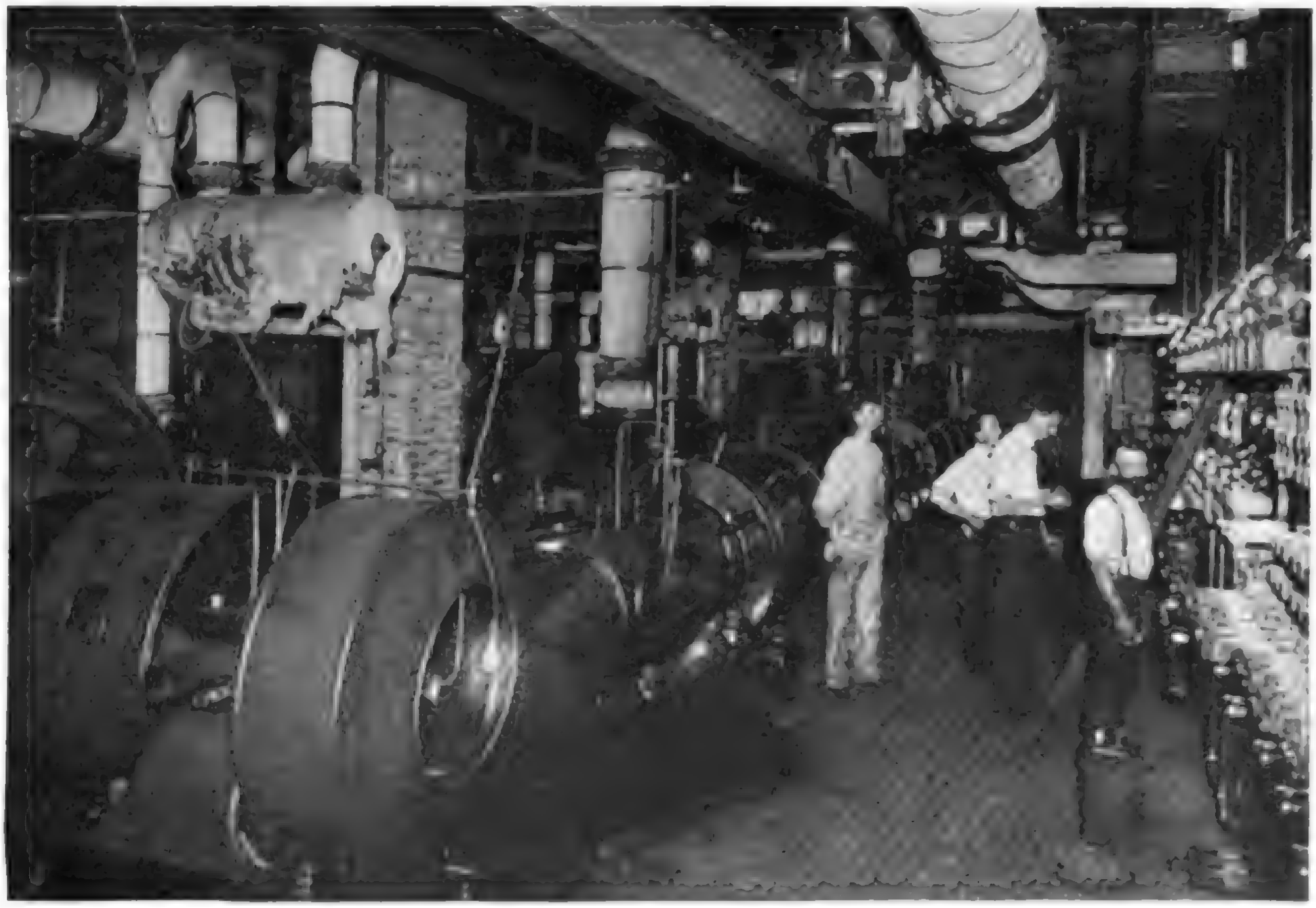

FIG. 1.—ENGINE ROOM OF THE NEW YORK WANAMAKER STORE.

gine were omitted. The engines are mounted together with their generators upon heavy cast-iron sub-bases which completely tie the high and low-pressure side together and also furnish support for the generators. Because of the many columns in the basement it was necessary to arrange the engines so that one of these columns would come between the cylinders which also necessitated a change in the position of the receiver. The exhaust steam from the engine and all auxiliaries is utilized for heating the buildings and also the hot water supply.

The electric generating equipment consists of six 300-kw direct-current, three-wire Westinghouse generators delivering current at an e.m.f. of 230 volts. The ratings of these machines provide for 25 per cent overloads almost continuously and 50 per cent overloads for at least two hours without excessive overheating. The neutral of the three-wire system is taken from auto-transformers back of the switchboard which are supplied from slip rings on the armature. The transformers are of small capacity, being designed for only a limited unbalanced load upon the system which has been very carefully planned for ease of balancing.

DISTRIBUTION SYSTEM.

The distributing system involves many interesting features and embraces radical departures in the arrangement of conduits, risers and panel-boards. The switchboard controlling the generator and distribution circuits is shown by Fig. 2 herewith. This is made up of fourteen panels of which six are devoted to the generators, two are totalizing, and the remaining six panels are for feeder circuits. Of these the three in the foreground control the feeders for the lighting system only, while the three at the opposite end of the board feed motor circuits. Each generator panel is equipped with two ammeters, a field rheostat handle, a voltmeter plug, a four-pole main switch and a four-pole "reversite" circuit breaker. Two voltmeters are swung from one end of the board in the usual manner, one of which is permanently connected to the bus-bars, while the other may be cut in on the leads of any generator by the usual switch. The totalizing panel at the left of the generator section is for the motor circuits, and is equipped with two voltmeters, an ammeter, a recording watt-hour meter and testing

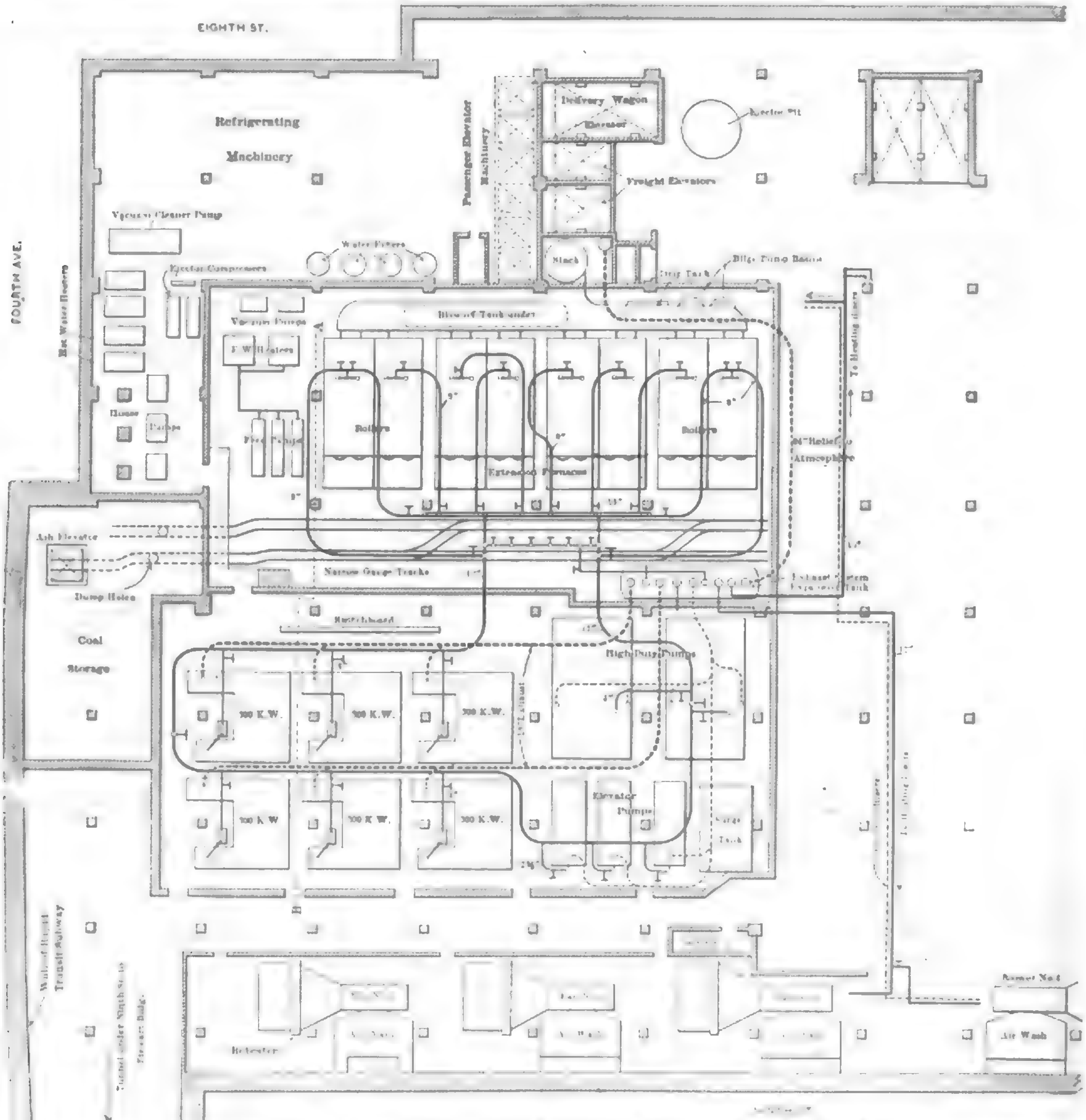

FIG. 1.—FLOOR PLAN OF MECHANICAL EQUIPMENT, WANAMAKER NEW YORK STORE.

equipment consisting of an ammeter, recording watt-hour meter and a selector switch for the voltmeter. The totalizing panel to the right of the generator section is for lighting circuits and is equipped like the power panel, excepting that the equipment is in duplicate because the lights are fed from a three-wire system while the motor circuits are two-wire.

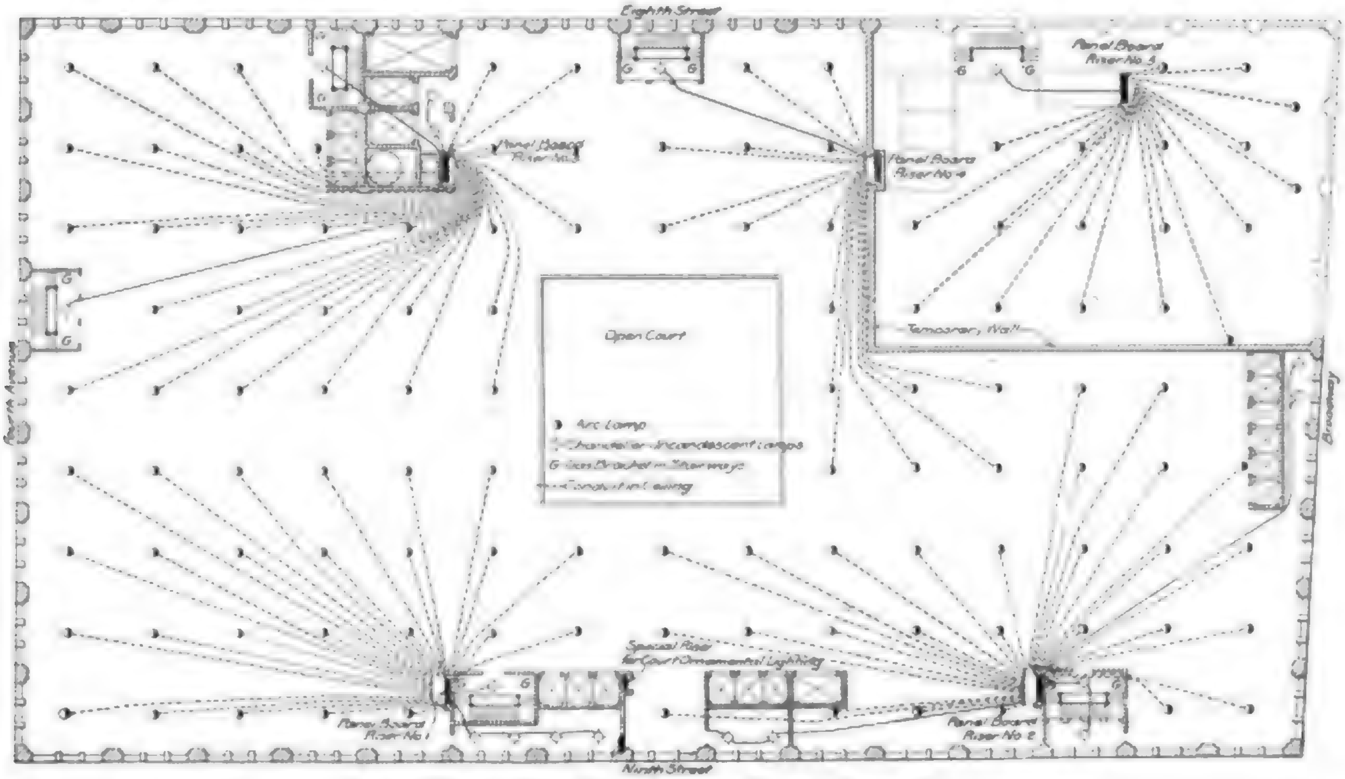

Fig. 4.—Typical Floor Plan, Showing Electric Light Circuits.

The power feeder panels control 31 motor circuits, four of which are in reserve and one is a large trunk feeder leading across the street through a tunnel to the older building. The lighting feeder panels control 14 three-wire feeder circuits, two of which are trunk feeders to the building across the street. Reference to the engraving will show that the switches on the board are in duplicate; one set being used for testing purposes. Each switch has immediately below it a switch of the same capacity which is connected with the testing equipment on the totalizing panel. By closing this switch and opening the regular feeder switch the power consumption of that part of the building fed through the feeder may be ascertained.

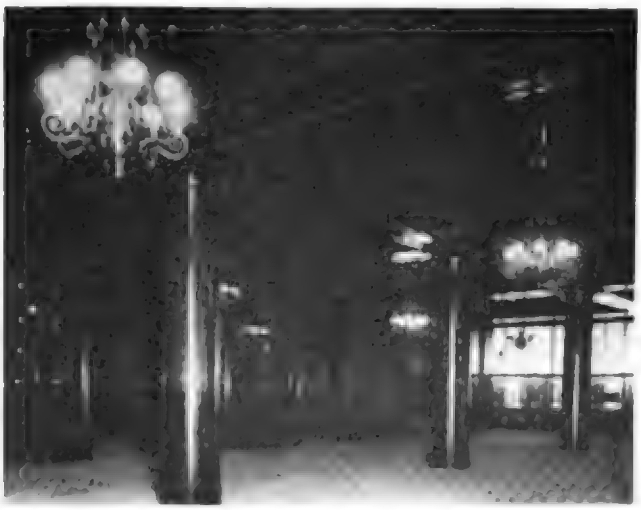

FIG. 5.—LIGHTING IN PIANO ROOM.

The entire ventilating outfit is driven by direct-current motors through Morse chains, the motors ranging in size from 5 hp to 60 hp and totaling over 400 hp With the exception of the elevator and feed-water pumps, all the pumps in the establishment are motor-driven; these include bilge pumps, compressors for sewage ejectors, house pumps supplying fresh water to tanks on the roof, pumps in the refrigerating room and pumps for the vacuum system for cleaning carpets, etc. Some of these motor-driven pumps are shown in the accompanying engravings.

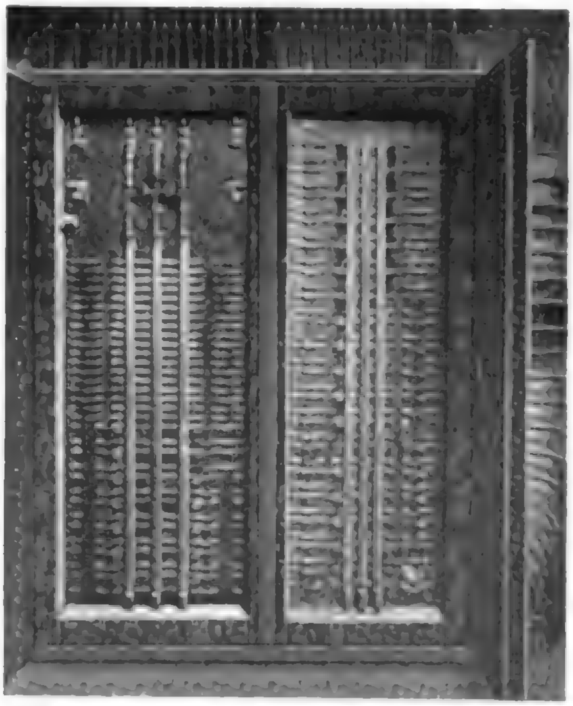

FIG. 6.—VIEW OF ONE OF THE LARGE PANEL BOARDS.

The building is divided electrically into five sections, four sections being at present in use. Each section has two centers of distribution, one below the first floor level and the other below the ninth floor level; the former supplies all the panelboards in its particular section from the sub-basement to the second floor, while the latter supplies the panelboards from the third floor to the attic. Sub-feeders extend upwards and downwards from these centers of distribution to panel boxes on each floor, which control the local circuits. The feeders rise to their respective panels in special shafts, which are in reality closets extending from floor to floor, the feeders passing through the floors in the usual manner. The panelboard itself is fastened to angle-iron supports extending from the floor to the ceiling above, and is encased in a sheet-steel casing, as shown in Fig. 6 herewith. This casing, together with the feeders and conduit, is located within a spacious closet with double hinged doors. The feeders are enclosed in conduit only where they pass through the concrete floor, being run as open work from floor to floor, the angle-iron supporting the panel-box also acting as a support for iron strips which hold the insulators through which the cables pass. The advantage of this arrangement, aside from the resultant economy, is that the entire panelboard and its connecting circuits are rendered easily accessible, being entirely unconcealed from floor to ceiling, and this without affecting the interior finish of the store. These risers are in all cases of heavy insulated cable 500,000 cir. mils to 1,000,000 cir. mils in area; sub-feeders range from 400,000 cir. mils to 500,000 cir. mils in area. The layout permits a maximum drop of five volts volts from the switchboard to the farthest outlet; the maximum allowable feeder drop being three volts, while the drop in banch circuits does not exceed two volts. It is thus possible with a generator voltage of 230 on a three-wire system to use 110-volt lamps in the farthest outlet.

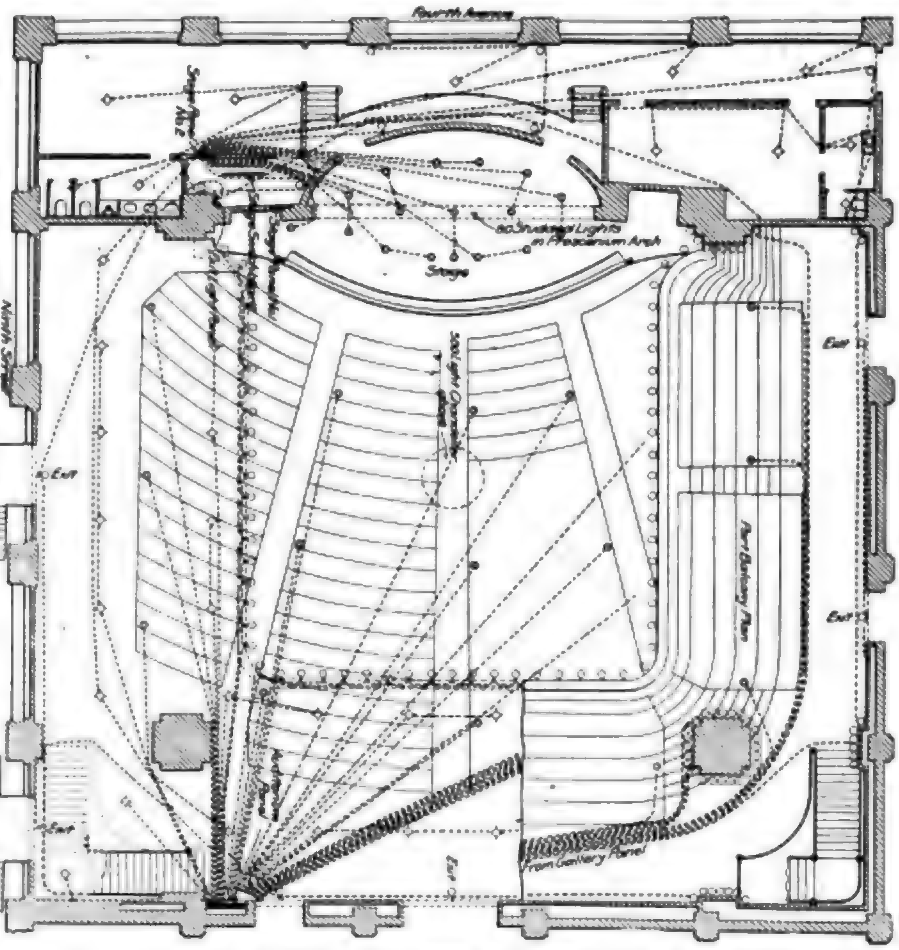

FIG. 9.—PLAN VIEW OF MUSIC HALL, SHOWING LAYOUT OF ELECTRIC CIRCUITS.

ARC AND INCANDESCENT LIGHTING.

The greater part of the general store illumination is furnished by arc lamps. These are spaced about 20 ft. apart in all directions, from 15 to 25 arc lamps being controlled from each panelboard in the riser closets. There are about 750 arc lamps at present installed; but these are confined to certain floors, there being no arc lighting on the second, third, fifth, sixth, seventh and ninth floors. When the building is complete there will be over 1,400 arc lamp outlets available. Each arc lamp is entirely independent of the other, being fed from a separate circuit from the panel and controlled through an individual knife switch and enclosed fuse on the panelboard. The individual circuits average 60 to 70 ft., the longest being 120 ft.; they are wired with No. 12 and No. 14 wire, depending on the length of the circuit. The arc lamps are placed midway between building columns and 10 to

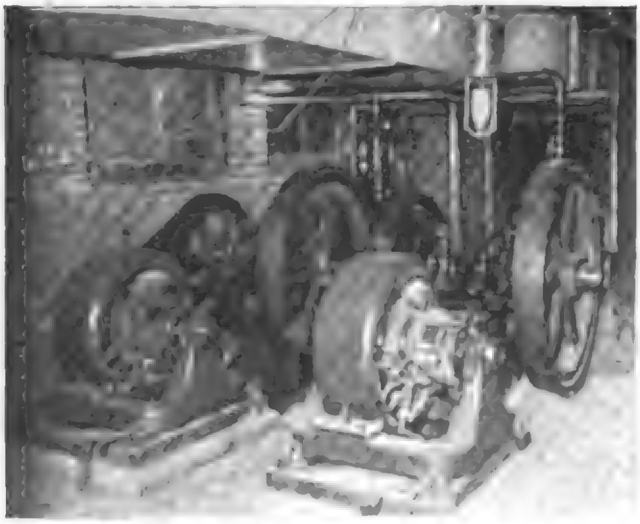

FIG. 7.—AUTOMATIC MOTOR-DRIVEN AIR COMPRESSORS.

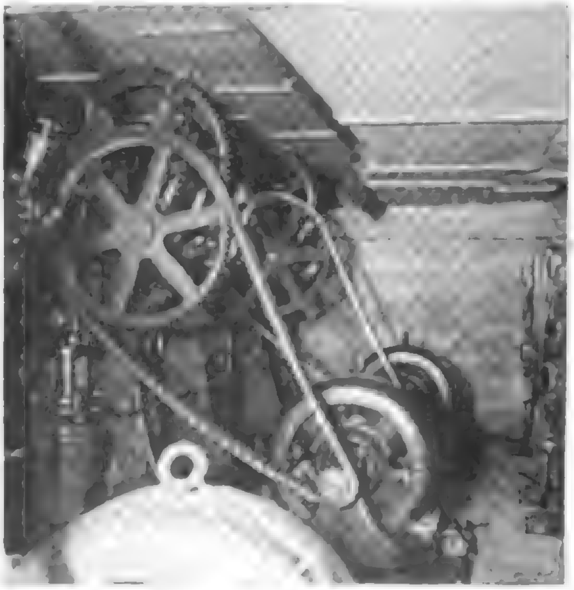

FIG. 8.—MOTOR-DRIVEN HOUSE PUMPS.

12 ft. above the floor. The lamps used operate at 115 volts and at 6.6 amp. have 1,200 nominal candle-power. The lamps are of Stanley-G. I. make and are of the enclosed type.

Incandescent electric lighting is depended on entirely on many floors, and is also used to supplement the arc lamps on other floors. In the sub-basement incandescent lighting is used very largely, 240 outlets being provided, while in the show windows both on the street and in the Rapid Transit Subway station, in the art gallery and in the music hall, concentrated lights are used with special Frink reflectors. In the piano show rooms on the second floor and also in the model house and the music hall, studded ceiling lights are extensively used, almost 800 outlets having been provided for this purpose. The chandelier lighting in one section of the piano room is shown by Fig. 5. It would appear from the engraving that the distribution of lights was not good, but this is not the case. The decorative color scheme in this section is of such a character that truthful photographic reproduction is impossible. The outlets in the conduit system number 4,824, of which 847 are for chandeliers, 297 for brackets, 777 for studded lamps, 494 for drop lights, 249 for attachment plug boxes and 222 for floor boxes, the remainder being used for switches, arc lamps, etc. All elevator shafts are provided with plug sockets at every floor in order to facilitate shaft lighting for mechanics at work in the shafts.

The general riser system is supplemented by a separate riser group for the ornamental lighting in the open court in the center of the building. Panelboards are installed at every third floor, which control branches to the intervening floors. There are no lights in the court, however, above the eighth floor, an ornamental skylight spanning the court at this point.

EXHIBITION OF RESIDENCE ILLUMINATION.

An innovation in department store equipment has been made in the Wanamaker store by the addition of a music hall having a seating capacity of 1,200 persons, and a model house. The latter is a typical two-story suburban dwelling erected within the building at the Fourth Avenue and Ninth Street corner of the sixth and seventh floors, occupying a space about 85 ft. square. Eighteen rooms are provided in the house, which will be used for exhibition purposes to demonstrate methods of furnishing and suggestions for furniture designs and interior decorations to harmonize. Fig. 10 shows the first floor plan of this model house, including the layout of the wiring and conduit for lighting. The Louis XV salon has a domed ceiling oblong in shape, around the edge of which is a row of 28 studded lights to heighten the artistic effect of the decorated ceiling. The room is also provided with five chandeliers and four two-outlet brackets, the center chandelier having nine lights and the others four lights each. The switches controlling the lights are placed near the door. In the dining-room a very pleasing effect is obtained by an arched ceiling having 40 studded lights and a four-light chandelier in the center. In addition three two-light brackets are provided at the sides and a floor outlet in the center of the room for a table candelabrum. The garden has a vined trellis around the four sides and a fountain in the center. Two rows of studded lights are placed in troughs fixed to the trellis work and special reflectors throw the light upwards, giving a soft moonlight effect. In addition there are 44 drop lights under the trellis for Chinese lantern effects.

The lights in the model house are controlled from a centrally-located panelboard in the hall, from which lead 42 circuits for the first floor and 15 circuits for the second floor. The lights are in almost all cases controlled from local switches, and six-light receptacles are provided for decorative light connections. Additional circuits other than those shown in the plan have also been provided for future decorative lighting schemes, and these are controlled from an auxiliary panel located beneath the stairway on the first floor. The model house panels are supplied by three 300,000-cir.-mil feeders from the No. 1 group of risers.

The lighting circuits in the music hall are shown in Fig. 9. In the center of the ceiling is a 300-light chandelier, while a row of 80 studded lights is arranged on the proscenium arch, and a row of 60 bracket lights skirts the inner edge of the balcony. The stage is lighted by a row of 80 footlights. There are, in addition, a large number of bracket lights and small chandeliers for lighting the sides and rear of the auditorium and balcony, a large number of studded lights over the rear of the balcony, and floor outlets in all parts of the auditorium floor and balcony for special lighting. In the right wing of the stage are two panelboards which control all the purely theatrical lighting; standard dimmers controlling the lighting intensity of the footlights, proscenium arch, large chandelier and floor outlets on the stage, the auditorium lighting being controlled from the rear of the auditorium. A special panel is devoted to the lighting of the exits, the exit lighting circuits being installed independent of the other panels. In this respect the lighting of the music hall conforms to regular theatre practice, exit lights being installed at the 12 exits to the fire escapes and store proper.

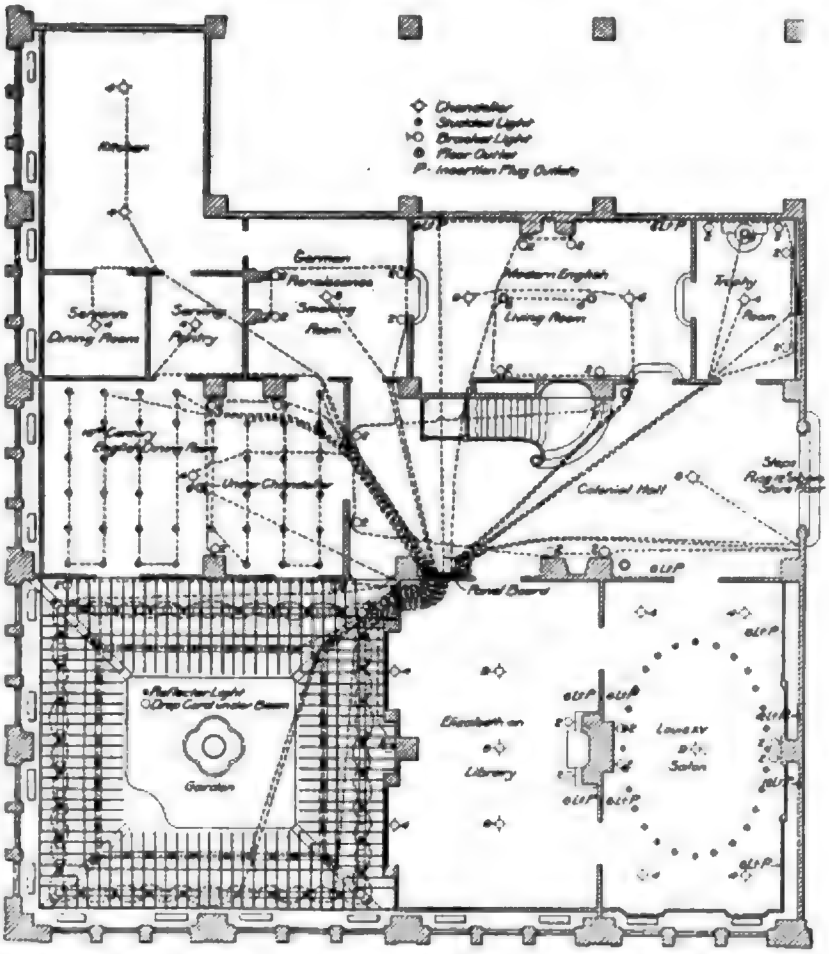

FIG. 10.—PLAN VIEW OF FIRST FLOOR OF MODEL HOUSE, SHOWING LIGHTS AND LIGHTING CIRCUITS.

The chandelier is wired for 24 circuits, each consisting of three No. 6 wires in conduit. The footlights and proscenium arch lights are fed from two circuits. The panels in the auditorium and balcony control 58 three-wire circuits, the general arrangements of which are indicated in the drawing. The pipe organ installed in the spaces on either side of the stage has a 15-hp motor to operate it and the echo organ is equipped with a 2-hp motor. Fresh air is supplied to the auditorium by a 30-hp motor-driven fan, while the vitiated air is pumped out by an exhaust fan driven by a 20-hp motor. Thus it will be seen that ample provision is made to insure an adequate supply of fresh air, and the removal of the foul air, which is so essential in a hall of this character.

TELEPHONE AND SIGNALING WIRING.

An interesting arrangement of conduits has been installed on all floors for bell, telephone and signal wires. Three lines of 1¼-in. galvanized-iron pipe are laid under the floor from the riser shafts and encircle the floor in such manner that all parts of the floor are within short range of the outlet points. Connection boxes are installed at intervals of 40 to 50 ft., into which the three lines of conduit are bushed. These boxes are of pressed steel 18 in. square and have tight-fitting brass cover plates flush with the surface of the finished floor. Service outlets through which connections are extended to telephones, bells, etc., are located approximately 10 ft. apart throughout the entire system. From these outlet tees and the vacant sides of the connection boxes, wires are fished under the floor to any desired point. The tees in the conduit lines are entirely concealed beneath the floor, but are accessible through removable sections of the flooring above them held by two screws. The tees are normally plugged, but are fitted with outlet bushings when connections are to be made through them.

The connections for these low-voltage circuits are made through 2-in. conduit risers located in the same closets with the lighting risers. These auxiliary risers are provided with special interconnected panels at every floor through which branch connections to the under-floor conduit systems are easily made. The interchanging of connections may also be easily accomplished at these panels, which are also valuable for making tests of the various systems.

All telephone lines within the building are run in conduit, as well as all bell and signal wiring, watchman's time detector circuits and fire alarm signal systems. Additional low-voltage circuits may be added at any time and for any purpose whatever with a minimum of trouble.

The wiring in the building is installed in extra heavy loricated conduit, of which over 75 miles is in use. The switch and panel-boards, some of the latter controlling over 60 circuits, were supplied by the H. Krantz Mfg. Co., of Brooklyn, N. Y. Bossert outlet boxes are used and Hart switches and baseboard plugs, the floor outlets being of Stanley-G. I. make. The architects and engineers of the building were D. H. Burnham & Co., of Chicago, and the Thompson-Starrett Co., of New York, was the contractor for the entire electrical installation.

Polonium Rays.

Thomson and Rutherford suspected that polonium rays, although they produce a positive charge by their impact, do not consist of purely positive particles, and Rutherford estimated that for every four α particles emitted one electron was also emitted by polonium, thus reducing their apparent positive charge. Soddy also supposed that both positive and negative corpuscles are generated by the impact upon the gas of neutral particles, which alone, he maintained, are emitted by the polonium. In order to test these questions P. Ewers has adopted a new apparatus which is described in *Physikalische Zeitschrift*. The apparatus consisted of a copper disc coated with polonium and surmounted by a nest of small copper boxes serving as diaphragms, and enabling the observer to control the path of the particles shot out from the polonium. The boxes had such dimensions that no particle could reach the upper plate unless it were projected at an angle of at least 55° to the lower plate. By employing magnetic and electric fields of different strengths he was enabled to prove that the negative particles are the slowly-moving electrons discovered by J. J. Thomson. He does not agree with Soddy and Bragg that the positive charges are acquired by collision, since higher potential gradients fail to increase the ionization of the residual gas.

Central Station Notes from Madison, Wis.

MADISON, WIS., has always been a place of unusual interest to central station men on account of its lighting plant occupying the position of a kind of school in which young men are educated in the practical part of the business for service in the other plants controlled by the American Light & Traction Company.

Madison is a rapidly growing city, having had in 1900 a population of 19,164, and according to the school census a population of 24,301 in 1905. The company has connected the equivalent of about 50,000 incandescent lamps of 16 cp. This includes the numerous Nernst lamps used for store lighting. The connected horse-power in motors is about 1,000.

USE OF NERNST LAMPS.

One of the first things that strikes the visiting central station man at Madison is the unusual number of Nernst lamps in use. These have been advocated exclusively by the company as giving better results in useful illumination than the alternating-current arc. At present writing there are 463 Nernst lamps connected. The three-glower size is the most common. It has been found that the cost of maintenance of these three-glower lamps, including labor and material, is about .75 cent per kw-hour. The maintenance of single-glower lamps is considerably higher, being over 1 cent. These Nernst lamps are inspected by a man who also brings in customers' meters for testing. He brings in the Nernst lamps whenever repairs or renewals of glowers are needed, substituting another lamp in the place of the one removed. The lamps when brought in are repaired by the man engaged in testing customers' meters.

FLAT RATE SIGN AND DISPLAY LIGHTING.

Another point which cannot fail to impress a visitor to Madison who is familiar with the usual appearance of down-town streets at night in a city of this size is that there is an unusual amount of sign and decorative lighting as well as show window lighting. The company has connected the equivalent of 4,279 16-cp lamps for this class of work. This sign lighting is taken at a flat rate of so much per year. This flat rate is equal to what the bills would be if the energy was sold according to meter on the Doherty system of charging used in Madison. These flat-rate lamps are turned on and off by the company's patrolmen and burn an average of six hours each night. The following figures are used in calculating the schedule of rates for this kind of work:

A readiness-to-serve charge of 15 cents per month or $1.80 per year per 16-cp lamp or its equivalent is first made. To this is added $12 per year or $1 per month for service charge to cover the expenses of the patrolmen, bookkeeping, etc. The amount of energy that will be consumed at 6 cents per kw-hour burning six hours per night is then caculated and added to the foregoing charges.

The effect of the campaign for this kind of contracts is made very apparent by the load curve for a typical day in December, 1903, as compared with December, 1904. At 7.45 p.m. in December, 1903, which was immediately after the evening peak, the load was 400 kw. The same hour in December, 1904, the load was 700 kw. The Doherty system of flat rate contracts for sign and display lighting was inaugurated at Madison in the summer of 1904.

POWER PRODUCTION.

The company owns two plants. The old plant is notable for its economy and the new plant for the collection of new prime-movers contained therein. The old plant is equipped with two Hazleton upright "porcupine" boilers of 300 hp each and one Stirling water-tube boiler of 300 hp. It is located so as to secure condensing water from the lake and coal from a railroad siding. The engine equipment consists of Russell medium speed compound condensing engines of various sizes, most of which are belted to generators. There is one large direct-connected, alternating current generator. This was one of the first plants to adopt the monocyclic alternating-current system, and some of the generators are of this type, being operated in parallel with three-phase apparatus. The lighting service is supplied by 2,300-volt primary, 60-cycle alternating current, and the power service by 500-volt direct current, necessitating the operation of two classes of generating machinery continuously.

This plant is a good illustration of the fact that it is not necessarily the newest and most ornamental station that makes the best showing in economy. While it is a substantially constructed and well-maintained station, many engineers would doubtless turn up their noses at the belted machinery and various other not altogether up-to-date features, until they learn that it holds the best record for economy of any of the electric power plants controlled by the American Light & Traction Company. This plant produces a kilowatt-hour with an average consumption of 5 lb. of Youghiogheny coal. This coal contains about 13,000 B.t.u. per pound. While this may not be a remarkable record for a large power plant with large, extremely economical units, it must be remembered that this is a plant of medium or even small size, and that the units are many of them belted and of various small sizes. The secret of the good record is undoubtedly due to the close watch which is kept on station economy. A combination of engines can always be found which will nearly fit the load, so that engines do not have to be run greatly underloaded. Three firemen are employed in this plant, each working a 10-hour shift, so that shifts overlap part of the day. All coal is brought out from the storage bin and weighed by the firemen before being used under the boilers.

The new plant is in a fine fire-proof structure adjoining the company's gas works. It contains three Westinghouse gas engines and a Westinghouse-Parsons steam turbine. These gas engines run on unpurified coal gas. They are of the three-cylinder type, two of them being of 280 hp each and one of 125 hp. They have been in operation about four years. They are used for operating railway generators, as the company sells energy for operating the street railways in Madison. The railway generators are operated in parallel with a 240-amp.-hour storage battery. These gas engines are excellent for responding quickly to emergencies. It has been repeatedly demonstrated that a gas engine can be started and have its generator carrying load in one minute. This is not a show performance, as on a number of occasions, when it has been necessary to shut down one of the engines quickly, another one has been started up to take its load without interrupting the railway service.

The Westinghouse-Parsons steam turbine was installed November, 1904. Tests have shown its steam consumption, including the dry vacuum pumps and the belted feed pump, to be 27.8 lb. of steam per kw-hour at three-quarters load. In actual service the consumption of coal per kw-hour is 4.54 lb. It is rarely worked below three-quarters load as it is employed as a peak load unit. The rest of the load is carried by the old station. The turbine runs an average of six hours per day. It is of 400 kw capacity, operating at 3,600 r.p.m. A device has been installed on this turbine by Mr. F. M. Richards, superintendent of manufacture for the company, which is designed to prevent accidents due to the failure of the oil pump. The float valve in the oil pump gives warning if the proper oil level is not maintained, so that the attendant can immediately start an auxiliary oil pump. The boiler plant supplying this steam turbine consists of two Wicks boilers, each of 300 hp. Only one fireman is needed at this plant, and he weighs all coal.

DISTRIBUTION.

The power distribution circuits are all 500-volt, direct current. No attempt is made to do much motor work off of the alternating lighting feeders. The lighting distribution is by means of single-phase circuits from three-phase bus-bars. All energy is metered at the station and at the consumer's service switch, except that no meters are used in flat-rate sign and display lighting, the consumption of which is known. The extent to which customers have been grouped on large transformers can be seen when it is stated that there are only 50 transformers connected. The standard sizes used are 10 and 15 kw capacity, although there are two large transformers of 50 kw capacity.

In the downtown district all of the secondary mains are connected together through the medium of fuses. Each section of secondary main is supplied by one transformer. In case the fuses blow on a transformer, it will not overload and blow the fuses on neighboring transformers, thus causing the spread of trouble. The fuses used between secondary sections are of the enclosed type. Transformer primary circuits are fused with D. & W. enclosed fuses. In the down-town district these section fuses are inspected about once a week, and the load on the transformer during the peak is measured to prevent overloading some transformers and underloading others, as is likely to occur where frequent measurements are not taken and a number of transformers are feeding into the same secondary network. This practice originated at Denver and was described by C. W. Humphrey, chief engineer of the Denver Gas & Electric Company, in a paper before the National Electric Light Convention in 1904. The secondary distribution is on the three-wire system. The neutral wire is not fused.

The neutral has not been grounded in the past, but the company is proceeding to do so as fast as possible. This will be done by means of buried copper plates in the manner indicated in the National Electrical Code. This is done in the interests of safety of life and property and to prevent dangerous voltages accidentally existing on secondary low-tension circuits. The company is troubled very little from crosses with other lines, because most of the primary feeders are on a high pole line far above the other wires on the streets, so that the falling of telegraph and telephone wires does not cause trouble to the light and power service. The company keeps a number of large maps, one for each class of distribution. Thus one map shows the primary feeders, another map shows the secondary mains, another the 500-volt power distribution and another the arc circuits.

The company has about 2,500 consumers' meters in its electrical department. To test these meters and inspect and maintain Nernst lamps two men are required, one for outside work to bring in meters and lamps, and another who does nothing but test and repair work. Meters are brought in for testing purposes about once in two years. Meters are mainly Westinghouse and high-torque General Electric types. It is considered that with modern meters this is a sufficiently frequent test.

The company charges $4.50 for making a service connection. In outlying districts, where a customer wishes service who is beyond the company's lines, extension will be made for him upon payment of the cost of the extension, and as new customers are added this amount will be rebated to the first customer. The company's position is that it is not in the real estate speculation business, and that the customer should assume risks incident to extending into places, the growth of which is uncertain.

NEW BUSINESS DEPARTMENT.

In common with other American Light & Traction Company properties, this company has a very active new business department, started in May, 1904. From that time until October, 1905, three men were employed in this department. Two men were then added, making five in all. More attention is given to pushing the gas business than the electric, although one-half of the solicitors' time is charged to the electrical department. About 95 per cent of the company's gas output is used for heating purposes, which goes to show how little legitimate competition there is between gas and electricity. The results produced by the new business department in securing sign and display lighting have been described in the paragraph devoted to that subject, in which it is shown that an enormous increase in the evening load after peak hours was made as a result of the first six months' work.

A clever bit of advertising was devised by Mr. George Williams, manager of the new business department, just before the holidays. He had photographs taken at night of 36 stores in Madison which had fine outside or inside electrical displays. Half-tone engravings were made from these and printed on a single sheet as a poster. In the middle of the sheet were the words:

"Snap shots of every-night illuminations in Madison, the ideal shopping center of Wisconsin. Christmas shopping has already begun in Madison. Madison stores are renowned for their reliability and select assortments; in fact you get more actual value and satisfaction from purchases made in Madison than is possible in most larger cities in the country."

These posters were furnished free to whatever merchants in Madison wished to send them to their customers in the surrounding country. It was a good advertisement for the merchants and indirectly an excellent advertisement for electrical display and was something to set the unprogressive merchant to thinking whether he had not better light up.

The system of paying solicitors in Madison was described by Mr. C. H. Williams in a discussion at the Northwestern Electrical Association and given in the February 3 issue of this journal, page 276. The solicitors received a fixed salary, plus a commission based on the amount and character of the business secured. A regular schedule has been made up for determining the number of points each class of business counts.

RATES.

The Doherty readiness-to-serve rate has supplanted the old system of rates for most of the long-hour business. Readiness-to-serve charges consist of 15 cents per month per 16-cp lamp, or its equivalent connected, plus $1 per month service charges, plus 6 cents per kw-hour for the energy consumed as measured by meter. This system of charging is especially favorable to long-hour customers. Those whose kw-hour consumption is low in proportion to the number of lamps connected, as in residences, find it cheaper to adhere to the old schedule, which is as follows:

Minimum bill, $1.00 per month.
16c. per kw-hour for consumption between 6,250 and 26,000 watt-hours.
14c. from 26,000 to 52,000 watt-hours.
13c. from 52,000 to 78,000 watt-hours.
10c. for 78,000 or more watt-hours.

The Doherty rate was put in effect quietly about four years ago. About 100 customers were taken on in a year on this contract without advertising it. After a year's trial, the company began to advertise it, with the result that most of the long-hour customers changed to the Doherty contract. The effect temporarily was to reduce the gross receipts, but in about a year, the change brought enough increased business to make up for the temporary set-back. The effect of the Doherty rate has been to keep down the number of lamps in a store and to encourage the longer use of the lamps installed. Thus, customers who had wired their stores for an enormous number of lamps, only a few of which were ordinarily used but which were turned on during the peak load, were influenced to cut down their connected load and increase the consumption of energy. This use of light a greater number of hours per day by certain merchants had its effect on other merchants on the same street, who were also obliged to light up evenings if they were to appear progressive.

The company furnishes free renewals of standard clear bulb lamps from 10 to 50 cp. The first installation of lamps must be paid for by the customer.

Mr. H. H. Scott is superintendent of the electrical department of this company, and John Corscot, a former mayor of Madison, is general manager.

New Type of Condenser.

A patent was issued March 13 to Prof. R. A. Fessenden to overcome the effect stated to exist in applying comparatively large metallic sheets to the surface of a dielectric, in which case it is practically impossible to prevent the formation of minute pockets between the metallic sheets and the dielectric, these pockets containing fluids which cannot be removed and the presence of which give rise to large losses. Several forms of condensers are described. In one small areas of tinfoil are applied to a plate of mica, the adjacent areas overlapping to a certain extent. In applying these areas to the dielectric, openings or spaces are left for the escape or removal of fluids, etc., and the edges of the coatings have an additional area of insulating material to prevent discharges from said edges. In another case the tinfoil is a single sheet containing numerous perforations, and in a third case the metallic coating is formed by flattening a sheet of wire gauze between rolls.

Single-Phase Equipment for the New York, New Haven & Hartford Railroad.

Our last issue contained a brief abstract of the paper presented by Mr. B. G. Lamme before the New York Railroad Club, and of the discussion which followed the reading of that paper. A few additional details are given below concerning the electric locomotive which was described by Mr. Lamme.

The novel features embodied in the electrical equipment of the locomotive reside in the multiple unit method of control, as was noted last week. The mechanical construction of the locomotive also presents several novel and interesting features which deserve special consideration.

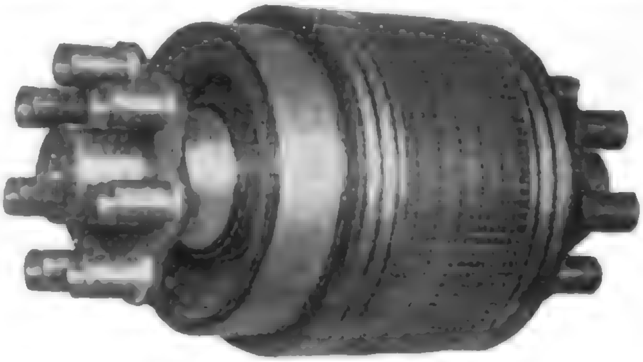

FIG. 1.—ARMATURE COMPLETE WITH QUILL.

Owing to the fact that the entire space between the wheels is occupied by the motors, it was impossible to transmit the draw-bar pull through the center line of the locomotive in the usual way. Instead of this, strong plate girders heavily cross-braced are carried outside of the wheels and the entire strain of the draw-bar is carried to these through strong box girders having top and bottom plates 42 in. wide. Directly underneath the girder at each end is a Westinghouse friction draft gear to which the draw-bar is attached. The entire design lends itself to a very strong construction without great weight. The cab is built up of sheet steel on a framework of "Z" bars. The apparatus inside the cab is carried on a framework of structural steel which is built into the cab and firmly anchored to floor and ceiling.

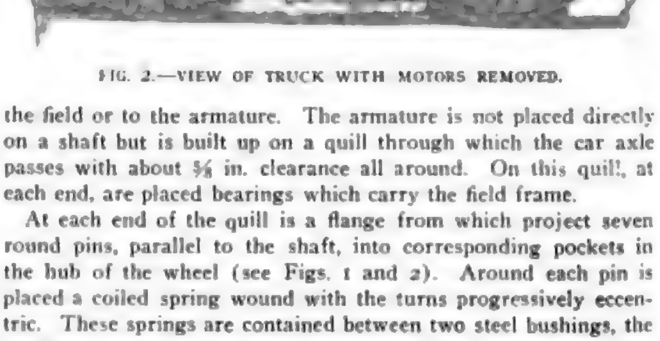

FIG. 2.—VIEW OF TRUCK WITH MOTORS REMOVED.

The frame and field of each motor are split horizontally and can be removed in halves in order to give access to the inside of the field or to the armature. The armature is not placed directly on a shaft but is built up on a quill through which the car axle passes with about ⅝ in. clearance all around. On this quill, at each end, are placed bearings which carry the field frame.

At each end of the quill is a flange from which project seven round pins, parallel to the shaft, into corresponding pockets in the hub of the wheel (see Figs. 1 and 2). Around each pin is placed a coiled spring wound with the turns progressively eccentric. These springs are contained between two steel bushings, the smaller of which slips over the pin, and the larger fits in the pocket in the wheel. These springs are amply strong to carry the entire weight of the motor, but are normally required to transmit only the torque of the motor and to keep the motor axis

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parallel to the axle. They allow a total vertical movement of about ¼ in. The end play of the motor, instead of coming directly on the wheels, is taken by strong coiled springs inside of the driving pins which press against covers in the outer ends of the spring pockets in the wheels. The torque on the motor frame is taken by heavy parallel rods which anchor the frame to the truck above and below the axle. These rods permit vertical or side motion of the motor, but prevent excessive bumping strains from coming on the motor driving springs. The entire weight of the motor is normally carried on springs supported from a steel frame surrounding the motor and resting on the journal boxes.

The frame, trucks and cab of this locomotive were built by the Baldwin Locomotive Company, on designs developed after many conferences between the New Haven Railroad Company, the Baldwin Locomotive Company and the Westinghouse Electric & Manufacturing Company. The design adopted was partially determined by the fact that the motor equipment must be suitable for use on both alternating and direct current. This to a certain extent controlled the number and size of the motors and thus affected the construction of the trucks and other parts. The results have turned out so well, however, that there is every reason to believe that this type of locomotive will be used in future even where alternating current alone is used.

The motors are internally of the same general type which the Westinghouse Company has been building for some time for interurban service. However, due to the relatively low speed of the motors, the maximum commutator speed is very low, being less than 3,000 ft. per minute when the locomotive is making 60 m.p.h. This may be compared with 5,000 to 7,000 ft. commutator speeds which are frequently attained in both direct-current and alternating-current, high-speed service with fairly large motors.

One interesting feature in these motors is the method of cooling. As a blower is used in the locomotive for cooling the lowering transformers it was decided to extend this method of cooling to the motors also. In the floor of the cab is an air conduit of considerable size from which air is piped to each motor. This method of cooling improves the continuous capacity of the motors so that the continuous rating is almost equal to the one hour rating. A further very great advantage in this method of cooling lies in the fact that the motors can be kept very clean in this manner, as the inside of the motor is kept under partial pressure at all times, tending to keep out dust and dirt, as all air flow is outward. The air furnished to the motor, being taken from the inside of the cab, can be kept relatively clean and dry.

On alternating current the motors are not operated in series parallel as on direct current, but are connected permanently in a given manner and the supply voltage is varied. This gives an equivalent of the series parallel, except that the number of efficient operating steps is much greater. There are six operative voltages, or running points, corresponding to six taps on the lowering transformer, while there are a small number of intermediate steps, which are used only in passing from one working point to another. The tests have shown that the acceleration on both alternating current and direct current is very smooth.

There is one feature in the direct-current control which is not generally found at the present time on direct-current equipments, namely, shunting the field coils for higher speeds. On the series position the motors have an efficient running point. It is usual railway practice to pass from the series to multiple position by the introduction of resistance, there being no intermediate efficient running speed. On the New Haven equipments, however, the type of motor used is one which permits an almost indefinite shunting of the coils without affecting the commutation or operation otherwise, and advantage is taken of this to obtain several higher speeds by shunting the field coils before passing into multiple. In this way several efficient running points are obtained between the series and the multiple positions.

When operated on direct current the current is fed directly to the motors. On alternating current, however, step-down transformers must be used as the trolley e.m.f. is 11,000 volts. The high-voltage trolley system is to be suspended from steel bridges, which span from four to six tracks normally, and which are placed at intervals of about 300 ft. The trolley wire is maintained in a practically horizontal position by means of a double catenary suspension in which triangular supports are placed about 10 ft. apart.

At points corresponding to anchor bridges, that is, about two miles apart, each trolley wire is broken by section insulators and is connected to the other trolley wires and to two feeder wires through automatic circuit-breakers. Otherwise each trolley wire, with its cables and supports, is insulated from the adjacent wires. In this way each wire is sectioned and a short-circuit on any one section can cut it out without putting the neighboring wires out of service. The two feeder wires just mentioned are carried the whole length of the alternating system, and by means of these and the arrangement of automatic switches, any entire section of four or more trolleys could be cut out of service and the sections beyond can be kept in service.

The high-voltage trolley will extend about 19 miles in one direction from the power house, and about three miles in the opposite direction to Stamford, and no transforming stations will be used on the part which is now to be installed.

In the main power house, which is located at Riverside, each of the generators is of the three-phase, steam-turbo type designed for 5,500 kw. These generators will at present be operated single-phase, in which case each is rated at 3,750 kw. As an illustration of the unusual conditions met with in the design of these 25-cycle machines, it is stated that a single complete armature coil weighs about 600 lb. However, as each machine has only two poles, the total number of armature coils is relatively small. As a machine in such service is liable to have short-circuits at times, the armature end windings are extremely well braced. As these machines are to feed directly into the trolley system, they are wound for the normal trolley tension of 11,000 volts, and in consequence one terminal of each machine is always grounded when in service. This point has been fully kept in mind in the design of these machines.

As the New Haven Railway Company contemplates operating certain existing direct-current systems from this power house, it was decided to add an additional leg to the armature winding, so that three-phase currents could be obtained for feeding into rotary converter stations for furnishing direct current for some lines which, at the present time, cannot be conveniently changed to straight alternating current. The New Haven Company also has other fields for three-phase power which it proposes to take care of as soon as it is feasible to do so.

The steam turbines for driving these generators are of the Westinghouse-Parsons type. The turbines are designed for the single-phase rating of the generators, as it is anticipated that the heavy service and the load peaks will be due to the railway load.

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Electric Musical Instrument.

A patent was issued last week to M. L. Severy and George B. Sinclair for a musical instrument, in which sonorous bodies, such as steel or iron strings, are vibrated through the effect of electric pulsations. The piano strings have double electromagnets located to present poles oppositely at the proper striking point of the string. In circuit with the electromagnets are a make-and-break device and a key for closing the circuit, the latter being actuated by touch at the piano keyboard. The make-and-break cylinder, which has one section or disc corresponding to each key, revolves at a uniform speed. When a contact at the key is made, a current is made and broken by the revolving make-and-break cylinder at such a rate as to give a definite number of magnetic pulsations to the corresponding electromagnet, which pulsations are communicated to the piano wire. Heretofore a difficulty encountered in this class of invention has been that among the 12 notes of an octave there are several which vibrate at a rate which can only be expressed fractionally, and exact correspondence cannot be obtained by forming a disc with a certain number of whole teeth and a fraction of a tooth. The inventors state that they have discovered that by leaving a blank space in the disc at the point where a fraction of a tooth would otherwise occur when the remainder of the disc was cut in accurate correspondence with its string's vibrations, they can obtain the desired perfect correspondence through practically the entire rotation of the disc and with no disagreeable alteration in the tone at any point. It is stated that the results accomplished by this simple expedient are wonderful, far beyond in volume and body of tone anything before accomplished in this line. The actuating electromagnet is double, and when one member is imparting a pull to the string the other member is dead. This is accomplished by having two brushes for each string, one of which is displaced circumferentially with respect to the other.

Starting Torque of Induction Motors.

By R. E. Hellmund.

Most of the publications treating of the starting conditions of induction motors deal with the determination of the average starting torque; that is, the average of the torque values which the rotor gives in its various positions. This value, however, is of little practical importance, since experience shows that in a motor which may have a good average starting torque, the torque for certain rotor positions is so small that the motor does not start up from such positions even under no-load. It is, therefore, very important to predetermine the value of the smallest starting torque, which may be called the "commercial starting torque." The purpose of this article is to deal with this question.

The only quantity having effect upon the change in the torque which takes place with variations in the rotor positions is the magnetic leakage, due to the changes in the zig-zag and belt leakage, the reluctance of the main flux bath being practically constant in most cases. It can easily be shown that the starting torque can be expressed in synchronous watts as the copper loss in the secondary conductors. Since with a certain value of primary and secondary resistances the secondary current at starting decreases with an increase of magnetic leakage, it will be appreciated that the starting torque, which is proportional to the square of the secondary current, decreases very rapidly with increase of the leakage.

In order to show how much the starting torque of the same motor may change for different rotor positions, there is shown in Fig. 1 a curve giving the values which the torque may assume for different values of the leakage coefficient. The upper curve in Fig. 2 gives the values which the leakage coefficient may assume in a three-phase motor with one slot per pole per phase in the stator and in the rotor, while the rotor occupies positions extending over a distance of only one half of the tooth pitch.

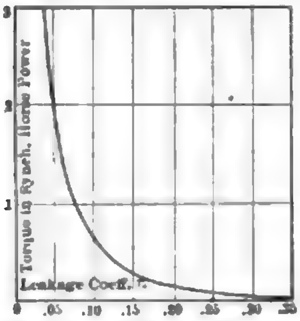


FIG. 1.—RELATION BETWEEN LEAKAGE COEFFICIENT AND STARTING TORQUE OF AN INDUCTION MOTOR.

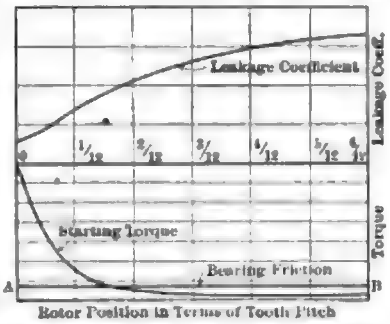
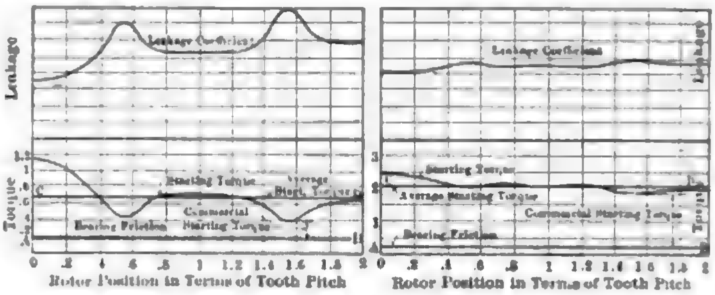


FIG. 2.—RELATION BETWEEN ROTOR POSITION, LEAKAGE COEFFICIENT AND STARTING TORQUE OF A THREE-PHASE INDUCTION MOTOR WITH ONE SLOT PER POLE PER PHASE IN THE ROTOR AND STATOR.

From this curve and that of Fig. 1 is derived the lower curve of Fig. 2, which shows the torque exerted by the rotor as a function of the rotor position. The straight line, *A B*, shows the torque which is necessary to overcome the bearing friction of this motor. It is obvious that the motor will not start up even under no-load from all rotor positions for which the curve is below the line, *A B*, while for the other rotor positions the torque of the motor is proportional to the distance between the line, *A B*, and the curve. The commercial starting torque of this motor is zero, while the average starting torque is fairly good. This case is, of course, more unfavorable than any which occurs in practice.

The upper curve of Fig. 3 shows the leakage of a four-pole, three-phase motor with four slots in the stator and in the rotor as a function of the rotor position as derived under certain assumptions from a curve given by Prof. C. A. Adams in his paper on "Leakage Reactance of Induction Motors."*

The torque of this motor for various rotor positions is given by the lower curve in Fig. 3. The average torque is 3,730 synchronous watts corresponding to 5 synchronous horse-power, while the commercial starting torque is only 1,790 synchronous watts corresponding to 2.4 synchronous horse-power; that is, 48 per cent of the average.



FIGS. 3 AND 4.—LEAKAGE COEFFICIENT AND STARTING TORQUE OF THREE-PHASE MOTORS WITH FOUR SLOTS PER POLE PER PHASE.

Similar curves are given in Fig. 4, for another four-pole, three-phase motor with four slots per pole per phase in the rotor and in the stator. The average starting torque is here 1,515 synchronous watts, corresponding to 1.9 synchronous horse-power, while the commercial starting torque is 1,230 synchronous watts, corresponding to 1.6 synchronous horse-power; that is 87 per cent of the average.

In this case the commercial starting torque will in reality be still better, since the motor has open slots in both members. Thereby the reluctance of the main leakage path is increased just for those rotor positions for which the leakage has its maximum; this causes an increased starting current and a better starting torque for these positions.

In this connection it may be shown that the choice of a small "largest common divisor" between stator and rotor slots is in reality not so important as usually assumed. If, for example, the motor, for which the torque is shown in Fig. 4, would be built with 16 poles while the other characteristic data stay the same, the commercial starting torque would be again 87 per cent of the average, in spite of the very large common divisor, $4 \times 3 \times 16 = 192$. In contradistinction to this result, the motor of Fig. 3 if built with 2 poles, has a common divisor of only 6, and the commercial starting torque is zero. It is very important, therefore, to know the value of the largest possible leakage coefficient of a motor, in order to predetermine its exact commercial starting torque.

A mathematical predetermination of the highest leakage coefficient from the dimensions of a motor is not always very simple. In most practical cases, however, certain standard motor types will be at the disposal of the designer, and it is a simple matter to find the largest value of the leakage coefficient by testing the motor for different rotor position.

After this it is possible to predetermine the commercial starting torque by simply using this largest possible leakage coefficient as basis for the calculation of the starting torque.

In a motor with squirrel-cage rotor it is necessary to take at the same time the eddy currents into account which are caused by the high frequency in the rotor end rings when the motor is being started. They have in some cases a considerable decreasing effect on the starting torque in so far as they increase the watt component of the starting current, thereby decreasing the secondary starting current and the synchronous watts.

Only in motors with wide open slots in both members is it necessary to take into account the influence of the rotor position on the reluctance of the main flux path.

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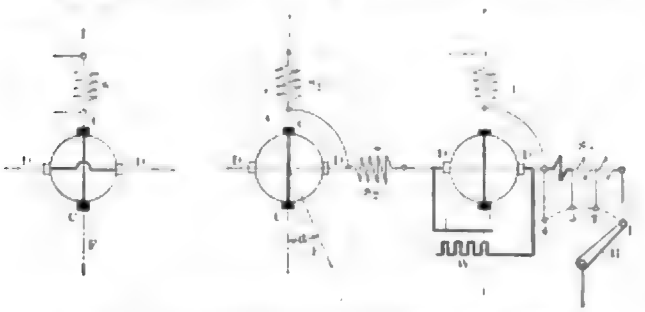
* Transactions of the International Electrical Congress, St. Louis. 1904. Vol. 1, page 706.

Self-Starting, Constant-Speed, Single-Phase Motor.

At a meeting of the British Institute of Electrical Engineers, held on March 8, a paper was read by Mr. V. A. Fynn describing a recently developed type of alternating-current commutator motor which possesses several features worthy of note. The machine starts with a good torque as a repulsion motor and operates with a high power factor as a modified single-phase induction motor. The characteristics of the motor may be understood most readily from a study of Figs. 1 and 2, which show diagrammatically the two forms of machines which are combined to produce the new motor.

In Fig. 1 the primary member is magnetized along an axis, *F*, by means of the winding, *S*. The secondary member, which consists of an armature provided with a continuous-current winding connected to a commutator, is short-circuited by means of the brushes, *C C* and *D D*, along two perpendicular axes, one of which coincides with the field axis of the primary member or stator. This motor has all of the characteristics of the single-phase squirrel-cage motor and is called a "shunt-induction" motor. It will not start from rest; if brought up to speed it will do useful work, running somewhat below synchronism, but its power factor is bad. It is very liable to spark at the commutator, and its output for a certain weight is small. The author obtains a starting torque by using the machine as a repulsion motor when at low speed, using the connections shown in Fig. 2. A stator winding, S_2, is added and the brush circuit, *D D*, is opened. The field in the axis of S_2 is due to the total current flowing through the stator windings, and it is practically in phase with it. This field is nearly in phase with the current in the rotor circuit, *C C*, due to transformer action from the winding, S_1. This machine possesses characteristics quite similar to those of the series motor. The author refers to it as a "series-induction" motor.



FIGS. 1 2 AND 3.—DIAGRAMS OF COMPONENT MOTORS.

The connections shown in Fig. 2 are used for starting purposes, and the machine is gradually converted to the connections shown in Fig. 1 as the armature increases in speed. A simplified diagram of the circuits employed is shown in Fig. 3. The switch, *H*, allows the turns in the winding, S_2, to be decreased at will. As the speed increases the rotor circuit is gradually closed through the resistance, *W*, the motor acquiring by degrees the characteristics of the single-phase induction motor. The author described special means employed to improve the power factor and to increase the output of the motor.

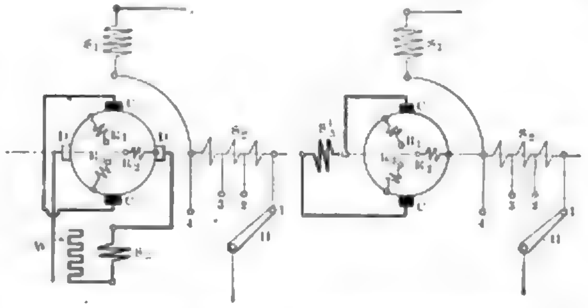
It has been shown that the motor in Fig. 1 is electrically the equivalent of a motor with a squirrel cage; it must, therefore, also behave like a motor having a rotor provided with a polyphase winding short-circuited by means of slip rings or otherwise; nothing in the nature of the motor would, therefore, be changed if, in addition to the two sets of brushes on the commutator, say, three equidistant points of the rotor, were short-circuited when up to speed. Use is made of a continuous-current and polyphase winding in the rotors, combined in such a way that, as far as the commutator is concerned, only the continuous-current winding is operative; while both continuous and polyphase windings are operative as far as the slip rings are concerned. The best possible use is thus made of the rotor winding space and copper. The commutator voltage depends on the continuous-current winding only. The polyphase winding is so disposed with regard to the continuous-current winding, as to obtain at the slip rings the highest possible voltage resulting from the combination of the two windings.

The method by which the phase of the motor field is varied in these motors consist in introducing into the circuit, *D D*, an auxiliary e.m.f. differing in phase from the e.m.f. produced in the rotor by cutting the primary field under speed conditions. The resultant of the two is then responsible for the motor field, and it has been found that an auxiliary e.m.f. differing materially in phase with the motor field gives the best results. Under these conditions the greatest phase displacement of the resultant e.m.f. can be obtained with the smallest auxiliary e.m.f., and without materially influencing the motor field strength.

The complete motor is shown diagrammatically in Figs. 4 and 5 in its two early forms, as arranged for "constant-speed work." For the sake of clearness, the slip rings have been omitted from the figures; they are connected to the points R_1, R_2, R_3 of the rotor winding.

The arrangement shown in Fig. 4 allows of the conversion of the motor from a series induction to a shunt induction machine by the gradual closing of the *D* circuit in combination with a gradual reduction of the number of turns in the group S_2, and, when desired, also in combination with a gradual decrease of the resistances inserted between the slip rings. A reduction of the resistances inserted in the *D* circuit and a reduction of the resistances between the slip rings increases the shunt excitation; a reduction of the number of turns in the group S_2 after the motor has started reduces the series excitation. At first both methods were used simultaneously on account of sparking difficulties, and one was naturally led to simplify this disposition by leaving out the *D* circuit altogether. The motor shown in Fig. 5 was thus evolved, and quite a number of such machines were built.

Although this last form of motor is simpler than that shown in Fig. 4, electrically it is somewhat inferior. The conversion from series induction to shunt induction working cannot be effected as smoothly with the help of the slip rings only (Fig. 5) as it can with the help of the *D* circuit (Fig. 4); and in the former case it is quite impossible in practice to avoid a very marked falling off in the starting torque curve, which makes this form of motor unsuitable when heavy and sustained starting torques are required. For light work, however, it is very useful, and its power factor under normal working conditions approaches unity. On the other hand, the starting torque curve of the motor in Fig. 4 (with or without the help of slip rings) is an almost straight line, and the motor in this form can be used in all those cases in which heavy and sustained starting torques are required, for instance: for elevator and similar work.



FIGS. 4 AND 5.—DIAGRAMS OF COMPLETED MOTORS.

It is stated that a maximum torque, two and one-half times the normal, can be secured with about one and one-half times the normal current. The motors will start light with about no-load current, or not more than one-fourth of the normal full-load current. The power factor can always be brought up to unity; this, however, may entail a heavier current in the rotor and slightly higher losses. On that account the smaller motors are not, as a rule, fully compensated, as it does not appear advisable to lower the efficiency for the sake of improving the power factor by some 5 per cent. Thus, for small machines up to 6 or 7 hp, the power factor is only raised to 0.7 or 0.8 at no load, reaching 0.9 to 0.94 under load. The power factor curve rises very rapidly at first, and as the load increases it remains nearly constant. The larger machines are designed for a power factor seldom falling below 0.9 and reaching 1; these can be made to take a leading current when desired.

The efficiency of these compensated motors closely approximates to that of good asynchronous machines with squirrel-cage rotors. In the smaller sizes it falls some 2 to 3 per cent below the latter, as is to be expected; since for small outputs only a small increase in the losses is sufficient to reduce the efficiency by several per cent. In this case the increased losses are mainly due to the friction of the brushes on the commutator and to the I^2R losses in commutator and brush gear. In the larger sizes the efficiency quite equals, and sometimes, for a large number of poles and high frequencies, materially exceeds that of the corresponding asynchronous motor. Altering an ordinary asynchronous single-phase motor to the construction which has just been described will increase its output from 30 to 40 per cent, besides vastly improving its power factor; but the increased output and the better power factor of these machines do not entirely compensate for the increased losses.

Parallel Operation of Synchronous Motor-Generators.

At the meeting last week of the American Institute of Electrical Engineers, Mr. J. B. Taylor read a paper dealing with some features affecting the parallel operation of synchronous motor-generator sets. In the early installation of these machines it was found that a set on being started and connected in parallel with others already carrying a load would, on some occasions, refuse to take any of the load, and at other times it would take a great deal more than its proper share of the load. As a result of these early troubles numerous station operators retain the impression that unless certain special combinations of field excitation are used at the instant of paralleling, the proper division of load will not result; and that once connected in parallel, further changes in field excitation will have no effect. The author showed, however, that the division of load depends upon the relative mechanical position of the poles of the generators when the motors are placed in parallel.

If the poles of the two generators are mechanically in the same relative position when the two motors are in parallel, then when the generators are connected in parallel there will be no interchange of current between the two generators. If, however, the poles of one generator are displaced from those of the other, then the current which flows locally through the generator circuits will tend to bring these two machines exactly into step; it will tend to accelerate one generator and to retard the other, so that one machine acts as a motor and the other as a generator with reference to this local current. The mechanical torque due to this action is transmitted through the shaft of each set to the corresponding driving machine, so that finally the machines assume a stable condition in which the machine which drives the generator which has become a motor for the local current, itself becomes to this extent a generator, while the other driving machine assumes a correspondingly greater load as a motor. It is seen, therefore, that the current which flows locally through the two generators is not "wattless," but it represents power, which is negative for one machine and positive for the other. Similarly, the local current in the motor circuits represents either positive or negative power according to the machine considered. The power in each case is approximately equal to that in the other and is the minimum that is possible for the mechanical displacement of the poles. That is to say, the mechanical displacement of the poles of the motors will increase, allowing that of the poles of the generators to decrease until the power circulating through the motor circuits increases to the decreased value of that in the generator circuits.

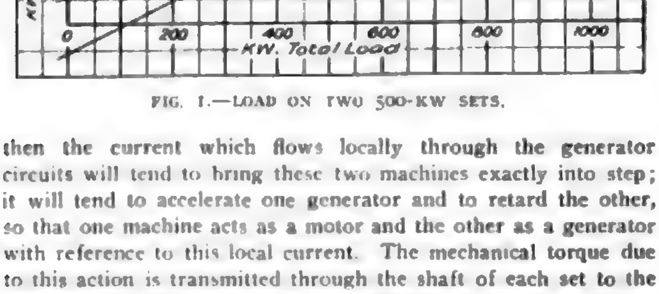


FIG. 1.—LOAD ON TWO 500-KW SETS.

A change in the field strength of one of the generators will not appreciably alter this circulation of power, but it will introduce a "wattless" current in the generator circuits.

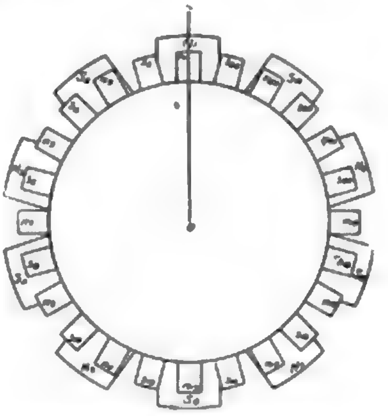


FIG. 2.—MECHANICAL ARRANGEMENT OF POLES ON A 25 TO 60-CYCLE SET.

Fig. 1 indicates the interchange of load between two 500-kw sets in which one machine took approximately 110-kw more than the other at all loads. This difference, a matter of about 20 per cent, was corrected by drawing off one of the revolving field cores and inserting a new key so as to give an offset of a few hundredths of an inch. At present there is a difference of only 10 kw in the loads taken by the two sets.

In discussing the placing in parallel of exactly similar motor-generators used in transforming from 25 to 50 cycles, or from 30 to 60 cycles, the author stated that it is apparent that, with the motors connected to the mains, the generators will necessarily have proper phase relations for connection in parallel, because every one of the north poles on one generator is directly in line with a similar pole on the other generator. With a set working between 25 and 60 cycles, however, the smallest number of poles possible is 10 for the motor and 24 for the generator. Fig. 2 represents such a set. A study of this figure will show that there are only two poles on the motor which will give proper phase relations on the generator end. Therefore, with one of these sets in service, to connect in parallel a second set, it is necessary to bring one or the other of these two poles to the reference point, the reference point being already determined by the set in service. This means that it is not sufficient to phase the set for one end only, but it must be phased for both motor and generator ends simultaneously. This may be done by one of several methods.

When the 25-cycle motors of the sets are in synchronism, the 60-cycle end of an incoming set has one chance in five of being correct for connecting in parallel with other sets already in service. The Chicago Edison Company uses a special synchronism indicator with two hands appearing on the same dial. The position of the 60-cycle hand on the indicator shows whether or not the phase relation is correct. If incorrect, the switch in the circuit to the synchronous motor is opened, and the set begins to slow down; the two hands of the synchronism indicator begin to revolve at different speeds, the 60-cycle hand making 2.4 revolutions for each revolution of the 25-cycle hand. The operator closes the switch at the instant when both hands appear at the top of the dial simultaneously, indicating proper phase relation for the two machines. At a substation of the Fonda, Johnstown & Gloversville Railway Company phasing lamps and a voltmeter are connected between the incoming generators and the bus-bars to show whether or not the phase relation is correct for connecting in parallel. If this relation is correct the voltmeter reading is normal and the lamps burn at normal brilliancy. Anyone of the other four possible phase relations will, however, give a different reading on the voltmeter and only partial illumination of the phase lamps. A double-pole, double-throw reversing switch in the field circuit of the synchronous motor is employed to allow the motor to drop back one pole at a time until the generator stands in the proper phase relation to the bus-bars.

The paper contains a table giving date on synchronous motor-generator sets, showing the required speed and number of poles for converting from one frequency to another, and indicating the chance of the generator phase being correct when the set is started by the synchronous motor. It is interesting to note that while a 25-cycle to 60-cycle set will be correct one time in five, a similar set used to transform from 60 cycles to 25-cycles will be correct only once in 24 times.

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The Relation of Load-Factor to the Evaluation of Hydroelectric Plants.*

By S. B. Storer.

The value of any water-power plant is due primarily to its earnings dependent on the market for its output, and secondarily to the type and quality of the apparatus installed and of the development as a whole. In the case of plants that are in process of development, or that are only partly loaded, the value is, of course, more or less of a speculative nature, and is estimated on the basis of possible and probable income. Prospective earnings as well as actual earnings necessarily rely on selling an amount of power equal to the maximum or the ultimate capacity of the development; and the number of hours per day during which the maximum capacity can be utilized is a definite factor in deciding the price at which the power is sold. This is equivalent to saying that earnings depend on the load-factor, where that is considered as the ratio between the average output of the station and its rated capacity. Carried to the extreme, zero load factor means no market for the power and consequently no value to the plant. The type or class of installation, whether good, bad or indifferent, does not affect such valuation, for the reason that the plant represents nothing as to earning power.

Few large hydroelectric plants exist to-day the values of which are not to a considerable extent speculative or problematical, owing to their operating at an output somewhat below their rated or their ultimate capacity. In some cases it has been so difficult to find a market for power that plants have passed through reorganizations with a resultant heavy loss to investors, and still are unable to show any profit or even to pay operating expenses, though power may be offered at rates so low as to be ridiculous when compared with the cost of generating it from coal or gas. No large water power development succeeds in marketing its output except through a reduction in its selling price to a point very much below that at which it could be produced from coal. Generally the load is obtained from a combination of low-priced power at the generating end with an additional load obtained by transmitting some distance to a market that will bring a higher price. At other plants the entire output is carried a long distance before a suitable market can be found. In both instances the cost of transmission lines and attendant apparatus should be added to that of the power-house development, and included in the cost of the plant as a whole; this may raise the price of power to such a point as to render it non-competitive with power produced by steam or by gas.

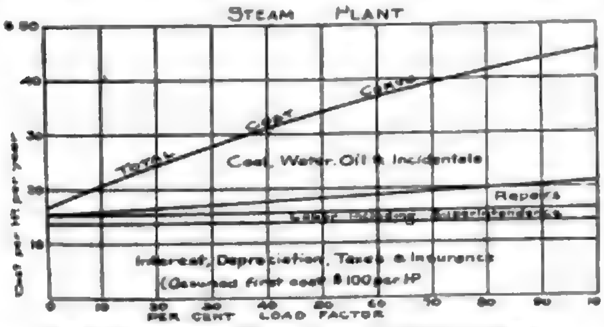

FIG. 1.—COST OF ENERGY FROM A STEAM PLANT.

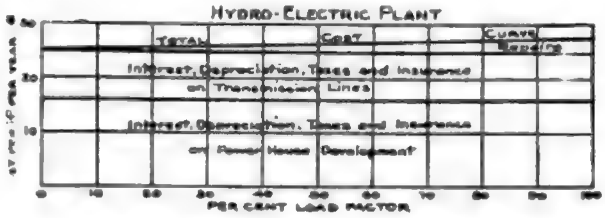

FIG. 2.—COST OF ENERGY FROM A HYDRAULIC PLANT.

This is particularly true of factories having low load-factors, due to operating only 8 or 10 hours a day. In such cases the necessary income can only be obtained through the sale of surplus power during the hours when the load is below the rated output of the power house. Similar conditions are well known, as they have been faced by every large water-power company. It will generally be found that the most successful plants are the ones that have the highest load-factor. The ideal load is one that remains constant throughout the 24 hours, the plant consequently putting out every kilowatt-hour within its capacity. Any water-power plant loaded in this way can sell power at a price very much below its cost when produced by steam, and still leave a good margin of profit on the investment.

It is generally conceded that the only object in developing a water power is to generate electrical energy at a cost much below that of generating it in any other way, and users of power are so well educated to this fact that they will not buy hydroelectric power unless the saving effected is considerable. It must be much more in fact than that for which they would, for any other purpose, make an expenditure several times as great as that necessary to replace other prime movers.

Comparing the cost of generating hydroelectric power with that from coal or gas is somewhat difficult, but the general method to be followed is shown graphically in the curves given herewith. Figs. 1 and 2, are made respectively for both steam plants and hydroelectric plants, and show the cost of production per horse power per year with relation to load-factor. In neither of these cases is the value given from an actual installation, but is merely an approximation indicating the general conditions as they might exist in any well-built power house of a rated capacity of from 5,000 to 50,000 horse-power. The principal difference between the two curves is due to the introduction of the variable items of coal, water and labor in the steam plant, while the fixed charges in both cases form the base of the area included under the curve. As usual, the fixed charges include interest, depreciation, taxes and insurance. With hydroelectric plants the operating expense is so nearly constant as also to become practically a fixed charge. The item of repairs is really

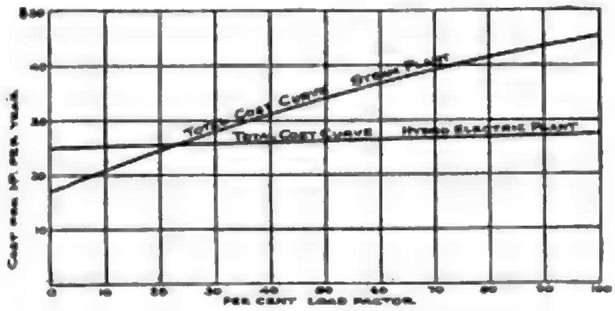

FIG. 3.—SUPERPOSITION OF COST CURVES.

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* A paper presented at the 205th meeting of the American Institute of Electrical Engineers, New York, March 23d, 1906.

the only variable in the curve, this generally being considered as increasing in direct proportion to the load-factor.

By superposing the two curves, as shown in Fig. 3, it will be seen that in this assumed instance they cross each other at 25 per cent load-factor, the cost per horse-power per year being identical at this point. At load-factors less than 25 per cent, the steam plant has the advantage, and hydroelectric power must be sold at a loss in order to be competitive. At all load-factors above 25 per cent, however, the advantage lies with the hydroelectric plant. The relative value of the two may be obtained by considering the variables—coal, water and labor—of the steam plant as the equivalent at any given load-factor, of a fixed charge, and by capitalizing this at a rate that will include interest, taxes, and depreciation, and adding it to the first cost of the steam plant we can thereby obtain an approximate value of the hydroelectric development.

Making the comparison in another way, the water operating the hydroelectric plant can be made a variable following the line taken by the coal of the steam plant, and by capitalizing the difference between the two curves an approximate value of the potential energy of the water can be obtained. Due consideration must be given to the fact that at load-factors of less than 25 per cent this capitalization is negative and must be taken from the actual cost of the plant, so that it is only at load-factors above 25 per cent that it has any real value. In addition the curve representing power cost from the steam plant must be discounted by an amount corresponding to whatever reduction must be made in hydroelectric rates to effect its sale.

The conclusion is that in all places where the flow of water is constant throughout the year the load-factor determines the earning power and hence establishes the value of any plant. Where an intermittent or insufficient supply of water may be stored and used during times of peak loads at a rate much higher than the normal flow of the stream the earning power is not dependent on the load-factor to so great an extent, but such hydroelectric plants are generally of small capacity, adapted for lighting purposes only, and are to be considered as an exception to which the above method of evaluation will not apply.

Design of Hydroelectric Power Stations.

A paper dealing with the design of hydroelectric power stations and having particular reference to the influence of the load-factor was read by Mr. D. B. Rushmore before the recent meeting of the American Institute of Electrical Engineers.

The author stated that hydroelectric installations naturally divide into somewhat clearly defined classes, depending upon conditions. The western high-head plant, with great fluctuations in stream-flow and with long ditches and pipe-lines, containing but few units and feeding into a high-tension network, is under different conditions from a low-head, many-unit, single-plant installation delivering power over short distances or to a single point. Reliability of service is not of such great importance in irrigation pumping as it is in the lighting supply of a large town. This is not always recognized in the discussion of comparative advantages of small complications necessary to obtain reliability of service as compared with extreme simplicity and home-made switching apparatus. Conditions which have proved satisfactory in the West could not be considered for systems which are never allowed to be out of service.

The number of plants to the system and the distribution of plants on different watersheds materially affect conditions of design and operation. A single plant with all the power transmitted to one place represents the most severe conditions; many plants, widely separated, on different watersheds, with steam auxiliaries and widely distributed use of power, the most favorable so far as load conditions are concerned. The class of service has an important bearing on the system of control. Where conditions of contract do not severely penalize trouble, much simpler arrangements can be used than where it is demanded that no expense be spared to insure against interruptions.

Upon the exact definition of load-factor there is a lack of agreement. In the paper it is designated as the ratio of the average output to the maximum output. For considerations of storage, the load-factor of stream-flow has a vital bearing on the amount and cost of development. The great problem of hydraulic development is to transform the stream flow to correspond to the load curve. The design of different elements is determined by various limits, some of which are but indirectly connected with the load-factor. Water conductors should primarily be of sufficient capacity for the worst conditions—not always the case. The grade of ditches may vary from 40 ft. per mile for small ones, to 10 ft. or less per mile for large, the allowable velocity depending on the soil. Velocities should be sufficient to prevent the growth of vegetation in ditches, but not sufficient to cause erosion.

Velocities in flumes may range from 8 to 20 ft. per second. Tunnels, when lined with concrete, may have a friction-coefficient of from 0.010 to 0.012. The complete cost may vary from $5 to $6 per cubic yard, or from $20 to $30 per lineal foot, for a 9-ft. tunnel. The coefficient of friction with rough rock walls will be from 0.030 to 0.035. For lined tunnels, 12.5 ft. per second is given as a conservative velocity. Velocities much higher are in use in short lengths.

Velocities in pipe lines vary from 3 to 15 ft. per second. Wooden pipes with low velocities are often used at the upper ends, but the greatest loss of head should occur at the bottom in the most expensive pipe. The thickness and factor of safety used increase with the head. For all high pressure work, riveted sheet-steel pipe is now universally used.

The best type of wheel to be used depends upon the head, quantity of water, speed, and range of load. Turbine wheels are efficient through only a small range of load, and under high heads are not easily regulated. In general, with low heads, large quantities of water and a number of generators to the plant, turbines are used. For small quantities of water, high heads, variable-head impulse-wheels are employed.

For large developments, the selection of reservoir sites and capacities requires special investigation. Often several main reservoirs check the river flow, and a regulating reservoir at the head of the pipe line gives constant ditch-flow and carries the load temporarily in case of accident to the water supply. If great fluctuations in stream-flow obtain, it is seldom possible, from a commercial standpoint, to store all the water. Where development exceeds minimum stream-flow, there are only a few high-head propositions where storage is not desirable; conversely, in many low-head installations the cost of storage is prohibitive.

Wheels and generators demand careful study to decide the best capacities. The size of the generator is usually indicated by some conditions in the proposition. The loss of one unit should not cripple the service. The generators and wheels should operate at points of best efficiency. The generator and wheel combinations are limited, and speeds are fixed by number of wheels, type, head and output. For one-plant systems the number of generators is preferably not less than four nor more than eight. For multiple-plant systems, one unit to the station is not uncommon.

The cost and value of efficiency in power plant designing is an important but not clearly understood subject. The rough approximation usually made is to compare the selling price of the increased output with the interest charge on the greater cost. Where the saving in energy can be sold, as is usually the case, a higher efficiency in water conductors means a greater output, and a greater capacity of installed apparatus with higher total cost, so that the investment charge for the gain in power is greater than usually considered. This is true of all parts of the chain of energy transformation. Water wheels can be made of the best efficiency by designing them for the special conditions, instead of using standard patterns, and by the employment of a high grade of material with careful finish. The life can be increased by use of expensive metals and by cleaning the water. Wheels probably differ in efficiency much more than electrical apparatus. Doubt simply implies difficulty in hydraulic testing and scarcity of reliable results.

With a limited water supply, storage of water determines the possible development. Variations in load occur by the hour, day, season and year. Auxiliary or regulating reservoirs at the head of the pipe-line take care of daily peaks, keep an even load on the water conductors, and serve to carry the plant over temporary ditch troubles, also serving as sand boxes. The location of the pipe-line often renders storage at this point impossible. In one case, a flume of large dimensions is used for peak storage. In another, the water supply to a flume several miles in length is cut off entirely and the total stream-flow used for another station.

Main reservoirs are on the river and regulate its flow. If these are of sufficient size, the total run-off can be used. The Reclamation Service is at present doing a great work in water storage, in some cases over a term of years. Snow is a natural form of storage, well illustrated at Puyallup, where with a great variation in rainfall a nearly constant stream flow is obtained. Forests, vegetation, and the soil fill the function of reservoirs. Dams are built to catch the underground waters.

For suddenly varying loads, as in railway and hoisting work, a fly-wheel is used to provide for instantaneous peaks. Irrigation laws may forbid the storage of water on old ditches. Electrical storage, at the distributing points, bears to the electrical system the same relation that the regulating reservoir does to the hydraulic.

The capacity of a water-power installation can usually be largely increased by the use of steam auxiliary plants. A steam plant can supply the deficiencies of stream-flow, and can carry peaks in any season. It may act as a regulator with steam turbine floating on the lines, the hydraulic generators running under constant load; it may act as a reserve in case of breakdown on line; and may serve to furnish the wattless current for the system, allowing other machines to carry greater overloads. The turbine unit may be run idle part of the year as a synchronous condenser, or may float on the line as such for part of the day and deliver energy at other times. Contracts for supply of continuous power, with severe penalty clauses, may necessitate the installation of an auxiliary plant at the distributing end of the line. Such a plant is now being installed at San Francisco.

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Recent Electrochemical Developments.

COPPER AND NICKEL.

We have repeatedly referred in these columns to the important problem of separating copper and nickel. On a large commercial scale this separation is at present carried out by the Orford process which is purely metallurgical. The molten matte is subjected to contact with sodium sulphide whereby gravity separates the lighter copper and iron sulphides from the heavier nickel sulphide. Naturally the separation cannot be very sharp and the resulting metals are impure. For this reason the endeavor of a series of experimenters has been in years past to devise an electrochemical process and we have to record here two new attempts in this direction, both being due to former engineers of the Orford Copper Company.

N. V. Hybinette patents for this purpose a double-fluid cell with the cathode department in the center, enclosed in a specially prepared diaphragm chamber, while the anode departments are placed outside. The anodes are made of the alloy of copper and nickel which is to be separated. Pure nickel sulphate containing a small proportion of a weak acid is supplied to the cathode department so that nickel is continually deposited upon the cathodes. The electrolyte is kept on a higher level in the cathode department than in the anode department, so as to produce a continuous stream of nickel sulphate solution through the diaphragm outside towards the anodes. From the anodes copper and nickel are simultaneously going into solution, but this mixed electrolyte cannot pass over to the cathode department on account of the opposite stream of electrolyte just mentioned. In the anode compartment an overflow is so provided that the mixed solution of copper and nickel sulphates continually flows off. From this mixed solution the copper is removed by cementation upon nickel or a nickel-copper alloy. The solution which thereby becomes pure nickel sulphate is then supplied again to the cathode department of the electrolytic cell. The nickel sulphate electrolyte, therefore, passes through a cycle. The copper is removed by cementation and the nickel by electrolytic deposition.

Woolsey McA. Johnson proposes to carry out the separation on the following principle: The copper nickel matte is subjected to the action of hot sulphuric acid whereby nickel is dissolved and hydrogen sulphide liberated while the residue consisting in part of copper sulphide is left. This residue is roasted to oxide and leached with sulphuric acid so as to form a solution which contains copper sulphate with a small amount of nickel sulphate. This solution is electrolyzed with insoluble anodes of lead, the gases from the roasting operation being passed through the bath. These gases serve the double purpose of reducing the e.m.f. necessary for electrolysis, for they act as a depolarizer, and of yielding sulphuric acid in such quantity as to be sufficient for subsequent solution of both the nickel and the copper of the residue. Electrolysis is continued until the presence of nickel would interfere with the deposition of copper. The solution is then transferred to other cells and further quantities of copper are deposited upon rotating cathodes. The electrolyte is then used for leaching new quantities of matte.

ZINC.

Of our modern metallurgical arts the production of zinc has undergone the least changes during the last 100 years. It is, therefore, not surprising that strong endeavors to apply electrochemical methods to the problems of this industry are at present made. De Laval in Sweden is known to use an electric furnace for the production of very pure zinc. While he uses an arc furnace, W. McA. Johnson in a recent patent proposes to use a resistance furnace. The patent refers mainly to the difficulty of smelting ores of zinc containing iron or other substances which are liable to flux or otherwise injure the walls of the retort. The remedy proposed in the patent is to interpose between the charge containing low-grade ore and the furnace wall a high-resistance charge containing high-grade ore and a layer of inert material, whereby the wall is protected against the action of the low-grade ore.

F. T. Snyder proposes a process which is partly electrothermic and partly electrolytic. The principle is to mix zinc sulphide ore with carbon and with a slag-forming material and to smelt the mixture upon a bath of molten slag in an electric furnace from which air is excluded, whereby the zinc sulphide breaks down while simultaneously carbon bisulphide is formed. The zinc vapor and the carbon bisulphide vapor are separately condensed.

VARIOUS ELECTRIC FURNACE PROCESSES.

In connection with the trial of the Héroult furnace at Sault Ste. Marie for the production of pig iron from ore two recent patents of this inventor is of great interest. The inherent commercial difficulty of using the electric furnace for pig iron production lies in the cost of electrical energy, and in order to reduce this energy it is necessary to utilize to the utmost the calories available in the fuel required for reduction. This means that the carbon should be oxidized to carbon dioxide and not to monoxide. For this purpose Héroult feeds the ore from the top and introduces the fuel at the base of the charge while protecting it from the action of the carbon dioxide generated by the smelting operation. A mixture of carbon monoxide and carbon dioxide is, thereby, formed with gradually increasing richness in carbon dioxide as the gases rise to the point at which the reduction of ore practically ceases. At this point oxygen is blown into the furnace to oxidize the remaining carbon monoxide and to increase the heating effect. One of Héroult's patents refers to his process, the other to the apparatus.

M. Ruthenburg patents an arrangement of the electrodes for a steel furnace which is quite different from his former well-known furnace construction and is more similar to Héroult's steel furnace. Upon the molten steel a layer of inert material, for instance fused slag of bauxite, is placed, while upon this slag flows a comminuted mass of coke or carbon. The carbon electrodes dip into this mass of coke. The heat is transferred to the steel bath through the layer of slag.

Henry Noel Potter, who has already done a great deal for the development of the electric tube furnace, patents two carefully designed constructions for two special purposes. One is intended for use when gases or vapors are to be passed into the furnace under pressure and are to be subjected to intense heat during the passage. The other type serves the opposite purpose, namely, when the heating process is to be carried out under reduced pressure, so that this type may be called a vacuum tube furnace.

LETTER TO THE EDITORS.

The Inverted Gas Burner.

To the Editors of Electrical World:

SIRS:—Referring to the editorial in your issue of March 17 commenting on my paper on the inverted gas burner read before the recent monthly meeting of the Illuminating Engineering Society, I would thank you to publish the concluding paragraph of the paper, which reads as follows:

"In conclusion, I may say with our English brethren, that the problem is not yet solved, but with so many capable engineers all over the world at work on the subject, a good, reliable, and simple lamp must be evolved, and then gas consumers will be provided with a burner that will give at least 60 candle power on a consumption of not more than three feet of gas, and when the fixture designer gets in his good work by constructing fittings to suit the burner, an enormous field will be opened up and the public will welcome the advent of an appliance that will give the decorative effect of an electrolier, but with more light and at a greatly reduced cost. Gas men must join me in hoping that this day is not far distant."

The purpose of my paper was to show to all interested parties the existing defects, and in some cases, to suggest slight improvements. If such a paper will hasten the perfection of the inverted lamp, I shall feel my effort was not in vain.

NEW YORK VICTOR A. RETTICH.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Design of Direct-Current Generators.—BRESLAUER.—The first part of a study in the design of a 500-kw. direct-current generator with some general remarks on dynamo design. According to the writer's experience there are very few generators at present in use in central stations which allow overloads up to 20 per cent, or even full load, to be suddenly switched off and on without moving the brushes and without showing any signs of sparking, although this is generally required of and can be fulfilled by the most recent machines and was a condition specified in the present case. The author gives the following formula for the reactance voltage: $e_r = 0.133 m_s l' i_m n \times 10^{-6}$, where m_s represents the number of conductors per segment, l' the magnetic conductivity, i_m the ampere turns of the armature and n is speed. Experience shows that the reactance e.m.f., e_r, thus calculated, must not, under ordinary conditions, exceed 2 volts if no brush movement is permitted from no load to 20 per cent overload. This, of course, is not the only condition, since the ratio of armature ampere-turns to the ampere-turns required for the gap, teeth and core is of no less influence, but must be treated separately. It must be understood that with a reactance e.m.f. of 2 volts, the brushes cannot be kept in the geometrically neutral point, but already require a fixed constant lead. For brushes in the neutral positions, as, for example, with reversible motors, a reactance e.m.f. greater than 1.1 volt is not admissible, but in cases where shifting of the brushes according to the load is allowed, the limit for e_r can be extended up to 3.2 volts. The author then compares his method with that of others for calculating the reactance e.m.f. and then applies his method to the special 500-kw generator under discussion. This machine has 10 poles, the normal current is 910 amp., there are 144 slots with 8 conductors per slot, and 575 segments. Hence, the total number of conductors is $8 \times 144 = 1{,}150$, and as the armature is lap-wound with 10 parallel circuits, the effective number of conductors would be $m = 115$. The total armature iron length (l) with insulation but without ventilating ducts is 27.5 cm., and the mean length of one conductor is 95 cm., leaving a free length of 67.5 cm.; therefore, $l' = l + 0.1\, l_f = 27.5 + 6.8 = 34.3$ cm. Further, as there are 1,150 conductors and 575 segments, the number of conductors per segment (m_s) is 2. The speed being 300 r.p.m., the formula for the reactance e.m.f. yields $e_r = 2.9$ volts. The reactance voltage is, therefore, very high. If we consider further that the output coefficient which is the ratio of the product $d^2 l$ to watts per revolution, $G = \frac{ld^2}{\text{watts per rev.}} = 32.4$, is rather small, and that the number of ampere conductors periphery is not higher than 240 per cm., or 960 per inch diameter, nothing abnormal can be found in these two values to explain the good results obtained with this machine. We know, however, that next to reactance voltage the ratio of armature ampere-turns per pair of poles *A T.*, to the ampere-turns for air-gap, teeth and core is of prime importance. This ratio in the present machine is 0.88 and at 20 per cent overload 1.05. In general if this ratio is above 0.7, a machine is not considered safe, and 1.0 is assumed to be the very limit. Hence, in this respect also the machine seems to be dangerous and to considerably exceed the orthodox limit of design. The article is to be continued.—Lond. *Elec.*, March 9.

Single-Phase Commutator Motor.—CZEPEK.—The author has made a series of tests of a four-pole motor which as a single-phase series motor was designed for a capacity of 7 hp at 110 volts, 50 periods and 1,500 r.p.m. The motor was tested as a direct-current series motor, as a single-phase series motor, as a repulsion motor, as a Winter-Eichberg motor with field and armature coils directly in series, as a single-phase induction motor and as a polyphase motor, the results being given in comparative tables. The influence of the brush position on the starting operation, the effect of a change of frequency, etc., are discussed. It is mentioned that a series motor should be designed for as low a frequency as possible while with the repulsion motor it would be wrong to go below a certain limit, since the frequency should not be too small in order to get high torque and high efficiency.—*Elek. und Masch.*, March 11.

Use of Mica.—ABBOTT.—In some notes on practical experience of a district office engineer it is mentioned that a rotating field alternator hummed badly and investigation showed that the finger plates on the stationary armature were not stiff enough to hold the outer laminations firm between the coil slots. Several efforts were made to stop the trouble by upsetting the iron and finger plates, without entirely stopping the trouble. Finally thin strips of mica were driven between the iron laminæ, after having been coated with shellac. This method was successful.—*Elec. Jour.*, March.

Voltage Regulation of Alternators.—LETROS.—The conclusion of his paper on the calculation of rheostats for regulating the tension of alternators.—*L'Eclairage Elec.*, February 17.

Lamps and Lighting.

Metallic Filament Lamp.—Some further information concerning the Kuzel metallic filament lamp which was noticed in ELECTRICAL WORLD February 17, page 354, and in the Digest March 23, page 487. The present information is given on the authority of the English agents. The metals are reduced to a colloidal state wherein their properties are somewhat modified by their very finely divided condition and Kuzel forms his filaments by forcing his colloidal preparation through a die. This, it is said, produces a much more durable filament than the ordinary wire-drawing method. Kuzel finds that by employing a mixture of different colloidal substances he obtains alloys with properties more suitable for filament construction than the components used separately, however high their fusing points. The lamps are exactly similar in appearance to the carbon filament type and the size of the bulbs identical. Two horseshoe filaments in series are used and the lamps can be made up to 110 volts. It is hoped, however, to extend the limit up to 220 volts. The actual mounting of the filament and exhausting of the bulb is precisely the same as for the carbon lamp, so that beyond establishing a new filament department no alterations are necessary in the equipment of an existing lamp factory. The efficiency claimed for the filaments for low-voltage lamps is indicated in the tests which were published, and it should be explained that the candle-powers given are mean horizontal, the Hefner unit being used. It has been found from a number of tests that a useful life of about 3,500 hours may be expected with a loss of candle-power varying from 2 per cent to about 11 per cent for lamps with a consumption in the neighborhood of 1 watt per candle, and that they will last as long as 5,000 hours with a diminution in light of 20 per cent. Lamps working at a consumption of about 0.75 watt per candle have been run for 1,000 to 1,100 hours with a loss of 3.5 per cent, and for 1,600 hours with a loss of 20 per cent. The lamps remain remarkably cool in use, as a very small portion of the radiation consists of infra-red rays. The lamps are equally suitable for alternating and continuous-current circuits, and can be overrun as much as 300 per cent without damage. The inventor looks forward to producing lamps with a consumption as low as 0.5 watt per candle.—Lond. *Elec.*, March 0.

Filament of a Mixture of Metallic and Electrolytic Conductors.—A filament made of an intimate mixture of a metallic conductor and an electrolytic conductor has the advantage over the purely electrolytic filament of the Nernst lamp that the former is a good conductor at ordinary temperatures and therefore needs no preheating. But on account of their non-homogeneous composition filaments of this kind are subject to considerable changes and the metal in the filament has a tendency to evaporate and to form a dark deposit on the lamp globe. Siemens & Halske propose to use tantalum as metal on account of its high melting point. Filaments made of a mixture of tantalum and a Nernst oxide are stated to be very durable and can be used in a vacuum while filaments of pure electrolytic conductors must be lighted in air wherefrom considerable losses of power result. With tantalum it is possible to make filaments of very high specific resistance. At the same time the temperature coefficient is favorable, since above a certain temperature the resistance becomes almost constant. Two methods are described for making such filaments. The first is to mix powdered metallic tantalum intimately with powdered zirconium oxide with a binding material like paraffin, and to bring this mixture into the proper form and sinter it together by heating with the electric current. The second method is to mix zirconium oxide with a conducting oxide of tantalum, which has the property of giving off its oxygen when an electric current is passed through it. A binding material like paraffin may again be used or not. By passing an electric current through it in a vacuum, the filament is heated to white heat whereby the oxygen of the tantalum oxide is completely given off if the oxygen gas set free is quickly removed by means of a pump.—*Zeit. f. Beleucht.*, March 10.

Incandescent Lamps with Reflectors.—Schaefer.—An illustrated article on the suitability of reflectors in connection with incandescent lamps. The author first shows that a reflector of half circular cross-section produces in general a rather non-uniform distribution of light while with a reflector of parabolic cross-section all rays are reflected in parallel lines, i. e., in one single direction, if the incandescent point is placed in the focus of the parabola. The trouble in using this property in connection with incandescent lamps is due to the fact that the filament cannot be considered as an incandescent point. Wulff has, therefore, devised an incandescent lamp in which the filament is a long, straight line while the reflector is made by bending a sheet so that its cross-section perpendicular to the direction of bending is a parabola. Each point of the filament is situated in the focus of a parabola. The lamp is of tube form, the filament being in its center in the form of a straight line and being held in tension by means of a spring.—*Elek. und Polyt. Rund.*, March 1.

Arc Lamp.—Simon.—A study of the dynamics of arc lamp phenomena and arc lamp hysteresis. The method of characteristic curves is made use of.—*Zeit. f. Beleucht*, March 10.

Power.

Voltage and Cost of Transmission Lines.—Adams.—The author emphasizes that distance rather than voltage is the prime factor in the cost of long transmission lines. The total cost may be divided into those for conductors and those for poles, pins and insulators. Within rather narrow limits the cost of conductors may be held constant by varying the voltage directly with the length. Over much wider limits the costs of supports for the conductors varies nearly as the length independent of the voltage employed. On very long lines the cost of supports alone becomes one of the main items. If the voltage of a transmission is increased with the length, so that the weight of conductors may remain constant for the same percentage of loss, then the cross-section of each conductor must be made smaller and the consequent reduction of mechanical strength in the conductor puts a limit to the practicable voltage for many lines.—*Cassier's Mag.*, March.

Steam Turbine.—An illustrated description of the Zoelly steam turbine. While these machines are comparatively new, there is believed to be about 72,000 hp of them at work or under construction, mostly on the European continent, in plants installed by the Siemens-Schuckert Company.—Lond. *Elec. Times*, March 8.

Superheated Steam.—Bibbins.—A long discussion of the results which may be obtained with superheated steam. Numerous diagrams and tables are given.—*Elec. Jour.*, March.

Drilling Machine.—An illustrated description of an electrically-driven portable drilling and tapping machine of German make.—*Am. Machinist*, March.

Electricity in the Foundry.—Knowlton.—A fully illustrated article on the use of electric power for foundry purposes, dealing especially with electric cranes, electric traction, the driving of various foundry machinery like sand sifters by electric motors, electric welding, etc.—*Cassier's Mag.*, March.

Traction.

Marseilles.—Dubs.—A long description of the tramway system of Marseilles. The total length of single track is 200 km. The power plant contains five generating sets of 1,000 kw, 5,500-volt alternating currents being transmitted to converter sub-stations.—*L'Industrie Elec.*, March 10.

Sub-Station.—A description of the Kingston sub-station of the London United Tramways Company. Three-phase currents are supplied to the sub-station at 11,000 volts with a frequency of 33⅓ cycles. There are seven separate 200-kw, single-phase transformers and two 500-kw rotary converters.—Lond. *Elec.*, March 9.

Electric Railway Engineering.—Cooper. The third paper of this illustrated serial deals with the control of cars and rails operated by direct current.—*Elec. Jour.*, March.

Installations, Systems and Appliances.

Speed Regulation for Operation of Alternators in Parallel.—Neel.—An illustrated description of the Bouvier speed regulator as used at the central station of Trouville for operating steam-driven alternators in parallel. In 1901 the International Society of Electricians in Paris proposed the study of practical means for using a single regulator for regulating the speed of any number of steam engines which drive alternators in parallel. The Bouvier regulator is claimed to fulfill this requirement in a perfectly satisfactory manner. The construction is shown in Fig. 1. The constant-load pump, *P*, drives a liquid which escapes through an aperture the section of which can be varied by a valve, *S*, the position of which is regulated by a centrifugal pendulum. For any speed of the pendulum the valve, *S*, has a certain position so that the pressure of the liquid has also a certain value. This pressure acts on a piston, *R*, and the pressure is counterbalanced by the pressure of the spring, *Z*. For any speed of the centrifugal pendulum the piston, *R*, therefore, has a certain position. The piston, *R*, is connected in a rigid manner with the lever of the admission valve of the prime-mover. Any change of speed will bring the piston, *R*, from its old position of equilibrium to a new one and the principal point is that there are no oscillations whatever in reaching the new equilibrium.

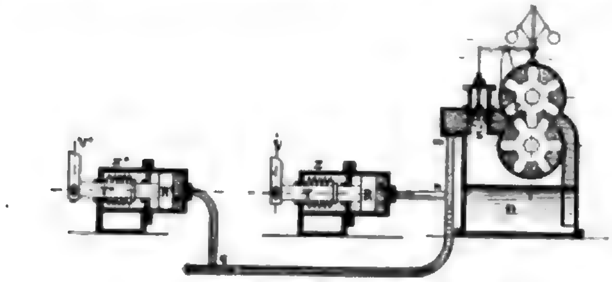

FIG. 1.—DIAGRAM OF BOUVIER REGULATOR.

The illustration shows the regulator connected to two prime-movers. The pump and the centrifugal pendulum are driven in synchronism with the prime-movers by electrical means which are described.—*L'Eclairage Elec.*, January 18.

Circuit-Breakers and Fuses in Series.—MARCHANT AND LAWSON.—It has long been known that when a fuse, designed to break circuit with a given current, is placed in series with a magnetic circuit-breaker, set for the same or even for some larger current, it is possible to put the circuit-breaker in action without blowing the fuse. The author has made a series of experiments with a circuit-breaker in series with different fuses. He first used the circuit-breaker in series with a number of equal fuse wires in parallel, and then tested the circuit-breaker in series with tin-fused wire of various diameters. These experiments were next extended to get the necessary data for obtaining a curve showing the relationship between the current through the magnetic circuit-breaker and the fusing current of wire in series with it, that will just not fuse for a given setting of the magnetic cut-out; a case which is, of course, one of great practical interest. The results of these tests are given in Fig. 2 and this curve is called the characteristic fusing current curve of the circuit-breaker. The whole area of it may be divided into two parts, one part shaded in the figure, such that if the point corresponding to a given current through the circuit-breaker, and a given fuse in series with the circuit-breaker, lie in it, the wire will be fused, provided of course that the current flowing exceeds the steady fusing current of the wire. If the point lies within the second part (left clear in the figure) the current corresponding to it will operate the circuit-breaker without blowing the fuse. It is interesting to note that any fuse wire smaller than that which blows at 5.4 amp. for this particular setting (25 amp.) will always be fused whatever the current flowing, provided, of course, it exceeds 5.4 amp. The authors finally describe some tests of the effect of various kinds of metal for the fuse. Their results point to the desirability of using fuses with high melting points, if the operation of circuit-breakers due to local short-circuits (say in a lighting system) is to be avoided. It is possible that the use of such fuses might obviate the necessity for the "time-lim't" circuit-breaker in many cases.—Lond. *Elec.*, March 2.

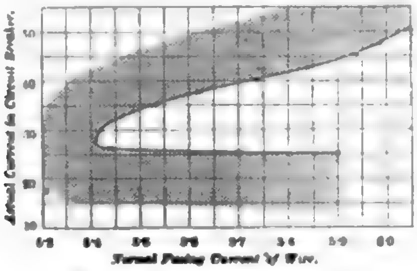

FIG. 2.—FUSE-CURRENT CURVE.

Storage Battery for Supplying a Lighting Network from a Tramway System.—JACOBI.—In many cases the erection of a separate central station would not pay in small towns and it is often preferable to take the current from an interurban trolley system which passes the town. In such a case a battery is installed which supplies the lighting current, and it may be charged by and worked in conjunction with a motor-generator. The author gives some calculations to show that in such a system the efficiency is in the average not more than 56 per c.nt. He describes an arrangement by which a higher efficiency is obtained. It is shown in Fig. 3. There are two batteries, each being divided into two halves and each half consisting of 120 storage cells. Current is supplied to the lamps by means of a three-wire system at 2 × 220 volts. One booster is used for both batteries. A three-pole switch, *U*, for each battery connects it either to the three-wire lighting network or to the two-wire trolley network. The earthed neutral wire of the lighting network is disconnected when the battery is charged. The charging resistance, *W*, is mostly short-circuited and is used only at the beginning of a charge for a short time. The operation is as follows: Both batteries are to be charged daily. Since on short winter days only seven hours are available for charging, the charge must be made with full current. It is not necessary to overcharge the cells every day to 2.7 volts, it is in general sufficient to go to 2.5 volts. For this purpose 3¼ hours are sufficient. In a certain moment the battery, *I*, may supply current to the lighting network whereby the switch, U_1, has the position shown in the illustration. When it is intended to begin the charge of battery *II* the end cell switches are connected to the last notch; switch U_2 is brought into the position shown in the illustration and the battery is thereby connected to the charging circuit while the neutral wire is disconnected. Finally U_3 is turned to the left, and by means of the charging resistance, *W*, the charging current is maintained constant, while the voltage of the cells rapidly increases. In not more than 10 minutes the e.m.f. per cell increases to 2.1 volts, so that the charge of 240 cells requires 500 volts and the resistance, *W*, is then short-circuited. The e.m.f. then increases slowly to about 2.25 volts per cell. Simultaneously the last end cells are disconnected since they are now fully charged. There are on each end four cells. The next four cells are charged for about 2¼ hours. After this time only the main cells of the battery—224 in number—are in circuit and receive now about 2.23 volts. After a short time the battery voltage begins to increase rapidly and the charging current would soon decrease if the charging voltage was not raised. U_3 is then switched to the right, the motor is started and the charge of the battery is continued by means of the booster. At 560 volts total e.m.f.—corresponding to 2.5 volts per cell—the charge may be discontinued in general. In certain intervals it becomes necessary to overcharge the batteries to about 605 volts. After the charge of battery *II* is finished, the booster is stopped, the lever of the rheostat, *W*, is turned to the first notch and U_3 is turned to the left, after having adjusted the end-cell switches. The two batteries are now working in parallel and supply current to the lighting network. In order to charge the battery, *I*, U_1 is turned to the right and the end-cell switches turned to the last notch; U_3 is turned to the left and so on. By this method it is

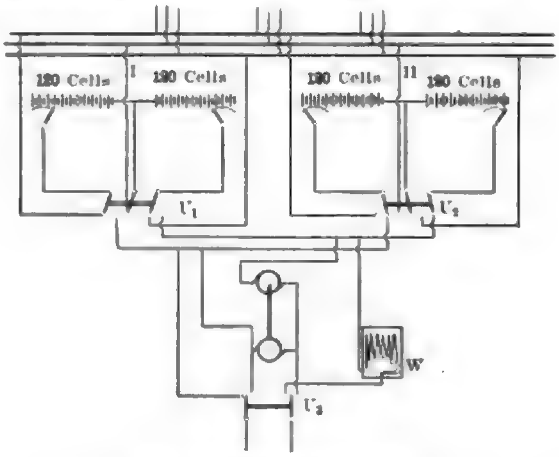

FIG. 3.—DIAGRAM OF CIRCUITS.

claimed that some 18 per cent of energy may be saved in comparison with the motor-generator system, while the first cost is about the same.—*Elek. Zeit.*, March 8.

Protective Apparatus.—Neall.—An illustrated article in which the author discusses foreign practice in the design of protective apparatus for transmission lines. He first deals with the use of resistances, especially water resistances, describes methods of installations, and discusses at some length the development of cable protection in Europe. The cable choke coil, used at the junction of overhead lines and cable, as may be seen from the illustration, Fig. 4, consists of a coil of a cable or a drum of suitable material. A weak point in the insulation near the line connection is supposed to offer the proper path to earth if a disturbance reaches the coil and the inductance of this arrangement facilitates the throwing back of the disturbance. Special insulation is provided between turns, and the whole coil is insulated from earth. Cables which are not connected to overhead lines are, nevertheless, subject to static disturbances. These may arise from switching, from short-circuit, etc. For this purpose there is employed what is essentially an artificial weakening of the insulation at a known place or spot, and therefore any failure of the cable can be concentrated at these points. This arrangement is shown in Fig. 5 with a sort of spark-gap consisting of two concentric electrodes, *A* and *B*, which are separated from one another by a layer of insulation and an oil film, *C*. *A* is connected to the conductor to be protected, *B* is connected to earth. *E* is a sort of comb arrangement of metal to prevent the breaking of the ground connection in case the lead sheath should be punctured by a bad short-circuit. The action of this device is as follows: On the arrival of the static disturbance the layer of insulation is punctured and the oil pours in to smother the arc, so that the trouble is only of short duration. Fig. 6 shows the practical application of this method. Special tanks or receptacles are provided to contain these safety devices. In the ground lead of each fuse there is inserted a resistance to assist the oil in suppressing the arc. In order to learn at any time the exact locality of a breakdown signal wires are run from each tank to a bell and signal board. This is readily arranged to indicate the location of the trouble, which begins by the operation of the protective device, the current passing on this exciting a branch circuit, which in its turn operates the bell.—*Electric Journal*, March.

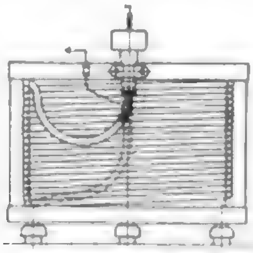

FIG. 4.—CHOKE COIL.

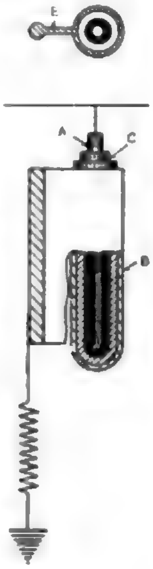

FIG. 5.—DIAGRAM OF TESTING APPARATUS.

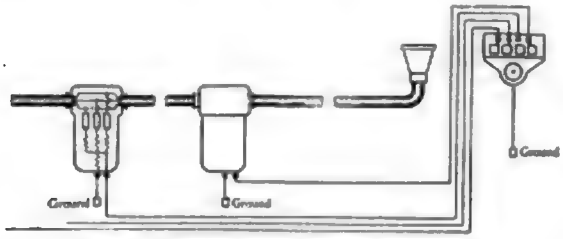

FIG. 6.—DIAGRAM OF TESTING CIRCUITS.

Electrophysics and Magnetism.

Break of an Inductive Circuit.—Hubbard.—A theoretical and experimental paper on the conditions for sparking at the break of an inductive circuit. The author hoped to find relations such as indicated in some experiments by Lord Rayleigh, existing between the constants of an oscillatory electric circuit, as the primary of an induction coil, the initial current, and the velocity with which the contacts of the break are separated, when the conditions are just sufficient to prevent sparking at the break. By neglecting the "lag" effect in the spark, a theoretical relation is found, which may be roughly expressed by saying that the velocity of break necessary to prevent a spark will be proportional to the frequency of oscillation and a linear function of the maximum induced potential, the latter implying a linear relation between velocity of break and initial current. The necessary velocity of break was found experimentally to be: first, a linear function of the initial current; second, for given current, increasing in value in a manner consistent with the equation when the capacity is diminished; third, diminishing according to the equation when the inductance is diminished. The assumption that the lag of the spark might be neglected did not hold true. It is possible to place a limit on the velocity of break necessary to prevent a spark at the break of an inductive circuit, if we know the inductance, capacity and initial current. The necessary velocity will be lessened by any condition which causes the absorption of energy from the primary, such as a closed secondary, hysteresis, heat losses, etc.—*Phys. Rev.*, March.

Magnetic Field and Coronal Streamers.—Trowbridge.—An illustrated account of experiments the chief results of which are as follows: When an anode in an X-ray bulb is also the end of a powerful electromagnet the application of the magnetic field results in the production of X-rays from a bulb which cannot be excited without the application of heat. When the cathode forms the magnetic pole a violet brush-like light appears on the cathode, on the side away from the electromagnet; while the fluorescent light is forced somewhat beyond the cathode. The use of Leyden jars in the case of low-potential coils greatly modifies the effect of the application of the magnetic field, while with coils giving sparks over 20 cm. with comparatively large Leyden jars in circuit the application of the magnetic field to either anode or cathode results in greatly increased production of X-rays. The application of a strong magnetic field at the anode with lines of force along the line of electric discharge forms a safe and useful method of regulation of X-ray bulbs. An electro-meter connected to the terminals of the exhausted tube shows a diminution of the apparent resistance of the tube when the anode is made the magnetic pole; and a rise in resistance when the cathode constitutes this pole. With Leyden jars in circuit the magnetic pole separates the oscillations, and rectifies the discharge to a certain extent.—*Am. Jour. of Science*, March.

Oscillations.—Kaelahne.—The first part of a mathematical paper on electric oscillations in metallic tubes of ring form.—*L'Eclairage Elec.*, Feb 24.

Electrochemistry and Batteries.

Conduction and Radiation of Heat.—Richards.—In the present installment of his serial on metallurgical calculations the author first gives the principles of heat conduction and radiation and applies these principles to the solution of various problems from practice; for instance, the losses of heat from pipes, etc. Tables are given of the constants determining the conduction and radiation of heat from various materials.—*Electrochem. and Met. Ind.*, March.

Pumping Chlorine.—Ashcroft.—An illustrated article on the use of chlorine gas under moderate pressures in the chemical arts. The article contains much practical information based on actual experience of the author, which should be useful in electrolytic plants producing chlorine gas.—*Electrochem. and Met. Ind.*, March.

Units, Measurements and Instruments.

Accelerometers.—Trotter.—An abstract of a paper on acceleration and methods for measuring it. The simplest of all methods for measuring horizontal accelerations by the deflection of a plumb bob was experimentally demonstrated. The recording pendulum instruments of Mallock and Lanchester were mentioned, and actual records taken by the former were shown. Other types of accelerometers described were those depending on the alteration of levels of a liquid, of which one example is that of Kapp, in which a long tube with upturned open ends is used, fitted partly with mercury and partly with water, and the alteration in level in the longer branch is observed. Another form which the speaker had himself often used consisted of a bent tube nearly full of liquid, similar to a spirit level. This was particularly convenient for use in railway trains. The indications of these instruments are of course, affected by gradients as well as by acceleration, so the result obtained is rather a measure of the force acting on the train than of the acceleration. Thus, when a train is "coasting" down a grade, the bubble remains stationary at the zero, except for the small deflection due to friction, even though the speed is rapidly increasing. Again, when a car is standing on a grade, the bubble shows a considerable deflection, which is in reality a measure of the force of the brakes holding the car up. This somewhat detracts from the use of these accelerometers from a passenger's point of view, but for investigation of the actual power required for traction the accelerometer ignores the effects of gradients and attends to the propulsive power in a remarkable way. For many purposes the actual measurement of draw-bar pull by a dynamometer is the most suitable method.—Lond. *Elec.*, March 9.

Telegraphy, Telephony and Signals.

Electrocapillary Recorder.—An illustrated description of an electrocapillary recorder devised by Orling for recording submarine cable signals. The instrument works on the principle of the well-known capillary electrometer. The apparatus is shown in Fig. 7; a light lever, *L*, rests upon the top of the column of mercury, *M*, and when raised by the latter, tilts a little aluminum carrier suspended from a horizontal cord, *A*. The carrier supports a delicate siphon, *S*, the upper end of which dips into a bath of ink, while the lower end faces the tape, *T*, upon which the signal is recorded, the siphon being kept in slight vibration by a thread attached to a vibrator, *V*, consisting of a light spring arm bearing on a moving wheel with a serrated rim. The receiving circuit is completed between the two bodies of mercury (shown black) through the electrolyte, into which dip the capillary tubes, *CT*, and when a potential difference is established between the terminals, according to the well-known phenomenon, the mercury rises or falls in the capillaries, and, therefore, in the vertical tube. The application to the recording of wireless signals is described.—Lond. *Elec. Rev.*, March 2.

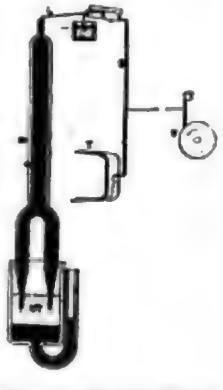

FIG. 7.—ELECTROCAPILLARY RECORDER.

Telephony.—Touanne.—The first part of a paper on the present status of telephony. In the present installment underground cable construction is discussed. The same issue contains statistical data on telephony and telegraphy in the Netherlands in 1904 and the official regulations on telephonic service between France and Italy.—*Jour. Tel.*, February 25.

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BOOK REVIEW.

Experimental Researches on the Flow of Steam Through Nozzles and Orifices. By Prof. A. Rateau. New York: D. Van Nostrand Co. 76 pages, 4 figures and 4 plates. Price, $1.50.

In the design of the steam turbine where the pressure or potential energy of the steam must be changed to velocity or kinetic energy, the matter of the law of the flow of steam through the nozzles or channels in which this transformation must take place is evidently of prime importance. The art of turbine design being still young and the literature on the subject meagre and of questionable accuracy, it seemed to Prof. Rateau when he first undertook the study of this apparatus, some ten years ago, desirable to check experimentally the theoretically derived laws. The present volume, though hardly more than a pamphlet in extent, describes the apparatus he devised for that purpose, gives the readings taken during his one hundred and fifty odd trials therewith and his deductions therefrom. While the conclusions are naturally of chief value to the rather small circle of steam turbine designers, the paper as a whole is interesting as showing that laboratory experiments when planned and carried out by a scientist having as broad and trained an intellect as Prof. Rateau admittedly possesses, become of decided practical value to a machine constructor. The agreement found between theory and experiment is most gratifying.

◆

Graphic Recording Electrical Instruments.

A complete line of accurate recording instruments has been developed by the Westinghouse Electric & Manufacturing Company the type of which is illustrated in the accompanying illustrations. These instruments are arranged to operate on the relay principle, the motor element actuating contacts, which in turn energize a pair of solenoids arranged to move the pen. They are designed for switchboard mounting and are enclosed in glass cases 13 in. by 16 in. by 9 in., with a removable high glass front giving access to the interior.

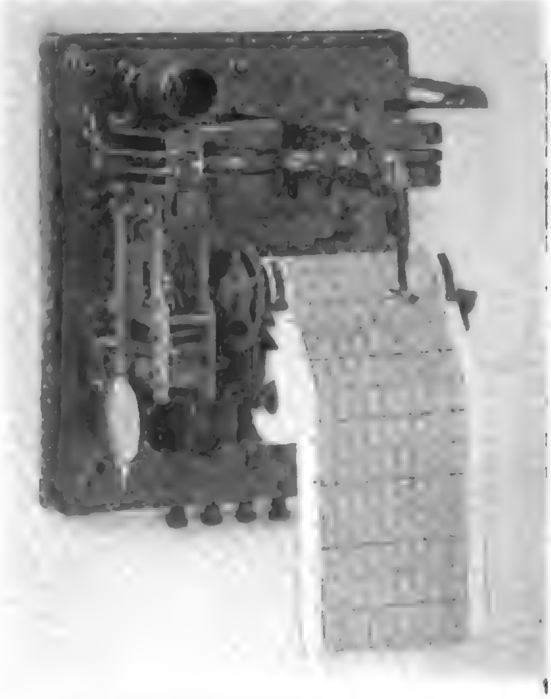

FIG. 1.—GRAPHIC RECORDER WITHOUT COVER.

The alternating-current motor, voltmeter and wattmeter coils are arranged in a manner similar to that of the standard line of Westinghouse precision instruments, and the registration is independent of frequency, external fields, temperature, voltage or wave form variation and equally correct on all power factors. The wattmeters are made for single-phase and polyphase circuits, the latter being correct at any degree of unbalancing.

The power factor and frequency meters have coils operating in the same manner as the corresponding Westinghouse indicating meters. The direct-current ammeters operate from shunts, thereby avoiding the heavy wiring necessary for mounting on switchboards. Shunts already installed for indicating meters may also be used to operate these meters, effecting a considerable saving in cost.

The record is made by a reservoir pen which is moved in a straight horizontal line across the paper, its motion being proportioned to the quantity to be measured, thus giving a scale having rectangular co-ordinates. The reservoir will contain a month's supply of the ordinary writing fluid used. The quickness of the pen's motion and consequently its sensitiveness may be easily regulated. Thus the record may be made to follow the slightest variation of the load, or else to slur these slight irregularities and form a more even line. The registering paper may be driven at speeds varying from 2 in. to 8 in. per hour, and is arranged to unwind from a continuous roll. The speed may be changed very readily by inserting an extra set of gear wheels. Two inches per hour is the standard speed regularly furnished.

The recording paper is neatly printed, accurately ruled and punched, the width being approximately 6 in.—a deflection of 5¼ in. representing full load. It is furnished in rolls of sufficient length to last two months at 2 in. per hour. The clock is self-winding, is of high-power design and requires no attention. The meter coils consume no more energy than other Westinghouse switchboard instruments, thus insuring correct ratio on the meter transformer. The solenoids are energized from a separate source of current so as to relieve the meter transformers of the power required, and are of sufficient torque to render the friction between the pen and the paper negligible. The construction throughout is very rugged and compact, no delicate parts whatever being used.

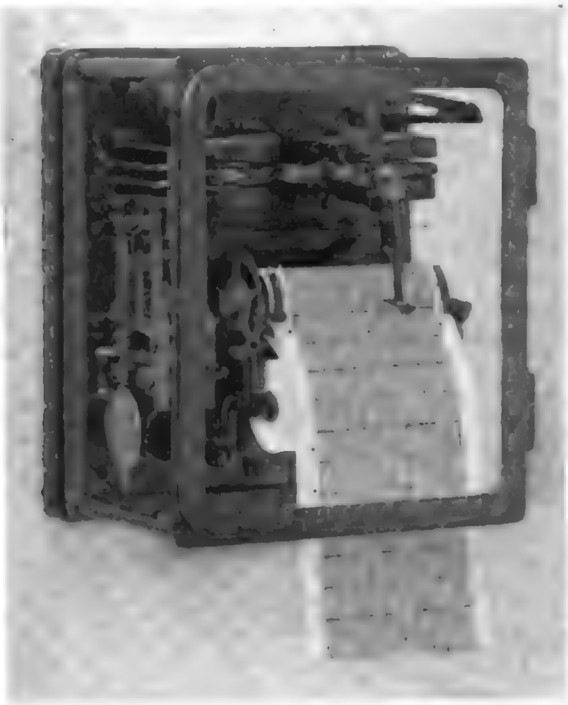

FIG. 2.—GRAPHIC RECORDER, WITH COVER.

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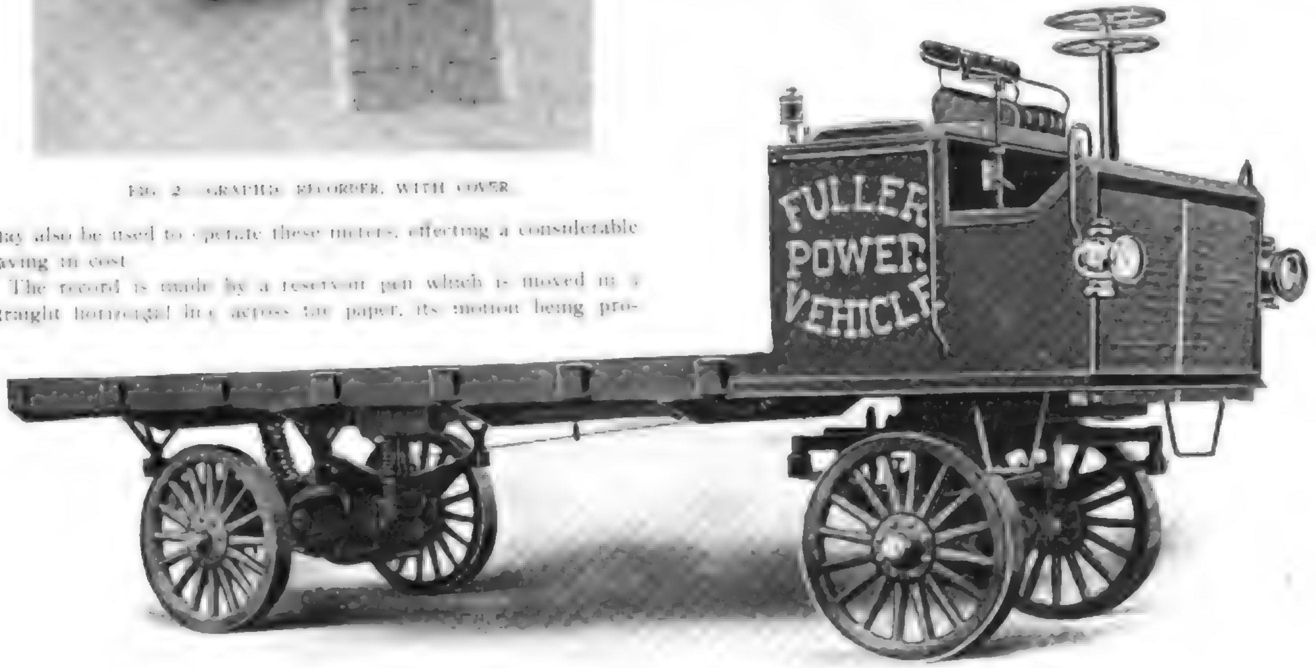
The Fuller Power Vehicle.

An interesting heavy electric truck is being perfected by the Fuller Power Vehicle Company, of Detroit, under, Mr. Rudolphus R. Fuller, manager of the Fuller Company, well known as a manufacturer of engines and dynamos. An illustration of one of these vehicles is shown herewith. The initial power is a gasoline engine carried on the vehicle and direct-connected to a dynamo. This furnishes power to two electric motors, one of which is geared to each axle. The carrying platform of this truck is 20 ft. in length by 6 ft. in width, over all. Four feet of the length is taken up by the engine, generator, water tank, fuel tank and radiator. The balance of the platform (6 by 16 ft.) is available for load. The vehicle is rated as having a carrying capacity of from five to seven tons net. The weight of the vehicle is given as about 6,000 lb. It is constructed entirely of steel, even to the tires. It has the artillery type of wheels with bearings of navy bronze and capillary oiling arrangements. The framing is of steel channels and I-beams. The forward end of the vehicle is supported on a turntable with ball bearings. As the forward axle is driven as well as the rear axle, the operator can turn the vehicle completely around within its own length. By driving all four wheels much better traction is of course secured than where the rear wheels only are driven.



ELECTRIC POWER VEHICLE.

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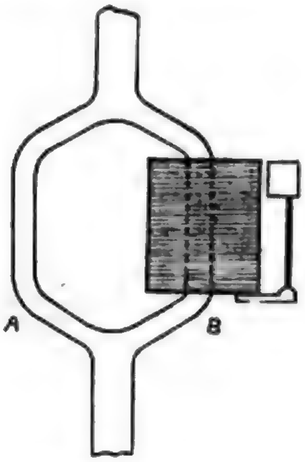
Time Lag for Circuit-Breakers.

The arrangement shown in the accompanying illustration is being used in England to obtain a time lag for circuit-breakers, by shunting an inductive circuit by a non-inductive one. Two circuits of thick copper rods are put in parallel, one of them being surrounded by a laminated horse-shoe magnet having an armature. A rush of current first goes through the non-inductive leg while the growth of current in the inductive leg is slow.

When the current becomes approximately equal in both legs there is only an exceedingly small force left to overcome the counter e.m.f. of the inductive leg. When the current in the inductive leg reaches a certain limit, the armature is attracted and makes contact, so as to work the circuit-breaker solenoid in the ordinary manner. The apparatus gives considerable time lag.



TIME LAG DEVICE FOR CIRCUIT-BREAKERS.

The Jenney Grinding and Buffing Motor Equipment.

The Jenney Electric Manufacturing Company, of Indianapolis, is putting out a very neat electric motor equipment for light service in grinding, buffing and polishing. The motor is mounted on a solid cast iron pedestal and has emery grinders or buffing wheels mounted on each end of the axle as shown in the accompanying engraving. The motor is for direct current and runs at 2,700 r.p.m. It is designed to carry two wheels of 8 in. diameter or under. It is furnished wired complete ready to connect to the power circuit with the starting resistance inside the pedestal and fully protected. The starting switch is mounted on slate attached to the pedestal convenient to the operator. The motor is, of course, provided with fully enclosed heads and dust-proof bearings. There are adjustable tool rests and water pots provided for each grinder. The arrangement is very neat as compared to belt-driven grinders requiring countershafts, high-speed belts and small driven pulleys.

GRINDING AND BUFFING MOTOR.

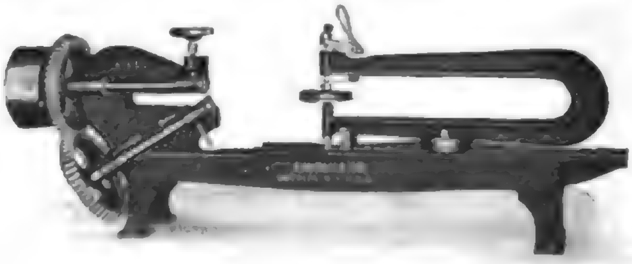
Reflecting Shade and Fixture.

The Holophane Glass Company has placed upon the market a new fixture called the "Pagoda reflecting arc," shown herewith. A small compact cluster is used carrying small "Holophane Pagoda" reflectors, surmounted by a large reflector of the same type. The combination gives a remarkably good distribution of light, and with its chain fixture presents, as will be seen, a handsome appearance. The shades, all consisting of clear glass, when lighted up present a brilliant appearance and add artistically to any place where they are used.

REFLECTING SHADE AND FIXTURE.

Shears for Armature Discs.

A special machine has recently been built by E. W. Bliss Co., Adams Street, Brooklyn, N. Y., for the purpose of cutting the outside and inside of armature discs and other metal rings of similar nature. As shown in the engraving, it can be driven by either belt power from a motor, etc., or by hand.

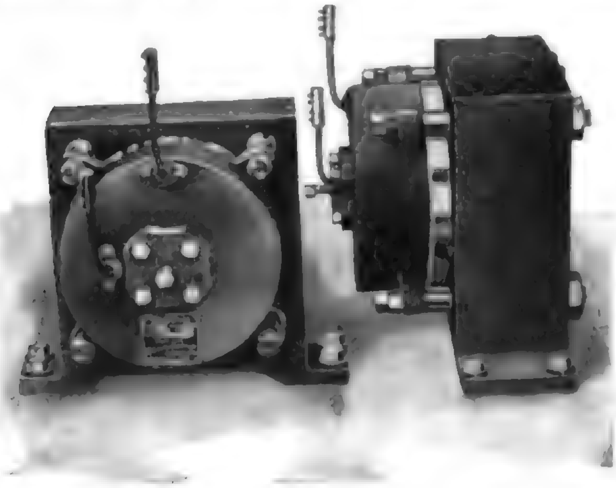


SHEARS FOR ARMATURE DISCS.

The angular position of the lower cutters insures a cut equally clean on both the outside and the inside edge of the disc. The machine has cut gears and is very carefully built throughout so as to meet the demands for a tool of great accuracy. The circle clamping head is rigidly guided in the ways and is also provided with side adjustment to set the clamping discs off the center line to bring them into proper relation to the cutters, viz.: opposite the point of cut when making outside cuts, and to set them opposite center cutter for cutting rings. The shear will cut stock up to No. 20 B. W. G. and the capacity of the smallest and largest circles is 3 to 40 in.

Magnetic Crane Brake.

In all cases where electrically-driven machinery requires frequent stops and reversals, the facility and speed of handling material, and also the safety of the crane or other machinery employed, depends upon the accuracy and reliability of the brake. The brake shown in the illustration herewith has been designed to meet the exacting requirements of this service. The brake is released by an electromagnet through a diminutive air-gap, which operates quickly with a comparatively small current and without any hammer blow. The brake force is always maximum and equally effective in either direction of rotation.



MAGNETIC BRAKE.

The heat is carried away from the friction surfaces by the circulation of oil and is effectively radiated from the entire surface of the friction case. The brake is adjusted to release on one-half full load current of the motor as a maximum. Due to the large pole area, the brake does not drop back until the current has decreased to about 1/10 the full value, insuring a continued release of the brake until the current is entirely cut off. This brake is made by the Electric Controller & Supply Company, Cleveland, Ohio.

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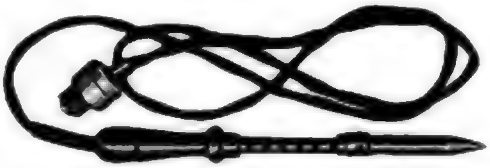
Electric Soldering Irons.

The accompanying illustration shows an electric soldering iron which has recently been placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. It is of compact construction and has been designed for close work, such as the soldering of jacks in telephone switchboards. The device is so simple that a novice can use it without instructions. The heat generating resistance is hermetically sealed from the air by a protective heat-resistant coating, which does not depreciate in the practical use of the soldering iron. The heating unit is readily removable. Between the heating unit and the heat-emitting surface there is placed a solid material of good heat conductive qualities. There is no mechanism or automatically movable elements within the soldering iron. It is stated that there is no possibility of short-circuit of the heating unit against the working surface of the iron, even though the unit be burned out intentionally by subjecting it to a voltage twice as high as the normal. The soldering device is manufactured for use without exterior resistance upon a circuit of 700, 500, 220, 110 or 80 volts, according to the specifications of the purchaser.



ELECTRIC SOLDERING IRON.

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Ground-Connection Clamp.

The recent decision of the insurance underwriters of the Philadelphia and Middle Division requiring in electrical installations the use of clamps for grounding metallic conduits or the metal sheaths of electrical cables, has led the Novelty Electric Company, Philadelphia, to design and manufacture a one-piece ground connection clamp, made of copper tubing, and of sizes to fit pipe from one-half to three inches in diameter, the lug taking a grounding wire of any size up to No. 4 B. & S. The clamp binds the wire very tightly, making a perfect electrical contact. This new type of clamp is shown in the accompanying illustration.

GROUND CONNECTION CLAMP.

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Ventilation of the Broadway Tabernacle.

Church auditoriums present a number of special difficulties in their heating and ventilating problems. In the case of the magnificent new Broadway Tabernacle, on upper Broadway, New York, there was one particular difficulty to contend with, namely, that under the auditorium there is a hall, which had to be left free of pipes and other objectionable features from an æsthetic point of view; in other words, there is no cellar in which pipes and ducts could be placed. A space between the auditorium and the ceiling below was provided for this purpose. This space is about three feet deep, but as it is due to the depth of the girders that carry the floor its usefulness for placing pipes and ducts was limited, as can readily be understood. After carefully considering all these points it was desired to use the blast system of heating, with mechanical exhaust and automatic temperature control for the auditorium, and direct radiators controlled by hand for the vestibules.

The seating capacity of this auditorium is 1,500. The apparatus was designed to supply 25 cu. ft. of air a minute per person to 1,600 persons, or a total of 40,000 cu. ft. of air a minute. It may be mentioned that in this case 25 cu. ft. a minute per person was about the maximum amount of air that could be introduced without causing drafts and noise, and this was introducing a large proportion of the air through top inlets. The entire use of bottom inlets would have been impossible without causing drafts, or considerably reducing the amount of air supplied.

A three-quarter housed centrifugal fan, built by the B. F. Sturtevant Co., Boston, Mass., is used to supply the air. This fan has a blast wheel 9 ft. in diameter by 4½ ft. wide, and is driven by a direct-connected motor. The fan is calculated to deliver 40,000 cu. ft. of air a minute at 130 r.p.m.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The continued winter weather retarded retail trade and affected jobbing sales and shipments, and building operations temporarily. The uncertainty as to the coal strike caused hesitancy in some lines of industry. Collections are slow owing somewhat to the effects of the weather conditions. Favorable features of the general business situation are the reported advance in wages in several industrial lines; the growth of the belief that there will be no coal strike and the strengthening of prices of leading staples, such as grain and cotton. General snow has put the winter wheat crop beyond harm, but planting operations are delayed. The pig iron market was dull, but there were many sales of steel rails, aggregating over 100,000 tons for the week. The steel rail production for 1906, it is estimated, will considerably exceed the large output of 1905. Some large contracts for structural material are pending, and a very heavy business in this line is looked for. The copper market was characterized by large and steady buyers of prime grade copper. Prices are 18⅝ to 18¾c. for Lake; 18½ to 18⅝c. for electrolytic and 18 to 18¼c. for casting stock. Machinery and machine tool manufacturers report an increasing business. Railway earnings are highly satisfactory and the ratio of net earnings to gross have never before been equalled. The reports for the first half of March show an increase of about 12 per cent in gross receipts as compared with the corresponding period last year. Gross receipts for January advanced 20.3 per cent over those of the same month in 1905, while the net receipts increased 44 per cent. In February gross earnings increased 25.6 per cent. *Bradstreet's* reports 170 business failures during the week ending March 22 as compared with 187 the week previous and 204 in the corresponding week last year.

LARGEST POWER STATION IN JAPAN.—That Japan is the center of electrical development in the East is evidenced by the installation of the largest electrical generating station in the Empire which the Tokio Electric Light Company now has under construction. This company already operates a steam-driven plant in the city of Tokio and the new plant will meet the increasing demand for power. The new plant, contracts for which have been recently closed, is located on the Tamagawa River, about twenty-five miles from Tokio, with which it will be connected by high-tension transmission lines, operating at a higher voltage than has been attempted heretofore in Japan. At the station the main generating apparatus will consist of five 3900-kilowatt Siemens & Halske machines directed connected to Escher Wyss water wheels. The generators will deliver 50 cycle current at 6600 volts. All high-tension switches are of the well-known General Electric H-3 oil type, motor operated and electrically controlled from a separate five-panel bench board. This system of remote control is also carried out for the rheostats and circuit breakers, which are also operated from the bench board. This switchboard will be furnished by the General Electric Company and is similar to one used in the New York Interborough station. The transformer equipment at the generating end of the line consists of nine 2000-kilowatt General Electric transformers, arranged for stepping up the voltage to 35,000 for transmission when connected in delta or 57,000 when Y-connected. For the present the current will be transmitted at about 40,000 volts, but eventually 60,000 volt transmission is planned. The receiving station will be located just outside the city and will contain the main step-down transformers, which are also furnished by the General Electric Company. The initial installation for the sub-station will consist of nine 1800-kilowatt units adapted to step-down the voltage from either 33,000 or 57,000 to 11,000 volts. The arrangement is thus suitable for the transmission voltage which is at present planned, and likewise will meet future needs when the transmission voltage is increased to 60,000. In the sub-station, as in the main generating plant, the switchboard will be furnished by the General Electric Company. From this station, on the outskirts of the city, all wires will be laid underground to various small distributing stations located about the city, transmission being at 11,000 volts.

MARCONI STOCK.—Considerable interest was aroused in Wall Street this week by the fact that stock of the Marconi Wireless Telegraph Company of America is at present being offered in widely distributed circulars at $100 a share, with interest at 5 per cent, guaranteed for five years by Reall & Co., of Philadelphia. These circulars state that the firm's contract to pay 5 per cent interest for five years is guaranteed by a bond of the Metropolitan Surety Company of New York and that the interest is payable at the West End Trust Company of Philadelphia. The Marconi Wireless Telegraph Company of America officially disclaims all connection with Reall & Co., of Philadelphia. An officer of the company states that the offer of its stock is being made without authority and against the wishes of the company. Officers of the Metropolitan Surety Company said that they objected to the form of the circulars being sent out by Reall & Co. because from them the inference might be drawn that the Metropolitan Surety Company was guaranteeing 5 per cent interest on the stock of the Marconi Wireless Telegraph Company. The Metropolitan Surety Company, it was added, is acting in no way for the Marconi Wireless Telegraph Company, and that its only undertaking in the matter of this interest is directly with the firm of Reall & Co. The curb quotations on Marconi stock are $35 asked and $33 bid.

THE H. C. K. COMPANY has just been organized with offices for the present at 45 Broadway. The corporation will make high grade electrical and mechanical specialties, devoting attention chiefly to the electric lighting field, and has already a number of meritorious novelties ready for the market. The president of the company is Mr. J. H. Hallberg, well known in the central station field and a prolific inventor, whose name is associated with some admirable specialties. Mr. H. B. Coles is the vice-president. Mr. P. H. Klein, Jr., is the secretary and treasurer, and is a man who has an unrivalled experience as a practical manufacturer in this field, dating back to the earlier Bergmann, Edison, Sprague, Interior Conduit and "G. I." days. He will virtually be at the head of the shop management. Mr. George H. Benjamin, the well-known patent attorney, will have charge of the legal and patent department. He has been associated with several of the interests above named, as well as with the Siemens & Halske, Ganz, Bridgeport Brass, Ansonia Brass & Copper, Standard Oil, American Sugar Refinery and other companies. This is a strong combination of engineering and technical talent, and a good deal will be expected of the new concern.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company's instrument statement for February and two months, ending February 28, 1906, compares as follows:

February—	1906	1905.	1904.
Gross output.	161,775	134,301	84,402
Returned.....	48,842	47,577	37,093
Net output.	112,933	86,724	47,309
January 1 to February 28—			
Gross output.	338,382	264,935	175,046
Returned.....	112,066	85,277	73,947
Net output.	226,316	179,658	101,099
Total outstanding	5,924,574	4,660,222	3,880,616

ALLIS-CHALMERS MOTOR OUTFITS.—The Milwaukee Coke & Gas Company has recently purchased a number of Allis-Chalmers direct-current motors. The new outfit will include an aggregate of a hundred horse power. The Allegheny County Light Company of Pittsburg, Pa., is a recent purchaser of two hundred horse power in Allis-Chalmers induction motors. The Glidden Varnish Company of Cleveland, O., has recently placed orders with the Allis-Chalmers Company for a number of motors, ranging from 5 to 20 hp.

SALE OF NATIONAL ELECTRIC PLANT.—A despatch from Milwaukee, Wis., says the plant of the National Electric Company, including all assets, was sold March 26 at the office of John S. Maxwell, referee in bankruptcy, to Charles L. Sullivan of Chicago for $500,000. The statement of Receiver John I. Beggs showed assets of $1,350,601 and liabilities of $1,242,000. Creditors will, it is stated, receive approximately 40 per cent of their claims.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was inactive and professional in character in the early part of the week, but later it developed strength, and sentiment changed from depression to renewed confidence in the maintenance of present prices. The United States Steel stocks were quiet, notwithstanding the very favorable annual report for 1905. Electric securities were weak and little business was done in them. Westinghouse closed at 161; General Electric at 168½—a decline of ½ point—and Allis-Chalmers 21⅛ and 58 for common and preferred, respectively. The last two quotations represent net losses of ¾ on common and 1¾ points on preferred. Brooklyn Rapid Transit closed with a net loss of 1⅛ points, the last quotation being 83, but Metropolitan Street Railway made a net gain of ⅜, closing at 112, ex-div. Interborough-Metropolitan common is quoted at 50⅜ on the curb and 4½s at 90½. A net advance of ¼-point is recorded in Western Union, which closed at 92½, and of ¼-point for Mackay Companies—on the curb—the closing quotations being 59½. American Locomotive, common and preferred, close at 68¼ and 116⅞, respectively. Transactions on the curb during the week were very small, most of them representing manipulations. Efforts were made to stimulate interest in the copper shares, but they failed. Following are the closing quotations of March 27:

NEW YORK

	Mar. 20	Mar. 27		Mar. 20	Mar. 27
Allis-Chalmers Co.	21	21⅛	General Electric	167	167
Allis-Chalmers Co. pfd.	59¾	58	Hudson River Tel.	...	...
American Dist. Tel.	30	30	Interborough Rap. Tran.	227⅛	228
American Locomotive	69¼	68	Mackay Cos.	59¾	59⅝
American Locomotive pfd.	118¾	115	Mackay Cos. pfd.	74	72½
American Tel. & Cable	92	92	Marconi Tel.	...	...
American Tel. & Tel.	136	138	Metropolitan St. Ry.	112	112
Brooklyn Rapid Transit	83¾	84	N. Y. & N. J. Tel.	...	...
Electric Boat	27	27	Western Union Tel.	91	92
Electric Boat pfd.	65	65	Westinghouse com.	161	158
Electric Vehicle	17	12	Westinghouse pfd.	...	...
Electric Vehicle pfd.	16	15			

BOSTON

	Mar. 20	Mar. 27		Mar. 20	Mar. 27
American Tel. & Tel.	137	138¼	Mass. Elec. Ry. pfd.	68½	69
Cumberland Telephone	117½	...	Mexican Telephone	...	4½
Edison Elec. Illum.	...	237½	New England Telephone	140	139
General Electric	...	167⅞	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	19¼	Western Tel. & Tel. pfd.	...	...

PHILADELPHIA

	Mar. 20	Mar. 27		Mar. 20	Mar. 27
American Railways	51	51	Phila. Electric	7⅜	7¼
Elec. Co. of America	11⅛	11⅛	Phila. Rapid Trans.	29¼	27⅞
Elec. Storage Battery	79	78	Phila. Traction	98¾	99¼
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Mar. 20	Mar. 27		Mar. 20	Mar. 27
Chicago City Ry.	160	165	National Carbon	91	96
Chicago Edison	156	160¼	National Carbon pfd.	118	116
Chicago Subway	49	49	Union Traction	...	...
Chicago Tel. Co.	116	117	Union Traction pfd.	...	...
Metropolitan Elev. com.	26¼	26¼			

DIVIDENDS.—The directors of the Westinghouse Electric & Manufacturing Company have declared the regular quarterly dividend of 2½ per cent on the preferred, the assenting and the non-assenting stocks payable April 10. The National Carbon Company has declared a dividend of 1 per cent on its common stock, payable April 14. The Bell of Missouri Telephone Company has declared a regular quarterly dividend of 2 per cent, payable April 2. The Chicago Telephone quarterly dividend of 2½ per cent is payable March 31. The directors of the Mexican Telegraph Company have declared the regular quarterly dividend of 2½ per cent on the stock, payable April 13, to stockholders of record March 31. The directors of the Hall Signal Company have declared the regular quarterly dividend of 1½ per cent on the common and the regular annual dividend of 6 per cent on the preferred, both payable April 2.

WESTINGHOUSE CAPITAL INCREASE.—The stockholders of the Westinghouse Electric Company, at a special meeting at East Pittsburg on March 26, voted unanimously to increase the capital stock from $25,000,000 to $50,000,000. The recent action of the board of directors, by which the company issued $15,000,000 convertible gold bonds of $1,000 each was also ratified. The attendance of stockholders was large, 389,543 shares being represented. The next annual meeting will be held in July, when a full financial statement of the company's business will be made.

THE WEST INDIA ELECTRIC'S ANNUAL.—The first annual report submitted by the new board of directors of the West India Electric Company, of Jamaica, at the annual meeting held in Montreal, Que., Canada, a few days ago, showed that very marked progress had been made. The gross earnings for the year amounted to $139,762.33, an increase of $8,596.08, or 6.55 per cent over the previous year. The net earnings amounted to $34,242.57, an increase of $6,111.39, or 10.09 per cent. The entire net profits have been placed to the credit of surplus account, and from that account has been written off for reinforcement of feeders, depreciation in value of stores, bad debts and accidents, the sum of $5,440.44, leaving a balance to the credit of surplus account of $142,883.04. The indebtedness to the Bank of Montreal has been reduced from $58,288.54 to $23,426.38. The following board of directors was elected: James Hutchinson, president; C. J. Fleet, K. C., vice-president; Hon. David MacKeen, W. Graham Browne, Henry Holgate, G. M. Webster and A. R. Oughtred. The earnings were chiefly from traction, but the electric lighting department showed earnings of $3,191. The company is now taking over the electric light system at Kingston, of the Jamaica Electric Light & Power Company, Limited.

ELECTRIC STORAGE BATTERY.—The Electric Storage Battery Company reports a most prosperous year in 1905. The income account shows as follows for the twelve months ending December 31:

	1905.	1904.	1903.
Gross	$1,467,486	$1,344,536	$1,761,058
Expenses	389,032	378,877	352,048
Net	$1,078,454	$965,659	$1,409,010
Other income	135,533	117,249	92,581
Total income	$1,213,987	$1,082,908	$1,501,591
Dividends	812,440	812,435	812,435
Surplus	$401,547	$270,473	$689,156

The principal items for the year compare as follows:

	1905.	1904.	1903.	1902.
Net	$1,213,987	$1,082,908	$1,501,591	$1,113,199
Dividends	812,440	812,435	812,435	812,427
Surplus	$401,547	$270,473	$689,156	$300,772
Previous surplus	3,198,864	2,972,633	2,323,354	2,022,582
Adjustments	43,416	44,243	39,877	.....
Total surplus	$3,556,994	$3,198,863	$2,972,633	$2,323,354

WASHINGTON RAILWAY & ELECTRIC.—The income account of the Washington Railway & Electric Company for the year ended December 31, 1905, compares as follows:

	1905.	1904.	1903.
Gross	$2,905,907	$2,644,360	$2,462,295
Expenses	1,478,466	1,355,822	1,328,052
Net	$1,427,441	$1,288,538	$1,134,243
Other increase	50,553	49,024	32,906
Total increase	$1,477,994	$1,337,562	$1,167,149
Interest and taxes	999,455	981,039	945,270
Surplus	$478,539	$356,523	$221,879

THE CENTRAL HOME TELEPHONE COMPANY, having a capital of $5,000,000, has been organized for the purpose of taking over the properties of fifteen or twenty independent home telephone companies in Kentucky and southern Indiana. The new organization, while primarily a holding company, is also a building and organizing company. E. L. Barber, of Massillon, O., is president of the company; Joshua D. Powers, of Louisville, is treasurer, and J. L. Monteith, of Bloomington, Ind., is secretary.

SOUTHEASTERN TELEPHONE.—The proposed increase of the stock of the Southeastern Telegraph and Telephone Company from $10,000,000 to $20,000,000 was authorized at the meeting of stockholders recently. Subsequently the stockholders held their regular annual meeting and re-elected the retiring directors.

WHATCOM COUNTY LIGHTING.—A mortgage for $2,500,000 to secure 5 per cent thirty-year bonds has been given by the Whatcom County Railway & Light Company, of the State of Washington, in favor of the City Trust Company of Boston. The mortgage covers all the company's property.

WISCONSIN MERGER.—Chicago capital is interested in the consolidation of the La Crosse (Wis.) Street Railway Company, La Crosse Gas & Electric Company, and La Crosse Hydro-Electric Light & Power Company, the combination of these public utilities involving $5,500,000.

CENTRAL & SOUTH AMERICAN.—The Central & South American Telegraph Company for the year ended December 31, shows gross, $1,316,249; net, $841,926; dividends, $463,536; surplus, $378,390. The gross was $170,000 better than 1904; and the surplus is nearly doubled.

GENERAL NEWS.

Construction News.

TEXARKANA, ARK.—The Texarkana Telephone Company contemplates improvements which will cost about $35,000.

EUREKA SPRINGS, ARK.—The City Council of Eureka Springs has granted the Citizens' Electric Company 81 years additional to its franchise for its lighting plant, which makes the franchise expire at the same time its electric railway franchise does.

ALBERTVILLE, ALA.—Edgar O. McCord, of Albertville, writes that the Fall City Hotel, Power & Mineral Water Company will develop the water power at Fall City at a cost of $35,000. Bids for construction will be received about July 1. Engineer, E. B. Kay, of Tuscaloosa.

RIVERSIDE, CAL.—The Riverside Power Company is said to have been purchased by the Pacific Light and Power Company of Los Angeles.

OAKLAND, CAL.—The Oakland Gas, Light & Power Company has begun the work of placing its wires underground in the business section of the city.

OAKLAND, CAL.—The Home Telephone Company of Alameda County, which is backed by the same financial interests that are behind the Home Company of San Francisco, was granted a franchise in Oakland for fifty years.

RED BLUFF, CAL.—The application of the Red Bluff & Redding Railway Company for a franchise to build a line down Main Street has been refused. After this action by the trustees, Chief Engineer W. D. Nicholson filed a petition formally asking for a franchise to build the road on Madison Street.

EUREKA, CAL.—Sealed bids will be received up to April 9 for a 50-year franchise applied for by the North Mountain Power Company for erecting and maintaining wires and poles for the transmission of electric heat and light over streets and roads in the town of Fields Landing. F. M. Kay is deputy clerk.

LOS ANGELES, CAL.—Senator Flint has introduced a bill at Washington granting the Edison Electric Company of this city permission to occupy certain lands for electric power plants in the San Bernardino, Sierra and San Gabriel forest reservations for a term of years, to be determined by the Secretary of Agriculture.

RIVERSIDE, CAL.—The Riverside Trust Company, the Riverside Water Company, the Riverside Land & Irrigation Company, and the the Chase Nursery Company are interested in the construction of an electric plant to supply power to the Santa Ana Valley. The plant will cost about $250,000.

SONORA, CAL.—The Tuolumne Electric Company is at present installing machinery at its electric plant on the Tuolumne, about two miles below the mouth of the Clavery River. The plant will furnish 2400-hp, and will supply power to the mines in the Big Oak Flat and Groveland district and also to a group of mines, which will be operated by the company.

SAN FRANCISCO, CAL.—The Central California Traction Company, which has just built 9 miles of electric railway in Stockton, is to immediately build a line 18 miles long between the latter city and the town of Lodi. The company has decided to issue $1,500,000 worth of bonds, the proceeds from which will be used for extensions, including the Lodi line.

PALO ALTO, CAL.—A press report states: The monthly report of the City Clerk developed the fact that a large number of the regular customers of the municipal plant were far behind in their payments, and the Town Board immediately passed resolutions calling upon the City Clerk to enforce the ordinance. There is still $1,600 due the city plant for light and water rentals from 863 customers.

SAN FRANCISCO, CAL.—The Weed Lumber Company, San Francisco, recently ordered Allis-Chalmers electrical machinery for Marysville, Cal. The new outfit consists of a 700-kw belted alternator and a small belted exciter, together with a large number of induction motors to be built at the Allis-Chalmers works, Cincinnati, ranging from 3 to 75 hp each, with a total aggregate of 248 hp.

SAN FRANCISCO, CAL.—Allan Pollok has resigned his position as manager of the San Francisco Gas & Electric Company, and, with Frank J. Kilpatrick of New York, representing Eastern capital, is said to be working up a proposition for selling a large water supply from the Stanislaus and Calaveras rivers to the city of San Francisco. In connection with the project is a water power capable of developing 20,000 hp.

OAKLAND, CAL.—The California Gas & Electric Corporation is preparing to build a new pole line along the foothills from Walnut Creek, back of Mount Diablo to Oakland, instead of through the city of Berkeley as at present. This will bring the double 60,000-volt transmission line of the Bay Counties system directly into Oakland and avoid passing through residence streets as is done now. Two carloads of [illegible] porcelain insulators have already arrived for the new line.

SAN FRANCISCO, CAL.—The California Gas & Electric Corporation is rushing the work of installing the new Deer Creek power-house at Cooper's sawmill with all haste. The site for the power-house is being prepared, and there will be considerable blasting necessary. A great quantity of concrete will be used, as the power house will be built of cement, steel and stone. The plant will have a capacity of some 8,000 hp, which is four times the amount generated at the Rome power house.

UKIAH, CAL.—The Snow Mountain Power & Water Company, owned by San Francisco capitalists, is preparing to supply water and power to Mendocino, Lake, and parts of Napa and Sonoma counties. The extensive works of the company will be finished about November 1. The capital of the company is $5,000,000, and the officers are: President, Charles N. Felton; vice-president, W. W. Van Arsdale; directors, George W. Scott, Timothy Hopkins and F. D. Madison, representing the Pillsbury interests. A tunnel one mile long has been bored connecting the Eel River valley with Potter valley, which is 430 ft. lower. Through this tunned water will be carried to the power plant at the mouth of the tunnel, where 20,000 hp will be developed. The water then will be carried in ditches to the Potter, Ukiah and Sonoma valleys for irrigation.

DURANGO, COL.—The Animas Power Company, which has already installed machinery in its big power plant building above Rockwood, and is in readiness to supply electric power for the mines and mills of the San Juan, announces that $600,000 more will be expended this year in enlarging the plant.

RED BLUFF, COL.—Negotiations have been concluded for the right of way of the new power line which will be constructed by the Northern California Power Company from its plant at Volta, near Manton, in this county, to Chico, and thence to the new sugar refinery at Hamilton. An auxiliary line for light and power will be built for the settlement at Los Molinos, and electricity will be supplied to the various subdivisions for irrigation and lighting. The land concern has also agreed to take 200-hp for manufacturing and pumping.

WILLIMANTIC, CONN.—Surveyors have completed to Storrs the survey of the proposed trolley line between Willimantic and Stafford. The route runs through Mansfield Center, Storrs and near Gurleyville, Chaffeeville and Hanks Hill.

NORWICH, CONN.—The plan to erect the power house of the Norwich & Westerly electric railway at tidewater has been abandoned and it has now been decided to build the plant at Hallville, near Poquetanuck, about four miles from Norwich.

NEW LONDON, CONN.—The Connecticut Railroad Commissioners have approved the plans and the method of construction of the new Preston, Ledyard & North Stonington Railway, which is to extend from Norwich to the northerly part of the village of Westerly. The new road will pass through the village of Old Mystic and Ledyard to Norwich and from there will go down along the Thames to New London.

NEW LONDON, CONN.—Plans which involve the relaying of the entire street railway track of New London, replacing the present 4-inch 48-pound rails with standard 8-inch 78-pound rails, pushing to completion the contemplated Jefferson Avenue loop, also a loop through Truman Street to Blackhall, the double-tracking of the Main Street line and also of the Bank Street and Montauk Avenue lines, were outlined by First Vice-President Townley and General Manager John K. Punderford of the Consolidated Railway at a conference held with the street committee at the office of Mayor Bryan F. Mahan in City Hall a few days ago.

WASHINGTON, D. C.—The work of increasing the capacity of the power house of the Washington, Alexandria & Mount Vernon Railway at Four Mile Run, Va., has been started. No change is to be made in the interior of the generator and engine room, there being ample space in the building for the installation of a new 1,500-hp turbine engine and two generators. This addition to the plant is made necessary by the increased number of trains that will be put in service during the coming summer, and by the fact that the power to light the new Luna Park and to run the attractions there will be furnished from the Four Mile Run plant.

WASHINGTON, D. C.—Bids will be received until April 10 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 431, water pipe and fittings, etc.; schedule 432, generating set, electrical supplies, etc.; schedule 433, electrical cable, electrical supplies, hydraulic jacks, pine, sheet copper, tool steel, bar iron, roof trusses, pipe and fittings, steam traps, etc.; schedule 434, circuit-breakers, pine, ingot copper, steel angles, etc.; schedule 435, twist drills, boiler test pump, sheet copper, angle iron, galvanized sheet steel, etc.; schedule 436, bolts, pig lead, etc., pipe and fittings, valves, etc.; schedule 437, pump, sheet brass, blacksmith's forges, pipe fittings, gate valves, angle valves, etc. Also until April 24 to furnish at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 440, concrete mixer, electrical conductor and supports, enameled iron conduit, corrugated tiles, iron pipe, foundry facings; schedule 441, steam pump, drills, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-General, U. S. N. Bids will be received until April 20, at the office of the Secretary, Smithsonian Institute (R. Rathbun, acting secretary), to furnish to the Smithsonian Institute, U. S. National Museum, International Exchange, Bureau of American Ethnology, National Zoological Park, and Astrophysical Observatory during the fiscal year ending June 30, 1907, the following: Plumbing and electrical supplies; building materials, etc.

CHIPLEY, GA.—A committee of citizens has been appointed with Colonel T. T. Murrah as chairman, to ascertain the possibility of organizing a company to construct water works and an electric light plant.

MARIETTA, GA.—The Georgia Manufacturing & Public Service Company, of Marietta, Ga., has purchased through the New York office of the Allis-Chalmers Company, one 18x36x42-in. heavy duty, cross-compound engine for use in that city.

ROCKMART, GA.—Bids will be received until April 9 by A. H. Graefer, clerk of the Council, for constructing an electric light plant, embracing boiler, high speed engine, heater pumps, switchboard, series arc light system, electric and steam material and building. Jos. M. Roman & Company, Engineers, Century Building, Atlanta, Ga.

NAMPA, IDA.—A. K. Stoddard has been granted a franchise to erect telephone poles and wires for an independent telephone company.

CUBA, ILL.—It is reported that a municipal electric light plant will be constructed here.

ALEXIS, ILL.—Fire destroyed the electric heating plant at this city, causing a loss of $3,500.

PEORIA, ILL.—A petition is being signed by the villagers for the establishment of a municipal plant and will be presented to the council at its next meeting.

ROSELAWN, ILL.—At a special meeting of the Village Board of this city the Interstate Traction Company was granted a franchise to build and operate its line through the village.

SPRINGFIELD, ILL.—The Springfield Consolidated Railway Company will extend its line on South Grand Ave., to the site of the proposed new club house to be erected near the Leland Hotel farm; an outlay of $16,000 will be involved.

CHICAGO, ILL.—The committee on local transportation of the City Council has recommended the passage of the ordinance permitting the Humboldt Park branch of the Metropolitan Elevated to be extended to the city limits at Seventy-second Avenue.

BARTLETT, ILL.—The Chicago & Oak Park Elevated Railway Company, of Chicago, has submitted plans to the promoters of the proposed new electric lines between Elgin and Chicago, for a Lake Geneva branch, which will pass through Desplaines, Palatine and Lake Zurich.

SPRINGFIELD, ILL.—A certificate has been filed with the Secretary of State for an increase of capital stock by the Elgin & Belvidere Electric Railway Company from $2500 to $1,200,000. The company is chartered to construct an electric railway from Elgin to Belvidere.

MATTOON, ILL.—The announcement is made of the consolidation of the Mattoon Telephone Company, the Coles County Telephone Company, and the Charleston Telephone Company, all three companies being taken over by the Coles County Telephone & Telegraph Company, which was recently incorporated for $100,000.

EAST ST. LOUIS, ILL.—Announcement was made March 23 of the merging of the East St. Louis & Suburban Railway and the Alton, Granite City & St. Louis Company, which connect St. Louis with a score of Illinois towns and cities within a radius of 40 miles. The new company will be incorporated with a capital stock of $14,000,000.

TROY, IND.—The firm of Gardner & McLaughlin has been granted the right to erect and operate an electric light plant in the town of Troy.

HAMILTON, IND.—This city has decided to issue bonds in the sum of $1,800, payable in ten years at 5 per cent interest, for the erection of an electric light plant.

SHELBURN, IND.—This city is to have a new electric light plant. The town board granted a franchise at its last meeting to a company composed of Thos. Duncan and others.

INDIANAPOLIS, IND.—The Indianapolis & Frankfort Traction Company has been granted a franchise by the town board of Sheridan to build an interurban line from Carmel north to Frankfort.

MT. VERNON, IND.—The election to vote a subsidy in aid of the construction of the Vanderburg & Posey County Electric Railway in Smith township on March 24 was carried in favor of the tax.

GOSHEN, IND.—It is stated that the Central Union (Bell) Telephone Company will expend about $50,000 in installing a complete new plant at Goshen. The plans have been approved and work will begin soon.

INDIANAPOLIS, IND.—The promoters of the Belt road, who are planning to encircle Indianapolis, held a meeting in this city March 23, at which it was decided to effect a permanent organization and secure a survey at once. The cost of road is estimated at $2,500,000.

JEFFERSONVILLE, IND.—It is announced by Charles Fiske, chief engineer of the Louisville & Indianapolis Traction Company, that the road, proposed to connect Louisville and Indianapolis, has been financed. The plan is to build from Sellersburg to Seymour, a distance of 42 miles.

FORT WAYNE, IND.—The proposition of the Home Telephone Company to take over the National Telephone Company, owning 1,000 miles of toll line and exchanges in Kendallville, Sturgis and other points, has been accepted. The price is $90 on a capital stock of $250,000. The National people will accept $225,000 in 6 per cent preferred stock of the Home Company.

KOKOMO, IND.—President Marott of the Kokomo, Marion & Western Traction Company is not only furnishing electricity for lighting and cooking purposes, but is to supply the Leach Stone Quarry Company with power for a motor to drive pumps now at work draining the water from the quarry. Upon the completion of this work the company will use the motor to secure power for the crushing plant. The Traction Company is also arranging to install motors at the big brick plant south of the city.

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company, on the completion of the additions to its present power house now under way, will install for light and power a 1000-kw Allis-Chalmers turbo generator unit. The new unit will generate current at 60 cycles, two phase, 2300 volts. Other electrical machinery, consisting of a 30-kw direct-connected engine-type exciter set, a 35-kw "Bullock" motor-generator set, together with switchboards, condensers and piping, will also be furnished by the Allis-Chalmers Company.

WYNNEWOOD, I. T.—N. S. Sherman, of Oklahoma City, Okla., has secured the contract for constructing water works and an electric light plant for $26,046.

TAHLEQUAH, I. T.—Frank R. Lewis, of Tahlequah, president of the Illinois River Light & Power Company, writes that it is proposed to develop the water power of Illinois River near Tahlequah, at a probable cost of $100,000.

FORT DODGE, IA.—The Fort Dodge Light & Power plant was sold to a syndicate in Grand Rapids, Mich., for $256,000.

MANCHESTER, IA.—The Manchester Light, Heat & Power Company will increase its capital stock from $15,000 to $30,000.

RED OAK, IA.—L. M. Griffin & Son, owners of the Botna Valley Mills, are contemplating the promotion of a scheme to provide electric lights for Elliott and Griswold.

DES MOINES, IA.—Lewis B. Why, of Fort Wayne, Ind., and Richard Townsend, of Decatur, Ind., who are said to be interested in the Indianapolis & Northwestern and the Indianapolis & Eastern Companies, were in Des Moines recently as the prospective promoters of an electric railway from Des Moines to Ottumwa.

HUTCHINSON, KAN.—The directors of the Hutchinson Interurban Railway Company have bought a site for a power house and car barns. Work is to start at once on the construction of the city electric line to be extended later both east and west to the country.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company is to expend $150,000 in improving its systems at Topeka. A new switchboard with a capacity of 9,600 lines will be installed in the exchange building at 211 West Sixth Street. The building itself is to be enlarged.

LEITCHFIELD, KY.—The City Council has passed an ordinance offering for sale a franchise for an electric light plant.

LOUISVILLE, KY.—A new ordinance has been introduced in the lower board of the General Council asking that a franchise be sold covering the whole city instead of only a restricted portion of it. The ordinance stipulates at what price electricity shall be sold by the company and the manner in which the conduits shall be laid and poles erected. It also states that the purchaser shall furnish to the city streets lights at $74 per month a light, which is $10 less than the city is now paying for lights. The ordinance was referred to the Revision Committee and ordered printed.

HOMER, LA.—The Town Council has granted Edward Sawyer, of Ruston, a franchise for an electric light plant at Homer.

PORTLAND, ME.—All the machinery has been purchased for the new substation of the Portland Lighting & Power Company.

CUMBERLAND, MD.—The Legislature has authorized the merger of the Westernport & Lonaconing and the Cumberland & Westernport Electric Railways.

NORTH ATTLEBORO, MASS.—The citizens have voted to appropriate $35,000 for enlarging the municipal electric light plant.

BROCKTON, MASS.—A proposition to purchase the electric light and the gas plants of this city has been presented to the Common Council.

WINCHESTER, MASS.—An investigating committee has been appointed to report at a future town meeting on the construction of a municipal electric light plant.

TEMPLETON, MASS.—The committee appointed to investigate the electric lighting project has reported to the town meeting in favor of establishing a municipal lighting plant, the power to be purchased from the Gardner Electric Light Company.

LEXINGTON, MASS.—At a recent town meeting a motion was presented, advocating a 5-year contract with the Lexington Gas & Electric Light Company, and that all arc lamps (30) be discontinued and replaced by 117 incandescent lamps. The matter was referred to the finance committee.

MILFORD, MASS.—It is reported that when the present arrangement expires between the Milford & Uxbridge Street Railway Company and the Milford Electric Light & Power Company, whereby the latter receives electricity from the former, the Milford Electric Light & Power Company will erect its own plant.

HAVERHILL, MASS.—The Haverhill Electric Company, in its latest proposition to the city, expresses itself as willing to undertake the build ing of a suitable system of conduits, to be completed within ten years, if the city will make a ten years' contract for arc lights at the present contract price of about $102 per light.

AYER, MASS. The report of the committee which was appointed at the last town meeting to inquire as to the advisability of the town operating a municipal electric lighting plant, is in the hands of the printer and will appear in the annual reports. The present operators of the plant are the Block Electric Lighting Company of Boston.

STONEHAM, MASS.—Stoneham is becoming interested in municipal ownership, presumably because the service rendered by the corporation is unsatisfactory. At a recent town meeting a committee on municipal lighting was appointed consisting of the following: Arthur N. Newball, Rev. J. H. Whitmore, Dr. Francis E. Park, Charles J. Emerson, James P. Monihan.

WEST NEWBURY, MASS.—The citizens of West Newbury are agitating the question of street lighting, and there is more or less interest in the scheme of uniting with Georgetown and Groveland in a system, which would probably mean electricity. Groveland has already worked in conjunction with the Georgetown committee in investigating the various systems of street lighting, and a report is expected within a short time.

WORCESTER, MASS.—The Worcester Light & Equipment Company, a new corporation to undertake to furnish light and power in Worcester under the old H. H. Bigelow franchise, has been formed with a capital stock of $100,000, and its certificate of organization has been filed at the State House. Albert M. Thompson is president; William J. Hall, treasurer; Winslow H. Robinson, clerk, and William E. Lewis, Elmer E. Carpenter, Paul Potter and Henry Schoenfeld, of New York, are directors.

CONSTANTINE, MICH.—H. von Schon, Detroit, is consulting engineer for a water power project on St. Joseph River, near this point.

MARINE CITY, MICH. Application has been made by E. J. Ottaway and others to the Common Council of this city, for a franchise to do a general electric lighting and power business in this city.

BERRIEN SPRINGS, MICH.—F. A. Bryan, of South Bend, Ind., general manager of the Berrien Springs Water Power Company, writes that the proposed power plant to be constructed on St. Joseph River will cost about $500,000.

DETROIT, MICH.—The initial plan for the new street railway proposed by Mayor Codd contemplates the occupancy of about 51 miles of streets, including 1 mile of subway. There will be something like 90 miles of double track, or less than half of the mileage of the Detroit United Railways city lines. The promoters have figured the cost and financing as follows: One mile of subway, $1,000,000; surface lines, $3,000,000; power house $500,000; total cost, $4,500,000, bond issue, $5,000,000; underwritten at 90 per cent will net $4,500,000.

BLOOMING PRAIRIE, MINN.—The Steele County Telephone Company will make improvements to the extent of $4,000.

LEWISTON, MINN.—The Lewiston Telephone Exchange Company will increase its capital stock from $10,000 to $25,000.

FOREST CITY, MINN.—A. H. De Long has in contemplation the development of the water power of Crow Wing River for electrical purposes.

ST. PAUL, MINN.—The assembly has passed a resolution directing the St. Paul Gas Light Company to extend its electric service in the Fifth and Eleventh Wards.

ST. PAUL, MINN.—The Twin City Rapid Transit Company is considering a 15-mile extension from White Bear to Forest Lake, giving St. Paul a north suburban line 30 miles long.

VIRGINIA, MINN.—The Virginia Light & Water Company is a recent purchaser of an Allis-Chalmers-Reynolds Corliss engine for direct connection to an electric generator. The new unit is 22x36 inches and will supply power for lighting purposes.

SHAW, MISS.—The Sanders-Johnson Company, of Vicksburg, has secured the contract for the construction of water works and an electric light plant here, for $24,503.

REDCLOUD, NEB.—John Martz, construction engineer, of Seward, writes that bids will be received about May 15 for the construction of an electric light plant for Redcloud, to cost about $15,000.

FT. OMAHA, NEB.—Bids will be received until April 14 by Maj. M. Gray Zalinski, Q. M., U. S. A., for furnishing and installing electric fixtures in certain buildings, and for extending the lighting system so as to make proper connections therewith at this post.

RYOLITE, NEV.—F. L. Dwight, of South Bullfrog, says that plans for an electric railway are in contemplation in that district.

CANAAN, N. H.—G. H. Gordon, town clerk, writes that the construction of a municipal electric light plant is in contemplation, but nothing definite has been done.

DOVER, N. H.—The Luddy-Currier Company is making extensive additions to its manufacturing plant, and will also install new and additional power equipment.

CAMDEN, N. J.—The City Council by a vote of 10 to 6, has adopted a report of the Street Committee recommending the preparation of a bill for passage by the Legislature providing for the issuance of $[illegible] bonds to enable the city to lay underground conduits.

NEWARK, N. J.—The Board of Trade has declared in favor of Newark establishing a municipal plant for the lighting of the streets and public buildings, and recommended to the Mayor and Common Council the employment of experts to decide as to the best means to be adopted in carrying out the project.

MORRISTOWN, N. J. At the March meeting of the Morris County Board of Freeholders, Frederick H. Alleman, secretary of the Morris County Traction Company, presented petitions representing over 50 per cent of the property owners on two proposed lines of single-track electric roads, and asked permission to build and run the trolley lines upon them. The first line is 3 miles long and runs through Rockaway Township to Denville and Mt. Tabor to the south side of Tabor Hill. The second line is 5 miles long, running on the county road from Mine Hill through Kenvil, Succasunna, Ledgewood, Hoptacong and Port Morris to Netcong.

PHELPS, N. Y.—The citizens have voted, March 20, to raise $2,200 per year for a period of five years for electric street lighting.

LAKE PLACID, N. Y. The State Gas Commission has granted this village permission to construct and operate an electric light plant.

SYRACUSE, N. Y.—The Independent Telephone Company is planning extensive improvements the present season, which include 15 miles of subway construction.

WATERTOWN, N. Y.—The Board of Public Works is considering the advisability of establishing a municipal plant. Attorney V. K. Kellogg states that he is in position to procure estimates for the installation of a municipal plant and the cost of operating.

NEW YORK, N. Y.—Bids will be received until April 2 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in the Stuyvesant High School, Borough of Manhattan, and for installing electric equipment in School No. 92, Borough of Brooklyn.

WATERTOWN, N. Y.—The Committee on Lighting has recommended to the Board of Public Works that the bid of the Watertown Electric Light Company for lighting the city for 5 years be accepted at $75 per light per year. If the contract is ratified by the Council, the company will be asked to make extensive improvements to its system.

RIVERHEAD, N. Y.—The Fisher's Island Railroad Company, recently incorporated, has been granted a franchise by the town of Southold. The company is capitalized at $12,000, and the directors are Walter Ferguson, Alfred L. Ferguson, John F. Dempsey, Frank E. Hine, R. C. Shanklin, Charles W. Gordon, Alfred W. Duter, Walter Ferguson, Jr., and Alfred E. Bullock.

BUFFALO, N. Y.—Work has begun on the wrecking of twenty cottages at the Front, where the new power house is to be built by the Cataract Power Company. On the site of these houses a power house is to be built which will be a receiving station for electricity manufactured by the Canadian companies. The current will be brought across the river by aluminum cables.

EAST AURORA, N. Y.—D. N. Rumsey, for the Buffalo & Southern Railroad Company, states that the company has secured rights of way along the whole route and the road will be completed by August 1. The route of the new road will be from the terminal of the Buffalo, Gardenville & Ebenezer Railroad through the towns of West Seneca, Ebenezer, Elma, entering this village on Maple Street. Work will be begun early in the spring.

MINEOLA, N. Y.—As soon as the weather will permit, the extension of the electric railway from Queens to Mineola will be built. It will be part of the Long Island traction system, bought jointly by the Long Island Railroad and the Belmont interests, and the third-rail system, it is stated, will be extended as far east as Mineola and Hempstead, and the work of double-tracking the North Shore Division from Flushing to Port Washington will be begun.

JAMESTOWN, N. Y.—Electric street lamps cost this city $1.78 each for each month last year, according to the annual report of the superintendent of the municipal lighting plant, which was made public recently. Nearly 400 street lamps of 1200 cp each are in use. The above price was obtained by subtracting from the entire expenses of operation, together with interest on the investment of $107,000 for the plant, and a charge of 7 per cent of that amount as depreciation, the amount paid to the city for commercial lights.

ASTORIA, N. Y.—The Allis-Chalmers heavy-duty cross-compound engine, 16 inches and 32 inches, which was recently purchased by the Astoria Light, Heat & Power Company, New York City, will be installed at the Lawrence Point Station. The new unit which is of 500 hp, will be placed in the same station with two Allis-Chalmers horizontal cross-compound engines, 23 inches and 46 inches by 48 inches, which were formerly in service at the Goldsmith Station of the Brooklyn Edison Company and which were recently replaced there by a 5000-kw Allis-Chalmers turbine-alternator unit.

BUFFALO, N. Y.—William F. Sheehan, of New York, is said to have organized a company capitalized at $10,000,000, which will establish an electric railway between Buffalo and Erie, Pa. Properties purchased and amalgamated by the new company are the street railway lines of Erie, the Jamestown & Chautauqua Lake Railway Company, the Chautauqua Lake Steamship Company, the Buffalo, Dunkirk & Western Company, the Dunkirk & Fredonia Railway Company and the Hamburg Railway Company. Among the interests represented are said to be the Widener-Elkins syndicate, Bertram, Storrs & Griscom, the Dolan interests of Philadelphia, and the Ryan-Belmont interests of New York.

NEW YORK, N. Y.—It is announced that the high-speed electric railway between Newark and the down town part of New York, which was projected some time ago, is to be built by the McAdoo tunnels companies in connection with the Pennsylvania Railroad Company. The road is designed to give a 15-minute connection between Newark and the City Hall, New York. It will be built by the McAdoo interests over the Pennsylvania's right of way, and there will be connection with the Pennsylvania at Harrison Street, Newark. There will be a 22-story terminal at Church and Fulton Streets, New York, and while there will be no connection for trains between the McAdoo tunnel and the Interborough lines, there will be a subway for passengers connecting the McAdoo terminal with the Interborough station at Fulton Street. The Newark line is to cost $6,000,000.

CHARLOTTE, N. C.—It is rumored that the Southern Power Company has absorbed the Whitney Reduction & Power Company.

ELM CITY, N. C.—The contract for a $10,000 municipal lighting plant has been awarded to the Electric Construction Company, of Richmond, Va.

DURHAM, N. C.—The Durham Traction Company is preparing to install a large steam turbine and motor-generator to operate its power and ice plants at Durham.

ROCKINGHAM, N. C.—Thomas F. Baxter, of the firm of Rond & Good, bankers, Boston, Mass., recently visited the water power development of the Bluitt Falls near this city. Mr. Baxter stated that the development of the power would be inaugurated within a few months.

MARION, N. C.—J. L. Morgan, director of the Marion Light & Power Company, writes that bids will be received at once for work in connection with the developing of the water power on Catawba River, which will cost from $8,000 to $10,000. Engineer, W. W. Latspeich, of Marion.

HICKORY, N. C.—Col. M. E. Thornton, of the Thornton Electric Light & Power Company, of this city, has secured possession of a valuable water power near here, where a plant will be constructed and electric energy transmitted to Hickory for the operation of the lighting and trolley systems.

MINOT, N. D.—The Minot Light & Telephone Company has increased its capital from $50,000 to $100,000.

ELLENDALE, N. D.—N. C. Peek, secretary of the Ellendale Light & Power Company, writes that it is proposed to construct an electric light plant there, at a cost of about $12,000. Engineers, Claussen, Burch & Pillsbury, of St. Paul, Minn.

YORKSHIRE, OHIO.—The Yorkshire Telephone Co., of Darke County, has increased its capital from $10,000 to $20,000.

CLEVELAND, OHIO.—The Washington Traction Company, a Springfield corporation, financed in this city, has increased its capital stock from $10,000 to $800,000.

PAINESVILLE, OHIO.—The Commercial Electric Company has been sold to J. R. Curtiss, trustee, of Geneva. It will ask for a franchise to furnish lights for the city.

DAYTON, OHIO.—The Globe Iron Works have been awarded the contract for furnishing the South Bend, Ind., water works and lighting plant with three turbine wheels, with all power connections.

MEDINA, OHIO.—F. O. Phillips, who has acquired the plant of the Medina Electric Light & Power Company, is preparing to overhaul the machinery and will add another boiler and other equipment.

COLUMBUS, OHIO.—Work has been commenced on the new $30,000 power plant to be used by the Columbia Electric Street Railway, Light & Power Company. The building will be erected at the foot of Pine Street.

WEST UNITY, OHIO.—The West Unity Power & Light Company, with a capital stock of $15,000 has been incorporated by James H. Miller, John A. Hollinger, Leon P. Charpoit, L. B. Kent, Lloyd L. Mann and others.

MASSILLON, OHIO.—Prominent citizens of Massillon have requested the Council to call an election with a view to issuing bonds for the erection of a municipal lighting station and the purchase of the water works plant.

LIMA, OHIO.—The Western Ohio Railway Company has arranged to light the villages of Rawson and Mount Cory. The company is going after residence and business lighting as well as power loads in a number of towns along its route.

ALLIANCE, OHIO.—The bid of the Alliance, Akron & Cleveland Electric Railway Company for a franchise to establish a route over certain portions of West Main Street was submitted to the Council and referred to the committee on railways and telegraphs.

CANTON, OHIO.—John E. Monnott, of Canton, promoter of the Canton & Youngstown Railway, claims that the financing of the road has been arranged for with eastern capitalists. The road will run from Youngstown to Canton by way of Mogadore, Atwater and Canfield.

WOOSTER, OHIO.—The Wooster Electric Light Company is going after farmers' business and is building a number of lines to points a considerable distance from the city. It is also building a line to the county infirmary, with several farmers' lines branching from it.

CLEVELAND, OHIO.—The Cleveland Light & Power Company is a recent purchaser of Allis-Chalmers Electrical Machinery, to be built at Cincinnati, consisting of a 200-kw, type H. I. generator, operated in connection with the present equipment for lighting and power purposes.

SALEM, OHIO.—The Salem Lighting & Power Company has taken an option on the lighting plants at Lisbon and Leetonia. A merger is proposed, including the erection of a large central lighting plant here, which will supply Salem, Lisbon and Leetonia, as well as farmers along the line.

BOWLING GREEN, OHIO.—The Toledo, Bowling Green & Southern Traction Company is buying right of way with which to rebuild portions of its line between Bowling Green and Findlay, cutting out a number of right-angle curves which now interfere with high speed. The company is planning for the through Dayton to Toledo limited service, which will probably be instituted early this summer.

CLEVELAND, OHIO.—Mayor Tom L. Johnson is endeavoring to get through the Council a measure providing for an appropriation of $40,000 for the purpose of enlarging the South Brooklyn lighting plant now owned by the city, by the installation of a 500-kw unit boiler and other needed accessories.

LEETONIA, OHIO.—Plans are being prepared by engineers of the Cleveland Construction Company, of Cleveland, for a large power station for the Youngstown & Ohio River Railway. The plant is to be located near Teegarden, Columbiana County, at which point the company has secured a large coal mine. (See Youngstown item below.)

CINCINNATI, OHIO.—Petitions signed by about 200 business men of Cincinnati and letters from merchants in some 40 towns urging the establishment of an independent telephone service in this city have been submitted to the Council Committee on Telephone by Attorney C. B. Matthews, of the Queen City Home Telephone Company.

NEWARK, OHIO.—Edward Kibler, one of the promotors of the Newark, Martinsburg & Mt. Vernon Railway, states that the company has now secured all the necessary franchises and that the work of constructing the road will start as soon as the weather permits. It is stated that Crosby & Company, of New York, will finance the road.

CANTON, OHIO.—The Arctic Ice Machine Company, of Canton, Ohio, has secured a $150,000 contract for a 200-ton ice-producing plant and an electrical plant for the Central Ice Company, Kansas City, Mo. It is also building a 40-ton ice plant for the Crystal Springs Ice Company, Cleveland. Electrical equipment will also be installed in the latter plant.

MASSILLON, OHIO.—The Massillon Light, Heat & Power Company has submitted a proposition for lighting the streets by electricity. The bid was as follows: 160 lamps for two years, $80 per lamp per year; five years $75, ten years $70; 180 lamps for two years $80 per lamp per year, five years $75, ten years $69.50; 50-cp. incandescent lamps $12 per year.

DAYTON, OHIO.—The Dayton Lighting Company, which is completing extensive improvements to its plant, has announced to the City Council that it will supply conduits for the city fire and police service free of charge, that the rate to the city in the future will not exceed 4 cents per kw-hour, and that beginning April 1, 1906, rates to consumers will range from 5.6 cents to 12 cents per kw-hour, with a discount of 10 per cent if paid before the 5th day of each month and that after April 1, 1907, the highest rate will be 10 cents per kw-hour, with the same rule as to discounts.

YOUNGSTOWN, OHIO.—The Youngstown & Ohio River Railway Company, which is being projected by Will Christy, J. R. Nutt, George Stanley, Max Goodman, Warren Bicknell and other well-known Cleveland people, will have a capitalization of $2,500,000 of common stock and $2,500,000 5 per cent twenty-year gold bonds. Of the stock, $1,700,000 will be issued immediately, while the bonds to be issued will be $1,500,000. It is thought it will cost about $1,500,000 to build the road, which will have a mileage of 56 miles. The main line will extend from Youngstown to East Liverpool, Ohio, and there will be a branch line from Washingtonville to Salem and one from Leetonia to Columbiana.

PORTLAND, ORE.—The city engineer has been instructed to prepare plans and specifications for a system of underground conduits.

AURORA, ORE.—The City Council has appointed a committee to confer with the Aurora Electric Company, and get prices for installing a system of electric lights.

SEASIDE, ORE.—A franchise has been granted to Rhodes & Welch to put in an electric power plant to furnish light to the city. They agree to turn on light in sixty days.

MILTON, ORE.—The City Council has taken steps to purchase the new machinery for the electric light plant. It will be a three-phase system with up-to-date machinery capable of generating 200 hp.

ASTORIA, ORE.—The Astoria Improvement Company has purchased the franchise recently granted W. W. Whipple, and will commence at once the construction of a gas and electric light plant and telephone system.

BAKER CITY, ORE.—J. K. Romig, of Baker City, secretary and manager of the Eagle River Electric Power Company, writes that the company will do its own construction work on the proposed hydro-electric power plant, the probable cost of which is estimated at $150,000.

PORTLAND, ORE.—The Portland Railway Company has decided on new construction work and extensions for this year to cost $200,000 and an appropriation of that amount has been made to cover the expenditures planned. Upwards of $50,000 will be spent for new buildings, and the remainder will go into projected extensions and double tracking.

EUGENE, ORE.—F. L. Chambers, president of the Chambers Banking Company, of Eugene; A. B. Wood, manager of the Oregon & Southeastern Railway and of the Oregon Securities Company; G. B. Hengen, of the Oregon & Southeastern Railway, and O. F. Paxton, of Portland, have applied to the City Council for a franchise to construct an electric railway system in Eugene.

PORTLAND, ORE.—The Portland General Electric Company will construct a new power plant in Oregon City at a cost of $2,000,000. The capacity will be 49,000 hp. The company has purchased the Citizens' Light & Traction Company, of Salem, and the Union Light & Power Company, of Silverton from Barstow & Chambers, and will construct a line and furnish light and power to all towns between Portland and Salem.

OREGON CITY, ORE.—The Oregon City & Farmers' Independent Telephone Company is installing its local exchange at Huntley Brothers Company's drug store, in this city, and instruments are being very generally subscribed for by the merchants and business men of the city. This system will be in complete operation within a few days and will place Oregon City people in communication with more than 500 rural subscribers throughout the southern and eastern parts of the county. Other rural lines in other parts of the county are being perfected, and when these have been connected with the system a practically complete network of telephones will be in operation throughout the county, with a subscription list approximating 1000.

PAOLI, PA.—The Paoli, Wayne & Overbrook Street Railway Company will apply for a charter on April 16.

SCRANTON, PA.—The Economy Light, Heat & Power Company has decided to construct a power plant on Dix Court.

LEBANON, PA.—The County Commissioners are considering the construction of an electric light plant to light the county buildings.

NANTICOKE, PA.—The Nanticoke Power Company has purchased the Susquehanna dam and will construct a water power plant at that point.

WILKESBARRE, PA.—The Mayor has signed the ordinance permitting the Wilkesbarre & Hazleton Electric Railway to enter this city and erect a large station.

HAZLETON, PA.—Superintendent Giles, of the Hazleton Electric Light & Power Company, is making extensive improvements to the company's property all over the city.

HUMMELSTOWN, PA.—Allen K. Walton, of Hummelstown, has purchased the water and electric light plant, and will make improvements, including the installation of larger dynamos.

YORK, PA.—Bills granting to the York Telephone Company and the Pennsylvania Company the right to construct and maintain conduits in this city have been vetoed by Mayor James St. Clair McCall.

ALTOONA, PA.—The Altoona, Hollidaysburg & Bedford Springs Railway Company is reported to have authorized an issue of $1,200,000 bonds. The road is projected to run from Altoona via Hollidaysburg to Bedford Springs, a distance of 40 miles.

HARRISBURG, PA.—The Central Pennsylvania Traction Company expects to extend its line from Rockville to Dauphin during the present year over the abandoned towpath of the old Pennsylvania Canal, now owned by the Pennsylvania Railroad Company.

SHARPSVILLE, PA.—The Youngstown Sheet & Tube Company is a recent purchaser of Allis-Chalmers electrical machinery to be built at that company's works in Cincinnati, and consisting of a 75 kw engine-type generator. The new outfit will be used for incandescent lighting and power purposes.

DANVILLE, PA.—Bids will be received until April 10 by the Board of Trustees of the State Hospital for the Insane (Dr. Levi I. Shoemaker, chairman, care Dr. H. B. Meredith, superintendent), at Danville, for the erection of a power house, electric generator plant, engines, boilers, motors, etc., and the wiring of the administration building, wards and other buildings, grounds, etc.

KINGSTREE, S. C.—The citizens have voted to issue $12,000 bonds for an electric light plant.

GIDDINGS, TEX.—Pfeil Bros. are preparing to install an electric plant at this place, and have their power house under construction.

GONZALES, TEX.—Mr. J. M. Murphy, of the Gonzales Telephone Company, is making arrangements to extend the territorial lines to the new town sites in this country along the Gulf Shore Railroad.

PALESTINE, TEX.—The Palestine Electric Light Company has applied for a new franchise, covering a period of fifty years, giving it the right to generate electricity for power, heat and light for the city of Palestine.

DECATUR, TEX.—A movement is on foot to establish a rural telephone exchange in Decatur, one that will give connection with all the other towns in the county that have telephone lines, and put every farmer who has a telephone in full connection with the whole county.

BRACKETT, TEX.—A new long distance telephone system is being put over this part of Texas with Spofford of this county as the central point. The lines have been staked from Spofford to Del Rio, Brackett, Eagle Pass, Uvalde and other places. About four months ago the Lone Star Telephone system covered most of the same ground and when the new one is complete there will be two complete lines. The new system is the Southwestern Telephone Company.

SHERMAN, TEX.—The North Texas Telephone Company recently organized here for the purpose of constructing and operating an independent telephone line from Sherman to Gainesville is now weaving a web of wires all over Grayson and Cooke counties. The capitalization of the company at the time of organization was $[illegible]. This was doubled a few months ago and now the company is again considering doubling the capitalization, making it $[illegible]. The company has purchased the exchange at Whitesboro, formerly owned by a local company, and toll line connections out of Whitesboro have been secured. These lines connect with McComb Bend, Fry, Sadler, Gordonville, Basin Springs, Red Branch and Dexter.

SALT LAKE CITY, UTAH.—W. P. Read and John Montgomery, of the Utah Light & Power Company, of Salt Lake City, are planning to extend their lines to Sandy, to furnish light and power to the residents and [illegible] of that town.

OGDEN, UTAH.—The Utah Light & Railway Company has just acquired 160 acres of land at the head of Ogden Canyon, for a new reservoir, which, when completed, will cover about 2,500 acres. The water conserved will be used to irrigate arid lands in the Salt Lake Valley, in addition to furnishing electric power for all purposes, both in Ogden and other parts of Utah.

SALT LAKE CITY, UTAH.—J. J. Chambers, president of the Inter-Mountain Power Company of Salt Lake City, says that one-half million dollars will be spent this year by the company on improvements. A dam will be built, 600 feet long and 85 feet high, forming a reservoir. A water wheel and generator will be put in at the dam. Contracts will be awarded during the next thirty days for 6,000-kw of electrical equipment and for 2,500 feet of wood and steel pipe.

EMPORIA, VA.—The Greensville Water Power Company will soon construct a 36-foot dam and install machinery to develop about 4000 hp. on Meherrin River, at Emporia.

BURLINGTON, VT.—The contract to extend the Burlington electric light plant has been awarded by the Electric Light Commissioners to the Westinghouse Machine Company, of Pittsburg, Pa., for $14,488.

ST. ALBANS, VT.—The Vermont Power & Manufacturing Company will make notable improvements in the plant and transmission line this spring. A duplicate transmission line from the power house to this city will be strung on the same poles, and new step-up and step-down transformers will be placed at either end of the line.

OLYMPIA, WASH.—The City Council has granted John L. Murray and associates a franchise for an electric light plant.

PRESCOTT, WASH.—Roberts & Henderson, of Waitsburg, have secured a franchise for an electric light plant in Prescott.

NORTH YAKIMA, WASH.—Ira P. Englehart has filed a petition for 3,000 cu. in. of water per second from Naches River, to be used for power and manufacturing purposes.

VANCOUVER, WASH.—The Skamania Co-operative Telephone Association has applied to the County Commissioners for a franchise to build a telephone line from Washougal to connect with the Association's line in Skamania County.

SPOKANE, WASH.—The Washington Water Power Company is planning to bury all its high-voltage lines in this city, although it will probably be a year or more before the conduits are actually installed. Delivery of poles and insulators has commenced for the extension of the line to Colfax and Palouse, which should be ready for service by July 1.

HUNTINGTON, WASH.—The town board has granted C. C. Johnson and W. Howard a franchise to supply the town with electric lights. It is the intention to put in a water power plant up the canyon to generate electric power for lighting system and to run a flour mill soon to be erected.

SEATTLE, WASH.—At the recent city election William Hickman Moore known as the municipal ownership candidate, was elected by a plurality of 15 votes. As a result of the election the city will probably proceed with the contemplated increase of the Cedar River municipal power plant that is now furnishing power for the city lighting.

PULLMAN, WASH.—An ordinance has been passed providing that the city lighting plant be leased to the Moscow Electric Light & Power Company, of Moscow, Ida., which proposes to reconstruct the entire lighting system of the city. The contract has been signed for a term of years, and the company will at once proceed to make the improvements.

SPOKANE, WASH.—George Donald, president of the Yakima National Bank, of North Yakima, Wash., announces that he and his associates will build a $200,000 hydro-electric plant to enter into competition with the Northwestern Light & Power Company, doing business in North Yakima, the latter owned by Robert E. Strahorn of Spokane. Power will be secured from the Nachez River.

BELLINGHAM, WASH.—The Whatcom County Railway & Light Company has mortgaged its plant, franchise, equipment, etc., for $2,500,000 to the City Trust Co., of Boston. Of the amount realized $500,000 will be used for completing the hydro-electric power plant at Noksack Falls, $1,400,000 will be used to pay off an old mortgage, and the remaining $600,000 will be used as required in future improvements.

SEATTLE, WASH.—The Bates & Clark Company, of Seattle, Wash., successor to the Bogart-Bates Company, engineers on the Pacific Coast, recently contracted with the Allis-Chalmers Company through its Seattle office for a lot of electrical machinery to be built at its Cincinnati works. The new outfit will consist of a 250-kw water-wheel type alternator, 60 cycle, three phase and 2,300 volts; also a small 6-kw exciter and switchboard.

SPOKANE, WASH.—The Lewiston-Clarkston Company is employing 125 men laying its new pipe line from Asotin Creek to Vineland for its new hydro-electric plant. This new line will give the company 200 feet greater fall than it had from the old ditch. Wood pipe is used for the gravity line. This company plans the development of 6,000 hp at the Grand Round River thirty miles south of Lewiston. E. A. Libby, president of this company, is quoted as saying that there will be an electric railway between Lewiston and Clarkston in the near future.

SPOKANE, WASH.—Jay P. Graves, president of the Spokane Traction Company, who recently purchased the Kettle Fall water power, has also purchased the "Bowl and Pitcher" power site, seven miles down the Spokane River, paying $[illegible] for it. The purchase includes the franchises in Spokane which was granted to the Spokane Light & Power Company

March 31, 1903. It is understood Mr. Graves and associates will put in a light and power plant at a cost of $500,000, which will be a competitor for the Washington Water Power Company.

WHEELING, W. VA.—Bids will be received by Major George A. Zinn, Corps Engineers, U. S., until April 10, for furnishing engines, boilers, pumps, etc., for lock No. 4, Little Kanawha River, West Virginia.

MILWAUKEE, WIS.—The Altpeter property, on the Kinnickinnic River, between Walker and Washington Streets, has been selected as the site of a municipal electric lighting plant by the council committee on finance and public buildings.

MILWAUKEE, WIS.—The Mechanical Appliance Company of Milwaukee, has ordered for the White Star Laundry, of Cincinnati, Ohio, a number of Allis-Chalmers motors which are to be built at the company's works at Cincinnati. These machines will range in capacity from 7½ to 15 hp.

BRANDON, MAN.—The flour mill owned by Alexander & Law was destroyed by fire, including all the electrical machinery.

TORREON, MEX.—It is said that over $150,000 has been subscribed by the leading business men of Torreon for the formation of a new company which proposes to erect in that city one of the most complete electric plants to be found in northern Mexico. According to the plans, which were made some time ago, all of the machinery to be installed in the new plant will come directly from the United States.

HALIFAX, N. S.—A special committee is considering the advisability of this city installing a municipal electric light plant. It is proposed to petition the Legislature for permission for the city to do commercial lighting, power and heating, and if same is not secured to purchase franchise of the Halifax Electric Tramway Company.

HAILEYBURY, ONT.—The Haileybury & Cobalt Telephone Company has increased its capital stock from $5,000 to $40,000 for the purpose of extending its system.

MEAFORD, ONT.—The citizens have voted to guarantee a loan to the Georgian Bay Milling & Power Company, to aid it in further developing the power dam at this place.

EUGENIA, ONT.—Bids will probably be received in May for the construction of a power plant here for the Georgian Bay Power Company. Engineer, H. von Schon, of Detroit.

MORRISBURG, ONT.—The Village Council has awarded to William Birmingham, of Ottawa, the contract for constructing a 1,100-hp electric plant on St. Lawrence River Canal, around Duplatte Rapids, for $73,600.

PORT BURWELL, ONT.—The Erie, London & Tilsonburgh Electric Railroad is applying for permission to build a line from here to London, passing along the shores of Lake Erie. The length of the line will be about 35 miles.

TORONTO, ONT.—Mackenzie & Mann, railroad contractors, have secured control of the stock of the Niagara, St. Catherines & Toronto Electric Railway Company and will build a number of extensions. The company now operates 37 miles of tracks.

PANAMA.—Bids will be received until April 13 at the office of D. W. Ross, general purchasing officer, Isthmian Canal Comm., for furnishing sheet steel and iron rivets, pipe fittings, valves, portable forges, water meters, tubular boilers, marine boilers, equipment for electric light plant, duplex pumps, feed-water heaters, condensers, steel stack, etc.

REGINA, SASK.—J. H. Haslam, of the Haslam Land Company, St. Paul, Minn., is negotiating for the building of an electric street railway in this city.

Company Elections.

ANDERSON, CAL.—The Happy Valley Telephone Company, which was organized recently at Olinda, has elected the following officers: President, M. A. Batson; vice-president, S. Hilton; secretary, L. D. Walker; treasurer, A. L. Walker; trustees, M. P. Buffum, J. H. Walker and G. H. Nutting.

SAN FRANCISCO, CAL.—At a recent meeting in this city of the Northern Electric Company which is building a new electric railway between Chico and Oroville Henry A. Butters was elected president. The board of directors includes J. Downey Harvey, Louis Sloss and E. R. Lilienthal, and the company, organized a year ago, is capitalized at $6,000,000.

KALAMAZOO, MICH.—At the annual meeting of the stockholders of the Grand Rapids & Kalamazoo Valley Traction Company the following directors were elected: E. J. Anderson, E. J. Henry, C. B. Kelsey, George Hefferan and W. H. Patterson. The officers of the board were elected as follows: W. H. Patterson, president; E. J. Anderson, secretary; C. B. Kelsey, treasurer. The directors announce that the construction work will be pushed rapidly when the weather will permit. It is stated that the line will be built only to Otsego this year, but cars will be running between Kalamazoo and that place by July.

PICKWICK, MINN.—The Pickwick New Hartford Telephone Company held its annual meeting recently and elected officers for the ensuing year. John Leeps was elected president; Ed. Justman, vice-president; George Davis, secretary, and J. M. Rutherford, treasurer.

ROCHESTER, N. Y.—The officers of the Rochester Railway Company, elected at its recent meeting, are: Horace E. Andrews, president; John J. Stanley and William M. Eaton, vice-presidents; W. M. Eaton, treasurer; J. C. Collins, secretary and assistant treasurer; R. E. Danforth, general manager; directors, Horace E. Andrews, of Cleveland; W. K. Vanderbilt, Jr., E. V. W. Rossiter, John Carstensen, W. J. Wilgus, W. C. Brown, A. G. Hodenpyl and Albert H. Harris, of New York; W. M. Eaton, Charles J. Bissell, George W. Archer, Charles T. Chapin and George F. Roth, of Rochester. The officers of the Rochester & Suburban Railway are: Horace E. Andrews, president; W. M. Eaton, vice-president; J. C. Collins, secretary and treasurer; directors, W. K. Vanderbilt, Jr., E. V. W. Rossiter, John Carstensen, W. J. Wilgus, W. C. Brown, G. W. Archer and C. T. Chapin. The officers of the Rochester & Sodus Bay Railway Company are: Horace E. Andrews, president; Granger A. Hollister, vice-president; J. C. Collins, secretary and treasurer; directors, Horace E. Andrews, W. K. Vanderbilt, Jr., E. V. W. Rossiter, John Carstensen, W. J. Wilgus, W. C. Brown, G. A. Hollister, W. M. Eaton and Benjamin Strong.

New Industrial Companies.

THE BEE ELECTRICAL COMPANY, New York, N. Y., has filed articles of incorporation, with the following directors: A. M. Bullowa, E. E. M. Bullowa and E. M. Bullowa. The company's capital is $500.

THE GALT ELECTRIC GAS FIXTURE COMPANY has been incorporated at Galt, Ont., with a capital of $40,000, to manufacture electric and gas fixtures. The directors include H. Dakin, R. G. Struthers and M. A. Secord, Galt, Ont.

THE LUMEX ANTI-VIBRATING SYSTEM, Millbrook, N. Y., has been incorporated by Harry Harris, J. J. Barber and S. F. Fromm. The company has a capital of $200,000 and will manufacture motors and other machinery.

THE APEX MOTOR COMPANY, Bergen, N. Y., has been incorporated with a capital of $15,000, and will engage in the manufacture of engines, motors, automobiles, etc. A. A. Sands, G. E. Parish, and F. O. Bullis are the incorporators.

THE F. H. AYER MANUFACTURING COMPANY is being organized at Chicago Heights, Ill., with a capital stock of $10,000, to manufacture and deal in electrical supplies. The incorporators are William E. Canedy, Fred H. Ayer and Vanness D. Smith.

AUTOMATIC FIRE SIGNAL TELEGRAPH COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital of $100,000. The directors are named as follows: A. M. Friedenburg, H. H. Kutner and A. L. Lowenstein, of New York.

New Incorporations.

GADSDEN, ALA.—The Gadsden Railway, Light & Power Company has been incorporated by G. H. Schuler, E. T. Schuler and O. R. Reed. The Schulers are owners of big mill and steel-making plants.

SAN LUIS OBISPO, CAL.—The Paso Robles Light & Water Company has been incorporated by J. A. Watt, M. R. Van Wormer, A. W. Copp, W. C. Henderson and W. S. Stanley.

REDDING, CAL.—The Latonia Telephone Company has been organized with officers as follows: J. R. Spann, president; J. H. Forbes, vice-president; Charles Kooser, secretary; H. G. Smith, treasurer.

SAN FRANCISCO, CAL.—The Citizens' Mutual Light, Heat & Power Company has been incorporated with a capital stock of $500,000 by Phillip Meyer, Peter Harder, Alexander Mackie, G. H. Bahrs and F. Hausmann, with place of business, San Francisco.

SAN FRANCISCO, CAL.—The Pescadero Railway & Improvement Company has been incorporated with a capital of $600,000 to build a branch to the Ocean Shore Railway at Pescadero. The shareholders are L. H. Sage, George Lieungh, R. J. Graham, W. L. Dean, J. H. Goldman, L. R. Notbohm and J. B. Rogers.

NAPA, CAL.—The Clear Lake & Southern Railroad Company has filed an application for a franchise to operate a railway on the streets of Napa. The company has a capital stock of $1,500,000 and the following five directors: K. J. C. Seymour, of Mill Valley, president; G. C. Calden, of Oakland, secretary; Joseph P. Lucey, W. E. Cashman and William T. Love, of San Francisco.

NAPA, CAL.—The Napa & Lockport Railroad Company has applied to the City Council for a franchise to construct and operate an electric railway in Napa. The new company is incorporated with a capital stock of $2,000,000. The directors include W. S. McConlick, of San Francisco, president; W. M. Doane, of San Francisco, secretary; R. M. Hotaling and W. M. Rank, of San Francisco; E. C. Amadee, A. S. Brown and F. W. Ansell, of Alameda County.

CHICAGO, ILL.—The Channakon Power Company, with a capital of $100,000, has been incorporated by Charles A. Monroe and others.

GRAND TOWER, ILL.—The Big Muddy & Grand Tower Telephone Company filed articles of incorporation March 20 with a capital stock of $800. The incorporators are M. W. Baysinger, C. D. Gardner and James Hudson.

MOLINE, ILL.—It is announced that the $10,000,000 deal of public utilities of Moline and Rock Island, Ill., and Davenport, Ia., effected by an eastern syndicate headed by J. R. Beetem, of Philadelphia, has been completed. The new company will be known as the Tri-city Railway & Light Company and will embrace the public service corporations of the three cities. Mr. Beetem was at one time general manager of the New York & Queens County Railway Company, of Long Island City.

GOODLAND, KAN.—A charter is reported to have been granted to the Goodland Heat & Power Company, with a capital of $50,000 to construct an electric light plant.

DIXFIELD, ME.—The Dixfield Light & Water Company has been incorporated for the purpose of supplying electricity and gas for lighting, heating and power, and water for domestic, fire and other purposes, in the towns of Dixfield, Peru and Mexico, with $50,000 capital stock, of which $500 is paid in. Officers: President, John A. Decker, of Dixfield; treasurer, James P. Johnston, of Dixfield.

IRON MOUNTAIN, MICH.—The Iron Mountain Light & Power Company has been incorporated with a capital of $50,000.

DETROIT, MICH.—The Co-operative Construction Company has been incorporated in the State of Michigan with a capital stock of $10,000, the main purpose of the organization being the promotion and construction of an electric railway from Grand Rapids to Ludington via Fremont, Herperia, Hart and Pentwater. The officers of the company are George E. Hilton, president; John Pikart, vice-president; John C. Anderson, secretary, and Thomas David, treasurer, all of Fremont.

RUTHTON, MINN.—The Currant Lake Co-operative Telephone Company has been formed with $10,000 capital.

ELLSWORTH, MINN.—A new telephone company has been organized here, which will establish lines and exchanges in the villages of the county. The incorporators are J. E. Foley, A. Combacker, N. U. Buck, W. P. Knowles, F. A. Severance and J. T. Beddall.

ALINE, MO.—The Aline Farmers' Mutual Telephone Company, with a capital stock of $2,000, has been incorporated by H. C. Geist and others.

ATKINSON, NEB.—The Citizens' Telephone Company, of this city, has filed articles of incorporation with the Secretary of State, with capital of $5,000.

TRENTON, N. J.—The Trenton Light & Equipment Company, with a capital of $100,000, has been incorporated by Louis Wolfson, William Schlessinger and William Wolfson.

WILLOW POINT, N. Y.—The Willow Point Telephone Company, with a capital of $500, has been incorporated by F. A. Pierce and others.

STERLING, N. Y.—The Red Creek & Fair Haven Telephone Company, with a capital of $910, has been incorporated by William Bailey and others.

ALLEGANY, N. Y.—The Citizens' Telephone Company, of Allegany, N. Y., has been incorporated with a capital of $10,000. Incorporators: C. L. McGavern, C. S. McGavern, O. J. Lewis, Allegany.

NASSAU, N. Y.—The Rural Home Telephone Company has filed articles of incorporation, with a capital stock of $50,000, and the following board of directors: I. R. Coughtry, E. M. Woodward, P. J. Callan and R. I. Hopewood.

PENN, N. D.—Penn Rural Telephone Company, with a capital of $7,000, has been incorporated by George Durgman, and others.

ELLENDALE, N. D.—Ellendale Light & Power Company, with a capital of $25,000, has been incorporated by Thomas Sefton, and others.

WASHBURN, N. D.—The Washburn Telephone Company, with a capital of $25,000, has been incorporated by August E. Johnson, Washburn; Charles N. Hendrise, Thomas W. Allshouse, Steele.

CLEVELAND, OHIO.—The Everett-Moore syndicate has incorporated the Sandusky, Fremont & Southern Railway to build a branch line for the Lake Shore Electric Railway. Incorporators are: T. H. Hogsett, H. H. Hogsett, M. C. Aleaman, George H. Kelley, George C. Ford and H. H. Johnson, all attorneys for the syndicate. Temporary capital stock is $10,000, and this will probably be increased to $500,000. The road will extend either from Sandusky to Fremont or Sandusky to Clyde, the exact route having not been fully decided upon.

ENID, OKLA.—A territorial charter has been issued to the Enid Street Railway Company. The company has a capital stock of $200,000 and was incorporated by P. J. Goulding, H. H. Champlin, Frank Bradford, W. L. Spencer and J. M. White.

NEWKIRK, OKLA.—A charter was issued March 23 to the Newkirk Commercial Mutual Telephone Company. The capital stock is $12,000. The incorporators are C. A. Johnson, H. M. Zeigler, A. J. Green, J. F. Hufbear, G. I. Milam, W. S. Cline and A. C. Harrington, all of Newkirk.

ASTORIA, ORE.—Articles of incorporation of the Astoria & Coast Interurban Railway Company have been filed. The capital stock of the company is $300,000, and the incorporators are Charles M. Cartwright, William L. Dudley, Edgar J. Daly, Sanderson Reed, B. F. Allen and J. Frank Watson. The main office of the company is to be at Astoria and its object is to build and operate a railroad between Astoria and Seaside and to engage in the business of supplying individuals and municipal corporations with electric lights, water and gas.

PENDLETON, ORE.—The Umatilla County Mutual Telephone Company was organized in Pendleton, when 50 farmers met and perfected the organization of the company. The new line will have over 100 telephones and more than 350 miles of wire. The territory will reach from Heppner on the west to the Washington boundary, and will be enlarged as time passes. The central office will be in Pendleton. At the meeting W. Harrah was elected president; A. Rupke, vice-president; H. H. Gilbert, secretary and treasurer. It is the intention to extend the lines of the new company until practically every farm in Umatilla County is served.

WEST CHESTER, PA.—A charter has been granted to the West Chester Steam Heat & Power Company, with a capital of $5,000, by Marshall H. Matlock, James E. Pyle, and others.

NEW BEDFORD, PA.—The New Bedford Telephone Company, with a capital of $5,000, has been incorporated. Directors: S. M. Porter, J. A. Brown, E. K. Cover, Pulaski; W. S. Lowry, E. A. Tobey, New Bedford; W. W. Brownlee, Ellis Smith, Lowellsville, O.

PITTSBURG, PA.—J. D. Callery, president of the Pittsburg Railways Company, has announced that the Castle, Shannon & Bethel Street Railway Company, controlled by interests identified with the Pittsburg Company, is being formed for the completion of the 11-mile link between Pittsburg and Washington, and that it will connect with the Washington line at Canonsburg. It is expected that the construction of the line will cost $1,000,000. The incorporators of the company are C. W. Lepper, purchasing agent of the Philadelphia Company; E. J. Cochran, who is in charge of teams; Frank McCarthy, clerk of the superintendent, and W. J. Horgan and David J. Woods, employees of the Pittsburg Railways Company.

PROVIDENCE, R. I.—The Westerly & Connecticut Railway Company has been incorporated with a capital stock of not to exceed $400,000. The incorporators are William Segar, James M. Pendleton, R. W. Perkins, H. H. Gallup and E. W. Jackson, with an office in the town of Westerly, R. I.

PIERRE, S. D.—Articles of incorporation have been filed for the Farmers' & Merchants' Telephone Company at Verdon, with a capital of $10,000. Incorporators are J. C. Barwell, and others.

GALLATIN, TENN.—A charter has been granted at Frankfort, Ky., for the construction of an electric railway from Stanford, Lincoln County, Ky., to Gallatin. The capital stock is placed at $150,000, and the incorporators are W. G. Schamberger, of Gallatin; J. I. White, Dr. Peyton, Harvey Helms, Judge Bailey, and other business men of Stamford, Ky.

NORFOLK, VA.—The Consolidated Electric Company has been incorporated with a capital stock of $15,000, by C. W. Breedlove. The objects of the company are to "fit railroad, lighting and power plants and telephone lines with electricity," and also to establish a general supply business.

MILWAUKEE, WIS.—The Milwaukee Telephone & Manufacturing Company, with a capital of $25,000, has been incorporated by Edward M. Maxwell, and others.

ARCADIA, WIS.—The Tamarack Telephone Company has been organized at Arcadia, Trempealeau County, and incorporated with a capital stock of $30,000. The incorporators are Calvin Gilberston, Albert Severson, Ole O. Olsen, Alexander Olsen and Thomas Thornson.

KIRKTON, ONT.—The St. Mary's, Kirkton & Exeter Telephone Company has been incorporated with a capital of $50,000 to carry on a general telephone business. The provisional directors include W. R. Carr, Kirkton; J. W. Graham, St. Mary's, and J. G. Jones, Exeter, Ont.

Obituary.

MR. GEORGE O. WHEATCROFT, assistant secretary and assistant treasurer of the Milwaukee Electric Railway & Light Company, died a few days ago at his home 321 Farwell Avenue, Milwaukee, Wis. Mr. Wheatcroft was one of the pioneer street railway men of Milwaukee, having been connected with the street railways since 1868. He was born in Derbyshire, England, June 14, 1851, and came to Milwaukee when he was 18 years of age, entering street railway service as a conductor.

PROF. R. O. DOREMUS. It is with deep regret that we note the death of Prof. R. Ogden Doremus, in New York City, at the ripe age of 82. Member of old English and Dutch families of Manhattan Island, he graduated from New York University, and as early as 1848 had equipped a laboratory. He was one of the founders of the New York Medical College, the Long Island Hospital Medical College, and Bellevue Hospital Medical College, urging in each case the necessity of provision of a chemical laboratory, where the students could have thorough chemical training. From 1851 to 1861 he was Professor of Natural History at the Free Academy, now the College of the City of New York, and afterward was appointed to the Chair of Chemistry and Physics in the same institution. He made the laboratory at Twenty-third Street and Lexington Ave. a famous centre for study, particularly in connection with electricity. His museum there was filled to overflowing with early electrical apparatus and instruments of great historical and technical value as bearing upon the early development of electrical industry. On one occasion at the Academy of Music, in 1855, when lecturing, he took daguerreotypes of all the persons in the boxes by an arc light and exhibited an induction coil with a 6-inch spark, a marvelous achievement in those days. His pioneer achievements in sanitation, toxicology, chemistry, etc., were not less notable, and he was also a founder and president of the Philharmonic Society. Two of his sons, Prof. C. A. Doremus and Mr. A. L. Doremus, are well known respectively in the electrochemical and electrical manufacturing fields.

Personal.

MR. A. G. STARR, general manager of the Maryland Telephone Company, of Harford County has resigned his position, to take effect April 1.

MR. C. L. EDGAR, president of the Boston Electric Light Company, has been bereaved during the past week by the death of his father, who had been ill for some time past, and who was buried this week at Rahway, N. J.

MR. JOHN S. ALLEN, formerly manager of the Beloit Electric Company up to the time of its consolidation with the gas and water companies, is now sales manager of the John Thompson Company, of Beloit, manufacturer of gas producers.

W. L. LINDER, who was at one time connected with French Thomson-Houston interests and now represents the productions of Mr. S. Bergmann in the French market, is on a visit to this country from Paris, and will stay on this side about a month, renewing old friendships and visiting the chief points of electrical interest.

MR. S. H. PITKIN. At the recent annual meeting of the Wellman-Seaver Morgan Company, of Cleveland, O., the office of general manager, which has been vacant since the death last June of Mr Charles H. Wellman, was filled by the election of Mr. S. H. Pitkin, whose present title will be first vice-president and general manager

MR. W. K. PALMER, consulting engineer, 718 Dwight Building, Kansas City, Mo, has been engaged by the city of Holton, Kan., to serve as an engineer in connection with the preparation of plans and specifications, for and the superintendence of construction of, the complete municipal improvements contemplated by the city, including water works system, electric lighting plant and sewerage system, to cost in the aggregate $83,000

MR. A. WILLIAMS, chief inspector, etc, of the New York Edison Company, has sustained a severe bereavement in the death of his father, the Rev. C S Williams, a well known Brooklyn clergyman, who for thirty years past has been a member of the Methodist Episcopal New York East Conference, and has filled a dozen pastorates in Brooklyn, as well as others, prior to that period, outside this district.

MR R. H. REED, whose efforts as sales manager for the Reeves Engine Co., of Trenton, N. J., have given the engine a wide reputation during the past four years, is to sever that connection on March 31. His executive ability, knowledge of business and natural talents form a combination of exceptional strength at the organization and selling ends of an engine business—a combination that we hope will not be lost to this particular field.

MR. JOHN JOLLY, manager of the Frontier Telephone Company, Buffalo, N. Y., has accepted an offer from the Indestructible Fibre Company, of New York, to become its general manager. He will leave Buffalo for New York to assume his new duties about April 1. The company manufactures imitation woods for cars, automobiles and interiors, and has a large factory at Massena, N. Y. Mr. Jolly has been connected with the Frontier Company since May, 1902.

MR. J. L. ADAMS, for the past eight years superintendent of the Hartford, Manchester & Rockville Tramway Company, Hartford, Conn., has tendered his resignation to John K Punderfoot, general manager of the Consolidated Railway Company. Mr. Adams has been offered the position of superintendent of the railway company operating lines in Columbus and Dayton, Ohio, which consist of about 150 miles of track. He will enter upon his new duties as soon as his resignation is accepted.

MR F. NICHOLLS.—*The Busy Man's Magazine*, an excellent publication issued in Toronto, Canada, has in its March issue an illustrated biographical sketch of that well-known Canadian, Mr. Frederick Nicholls, vice-president of the Canadian General Electric Company, and formerly president of the National Electric Light Association. He is well described as "one of the most aggressive and epoch-making Canadians that ever came out of England." In addition to the electrical interests he has developed so successfully, Mr. Nicholls is now deeply interested in steel works, mines, railroads, newspapers, etc., and still has time to build and sail, for patriotic glory, international yachts in the competitions on the Great Lakes.

MR. D. H. WILSON, JR., has been appointed electrical engineer of the Erie Railroad, in charge of the power plants and other electrical equipment along the entire system. The Erie Railroad, in recognition of the increasing importance of the electrification work which is being pushed on sections of the system in New York State, has created the office of electrical engineer Dr. David H. Wilson, the new appointee, comes to the road from the American Locomotive Company. He will devote himself at first to the work of equipping the Erie's big power house at Hornellsville. He has been trained in the shops as well as in the schools. After serving a four years' apprenticeship in the Rogers Locomotive Works at Paterson, N. J., he studied electrical engineering at the Bliss School in Washington, and then graduated from Purdue University. Before his connection with the American Locomotive Company, Mr. Wilson was on the staff of J. G. White & Co.

MR. J. W. LIEB, JR.—On Thursday evening, March 15, Mr. J. W. Lieb, Jr., third vice-president and associate general manager of the New York Edison Company, lectured before the members of the Electric Club, at Pittsburg, an organization composed of apprentices and engineers of the Westinghouse Companies, on the subject of "Generation and Distribution of Current for Lighting and Power on Manhattan Island." Mr. Lieb gave a statement of the growth of the apparatus and systems of his company from the earliest days, and presented in connection therewith some excellent illustrations by means of lantern slides. He cited various points in connection with the present operation, calling attention to the variety of service afforded the public. He also showed load curves which were characteristic for different sections of the city, and showed the variations in these curves at different seasons of the year. The lecture was well attended and highly appreciated.

KAFER, MATTICE & WARREN.—Three distinguished engineers have just formed a partnership under this title with offices at 60 Wall Street, where they will practice as consulting engineers. The firm includes Mr. John C Kafer, past president of the Engineers' Club; Mr A. M. Mattice and Mr. B. H. Warren, both well known in the electrical field from their recent prominent connection with Westinghouse and Allis-Chalmers interests. The scope of the work of the firm includes specifications, estimates and plans for steam, hydraulic, gas and electric power plants, also for mills, industrial establishments, water works and mining plants; improvement of existing plants; examination and valuation of and advice concerning industrial properties, steamships and yachts; specifications and plans for marine machinery; advice as to scope and value of inventions; supervision of construction and operation of plants; acting as agents for estates and capitalists in the purchase and operation of power and manufacturing properties, and engineering work in general.

MR. GEORGE HERBERT ROWE has become associated with W. Owen Thomas, consulting engineer, First National Bank Building, Chicago. Mr. Rowe is a graduate of the University of Michigan, class of 1891. From 1891 to 1893 he was an instructor in electrical engineering at that university, leaving there to take the chair of physics in Colorado University. From 1900 to 1901 he was on the staff of designing engineers of the General Electric Company. From 1903 to 1905 he was professor of electrical engineering at Leland Stanford University in California, leaving there to become designing engineer with the Western Electric Company at Chicago in 1905, which position he has just left to become associated with Mr. Thomas. He is well known through his contributions to technical literature, most notable among which are his papers on wave form variations of long-distance lines, presented to the A. I. E. E., alternating-current laboratory testing, in the *Journal of Electricity*, and a new harmonic analyzer, described in the Electrical World. He has made a translation of Heyland's circle diagram papers jointly with Mr. R. E. Hellmund which is about to be published. He is a member of the A. I. E. E. and the Society for the Promotion of Engineering Education. By virtue of his intimate acquaintance with technical matters pertaining to machine design, he is a most valuable acquistion to Mr. Thomas' staff.

Trade Publications.

RAILWAY MOTORS.—The General Electric Company, Schenectady, N. Y., has issued supply catalogue No. 7595 dealing with repair parts of G. E.-61-A and B railway motors.

DIRECT-CURRENT MOTORS AND GENERATORS.—The Allis-Chalmers Company, Cincinnati, Ohio, has issued instruction book No. 5003, dealing with the installation and operation of direct-current motors and generators.

FREQUENCY CHANGERS.—The National Electric Company, Milwaukee, Wis., is sending to its friends a neat half tone illustration showing a 1,000-kw frequency changer. This is one of a recent order for four of these machines received by the company.

REINFORCED CONCRETE.—The Trussed Concrete Steel Company, Detroit, Mich., has issued an interesting and instructive catalogue dealing with Kahn trussed bars. The catalogue is a treatise on reinforced concrete and contains records of numerous tests made upon trussed bars.

WATT-HOUR METERS.—Bulletin No. 4,432 of the General Electric Company, Schenectady, N. Y., gives an interesting discussion of high-torque induction watt-hour meters and prepayment attachments, for recording the amount of electrical energy used, and for insuring that the proper payment is made therefor.

DIRECT-CONNECTED GENERATORS.—The Triumph Electric Company, Cincinnati, Ohio, has issued as bulletin No 281 a well-prepared description of engine-type, direct-current generators. The essential features embodied in the construction of these machines are clearly illustrated and discussed at length.

VARIABLE-SPEED, DIRECT-CURRENT MOTORS.—The Westinghouse Electric & Manufacturing Company, Schenectady, N. Y., uses circular No. 1117 to present the advantageous features of the auxiliary pole type of direct-curent motors. These motors permit of a speed range of four to one on a single voltage by field control.

MACHINE CONTROLLERS.—Flyer No. 2174 of the General Electric Company, Schenectady, N. Y., illustrates and describes briefly speed regulating rheostats for use with shunt or compound-wound motors which drive machine tools or similar equipments. They are designed to reduce the speed by inserting resistance in the armature circuit.

PANELETTES.—The H. T. Paiste Company, Philadelphia, Pa., has issued bulletin No. 30, which describes panelettes, 125-volt and 250-volt rosettes, cut outs, attachment plugs and baby knife switches. Each panelette is a unit complete in itself, ready to install and there is not a wire to be found on the face. These are shown with and without branch switches.

MEASURING INSTRUMENTS.—Price List No. 5143 of the General Electric Company, Schenectady, N. Y., relates to electric measuring instruments, including astatic ammeters and voltmeters, horizontal edgewise instruments, round pattern instruments, curve drawing instruments, ground detectors, synchronism indicators and line drop compensators for alternating current circuits.

COAL-HANDLING MACHINERY.—Catalogue 063 of the C. H. Hunt Company, West New Brighton, Staten Island, N. Y., deals with coal-handling machinery for power stations, boiler rooms, coaling stations, gas producers, coal yards, shipping docks, manufactories, etc. The catalogue is profusely illustrated, and no pains have been spared to show the constructional features of the apparatus.

BELT CONVEYORS.—The Robins Conveying Belt Company, Park Row Building, New York, has issued a series of single sheets No. 1 to 9 inclusive, explaining and illustrating belt conveyors for handling coal, ore, cement, refuse, etc. Each sheet is devoted to a certain type of conveyor, and the brief descriptive matter is effectively supplemented by illustrations showing the conveyor in actual service.

ROTARY CONVERTERS.—Bulletin No. 4,443 of the General Electric Company, Schenectady, N. Y., gives an instructive discussion on rotary converters for railway service. The advantages arising from using six-phase converters rather than three-phase machines are mentioned, and numerous diagrams are shown of the connections of transformer windings for obtaining six-phase currents from two-phase or three-phase circuits.

SWITCHBOARDS FOR ISOLATED PLANTS.—The General Electric Company, Schenectady, N. Y., has issued as bulletin No. 4,435 an illustrated description of isolated plant switchboard panels with circuit breakers. These panels provide for controlling 125-volt, direct-current generators of from 5 to 85 kw capacity and 250-volt generators of from 10 to 170 kw capacity. They also provide for the control of from two to six-feeder circuits.

RAILWAY AND LIGHTING SUPPLIES.—The latest catalogue of the Elmer P. Morris Company, 51 Dey St., New York, deals with wrought iron and steel tubular poles and pole brackets for electric railways, electric lighting, telegraph and telephone service and also a complete line of overhead line material used in the construction and operation of electric railways. This catalogue, which is designated as No. 12, will be sent to parties interested upon request.

NORTHERN ELECTRIC BULLETIN.—The electrical equipment produced by the Northern Electrical Manufacturing Company, Madison, Wis., is characterized by ease of application and convenience of arrangement, location, and operation. For certain classes of work a special type of variable speed motor, described in Bulletin 45, has been developed. Northern multi-speed motors, as they are termed, are especially designed for application to engine lathes. Bulletin sent promptly on request.

MACHINE TOOLS.—The 1906 edition of the general catalogue of the Brown & Sharpe Mfg. Co., Providence, R. I., which relates to machinery and tools, contains 514 pages, and has been thoroughly revised. The catalogue is invaluable as a book of reference to the workman, on account of the large number of tables and other general information which are found on its pages. This catalogue will be mailed to any address without charge upon application, or it may be obtained from hardware and supply dealers.

HARMONIC CONVERTER.—The Dean Electric Company, Elyria, Ohio, uses folder No. 5 to present the advantageous features of the harmonic party line telephone system and to describe the harmonic converter. The converter is a device for supplying alternating current for selective party line ringing. It is designed to do all of the ringing of the exchange including that of regular lines and toll lines, and with the proper selecting keys will furnish current for ringing selectively eight parties on rural lines.

LOOMIS-PETTIBONE GAS GENERATING PLANTS are attractively described by means of diagrams and colored plates in a new pamphlet that is being issued by the Power and Mining Machinery Company, Milwaukee, Wis. This system gasifies bituminous coal, wood, charcoal, lignite, etc., and produces a gas that is particularly adapted to the operation of gas engines. The water gas made by this system can be used separately in various heating work, such as forging, welding, tempering, etc. This pamphlet can be had upon application to the company.

CENTRAL ENERGY TELEPHONES.—Bulletin No. 15, of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is an extremely neat publication dealing with central energy telephones and their parts. Views are given of wall telephones, "central energy" residence and hotel telephones, portable desk telephones, combination telephones, cabinet telephones and telephone parts. The bulletin describes a new type of combination telephone which has the hook in combination with the receiver, whereby the act of raising the instrument to the ear signals the central office.

AUTOMATIC CLUTCHES.—In Booklet D, which is given the title "[illegible]," the Automatic Clutch Company, Akron, Ohio, gives an illustrated description of its automatic clutch, which is self-adjusting and tightens the grip as the load increases. The enclosed clutch consists of a sleeve forming an oil-tight and dust-proof case which encloses the working parts of the clutch, allowing them to operate in a continuous oil bath, and protecting them from dust and dirt. It is claimed that when the case is once filled with oil, this clutch will operate for months without attention.

BUSINESS MANAGEMENT is the title of a pamphlet in neat form compiled by W. J. [illegible], certified public accountant, 115 Broadway, New York. It is a neat, concise and comprehensive treatment of the [illegible] whose work enables the business man to get and keep a close grip on his affairs, so that he can tell at any moment how things are going, and on the information furnished him can increase efficiency, control expenses and win out where before he was suffering from unsuspected extravagances and losses, or was not pushing the right branches of his trade.

DIRECT-CURRENT MOTORS AND GENERATORS.—The Stanley-G. I. Electric Manufacturing Company has issued bulletin No. 601, dealing with high-grade, direct-current motors and generators. A few illustrations are given of motor application and accessories, also tables of much value to purchasers, enabling them to select the motor or generator best suited to their requirements. By referring to the tables and rules governing the installation of electrical apparatus, the proper method of wiring, as well as the size of wire, can be determined. Information is also given concerning the size of shafting, pulleys, belting and the distance hangers should be spaced apart.

SINGLE-PHASE INDUCTION MOTORS.—A bulletin of considerable practical interest has recently been received from the Wagner Electric Mfg. Co., St. Louis, Mo., dealing with single-phase, constant-speed, self-starting alternating-current motors. These motors receive their torque from being started as repulsion machines, while they operate as induction motors when full speed is reached and the secondary is closed upon itself. The conversion from the repulsion to the induction connections is accomplished either automatically by a centrifugal device, or manually by the variation of the resistance included in the secondary circuit. The features are discussed at great length in bulletin No. 75.

CONTROLLERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a series of bulletins for its loose-leaf catalogue, dealing with the general subject of motor controllers. Bulletin No. 16 describes motor-starting rheostats with automatic release for switchboard mounting. Bulletin No. 45 is devoted to compound speed-regulators with renewable segments. Bulletin No. 70 treats of self-starters for non-reversible motors operating belted elevators, pumps, etc. Drum-type reversing switches for electric elevators are discussed in bulletin No. 72. Compound controllers for rotary printing presses are described in bulletin No. 65. Bulletin No. 67 relates to non-reversible drum controllers, while drum controllers with two reverse speeds especially adapted for printing presses are treated at some length in bulletin No. 68.

News of the Trade.

THE CONSOLIDATED ENGINE STOP COMPANY has recently moved its offices from 100 Broadway, New York, to 130 East 12th Street, where its New York City factory is located.

THE CENTURY ELECTRIC COMPANY, of St. Louis, filed a statement on March 22, to show that it had made an increase in its capital stock from $30,000 to $75,000, 60 per cent of the increase being paid in.

DOSSERT & CO., manufacturers of the Dossert cable joint, have recently moved into their new factory at 242 West 41st St., New York. The plant is equipped with all the newest machinery obtainable in order to take care of their increasing business. Mr. H. B. Logan is now general manager of this company.

THE TETER-HEANY DEVELOPING COMPANY, of York, Pa., is being reorganized preparatory to establishing a large new plant for the manufacture of Teter-Heany fireproof insulating wire. The company will have a capital of $500,000, and the following are the officers: W. F. Bay Stewart, president; Daniel F. Lafean, vice-president; William F. Ramsey, secretary; Charles C. Frick, treasurer.

MR. ARTHUR P. STANLEY, who has widely been known for the past twenty years in the field of electrical manufacturing and supplies in New York City, has resumed his connection with the firm of P. M. Fletcher Company, with which he started in the electrical business a score of years ago. The firm's offices and headquarters are at 32 and 34 Frankfort Street, where Mr. Stanley hopes to be found until at least 1926.

THE DEWEY DOCK.—The Dewey floating dry dock, the largest floating dry dock ever built, has so far withstood the raging storms at sea, and is now again on its way to Cavite, Philippine Islands, where it is intended for service. A somewhat novel feature of this huge structure is the complete lighting plant. The essential factor in this installation is a generating set furnished by the B. F. Sturtevant Company, of Boston, Mass.

THE SPLITDORF LABORATORY at 17 to 27 Vandewater Street, New York, has grown so rapidly within the last few years that at present it is doubtful if it is not one of the largest laboratories of its kind in America. It is one of the oldest, having been established nearly fifty years and its staff now comprises some of the best talent to be procured in the technical field. It makes a specialty of developing inventions and experimenting with and perfecting all kinds of electrical and scientific apparatus and machinery.

POWER AND MINING MACHINERY COMPANY.—In order to better handle its rapidly increasing business from the Rocky Mountain District, the Power & Mining Machinery Company, Milwaukee, Wis., has opened an office at [illegible] 17th Street, Denver, Col. This new office is in charge of Henry J. Jurs as district manager, who will give his personal attention to all inquiries coming from Colorado, Wyoming and New Mexico for the varied lines of machinery manufactured by this company. Mr. Jurs is thoroughly acquainted with his territory through his recent connection with the A. Leschen & Sons Rope Company, St. Louis, as its western manager-in Denver. Mr. Jurs began his career as a machinist, working his way up through the draughting room. He then entered the service of the Union Iron Works, San Francisco, California, and was regarded by them as their most capable commercial engineer. He left the Union Iron Works to take a position with the Baker & Hamilton Company, San Francisco, in charge of its steam engine and boiler department, and later was made manager of its large shops located at Benicia, Cal.

THE BOSTON INCANDESCENT LAMP COMPANY, of Danvers, Mass., is remodelling the building formerly occupied by the skating rink and will establish its factory and offices therein when completed. It is expected that the building will be ready for occupancy by May 1. New electrical apparatus and machinery will be installed, and when fully equipped the factory will be one of the best for the manufacture of incandescent lamps.

D. ROUND & SON, of Cleveland, Ohio, manufacturers of chains and chain hoists, are making a specialty of the Simplex portable crane and hoist, a very convenient outfit for the repair shop for handling armatures, motors, wheels, axles and other heavy articles up to two tons. The device, which is made in eleven sizes, is compactly built and has large wheels causing it to roll easily. The company also makes a large line of chain hoists, screw hoists and trolleys.

THE CLEVELAND ARMATURE WORKS, of Cleveland, Ohio, is preparing to erect a new factory building at St. Clair and Kirtland Streets, that city. The new building will have a floor space of 16,000 square feet. All machinery will be electrically driven and the various machine tools are now being equipped with motors which the company is manufacturing itself. Heretofore it has confined its efforts to the production of motors up to 10 hp, but after the new factory is started it will build motors up to 25 hp.

ALLEN FLUXES.—The following letter received by L. B. Allen Company, Inc., Chicago, manufacturers of Allen-flux and other electrical compounds, from New Orleans, La., under date of March 12, 1906, shows how this enterprising firm is exploiting its products to the consumers throughout the country so as to benefit its jobbing dealers: "Yours of the 9th inst. received, and must say that I have already acknowledged receipt of your samples and have tried them and found them to work perfectly. Am very pleased at the result."

A LARGE PIPE COVERING CONTRACT.—The H. W. Johns-Manville Company, through its Chicago branch, has just completed a large contract for the installation of "Fire Felt" pipe and boiler covering in the new plant of Sears, Roebuck & Co., of Chicago, involving an expenditure of several thousand dollars. "Fire Felt"is absolutely fireproof, elastic, light in weight, and unaffected by expansion or contraction of pipes. The above is but one of many large contracts that this company has recently executed all of which bears testimony to the fact that the largest and most exacting firms have found it to their advantage to place work of this kind under the supervision of experts.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 20, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N.Y.]

815,330. LAMP RHEOSTAT; Thomas J. Bull, New York, N. Y. App. filed June 15, 1903. A resistance designed to be inserted into the usual lamp socket for the purpose of operating miniature incandescent lamps. A cylindrical casing contains a lamp having an air space around it for cooling purposes, to cut off the light from the lamp. The casing also has a resistance winding which can be varied.

815,356. SYSTEM OF EXCITATION FOR INDUCTION MACHINES; Maurice Leblanc, Paris, France. App. filed Jan. 28, 1903. The combination of a course of multiphase current, and a phase-regulating dynamo-generator of the direct-current type having its armature connected to the several branches of the multiphase circuit and having its field traversed by a periodically-varying flux.

815,357. PROCESS OF EXCITATION FOR INDUCTION MACHINES; Maurice Leblanc, Paris, France. App. filed Feb. 5, 1904. The process of producing the effect of an added negative resistance in one member of an asynchronous machine by impressing thereon an electromotive force of the frequency of the current in that member, but of a phase in opposition to the voltage inserted by such current.

815,360. DEVICE FOR RECHARGING THE STORAGE BATTERIES OF AUTOMOBILES, Lamar Lyndon, New York, N. Y. App. filed Mar. 23, 1905. A special type of induction motor having two commutators is employed upon a vehicle and when the batteries are charged from an alternating current circuit the motor is arranged to be operated as a rotary transformer, so that the batteries may be properly charged.

815,365. ELECTROMAGNET; Ernest H. Miller, Lancaster, Pa. App. filed Nov. 26, 1904. A form of solenoid magnet designed to secure a large power for the purpose of working magnetic brakes. A pair of solenoids are assembled upon a yoke which has conical studs projecting therein and the armature is of U-shape with internally coned pole faces.

815,370. SAFETY EQUIPMENT FOR SERIES ELECTRICAL DISTRIBUTION SYSTEMS; Frederick J. Murman and Albert B. Shreve, Mount Vernon, N. Y. App. filed May 2, 1904. An arrangement for cutting out defective apparatus in a series circuit. At various points a shunt is arranged which is normally open by a minute spark gap. In case of a defect in any apparatus, the resulting high potential at the gap causes a jump spark which actuates a magnetic circuit closer through the shunt.

815,380. TELEPHONIC APPARATUS; John G. Roberts, Detroit, Mich. App. filed June 26, 1900. In combination with the ringing apparatus of a telephone substation, a ringing device located at the central station, consisting of a continuously revolving shaft, an armature revolving therewith capable of movement longitudinally in the line of the shaft, a circular electromagnet concentrically embracing the shaft, but elastically attached to a fixed portion of the sustaining frame, electrical means for energizing said electromagnet for the purpose of bringing the armature in contact therewith, whereby said armature compels a partial rotation of the electromagnet, means attached to the periphery of the electromagnet whereby a series of ringing contacts are made to actuate the ringing mechanism at the substation, an electromagnetic means for automatically discontinuing the circuit energizing the electromagnet whereby the armature is released therefrom and the electromagnet returns automatically to its original position by virtue of the resiliency of its elastic connections.

815,384. STATIC DISCHARGER AND LIGHTNING ARRESTER; Henry M. Shaw, East Orange, N. J. App. filed Feb. 8, 1905. A lightning arrester for high potential circuits employing a series of spaced carbon rings of peculiar form separated by perforated mica discs. The purpose is to give a spark gap for lightning discharges which will not induce an arc for the main current.

815,405. AUTOMATIC RINGING AND LISTENING KEY; Albert Carliss, Chicago, Ill. App. filed June 20, 1901. An attachment for telephone switchboards having an upwardly projecting lever with a knob which can be thrown in alternate directions. The knob presses different contact blades together and under certain circumstances is locked by an electromagnet.

815,406. AUTOMATIC ELECTRICAL SELF-SOLDERING RESET FOR THERMAL PROTECTORS; Frank B. Cook, Chicago, Ill. App. filed Apr. 27, 1905. The thermal coil is disposed in a cylindrical casing which is normally soldered against rotation. A spring member bears against the cylinder to produce rotation in case the solder is melted. After actuation the solder hardens so that the device may be reset in a new, but operative relation.

815,418. INSULATOR FOR ELECTRIC APPARATUS; Harleston C. Gesner, New York, N. Y. App. filed June 26, 1905. Insulator or high resistance consisting of particles of an alloy of iron and hydrogen fritted into a coherent mass.

815,419. PRODUCTION OF ARTICLES OF ALLOY OF IRON AND HYDROGEN AGGLOMERATED IN STRONG COHERENT BODIES; Harleston C. Gesner, New York, N. Y. App. filed July 7, 1905. An article consisting of particles of an alloy of iron and hydrogen, compressed and agglomerated into strong coherent bodies.

815,444. MOTOR; Frank E. Lewis, Troy, Ohio. App. filed June 15, 1905. An enclosed motor of the usual bi-polar type in which the two poles are each formed of a pair of closely adjacent poles lying in separate magnetic circuits.

815,459. ALTERNATING-CURRENT MACHINERY; Addams S. McAllister, Ithaca, N. Y. App. filed Dec. 14, 1903. A single-phase alternating-current generator made up of a plurality of field-core sections; a plurality of field coils, one on each section and each coil closed upon itself and free from connection with the others of said coils, and an electric circuit including a rotor provided with a commutator; a plurality of sets of brushes adapted to contact with said commutator; lead wires; and a switch for connecting at will either of said sets of brushes with said lead wires.

815,471. INSULATOR; George L. Ricks, Yuma, Arizona Territory. App. filed Mar. 8, 1905. The two parts of a porcelain insulator can be nested or fitted together so as to clamp a wire there between when the insulator is screwed upon a supporting surface.

815,490. ELECTRICAL GUN; Martin E. Thomas, Batavia, Iowa. App. filed Nov. 1, 1905. A gun designed to fire a gun-powder charge by electricity. Has dry batteries and a spark coil in the stock by which a jump spark can be induced through the powder chamber.

815,498. ELECTRIC CONDUCTOR; Welby D. Weir, Winnsboro, Texas. App. filed Feb. 13, 1905. A telephone connection for telephone switchboard formed of a pair of concentric chains somewhat similar to the well known flexible metallic tubing. The purpose is to avoid breakage by continued wear, incident to the usual stranded connections.

815,499. AUTOMATIC OVERHEAD TROLLEY CONTACT DEVICE FOR OPERATING ELECTRIC SIGNALS; Beecher D. Whitcomb, Shawomet Beach, R. I. App. filed Nov. 20, 1905. Supported by the usual hangers and guy wires of the trolley is a frame having a compound lever arrangement with a depending tappet in the path of the trolley wheel. The movement is such as to trip a contact lever into operation during the passage of the car.

815,506. INSULATOR; Herbert S. Blynt, Steubenville, O. App. filed Jan. 7, 1904. A porcelain block has a specially-formed groove therein so constructed as to impart a kink or bight to the wire when the latter is stretched there through. The insulator is designed to hold the wires upon a wall or similar surface.

815,548. PROCESS OF PRODUCING AROMATIC ALCOHOLS AND THEIR DERIVATIVES; Charles Mettler, Munich, Germany. App. filed Nov. 2, 1904. Process for the production of aromatic alcohols and their ethers, which consists in exposing the aromatic ethers in a dissolving agent, capable of conducting the electric current in the cathode space of an electrolytic apparatus in using for the cathode a material of a specially high cathodic tension, then neutralizing the cathode liquid, then separating the reaction product and finally distilling.

815,557. ALARM FOR INCUBATORS; Fay T. Porter, Morristown, Ind. App. filed May 20, 1905. The usual incubator has a thermostat therein, the lever of which is extended outside of the incubator box and has hood or cap which is dropped over the usual air circulating opening in case the temperature falls to a low limit. At the same time an alarm circuit is completed.

815,578. CONTROLLER OPERATING MEANS; A. J. Brown, Norwood, O. App. filed July 11, 1904. The controller handle is connected to the controller shaft through an intermediate spring connection and a specially arranged detent resists movement of the controller shaft until after a predetermined movement of the handle has taken place. The shaft then follows the handle with an abrupt movement.

815,605. ELECTRICAL CONNECTOR FOR ELECTRIC LAMPS; Ernest A. Lowe, North Plainfield, N. J. App. filed Jan. 21, 1905. The threaded shell, and the central stud, of the socket are both connected to needle points which are contained in guiding grooves adapted to receive the usual circuit wires. The connections are thereby made through the needle points.

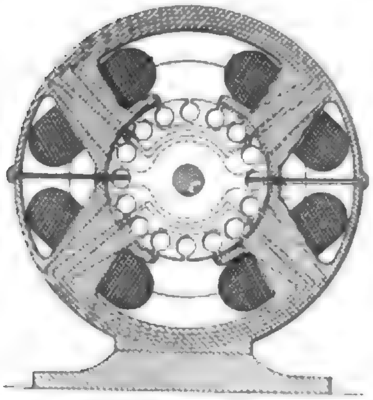
815,628. SECONDARY BATTERY; Emil L. Oppermann, London, England. App. filed Apr. 11, 1905. A composite material for secondary electric battery plates, consisting of active paste containing finely-subdivided filaments of material destructible by the electrolytic action of battery liquid, said filaments not exceeding one-sixteenth of an inch in length.

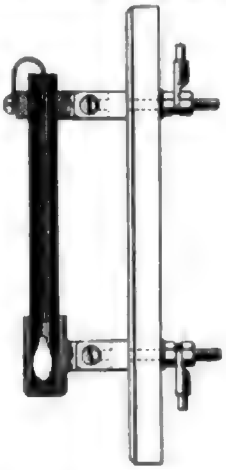
815,673. CONCENTRATOR; Quincy Bent, Lebanon, Pa. App. filed Apr. 14, 1904. An inclined table is mounted to have imparted to it the usual vibratory motions, and is studded with small electro-magnets.

815,679. CONCENTRATOR; Harry H. Campbell, Steelton, Pa. App. filed Apr. 14, 1904. 815,729. Relates to modifications of the above, and particularly to the arrangement by which the electro-magnets have a special movement independent of the movement of the table and transverse thereto.

815,729. TRANSFORMER; Walter S. Moody, Schenectady, N. Y. App. filed Dec. 13, 1901. In order to avoid the excessive insulation ordinarily required about the cores of a transformer, the windings are arranged with the secondary outside on one core and inside on the other. This arrangement brings the low potential parts of both primary and secondary adjacent the cores. With this arrangement a less insulation is required than otherwise.

815,746. FUSE CLAMPING TERMINAL; Arthur C. Savage, Schenectady, N. Y. App. filed July 20, 1904. A pair of clamp jaws move diagonally toward one another by a screw connection so as to exert a very heavy clamping force upon the fuse wire.


815,444—Motor.


815,804—Thermal Cut-out.

815,752. TELEPHONE ATTACHMENT; Joseph Silverman, San Francisco, Cal. App. filed Jan. 25, 1905. The combination with a receiver and mouthpiece of a telephone, of a holding device for the receiver said device comprising a stand having a vertical standard, a carriage supported on the standard and having a portion extending from one side, an arm lying in a plane at one side of the standard and having its inner end bent at right angles and pivotally secured to the extended portion of the carriage and a swiveled clasp on the outer end of the arm adapted to support the telephone receiver.

815,753. TELEPHONE ATTACHMENT; Joseph Silverman, San Francisco, Cal. App. filed Nov. 23, 1905. The combination with a telephone of an attachment therefor having means for holding down the hook, said means including an adjustable arm carrying a vertically reciprocating part to embrace the hook, a spring on said arm operating on the hook in opposition to its tendency to lift, and means for reciprocating said part in opposition to said spring.

815,756. SYSTEM OF ELECTRICAL CONTROL; Frank J. Sprague, New York, N. Y. App. filed Sept. 22, 1898. The combination of a motor, a source of supply, means for connecting the motor to the source of supply, a shunt around the motor, a controller for the motor, and means for opening the shunt when the controller is brought to a predetermined position.

815,765. ELECTRIC TRANSFORMER; Matthew O. Troy, Schenectady, N. Y. App. filed Oct. 20, 1904. A three-phase transformer in which the primary windings are connected in the usual delta formation, while the secondary coils are lapped into a special circuit with one another, the purpose of which is to prevent the usual unbalancing of voltage in the secondary windings.

815,764. ELECTRIC PLUG CONNECTION; Julius C. Tournier, Schenectady, N. Y. App. filed July 11, 1904. Details of a porcelain plug connection having a threaded shell, and the usual central stud extended into an interior chamber from which the usual connections are made. The plug is designed to receive a fuse wire if desired.

815,804. THERMAL CUT-OUT; Charles E. Eveleth, Schenectady, N. Y. App. filed Aug. 4, 1903. The end of a fuse wire is soldered to a fusible plug of a "sparklets" capsule. When the fuse wire melts the rush of cold carbonic acid gas blows out the arc formed thereby.

815,809. TELEGRAPH KEY; John J. Ghegan, Newark, N. J. App. filed Jan. 28, 1905. A form of telegraph key having a spring lever supported to vibrate in a horizontal plane. The lever has a vertical flat disc for the engagement of the fingers.

815,814. MEANS FOR PREVENTING ACCUMULATION OF STATIC ELECTRICITY UPON BELTING; Charles M. Green, Lynn, Mass. App. filed Feb. 5, 1903. The patentee proposes to render the surface of a belt conducting so as to dissipate static electricity. For this purpose the belt is painted with a graphite compound or is threaded with a network of metallic wires.

815,822. RELAY; Reinhold Hermann, Crafton, Pa. App. filed Mar. 28, 1904. Details of a relay having a magnet hung from the glass casing of the instrument, and having a contact lever with a conical carbon point, through which the electrical connection is made.

815,824. HIGH POTENTIAL SWITCH OR CIRCUIT BREAKER, Edward M. Hewlett, Schenectady, N. Y. App. filed Feb. 7, 1900. A circuit breaker for high potential circuits having a yoke with the switch rods depending therefrom, and worked by pneumatic cylinder. The switch rods plunge into an enclosed oil bath before engaging the sockets by which the circuit is completed.

815,825. ELECTRIC SWITCH; Edward M. Hewlett, Schenectady, N. Y. App. filed July 27, 1904. Another form of high potential circuit breaker in which the movable element consists of metallic rods or bridges clamped about insulators on the movable member, and which are moved through an oil bath against stationary spring blades.

815,826. TRAIN CONTROL SYSTEM; George H. Hill, Schenectady, N. Y. App. filed Aug. 20, 1904. Details of a train control system in which the usual contactors while normally controlled by the pilot circuit as at present are rendered inoperative in case there is no current in the motor circuit of that particular car.

815,831. APPARATUS FOR OBSERVING THE OSCILLATIONS OF LIGHT BEAMS; Andreas W. Hornauer, Charlottenburg, Germany. App. filed May 13, 1904. The light beam is directed against a revolving cylinder having a non-circular contour, the effect of which is to cause a peculiar curve to be generated in space by the spot of light on the cylinder. The changes in the form of this curve indicate the changes in the electrical circuit which is being studied.

815,836. VAPOR ELECTRIC APPARATUS; Alexander M. Jackson, Schenectady, N. Y. App. filed Jan. 29, 1906. In order to avoid the blackening of mercury-vapor tubes by the disruption of the anode caused by the mercury molecules impinging there against, the patentee surrounds the anode with a special form of condensing chamber which serves to protect the glass of the casing from being blackened.

815,847. DYNAMO ELECTRIC MACHINE; John P. Mallett, Madison, Wis. App. filed May 21, 1904. The laminated pole face has grooves extending there across through which bolts pass so as to clamp a pair of castings on the edges of the poles. These hold the usual magnet coil in place.

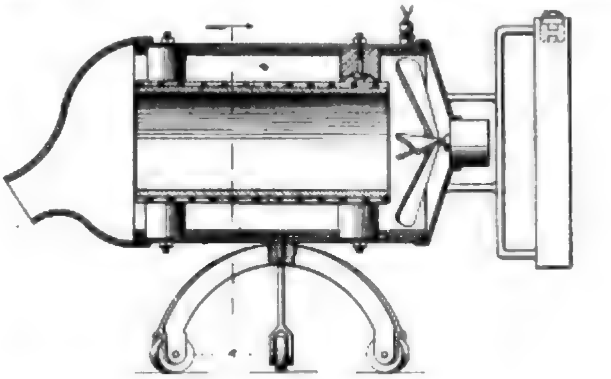
815,863. VARIABLE VOLTAGE ELECTRIC TRANSFORMER FOR CAUTERY AND DIAGNOSTIC WORK; Earl H. Rollinson, Albany, N. Y. App. filed July 18, 1905. The primary element of the transformer is wound on a support which is movable relatively to the secondary so that the secondary current may be varied as required.

815,875. PROCESS OF DEEP ETCHING OF ZINC BY ELECTROLYSIS; Otto C. Strecker, Darmstadt, and Hans H. Strecker, Mainz, Germany. App. filed May 26, 1904. The hereindescribed electrolytic process of deeply etching zinc which consists in exposing a zinc plate as an anode to an electric current of at least two amperes per square decimeter of the active surface while submerged in a path of zinc-salt.

815,881. PROCESS FOR THE REDUCTION OF ORES; Clinton P. Townsend, Washington, D. C. App. filed Apr. 12, 1902. The herein-described method of reducing sulfid ores, which consists in supporting the ore in a body of fused electrolyte which is substantially inert toward the ore and passing an electric current to said ore as cathode.

815,889. TELEPHONE TRANSMITTER; Ernest E. Yaxley, Chicago, Ill. App. filed Sept. 26, 1905. A telephone transmitter including a speaking diaphragm, an electrode actuated thereby, a second electrode, a chamber and subdivided material within said chamber interposed between and in contact with said electrodes, said chamber including an apertured resilient diaphragm engaging the inner face of the electrode moved by the speaking diaphragm, the said subdivided material having access to the electrode moved by the speaking diaphragm through the aperture in the diaphragm forming a part of said chamber.

815,890. ELECTRIC SIGNALING SYSTEM; Samuel M. Young, New York, N. Y. App. filed Oct. 18, 1904. A railroad signal system in which the track is divided into sections and the successive sections are energized with alternating currents. Inductive bonds are employed for connecting the various sections so as to insulate them against the alternate currents without impairing their continuity to the direct. The signal circuits are worked by the short-circuiting of the alternating potential in the usual way.


815,915—Hot Blast Apparatus.

815,891. ELECTRIC SIGNALING SYSTEM; Samuel M. Young, New York, N. Y. App. filed Oct. 18, 1904. Relates to modifications of the above and particularly to a feature by which the two tracks are connected by inductive bonds so as to be insulated from one another against alternating currents but in communication for the passage of direct currents.

815,903. FLUID PRESSURE SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed Feb. 24, 1903. The air compressor is driven by an eccentric on the car axle which is made operative by a magnetic clutch electrically operated in case the pressure of the reservoir falls below a certain amount.

815,908. RHEOSTAT FOR STARTING AND CONTROLLING ELECTRIC MOTORS; Winterton J. Day, Schenectady, N. Y. App. filed Sept. 14, 1904. The usual no-voltage release coil of the rheostat is disposed upon an arm which can be set at various positions so that the motor may be set for a slow speed if desired.

815,915. HOT BLAST APPARATUS; Joseph Fallek, New York, N. Y. App. filed July 10, 1905. Specific construction of a heater having a resistance coil surrounding the casing through which air circulates under the influence of a fan. Switches are arranged for independently controlling the heating circuit and the motor circuit.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the ELECTRICAL WORLD 27,000 *copies are printed. Total circulation for* 1906 *to date,* 275,000, *an average of* 19,643 *per week.*

NEW YORK, SATURDAY, APRIL 7, 1906.

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GROUNDING THE FRAMES OF ALTERNATORS.

There is still much dispute among central station men as to whether the iron framework of alternators should or should not be grounded. There are arguments to be made on both sides. The principal argument for grounding alternator frames is that, in the case of high-tension alternators, the attendants are liable to receive a dangerous shock from accidental contact with the frames, a condition impossible if these frames are permanently grounded. The principal argument for not grounding the frame is that such grounding increases the dielectric stress upon the insulated winding in the machine and tends to increase the risk of damage from lightning, static high-potential or internal short-circuit. The question is by no means of recent utterance. In the early days of electric arc lighting twenty-five years ago it was the rule to mount high-tension arc generators on wooden bases, to lay mattings of insulating material around them, and to direct the attendant in adjusting any part of the machine to keep one hand in the pocket. Now, however, pressures have increased to such a degree that the only safe procedure is to keep both hands in the pockets and keep the pockets away from the machine unless the machine framework is permanently grounded.

As a choice between protecting employees from injury on the one hand, and protecting dynamos from injury on the other, the former is the only logical, humane and defensible selection, as soon as the voltage developed by the dynamo becomes dangerous to life. Not only is it a kinder selection to the attendants, but it is also the more economical. The increase of risk to the insulation of the dynamos is quite small if the machine is well built and the lightning arrester and static arresters are adequately installed. If however, the machine framework is not permanently grounded and an attendant should be injured by shock in any way, either in the ordinary performance of his duty, or against rules, a jury is likely to bring a verdict of damages against the owners of the power station. The only defensible course is to save humans even if you wreck machines. Generator frames, switchboard frames, transformer frames should all and always be grounded in high-tension systems.

THE EFFECT OF THE READINESS-TO-SERVE RATE ON COMMERCIAL LIGHTING.

We have recently printed accounts of a number of central stations in southern Wisconsin which have adopted the readiness-to-serve method of charging for electric energy, as modified by Mr. H. L. Doherty. This method of charging, which is almost too well known to need description, as applied in these cities consists in a readiness-to-serve charge of 15 cents per month per 16-cp lamp connected, plus a service charge of $1 per month. In view of these readiness-to-serve charges, which are supposed to take care of interest on investment and cost of maintaining service at a customer's premises, the rate per kw-hour for energy as measured by the meter is usually low, being 5 or 6 cents per kw-hour. Customers have usually been given the option of this system or a rate of from 10 to 15 cents per kw-hour with a minimum bill of $1 per month. The readiness-to-serve system has never been popular among residences for the simple reason that its fixed charges amount to more than the bills would come to under the old meter rate. The ones to gain by it have been the stores, restaurants, saloons and other long-hour users. It is interesting to note that in a small city where stores close at 6 o'clock with the exception of one or two nights a week, the merchant who is paying 12½ cents per kw-hour is not able to save much if anything by changing to the Doherty rate if his kw-hour consumption remains the same as it did before. However, if he wishes to go into evening window display lighting or to keep his store partially lighted during the evening as an advertisement even though it is not open, the readiness-to-serve system gives him a chance to do it at a much lower price than he would have to pay at full meter rates. It is here that the true value of this system appears, namely, that it encourages the long-hour use of current, and in the end raises the standard of illumination in the business part of a town, so that the gross revenue, even though temporarily curtailed by the sudden adoption of the system by a large number of long-hour users will, in the end, far exceed what it could have been under a continuance of the old rate system.

Illumination as a Practical Art.

Considering that artificial illumination must in a certain sense have been coeval with civilization, and that, therefore, the art of illuminating has been practiced since prehistoric times, it is wonderful how slow has been its progress from an economical or technological standpoint. It is only occasionally that we find ourselves in a hall, building or enclosure where the lighting at night is at once sufficient, agreeable, and economical. Oftentimes we find an abundance of illumination, but with so much glare in the eyes that they are pained. Often again the light may be pleasant, but the illumination is insufficient for the practical purposes to which the building is devoted. Finally, we frequently meet cases where the light has been installed economically from the standpoint of maintenance, but the contrasts and shadows are distressing. The art of modern illumination consists in giving adequate illumination everywhere in a graceful, uniform, convenient and pleasing manner, with the minimum waste of light, and the minimum expense of installation, maintenance and depreciation. One of the most distressing defects frequently observed in lighting is that the luminous source is dazzlingly exposed to the eye, instead of being concealed from direct vision. "Let your light so shine before men that they may see your good works," and not your naked incandescents or arcs, should be the rule of the illuminating engineer. The sun sets us a shining example in this matter. At noontide, in the fullness of his power of about 10^{27} standard British candles, he occupies a position outside the ordinary range of view, so that we see everywhere objects sunlit with a mean illumination of about 7,000 candle-feet. When, on the contrary, he sinks at evening into the normal field of view, he interposes hundreds of miles of absorbent air between the tangentially viewing observer and himself, so that the eye is no longer blinded by the glare.

How different is this practice from that of those designers of a theatre who hang, almost in the line between the stage and its observer, a large cluster of vivid incandescent lamp filaments, having brightness of maybe 40 candles per sq. cm. of surface The retina of the eye is unable to withstand this glare, so the iris diaphragm or pupil of the eye automatically contracts. The observer then sits for several hours trying with pin-point pupils to watch closely the picture presented on the stage beyond, and goes home wondering why he feels so fatigued. Occasionally we see an attempt made to ameliorate this condition by the employment of frosted incandescent lamp globes, or of frosted outer containing globes. Although these present an enlarged aspect, they are more tolerable to the retina, because the brightness of the light may be cut down to a maximum of only a few candles per square centimeter of emitting surface. But the frosting absorbs an appreciable portion of the total light emitted, so that the benefit to the optic nerves of the observer is not gained without waste. Only at rare intervals do we enter a hall where the light is not only diffused and spread uniformly, but the lamps themselves are concealed from direct vision. When this is skillfully done we not only rejoice in the effect produced, but we unconsciously give salutation to the appreciative care and technically trained forethought of the illuminating engineer.

The same physiological law necessarily pervades the whole domain of domestic lighting. We want to secure a clear picture on the retina of each object we look at in turn, be it a book page or a wall portrait. In order to secure this picture on the retina with a reasonable minimum of artificial light production, we need the pupil to be kept widely opened or the iris diaphragm left large in aperture. If this condition is to be brought about we must cut off all bright lights or luminous sources from direct admission to the little camera of the eye. This means that the incandescent lamps must be so placed, or shaded, or englobed, that they will not irritate the retina. One of the principal advantages of the incandescent lamp over the gas lamp is that it permits of being so treated to a very marked degree. In fact, it is impossible to secure from gas lighting in general, the same pleasing, decorative and shaded effect that electric incandescents can be made to furnish with a little care and attention to detail. It pays the central station manager, therefore, to study the rules of physiological lighting, or hygienic lighting, because once the public has been cultivated to appreciate the æsthetic and healthful capabilities of electric lighting it will not hesitate to adopt incandescent lighting in preference to illumination by flames.

Levelling the Central Station Load.

The pet abomination of every central station man is the peak. It looms, forbidding, before his balance sheet, it throws a sinister shadow across his path even at noonday, and renders gloomy the approach of sunset. His most earnest desire is somehow to get out from under it or to get it out of the way. Now there are two ways in which one can remedy inequalities; one can cut down the hills, and one can fill in the valleys. If fortune favors indeed one can combine the processes and use the cuts to furnish material for the fills. In central station working likewise the same processes can be carried out. Peak load can be discouraged, off-the-peak load can be built up, or part of the peak can be transferred. If one carry the analogy a little further it will be seen that as regards the general level, cutting down the peak must be accompanied by filling or the total average load will fall. Filling, however, of necessity raises the average load. In central station work raising the mean load means an increase of more or less profitable business irrespective of its nature, provided that the relative height of the peak is not unduly increased. As the central station business has been carried on, we are inclined to think that the proper balance between cuts and fills has been often lost sight of to the detriment of the business.

Any plan which starts on the theory of penalizing peak load as such is strategically bad. It may be successful in reducing the peak, but it is exceedingly likely at the same time to reduce the valley level as well. Hence two-rate meters and modifications of demand systems introduced specifically to hit the peak load have been in practice only moderately successful. Unhappily almost every common kind of load holds over the peak to a certain extent, but every sort of constant load which holds over the valleys as well helps out, by reducing the proportionate height of the peak. Perhaps the motor load is as good an example as any when properly developed. The frequent trouble is, however, that it is not properly developed for the purpose in hand. The little motor of a horse-power or two pegging steadily along hour after hour is from the load standpoint by far the best thing to cultivate, but a very brief study of rates as they are worked will disclose the fact that the small motor business is not pushed as it should be, while larger motors, often on elevator or other work which has a more or less conspicuous peak, is taken on in rather large amounts. Of the lighting load something quite similar holds good. An office building has perhaps the most formidable peak to be found in the case of any customer, and yet it is not infrequently taken aboard at a very low figure, lest an isolated plant should go in. The thousand and one little shops that keep open through the evening are highly desirable from the standpoint of load, but in most American cities where does their custom go?

The answer is, very often, it goes to the gas company. Too many central station managers hold the opinion that the small consumer is a creature not to be encouraged, and so he makes cheap rates to a department store that shuts down promptly at 6 o'clock, and allows the little fellow who uses light five or six hours per day to burn Welsbachs, which he does, to be sure, very cheerfully. And has he ever noticed that the gas company, many of whose largest customers he has skillfully gathered in, has had to lower its dividends because of said manager's aid in loading it up with "unprofitable" small consumers? Electric signs have proved an excellent load to encourage since they hold over well into the evening, but has a thorough canvass been made to see what all day or all night business can be captured? The investment represents the peak load, while the receipts represent the average load, and the time has now come when it will pay the central station manager to make a note of this fact and pin it in his hat. A careful study of the uses of electricity will disclose the fact that there is a large aggregate amount of odd business of various sorts, how odd and queer only the canvasser can ever properly appreciate, which can be secured by persistent effort, and which holds pretty steadily through the day or night as the case may be. Lamps, small motors, heaters for various purposes, even minor electrochemical processes, all add their quota to the possible steady load. And there is, too, a chance in some places for getting load which is distinctly specified as off the peak. In some localities this is taken on in considerable amounts and at good profit. It is excellent filling material even at a moderate profit and should not be neglected. The long and short of it is that in hunting new business it is not always the easy and obvious thing that pays—attention devoted to the unusual and unexpected will often result in every desirable additions to the total load.

The Handling of Sign Business.

The development of electric sign and display lighting has been remarkable in a number of cities, but is only in its first stages with respect to the country as a whole. The question of how best to develop this kind of business among the merchants in a town and what system of rates to adopt is being considered in a number of places. Several methods of handling this business are in use. The most common method is to connect the merchant's sign and display lighting on his regular meter, allowing the merchant to look after the time of cutting in and out his signs and window displays. The merchant may have a time switch to cut out his lighting at whatever hour he desires, or a private patrolman employed by a number of merchants on a street may have this added to his duties. Another common plan and one that has been used by a number of companies which have made a most notable development of their sign and display lighting business, is to make a contract with a merchant or other customer for a certain number of sign or display lamps to be burned a specified number of hours per year at a fixed price for the term of the contract. The hours of burning specified in the contract may be from dusk to 11 p.m. or any other hours which local conditions seem to suggest as profitable. The company then has a patrolman whose duty it is to turn on and off these lights at the specified hours every night. Since the company has control of the switches on these lights and is able to calculate in advance the number of hours of burning per month, meters are unnecessary on this class of business. Various modifications of these two plans suggest themselves. For example, the display lighting might be on the customer's meter, but the company might maintain a patrolman to turn it off and on according to contract. In case the company did not care to keep a patrolman on this kind of work, the company might install its own time switches to do this.

Where sign business has not been very fully developed by a central station company, it is usually being done on a meter basis and is entirely under the control of the merchant. This has the advantage from the central station man's point of view that it does not necessitate any special looking after by the company, as the customer takes care of his own sign and sees that it is turned on and off. Sign business can, as a rule, be got on the customer's regular meter rates only when some system of charging is in vogue whereby a low rate is given for long-hour business; otherwise the cost of operating signs and window displays or anything taking energy after business hours is likely to be looked upon by the merchant as prohibitive. Assuming, therefore, that the regular rates for long-hour business are low enough to put sign lighting within the reach of the merchants, is it better to take sign lighting for a given number of hours per month at a flat rate equal to the regular meter rate for an equal amount of consumption, or should it be left to the merchant to handle the load on his existing meter? The greatest objection that has been found with sign lighting when not done on a flat rate contract and turned on and off by the company, is that the merchants attempt to economize by turning off sign and display lighting many times when otherwise if on a flat rate under contract for a certain number of hours' burning they would not be turned off. The practical result of this is that the company loses revenue from sign lighting which it would get under a flat rate. It is probably true that some merchants can be induced to put in a sign, the operation of which is under their own control so that they can use it as little or as much as they please. It is equally true that many merchants will prefer to make flat rate contracts for a certain amount of advertising by means of sign and display lighting rather than purchase sign and display lighting equipment without a definite idea of how much it will cost them to operate it.

It is to the central station company's interest to have all the sign and display lighting on a street in operation every night as long as people are on the streets, not only on account of the revenue from this lighting, but because of the effect it has on other merchants on the street in inducing them to make their places of business attractive by night. Another strong point of the flat rate sign scheme is that by making a long time contract with a merchant, say for two years, the price of the sign can be included in the contract and a good sign customer secured where the first cost of the sign might sometimes prevent. Some managers are opposed to flat rates as being a step backwards, but where the burning of sign and display lighting is absolutely under the control of the company and the flat rate made is calculated to be equal to the company's regular meter rates for a similar use of energy, there can be no possible objection to it other than the cost of labor involved in turning these lights on and off. Some companies have tried time switches as substitutes for patrolmen and others solenoid-operated switches on a special switch circuit controlled at the central station or some convenient central point. These plans have certain advantages in saving of labor, but are open to the objection that a sign is not inspected by an employee of the company twice a day as it is when a patrolman visits each installation in person to turn it on and off. In fact, it is one of the strong points of the flat-rate system with patrolmen that sign and display lighting is carefully watched and burned-out lamps replaced either the night they are noted or the next day. In this way signs can be kept in first-class condition and be a good advertisement for the electrical advertising business, whereas a sign with one or two lamps burned out presents such a dilapidated appearance as to be anything but a recommendation for electric sign advertising. It is one of the objections to the system of having signs controlled by the customer that they are not watched as closely as when controlled and maintained by the company.

NATURAL GAS COMPETITION.

Our Kansas central station friends are at the present time going through an experience which is similar to that of Indiana and Ohio central station men at the time the use of natural gas was introduced in those States. A brief review of the effect of natural gas upon central station business in Indiana and Ohio will therefore be of interest not only to Kansas central stations but to stations in any part of the country where cheap gas competition exists. In Indiana natural gas is no longer a factor in the situation, the supply being almost exhausted. While obtainable the gas was used recklessly, and being sold very largely on flat rates, the waste was so enormous that the supply did not last nearly as many years as it would have done under more conservative use. Whether this will be the history of the natural gas business in Ohio and West Virginia remains to be seen. It is also impossible to tell whether new gas fields may be opened up. Natural gas is not being used in Ohio with such waste as it was in Indiana, as it is being sold largely by meter. However the rate is so low that it is lavishly used. It is the testimony of central station managers, borne out by our observation in Ohio cities served by natural gas for three or four years past, that natural gas competition cuts but little figure in the case of residences in which electric light is already in use and in the better class of stores. In the smaller stores and saloons, natural gas used in mantle burners is so ridiculously cheap that it is difficult for electric service to stand out against it because in such places there is but little consideration given to the questions of general appearance, ventilation, heat and inconvenience. An amusing aspect of the situation is that not only can a small storekeeper flood his store with light from natural gas mantle burners at a ridiculously small price when gas is selling at 30 cents per 1,000 cu. ft., but he can also practically do without other means of heating in the winter. What these places with their numerous gas jets are like in the summer can well be imagined.

This brings out another interesting phase of the situation, which is that some stores use so-called gas arcs in winter both for heating and lighting and take central station service in the summer because of the heat of the gas burners. The condition of the air in stores in the latitude of Ohio which are heated by means of gas burners throwing all the products of combustion out into the room, can well be imagined. The air is fit for no human being to live in and the clerks in these stores show it. These store owners would probably stand aghast at the idea of having their houses equipped with natural gas furnaces, the products of combustion which usually go up the stove pipe to the chimney discharging into the living room. They would probably not permit such a furnace to be installed even under their stores, but still cling to the idea that it is economy to heat and light their stores in a manner which is the equivalent of the method mentioned as far as the pollution of the air is concerned. The effect of this custom of using electric light for store lighting in summer only is so pronounced in some cities that some central station companies have their maximum peak load in the down-town district in the summer rather than in winter. All over the state of Ohio in buildings where natural gas is used there is the same indefinable smell due to the products of combustion thrown off from gas burners. This smell together with the inherent inconvenience of lighting gas with matches and the ruining of interior decorations is keeping the natural gas out of residences wherever the central station companies are reasonably wide awake. In the better class of stores and in window display and sign lighting, electricity still has things its own way. The most wide awake managers in the gas districts fully realize that residence lighting is the bulwark of their business which neither natural gas nor isolated plants can ever be able to take away from them, and they are making corresponding efforts to extend that business.

Natural gas also is a serious competitor of the power department of the central station business. Gas engine salesmen are, of course, active, and as far as the bare cost of gas is concerned, the gas engine can be operated very cheaply on 30-cent natural gas It is usually only a question of time, however, until the user of the small gas engine has trouble with it, either mechanically or electrically. It is also a decidedly disagreeable thing to have on the premises with its unremitting coughing and banging, and the employee whose duty it is to start the thing occasionally gets thrown violently against the wall by a back kick or something of the sort. Taken altogether, by watchfulness and persistence on the part of the central station manager or solicitor the gas engine power user can frequently by being approached at the right time be brought over to central station service. Small isolated gas engine driven electric lighting plants are quite common but the service from these is so poor as regards steadiness of light and occasional interruptions to service, that it is indeed a hard customer who will not in time come to the central station.

As to just how much influence the incoming of cheap natural gas will have immediately on any given central station company's income, depends very much on the character of the town and the character of the load which the company has built up. We have in mind one small manufacturing town with a large number of small stores and saloons and but little residence lighting where the central station's gross revenue was reduced about 25 per cent the year natural gas came to the town. If a central station company is depending for a large percentage of its income on the cheap class of stores and has neglected the residence lighting and allowed the stores to put in isolated plants, it is apt to be in a bad way when natural gas strikes the town, unless it begins promptly to push its residence lighting business and to get all the possible power users on to central station service before they are induced to change from steam engines to gas engines. If the company has the residence district well covered, has developed its power business as it should so that it is turning nearly all the wheels in the town and has a good lot of electric sign and display lighting, its revenues should not suffer seriously. If rates are reasonably low, it is not advisable to lower them with the idea of meeting natural gas competition, because the natural gas is so very cheap that if it is a question of price only, certain customers will be lost anyway, while the customers who consider electric light on its merits will usually pay the old rate just as willingly as any reduced rate. It is, of course, well for the manager in a town about to be invaded with natural gas to look well to his customers' installations to see that they are getting the best results possible for their money; and if inexpensive changes can be made, as they frequently can, which will give much better results, the customer should be persuaded to make them rather than to pipe for gas. In fact, in many cases such changes could well be made by the company subject to the customer's approval, as the amount of money involved would not be large in case the changes were not acceptable.

The Outlook for Central Station Business.

It must be apparent to any one who makes a tour of inspection of a number of central stations of all kinds and sizes selected at random in any part of the country, that there are great undeveloped possibilities in the central station business when the total results are averaged up. He will find a central station in one city developing certain classes of business and neglecting others equally as good. In the next town he will find the conditions reversed. If we add up the possibilities of development of a number of central stations, the results are startling in their magnitude. Large numbers of companies have not given the attention to building up a residence lighting business which they should. There are large residence areas in many cities in which no electric light service wires can be found. Residence lighting may require a little more investment for a given number of customers than down-town lighting, but it is nevertheless a most desirable kind of load when secured in sufficient quantity. Like any other business it is not profitable if carried on in a small and scattered way. A large number of companies have not developed a respectable power load, which is due partially to inactivity, and partially to a system of rates which practically keeps would-be power customers away from central station service. Sign and display lighting for advertising purposes by merchants in down-town districts is a source of revenue which is but little worked in the majority of places, although there are striking examples of what can be done with it in some cities. In a large number of small towns there is no day service, although by proper effort a good day load could be secured. In this connection there is frequently a chance to secure a contract from the city for pumping water. Such work can be economically done by a central station when the station capacity is not needed for other work, and is a great help to a small plant as well as an economy for the city. In every live town there should be a demand on the part of the merchants for higher standards of illumination from year to year. The well lighted store of ten years ago is not a well lighted store to-day, and there are plenty of stores to-day which need brightening up. Of course, in some of the larger cities a few stores have about reached the limit of possible useful or display illumination, but these exceptions do not prove anything against the general assertion that there is every reason to expect greater expenditure of money from year to year by the merchants in any given town for illumination. It is for the central station companies to work up the matter and get merchants in their respective cities into a more liberal use of light, not only during open hours but after stores are closed in the evening.

Besides these thoroughly demonstrated possibilities along lines which have been worked out by the more progressive companies, there is the electric heating business to figure on in the immediate future. Of the revenue producing heating devices, the electric flat iron has already begun to show results to central station companies which have had the foresight to actively push its use. A good increase in the day load of central stations can certainly be looked for from this quarter if only the companies will make the effort to get these flat irons on their circuits. Besides this there are the other smaller cooking and heating devices which, while not great revenue producers, are good advertisers for the business and all help to swell the gross receipts. The field of heavier cooking is also undeveloped but will undoubtedly become an important source of revenue, though perhaps not in the immediate future. We have mentioned here only common, well known branches of the central station business. Attentipn has been called to them hundreds of times in the technical press and before conventions. We know nevertheless that the majority of central station companies are weak along certain lines and are neglecting some of the branches of the business named. Some are neglecting some lines; their neighbors are neglecting others. To sum up, if all the companies would work all of the branches within reasonable limits there would be such a growth of the central station business as has never been witnessed since its beginning.

Intelligent Use of Electric Supply.

Mr. E. R. Weeks, past president of the National Electric Light Association, at the recent annual meeting of the Manufacturers' and Merchants' Association of Kansas City, delivered an interesting address on applied electricity. He criticised the uneconomic work done on and by many plants, and said: "Ignorance of good practice in electrical engineering is equally expensive to the merchant. Since he usually has no knowledge by which to determine the kind of machinery best suited to his needs or the proper cost of its operation, he, too, is at the mercy of unscrupulous vendors of current and apparatus. A certain hydraulic elevator in this city is now costing $3.49 per car mile, while an electric elevator in the next block, with one-third more load, costs by meter only 36 cents per car mile. On the other hand, a new pair of lifts operated by electricity at 4 cents per kw-hour by meter, was recently costing $350 per month, while another pair of purely mechanical lifts doing much more work were costing only $142 per month. After thorough test and reconstruction, the cost of running the pair of electrics dropped to $65 for last month, although the service had increased 10 per cent."

As to the beauty and value of electrical products, and the fine skill needed in their manufacture, he remarked: "As manufacturers and vendors of industrial products, it will interest you to hear that in the electrical arts is now found the most costly pound of manufactured product. It has long been supposed that a pound of hair springs has the greatest pecuniary weight; being at wholesale rates, $42,000. I feel sure that those among you who have paid this price will be surprised at the statement of fact that the wholesale cash value of one pound of carbon filaments for incandescent lamps is $60,000, or 109 times its weight in gold. Some of you who are accustomed to buy and sell by the car load may think that the purchase of one pound of a commodity should be called a retail transaction; but when I state that 42,000 hair springs or 30,000,000 filaments are required to balance a pound of butter, I think you will all agree that even as small a weight as an ounce of either would constitute a wholesale consignment."

Ohio Independent Telephone Association.

At the annual meeting of the Ohio Independent Telephone Association, held at Columbus, Ohio, March 29, the attendance was but little short of 500. President Beam in his address stated that the independents in Ohio have made remarkable strides during the past year and that investment in the State is more than $30,000,000, and Secretary Reamer reported that 135 out of the 325 independent companies in the State were members of the Association. President James R. Hoge, of the National Interstate Telephone Association, presented a paper on "National Development and Progress of the National Interstate Telephone Association," in which it was stated that independent trunk lines now extend from Albany, N. Y., to Kansas City, and that about 3,200,000 independent telephones are now in operation. In the larger cities the independents are increasing their business at from 500 to 1,000 telephones per month, and the independent movement is progressing at a rapid rate in the New England States. Mr. Hoge advocated that particular attention should be given to developing farmers' lines.

The Association took prompt action concerning a bill in the Ohio Legislature, the passage of which would inflict a tax of $1 per telephone in the larger cities of the State. A committee and members of the Association acting individually, opposed the measure, and though reported from the committee it was defeated on the floor. Resolutions were adopted expressing the dissatisfaction of the independent telephone interest on the manner in which it had been treated in Cincinnati, all efforts to establish an independent telephone system there having been persistently opposed. Mr. W. B. Woodbury, of Detroit, said that everything looked favorable for the establishment of one of the finest exchanges in the country in that place, and Mr. Edward L. Barker reported that the first long-distance line to the Gulf would be completed in about four months and that another line is complete to Birmingham, Ala., and will be continued to the coast. A discussion brought out that independent telephone securities have largely enhanced in public estimation during the past two years, and in another discussion there was a consensus of opinion that intercourse should be withdrawn from all independent companies using the Bell long-distance lines.

The following officers were elected for the ensuing year: President, Mr. Frank L. Beam, Columbus; secretary, Mr. O. Welsheimer, Columbus; treasurer, Mr. Ralph Reamer, Cleveland. In the evening a banquet was served at which Hon. H. M. Daugherty presided as toastmaster. Among those responding to toasts were Mr. Frank A. Davis, of Columbus, and Col. J. D. Powers, of Louisville.

Report on Niagara Falls Power.

The International Waterways Commission has made a report to the Secretary of War on the preservation of Niagara Falls, and this report has been transmitted to Congress. Some practical suggestions are made as follows: "The Secretary of War be authorized to grant permits for the diversion of 28,500 cu. ft. per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows: Niagara Falls Hydraulic Power & Manufacturing Company, 9,500; Niagara Falls Power Company, 8,600; Erie Canal or its tenants (in addition to lock service), 400; Chicago Drainage Canal, 10,000.

"All other diversion of water which is naturally tributary to Niagara Falls to be prohibited, except such as may be required for domestic use and for the service of locks in navigation canals. Suitable penalties for violation of the law to be prescribed.

"The foregoing prohibition to remain in force two years, and then to become the permanent law of the land, if in the meantime the Canadian Government should have enacted legislation prohibiting the diversion of water which is naturally tributary to Niagara Falls in excess of 36,000 cu. ft. per second, not including the amount required for domestic use or for the service of locks in navigation canals. It is assumed, however, that an understanding upon the subject should be reached by treaty. The object of such legislation would be to put a stop to the further depletion of the falls and at the same time inflict the least possible injury upon the important interests now dependent upon this water power.

"The amount to be diverted on the Canadian side has been fixed with a view to allowing to the companies on that side the amounts for which they now have works under construction, which are: The Canadian Niagara Power Company, 9,500; Ontario Power Company, 12,000; Electrical Development Company, 11,200; Niagara Falls Park Railway Company, 1,500; Welland Canal or its tenants (in addition to lock service), 1,800."

The report states that the amount of flow thus far diverted on the American side has been only 27,800 cu. ft.

Tests of a 500-Kw. Westinghouse-Parsons Turbine.

A test of a 500-kw Westinghouse-Parsons steam turbine was recently made at the East Pittsburg works of the Westinghouse Machine Company by Ludwig & Company, Engineers, of Atlanta, Ga. The turbine was designed to develop normally 750 brake hp with a steam pressure of 175 lbs. at the turbine throttle, 150° F. superheat, 28-in. vacuum absolute, and running at a speed of 3,600 r.p.m. The tests were made to determine the fulfillment of the builders' guarantees and the general running qualities of the turbine under ultimate conditions of service. The turbine was subjected to different loads by means of a water absorption break. The data of the test are plotted in the accompanying curves, and some of the numerical results are given in the following tables:

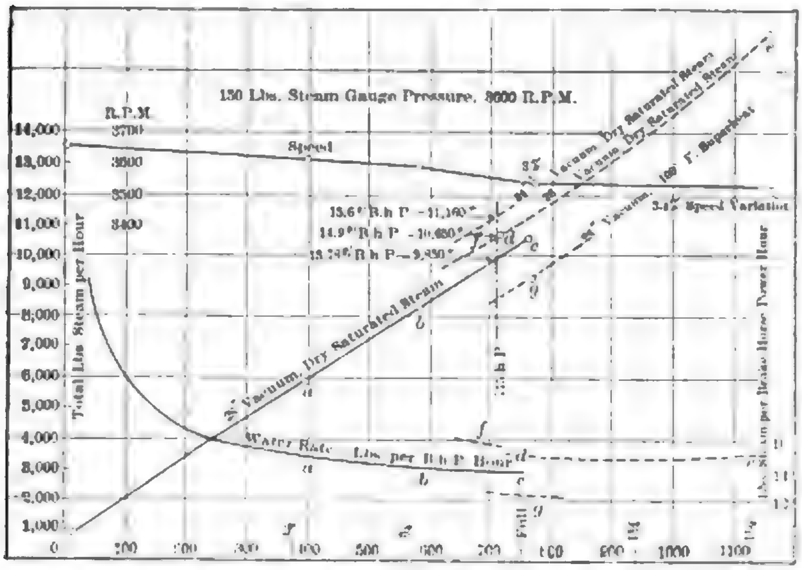
Saturated Steam.

	Full Load.	¾ Load.	½ Load.
Lbs. per hp-hour from test............	13.68	14.05	14.92
Corrected for 28-in. vacuum...........	13.47	14.05	14.92

Superheated Steam.

	Full Load.	¾ Load.	½ Load.
Lbs. per hp-hour from test............	12.7	13	13.8
Corrected for 150° superheat..........	11.7	13	13.8

The tests showed that the steam consumption decreases about 10 per cent per 100° F. of superheat, and numerous tests have shown that the steam consumption of this type of turbine changes from 3½ to 4 per cent per inch of vacuum. The no-load steam consumption was found to amount to 7 per cent of the full load consumption with saturated steam. Assuming that this percentage remains constant up to full load, the practical efficiency of the turbine will be 93 per cent and the steam consumption per indicated hp-hour will be 12.7 lbs. of saturated steam, and 10.75 lbs. with 150° superheat.



PERFORMANCE OF WESTINGHOUSE-PARSONS TURBINE.

The extreme speed variations were 2.3 per cent from ½ load to 1½ load; 3 per cent from no load to full load, and 3.4 per cent from no load to 1½ load. With the full load suddenly turned off and on, the extreme speed variation from no load to full load was 3 per cent and from full load to no load 2.6 per cent. During this test the safety stop with which the turbine is equipped to prevent racing in the event of any accident to the governor mechanism, operated at 3,780 r.p.m., or about 5 per cent above the normal running speed of the turbine. The tests showed that under practical conditions of service (where the vacuum is liable to fall from 28 to 26 in. on overloads) the steam consumption of the turbine between ½ load and 50 per cent overload varied by only 4½ per cent from the average, and probably with a uniform degree of superheat the variation would have been still less.

CURRENT NEWS AND NOTES.

CHICAGO MUNICIPAL TROLLEYS.—By a referendum vote the people of Chicago have declared this week in favor of the municipal ownership of the street railways, but against their municipal operation. The question of issuing $75,000,000 worth of Mueller law certificates was also answered in the affirmative, the majority being 3,339. The Mueller law, which lacks the authority of the Supreme Court and the validity of which is open to some doubt, is a legislative act passed several years ago, authorizing the issuance of "certificates," a sort of bonds to be used for the purchase of public utilities by any city wishing to go into the business.

SCIENCE AND SPIRITUALITY.—At Bristol, England, on March 30, Ambassador Whitelaw Reid, speaking at a university dinner, drew an interesting comparison between the educational progress in Great Britain and the United States. In England, he said, the tendency of university courses was now becoming more in the direction of scientific and technological knowledge, but in America the belief was growing that it might be advantageous to give greater attention to old studies, pure scholarship and literature, and that scientific education might be carried too far for the best interests of the rising generation. "In my belief," said Mr. Reid, "the time can never come when spiritual things will not outweigh those merely material."

NIAGARA FALLS WATER POWER.—The Ottawa Board of Trade has adopted a resolution declaring that the Canadian Government should not enter into any arrangement that would interfere with the right of Canada to develop water power at Niagara Falls, or at any other point along the international boundary. The resolution declares that "in view of the fact that the Province of Ontario is largely dependent upon foreign coal for industrial and domestic purposes" it should develop its water power. The resolution also called on the Canadian Government to enact legislation to prohibit manufacturers of electric energy in Canada from selling and transporting the same across the border under any contract not terminable within one year.

TELEPHONY IN CANADA.—Advices from Toronto state that the Dominion Government has abandoned the proposal to nationalize the telephones of Canada, and has adopted the policy of bringing the Bell and its competitors under the control of the railway commission. The rates will be supervised, the Bell exclusive rights to enter railroad stations cut off, and the company be compelled to give connections with independent companies. Movements are on foot in Ontario, Quebec and Manitoba looking to the provincial or municipal ownership of all the telephone lines, but it looks as if the Federal Government will refuse power to expropriate. The Grand Trunk Railroad, it is said, has decided to spend $300,000 in equipping its lines with telephones.

MUNICIPAL ELECTRICIANS.—The eleventh annual convention of the International Association of Municipal Electricians will be held at New Haven, Conn., August 15, 16 and 17, 1906. At this meeting the following papers will be presented and discussed: "History of the Fire Alarm and Police Telegraph," "Details of Certain Auxiliaries to Fire Alarm Apparatus," "Advisability of Protecting Municipal Electricians by the Civil Service Laws," "Comparison of Underground and Overhead Wiring, and of the Relative Values of Single, Rubber-covered Wire and Lead-encased Cable for Underground Construction," "Conditions Surrounding the Inspection of Wires in the Southwest." In addition to this the Question Box will be a feature at the meeting. Mr. Frank P. Foster, Corning, N. Y., is secretary.

STEAM TURBINE INVESTIGATION.—The name of Mr. W. E. Moore, of Connellsville, Pa., has been added to the committee for the investigation of the steam turbine, which is to report at the Atlantic City meeting of the National Electric Light Association. In order to complete the data for the report, the committee met this week at the office of Mr. Irving E. Moultrop, in Boston. Mr Moultrop has just returned from Europe, where he went for the purpose of gathering data regarding turbine operation abroad. From Boston the committee will visit the General Electric Works at Lynn, Mass., and the Providence Engineering Works, Providence, R. I. It will then proceed to Schenectady for a day at the General Electric works, will visit Utica, Chicago and Milwaukee, and on the return trip will visit the works of the Westinghouse Company at Pittsburg. The coming report is expected to contain much matter not heretofore published.

TROLLEYS IN JAPAN.—United States Consul-General Miller, of Yokohama, reports that a scheme is on foot among members of the Osaka City Council to organize an electric railway company to run between Osaka and Kyoto. The capital stock proposed is $2,500,000. This is encouraging, as the electrical activity in Japan slackened somewhat with the cessation of the war.

THE OHIO ELECTRIC LIGHT PROCEEDINGS.—D. L. Gaskill, Greenville, O., secretary of the Ohio Electric Light Association has just issued the *Transactions* of the last annual convention. These proceedings were considerably delayed in appearance by the loss of some of the papers in transit and by a general printers' strike at Cleveland where the work was being done. The book is bound in board covers in convenient shape for ready reference.

INCREASE IN LOAD.—The Janesville (Wis.) Electric Company, between January 1 and March 10, in a town of about 10,000 inhabitants, secured 15 new residence customers, 8 commercial lighting customers and 9 power customers. From January 1 to March 1 a special offer to residence customers was in force giving them 50 per cent reduction on bills for the first four months if connected during that period. It would be interesting to know how many other central stations can show an equal growth in communities of the same size.

CARNEGIE TECHNICAL SCHOOL.—It is announced that Mr. Andrew Carnegie has given $2,000,000 in addition to previous gifts for the maintenance of the Carnegie Technical Schools. Mr. Carnegie has already given more than $1,000,000. None of the latest gift is to be used for the erection of buildings. It is also announced that Mr. Carnegie expressed a desire that the Margaret Morrison Carnegie School for Women be completed as soon as possible, and assured the committee that he would meet the expense. It is expected the technical schools will have cost about $5,000,000 when completed.

STREET RAILWAY MEETING.—Secretary B. V. Swenson, of the American Street and Interurban Railway Association, has issued a preliminary announcement as to the 1906 convention. It will be held at Columbus, Ohio, October 15-20. The city has four first-class hotels guaranteeing about 1,100 rooms, and accommodations can be reserved now by addressing Mr. B. H. Harmon, secretary convention committee, Columbus Board of Trade. The exhibit halls will be on the State Fair grounds, about 15 minutes' ride from the principal hotels, and the convention hall is in close proximity to the exhibits. Current at 500 volts direct and 110-220 volts, 60-cycle, alternating, will be available. Detailed plans and days for the parent and associate bodies will be announced in due course.

ELECTRICAL METHOD OF MAKING ARMOR PLATE.—A patent recently issued to Lieut. Joseph Straus, of the United States Navy, describes a method for electrical manufacture of armor plate. The desideratum of armor plate is an exterior sufficiently hard and thick to prevent penetration of projectiles striking it, and having a tough inner portion capable of withstanding the racking strains to which the plate is subjected from the impact of projectiles. Armor plates in the past have been constructed to fulfill these conditions by a cementation process producing a decremental carburization of the plates from the outer face inward, or by fastening to a large body of soft steel small plates of hard steel. The process of Lieut. Straus is for producing a composite armor plate like the last mentioned, in which, however, the small hard plates are united to the large tough body piece by electric welding. By this means not only can a very perfect union be secured but there will be a diffusion decrementally of carbon from the hard small plates to the large plate of tough steel, this diffusion of the carbon being controlled by proper manipulation of the temperature of the plates.

CIVIL SERVICE OPENINGS.—The United States Civil Service Commission announces an examination May 2 for six vacancies as electrical assistant in the Signal Service at Large, at $900 per annum salary. Applicants should be thoroughly familiar with the practical side of electricity as applied to telegraph, telephone and cable engineering, and also with the methods of testing and installing electrical instruments used in fire control, such as storage batteries, telegraphs, electric clocks, telephones, etc. Age limit, 20 years or over on the date of the examination and applicants must be citizens. The commission also announces a vacancy in the same force as assistant electrical engineer, at $1,400, for which post examinations will be held May 3-4. There seems to be difficulty in filling the positions at the lower salary. All who wish to undergo the examination at any of the designated centers should apply to the commission offices, Washington, D. C., for the necessary forms, etc.

PRODUCTION OF HIGH VACUA.—A recent patent granted to Prof. James Dewar, of Cambridge, England, describes an interesting method for obtaining very high vacua. This consists in placing the receptacle to be exhausted in connection with another receptacle containing charcoal, and then subjecting the latter to very intense cold by immersing it, for example, into a vessel containing liquid air. When air is the gas to be absorbed, as in the manufacture of incandescent lamps and Rontgen ray tubes, the following data give an idea of the proportion which the charcoal should bear to the volume of air to be absorbed when liquid air is the cooling agent: A vessel containing 1,500 cm. of air at atmospheric pressure was put into communication with 30 grammes of cocoanut charcoal placed in a side vessel immersed in liquid air. The pressure within the vessel fell to 50 mm. of mercury. When by means of a pump the same vessel was exhausted by half an atmospheric pressure before the charcoal was cooled, the cooling lowered the pressure to a vacuum higher than that in which an electric discharge produced the well-known striae. When the pump was operated to reduce the pressure to one-quarter atmospheric pressure before the cooling, the latter produced a vacuum in which it was exceedingly difficult to get an electric spark to pass.

ELECTRIC IRONS IN A CLOTHING FACTORY.—One of the clothing factories of Goldsmith, Joseph, Feiss & Co., at Cleveland, Ohio, has 95 electric irons in use for pressing. This firm also has another smaller establishment in Cleveland using electric irons. The irons are mostly of 16 lb. weight, and are of Simplex manufacture. They are used on pressing tables which are equipped with swiveling arms on which the irons are placed. The pressing tables can be raised by a foot treadle so that the operator has a minimum of manual labor to perform, as he has merely to swing around the iron (the weight of which is taken by the swiveling arm) and raise the table so as to bring pressure up against the iron by means of the foot treadle. That electric irons should be used on such a large scale in a factory of this kind speaks volumes for its advantages. The reasons for the adoption of electric irons in the factories of Goldsmith, Joseph, Feiss & Co. are, first, the reduction of fire risk, because no matches are necessary; second, saving of time as compared to charcoal heated irons; third, absence of damage to goods, and fourth, no pollution of the air because of the irons. If a gas iron with gas jet inside the iron were used the workman would have to have matches, which in itself would be a considerable fire risk where so much lint exists as in a clothing factory. There is also some danger of scorching the work with a sudden puff from such a gas-heated iron, when it is used rapidly. These gas irons are also objectionable in such a factory because of the air they pollute. Charcoal heated irons were considered out of the question as compared with the electric because of the pollution of the air and the large amount of time lost in refilling them and getting them at the right heat. There is no doubt that the factory is able to turn out much more work than with any other kind of iron. Electricity for this factory is supplied by the Cleveland Electric Illuminating Company. A number of other factories in Cleveland are also using electric irons.

MULTIPLE-UNIT, SINGLE-PHASE CONTROL.—It is reported by the London *Electrician*, that Messrs. Siemens Bros. & Co., have obtained very promising results from experiments with an electro-pneumatic multiple-unit control equipment for single-phase motors.

ELECTRIC TRACTION COMMANDED.—The New York State Railroad Commission has just recommended, after an examination of the traffic conditions, that the New York City Railway Company install electricity on several street car lines on the lower east side of Manhattan Island. It is high time, indeed, that the last street car horse was banished from New York City.

NEW YORK TRAFFIC.—In 1905 no fewer than 93,000,000 street railway passengers paid fare in New York, in excess of the number in the preceding year. The State Board of Railroad Commissioners made public last week a compilation of statistics of the number of passengers carried and transferred on the street surface, elevated and subway railroad lines of New York City during 1905, as compared with 1904. The number of paid fares was 1,171,151,698, an increase of 93,493,451. The number transferred was 271,195,524, an increase of 7,816,362. The car mileage was 230,249,455, an increase of 28,664,543.

PROTECTION OF WIRES.—The Waddell bill introduced in the New York Assembly provides a clause in the penal code as follows: "Every person who knowingly, or without authority of the owner or managing owner thereof, or who maliciously takes down, removes, injures, interferes with or obstructs any line erected or maintained for the purpose of transmitting electricity, or any part thereof, for any purpose whatsoever, or any insulator or cross arm, appurtenance or apparatus connected therewith, or severs or in any way interferes with any wire or cable thereof, is punishable by imprisonment in the State prison not exceeding five years, or in the county jail not less than six months."

ILLUMINATING ENGINEERING SOCIETY.—The April meeting of the Illuminating Engineering Society will be held in the Edison Auditorium, 44 West 27th Street, New York, on the evening of Thursday, April 12. The programme of the evening is a discussion of the subject of "Interior Illumination." Three short introductory papers will be presented by a gas engineer, an electrical engineer and an acetylene engineer, respectively. Invitations have been issued to gentlemen representing the several interests among the membership of the Society to take part in the discussion, which will then be made general. The membership of the Society is growing rapidly, the total enrollment to date being 320.

A CHALDAIC CRYPTOGRAM is cleverly contrived to catch the curious, in a cream-colored circular issued by the Chicago Edison Company. It was originated and copyrighted by Messrs. D. H. Howard, of the company, and H. A. Seymour, who edits the local Edison bulletin called *The Electric City*. When a man has mastered the muddle of marks he makes out a mysterious monition to be wise, by using central station current. We are informed that these folders, the ingenious inscription on which only becomes legible when held up to the light, can be obtained in any quantity from the publishers on request, for use as a supplement to monthly Bulletins, or to be used separately as an advertising folder to be sent to a selected list.

THE COAL TAR INDUSTRY.—This year is the jubilee of the epoch-making discovery by William Henry Perkin of the dyestuff "mauve," by which the foundation was laid of the coal tar industry and great stimulus given to the study of organic chemistry, and chemistry in general. Thus the modern progress in the manufacture of synthetic medicines, photographic developers, artificial perfumes, sweeteners, and explosives is entirely due to the original work of Perkin. The Chemists' Club of New York City is to hold a meeting at its house on April 7 at 8.15 p. m. to consider what steps should be taken to associate this country in the proposed celebration in England and Germany. General and executive committees will be formed.

KITES FOR WIRELESS.—A special dispatch from Washington, D. C., for March 27 says that Dr. Alexander Graham Bell's tetrahedral kite was put to use on that day in some remarkable experiments at Arlington with wireless telegraphy. Dr. Bell loaned one of his largest kites, having 230 cells, which was operated by W. F. Bedwin. The kite was sent up 2,000 ft., and from antennæ 400 ft. long messages were caught and transmitted down over a steel wire. Messages were received from the United States naval wireless station at the Washington Navy Yard, from the DeForest station at Galilee, N. J., near the Atlantic Highlands, and from the steamer Bermudian, 100 miles out from New York and more than 350 miles from the kites. At the end of the wire stood A. Potter of the United States Weather Bureau, with one hand on the wire. His other hand clasped that of G. D. MacDonald, representing Mr. Bell. Mr. MacDonald had hold of the receiver, so that the operator caught the messages from the kites 2,000 ft. in the air through the bodies of the two men. Long messages were sent and received.

CENTRAL'S HIGH VOLTAGE CABLES.—Commissioner Ellison, of the New York City department of water, gas and electricity, has declined to issue a permit to the New York Central Railroad for carrying its 11,000-volt cables overhead along the line. He defines his position as follows: "The public rides over the road, even if it is excluded from walking along the right of way. Therefore the public is entitled to protection, and it would be in serious danger if the wires were placed overhead. The falling of a single one of those heavy voltage wires would cause serious damage, and possibly great loss of life. In the Bronx, the road in many cases crosses thoroughfares at grade between Mott Haven and Spuyten Duyvil. It is too bad to knock out the entire plans of the Central people, but I feel that the people must be protected, and I do not think they would be protected if this permit were granted by me." The attorneys for the New York Central may begin mandamus proceedings against the Commissioner.

ATLANTIC WIRELESS.—The subjoined statement has been given out by the De Forest Wireless Telegraph Company regarding wireless communication with Dursey Head, South of Ireland, the home of Lord Armstrong, president of the English De Forest Company, from the company's station at Coney Island. "Wireless communication with the old country is yet to become an established fact. We have succeeded in reaching a point on the southern coast of Ireland with the wireless, but only as an experiment. During this past week a number of words, in code, have been intelligently sent by wireless from our station at Coney Island to a receiving station at Lord Armstrong's castle in the south of Ireland. We haven't yet established a sending station on the other side. We learned by cable of the success of our experiments. Our operator at Coney Island in communicating with Ireland was furnished with an exact programme, which he followed out to the minutest details. Each code message was sent at a five-minute interval and each time in a different key, pitch or tone. The reason for this is that every specific distance seems to have a key, pitch or tone of its own, which must be established by experiment. For instance, if our operator at Coney attempted to send a message to Boston and Philadelphia simultaneously on the Philadelphia pitch, Boston would complain that it was getting its message in bad shape. If the Boston pitch were used, Philadelphia and all the shorter distance cities might intercept the message. We only await now the equipment of the sending stations in Ireland to complete a transoceanic communication. Our experiments have proved successful beyond our most sanguine expectations."

TROLLEY EARNINGS.—The dividend payments in April for street railways for the March quarter are estimated at $5,791,840. This would appear fairly correct. The total dividends reported for 1902 amounted to $15,882,110.

TROUBLES IN RUSSIA are recrudescent, but the government is taking some new precautions. A plan has been worked out for a wireless telegraph system in case of another strike of the railroad and telegraph operators, and soldiers are being taught how to operate the telegraph lines.

CHICAGO MUNICIPAL LIGHTING.—The council has appropriated the $500,000 asked for by William Carroll, city electrician, to reconstruct the city arc lighting system so as to utilize the power offered the city recently by the trustees of the Drainage Canal from the new water power plant near Lockport.

SEATTLE PUBLIC OWNERSHIP.—Mayor Moore in a message recommends that popular vote be taken to decide if the city desires to construct and own new extensive street car system. He says no important route should be given away meanwhile to the Seattle Electric Company, now operating a system.

ELEVATED FOR CINCINNATI.—While other cities are going in for subways, Cincinnati is to have an elevated electric road, and a bill has been introduced in the State Senate to give authority for the erection of an overhead road from one of the suburbs to the downtown business district. A company has been formed.

SOLDERING ALUMINUM.—A solder for aluminum has been invented, says United States Consul Atwell, of Roubaix, France, by Fernand Hecht, a mechanic of that city. With a soldering iron he can join together two pieces of the metal or join aluminum to copper, brass or iron. The invention is simple, no acids or salts being used. Mr. Hecht exhibited his process satisfactorily before the professors of chemistry of the Faculty of Science, and was also awarded a medal from the Northern Industrial Society of France for making a discovery of great importance.

GREAT TROLLEY NETWORK.—It is announced from Cleveland, Ohio, that a consolidation of 541 miles of Illinois and Wisconsin traction lines, with more than $20,000,000 capital, is contemplated by Cleveland capitalists who are identified with the recent merger of the Aurora, Elgin & Chicago Railroad Company; Elgin, Aurora & Southern Traction Company, and the Cook County & Southern Railroad Company, making 154 miles of track. The projected consolidation will afford continuous traction connection from the heart of Chicago west to Dubuque, Iowa, north to Madison, Wis., and south to Plano and Joliet.

HOUSEHOLD MOTORS IN FRANCE.—United States Consul Covert reports that during the months of July and August, 1906, there will be held at Lyons, France, a general exposition of all electrical devices that can be applied to domestic uses. It will be conducted under the auspices of the Agricultural and Scientific Association of Lyons and no motor will be accepted for exhibition which is over 1 hp. The object of the exhibition is to bring cheap electrical appliances nearer to the people in order that the great mass may derive some benefit from them—motors that may be used on embroidery, sewing and knitting machines, ventilators, vacuum carpet and rug cleaners, house cleaning machines, floor polishers, carts for transporting objects, turning spits in cooking, etc. Motors for weaving are excluded. They have been in use in and around Lyons for the last three years, and it is deemed advisable to have an exhibition at an early day exclusively for such motors. Lyons is in a position to benefit greatly from cheap hydro-electric power.

NIAGARA POWER.—President Roosevelt has recommended Congress to act promptly for the preservation of Niagara, without waiting for a Canadian treaty. From the Dominion it is announced that steps will be taken to stop Niagara power exportation. The matter arose in a discussion at Ottawa on a motion by Mr. Monk for a return describing all water powers under Dominion control. Mr. Hyman, minister of public works, said there was no doubt of a federal control over the export of electric power. The government had therefore lain down a policy to govern their courses, several applications being now before them. Right to export power would only be granted subject to revocation at short notice; there would be no claim against either provincial or Dominion Government arising out of such revocation, and the companies would be subject to such rules and regulations as the government saw fit to impose. Action would also be taken to prevent spoliation of the scenic beauty of the falls.

POWER FROM COKE GASES is discussed in a report from U. S. Consul Wallace, of Crefeld, Germany. One of the coal mine companies operating in the district manufactures coke and has almost completed the erection of a large electric power plant to deliver electric current to cities and villages within reach. This company purposes to utilize the hot gases formed in the manufacture of coke to drive the dynamos of its plant. The coal and coke company can produce, by this plan, electric current for commercial purposes very cheaply, and, as the plant will be an alternating-current system, the firm is contracting to deliver it to important places at a distance. The city of Crefeld has completed a contract with this company to have electric energy delivered supplying all its needs at a price much lower than the city could supply it; and the city officials are rejoicing that the occasion presented itself to them at such an opportune time. The distance from the electric plant to Crefeld-Linn and the harbor territory is about 10 miles, but the contract with the city is made to cover a large additional district, which is to get electric energy cheaper than the plants in operation can make it under the old system

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ELECTRIFICATION IN ENGLAND.—Discussing at some length the general subject of electrifying steam railroads in England, the London *Statist* says with regard to the Great Eastern Railway: "Another railway which has been considering the question of electrification, to which allusion has more than once been made in the chairman's reports, is the Great Eastern Railway Company. Here the prime difficulty is not as yet the loss of traffic to competing systems, nor is it so much the desire for increasing their traffic or reducing their working expenses, which were the main causes of the electrification schemes already carried out. It is rather the increasing difficulty which is being experienced in coping with the suburban traffic, which is constantly increasing in magnitude. Those who remember Liverpool Street Station when it was first completed are aware that it has been again and again extended at enormous cost, and that this has been almost entirely necessary for the purpose of handling the suburban traffic, which the company's energetic policy has built up. In addition to this, the company has widened its carriages and provided more powerful locomotives, and in some cases, we believe, lengthened its platforms; but it is doubtful whether any of these expedients can be more than temporary, and whether something more radical will not have to be done. At one time it was proposed, in view of the competition of another line, to lay a second line underneath the present one; but the experience gained by those companies which have already converted their systems would appear to show that electrification is the most probable solution of the difficulty, and we anticipate that in time that will be the one adopted. The general manager has, however, recently stated that at present the company is not satisfied that any of the existing systems of electric traction offer sufficient advantages to induce them to adopt it or to make them certain that the improvement effected by its adoption would be sufficiently lasting and complete to justify the change."

The Nassau (L. I.) Light and Power Company.

THE central station of the Nassau Light & Power Company at Glen Head, Long Island, furnishes an interesting example of unlooked-for development in the electric light and power field in rural districts. Six years ago a number of wealthy men having country seats near Roslyn wishing electricity for their residences and finding no station to supply it determined to build a station to supply their collective wants rather than to install individual isolated plants. In order also to remove the station as far as possible from their dwellings it was determined to build the station on Hempstead Bay, near the present site, and to install two-phase alternating-current apparatus. Property on the bay front, however, took a jump of over 500 per cent in value when the owners found who the prospective purchasers were to be, and a station was built on the line of the Long Island Railroad on the outskirts of Roslyn. Coal could then be easily obtained and wells were driven to supply the water necessary for the operation of the plant. Before building operations had begun the towns of Roslyn and Mineola requested to be supplied with electricity for street lighting and a plant having a capacity of 1,000 hp was erected. The company at that time had a capital stock of $100,000.

The growth of the company since then has been very rapid. The North Hempstead Light & Power Company, and the Municipal Electric Light Plant at Hempstead were giving a very unsatisfactory service, and these were absorbed and the energy for lighting and street car motors supplied from Roslyn. Shortly after the Franklin Electric Illuminating Company was absorbed and the name of the Roslyn Light & Power Company changed to the Nassau Light & Power Company and the capital stock raised from the original $100,000 to $2,000,000. A new station was erected on Hempstead Bay in the village known as Glenwood, and sub-stations maintained at Roslyn, Oyster Bay, Port Washington, Hicksville, Hempstead and Great Neck. These sub-stations, together with the main generating station, supply electric energy to Baldwins, Floral Park, Glen Cove, Glenwood, Great Neck, Hempstead, Hicksville, Hyde Park, Mineola, Port Washington, Roslyn, Sea Cliff and Westbury. The near-by towns are supplied with two-phase current as heretofore, while two-phase current is stepped up and transmitted as 6,600 three-phase current to the distant towns. The territory covered comprises a large section of the central portion of Long Island, and being of a suburban character involves distribution in a large number of sparsely settled villages.

The equipment at the original station in Roslyn consisted of one 100-kw and two 150-kw belt-driven alternators, the engines being operated condensing and involving the use of water-cooling towers. The output was increased in 1903 by the addition of a 400-kw Westinghouse turbo-generator, which brought the total generating capacity up to 1,200 kw. The demand from outlying districts, however, gradually became so great that it was necessary to add to the equipment, and it was finally decided to abandon the station at Roslyn and build a new station of modern design on Hempstead Bay and provide ample capacity for any unexpected development. The two 400-kw, two-phase turbo-generator sets at Roslyn were removed to the new site and a 1,500-kw General Electric two-phase turbo-generator set added.

The site of the new station at Glenwood is about four miles distant from the original plant, and not only possesses abundant water supply, but an excellent harbor also permits shipments of coal and machinery to be received directly by harbor boats from New York City. Back of the plant is a 75-ft. hill on which is a large tank to which water is pumped for a gravity water supply to the station. The turbine room is 68 ft. by 78 ft., while the boiler room is 175 ft. by 58 ft., both rooms thus forming an ell at the corner of which is a [illegible] brick stack. The layout is such that when the present building becomes inadequate the structure may be duplicated by the addition of a 175-ft. boiler room and a 68-ft. turbine room to the south.

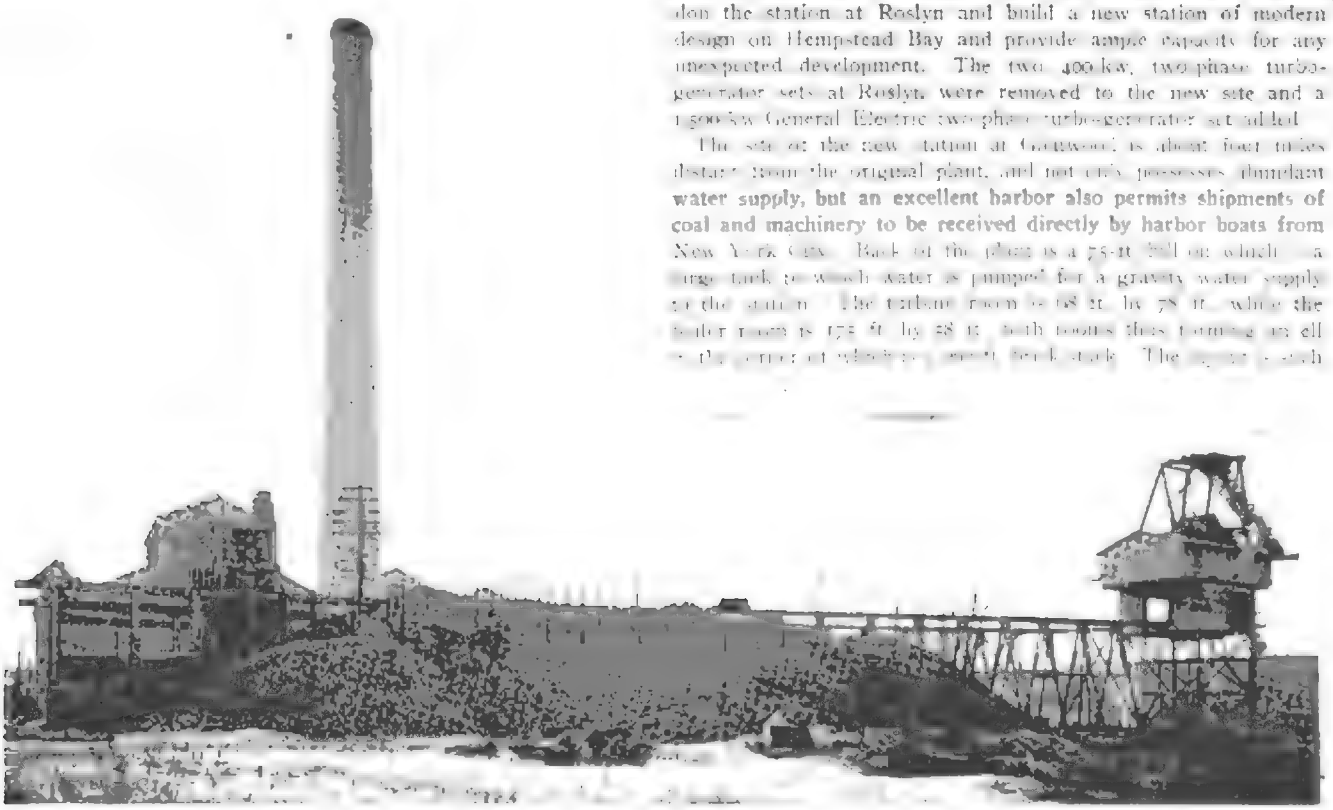


FIG. 1.—POWER HOUSE OF THE NASSAU LIGHT AND POWER COMPANY, SHOWING COAL STORAGE EQUIPMENT.

The power house is of steel frame construction, the roof trusses being provided with monitors for lighting and ventilation. The turbine room has a main roof span of 44 ft. and two bays each 18½ ft. wide. The central portion has a clear height to the bottom of the roof trusses of 36 ft. to permit the use of a central traveling crane; the east bay has a clear head room of 24 ft., while the west bay has three galleries which are devoted to the electrical control equipment, transformers and auxiliary apparatus. Over the center of the top gallery is a cupola which rises above the level of the roof and serves as a wire tower for the outgoing distribution lines. The boiler room involves similar construction, but has a larger roof monitor in order to accommodate the coal distribution conveyor. This monitor is 20 ft. wide and 10 ft. high and is heavily braced to carry the additional load. The roof structure also carries the additional load of a row of elevated coal storage bunkers which are arranged over the firing floor in front of the boilers as shown by Fig. 2. The roof trusses are reinforced on this side and are assisted in carrying the weight by 12-in. girder posts rising at each side of and in the middle of the boiler settings. An unusual feature of the boiler house construction is its width, a clear space of almost 20 ft. being provided between the rear of the boilers and the division wall. This space is reserved for the possible installation of fuel economizers, the use of which was carefully considered in the original design; but is not as yet warranted. Everything has been arranged, however, so that their installation is possible and at a minimum expense. On account of the low cost of the site this extra space could easily be provided, and is at present being used by a well-equipped machine shop containing a lathe, drill press, pipe threading machine, emery wheel, forge and the necessary tool equipment. An electrically-driven pump is also located in this space and supplies the tank on the hill opposite which furnishes the water supply at the plant.

The plant is peculiarly situated as regards coal supply. The site has no railroad connection so that fuel must be brought by boat or carted from the railroad four miles away. There is a minimum depth of water in the channel opposite the station of from 8 to 10 ft. at mean low tide so that the ordinary coal canal boats are easily accommodated. The bay is, however, frozen over in the winter months, making navigation impossible, and a large storage yard has, therefore, been provided at the northerly end of the site. This yard has a maximum storage capacity of 8,000 tons and embraces a wharf 110 ft. wide and projecting out 90 ft. from the shore line, with coal-handling equipment for unloading barges and delivering coal to the boiler room. This amount of coal is more than sufficient to operate the station during the two or three winter months when the bay is liable to be frozen over.

The coal-handling equipment and coal storage yard are shown by Fig. 1. Coal is stored on a level platform of filled ground 220 ft. long and 90 ft. wide, extending from the front of the boiler house to the wharf. The coal is delivered by dumping cars which travel on three lines of elevated track. The trestles are graded for uniform slope so as to permit the loaded cars to drift by gravity to the dumping blocks, after which they are returned to the loading hopper by automatic mechanism. The loaded car automatically grips a cable line near the dumping point and a gearing serves to lift a heavy counterweight by means of the momentum of the loaded car. After the car trips and the coal is released, the energy stored in this lifted counterweight serves to kick the car up the incline to the tower. The dumping block is adjustable upon any of the trestles, so that coal may be delivered at any point in the yard. The coal-hoisting tower is fitted with a one-ton clam-shell dredging bucket and has a capacity of 50 tons per hour. The boom has a maximum reach beyond the wharf line of 19 ft. and is 54 ft. above mean water level. It is pivoted so as to permit it to be swung to one side and allow masted vessels to tie to the dock. The operating machinery in the cabin consists of an Exerter double steam hoisting engine with drums for the hoisting and bucket-closing movements and a motor-driven crusher. In the roof of the cabin is a five-ton receiving hopper into which the clam-shell bucket empties when unloading from boats. The coal passes from this hopper through a crusher operated by a 15-hp induction motor, into a small loading hopper beneath and thence into the cars. A turntable enables the cars to run on any trestle.

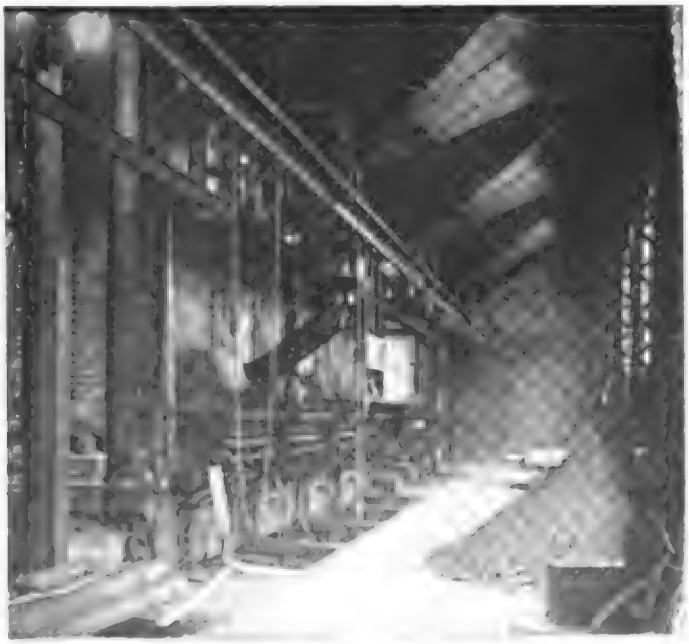


FIG. 2.—BOILER ROOM, SHOWING TRAVELING AND WEIGHING COAL HOPPER.

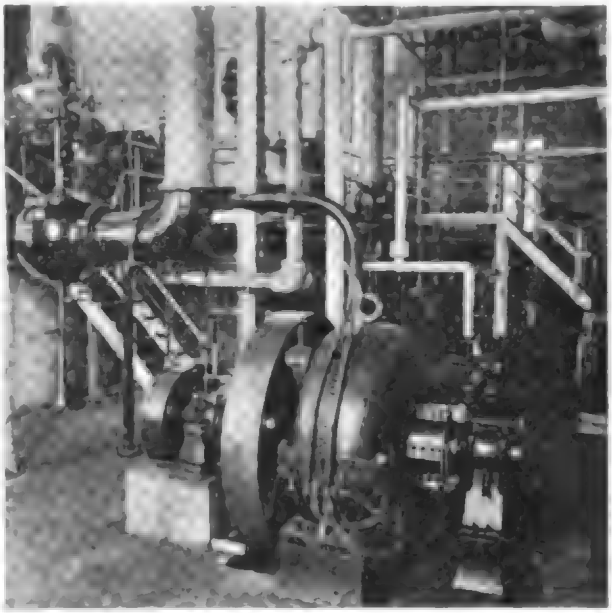


FIG. 3.—STEAM-DRIVEN EXCITER AND PUMPS.

Coal is handled from the storage pile to the elevated bunkers in the boiler house by means of a system of scraper conveyors in tunnels beneath the storage platform, an elevator bucket conveyor and a scraper distributing conveyor extending longitudinally through the boiler house for delivering to the various storage bunkers. Beneath each trestle is an arched concrete tunnel extending inshore from the wharf 210 ft. and emptying into a transverse tunnel, where a cross gathering conveyor delivers the coal received from the longitudinal conveyors to an elevating bucket conveyor for delivery to the boiler house. The conveyors are operated by a 15-hp induction motor which drives the scrapers at a speed of 90 ft. per minute at which speed the conveyor system has a capacity of 50 tons of coal per hour. Outlet hoppers are provided about every 12 ft. in the longitudinal tunnels beneath which are receiving hoppers with delivery spouts and aprons to direct the coal into the conveyor trough. From the cross tunnel the coal is elevated by a bucket conveyor to a height of 35 ft. above the storage platform level where it is dumped into the conveyor in the boiler house monitor. There is also a direct chute connection with the elevating conveyor which permits of coal being delivered direct from the cars when a boat is unloading thus dispensing with any rehandling.

The distributing conveyor in the boiler house monitor is similar in design and capacity to those in the tunnels beneath the storage platform, and is operated by a 10-hp induction motor located within the boiler house. This conveyor is carried from the delivery spout of the elevating conveyor to the boiler house monitor by a wooden supporting structure inclined at an angle of 15°. Within the boiler house the conveyor is carried in the framework of the monitor and the scraper trough has dumping outlets at frequent intervals with chutes to permit the delivery of coal into any of the bunkers over the fire room floor. These bunkers are 15 ft. square at the top and 8 ft. deep and have a capacity of

15 tons. A traveling weighing hopper delivers the coal from the bunkers to the stokers in measured lots of 1,000 lb. or less. This device is shown in Fig. 2. It consists of a cylindrical receiving hopper 28 in. in diameter and 3 ft. high, which with its weighing mechanism travels on a runway of 8-in. channels beneath the undercut gates of the bunkers, thus permitting coal to be taken and measured from any bunker and delivered into any of the stokers. The scale mechanism is suspended from a car framework, beneath which is suspended the swinging compensating links and reducing levers for the scale upon which the hopper is supported. The car and hopper are caused to move along the runway by a chain wheel mounted on one of the axles of the car, the chain being within easy reach from the floor. The outlet gates beneath the bunkers are provided with chain connections for ease in opening and closing from the floor in measuring out quantities of coal. The delivery chute beneath the hopper is suspended by a ball bearing joint which permits it to be swiveled from one side to the other when traveling along the runway. The entire coal-handling equipment, including the unloading tower, trestle lines and automatic car operating system, tunnels and scraper conveyors, etc., was built by the Exeter Machine Works, Pittston, Pa., after the designs of the consulting engineer, Mr. C. O. Mailloux.

The present boiler equipment consists of four horizontal water-tube boilers built by the Aultman & Taylor Machinery Company, two being of 425 hp and the other two having a capacity of 500 hp each. The boilers are installed in two batteries and are equipped with Foster superheaters capable of raising the temperature of all steam delivered at the rated capacity of the boilers, 150° F. above saturation. The boilers have delivery nozzles for both saturated and superheated steam, which is delivered to the turbine room by a duplicate piping system, one for the superheated supply to the turbines and the other for supplying saturated steam to the auxiliaries. Each boiler is equipped with a Roney stoker operated by standard Westinghouse stoker engines, two of which are installed with coupling connections between the sections of the driving shaft so that either may operate both stokers together, or either battery separately.

Ashes are removed through a tunnel beneath the furnace ash-pits, cars running upon the narrow-gauge track permitting the ashes to be dumped directly into them. Each furnace is fitted with a fire brick lined ash-pit, in the lower outlet of which are trap doors. These doors are normally held up in place by sector blocks upon a rocker shaft beneath. The hand wheel upon this shaft is fitted with a connecting rod and lever by which it is possible to dump first one door and then the other without discomfort to the operator. The trap doors are of ½-in. steel plate lined upon the inner side with cast iron for protection from the heat of the ashes. There is also a soot chute connecting from within the boiler setting to this ash-pit, by means of which soot can be shoveled out without bringing it into the boiler room. The ash cars are elevated to the surface for dumping by means of a plunger elevator. The smoke flue connections to the stack are beneath the boiler room floor in a space at the rear of the boiler settings. Each boiler has a flue connection extending from the rear of the setting and connecting with the main flue, which is of substantial fire brick construction.

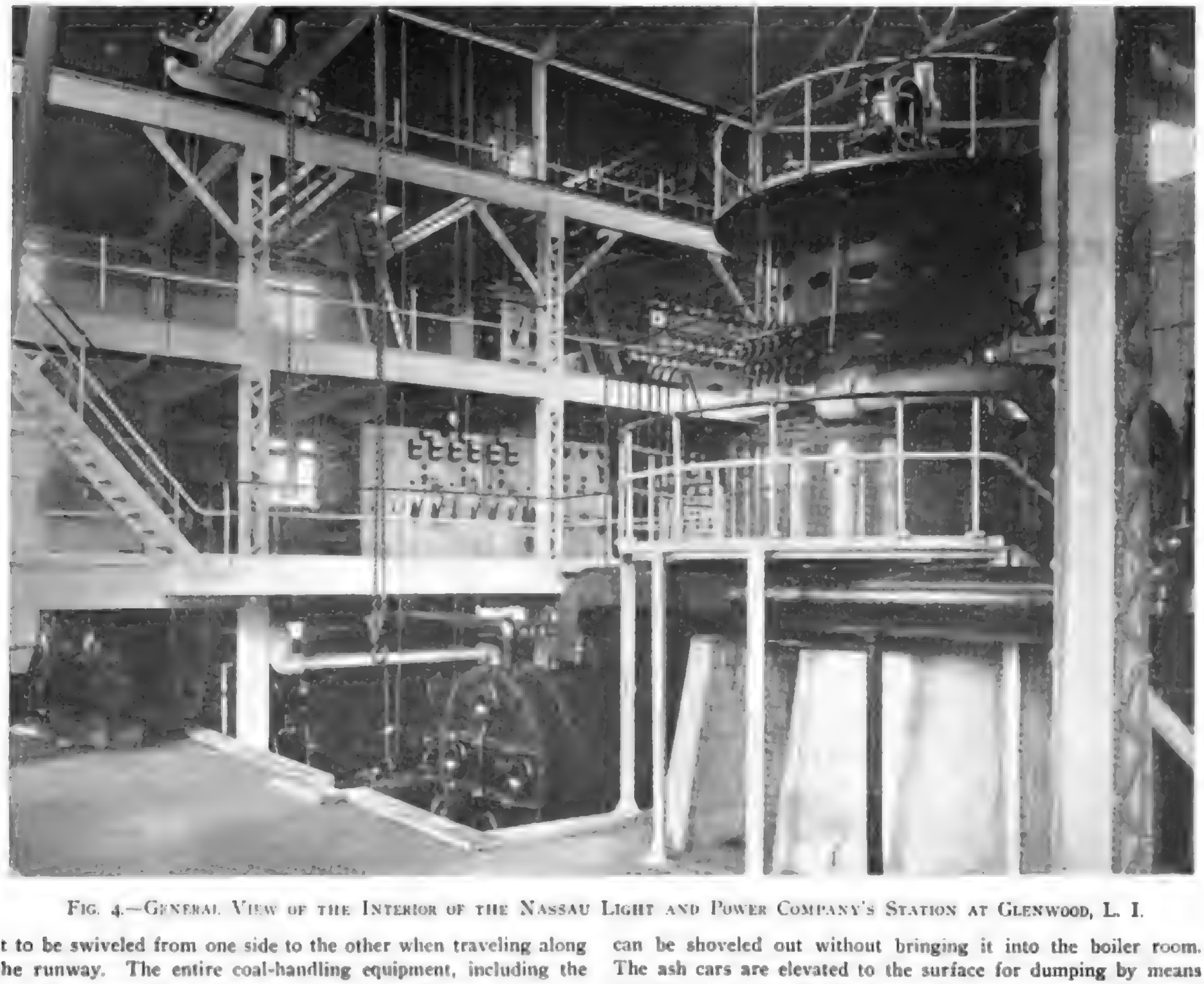


Fig. 4.—General View of the Interior of the Nassau Light and Power Company's Station at Glenwood, L. I.

Two 5,000-hp closed feed-water heaters located in the side bay of the turbine room and fed with exhaust steam from the auxiliaries heat the boiler feed supply. The heaters are cross-connected so as to permit either one to be operated independently for facilitating examination and repairs to the other. Feed pumps are also installed in duplicate, either one being capable of supplying the boiler equipment. The water supply for the station is obtained through a pair of 3-in. driven wells at the rear of the boiler house adjacent to the stack. Water is pumped from these wells by an electrically-driven triplex pump to a 50,000-gal. storage tank upon the hill opposite the power house. The water in the tank upon this hill being about 80 ft. above the level of the water service mains in the boiler room, a delivery pressure upwards of 40 lb. is available by gravity for fire protection and local service. The water is of excellent quality and is thus serviceable for the "make-up" to the condensation of the turbines for boiler feeding purposes. The main boiler feed supply is stored in two hot water cisterns in the boiler room. Each of these cisterns has a capacity of 2,000 gal. and receives the condensation from the condensers directly, the make-up being added automatically by a float valve on the water service connection to the cistern. Six-inch suction connections from the feed pumps are made in duplicate to the cisterns for either pump. These 6-in. lines enter the cisterns through stuffing box sleeves in the side of the cistern wall about 3 ft. beneath the normal water level.

The steam turbine generating equipment of the station as at present installed consists of two 400-kw Westinghouse turbo-generators and one 1,500-kw General Electric turbo-generator unit, space being provided for an additional 1,500-kw unit when future growth so demands. The turbines embody the well-known standard construction of the Parsons and Curtis types, as adapted for direct connection to revolving field, two-phase alternators, the Westinghouse units running at 3,600 r.p.m. and the General Electric unit at 900 r.p.m. Superheated steam is supplied to the turbines through 5-in. lines from the 12-in. main superheated steam header to the two small units and a 10-in. line to the 1,500-kw unit. Each of these superheated steam connections is, however, interconnected with the 8-in. saturated steam header in the boiler room for purposes of reserve supply, which in case of accident to the superheated line would enable the turbines to be operated temporarily with saturated steam. The two steam headers are similarly interconnected in the boiler room so that the saturated header may be used for the supply of superheated steam temporarily if necessary. The superheated piping system was installed by Westinghouse, Church, Kerr & Co., while all other piping was erected by the Nassau Light & Power Company. All piping is well lagged and all branches are equipped with drip connections which are drained by return steam traps.

The turbines are operated with individual surface condenser equipments, which are located underneath the operating gallery and in close proximity to the exhaust connections. The two small turbines have 30-in. exhaust openings and 14-in. atmospheric exhaust lines fitted with back pressure valves. The Curtis turbine has an exhaust connection of rectangular section with an 18-inch atmospheric exhaust line. The surface condensers used are all of the well-known Worthington counter-flow type with air coolers, condensation being removed by two-stage turbine centrifugal pumps. The condensers for the small turbines have a condensing surface of 2000 square feet, while that for the 1500 kw unit has a condensing surface of 6000 square feet. The centrifugal pumps for the condensers connected to the smaller turbines are each independently driven by a 5 hp induction motor, while the pump for the large condenser is operated by a 10-hp motor. Dry vacuum pumps are used in connection with these condensing units, that for the large condenser being

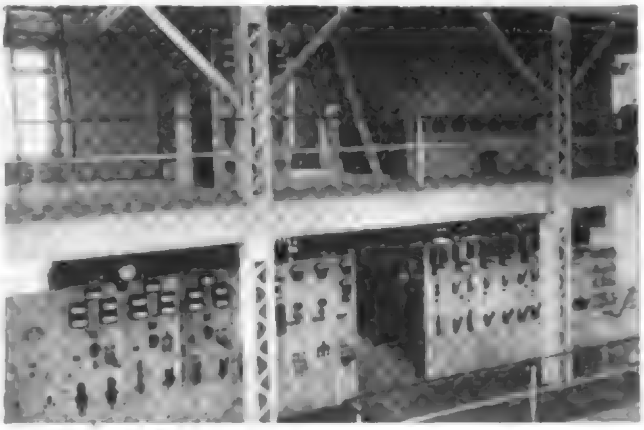


FIG. 6.—SWITCHBOARDS IN GLENWOOD POWER HOUSE.

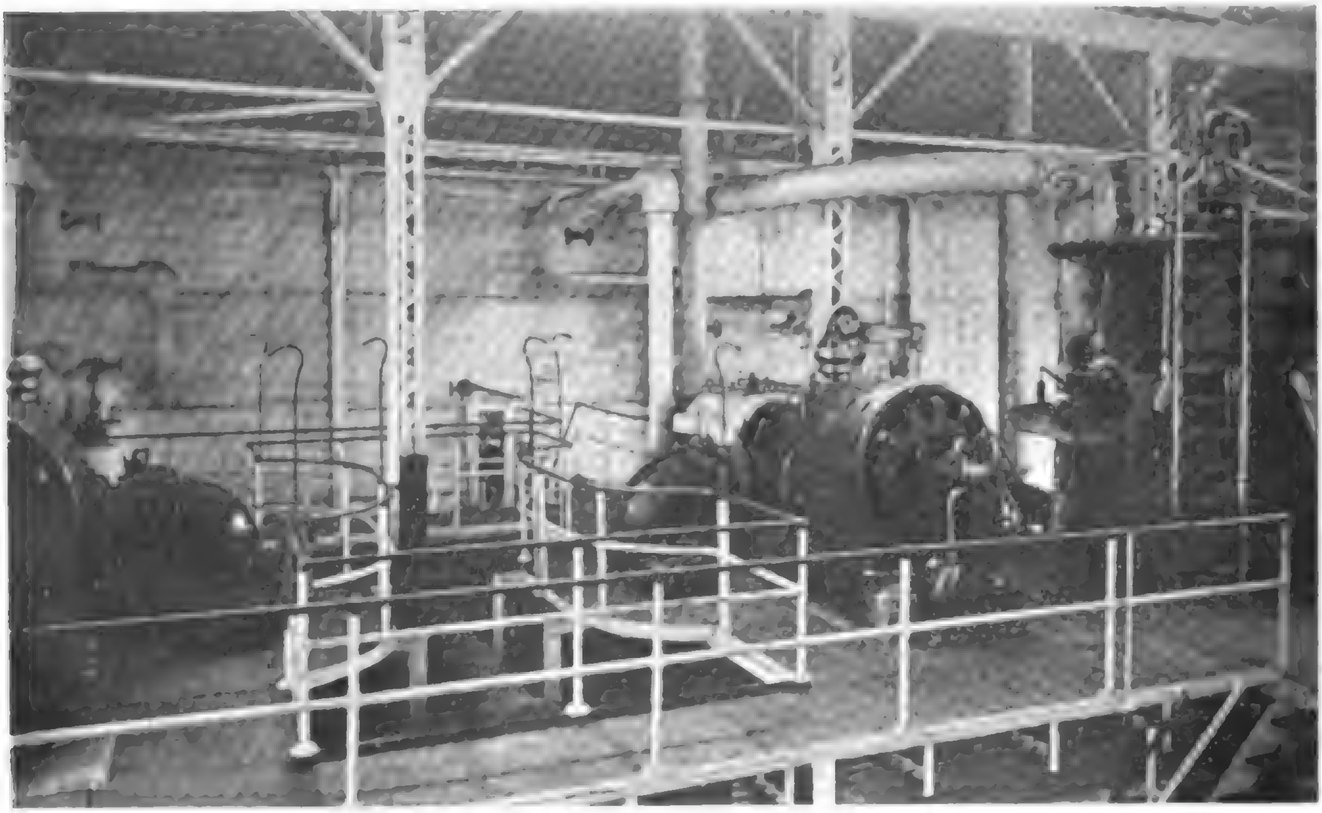


FIG. 5.—VIEW OF TURBO-GENERATOR SETS FROM SWITCHBOARD GALLERY.

a 10 x 16 x 18-inch Worthington dry vacuum pump, while the two 400-kw turbines are served by a single 8 x 14 x 12-inch vacuum pump. Circulation water is supplied to the condensers by two No. 14 Worthington volute centrifugal pumps located beneath the switchboard gallery with direct suction connections to the intake water tunnel leading into the bay. Each of these pumps is driven by a vertical automatic steam engine and has 15-inch suction and delivery connections. The deliveries from the two pumps unite in a 20-inch header, from which the connections into the air coolers and their condensers are taken. The discharge connections consist of two 15-inch lines, one for the large condenser and the other for the two smaller units. Considerable reserve capacity has been provided in the intake and discharge tunnels, which were designed for eventually supplying a station with a rated capacity of 5300 kilowatts.

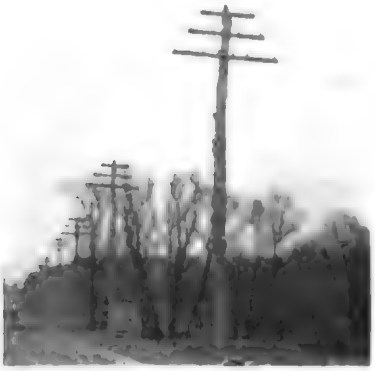


FIG. 7.—TRANSMISSION LINE.

The electrical generating equipment at the station consists of two 400-kw Westinghouse turbo-generators and one 1500-kw General Electric turbo-generator each generating 60-cycle two-phase currents at a potential of 2200 volts. Duplicate exciter sets are installed consisting of a 35-kw motor-generator set on the main gallery and a 50-kw steam-driven generator shown in Fig. 3. The transformer equipment shown by Fig. 8, consists of three 200-kw and three 100-kw American transformers which step up the primary potential of 2200 volts to 6600 volts for distribution. There are in addition four 17½-kw 3-ampere General Electric constant-current transformers for street lighting circuits.

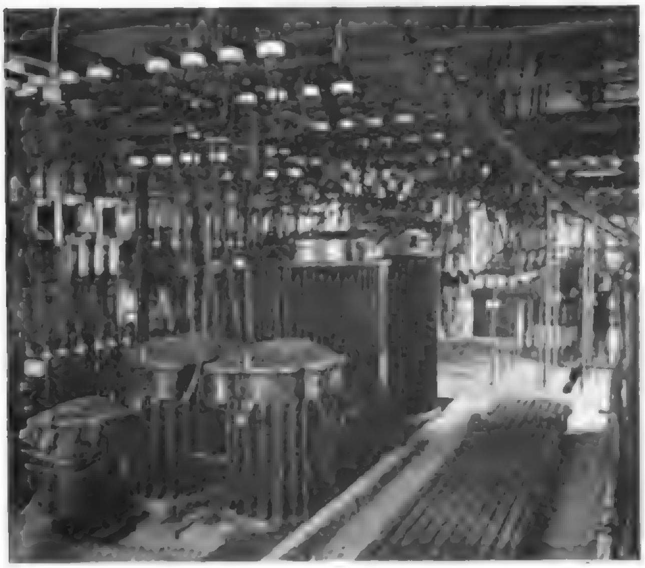


FIG. 8.—REAR VIEW OF SWITCHBOARDS, MAIN GALLERY.

Three galleries are provided for the controlling switchboards; on the first or main gallery are the generator, exciter and transformer panels; on the second or feeder gallery are the high and low tension feeder panels, while on the third gallery or tower are the lighting arresters, choke coils, etc., for the outgoing low-tension lines. A view of the main and feeder galleries is given in Fig. 6. There is a panel provided for each of the three turbine sets and one spare panel. Each is fitted with ammeters, wattmeters and voltmeters and with polyphase recording watt-hour meters on the rear of the panel. Each panel also contains synchronizing plugs and two interlocking oil switches, while on top of the generator switchboard is a General Electric synchronizer mounted on a swinging bracket. Forming part of the generator switchboard are two panels for the exciter units and one spare panel fitted with ammeters, voltmeters, balance indicators and knife switches, also one regulator panel fitted with a Tirrell regulator and one main transformer bus-bar panel fitted with interlocking switches for each bus-bar with time limit relays.

To the right of the generator switchboard on the main gallery are six transformer panels fitted with single-throw double-pole oil switches on both the low and high tension sides of the transformers and with ammeters on the primary circuits. To the right of these panels are two station panels fitted with knife switches for controlling the station light and motor circuits.

On the second gallery are four two-phase 2200-volt circuit panels fitted with double-pole double-throw switches, ammeters and General Electric spring-expulsion fuses. Pilot lights are located on each phase of each circuit. There are also four series incandescent street lighting panels of standard design fitted with ammeters. Separated from these panels and situated to the left are three high-tension feeder panels, one spare, having ammeters and oil switches with automatic relays. Choke coils and arresters are fitted to both the high and low-tension feeders in the tower, the arresters being of the low equivalent Westinghouse type.

The general switching arrangement is as follows: There are two sets of bus-bars permitting the generators, transformers or circuits to be connected to either set. The connection from the 1,500-kw unit to the switchboard is made with 500,000-cir.-mil rubber-insulated asbestos-covered cable tested for 10,000 volts. The cables from the 400-kw units are of No. 1 conductor insulated in the same manner as the other cables. The generator and transformer bus-bars are made up of copper bars 2 inches by 5/16 inch in cross-section. High-tension circuits are run from the Glenwood power house to sub-stations located at Oyster Bay, Roslyn and Hempstead; from which sub-stations the current is stepped down to 2200 volts for local distribution and street lighting circuits. In addition low tension feeders are run from Roslyn to sub-stations at Great Neck, Port Washington and Hicksville, where street lighting transformers, local circuit panels and regulators are located.

The company has recently secured control of the Oyster Bay Electric Light & Power Company, and it is its intention to use this company's station as a sub-station and abandon the present sub-station at Oyster Bay and in addition shut down the old steam plant consisting of 300-hp in high speed engines and two 200-kw single-phase alternators which run only at night, and maintain a day and night service. The high-tension transmission line is of No. 6 hard drawn copper wire, and the insulators are of triple-petticoat glass. It is the intention of the company to eventually operate the transmission lines at a potential of 10,000 volts and the switchboard galleries and tower have been laid out with this in view. All circuits feeding districts within a five-mile radius are supplied with energy at 2200-volts.

The plant was designed by C. O. Mailloux, the details and supervision being in charge of his assistant, W. H. Heath. Since the early part of last summer the station has been operated by J. G. White & Company, who are represented by K. B. Thornton, manager of the plant. The officers of the company are E. D. Morgan, president; C. H. Mackay, vice-president; C. I. Reeves, secretary and treasurer; John Sarano, superintendent and chief electrician, and J. W. Wood, chief engineer. We are indebted to Messrs. Heath, Thornton and Sarano for courtesies extended in the preparation of this article.

The Boston Edison Company's Work in Wellesley.

The Edison Electric Illuminating Company, of Boston, has recently made a contract to supply the town of Wellesley with electricity at a wholesale rate, and the details of the arrangement well illustrate the advantages which accrue to a suburban community which becomes a central station customer instead of attempting to realize the doubtful economies of a municipal plant. Wellesley is an attractive residential suburb of Boston located 15 miles west of the South Terminal station on the Boston and Albany Division of the New York Central lines. Its population is something in excess of 5,000, and it is the seat of Wellesley College, a girl's educational institution of international celebrity.

Originally the town purchased current for street and commercial lighting from the Natick Gas & Electric Light Company. Under the Natick contract the rate per kilowatt-hour for both residence and business lighting was 14 cents flat. In 1903 the Edison Co. took over the Natick Co.'s business, and, of course, continued to supply the town at the old rates. The town owned all the poles at this time. As the time of expiration of the Natick contract approached, the question of building a municipal plant came up. The Edison Company was asked if it would supply electricity at the town line on a flat rate of 3 or 4 cents. The company could not do this, but instead it made the town a proposition on the basis of a standard lighting contract, by which, on the basis of the last year's business, a net rate of 6 cents per kilowatt-hour at the town line was made possible. The town was to purchase all the wire, transformers, meters, etc., which belonged to the Edison Company upon its distributing system within the limits of the municipality. The proposition was accepted at the October, 1905, town meeting, and a seven-year contract signed. On January 1, 1906, the Edison property was taken over and the current for the town supplied from the adjacent Edison stations in Natick and Newton. In the very near future the current of Wellesley will all be supplied over a four-wire, three-phase line about two miles long, extending from the Edison distributing station at Walnut St. and Commonwealth Ave., Newton, to a distributing station to be built by the town of Wellesley near Wellesley Hills Square. The current will be generated at the great L Street station of the Edison Company in South Boston, whence it is to be transmitted to Newton over a line operated at 6,600 volts and about 10 miles long.

The Edison meters are to be installed in the distributing station at Wellesley Hills Square, and the drop in voltage between the town line and this station is not to exceed 1 per cent.' The street lighting in Wellesley is furnished by 25-cp series incandescent lamps, the equivalent 16-cp street lighting connected load being 1,043 lamps. The commercial and residential lighting loads amount to 8,251 equivalent 16-cp lamps.

Under the terms of the new contract all bills are rendered monthly to the town on the basis of 1 cent per 16-cp lamp hour consumed, until the consumption for the month exceeds 2,964 times the number of hours shown in the following table, this product constituting the minimum at which bills are rendered during each month:

January, 50 hrs.; February, 40 hrs.; March, 30 hrs.; April, 30 hrs.; May, 20 hrs.; June, 20 hrs.; July, 20 hrs.; August, 20 hrs.; September, 30 hrs.; October, 40 hrs.; November, 50 hrs.; December, 50 hrs.; total, 400 hrs.

The 2,964 lamps mentioned above represent the estimated maximum number of lamps lighted at any one time, and this figure is to be used as the basis of the primary lamp hour charge until the installation of a demand meter by the Edison Company. The maximum reading of the demand indicator between November 1 and the following February 1 of each year plus the load as estimated by the company on any circuits not connected to the indicator, will be substituted for the above figure, 2,964. If the town pays its monthly bill within 10 days after presentation, the rate of charge for all electricity consumed in excess of the above minimum is to be .4 cent per lamp hour. Otherwise, the charge remains at 1 cent. In case the gross lamp hours consumed in any one month exceed 10,000, the secondary lamp hours for that month are to be billed at .25 cent. Whenever the bill figured at the primary rate of 1 cent per lamp hour and secondary rate of .25 cent per lamp hour is over $150 in any one month, then 40 per cent discount is allowed on the excess of the bill up to $550, and 50 per cent discount in excess of $550.

In case the yearly cost does not exceed 6 cents per kilowatt-hour in the average, the difference of 8 cents per kilowatt-hour between the old 15 cent price and the new one can be applied either to the reduction in the cost of street lighting, or, if it seemed best, after maintenance and operating expenses are paid within the town, it is possible that some reduction might be made to the individual consumer. The price depends entirely upon the maximum demand and the actual current consumption as indicated by meter. In the two months of 1906 in which the new plan has been in operation the cost of current per kilowatt-hour to the town has actually been less than 6 cents. The January consumption, 28,000 kilowatt-hours, was billed at $1,233, or 4.43 cents per kilowatt-hour delivered at the town line; the February load gave an output at the town line of 24,000 kilowatt-hours, costing 4.3 cents per unit delivered. These prices are, of course, low, partly on account of the winter season with its long hours of darkness, and it is very probable that the lower consumption of current in the spring and summer months will be billed at higher rates. What the average for the year 1906 will be cannot be foretold, but there is good reason to expect it will not be much in excess of 6 cents. The arrangement with the Edison Company saves the town a heavy investment in generating plant and does away with the trouble of operating a central station upon the town's responsibility; it enables the service to be extended with the greatest facility; opens the way to a possible reduction of current over old bills; and places the reliability of an Edison station at the service of even the smallest consumer. Not the least advantage is elimination of the haulage of large quantities of coal through the beautiful residence streets of the town, and the doing away with a smoke nuisance in the neighborhood. Plans for the securing of new business are not fully organized as yet, but the town holds the entire matter in its hands and has every advantage claimed by the advocates of municipal ownership in reference to dealings with private consumers and control of the service within the community. The Edison Company's experience in methods of getting new business has been placed at the town's disposal.

The service in the town is under the supervision of the Board of Water and Municipal Light Commissioners. The chairman of this board is Mr. F. L. Fuller, the other members being Mr. O. L. Schofield, and Prof. C. E. Fuller, of the Massachusetts Institute of Technology, secretary. Mr. G. G. S. Perkins is the manager of the electric light service, and Mr. F. O. Johnson is the treasurer.

Unbroken lamps are renewed free of charge for installation and renewal, and all current is sold to consumers by meter at the flat rate of 14 cents per kilowatt-hour with a minimum charge of $1 per month. The standard voltages of the commercial system are 110 and 220, and the frequency of the entire alternating current system is 60 cycles. When overhead wiring is used, no charge is made for the installation of service, provided the point of entering is not over 100 ft. from the street line. Where underground service is used the town will install the service 5 ft. beyond the street line without charge. The town does not install or become responsible for inside wiring. Lamps are furnished consumers in 8, 16, 32 and 50-cp sizes, plain frosted bulbs. On special application 100-cp lamps in clear glass and 50-cp Meridian lamps are furnished free for renewals, but not for installations. Alternating current motors wound for 110 volts are allowed to be installed by the consumer, but anything in excess of 2 hp requires a special agreement with the Commission. Very few motors are thus far in use in Wellesley. Current for domestic service is furnished continuously 24 hours per day.

Differential Central Station Rates.

The report submitted March 16 to the Chicago City Council by Mr. Bion J. Arnold and Mr. William Carroll, Chicago city electrician, on the question of the reduction of Chicago electric lighting rates is of much interest aside from the main purpose of the report, on account of the discussion contained on the general subject of equitable central station rates. The main purpose of the report was to give the results of an investigation into the business of the Chicago Edison and Commonwealth Electric Companies to assist the Council in the consideration of a proposed reduction of rates charged by these companies.

The report is divided into two parts, in one of which is considered the question of a reasonable maximum demand on the assumption that the companies cannot be compelled to accept less than cost; the second part taking up the question of a reasonable rate on the assumption that the companies can be required to serve a portion of their customers at less than cost, provided the returns on the total lighting business are reasonably profitable. In the preliminary portion of the report it is brought out that there is very little complaint as to the quality of service which the Chicago companies are rendering. These companies employ the highest grade of engineering skill, the most improved equipment and the latest advances in the art of generation and distribution, the result being an electric lighting system which is to be commended for the reliability and quality of its service. While the use of large modern generators in great central power stations is decreasing the cost of producing electrical energy, this is off-set to a certain extent through transmitting the energy to longer distances and distributing it over wider territories.

The report states that when the electric lighting business was new there was a general adoption of a maximum rate of twenty cents per kilowatt-hour. This rate has been gradually reduced in different cities, the most notable example being the recent action of the city of New York, where the maximum rate has been put at ten cents per kilowatt-hour in the borough of Manhattan, a congested district, and at twelve cents per kilowatt-hour in the borough of Brooklyn, where the distance of transmission is greater and the business more widely scattered.

In Chicago the use of the Wright demand system of metering and charging for electric lighting furnished by the Edison and Commonwealth Companies is almost universal. With this system two meters are connected for each customer, one (the watt meter) to show the kilowatt-hours of electrical energy actually supplied during any month or other period, and the other (the maximum meter) to show the greatest demand made at any one time. Both meters are read monthly. The charge for current is made at the rate of twenty cents per kilowatt-hour for that amount of energy equal to a thirty hours' use of the capacity indicated by the maximum-demand meter, and at the rate of ten cents per kilowatt-hour for all current in excess of this amount. The maximum charge is subject to a discount of 20 per cent. for the prompt payment of the bill, and the low rate charge is subject to varying discounts according to quantity used. No minimum is charged. The original installation of lamps and lamp renewals are furnished free.

The intention of this system of charging is to make *good* customers of all users—that is, as far as possible, to make each customer pay not only for the cost of actually producing his current, but also to stand his equitable share of the fixed charges upon the investment which is has been necessary to make in order to get ready to serve him. The demand meter differentiates between "short-hour" users and "long-hour" users, and gives the benefit of the lower or secondary rates to a customer only after he has paid for sufficient current at the maximum rate to reimburse the company for the use of its capacity as indicated by the maximum meter.

The necessity of some such system of charging arises from the fact that electric companies must manufacture the most of their product only as required, and, therefore, cannot in fairness to themselves, or to the community, charge a flat rate similar to that of the gas companies who can manufacture gas at a uniform rate and store it in gasometers. Storage batteries are used by electric companies to accomplish a similar object, but the cost of batteries prohibits their use for any considerable amount of the load. There are a number of systems of charging in use in different cities, all of which have been adopted with the idea of dividing the charge for current into two parts, one varying with the fixed expenses on the entire system, and the other varying with the output of the generating plant. The system now in use in Chicago was adopted after a careful investigation and has been thoroughly introduced so that at present over 95 per cent. of the lighting customers of the two companies are served through the double meters.

It should be pointed out, however, that the movement to reduce the maximum rate and the system of charging provided by the Wright maximum meter are diametrically opposed. To reduce the maximum would ordinarily mean to equalize the schedule of rates, that is, if the maximum is reduced and the income remains the same, then the minimum must be correspondingly increased, the movement being toward a flat or uniform rate, and this is exactly what the advocates of the Wright demand system are trying to get away from.

The working out of the Wright demand system to its logical conclusion would mean that each customer would stand on his own feet and pay for the actual and equitable cost of his service plus a profit, and if this could be done the supply companies would be doing no part of their business at a loss; but this cannot be accomplished if a limit is put on the maximum charge.

On the other hand, if the maximum charge is reduced, the lighting companies will be forced to do a certain amount of their business at a loss, that is, the "short-hour" consumers—who are the ones most affected by the maximum rate—will be getting their current at less than actual cost, and the loss must be made up by a reduction in income or by making higher than would otherwise be necessary the rate to the "long-hour" consumer.

Theoretically each customer should pay for his own service, and as the Wright demand system aims to accomplish this result, it is theoretically a step in the right direction. On the same theory, however, every merchant should charge proportionately more for the delivery of small purchases than for larger ones—that is, if a pound of coffee or a yard of silk is delivered by itself a higher charge per pound or yard should be made than would be the case if this small purchase were to be delivered with a larger bill of goods. This policy would not be considered good business. As other merchants consider it to their interest to do a certain amount of their small business at a loss it is not surprising to find that public sentiment is in favor of reducing the maximum rate for lighting, even if the supply company must make up this loss by a slightly larger charge than would otherwise be made upon their larger sales.

The problem, therefore, resolves itself into the establishing of a fair balance. The desire of the lighting companies is to make each customer pay his own bills, and, therefore, they wish to maintain a schedule with a high maximum and a low minimum. The sentiment of the public is apparently to reduce the maximum so as to give the greatest number of customers the benefit of a comparatively lower rate, even if this benefit is to be secured at a loss to the companies, or at the expense of the wholesale customers. The question, therefore, involves the rights of the "short-hour" customer, of the "long-hour" customer, of the wholesale customer, and of the producer, and should not be settled entirely in favor of any one and at the expense of the others.

Taking up the question of a reasonable maximum rate on the assumption that the companies cannot be compelled to accept less than cost, two ways to alter the present maximum rate are mentioned:

a. By changing the maximum part of the rate to 15c, to 14c, to 13c, to 12c, to 11c, or to 10c, as may be agreed, leaving the secondary part of the rate at its present amount, viz., 10c. The reduction of the maximum rate in this way to 10c without changing the secondary rate would thus ultimately result in a "flat" rate which would treat all customers alike irrespective of the amount or character of their demands.

b. By changing the *time* during which the demand registered by the maximum meter must be used before the customer gets the benefit of the secondary or lower rate. At present this maximum demand (in kilowatts) is multiplied by 30 (hours) to get the kilowatt-hours which must be used at the maximum rate before the secondary rate is applied. This 30 hours might be reduced to 20 hours, to 15 hours, or to 10 hours, and the result would be to reduce the customer's bill. It should be borne in mind that the maximum demand meter does not indicate the length of time during which this greatest demand continues. Whether or not this system works an injustice depends upon the character of the customer's load. For instance, in the case of a flat owner using his maximum number of lights for only two or three evenings in a month the practice of charging for 30 hours' use of this maximum capacity would be wrong, but to a restaurant keeper using his maximum capacity for four or five hours a day, or 150 hours per month instead of thirty, the practice of using the constant 30 is not unfavorable to the user.

There can be no doubt that with the maximum rate as at present that some customers are served at a loss. In fact, figures have been compiled by the companies showing that a large percentage of their customers are supplied at present at less than cost. In spite of this fact, however, the companies have evidently thought it best to reduce their maximum rates, which indicates their willingness to do a certain amount of business at a loss. If this is "reasonable," how far can it be carried?

No attempt was made in the investigation to discuss at length the minute details of the method used by the companies in figuring their costs to their smaller customers. A very cursory examination of the subject will lead to the conclusion at once that some of the business is carried on at a loss, and that quite a number (perhaps 25 per cent) of the customers are not producing a profit. A reduction in the maximum rate will naturally increase the number of customers in this class, which number is claimed by the companies to be at the present time over 10,000.

Although the *number of customers* getting served at a loss may appear large, the *total amount of actual loss* to the companies when measured in dollars compared to the total income from all lighting customers is small, for it is only those using a small amount of current that are supplied at a loss.

It is only by arbitrarily reducing the maximum rate in one of the ways indicated above that the "short hour" customers will get the benefit of advances made in the art. For instance, the actual cost for fuel used in producing the electric current of the companies under discussion is such a small proportion of the total cost of supplying a small or "short-hour" customer that if some method were discovered whereby the cost of fuel could be entirely eliminated, the investment remaining the same as at present, the reduction in the maximum rate, if the entire benefit were to be given to the customers, would only amount to ½ cent per kilowatt-hour. To a customer paying the 16-cent rate this reduction would not be material, while to a wholesale customer getting energy say at 4 cents per kilowatt-hour, a reduction of ½ cent per unit would produce a considerable saving.

Improvements are being made in the art of generating and distributing electrical energy which are gradually decreasing the cost. The volume of the electric lighting business in Chicago is increasing rapidly, and this increase is gradually decreasing the cost of each unit of current distributed. The larger sizes of the generating units now available make the cost of getting ready to serve each customer less each year. The use of batteries to insure reliability of service and the extension of the circuits into larger and more sparsely settled territory are offsets, however, to the general tendency toward a reduction in cost.

If the contention is made and maintained that the companies are not to be expected to do any business whatever at a loss then the present maximum rate cannot be reduced. If the question is how much of their business they can be expected to do at a loss, then the answer can only be scientifically determined by going more deeply into their affairs than has been done thus far in this discussion. It is only by taking a broad view of the entire business that a conclusion can be arrived at as to whether the maximum rates can be reasonably reduced.

The report then takes up the discussion of a reasonable rate on the assumption that the companies can be required to serve a portion of their customers at less than cost, provided the returns on the total lighting business are reasonably profitable.

There are a large number of combinations of the maximum and minimum rates which can be made. The companies, it seems, are willing to agree, under certain named conditions, to reduce their present rates of 16 cents and 10 cents to a maximum of 14 cents and a secondary of 9 cents for the next two years, with a further reduction to 12 cents for the maximum rate and 8 cents for the secondary for the last three years of the next five year period.

In order to show the relative influence of these suggested rates upon the income of the companies as compared with other rates, including a flat rate of 10 cents per kilowatt-hour, the following table has been compiled:

Possible Changes in Rates in Cents per Kilowatt-Hour.	Total Income at Various Rates	Percentage Total Income at Various Rates.
20 and 10	100.0%	None
16 and 10	92.8	7.2%
16 and 10—with 10 hrs. time limit.	89.2	10.8
14 and 10		
14 and 9—suggested by companies for 2 years	85.8	14.2
12 and 10—		
14 and 8	82.3	17.7
12 and 9		
10 and 10 flat rate		
14 and 7	78.8	21.2
12 and 8—Suggested by companies for last 3 years		
12 and 6	71.6	28.4

The above table shows that:

a. The reduction in rates already in force and made voluntarily by the companies amounted to a reduction in their gross income from lighting of 7.2 per cent. This does not include the loss sustained by waiving their minimum charge, which was done at the same time.

b. The reduction of rates for the first two years to 14 cents and 9 cents, as suggested by the companies, means a further reduction of 7 per cent. from their original income, or a total reduction of 14.2 per cent.

c. The reduction to 12 cents and 8 cents as suggested by the companies, means a further reduction amounting to a total of 21.2 per cent of their income.

d. This last rate of 12 cents and 8 cents is actually less than a flat rate of 10 cents per kilowatt-hour, on account of the fact that the amount sold at the secondary rate averages twice the amount sold at the primary rate, so that under these conditions a rate of 12 cents and 8 cents is the same as an average flat rate of 9⅓ cents.

e. A reduction of rates to 12 cents and 6 cents would mean a 28.4 per cent decrease in an income based on a rate of 20 and 10.

f. Either of the combinations of rates (14 and 8) or (12 and 9) are an exact average of the two sets of rates proposed, that is (14 and 9) and (12 and 8).

To determine whether or not it would be reasonable to ask the companies to do more at this time than they have indicated their willingness to do, a careful study and analysis has been made of the figures submitted, with the following results:

a. The full valuation of the properties and franchises as fixed by the Board of Equalization for taxation purposes is $25,707,000.

b. To make an inventory in order to get at the exact physical value of the properties, or to make an estimate of a replacement value would take more time than has been allowed for this investigation.

c. The sum total of the outstanding bonds and stocks does not exceed the published investment upon which interest and dividends are paid. That is, dividends are not paid upon stock which represents the value of the franchise. No bonds or stock have been recalled, however, to take care of depreciation.

d. Interest at the rate of 5 per cent. is paid on the bond issue and dividends at the rate of 8 per cent annually are paid on and stock issued. The average annual charge for interest and dividends is 6.5 per cent on the total par value of the bonds and stock.

e. The surplus earnings over and above interest charges are allowed to remain in the property to overcome the depreciation. The accumulated surplus and depreciation account amounts to about one-half of a theoretical depreciation account calculated on a basis of 6 per cent per annum. In other words, it appears from the figures submitted that the companies have not been earning sufficient surplus to equal an annual average depreciation of 6 per cent. (Land is not included in the depreciation calculation.)

f. The lighting load is increasing at about the rate of 7,500,000 kilowatt-hours each year.

g. The operating costs are decreasing gradually as improvements are made and economies are introduced, but the income per kilowatt-hour has decreased in about the same proportion, which means that the large users and not the companies have been getting the larger proportion of the benefit of the increased economies due to the improvements.

h. The investment per kilowatt of connected load is now only about one-half as much as it was five years ago and it is mainly on account of this decrease in investment per unit of capacity that the price per unit of energy sold may be expected to decrease.

i. The percentage of current sold compared to the amount generated is decreasing instead of increasing. This is due to an increase in transmission and sub-station losses incidental to serving a larger territory.

j. The ratio of net earnings to gross earnings of the Chicago companies is slightly less than the average of a number of lighting companies in other large cities.

After a very careful study of the situation the report sets forth the conclusion that the Edison and Commonwealth Companies can afford to reduce their lighting rates.

If there is no desire on the part of the city to embarass these companies in their efforts to extend their lines and to render efficient and reliable service then their offer to reduce their rates to 14 cents for the maximum rate, and 9 cents for the secondary rate, for two years from the present time, and to 12 and 8 cents for the next following three years, may be considered reasonable and fair.

A thorough investigation of the affairs of the companies might show that these companies could afford to reduce their rates to 10 cents and 5 cents (equivalent to a flat rate of 6⅔ cents), but from all figures which have been submitted this rate, at the present time would be a hardship and would probably seriously embarrass the companies, but it is reasonable to expect that the companies can afford to and probably will eventually reach this latter rate.

Central Station Notes from Watertown, Wis.

The Watertown Gas & Electric Company operates two power plants; one, hydraulic, on the Rock River about a mile from the center of town, and the other a steam plant down-town. The latter is operated only during the evening. The company has been pushing the gas end of its business more actively of late than the electric, as the electric plants are loaded to their capacity and the gas plant is not. The capacity of the electric plant will be enlarged, soon after which a more active campaign for business will be begun. The connected lighting load is now about 3,500 alternating-current incandescent lamps and 25 commercial arcs.

The company has followed the example of a number of other towns in southern Wisconsin and adopted the Doherty readiness-to-serve system of charging, for those who desire it. The readiness-to-serve charge is 15 cents per month per 16-cp lamp after which the customer pays 6¼ cents per kw-hour for energy used. The other system of charging is a minimum bill of $1 and 12½ cents per kw-hour for energy used. The Doherty rate in Watertown, contrary to the experience in other neighboring towns, has not proved very popular among the merchants. Saloons are about the only class of customers taking advantage of it. Stores close at 6 p.m., except two nights per week, and for them the bills will be about the same whether they adopt the Doherty rate or the 12½ cents per kw-hour. If the merchants did show window lighting or display lighting during the evening after closing, the Doherty rate would be an advantage to them, and this is probably the reason for its popularity in neighboring towns where storekeepers have taken advantage of it to do display lighting.

The company furnishes free renewals of lamps of 2, 4, 8, 16 and 32-cp of the regular shaped clear bulb types. Special lamps are furnished at the difference in cost between them and the standard lamp of the same candle-power.

Central Station Questions Before the Association of Electric Lighting Engineers of New England.

At the fourth annual meeting of the Association of Electric Lighting Engineers of New England, held in Boston, March 21, five papers were presented treating of central station topics, abstracts of which are given below:

PROTECTION FROM HIGH VOLTAGES.

Mr. G. E. Palmer, of the Pettingell-Andrews Company, Boston, presented a paper entitled "Line and Station Protection Against High Potentials." Mr. Palmer began by pointing out that almost any line can be protected against high potentials if sufficient insulation and enough protective devices are installed, but stated that it was after all more feasible to try to protect the weak spots in a system than to attempt to insulate or protect it all on the same scale of investment. The majority of so-called static breakdowns in cables are due to defects which follow short-circuiting. The lightning arrester is merely a weak point in the system purposely made weak, and it should in all cases permit line discharges to continue without going out of service or without permitting arcs to form. Zinc, antimony, cadmium, bismuth and mercury are ideal metals for use as electrodes in lightning arresters, for their vapor does not perceptibly decrease the resistance of the gap. The ideal construction should allow equal opportunities at all points for the discharge of high potentials.

A very significant phenomenon was noted in a telephone circuit which Mr. Palmer installed in the Middle West. The circuit was about 100 miles long and the work in hand was the rebuilding of an old line. It was found that when new clean insulators were used, the line was very noisy and almost too poor for service. The insulators of the old line were put back, dirty from their former service, and the line at once became one of the best in the whole exchange. The distributed leakage took care of the static discharges without the least trouble.

Mr. Palmer suggested the construction of a special insulator which would offer a high resistance path to earth, constituting a "crack" in the electrical system. The idea would be to dip the insulator into a metallic solution before glazing it, mounting it in service upon iron pins with a common metallic ground connection. The metallic film would not act as a conductor in the ordinary sense for its resistance might be as high as 50,000 ohms, but it would be able to dissipate abnormal static discharges without punctures. It is not now considered good practice to protect series arc circuits with arresters designed to protect the system against the potential due to open circuits.

Mr. Palmer concluded by describing his device to prevent the abnormal use in potential on a constant-current arc circuit as the tub transforming coils come together on open circuit. To prevent opening the other circuit or circuits of the transformer in case any one transformer circuit opens, an additional lightning arrester and impedance coil are placed across each circuit, so that the discharge potential passes through the impedance coil, operates a solenoid plunger and short-circuiting trip which dead short-circuits the line affected and leaves the balance of the lights burning steadily.

In the discussion which followed, Mr. G. R. Stetson, of New Bedford, mentioned a number of insulation punctures in customers' motors, which had recently occurred on his system, and stated that the trouble was finally eliminated by installing arresters and kicking coils at each important motor. With a fluctuating load this seems to be the safest course. Several other managers stated that it had been found necessary to isolate the transformers supplying wireless telegraph stations with power, and to discontinue the ordinary ground wire.

THE MAXIMUM DEMAND SYSTEM.

The next paper was by Mr. J. S. Codman, of Boston, the subject being "Discrimination in Rates." Mr. Codman began by pointing out the prevalent opinion on the part of the public that any other change for electric current than a uniform meter rate of so much per kw-hour is discrimination. Sometimes central station men subscribe to this idea, and it is high time that the public should be made to appreciate that systems in which the rates to different customers vary are not necessarily discriminating, but on the contrary, if they are properly devised, they approach ideal conditions of equity far more than a flat meter rate. A private company cannot be fairly charged with discrimination if it adopts a system of rates proportional to the cost of supply, and as a matter of fact private companies in this country have gone much further in this direction than have municipalities, while just the reverse ought to be the case, and no better example of the progressiveness of the private company could well be cited.

It will not do to establish a rate for the majority of the customers and then make special discounts to individuals, even if it does cost less to supply those individuals. Instead a schedule of rates should automatically make the rate proportional to the cost; it should be published and open to general inspection, and above all, the public should be made to understand that the rates will be adhered to under all circumstances.

Of all the systems, the flat meter rate is the worst as regards discrimination, since under it the charge is farther than with any other system from being proportional to cost, for the reasón that the expenses proportional to the electricity produced from a small part of the total expenses, including interest and depreciation. Ordinarily the expenses proportional to output are not more than 15 or 20 per cent of the whole. An increase in current consumption of, say, 10 per cent, will only increase the total expenses to the company about 2 per cent, which means that the profit of the company at the given rate is liable to become exorbitant. If the consumption decreases 10 per cent the decrease in expense to the company will only be about 2 per cent, which may unduly reduce or wipe out the entire profit.

From 50 to 60 per cent of the expenses of a station are proportional to the maximum load which the station is called to carry, for it is this which determines the size of equipment. The interest, depreciation, taxes and insurance on this portion of the investment are proportional to the maximum demand, as are also part of the station wages, repairs and a small fraction of the coal, water and waste. Hence a charge based on the maximum demand will be more nearly proportional to the cost of supplying current than a charge based on the consumption. This is roughly the basis of the old contract system where a charge is made for each lamp on its equivalent in other apparatus. This had the great disadvantage of having no tendency to economize in the use of current, since there is no consumption charge. The contract system is well fitted, if based on the actual maximum demand, to smaller water power plants where moderate waste of current is not a serious matter.

The most modern system of charging is known as the demand system. It prevents waste just as well as the uniform meter rate, and yet makes a rate much more nearly proportional to the cost. Mr. Codman then cited a number of cities using the demand system, among which were Boston, Brookline, Chester, Haverhill, Walden, New Bedford, Springfield, Bangor, Manchester, Portsmouth, Rutland, Bennington, Middlebury, New Haven, New York, Denver, Cleveland, Minneapolis, St. Paul, etc. The demand system is based on the consumption and also upon the actual maximum load which occurs at the customers' premises. There are from 20 to 40 per cent of the expenses of a central station remaining which are proportional neither to maximum demand nor consumption, and the expenses have to be added somewhere, dividing them between maximum demand and consumption as seems best. If the charge is to be proportional to cost the rates must necessarily vary between customers.

With a demand system under which the charge is based on the maximum demand and the consumption both, the average rate per unit of consumption and the average rate per unit of maximum demand both vary. The customer who gets the lowest average rate per unit of consumption gets the highest average rate per unit of maximum demand, and vice versa. This system is not only best for the electric light companies, it is also best for the public, since it results in lower average prices.

Mr. Codman then described some of the various demand systems, including the Hopkinson and Wright systems and the systems in use by several of the large Edison companies, pointing out their similarity of principle and showing how the same general results may be obtained by widely different divisions of the rates of charging. Service charges are made on the assumption that a part of the expenses are directly proportional to the number of customers, and should therefore be divided directly among the customers at so much per head. This is justifiable, as there are probably expenses amounting to perhaps 10 per cent of the total which are proportional to the number of customers, such as clerical work in making out bills and keeping customers' accounts, meter reading, etc., and it is truly scientific to make a separate charge to cover them. Most companies cover this expense by a slight additional charge per kilowatt-hour and a minimum bill of one or two dollars per month.

Wholesale discounts for quantity of consumption are often given with a demand system and they are justifiable because a large consumer can be supplied at a lower rate per kilowatt-hour than a small customer. When wholesale discounts are given they should be given on the "block" system.

Some companies take the connected load as the maximum demand. This is seldom just; it seriously impairs the flexibility of electricity in an installation and discourages the use of new applications. Estimates of the average maximum demand for each class of customer are likely to be inaccurate unless based upon a wide range of data, and even if once determined the conditions often change. Instrumental measurement of the demand is the best course; the customer can make changes without notifying the company; no extra inspections are necessary, and a better choice in wattmeters can often be made through a study of the demand indicator readings. The customer can connect whatever apparatus he wishes, for the indicator will show only the power supplied to such apparatus as may be simultaneously in actual service. Demand indicators of 25 amp. capacity only cost about $6, and even large instruments of several thousand amperes cost but $30 or $40. They are simple to install, cost very little for maintenance and absorb but a trifle of energy.

In presenting to the customer a contract based on the annual maximum demand, it should be impressed on him that the charge is based on the number of his lamps, but that a concession is made by the company if during the course of his contract he never uses all his lights simultaneously. The company can put it this way: "We realize that in the course of the year it is possible that you will not use all your lamps simultaneously, and if such is the case we will give you the benefit of that fact by basing the charge to you on the maximum number of lamps simultaneously in use as shown by the reading of the demand indicator." If this is done, the customer will look upon the demand indicator as a device for lowering his bills. Mr. Codman closed by discussing the pros and cons of limited vs. measured demand contracts, pointing out the usefulness of each in relation to regular and abnormal current consumption by customers.

NEW INCANDESCENT LAMPS.

Dr. Louis Bell, of Boston, gave an address upon "Progress in Methods of Incandescent Lighting." He pointed out the need of smaller arc lighting units or their equivalent in high efficiency lamps, and then sketched the German researches upon elements with high melting points in the quest of new filament material. The efficiency of a light producer depends almost entirely upon its temperature. Tantalum was found to be hard, ductile, of a higher specific resistance than platinum, and attacked only by hydrofluoric acid. It is almost infusible, had formerly been obtained only in the form of a black powder, and had to be melted in vacuo in the electric furnace before it could be used for filament work. Dr. Bell described the tantalum lamp and exhibited one of 22 cp to the Association in operation upon the hotel chandelier. Tests which Dr. Bell made upon a number of tantalum lamps showed an average consumption of about 2 watts per cp, and a life of 800 hours on direct current. With a 22-cp tantalum lamp a wattmeter revolves only two-thirds as fast as with an ordinary 16-cp lamp. On alternating-current circuits the results are somewhat less favorable. After about 200 hours the filament gets brittle, and tends to draw tight a little quicker than does the ordinary carbon filament. Such lamps would not be used in service where there is much vibration. They cost about $1 abroad, and at any price above 5 cents per kw-hour are cheaper than the ordinary incandescent, even if the latter is renewed free of charge. The filament is still not quite perfected.

Dr. Bell also exhibited an osmium lamp in operation. It had a consumption of about 1⅗ watts per cp. Osmium is so rare that these lamps are rented, abroad, and it is doubtful if they will come into very wide use in this country. It exceeds the tantalum lamp in brilliancy and is about 24 cp in rating. There is not the same tendency to draw light as in the tantalum lamp. He then discussed the high-efficiency General Electric lamp, with a graphitized carbon filament and predicted that although the efficiency is at present from 2.5 to 2.75 watts per cp, it is probable that within a year or two we shall have a 2-watt lamp. The life is good, on the whole, and a 20-cp lamp is promised soon. It is a good point that the resistance of the filament is nearly uniform, being almost entirely independent of the temperature. It is hard to get long life and low candle-power in a high-voltage lamp. The advent of the high-efficiency lamp means that a great many more lamps can be installed on the present systems, and if the experience of the past is any criterion it is probable that the number of new customers will more than pay for the reduction in price per lamp-hour which will follow. In the use of these very efficient lamps lies the opportunity for fighting cheap gas lights. In the brief discussion which followed the point was brought out that the life of a tantalum lamp on an alternating circuit is only about half that on direct current.

CENTRAL STATION ADVERTISING.

Mr. Converse D. Marsh, of the Bates Advertising Company, New York, gave an address upon the "Best Methods of Advertising for Electric Light Companies." He stated that for many years central station men had devoted their energies largely to the perfection of their equipment, but that the time had come when business getting was a very important question. Advertising is the key to the problem. Mr. Marsh emphasized the value of direct mail solicitation in paving the way toward interviews by solicitors with prospective customers. Unless a solicitor has some such basis upon which to proceed, it will generally occur—and through no fault of his own—that the actual time each day in which he can be face to face with his prospective customer is only a very small percentage of the entire working period. The solicitor doesn't know primarily who are the interested people, and the cost per call is liable to be pretty high.

House-to-house letters are not as effective as mailed appeals. The best plan is to select one branch of applications, as sign work, and to follow up the campaign from 12 to 30 times per year with pointed appeals, each varying somewhat from its predecessor. The time of year should be borne in mind. Power can be talked at any time, but arc lamps are best handled in the dark months. Residence lights would not be discussed as much in vacation time. Newspaper advertising is good, but the results cannot be checked as with direct mail solicitation. Illuminated signs ought to be more widely used by central stations. A monthly business magazine is good if well conducted, but all sorts of tricky and "funny" advertising—the Sunny Jim kind—is likely not to be profitable in the long run. A good plan is to see if an advertisement sounds well when read aloud to a customer.

SINGLE-PHASE MOTORS.

Mr. W. A. Layman, general manager of the Wagner Electric Manufacturing Company, St. Louis, presented a paper on "Alternating-Current Motors, Single-Phase vs. Three-Phase." The writer stated that it was not his intention to advocate the use of single-phase motors to the expulsion of polyphase machines, but rather to advocate the more extended use of single-phase machines and to present the points of preference in favor of the latter.

The principal advantages of a single-phase distribution over that of a polyphase are simplicity, flexibility and saving in the cost of supplying current to customers. The chances of breakdowns, grounds, etc., are reduced in direct proportion to the number of wires used to transmit the power. Crossing over problems and the turning of corners are much more difficult with polyphase distribution. If polyphase generating stations hold to polyphase motors exclusively the distribution system will be reduced to a minimum of flexibility. Single-phase motors on existing lighting lines mean maximum flexibility. Pioneer lines reaching out for new business are almost invariably single-phase. The first customers usually require lighting; later power is wanted. Scattered power calls cannot be profitably handled by extending a second or third phase. Where the load is of such size that the building of two or three polyphase lines is economical, polyphase power can be transmitted without affecting the rest of the system, and power and lighting service made available at any point with a minimum of labor and expense.

With single-phase distribution there is a saving in the cost of the line. The fact that a given amount of power can be transmitted at the same loss with 25 per cent less copper, three-phase than single or two-phase, is not the whole story. The cost of insulation must be paid for, which brings the saving down to about 15 per cent actually, and any special work is more expensive, especially in line erection. The cost of wires for a two-phase system will be about 10 per cent more than for a single-phase line of the same capacity. The principal saving in single-phase distribution is in the transformers. A polyphase motor requires at least twice as many transformers as a similar single-phase motor installation. Between ¼ and 40 hp the increased first cost of transformers runs from 15 to 100 per cent, where a separate transformer installation is put in service for each power customer. No sane central station man will put into service a ½-hp or even a 1-hp polyphase motor and provide transformer service for it. Single-phase distribution also means a saving in investment, interest and depreciation in stock transformers. On the average it probably costs twice as much to erect and put in service two transformers as to install one, allowing for the extra cross arm space and frequent heavier construction. The losses in two transformers are increased about 25 or 30 per cent. There is also a saving in secondary construction cost, including the installation labor and cost of wattmeters.

On a polyphase system the problem of balancing is simplified because of the even loading of the phases, but this is not a serious objection to single-phase work, practically carried out. The chances are that the motors will be evenly balanced, if a little care is exercised. The difficulty of balancing becomes less and less as the power load increases, because each new installation represents a smaller percentage of the total connected power load.

In small installations single-phase generators would naturally be recommended, even though their capacity for the same heating is from 70 to 80 per cent of the capacity of a polyphase machine. In large installations polyphase generators are desirable even if complete single-phase distribution is contemplated. Feeder circuits can easily be transferred from phase to phase. Single-phase motors give much less trouble than direct-current motors, and are as satisfactory as polyphase machines. The single-phase motor is now as well adapted to variable-speed work as is the polyphase machine.

Mr. Layman then described the torque speed characteristics of the single-phase motor, and discussed the methods of starting these machines without load, either by phase splitting or by the use of the repulsion principle. The split-phase motor gives a starting torque of about 30 per cent of the full-load torque. The Wagner motor starts as a repulsion machine and develops about two or three times full-load torque at starting. This torque increases rapidly during acceleration, until at about ⅓ normal speed, the torque is about five times full load and running torque, then the torque decreases to full-load torque at full speed. The brushes are then automatically lifted from the commutator and the latter short-circuited, so the machine runs as an induction motor. The acceleration is very rapid from zero to half speed, say, 3 or 4 seconds out of 15 required to come to full speed from zero. Non-inductive resistances can be used to increase the power factor, if desired. As a rule motors smaller than 5 hp do not need starting boxes. Some companies will not accept polyphase motors of any size where a single-phase motor of the same capacity can be obtained, notably the Public Service Corporation of New Jersey. The latter supplies light and power from the same mains, and installs separate transformers for power service.

The Wagner Company is now making a line of motors operating at 1,200 r.p.m. on 60 cycles, either reversible or non-reversible up to and including 3 hp, which are developments of the repulsion type of single-phase motors. These are being successfully used for variable-speed fan and light hoisting work, and are controlled either by resistance or auto-transformers. Mr. Layman described the Schuler type of motor at considerable length. This is largely used in sizes above 5 hp; it can be readily reversed and the torque and current well controlled by variable resistance. In this way the current at the start can be held down to about 25 per cent in excess of full-load current, and the starting torque, 50 per cent over full-load running torque. Speed regulation is satisfactory down to about 40 per cent of normal speed at full load.

MAGNETITE ARC LAMP.

Mr. Richard Fleming, of the General Electric Company, presented a paper on "Recent Progress in Arc Lighting." Mr. Fleming pointed out the apparent limit of development which had been attained in the carbon arc, and discussed the flaming arc, in which salts of silicon and cadmium are incorporated with carbon in the pencils. Where color is not material, as in the lighting of large areas out of doors, the flaming arc serves a good purpose. The arc stream is cone-shaped and the life about 16 hours per pair.

The "iron arc" or the magnetite lamp was stated to give the nearest approach to daylight. In this lamp black oxide of iron is mixed with salts of chromium, titanium, etc., so that the life, quality and efficiency of the arc may be increased. The useful life is from 150 to 200 hours. The "carbons" are enclosed in thin iron tubes 8 in. long and ⅝ in. in diameter. A special form of lamp with a chiminey is needed to enable the electrodes to be burned successfully. The upper electrode does not consume, and the electrodes must be separated when not in service or welding takes place. The lower electrode is fed upward by the mechanism, and the arc is not controlled by magnets during operation. The arc is well fixed in position, and first-class effects can be obtained by the use of reflectors. In street work the bulk of the light is thrown down at an angle of 10 or 20° below the horizontal These lamps are not used on alternating circuits except with the mercury vapor rectifier and constant-current transformer. Designs are now completed for magnetite lamps to operate on 110 and 220-volt circuits. A few years ago nothing much better than 1.75 watts per cp could be obtained, but now in arc lighting ½ watt per cp is readily secured. It is probable that the improvements of the future in the magnetite lamp will be chiefly in the direction of the electrode composition.

Steam Features of the Wanamaker Power Plants.

IN the power plants of both the new stores being erected for John Wanamaker in New York and in Philadelphia, there are some interesting steam features, some of which are departures from ordinary steam practice, while others are the result of necessity to meet certain peculiar and special conditions. In the New York plant, the high-pressure steam piping involves a main and auxiliary header in the boiler room with a ring encircling the engine and pump room. The arrangement of connections to the headers is peculiar. All boiler delivery connections are carried directly to a main 16-inch header, which is divided into two sections, while an 8-in. auxiliary header is

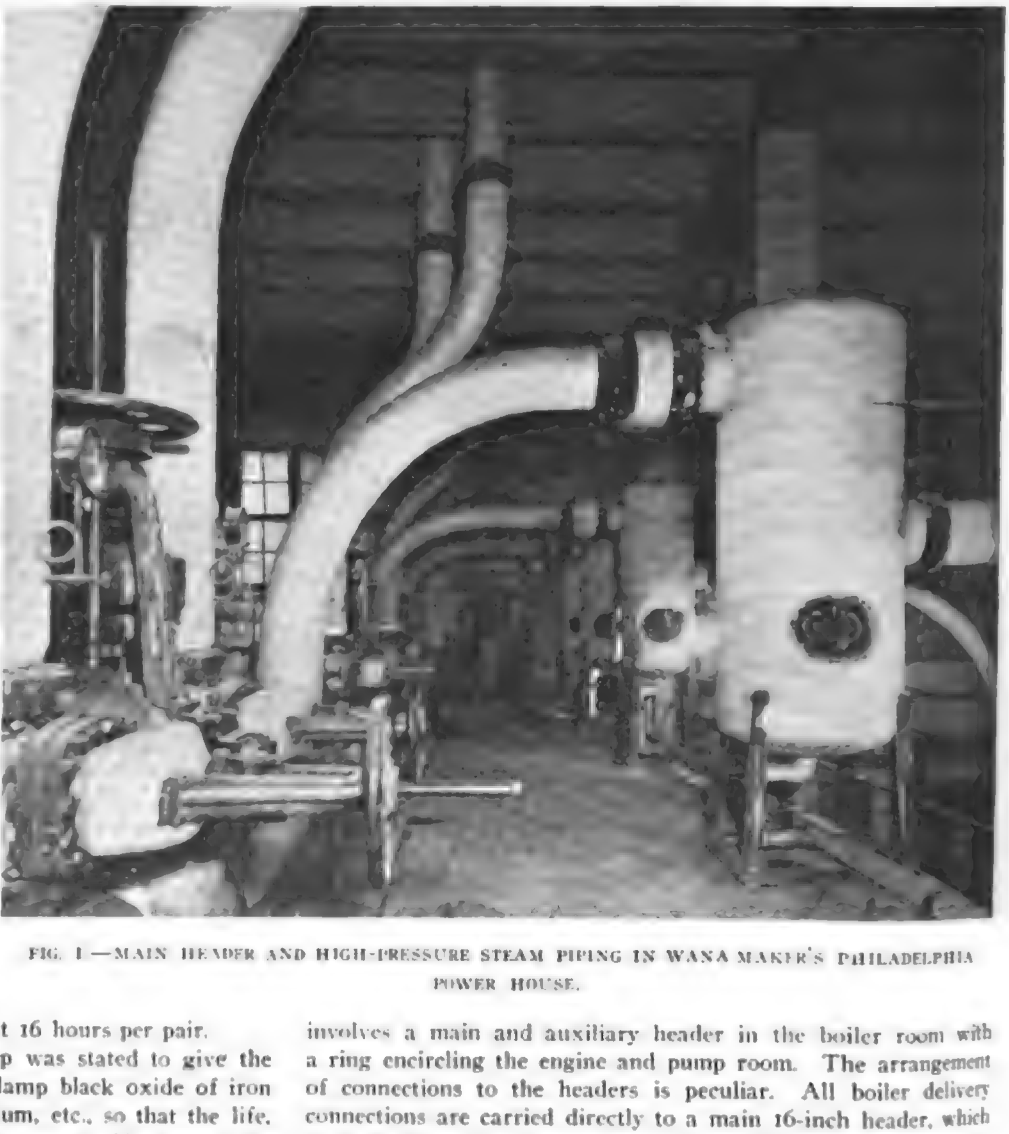


FIG. 1.—MAIN HEADER AND HIGH-PRESSURE STEAM PIPING IN WANAMAKER'S PHILADELPHIA POWER HOUSE.

fed only through the connections which lead into the engine room to the ring main. The purpose of the auxiliary header is chiefly to supply the auxiliary steam-using equipment in the boiler room, rather than to serve as a duplicate source of supply to the engine room; but it does form a connecting link which can be used in cases of emergency to supply one half of the ring main if the other section of the main header is out of service. Each half section of the main header is connected to one leg of the ring main of 12-in. pipe. The auxiliary header is connected between these 12-in. leads, and at this point are auxiliary boiler connections from the end boilers. These consist of regular 8-in. boiler branches which are intended for a by-pass connection to the engine room, if by any chance, both sections of the main header should become disabled. This arrangement effectively safeguards the steam supply without the necessity of running duplicate connections from each boiler to an auxiliary header, two boilers being capable of carrying sufficient overload to prevent a shut down of the plant in such an emergency. The ring main is also sectionalized by means of gate valves so that the operation of units of every class is insured in spite of possible disablement of any particular section of the main.

Features of interest are involved in the construction and arrangement of the engines. On account of the numerous building columns it was necessary to locate the engines so that one of these columns would come between the high and low-pressure cylinders of each engine; but the receiver could not be connected in a direct line between the high and low pressure connections on this account. The receivers were therefore located in each case about midway between the column and the generator base and kept as close to the floor as possible on account of the fact that the basement is located below mean high water. For this reason also it was necessary to keep all pipes above the floor as much as possible and the low-pressure cylinders of the engines were therefore turned bottom side up so as to allow the steam to enter the under side of the chest, and the exhaust to escape from the upper side of the chest, which is rather unusual. It has been found, however, that with the low-pressure cylinder and chest well drained no trouble is experienced on account of this peculiar arrangement.

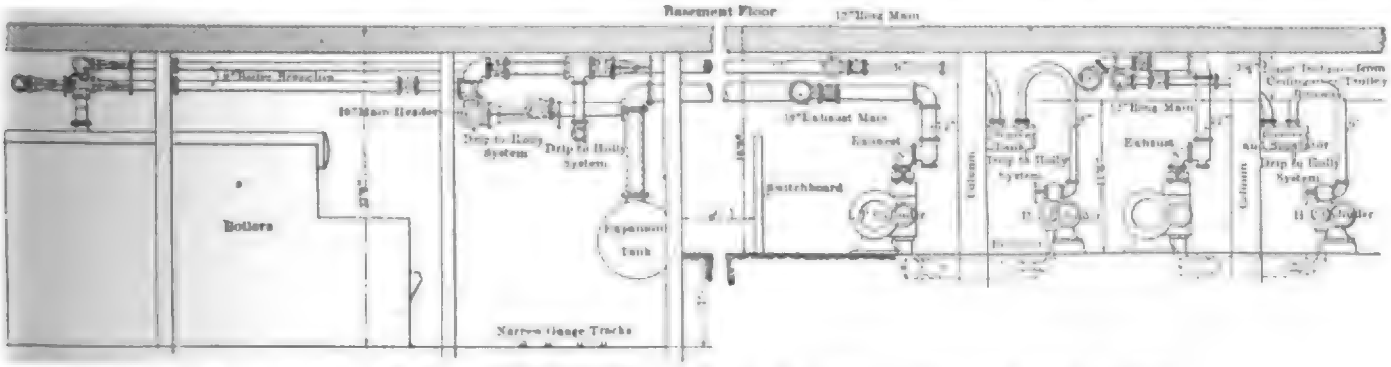


Fig. 2.—Elevation of Steam Piping in Power Plant of Wanamaker's New York Store.

The exhaust steam supply is greatly simplified by the use of an expansion tank, the function of which as a receiver, muffler tank and oil separator also obtains in the Philadelphia plant. This tank is 25 ft. long and 6 ft. in diameter and into it all the exhaust steam from all steam-using apparatus in the building is carried. This not only simplifies the exhaust connections to the heating system, but also eliminates back pressure which would have been present had a complicated exhaust system been used. All apparatus using exhaust steam is fed from this expansion tank.

The piping systems in the Philadelphia plant are of more than ordinary interest on account of the contracted spaces surrounding the apparatus and the arrangement of the latter in tiers. The high-pressure steam piping, and particularly the steam header on the second mezzanine floor, has a remarkably novel arrangement which has many features to commend it for use in the contracted spaces imposed by conditions in large cities. A view of the piping on this floor is shown in Fig. 1. The boiler connections from the floor above are carried down from stop check valves through 10-in. branches with easy bends. Each boiler delivers steam through a 10-in. stop check valve which prevents the delivery of steam to any boiler not under steam pressure. The 18-in. header is of wrought steel, with flanged cast steel nozzles on the upper side for branch connections and is divided into three sections for sub-division of the equipment if desired. The middle section is fed by two boilers and the outside sections by three boilers each, the latter sections being connected by a 12-in. by-pass at the rear which gives all the advantage of a ring main in flexibility of arrangement. The floor being open on the engine room side, connections to the engines are easily made. Two 12-in. lines from the large engines are first taken through 42-in. vertical steam separators as shown, and the 8-in. lines to the three smaller engines first pass through 30-in. separators whence they are led to the engine throttles. The valves dividing the main header are motor-driven. The boilers may be operated with either natural, forced or induced draft, or with forced and induced draft combined. The boilers being on the fifth floor which brings the breeching about 65 feet above the level of the street, it was out of the question to erect a large smoke stack, so that four short steel stacks are used, necessitating some form of forced or induced draft, or both.

The Wiring and Maintenance of Shunt and Compound-Wound Motors.

By William Kavanagh.

Owing to their ease of erection and operation, manufacturers have adopted the electric motor for power purposes, so that it is to the interest of the motor attendant to learn all that is necessary with respect to motor maintenance and operation. Shunt or compound-wound motors are usually employed and the wiring and care of both types will be considered in a practical way in what follows, so that those interested may be enabled to master the details quickly.

The wires leading to a motor must have a sufficiently large current carrying capacity to permit the maximum amount of current to flow through the motor. To show how to determine the amount of current that the wires must carry we will assume that a motor is to operate on a 250-volt circuit. Since a watt is equal to the product of a volt × an ampere, and 746 watts are equivalent to one horse-power, dividing 746 by 250 will give the amount of current required to develop one horse-power under that tension; this current is 2.98 amp. Granting that a 25-hp motor is used, the wires will need to be of sufficient size to carry 25 × 2.98, or 74.5 amp. Motors are, however, required at various times to operate under overloads, and for this reason the current carrying capacity of the wires must be sufficiently large to conduct at least from 25 per cent to 50 per cent excess current, the former figure being required by the Underwriters.

Having determined the amount of current the wires must carry, by reference to a table giving the carrying capacity of wires the size or number of the wire that will conduct this current with safety may be ascertained. Both the gauge number and the cross-section of the wire in circular mils are given. For the motor under discussion the table shows that a No. 5 wire will carry 77 amp., so that by taking wire two sizes larger the anticipated overload may be carried with safety. This wire will be a No. 3 B. & S. gauge, which will safely carry 110 amp. Should the motor be required to operate under a larger overload a No. 2 wire should be installed.

The mains are led from the switchboard of the generating station to the factory or other building, where they are connected to a panel box similar to that shown in Fig. 1. The main wires are usually run through iron-armored conduit and are connected to the bus-bars, *B B'*, by means of the main switch, *S*, and the fuses, *F*. Any number of power lines may be connected to the bus-bars, provided the current carrying capacity of the mains is not exceeded. Each line leading from the box is connected to the bus-bars by means of a switch and fuse, as shown at *P* and *P'*. From the box the wires are run to the different motors, which may be attached to the ceiling or floor, or may be situated on shelves or platforms.

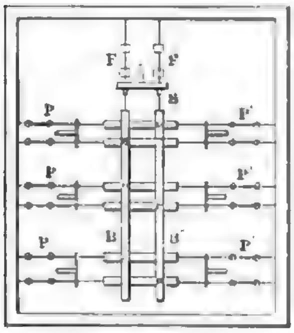


FIG. 1.

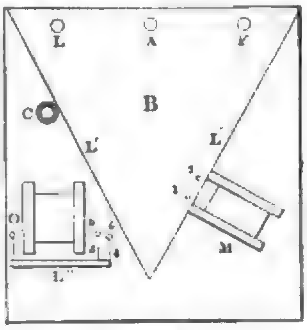
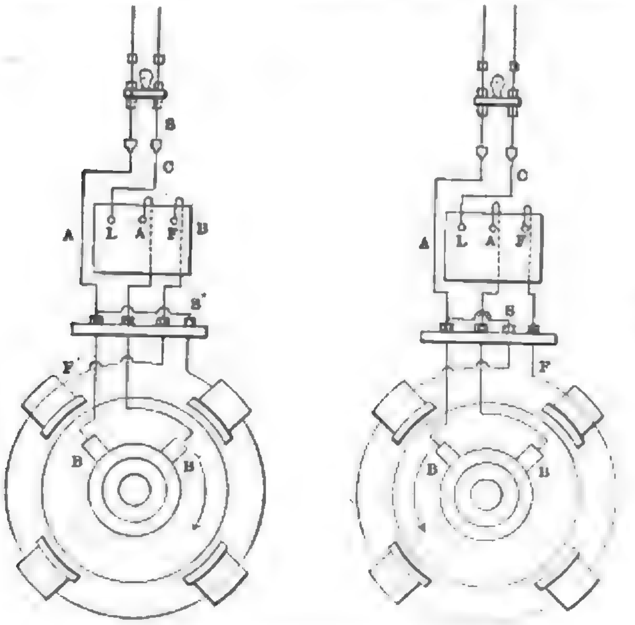


FIG. 6.

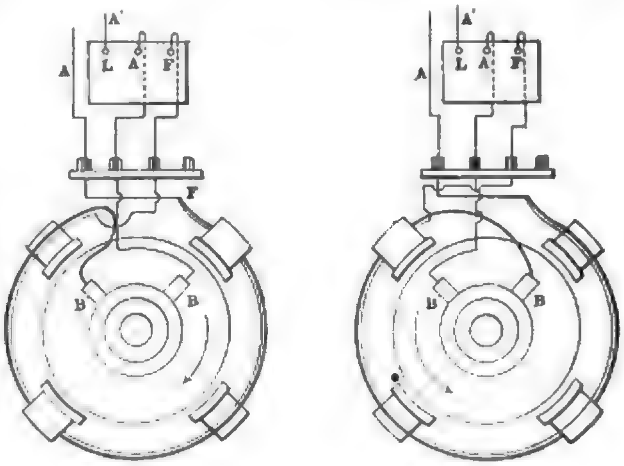
A diagram of connections for a shunt-wound motor is shown in Fig. 2. The wires from the panel box are connected to the switch, *S*, usually located in a convenient place. The starting box, *B*, is erected near the motor so as to obviate the necessity of long leads, and also that it may be within easy reach of the operator. The leads from the switch, *S*, are connected as follows: The line, *A*, is connected to the brush, *B*, and the line, *C*, is connected to the starting box at *L*; a wire leads from *A* on the starting box and goes to the brush, *B'*; another wire runs from *F* on the starting box to the field wire, *F'*, the other field wire being connected to the shunt, *S'*, as shown. When connected as in Fig. 2 a motor will rotate in a right-hand direction when the armature is viewed from the commutator end. Fig. 3 shows the connections of a motor for left-hand operation. The line, *A*, is connected to the brush, *B*, and the line, *C*, is connected to *L* on the starting box; a wire running from *A* on the starting box is connected to the brush, *B'*, and another wire connects *F* on the starting box with the field wire, *F'*. The shunt, *S'*, is connected to the other field wire, as shown. It will be noticed that the wiring for right and left-hand rotation is the same with the exception of the shunt-field connections.



FIGS. 2 AND 3.—SHUNT-WOUND MOTORS.

Fig. 4 is a diagram of connections for a compound-wound motor. The line, *A*, in this case is not connected directly to the armature, as in the case of the shunt-wound motor, but is connected to both field wires as indicated at *F*. The line, *A'*, is connected to *L* on the starting box as in the case of the shunt-wound motor, and a wire leads from *A* directly to the brush, *B*, and the brush, *B'*, is connected to the heavy field or series winding, as shown. The line from *F* on the starting box is connected to the lighter field or shunt winding, as indicated. A compound-wound motor connected in this way will rotate clockwise. A method of wiring the motor for counter-clockwise rotation is shown in Fig. 5. By tracing the connections it will be noticed that the wiring is the same with the exception that the brush, *B*, is connected to the same field wire as *B'* in Fig. 4.

The application of a push button switch for stopping motors is becoming more general because of the resulting convenience. Switches of this type may be located near the operator of a machine or group of machines, so that in case of accident it will not be necessary for the operator to pull the main switch, which might be some distance away. Push button switches find their greatest application in printing establishments, the presses and folding machines being equipped with as many as four, so that the operator may stop the machine from four different places. A diagram of connections showing the application of the push button switch is given in Fig. 6. Here *B* is a starting box, *M* a retaining magnet, *L'* the operating lever and *O* the overload attachment. The lever, *L'*, is held in position by the magnet, *M*, when this is energized. If the current is shunted the retaining magnet, *M*, will be demagnetized and the lever, *L'*, will fly back against the rubber cushion, *C*, thus stopping the motor. The push button is connected to the points 1 and 2, and when the circuit through the button is closed, current from the magnet, *M*, is shunted and the motor stopped, as explained above. The overload attachment, *O*, operates on the circuit exactly like the push button, except that the former is automatic. The amount of current flowing around the magnet determines the distance between the lever, *L''*, and the overload attachment, *O*. Should the current exceed a predetermined amount, the lever, *L''*, will be attracted, thereby bringing the points, 3-4, in contact with the points, 5-6, thus shunting the current through the magnet, *M*, and stopping the motor. An index plate is attached to the magnet, *O*, so that by raising or lowering the lever, *L''*, the amount of current flowing through the magnet, *O*, may be increased or decreased at will.



FIGS. 4 AND 5.—COMPOUND-WOUND MOTORS.

An Example of House Lighting Design.

By J. R. Cravath and V. R. Lansingh.

In order to illustrate further the principles which have been set forth by the writers in previous articles on residence lighting, the authors have selected for presentation the design of the lighting for a specific house where the planning of the illumination could be treated with a free hand from the beginning. The planning of the illumination for a house or any building should precede that of planning the wiring, because illumination is the ultimate purpose for which the wiring is to be installed. As illumination is the primary object desired, we should work back from the desired illumination to the outlets, installation of wires and machinery and not vice versa, as is too frequently done.

The accompanying plans shown here in Figs. 1, 2 and 3 are of a house recently built in Pasadena, Cal., where the owner desired to obtain excellent illumination with a minimum operating cost. It was recognized at the outset that the first cost of installing the lighting system was small when compared with the running or operating cost from year to year and therefore an effort was made to reduce operating expenses by securing a maximum efficiency of illumination rather than to cut down the cost of installation in general.

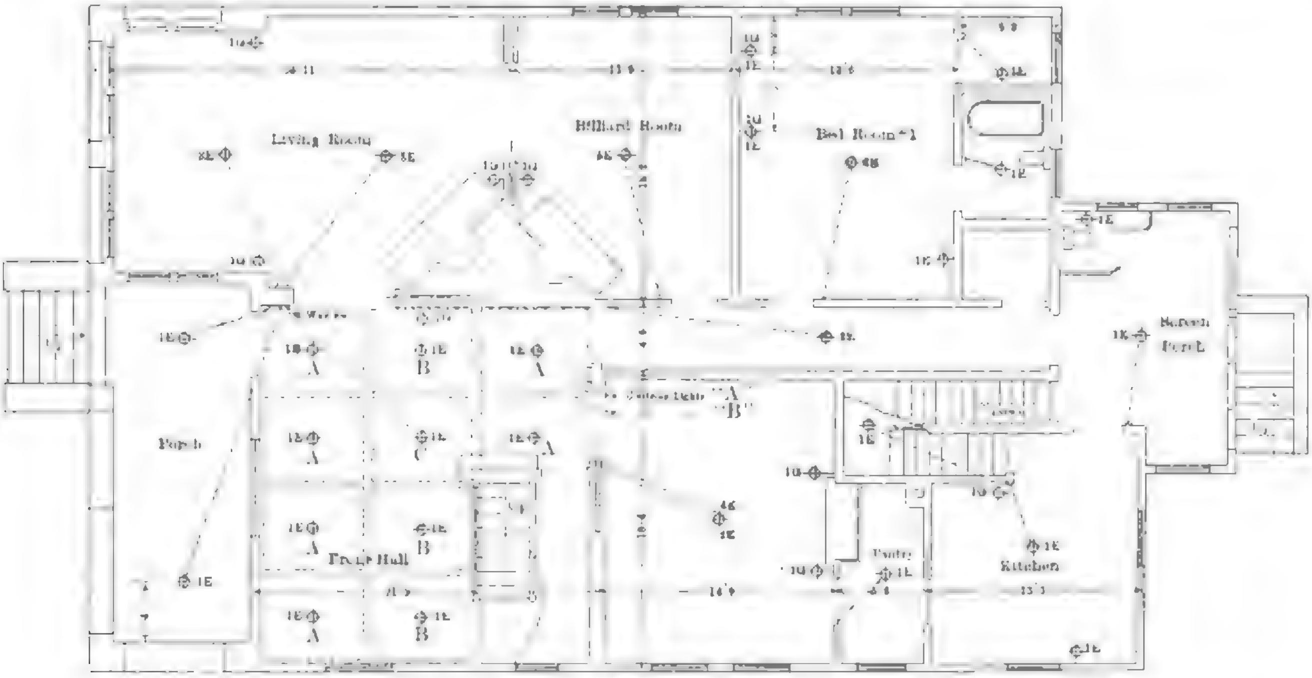


Fig. 1.—Plan of First Floor.

Globes and reflectors were used in the majority of places for directing light in the particular directions desired in each case and so combining economy with pleasing appearance.

The sketches for the chandeliers and brackets as herewith given (Sketches 1 to 8), are rough, free-hand drawings intended only for the purpose of indicating at what angle the globes or shades should hang and indicating only in general the style of fixture; the selection of fixtures being left entirely to owner and fixture dealer with the sketches for guides. The accompanying plans which show the location of the fixtures and switches together with the sketches of fixtures, and the acompanying table or schedule furnish nearly all the information necessary for the contractor so that as regards this part of the work but few other specifications are necessary. It should be noted on the accompanying schedule that in the case of all wall brackets the height of the outlet is in every instance specified and in the case of lights suspended from the ceiling the height of the socket from the floor is given. From such a schedule together with a plan showing the location of lights the wireman can immediately take off all that is necessary for his use and the fixture man has complete specifications except as to the particular design of fixture. The specifications for the wiring are outside the province of this article. Although electric lighting is depended upon almost entirely in this house, a few gas jets have been provided for use should the electric service be temporarily interrupted.

The location of fixtures is marked on the plans by the usual cross and circle. *1E* marked opposite a fixture on the plans indicates one electric socket, *2E*, two electric sockets, and so on. Gas tips are indicated by the mark *1G* opposite the fixture. Push flush switches are indicated by straight heavy lines with dotted lines leading to the lights they control whenever feasible. Snap switches are indicated by half circles. There is need for a standard system of symbols to indicate these matters, but as this subject has never been extensively discussed, the authors will not attempt to propose such a set here, as that is a matter which might well be taken up by the Illuminating Engineering Society.

In planning the location of fixtures, especially that of wall brackets in bed rooms, it is desirable to have some means of quickly showing the probable location of furniture or of trying the furniture in different locations. For doing this either in conference with the owner of the house or even if the entire matter is left to the illuminating engineer, a plan adopted by Mr. J. Kermode of the Cleveland Electric Illuminating Company is to be recommended. Miniature furniture carved out of wood to the same scale as the architect's plans is provided so that beds, dressers, chairs and tables can be ranged in the room under consideration just as they would probably be after the house is finished. In this way both the engineer and the owner can see what is wanted much more quickly than by attempting to picture the situation mentally and measure up the available spaces with a rule. The reasons for adopting the plans as shown can best be seen by considering each room briefly.

Porch.—One light was placed in front of the door to light the doorway and steps. Inasmuch as the porch would probably be used in the evening another light was desirable and placed at the other end. These lights are controlled by separate switches so that only one need be turned on. A ball globe with directing prisms was specified because of its handsome appearance and its ability to throw the light strongly downward, although reflectors would have given a greater amount of downward light. In case it is desired to read on the porch, 16-cp lamps are necessary, otherwise 8 or 4-cp would suffice.

Front Hall.—The lights in the front hall or reception room were placed on three separate circuits. One light which can be used as a night light, is controlled both from a 3-way switch placed close to the entrance and by another 3-way switch upstairs. Lights *A* were placed on another switch and lights *B* on a third switch. With these three switches it is therefore possible to get a number of combinations of light, and the arrangement is such as not to interfere with the symmetry and artistic effect of the lighting when they are not all turned on. The gas bracket in this hall has a globe which will throw the maximum light sidewise so as to light as much as possible the entire hall.

Living Room.—As this room was large, two chandeliers were used, equipped with cut glass prism balls hanging straight down so as to throw the maximum light on a table or on the book of a person sitting underneath.

Billiard Room.—In order to provide first, uniform table illumination of sufficient strength; second, avoid shadows which are unavoidable when the light is concentrated over the middle of the third table; third, keep the light as much as possible out of the eyes of the players to prevent blinding; fourth, provide sufficient general light in the room to make it possible to count the string easily and, fifth, keep the glassware out of the way

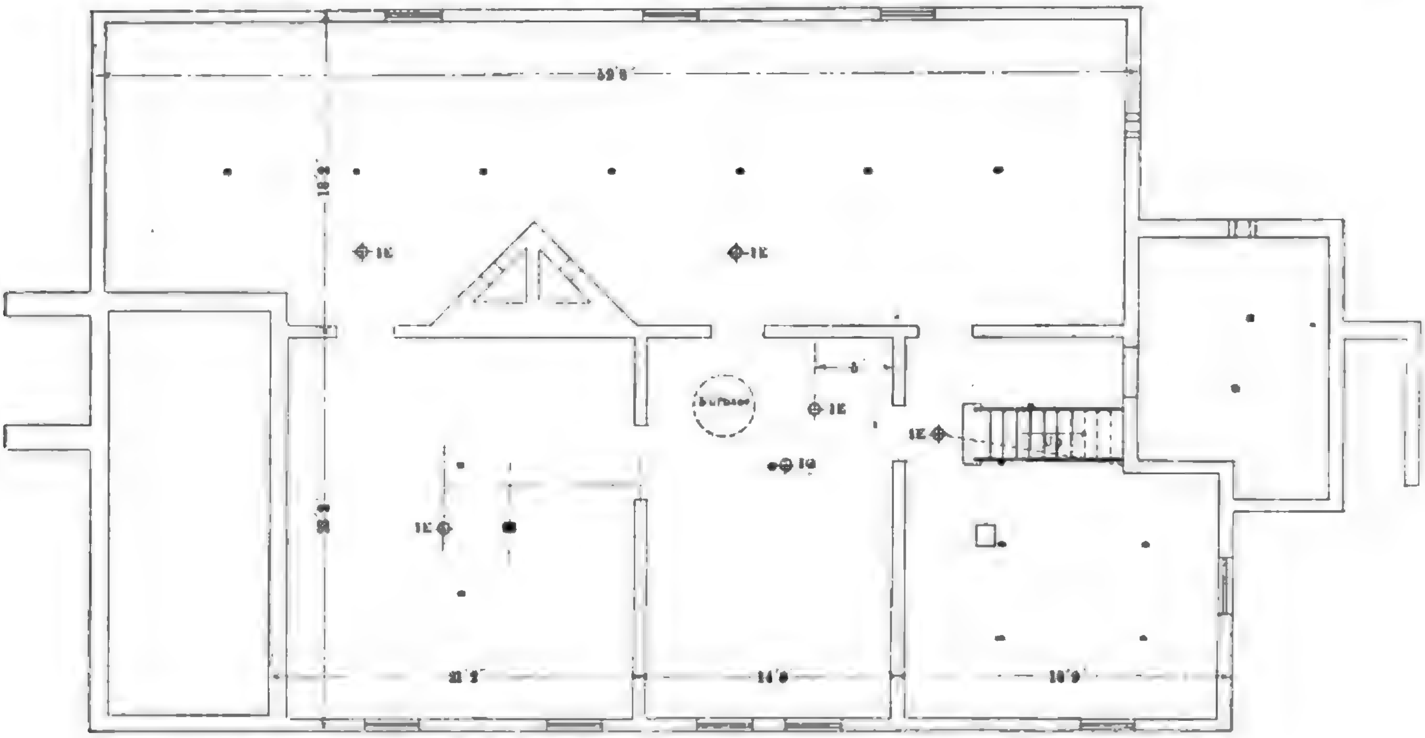


Fig. 2.—Plan of Cellar.

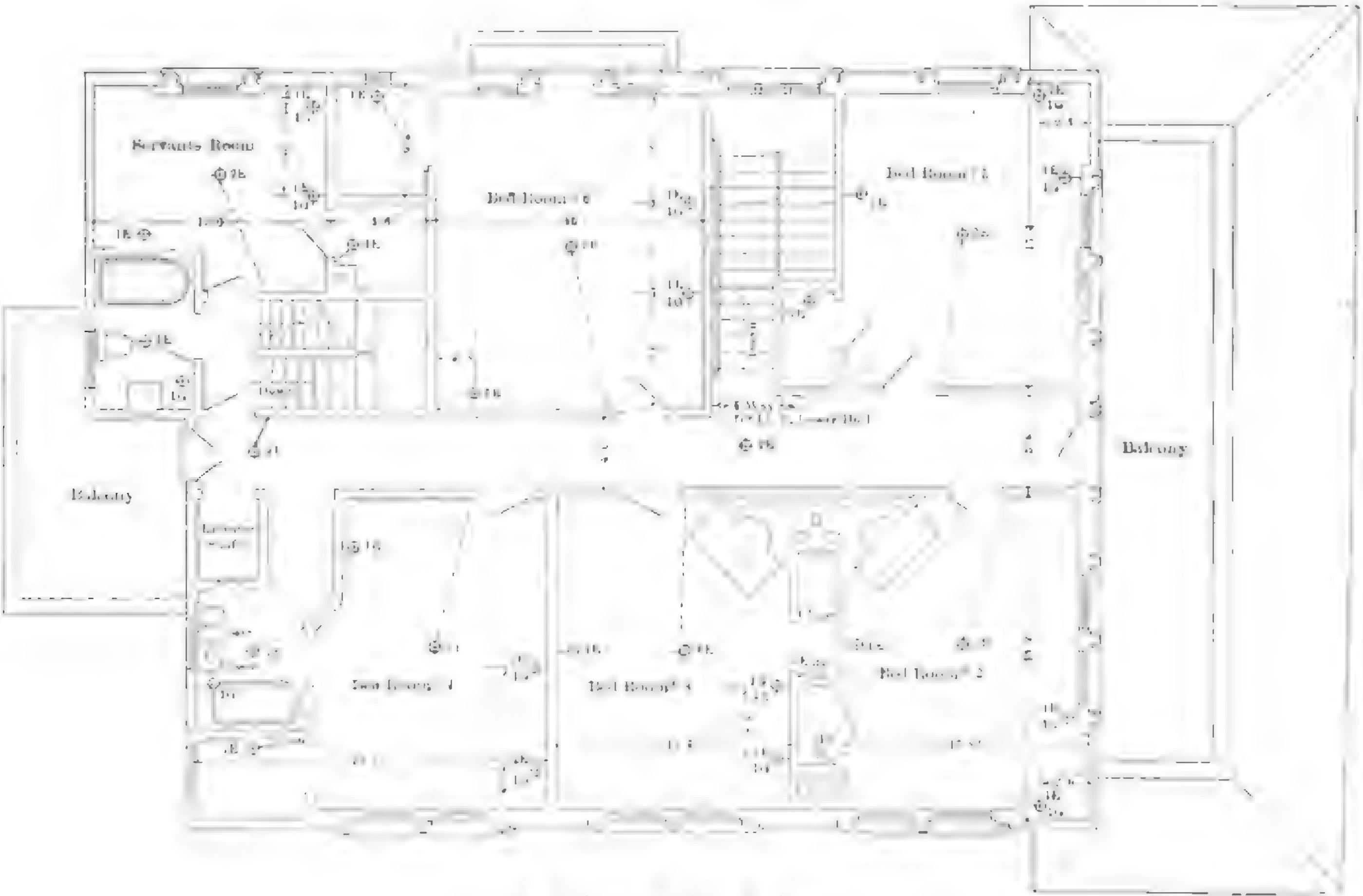


Fig. 3.—Plan of Second Floor

where it will not be easily broken, the arrangement of the five lamps over the table is indicated in sketch No. 5, was decided upon; the dimensions on the sketch being those found by experience in billiard rooms to give satisfaction. The bed of a billiard

Location.	No fixt.	Lights per fixt., gas	Lights per fixt., elec.	Ht. outlet.	Ht. socket.	Style socket.	Sketch No.	Diam. holders.	Cp. of lamps.	Remarks.
Basement.										
Stairway room	1	..	1	Ceiling	Ceiling	Keyless	..	2 ¼-in.	16	
Furnace room	1	1	..	5 ft.	..	..	..	..	1 5-ft. tip.	
Furnace room	1	..	1	Ceiling	5 ft. 6 in.	Key	Drop cord	2 ¼-in.	1 16-cp.	Cord adjuster.
Front room	1	..	1	Ceiling	5 ft. 6 in.	Key	Drop cord	2 ¼-in.	1 16-cp.	Cord adjuster.
Ash pit	2	..	1	Ceiling	5 ft. 6 in.	Key	Drop cord	2 ¼-in.	2 16-cp.	Cord adjuster.
First Floor.										
Front porch	2	..	1	Ceiling	Ceiling	Keyless	4	3 ⅜-in.	2 16-cp.	
Front hall	9	..	1	Ceiling	Ceiling	Keyless	4	3 ¼-in.	9 8-cp.	
Front hall	1	1	..	5 ft. 6 in.	..	..	..	4-in.	10-ft. tip.	
Hall closet	1	..	1	5 ft. 6 in.	..	Key	6	2 ¼-in.	1 4-cp.	
Living room	2	..	3	Ceiling	6 ft. 9 in.	Keyless	Selected	3 ¼-in.	6 16-cp.	Lights to hang straight down.
Living room	3	1	..	5 ft. 6 in.	..	..	Selected	4-in.	5-ft. tips.	
Billiard room	1	1	..	5 ft. 6 in.	..	..	Selected	4-in.	5-ft. tips.	
Billiard room	1	..	5	Ceiling	7 ft.	Key	5	2 ¼-in.	5 16 cp.	
Bed room No. 1...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	6 ft.	..	Pull 18-in. chain	2	1 ⅝-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 ⅝-in.	1 4-cp.	Angle to be 30° instead of 20°.
Bed room bath.....	1	..	1	Ceiling	8 ft.	Keyless	9	2 ¼-in.	1 4-cp.	
Hall	1	..	2	Ceiling	8 ft.	Keyless	8	1 ⅝-in.	2 8-cp.	Hung up and down and not across the hall.
Screen porch	1	..	1	Ceiling	8 ft.	Keyless	Selected	2 ⅝-in.	1 8-cp.	Hangs straight down.
Screen closet	1	..	1	5 ft. 6 in.	..	Key	6	2 ¼-in.	1 4-cp.	
Kitchen centre	1	..	1	Ceiling	Ceiling	Keyless	..	2 ¼-in.	1 16-cp.	
Kitchen on sink....	1	..	1	Ceiling	Ceiling	Key	9	2 ¼-in.	1 4-cp.	
Kitchen side	1	1	..	5 ft. 6 in.	..	..	..	..	5-ft. tip.	
Pantry	1	..	1	Ceiling	6 ft. 6 in.	Pull	9	2 ¼-in.	1 8-cp.	
Dining room	1	..	5	Ceiling	..	Keyless	3	{1 ⅝-in. {2 ¼-in.	4 8-cp. 1 16-cp.	Round frosted. Frosted.
Dining room	2	1	..	5 ft. 6 in.	..	..	..	4-in.	5-ft. tips.	
Second Floor.										
Bed room No. 2...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 ⅝-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 ⅝-in.	1 4-cp.	30° instead of 20°.
Bed room No. 3....	1	..	3	Ceiling	8 ft	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 ⅝-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼ in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 ⅝-in.	1 4-cp.	30° instead of 20°.
Bed room No. 4...	1	..	3	Ceiling	8 ft	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1		1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 ⅝-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 ⅝-in.	1 4-cp.	30° instead of 20°.
Bed room No. 5...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	6 ft. 3 in.	..	Pull 18-in. chain	2	1 ⅝-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 ⅝-in.	1 4-cp.	30° instead of 20°.
Bed room No. 6....	1	..	3	Ceiling	8 ft.	Keyless	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 ⅝-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼ in.	2 8-cp.	
Bed room closet ..	1	..	1	7 ft. 6 in.	..	Keyless	2	1 ⅝-in.	1 4-cp.	30° instead of 20°.
Servant's room	1	..	2	Ceiling	8 ft.	Key	7	2 ¼-in.	2 8-cp.	
Servant's room	1	..	1	5 ft. 6 in.	..	Pull 12 in. chain	2	1 ⅝-in.	1 4-cp.	
Servant's room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼ in	2 8-cp.	
Servant's closet ...	1	..	1	Ceiling	7 ft.	Keyless	9	2 ¼ in.	1 4-cp.	
Servant's bath	1	..	1	Ceiling	8 ft.	Keyless	9	2 ¼-in	1 4-cp.	
Servant's bath	1	1	..	5 ft. 6 in.	..	..	..	..	..	
Main bath	1	..	1	Ceiling	8 ft.	Keyless	9	2 ¼-in.	1 4 cp.	
Main bath	1	1	..	5 ft. 6 in.	..	..	9	..	..	
Hall front	1	..	2	Ceiling	8 ft.	Keyless	8	1 ⅝-in.	2 8-cp.	Hangs up and down and not across the hall.
Hall rear	1	..	1	Ceiling	8 ft.	Keyless	9	3 ¼-in.	1 4-cp.	
Attic.										
Ceiling	1	..	1	Ceiling	8 ft.	Keyless	Drop cord	2 ¼-in.	1 32-cp.	
Between windows..	2	..	1	about 3 ft.	..	Key wall socket	..	..	..	

SUMMARY.

25 gas outlets.
[illegible] electric outlets.
98 sockets for 97 lamps.

21	4-cp standard lamps.
4	8-cp round frosted.
1	16-cp frosted.
19	16-cp standard.
1	32-cp standard.
51	8-cp standard.
97	Total

NOTE.—Basement and attic lights will be supplied complete by wiring contractor.

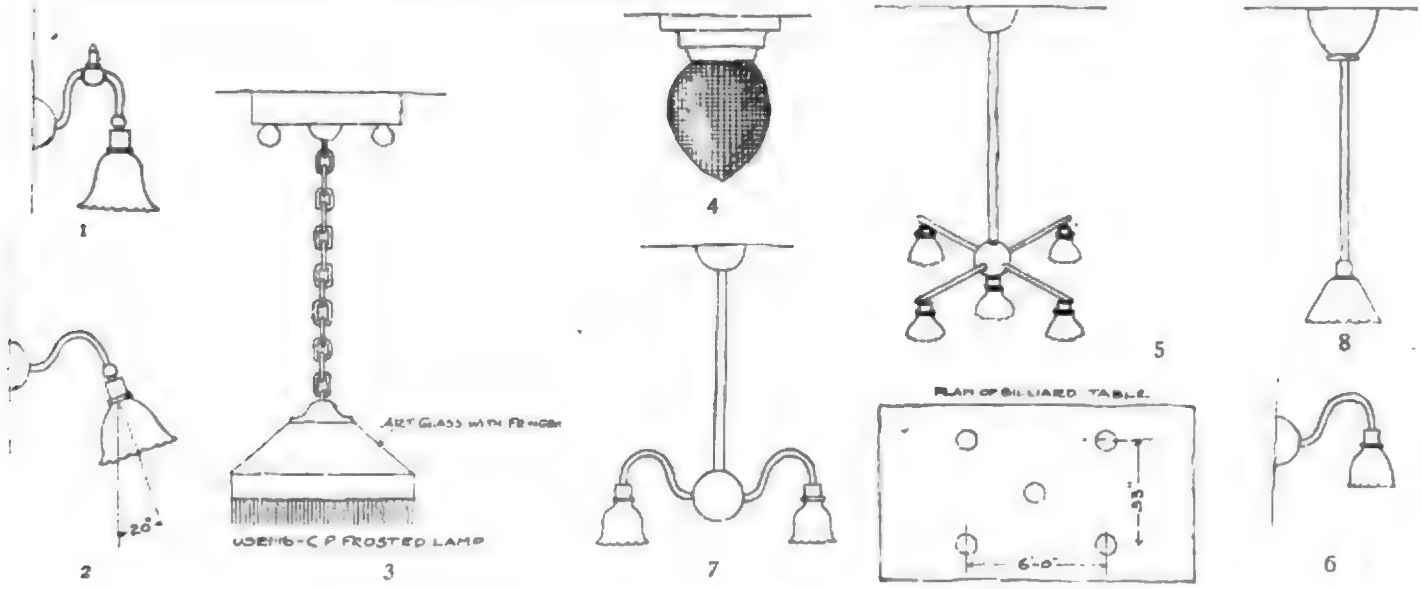


FIG. 4.—SKETCHES OF CHANDELIERS, BRACKETS, ETC.

table is generally 31 inches above the floor and if the lights are from 7 to 4 feet above the bed of the table the results will be satisfactory. Generally speaking, the lights when using the shades specified (give an even distribution of illumination over an area 45 deg. each way from the vertical) should be for a 5 x 10 ft. table 6½ ft. apart lengthwise and 3 ft. apart sidewise. For a 4½ x 9-ft. table they should be 6 ft. lengthwise and 33 inches sidewise. In both cases the sockets should hang 7 ft. from the floor which would bring the reflector about 4½ ft. from the bed of the table.

Bed Room.—The bed rooms were all treated practically alike. The general illumination is given by a 3-light chandelier placed in the center of the ceiling, 8 ft. above the floor. The lights are pointed downward and provided with a rather concentrating form of reflector with 8-cp lamps, which gives a good light throughout the room and provides sufficient concentrated illumination for writing and reading directly underneath. With very dark walls this candle-power might have to be increased somewhat. With light walls it is ample. A bracket is provided on each side of the dresser, the brackets being placed 5 ft. apart and equipped with glassware designed to throw the light on a person standing in front of the mirror. With the form of chandelier used (which is close to the ceiling), sufficient light is thrown on the top of a person's head to light the hair and make unnecessary a bracket or pendant light over the top of the dresser, otherwise such a light would be advisable. Over the head of the bed is provided a 4-cp lamp in a concentrating reflector with a chain socket to provide for reading in bed and for a light of easy access for one awakening in the night. Gas is provided in each room simply for use in case of breakdown to the electric service, which unfortunately is all too common in that city, owing to the tremendous expansion of the business.

Center Halls.—The center halls were lighted by 2-light chandeliers with lamps pointing lengthwise of the hall and provided with concentrating reflectors at such an angle (Fig. 5) as to light the ends of the hall.

Bath Rooms.—A 4-cp lamp placed in a prismatic reflector upon the ceiling is all that is necessary unless the room is used for shaving. In the latter case two 4-cp frosted lamps placed one on each side of the mirror are sufficient.

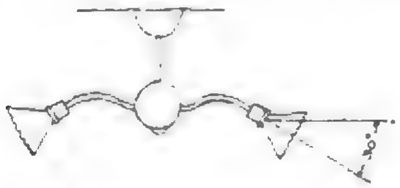


FIG. 5.—CENTER HALL CHANDELIER.

Kitchen.—One lamp was placed in the center of the ceiling of the kitchen for the general lighting of the room. The reflector chosen, No. 7381, lights evenly the entire lower portion of the room. A lamp was placed in a bracket over the sink to give a strong light where most needed in dish washing.

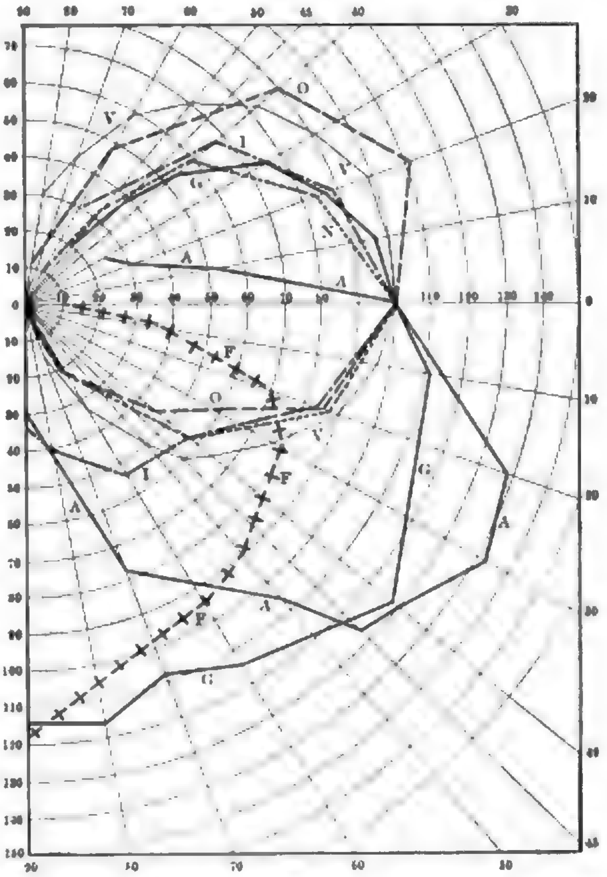
Dining Room.—The principal lighting of the table is by an art glass dome in which is a lamp pointing straight down and equipped with a prismatic reflector of a type which will light the whole top of the table evenly and allow some to go through the art glass for decorative purposes. The general lighting of the room is by means of round frosted lamps at the ceiling as indicated in Sketch 3. These notes, in connection with the plans and sketches will enable the reader to make a thorough study of the methods and reasons for arrangements adopted.

It is of interest to note the candle-power of the lamps actually used after a study of the lighting effects had been made upon the completion of the house. In this house the changes made in the schedule were as follows:

In the basement and attic all the lamps were changed to 8-cp, for general illumination; special illumination being taken care of by an extension plug and lamp on portable cord. As the porch is not used for reading, the lamps were changed from 16 to 8-cp. In the living room a special form of fixture being adopted, the number of lamps of 16-cp was increased from 6 to 8. In the halls, as the walls and ceiling were light 4-cp instead of 8-cp lamps proved ample. In the kitchen the candle-power of the lamp over the sink was increased from 4 to 8 cp.

Comparative Distribution of Light from Various Illuminating Sources.

The accompanying curves showing comparatively the distribution of light from various sources of illumination, formed part of a paper printed in a German gas journal, the author being Prof. H. Drehschmidt, of Berlin. The measurements were made by means of an arrangement due to Schmidt and Haensch, employing a mirror attached to a jointed parallelogram whereby the light at any angle is directed horizontally for photometric measurement. For comparative purposes the horizontal intensity is 100 hefners for each source.



DISTRIBUTION OF LIGHT FROM VARIOUS ILLUMINATING SOURCES.

Of the several curves *W* is that of the ordinary Welsbach lamp, *O* that of the osmium lamp, *N* that of the Nernst lamp, *A* that of the electric arc, *I* that of the electric incandescent carbon filament lamp, *F* that of the electric flaming arc and G that of an inverted incandescent gas burner.

Commenting on these curves, Prof. Drehschmidt says that of the sources *I*, *O* and *N* (with vertical magnesia rod) send about as much light upwards as downwards. The electric flaming arc, *F*, though it sends all its light downwards, gives very poor lateral illumination and strongly illuminates only a limited region below the lamp. The electric arc, *A*, is best at about 30° below the horizontal, but is pretty poor immediately beneath. The distribution of light by the inverted gas incandescent lamp is materially better than the distribution from the other sources as indicated by the curves plotted.

The Design of a Small Central Station.—II.

By James F. Hobart.

ENGINE, PULLEY AND BELT.

When selecting an engine for any given duty, the principal things to be considered are that the engine pulley is of sufficient width of face and diameter to give the necessary belt surface for transmitting the required amount of power; the proper location of the engine in regard to the power distribution, and the direction of rotation of engine in order to avoid the use of crossed belts and to secure proper belt lengths. In order to secure a belt surface, it is absolutely necessary that the belt have sufficient width and velocity to pull the load without too great a tension to the inch of width. The catalogues of more than one reputable manufacturer of transmission machinery, in their tables of "horse-power of pulleys" assume as a base in the calculations 88 pounds pull to the inch of width of double belts, and 66 pounds to the inch for single belts of leather. A power transmission based upon these figures will do the work expected, but the belt will not have the lasting qualities which are desirable in a transmission of this kind. The belt which is operated under 88 pounds working strain will be in constant need of belt dressing, repairs and other attention; hence it is in order to "use wider belts and larger pulleys." The above statement is constantly met with in engineering books, and engineers preach it about every time one of them talks about belting, but it does not seem that many of the eminent writers and talkers have placed themselves on record as to what working strain should be permitted in any belt.

The working strain for double belts which will give universal satisfaction, with little or no cost of repairs, is forty pounds pull to the inch of belt width. Single belts are not considered as they should never be used in power work where any considerable quantity of power is to be transmitted for the reason that it does not pay to bother with light belts or with the "single belt" pulleys which are supposed to be furnished for single belts to run upon. Specify double-belt pulleys and use double belts upon them and give a working pull of 40 pounds to the inch of belt width and the transmission thus arranged will never give trouble and the belts will never slip.

Let this working pull be applied to the engine belt of the factory under consideration. The engine pulley is eight feet in diameter and the engine speed is 130 r.p.m. What should be the width of the belt to deliver 100 hp to the main shaft? With a pulley diameter of 8 feet, the belt speed at 130 r.p.m. would be 3,267 feet per minute. A hp of 100 would require a force of 3,300,000 foot pounds to the minute, or a pull of 1,010 pounds on the belt. Giving a working strain of 40 pounds to the inch of width, the belt should be 25¼ inches wide to meet the requirements. As the belt actually used is only 16 inches wide, the pull to the inch of width must necessarily be 63⅛ pounds to the inch.

The working pull given above is not at all bad as engine power transmissions go, but it would be desirable to increase the diameter of the engine pulley to 10 feet in order to attain a belt speed of about 4,000 feet to the minute (4,080.3 feet) which would call for a belt width of 20.22 inches for a total pull of 808.8 pounds. Twenty inches of belt width on a pulley 10 feet in diameter would be the ideal drive for the engine in question.

From the main shaft it was necessary to take power in three portions, somewhat as shown by Fig. 1, the illustration representing in plan and elevation (not to scale) the distribution strains which had to be resisted by the timbering upon which the shafting was placed. The pull upon the engine belt is given on the elevation drawing. It is 1,010 pounds on the angle made by the belt. Reducing the pull of the belt, or more strictly speaking, resolving it into horizontal and vertical fractions or components, it is found that the horizontal pull to be resisted by the journal supports is about 877 pounds. But there is another strain to be taken into account—that of the belt due to its weight, which includes the strain of the belt due to the tightness with which it is placed upon the pulleys.

The working strain of any belt is something entirely separate from the pressure horizontally upon the journals due to the power pull (torque) of the belt. When the belt is placed upon its pulleys (assumed to be both in the same horizontal plane), the strain due to the tightness of the belt is due entirely to the weight of the belt to the running foot, the distance apart of the pulleys and the flatness of the inverted arch or catenary formed by the suspended belt between the pulleys. This is easily calculated by the formula pertaining to the catenary, provided the weight of the belting is known and the deflection of the belt has been measured. When the belt is at rest both folds are under equal strain, but when the belt is in motion the working fold flattens its catenary while the idle or return fold of the belt increases its catenary, or drop.

Rather than figure the strain caused by each and every belt, the writer has adopted the "rule of thumb" method of assuming the strain on the working fold of the belt to be 88 pounds to the inch of width, and the strain on the idle or return fold to be 44 pounds to the inch, making a total of 132 pounds pull to the inch of belt width to be sustained by the journal bearing supports. In other words, if the belt and its shafting and pulleys were carried on the tops of piers, there would be a force of 132 pounds to the inch of belt, tending to tip over the piers in question.

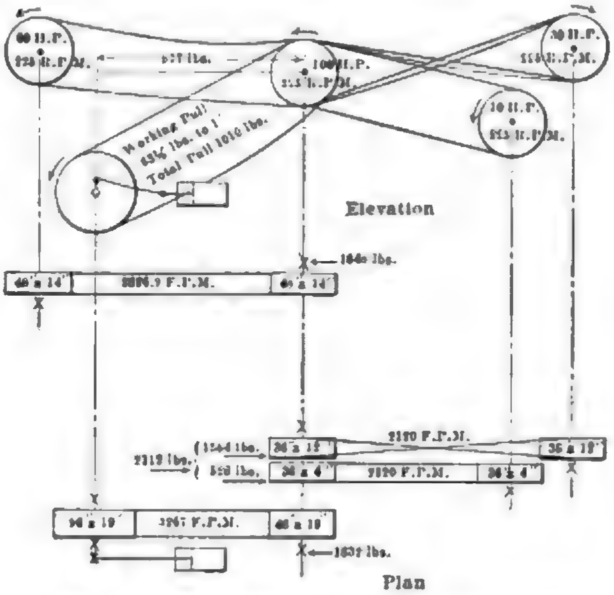


FIG. 1.—JOURNAL STRAINS IN POWER DISTRIBUTION.

The 16-inch engine belt, then, instead of pulling 1,010 pounds toward the engine, should be regarded as pulling 2,112 pounds and its horizontal component will be taken as 1,832 pounds instead of the 877 shown on the elevation in Fig. 1. The arrow at the bearing near pulley from engine (on plan, Fig. 1) indicates the direction of the force of 1,832 pounds acting at that point. The belt on the 48-inch by 14-inch pulleys has a velocity of 2,826.9 feet per minute, and its pull when handling 60 hp would be about 50 pounds to the inch of belt width. Assuming this belt to have a pull of 132 pounds on each of its 14 inches, the total strain on the bearing at that pulley would be 1,848 pounds, as indicated at the direction arrow at the pulley in question.

The two 36-inch pulleys remain to be figured. The belt speed over these will be 2,120 feet per minute, and the pull will be 467 and 156 pounds respectively. Applying the "rule of thumb" gives a pull of 1,584 and 525 pounds respectively on a 12-inch and a 4-inch belt, a total pull of 2,112 pounds to be sustained by the bearing close to the two pulleys. It is true that some of the pull of the engine belt and the 12-inch and 4-inch belts will be carried or neutralized by the belts pulling in the opposite direction, but no account is taken thereof, save to let it go toward a small factor of safety when designing a pier to carry the middle bearing of the shaft, as shown diagrammatically by Fig. 2.

SHAFT BEARING PIERS.

It was necessary that the shaft be located 16 feet from the ground or floor line, and a masonry pier could not be used on account of the cost of brick; therefore a timber trestle was constructed as shown by the illustration, the native long-leaf yellow pine being used. This material weighs five pounds to the superficial foot, one inch in thickness; therefore the timber weighs about 60 pounds to the cubic foot. The pull at the top of the pier, 16 feet from the floor line, has been shown to be 2,112 pounds. The frame work, exclusive of the sills, weighs about 1,940 pounds and its moment about the bottom of the right hand end of the sill is about 9,700 pounds. The sill and the foundation proper, which is 12 inches deep, weighs 2,512 pounds, and its moment at the point indicated above (at the end of a 5-foot lever arm) is approximately 10,048 foot-pounds.

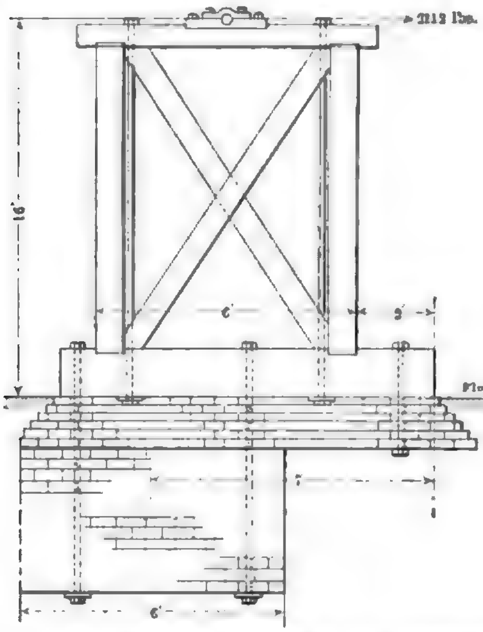


FIG. 2.—WEIGHTING A SHAFT BEARING FOUNDATION.

The moment of inertia of the shaft about the same point with the radius of gyration of 16 feet is about 33,792 foot-pounds, whereas the timber work and foundation possess only about 19,748 foot-pounds resistance. The trestle would, therefore, tip over, or at least its left-hand side would be lifted from the ground by the pull of the belts.

To prevent the tipping of the trestle, a section of brickwork was built under one end of the trestle as shown by Fig. 2. To find the number of brick necessary for this sub-foundation it was assumed that the center of gravity of the sub-foundation fell in a vertical plane 7 feet from the right-hand end of the trestle sill; hence dividing 7 into the deficiency above noted (13,944 pounds), it is found that 1,992 pounds should be added as shown by Fig. 2, in order that the pull of the belts could be balanced. A factor of safety of at least 3 should be employed in cases of this kind, which gives 5,976 pounds to be added to the foundation. As 1,000 bricks are supposed to weight 4,000 pounds, it would require about 1,500 bricks to make the foundation heavy enough to withstand safely the pull of the two belts, 4 inches and 12 inches wide, respectively.

To connect the timber work with the brick foundation, three anchor bolts were inserted as shown by the drawing. The sill was dropped over the tops of the foundation bolts, which were previously set by means of a templet, and the sill was bored in accordance with the same templet. The 16-foot rods were also put in place before the sill was placed upon the foundation prepared for it. The trestle has proved itself ample for the work it has to do, and as yet it has not shown any indication of failure. The supports at either end of the shaft were carried by timbers framed between posts, both the top and bottom of which could be securely fastened so that no weighted base was necessary.

SHAFT BEARINGS.

There is another point which goes far toward making a well-running power transmission, and that is the kind of journal bearings used. In all heavy transmissions, and in all light ones, too, whenever possible, avoid the use of the drop hanger. Use the pillow block and there will be no trouble with the shafting. The first choice is the self-adjusting, ring or chain self-oiling pillow block, but good service may be derived from the wick oiling pillow blocks if the management will not stand the slight additional expense of ring or chain oilers. Even plain "rigid flat boxes" are preferable to drop hangers, and if the boxes are carefully set in place and fitted to the timbers upon which they rest, and fitted with self-feeding lubricators, they may be depended upon to stay where put for a long time to come.

The post-hanger may be sparingly used, but it is about as well to use flat boxes for post work also, the lubricators above mentioned taking care of the bearings in a most perfect manner. Fig. 3 is a sketch of one of the lubricators as applied to a flat box used as a post hanger. The device consists of a brass shell, pipe-threaded into the metal of the box-cap. These lubricators are made to fit 3/8-inch, 1/2-inch and 5/8-inch pipe threads. The lubricant comes in the form of little solid cylinders about three diameters in length. To apply to a new bearing, first fill the journal thoroughly with oil, then pull back the spring in the lubricator by means of the projecting wire. In Fig. 3, *A* indicates the common flat box which is to be used as a post hanger; *B* represents the lubricator shell; *C* the stem above described by means of which the helical spring inside the lubricator is compressed for the insertion of one of the grease candles, *D*.

When the lubricator is first attached, two of these candles should be inserted, as one of them is well used up in filling the passage to the shaft. After once filled, the oiler need never touch the lubricator until he sees by the position of the wire, *C*, that the candle of lubricating material has melted and been forced into the bearing. In Fig. 3 is also shown the proper method of hanging a flat box when it is to be used as a post hanger. The box, *A*, is bolted to the post, *E*, and further supported by means of the board or plank, *F*, which is fastened securely to the post by means of spikes, lag-screws or bolts as occasion may demand.

It will not do very well to use a self-oiling pillow block of the chain or ring oiling type as above directed, although some forms of capillary boxes work very well in the position shown by Fig. 3. Such boxes will work as post hangers when the shape of the oil reservoir is such that it will still hold some lubricant with the box set on end as shown. To be sure, ring-oiling boxes can be used as post-hangers if the reservoir business be dispensed with and the automatic lubricators used with

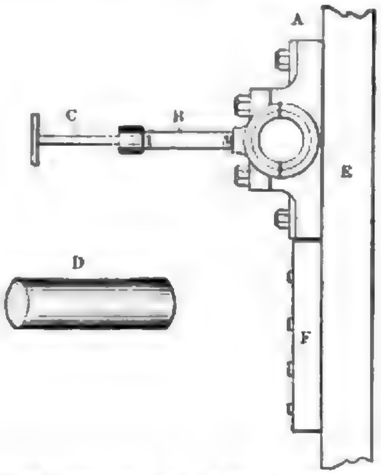


FIG. 3.—FLAT BOX ARRANGED AS A POST HANGER WITH POSITIVE LUBRICATOR.

them as in Fig. 3; but this makes a rather expensive arrangement and should be resorted to only in order to get out of some difficulty, such as shortage of proper boxes, wrongly selected material, or changes from original design, which, by the way, are sometimes quite necessary in the field, and which cannot well be done without ordering other bearings. In such cases the expedients above noted and described will be very welcome to the engineer who, in order to, produce results, must make changes quickly and as best he may. He can talk with the office about it afterwards.

The flat boxes work very well "stood up," and if a good tight liner is well fitted between box and cap below the shaft, the oil will not give trouble by running out under the cap. For very heavy work, the boxes may be let into the post from ½ inch to 1½ inches, according to size of box, instead of using the piece fastened on as at *F*, Fig. 3. This is the usual practice for shafts 2 7/16 inches and greater, in diameter. Where adjustment is wanted, the cut for the box may be made long enough to include a wedge or taper key at the end of the box, the wedge or key to be slotted and fastened by means of a lag-screw. The wedge may also be used with the fastened-on piece, *F*, Fig. 3; but wedge adjustments are seldom necessary with shafts less in diameter than the figure given above.

It is frequently desirable to substitute the rigid flat box or the self-oiling, self-adjusting pillow block for a drop hanger, and Fig. 4 shows a good way of accomplishing it. Two short blocks are let into the lower side of the timber from which the shaft is to be suspended, as at *A* and *B*. Another short piece of timber, *C*, is also boxed on to the blocks, *A* and *B*, and a bolt is put through both timbers, as shown close to the blocks, *A* and *B*. It is then an easy matter to place the boxes or pillow blocks each as shown by Fig. 4. The depth of blocks, *A* and *B*, and the length of timber, *C*, may be according to circumstances.

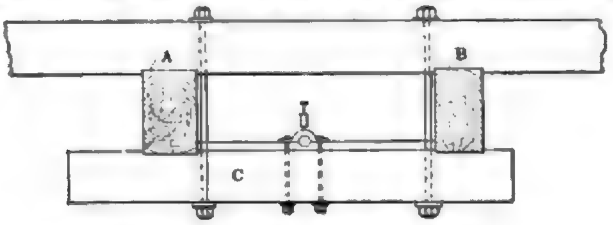


FIG. 4.—FLAT BOX USED AS DROP HANGER.

The depth of the blocks, *A* and *B*, need be only sufficient to allow the application of the lubricator as shown by the engraving. Their distance apart can well be made longer than is necessary for operating a wrench on the box bolts, for a little room on either side of a journal bearing never yet came amiss.

There is usually a hole through the bottom of every flat box, and it is frequently in order to take advantage of the fact by inverting the box, as shown by Fig. 5. To do this trick, the hole in the bottom of the box, which is usually filled with babbitt metal, is drilled out and tapped to fit a ½-inch or ⅝-in. pipe, a piece of which, long enough to pass through the timber, is screwed into the box as shown. A coupling is placed on the upper end of the pipe and one of the automatic lubricators is screwed into the coupling. The box, let into the bottom of the timber, or held by two boards fastened on, makes a very neat arrangement for hanging a shaft close to the under side of a timber. A factory recently erected by the writer did not contain a single journal bearing except rigid flat boxes. The larger sizes were wick-oiling (capillary), but they all were rigid, and without even the pretence of adjustability. These boxes were all carefully set, level and in good alignment, and a nicer running lot of shafting never was started up. Not a bearing had to be changed. Every belt ran as true as a die, and there was no trouble with belts running off one side of its pulley.

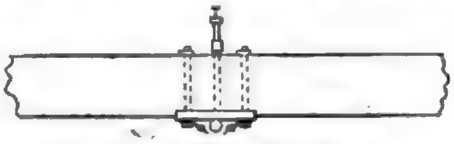


FIG. 5.—INVERTED FLAT BOX.

It is a lamentable fact that the selection of belting is usually governed almost entirely by the cost of the several varieties and kinds of belting. There are certain places where leather, rubber and stitched cotton belts each are preferable, but the man who frequently has the selection of belting, purchases one kind right through, for each and every imaginable kind of service. Thus, cotton belts may be selected for all the main drives except the engine. When this is the case, use belt tighteners freely. They will save valuable time which otherwise will be spent in taking up belts, not once, but many times.

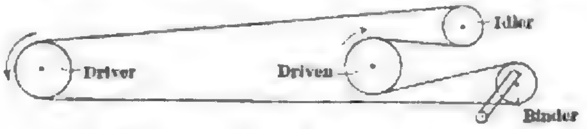


FIG. 6.—GETTING RID OF CROSSED BELT.

Fig. 1 shows one of the main belts crossed and a 14-inch belt at that. This was in accordance with the designs furnished, but the writer dispensed with the crossing of the belt by adding two idle pulleys, arranged as in Fig. 6, one of the new pulleys also doing duty as a tightener. This arrangement worked perfectly, and proved an excellent investment as regards extending the life of the belt to which the scheme was applied. The arrangement is so clearly shown by the engraving that no further description is necessary.

New Methods in the Care of Brush Arc Generator Commutators.

By C. M. Green.

THE number of Brush arc generators now in use and the importance of the condition of the commutator to the operation of this machine makes new and better methods in the care of the commutator well worth attention.

The present style of three-finger pressure and two thin leaf brushes used together as one brush has a much lighter bearing against the commutator, and consequently wears it less, giving at the same time a better contact than the old solid three-finger type. If, then, the commutator receives attention for a few minutes each day just before the generator is shut down, it will wear till the copper tips of the wood blocks are almost worn through, the best record being, so far as known, three years and six weeks without renewal, and sixty-three days at ten hours a day without resetting the brushes. However, when new wood blocks or insulating segments are necessary, they are sometimes too high, owing to the worn condition of the copper segments.

The segments may be taken down in the following manner: First, remove the brushes; see that the cover is on the regulator to keep out the dust, put over the regulator and rheostat a cover of carriage cloth, a similar cover being provided for the operator. A flat wood rasp should be held as shown in the illustration, one end being held firmly against the brush holder stud, while the other is brought down until it makes a light cut, only the high parts being touched till the entire ring is cut to a uniform diameter. All of the rings should have finally the same diameter. This should be followed by sandpapering as shown in the second illustration.

Wrap a piece of No. 3 flint paper about a piece of hard wood sixteen inches by 1¾ inches square. If the commutator has four rings, use sheets 16 in. by 9 while if it has three rings, use sheets 11 in. by 9. Working in succession all sides of the block and moving it lengthwise will use up economically the entire sheet. Pressure on the ends of the stick should be equal, else the rings will be cut unequally; also the entire number of rings on the commutator should be sandpapered at the same time, except when removing the wire edges, at the finish. To disregard these points is likely to ruin the segments and blocks. Next, test all the segments and blocks carefully with a straight edge to see if they line up. Finish the commutator with No. 2-0 flint paper. Finally spread a little oil across the flint paper that you have been using and apply it to the commutator; it will remove the particles of dust, giving sufficient lubrication and polish.

The commutator of a machine in commercial use should be put in first-class condition at the end of each run, as soon as the current is shut off. A piece of No. 2-0 flint paper wrapped about a stick as previously described, should be applied to the commutator until the rings are bright and smooth. The brushes need not be removed. The machine should be cleaned immediately after it is stopped since five minutes at that time will give better results than half an hour when the machine is cold.

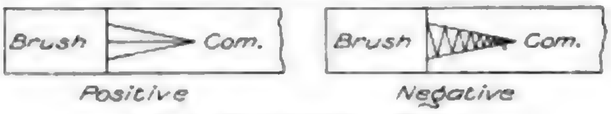


FIG. 1.—CHARACTERISTIC SPARKS.

The polarity of the Brush arc generator is readily seen by the sparks, the negative spark having a zigzag center while the positive spark has a straight center, as the diagrams in Fig. 1 show. The negative spark should be horizontal on the brush.

The setting of the brush-holder studs and brushes is given in the following paragraphs because of the influence it has on the proper running of the commutator, although the methods are not new.

The brush-holders must line up to a straight edge and their edges must be parallel to the centre line of the commutator, and the bearing surfaces of all the brush-holders must give the same angle with the commutator when tested with a gauge as shown in the diagram, Fig. 2.

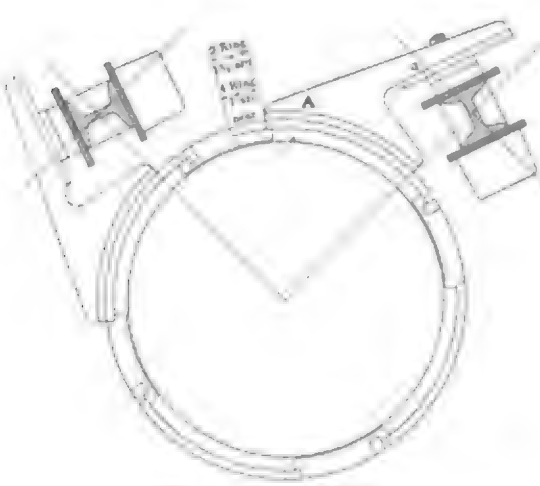


FIG. 2.—COMMUTATOR.

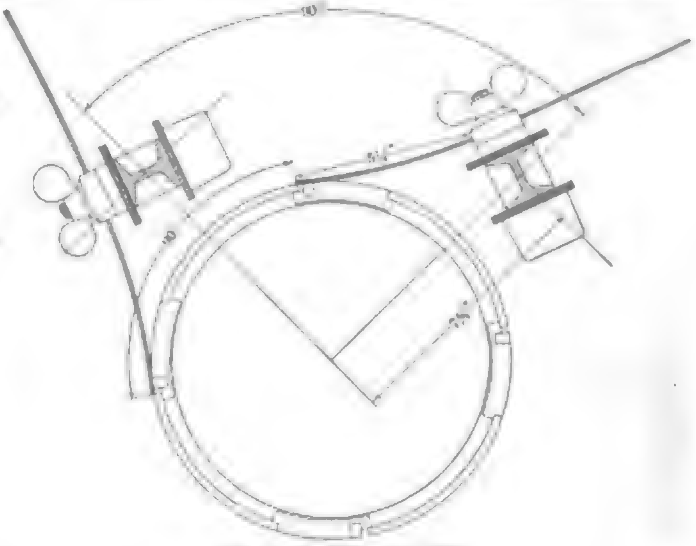
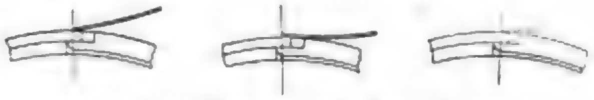


FIG. 3.—BRUSH SETTING.

Line up the brush-holders, using a wood block and hammer, if necessary. Remove the clamps, placing them so that each may readily be returned to the brush-holder from which it came. (These are not interchangeable.) Place the stud gauge on one of the inner brush-holders, sliding it along until it touches the commutator; turn the brush-holder stud till the gauge shows the slant of the brush-holder to be correct; move the rocker till the end of the gauge is even with the edge of a segment on the commutator, then clamp the rocker. Turn the other brush-holder stud till the gauge, sliding on the inner brush-holder, rests on the commutator, when the end of the gauge should reach to the edge of a break in the commutator 90° from its former position. Change the position of the arm if necessary with a hammer and wood block. Then adjust the studs parallel to the commutator by packing the shoulders of them with mica if necessary, or turning the mica washers, using the stud gauge on the inner and outer brush-holders. As the gauge slides along the brush-holder it should meet and fit the commutator exactly, the mark being at the edge of the brush-holder. Also examine the slant with respect to the commutator (by means of the gauge) of each brush-holder when the commutator and brush-holder are parallel, correcting them by packing mica beneath them so that they will all slant the same (Fig. 3).



FIGS. 4, 5 AND 6.—DIAGRAM OF BRUSH SETTINGS.

The brushes should be so arranged that the ends of the thin leaf brushes reach to the ends of the three-finger pressure brush yet do not overlap. The brushes should line up with the segments in an axial direction and should not overhang.

In setting the brushes, commence with the inner pair and set one brush 5 5/16 in. from the holder to the tip of the brush, then rotate the rocker or armature until the tip of the brush is exactly in line with the end of a copper segment. The other brush should be set on the corresponding segment 90° removed (the same relative position on the next segment forward) but if the length of the brush from the holder is less than 5 5/16 in. move both brushes forward until the length of the shorter one from the holder is 5 5/16 in. Now set the two outer brushes in the same manner, clamping them firmly in position and by using a straight edge or steel rule, all the brushes may be set in exactly the same line and firmly secured. If the spark on one of the brushes is a trifle longer than the others, move the brush forward a little so as to make the sparks all of the same length at full load. Equality of the spark lengths is desirable, but not absolutely essential; it gives at a glance an indication of the running condition of the machine.

Brushes should bear on the commutator from the end back from 1/8 to 1/4 of an inch, or in one case, Fig. 4, they will drop into the commutator slots and pound the copper tip of the wood blocks, causing the fingers of the brushes to break off. In the other case, Fig. 5, the brushes bearing too far from the ends, or being set too long, the point of the brush will not be in contact with the segment, thereby prolonging the break and allowing the spark to follow to the brush tip with consequent burning of both segments and brushes. Both of these faults, together with the brush set correctly, Fig. 6, are shown in the diagrams above.

FIG. 7.—FILING THE SEGMENTS.

Wiring With Flexible Conduit and Armored Cable.

By Louis J. Auerbacher.

THERE are two kinds of flexible conduit—fibrous and metallic. Two much-used makes of fibrous conduit on the market are known by the trade names "Circular Loom" and "Flexduct" and are illustrated by Figs. 1 and 2, respectively. Both of these fibrous conduits possess the same general characteristics; both are approved by the National Board of Fire Underwriters, and both conform to the following data:

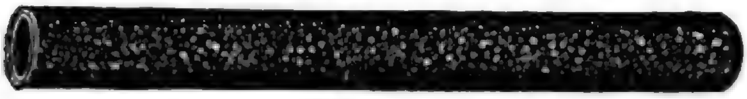


FIG. 1.—"CIRCULAR LOOM" FLEXIBLE FIBROUS CONDUIT.

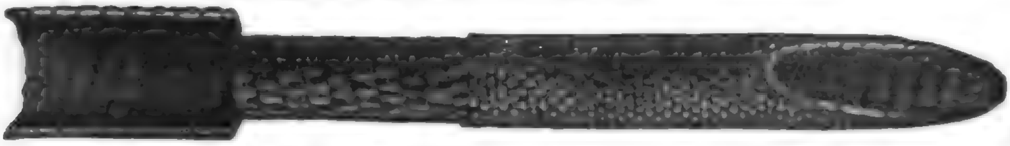


FIG. 2.——"FLEXDUCT" FLEXIBLE FIBROUS CONDUIT.

Inside Diameter.	Outside Diameter.	Feet per Coil.	Largest size of wire taken for easy pulling.
¼	11/32	250	No. 14 B. & S.
⅜	⅝	250	" 12 "
½	¾	200	" 8 "
⅝	⅞	200	" 4 "
¾	1 1/16	150	" 2 "
1	1⅜	100	" 00 "
1¼	1 11/16	100	200,000 c.m.
1½	2 1/16	...	400,000 "
1¾	2½	...	600,000 "
2	2¾	...	800,000 "
2¼	3	...	1,100,000 "
2½	3¼	...	1,300,000 "

In addition to being used for complete wiring installations, this type of flexible conduit is also very largely used in connection with moulding and exposed wire work as described in previous articles. Fibrous conduit must not, however, be used in damp places or in fire-proof buildings. Its particular field is finished frame buildings, where it can be easily fished from outlet to outlet. Fibrous conduit having an internal diameter less than ⅜ in. will not pass inspection, and when installing fibrous conduit it is best not to draw in the wires until the building is finished, so that any nails driven through the conduit will be located when the wires are being pulled in. On the other hand, if the wires were pulled in prior to the completion of the building, any nails piercing the conduit might easily cause trouble, if not actual damage. Duplex wires must not be used in fibrous conduit; single-braid, rubber-covered wire should be installed instead, double-braid wire not being required by the rules.

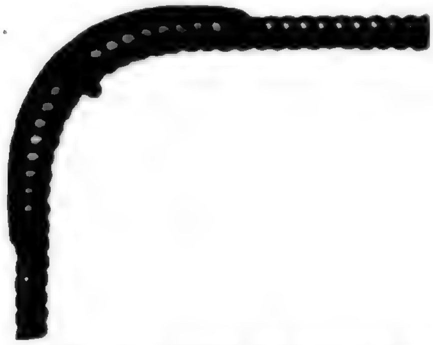


FIG. 6.—ELBOW CLAMP FOR FLEXIBLE METALLIC CONDUIT.

The "fishing" of conduits in finished houses constitutes one of the most difficult tasks of a wireman. The journeyman must be a good carpenter and mechanic as well as wireman to do a neat job. He must understand the construction of partitions, floors, casings, etc., and be an expert at taking up pockets. Where hardwood floors are encountered the taking up of pockets is rather difficult, since these must be relaid so as to make the opening inconspicuous.

A steel tape about ¼ in. wide and 50 ft. long known as a "snake" is employed for "fishing"; the ends being heated and turned over as shown in Fig. 3. It is oftentimes necessary to fish from two pockets so as to engage the end of one snake in the end of the other. A loop of twine is fastened to the end of one snake and the turned-in end of the other snake is opened slightly. The snakes are then worked toward each other and turned about until the ends engage, as indicated by Fig. 4, when one is pulled through from outlet to outlet and the tubing fastened to it for pulling in. For vertical fishing a chain is employed. This is fed in at the outlet until it reaches the floor, the sound made by it in striking the floor serving to indicate where the pocket should be taken up and the chain pulled through.

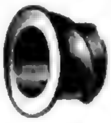
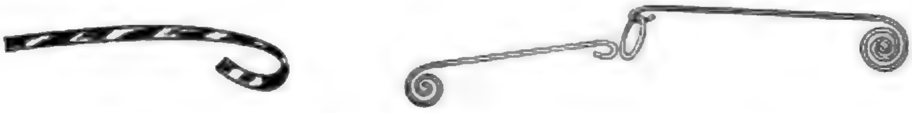


FIG. 7.—BUSHING FOR FLEXIBLE METALLIC CONDUIT.


FIGS. 3 AND 4.—STEEL "SNAKE" EMPLOYED FOR "FISHING" CONDUIT.

Folding door recesses are frequently used to bring circuits in. The doors may be taken out so as to give the wireman plenty of room, and the conduit should be well secured so as not to interfere with the sliding of the door. It is also well to locate switches at sliding doors for this reason. Iron outlet and switch boxes should be used in connection with fibrous conduit. It is not necessary to have the cut-out boxes lined with iron, since asbestos will answer as well.

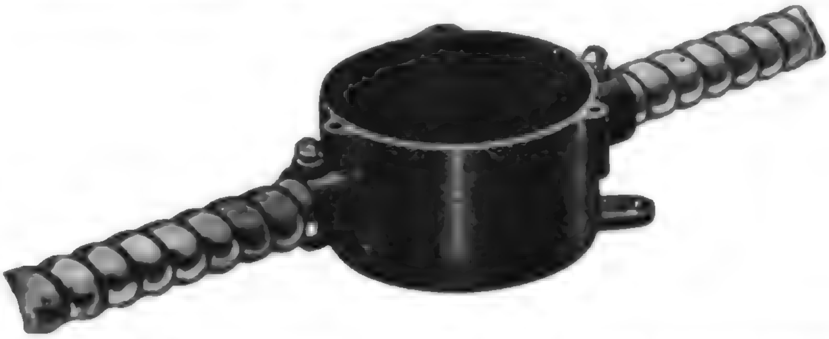


FIG. 8.—STRAIGHTAWAY JUNCTION BOX FOR FLEXIBLE METALLIC CONDUIT.

Flexible metallic conduit is known to the trade as "Greenfield" conduit and is made in the following sizes:

Outside. Diameter.	Inside Diameter.	Feet per Coil.	Largest wire accommodated 1 wire.	2 wire.	3 wire.
5/16	.5	200	..	..	..
⅜	.6	200	..	..	..
½	.95	100	8	12	..
¾	1¼	50	2	10	12
1	1½	50	00	6	8
1¼	1¾	50	200,000 c.m.	3	5
1½	2.05	50	400,000 c.m.	1	3
2	2.55	50	800,000 c.m.	200,000 c.m.	00

Greenfield conduit may be used on any kind of installation, and for many purposes it is far superior to rigid conduit. Though the first cost of the former is somewhat higher than that of the latter, when all conditions are taken into account it will be found to be cheaper. This type of conduit does not require the

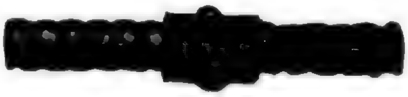


FIG. 5.—COUPLING FOR FLEXIBLE METALLIC CONDUIT.

cutting of threads, or fitting of elbows, and can be easily and quickly installed. Since the conduit is made in long lengths, few couplings are necessary. The writer does not look with favor on flexible conduit for new fire-proof buildings; but for all other classes of buildings where a conduit job is wanted, flexible conduit is not only cheaper to install, but also makes a good installation. In order to dispose of short ends which quickly become scrap, one of these should be coupled to a new coil. Fig. 5 shows a coupling suitable for this purpose as well as for joining coils of conduit.

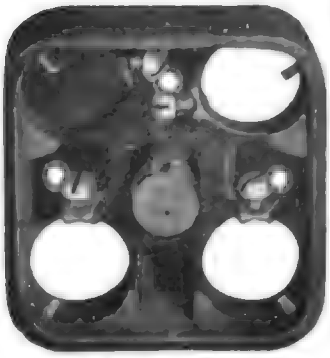


FIG. 9.—OUTLET BOX.

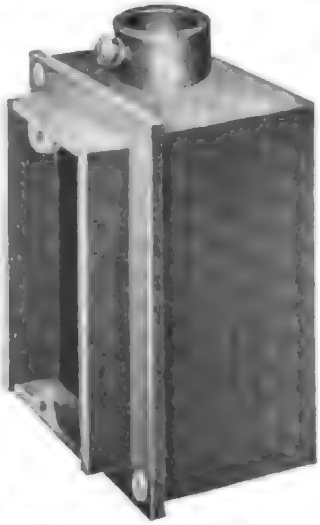


FIG. 10.—FLUSH SWITCH BOX.

To cut Greenfield conduit a fine hacksaw should be employed, and in making a turn or elbow the conduit should be fastened in three places, or a special fitting shown by Fig. 6 may be used for this purpose. It is needless to say that all conduit should be securely and rigidly fastened. The same rule about pulling in wires after the building is completed applies to Greenfield conduit as to the fibrous conduit. An approved form of outlet bushing for Greenfield conduit is shown in Fig. 7.

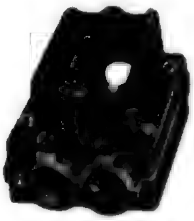


FIG. 11.—SPLIT CLAMP SWITCH BOX.

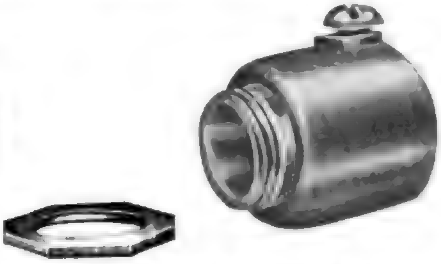


FIG. 12.—LOCK NUT AND BUSHING FOR IRON-LINED PANEL BOXES.

Double-braid, rubber-covered wire must be used in flexible metallic conduit, and no conduit smaller than ½ in. internal diameter will be passed by the Underwriters. At all outlets iron outlet boxes or switch boxes must be installed, and the conduit must be securely fastened to the boxes and must be provided with proper bushings. Figs. 8, 9, 10 and 11 show a number of iron outlet boxes suitable for this purpose.

Conduit should not be employed in places subject to dampness, unless the conductors are lead-covered. Flexible metallic conduit is less liable to give trouble through accumulated moisture than rigid conduit, since it is ventilated over its entire length. The writer has seen many short-circuits in rigid conduit due to accumulated moisture. Greenfield conduit should be properly grounded as required by the Code. At iron-lined panel boxes the use of a bushing shown by Fig. 12 in connection with a lock-nut makes a connection of this kind easy.

FIG. 13.—TWIN CONDUCTOR ARMORED CABLE.

A good system of wiring may be installed by employing flexible steel armored cable. Fig. 13 illustrates a steel-armored cable known to the trade as BX. This cable is made with conductors of No. 6 B. & S. gauge to No. 14, and since the greatest field for this cable is for circuit wiring No. 14 is the size most frequently used. Where the runs are over 100 ft. No. 12 cable should be used. Steel-armored conductors are cheaper to install than fibrous tubing, and make a much more satisfactory job. The saving in labor over that required to install fibrous tubing is considerable, and for finished private house work there is nothing superior, since the conductors are easily fished. BX cable is made by winding a sheet steel sheathing around a pair of specially insulated conductors.

Steel-armored conductors should be continuous from outlet to outlet, without a splice. When it is desired to tap a circuit this should be done by means of a junction box. At all outlets suitable outlet boxes must be used. Fig. 15 shows a duplex enameled iron bushing used in connection with the outlet box shown by Fig. 14, and Fig. 16 shows a single bushing used in switch boxes and at panelboards. The sheathing of BX cable must be grounded, and at all outlet and switch boxes a clamp must be employed to hold the cable in place. This clamp may also serve to properly ground the cable. At panel centers the sheathing of the cables is connected together by means of a copper wire soldered to each cable as indicated in Fig. 17. A good type of switch box for BX cable is shown by Fig. 18.

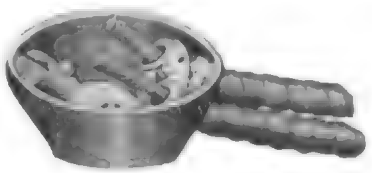
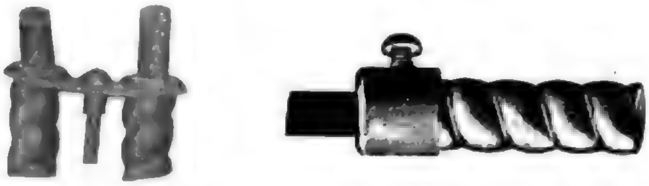


FIG. 14.—OUTLET BOX FOR ARMORED CABLE.


FIGS. 15 AND 16.—BUSHINGS FOR OUTLET BOXES.

To properly cut BX cable a fine hacksaw is necessary. Where dampness is present BXL cable should be employed. This cable has a lead sheath between the conductors and the steel armor and is especially applicable for stables and other places subject to fumes. This cable will not fit the outlet box illustrated by Fig. 14; a box similar to that shown in Fig. 8 may be employed, the single bushing shown by Fig. 16 being used at the outlet.

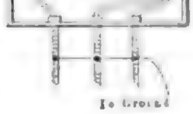


FIG. 17.—GROUNDED ARMORED CABLE.

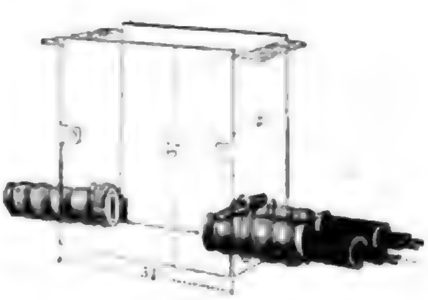
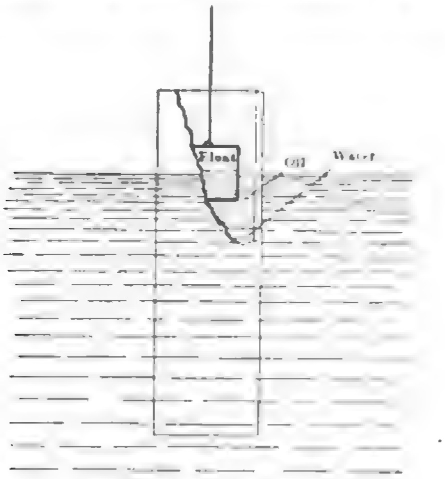


FIG. 18.—CLAMP SWITCH BOX FOR ARMORED CABLE.

LETTERS ON PRACTICAL SUBJECTS.

WATER LEVEL RECORDER.

It is often desired to obtain a continuous record of the water level of rivers. Large water power companies require a continuous record of the level of the forebay, and in various places this record is of great value. Numerous devices for obtaining such a record are on the market, and nearly all are based on the use of a float. The objectionable feature of these floats is that they freeze in winter and the record is interfered with. The writer has used the following scheme with much success: An iron pipe 6 in. to 8 in. in diameter, large enough to give plenty of clearance around the float, is suspended in the water to a depth of several feet. If necessary the river bed may be excavated. Into this pipe is poured kerosene to a depth of about 12 in. The float is then put into the pipe. Kerosene being lighter than water remains on top and the float rests in the oil. Since oil does not freeze at temperatures as low as 30° below zero F., the float will not freeze in and the record will not be interrupted. The iron pipe must, of course, extend deep enough into the water to prevent the oil running out when the water is at its lowest. The graphic record should be checked with a sight reading gauge at least twice every 24 hours.



WATER LEVEL RECORDER.

Albany, N. Y. Edward Wiggen

PECULIAR BEHAVIOR OF INCANDESCENT LAMP.

I do not know whether it will be considered justifiable to turn your correspondence department into a question box, but a matter has come to my attention recently which I thought might be of interest to some of your readers, and at the same time I am desirous of gaining any information possible on the subject. The point in question is this: In my room several incandescent lamps are supplied from a common feeder, and I noticed that one of the lights flickered in a most annoying manner. As a rule only one of the lamps is in use at one time, and I laid the trouble to very poor regulation. Using two or more lamps, however, destroyed this theory, since the lamp in question was the only one which did not glow steadily. Changing the lamp from one socket to another showed that the trouble lay with the lamp and not with the supply circuit in any way. The filament is apparently in good condition so far as can be observed by external inspection. I hardly think the cause of the disturbance lies in the connections leading into the bulb, as shaking the lamp has no appreciable effect on the behavior. The fluctuation does not exist at all times and is more pronounced at certain times than at others. The light will drop to about half candle-power, sometimes suddenly, as if due to a very brief short-circuit on the line, and at other times the dimness will last for a second or nearly as long. The lamp is of 16 cp and operates at an e.m.f. of 52 volts. I should be glad to hear if any of your readers has had a similar experience, and if so what reason has been assigned for the peculiar behavior of the lamp.

Wilkinsburg, Pa. C. A. Carpenter.

A STRANGE ENGINE POUND.

For over a year we were worried by a most puzzling case of engine pounding on a high-speed engine. We had tried time and again to get rid of the trouble, but never succeeded in remedying it. Finally an expert was called in and after a long search, he declared that the pound was caused by the sound of the exhaust into the open air telephoning back on the pipe to the engine. This pipe, which was made of tinned iron, was very long and extended vertically from the engine on the ground floor to the roof of a high building. We disconnected the exhaust pipe, changing it so as to run underground to the outside of the building, and we had no further trouble.

Lancaster, Ohio. Royal Wolfe.

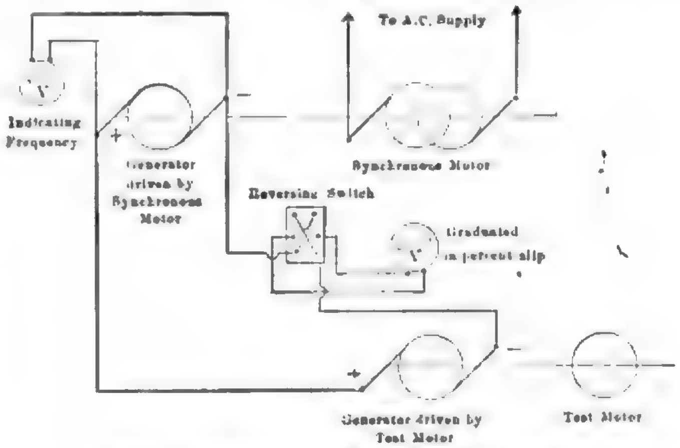
REPRESENTING ARMATURE WINDINGS.

I have read the article by Mr. Burke in your issue of March 3 and have also carefully considered the diagram given. I must say, however, that I cannot see the connection between his diagram and the one given by me in the February 3 issue, the only similar points being that both have two circles and some curved lines. Mr. Burke's diagram has to do with telegraphic work, while mine is a representation of the windings on an armature—two subjects as widely different as it is possible to get them. Even if I had seen Mr. Burke's diagram before it was published, I have serious doubts whether I should have connected it with the idea I had in mind. It is only necessary to place the two diagrams side by side to note their extreme dissimilarity, and I was greatly surprised to read that Mr. Burke has through some mistaken idea connected them.

Baltimore, Md. E. K. Stembridge.

METHOD FOR DETERMINING THE SLIP ON INDUCTION MOTORS.

At present there are several methods employed for determining the slip on induction motors, each of which has its advantages and disadvantages. The writer has devised a very accurate and convenient method by which the percentage slip may be read directly from a scale. Fig. 1 is a diagram of the apparatus, which consists of two similar magneto generators connected in series opposition. Millivoltmeters are connected as shown, the voltmeter across the reversing switch indicating the difference between the e.m.f's of the two generators. The e.m.f. produced by the magneto generator with a millivoltmeter as a load will be proportional to the speed and will be a direct indication of the speed. The two magneto generators are first direct-connected and run at synchronous speed and their voltage is adjusted so as to read exactly the same on the voltmeter used for the slip measurement. At this same speed the deflection on the second voltmeter is noted and this reading, which is maintained throughout the test, serves both to show that the synchronously-driven generator is being run at the desired speed and that the line frequency is correct. The e.m.f. registered on the voltmeter at syn-


To A.C. Supply
V
Indicating Frequency
+
−
Generator driven by Synchronous Motor
Synchronous Motor
Reversing Switch
V
Graduated in percent slip
+
−
Generator driven by Test Motor
Test Motor

DETERMINING THE SLIP OF INDUCTION MOTORS.

chronous speed represents 100 per cent slip at a certain frequency, and if this point is marked and the scale divided into 100 equal parts the voltmeter will read directly in per cent slip. For any other frequency the maximum deflection will be equal to the e.m.f. produced at synchronous speed times the ratio of the frequencies, and the scale may be divided into an equal number of parts as before. As many scales as frequencies will be required and these can be plotted on concentric circles on the face of the voltmeter with the zero percentage lines coinciding.

Where the ratio of the number of poles in the synchronous motor and the tested motor is not indicated, it is necessary to connect the shaft of the generator driven by the test motor to the shaft of the test motor by gears in the same ratio. It will be found convenient to use the same speed changing device as is employed with liquid tachometers. It is preferable not to resort to belting on account of the possible belt slip that is likely to occur. All the apparatus except the generator driven by the test motor may be conveniently and permanently placed. With the alternator field rheostats within reach and the voltmeters side by side, one observer is all that is required for obtaining quick and accurate readings. The most convenient method for adjusting the voltages of the two magneto generators is by shifting their brush positions. It is well to check each machine occasionally to see that the needle coincides exactly with the 100 per cent slip mark when running at the synchronous speed for that frequency scale.

Lynn, Mass. J. D. Shaw.

MOTOR OPERATION IN TEXAS.

With reference to G. McL.'s trouble in operating an electric pumping plant in Texas, as recited in the Questions and Answers page last month, I would suggest that the reason for decreased output of motors driving centrifugal pumps may be due either to worn pump runners or to the lowering of the water level. Either cause will be made manifest by a decreased flow of water and decreased registration on the electric motor. I have investigated many such cases and have found that the above causes were invariably present. This suggestion may possibly be of service to him in locating and remedying his trouble.

Rochester, N. Y. R. J. C. Wood.

MR. M'KEEHAN'S PROBLEM IN MOTOR CONTROL.

I enclose herewith a sketch (Fig. 1) showing a solution to Mr. McKeehan's problem of controlling a 5-hp, three-phase induction motor from two points. It is assumed that no auto-starter was used in connection with this motor, and that the distance between the two controlling points will not exceed, say, 500 ft., and therefore the cost of running two additional wires would not be a serious objection. The two double-pole, double-throw switches are used for reversing purposes only, while the two three-pole, double-throw switches are used for starting and stopping the motor. Assuming that switches *A*, *B*, *C* and *D* are thrown to the left, it is obvious that the circuit will be closed and the motor will then run in a given direction, but if either of the reversing switches, *A* or *B*, is thrown to the right the motor will run in the opposite direction. To stop the motor at *F* the switch, *D*, is thrown to the right, and to start the motor from *E* the switch, *C*, is thrown to the right also. If the motor is stopped at *E*, by throwing switch *C* to the left, it may be started again at *F* by throwing switch *B* to the left, or vice versa. With this scheme it is impossible to short-circuit the system and the motor will always be ready to start from either location, provided that care be taken to see that all switches are fully closed in one of the two positions, and not left partly open.

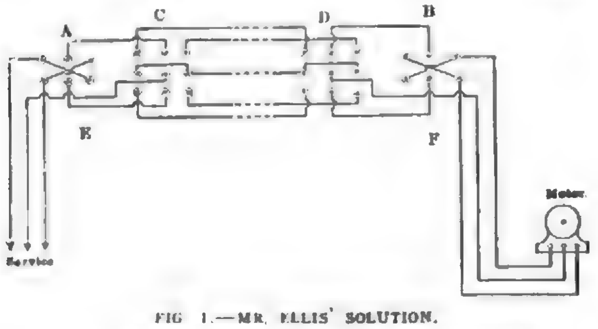


FIG. 1.—MR. ELLIS' SOLUTION.

New York City. Benson O. Ellis

[A similar solution was received from Mr. F. M. Farwell, Schenectady, N. Y.—Editors.]

I submit the enclosed diagram (Fig. 2) as a solution of the problem in three-phase induction motor wiring as given in the March 3 issue of the Electrical World by Mr. D. C. McKeehan. By tracing the connections as indicated by the diagram, it will be found that the motor may be started at the bottom of the incline and then stopped and reversed at the top of the incline, or vice versa. Ordinary triple-pole, double-throw switches are to be used, conforming with the Underwriters' rules in regard to the voltage of the system.

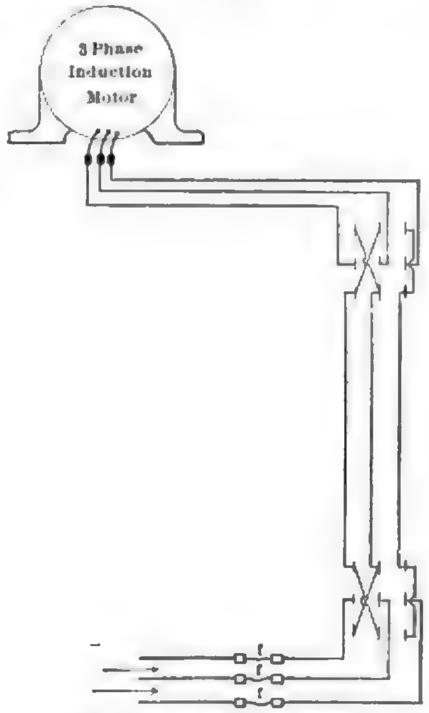


FIG. 2.—MR. NUTE'S SOLUTION.

Woronoco, Mass. E. L. Nute.

[A similar solution was received from M. C. Turpin, Philadelphia, Pa.—Editors.]

Referring to Mr. D. C. McKeehan's inquiry for suggestions for starting a three-phase motor from either of two points, I submit the following diagram (Fig. 3). Referring to the illustration, *A* and *A'* are double-pole, double-throw reversing switches located, respectively, at the top and bottom of the in-

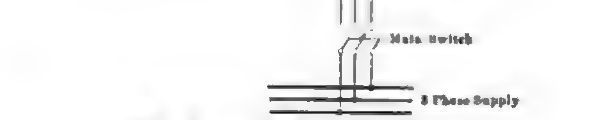


FIG. 3.—MR. WILLARD'S SOLUTION.

cline; *B* and *B'* are double-pole, double-throw switches for starting and stopping the motor; *R* and *R'* are resistances, if these be necessary, in series with the rotor windings for starting. All the switches should be closed in some position at all times and all rotor resistance cut out except when starting. If the *B* switch in either station be thrown over, the motor will start in the same direction as when last running. If both the *A* and *B* switches are thrown over the motor will start in the opposite direction. Throwing over either *B* switch will stop the motor if it is running.

Schenectady, N. Y. W. W. Willard.

Fig. 4 herewith is submitted as a solution to Mr. McKeehan's problem in motor wiring. The problem does not state whether the motor requires a starting box or not, but inasmuch as a motor of this size may be operated without a starting box, none is shown in the diagram. *D* is a double-pole, double-throw knife switch, and *A* is a pole reverser. With these explanatory remarks the connection should be easily followed.

Boston, Mass. J. S. York.

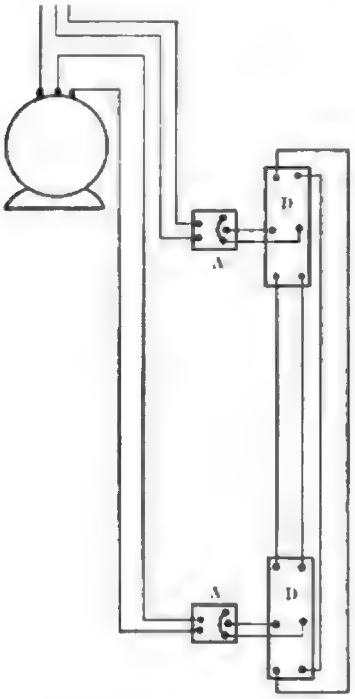
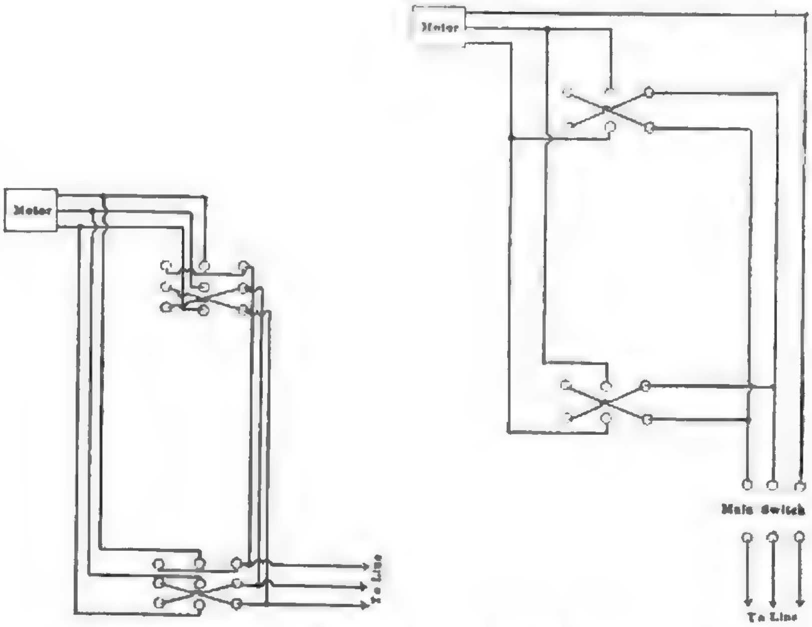


Fig. 4.—Mr. York's Solution.

I would offer the accompanying diagrams (Figs. 5 and 6) as solutions to Mr. D. C. McKeehan's problem in three-phase induction motor connections as published in the March 3 issue of the Electrical World. If a main switch is not used, two three-pole, double-throw switches connected as shown in Fig. 5 will fulfill the conditions, but if a main switch is used two extra double-pole, double-throw switches may be connected as shown in Fig. 6 for control. This latter method obviates the use of one wire from one switch to the other, but requires a main switch which would probably be used in any case.

Athens, Ohio. F. S. Driggs.



Figs. 5 and 6.—Mr. Driggs' Solutions.

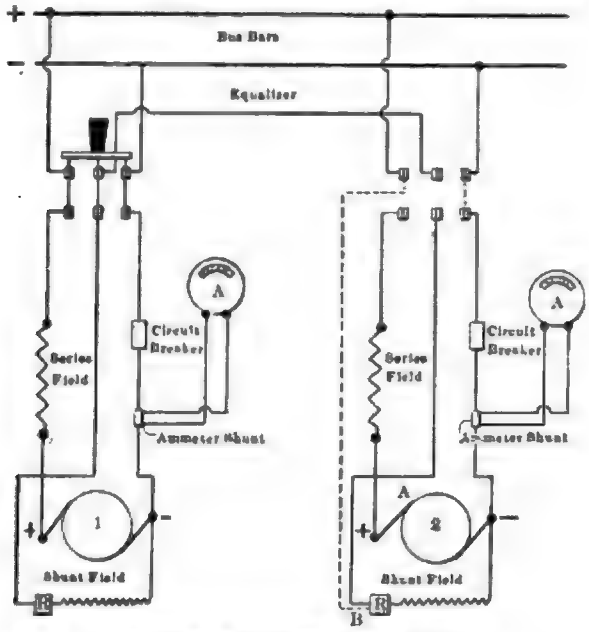
[Although all of the foregoing solutions are operative under certain conditions, those offered by Messrs. Nute, York and Driggs are not so under certain other conditions. In Mr. Nute's solution it is impossible to start the motor from one end if the switch at the other end is open; the same is true of Mr. York's solution. Neither of the solutions offered by Mr. Driggs is foolproof, since in both instances it is an easy matter to short-circuit the line by throwing in both switches.—Editors.]

REVERSING THE POLARITY OF GENERATORS.

Referring to Mr. William Kavanagh's letter on the reversal of the polarity of a generator, in one of your recent issues, there is something I would like him to explain. He states that when a generator becomes reversed the way to remedy it is to lift the brushes off the commutator, connect the machine terminals to a live bus by means of fuses and then lower the brushes. The fuses will blow and the machine will be re-reversed in polarity. It is a mystery to me why he uses the fuses or lowers the brushes. All that is necessary is to raise the brushes and close the machine switch on the bus. This will cause a current to flow through the shunt field in the same direction as it should when the machine is running right. Another statement made by him to which I do not agree is that the burning out of a rheostat or the breaking of a field wire would reverse the polarity of a machine. In his article he speaks of a compound-wound dynamo. The opening of the shunt field in this case would simply cause the machine to run as a series machine. Of course, the voltage would drop and if it were running in multiple with other machines the machine would drop its load or motorize, but even this would not always reverse the polarity.

Brooklyn, N. Y. F. E. Davey.

I was much interested in the article by Mr. Kavanagh on the reversal of the polarity of generators, a condition which is much more common with shunt-wound machines than with compound-wound machines. The method described by Mr. Jones in the February number is certainly simplicity itself and a vast improvement over the method described by Mr. Kavanagh. The method proposed by the latter may, however, be greatly simplified if only half of the brushes are raised from the commutator of generator No. 2; that is, all the brushes connected to the positive leg of the machine. The main switch may then be closed without any blowing of fuses or other pyrotechnic display, since the armature circuit is open at *A*, the brushes being raised or insulated from the commutator. Current will then flow through the shunt field circuit, and half of the current from generator No. 1 will flow through the equalizer and series coils of generator No. 2, thus giving both shunt and series excitation. After a few seconds the switch may be opened slowly so as to draw out the arc before the circuit is actually broken. This will reduce the field reaction to a minimum. The insulation may now be removed from under the positive brushes and the machine built up in the usual manner. While this method is fairly good, it has the disadvantage of being only applicable to cases where the armature is not in motion. The following method of reversing or re-reversing the polarity of a machine is quite simple and is applicable to shunt and compound-wound machines, whether in motion or at rest. Referring to the accompanying illustration, assume that generator No. 1 is carrying the load and that generator No. 2 is reversed. If the main switches are all of the single-pole type, the negative main switch of generator No. 2 should be closed, or if the main switch is triple-pole, it may be left open and a piece of wire put across the negative clips. The field wire should now be removed from the binding post on the rheostat at the point marked *B*, and a wire used to connect the bus-bar side of the positive switch to this binding post. If there is a switch in the field circuit the change of connections may be made at the switch instead of at the rheostat, care being taken to make the change on the side of the switch from which the lead runs to the machine and not on the side which leads to the rheostat. If the armature is in motion the resistance in the rheostat may be cut out until the machine is generating normal voltage when the resistance may again be cut in and the temporary wire removed from the rheostat or field switch. Replacing the proper wire and removing the temporary wire across the clips of the negative side of the main switch, the machine is ready to be built up as usual. Two or three minutes are all that is required to re-reverse a machine by this method, and the only material necessary is a screwdriver and some wire.



OPERATING GENERATORS IN PARALLEL.

Niagara Falls, N. Y. E. C. Channing.

MR. DIMOCK'S PROBLEM IN APARTMENT HOUSE WIRING.

With reference to the problem in apartment house wiring submitted by me last month, I enclose herewith a diagram showing how the problem was solved. P_1, P_2 and P_3 are three-point, or open-and-break push buttons to ring bells 1, 2 and 3, respectively, and at the same time indicate on the annunciator, *A*, and ring bell *B*, which is of the single-stroke type. Switch S_1 was provided to ring all the bells simultaneously and at the same time throw extra batteries into circuit. In order to change from one battery to the other, in case one gives out, the switch, S_2, was provided.

Brooklyn, N. Y. W. K. Dimock.

Fig. 2 is submitted as a solution to Mr. Dimock's problem in apartment house wiring, which appeared in the March 3 issue. To make the required connections it is necessary to use one two-point switch and one one-point switch, which has an extra contact or clip. This clip may be made from a piece of spring brass or copper and bolted or screwed to the base of the switch, as shown in the lower portion of the diagram. Under normal conditions switch No. 2 will be on the right-hand contact, thereby placing the original battery in circuit. By tracing the current through one of the push buttons it will be found that the respective apartment bell will operate in multiple with the annunciator drop and the janitor's bell. When it is desired to throw on the extra set of batteries, switch No. 2 is placed on the left-hand contact. When all bells are to ring at once in case of fire, switch No. 1 is closed. By tracing the connections it would be evident that two batteries are now in multiple and that the janitor's bell and each apartment bell with its annunciator also operate in multiple.

Jersey City, N. J. A. E. Bauhan.

Enclosed find a solution (Fig. 3) to Mr. Dimock's problem in the Electrical World for March 3. The multi-point switch at the left selects the batteries. With the four-pole, single-throw switch open each push button when pressed causes its respective bell to ring and also the bell and annunciator in the janitor's room. With the four-pole switch closed all the bells will ring and all the annunciator drops will fall, thus indicating that the bells in all the rooms have rung. It is plain that the four-pole switch also throws two extra batteries on the line in multiple, irrespective of the position of the multi-point switch.

Springfield, Wis. R. E. Gibbs.

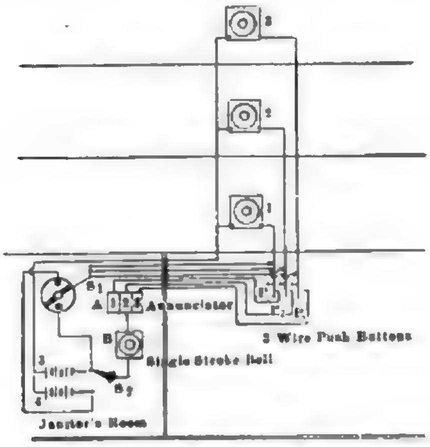


FIG. 1.—MR. DIMOCK'S SOLUTION.

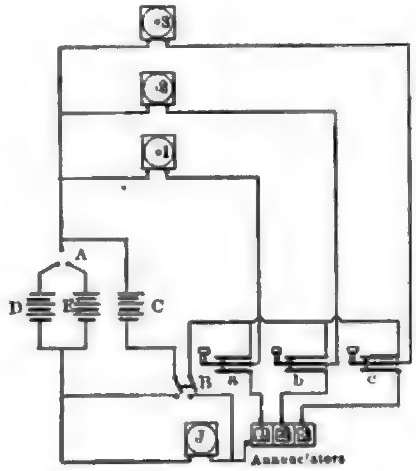


FIG. 4.—MR. WILSON'S SOLUTION.

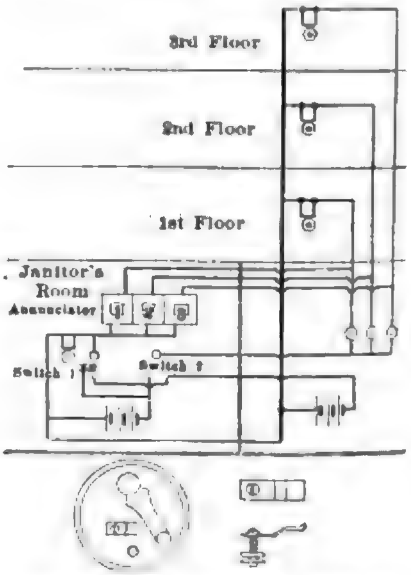


FIG. 2.—MR. BAUHAN'S SOLUTION

I submit the enclosed drawing (Fig. 4) as my solution to Mr. Dimock's problem. *A* is a two-point switch to cut in either battery, *D* or *E*. *B* is a double-pole, single-throw switch cutting in battery *C* and closing the circuit through the bells 1, 2 and 3 in multiple when the switch is closed. This operates bell *J* in the janitor's room, but not the annunciators. The bell *J* should be of the closed circuit type; that is, it should not open the circuit while ringing and should be able to carry the excess amperage required to ring all the bells simultaneously. The push buttons.

a, *b* and *c*, are three-point, make-and-break contact switches, the upper contact being connected to a common wire to one side of switch *B*. Each bell and annunciator may be operated by its respective push button, at the same time ringing bell *J*.

CLAY CENTER, KAN. M. C. WILSON.

The accompanying sketch (Fig. 5) is submitted as a solution to Mr. Dimock's problem in bell wiring. Referring to the drawing, *A* is a lever switch, which when closed short-circuits all the contacts; *B* is a three-way switch, used for cutting in a fresh battery when one gives out; *C* is the annunciator in the janitor's room, and *D* the janitor's bell. *B'*, *B''* and *B'''* are the different batteries.

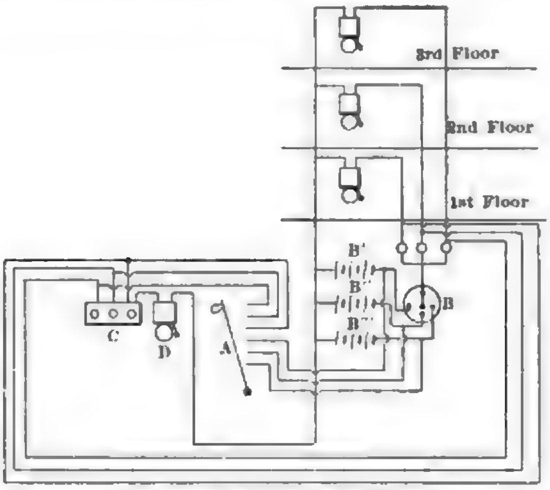


FIG. 5.—MR. SIMON'S SOLUTION.

NEW YORK CITY. M. SIMON.

Enclosed is a solution to Mr. Dimock's problem in bell wiring. Referring to Fig. 6, S^1 is a two-pole, double-throw switch and S^2 is a four-pole, single-throw switch. Starting with S^1 in the upper position, battery *a* is in circuit and by pressing button B^1 bells 1 and 1^1 with the annunciator will be thrown in parallel, and will, therefore, both ring. The same is true of each of the other circuits of two bells when the respective button is pressed. In case of fire or general alarm the four-pole switch, S^2, is closed, thereby throwing batteries *a*, *c* and *d* in circuit simultaneously, the wiring being arranged so that one battery wire will do for the entire system, while a circuit of two bells will be connected to the negative side of each battery. In the event of battery *a* giving out, the switch, S^1, would be reversed and the battery, *b*, thrown in.

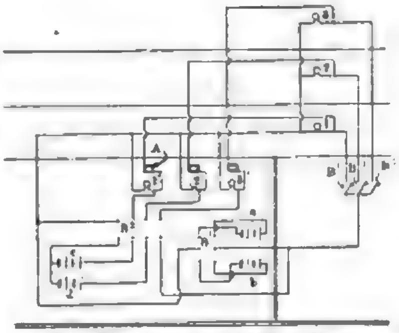


FIG. 6.—MR. RYAN'S SOLUTION.

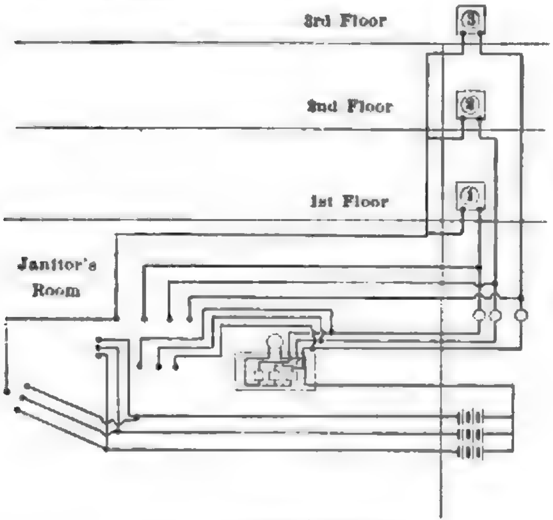


FIG. 3.—MR. GIBBS' SOLUTION.

SHAWINIGAN FALLS, P. Q. J. RYAN.

A solution to Mr. Dimock's problem in apartment house wiring is shown by Fig. 7 herewith. Referring to the diagram, *A* is the annunciator, *B* the janitor's bell, *C* a switch for throwing in different sets of batteries, *D* the alarm switch, which also throws in an extra set of batteries, and *E* is the push button. Inasmuch as four bells would be ringing at once, each bell circuit would have to have an equal resistance or the bell with the highest resistance would ring too feebly, if it rang at all.

CHICAGO, ILL. W. D. LEONARD.

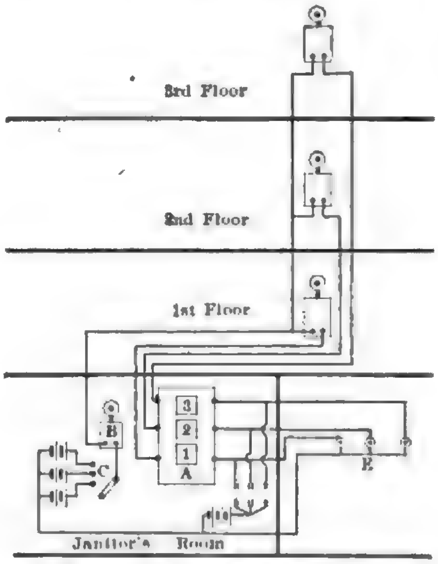


FIG. 7.—MR. LEONARD'S SOLUTION.

I submit the accompanying diagram (Fig. 8) as a possible solution to Mr. Dimock's problem in apartment house wiring. A double-pole, double-throw switch is used for changing over one battery to the other, and a four-pole, single-throw switch for ringing all the bells at once. Each bell can be rung from its respective push button as before, and the annunciator and its bell will be operated at the same time also. When the double-pole switch is closed upward battery *a* is in circuit, and when closed downward battery *b* is in circuit. When the four-pole switch is closed all the bells will ring and the two batteries will be thrown on the circuit in multiple, regardless of which one was in circuit alone.

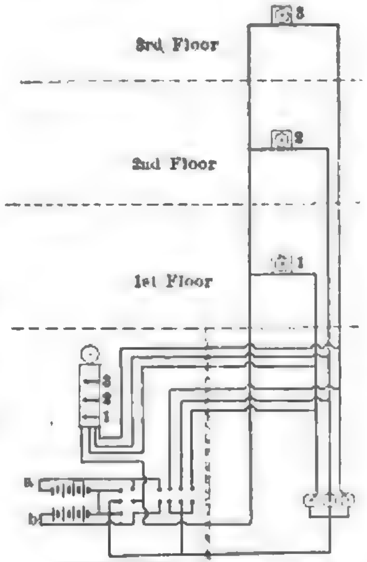


FIG. 8.—MR. EVANS' SOLUTION.

EATON, IND. CHESTER A. EVANS.

QUESTIONS AND ANSWERS.

How may I vary the speed of an induction motor? F. C. B.

The speed of an induction motor may be varied in two ways; either by varying the primary voltage of the motor, or by introducing variable resistance into the secondary circuit.

Kindly advise me as to the size and amount of wire generally used in the armatures of street railway motors. E. K. W.

The size of wire usually employed is No. 9 cotton-covered; the amount depends upon the size of the motor.

Can you inform me where I can obtain a B. & S. wire gauge to measure wire from No. 36 to No. 0000? M. J. C.

We do not know where you can obtain such a gauge and doubt if there are any such built. The ordinary wire gauge will measure the size of wires from No. 36 to No. 0. For sizes larger than these a micrometer is employed.

I have a 110-volt, 125-cycle, alternating-current fan motor and wish to rewind it for 60 cycles. How may I do this? M. M. H.

It is not practicable to rewind your 125-cycle motor for 60 cycles. The motor will operate on an 80-volt, 60-cycle circuit, but will only revolve at half the speed.

Where can I obtain information on "electrodeless conduction"? S. H. G.

The most complete information published on the subject that we know of is contained in a paper by A. B. Marvin in Vol. 3 of the Transactions of the American Electrochemical Society.

I have a ¼-hp. shunt-wound 220-volt motor running at 910 r.p.m. and wish to use the same as a generator. At what speed should the machine be run and what would be its output? J. C. V.

You may drive your motor as a generator at a speed somewhat higher than 910 r.p.m. and practically receive 3.25 amp. at a potential of 220 volts.

Kindly tell me what slots are to be used for the two leads of any coil of an armature having 160 commutator slots and 80 core slots, the motor being a six-pole machine and the armature having a wave winding. Which slot should be used for each side of the same coil for core spacing? D. E. R.

Use slots 1 and 54 for the two leads of the armature coil, and slots 1 and 13 for each side of the same coil for core spacing.

How is a Ruhmkorff coil used in testing the vacuum of incandescent lamps? F. A. B.

The coil is placed in operation in a darkened room and the lamp bulb is held in the hand while the base of the lamp is brought near one terminal of the coil. If the vacuum is good no effect is visible in the lamp. If, however, the vacuum is low a blue or yellow haze fills the bulb. A cracked lamp gives no glow whatever.

How can the direction of rotation of single-phase motors be reversed? S. A.

Since the direction of rotation of a single-phase motor depends on the direction in which it is started, and since, also, at starting with a phase-splitting device a motor is in reality a two-phase machine, the reversal of either phase will start the motor in the opposite direction. Therefore, to reverse the direction of rotation of the motor, interchange the leads of the starting winding.

Can polyphase alternating current be used satisfactorily on wood-working machinery in a mill having about 50 machines which are being constantly started and stopped, possibly five or more times an hour. We are figuring on changing from direct to alternating current, and would like to know if it is practicable to use three-phase induction motors. W. L.

It is perfectly feasible to use polyphase induction motors on wood-working machinery; in fact, the absence of a commutator renders the use of these motors in such places desirable.

Kindly give a good formula for filling in holes between segments of commutators. L. E. S.

Material for filling in holes between segments of commutators may be made by mixing ground mica with a binder of some good insulating and heat-resisting varnish. It is, of course, understood that substances of this kind are only useful for making temporary repairs. It will be necessary to put in an entirely new piece of mica if a satisfactory job is desired.

Of what use are tripping coils on the circuit-breakers of rotary converters? W. F. T.

These are intended to open the breakers and prevent the rotaries from racing. Without such a precaution, if two or more converters were running in parallel on the direct-current side and one should fall out of step on the alternating-current side, the other machines would commence to feed this one and drive it as a motor at a dangerous speed.

What type of motor may be used for running machinery, power being taken from street railway circuits, and what, if any, special devices are used to secure a constant speed of these motors under the excessive variation in voltage? W. A. H.

Shunt-wound motors are usually used for this purpose, and if the field cores are below magnetic saturation and the armatures have small resistances, the speed of such motors is almost constant, even though the voltage may change considerably. Motors having commutating poles will also act in the same way.

We have a three-phase motor which until recently was giving perfect satisfaction. It now refuses to start, but by pulling the belt rapidly the motor continues to rotate and gradually attains its normal speed. What is the cause of this? E. I.

One of the wires leading to your three-phase motor is broken. If a three-phase motor is running while connected to the supply circuit by three wires in the usual way, and one of these wires is broken the motor will continue to rotate and to perform its work, but if the motor is stopped it will not start up again unless assisted in the manner you describe.

Kindly explain the benefit derived from grounding the secondary circuit? Supposing the insulation between the primary and secondary coils of transformers should break through, would it not burn out the fuses on the secondary and open that circuit? I do not understand why the grounding of the secondary circuit will prevent a person from getting a shock from a lamp socket. L. W. S.

If the insulation between the primary and secondary of a transformer breaks down and the primary line insulation is defective, any one touching any live part of the installation and who is also grounded would probably be seriously injured if not killed. Even with the primary insulation intact there would be danger owing to line capacity. If the secondary is connected to ground, the chances for harm are very much lessened, since the current will not take the path of high resistance through the body of a person while a more direct path through a low-resistance wire is open. This safeguard to life in itself is sufficient justification for grounding the secondaries of transformers.

How would the primary of a 12-in. spark induction coil be wound for a 110-volt circuit to pass, say 50 amperes? If the resistance of wire to carry 50 amperes only is taken into account the number of turns grow so large that the self-induction of the winding is prohibitive. I would be obliged for any data or references on this subject. C. R. LeC.

The current ordinarily used by a coil giving a 12-in. spark on a 110-volt circuit is nearer 5 amp. than 50. In a certain coil the primary is about 15 in. long, and is wound with three layers of No. 16 double cotton-covered wire. The tubing insulating the primary and secondary windings is of ¼-in. pure rubber. The secondary is wound in sections with a silk-covered wire about No. 46. The principle applying to the design of the winding of a primary coil is that the number of turns should be a minimum and the current a maximum. The best method is to make a trial coil of few turns and then with a rheostat in circuit pass varying currents until the best effect is produced. Knowing the number of amperes and the turns of the coil, the ampere-turns will be determined. The final size of wire will then be fixed by the space available and the heating of the wire. A single layer of heavy wire would be better than a double layer of a lighter wire. Instead of putting in the primary the resistance necessary to cut down the current from the 110-volt circuit, this resistance should be placed exterior to the coil. Owing to the nature of the magnetic circuit and the many variables entering, the primary of an induction coil does not admit of calculation, and should be determined experimentally for every type.

CENTRAL STATION SALE OF CURRENT

THE CENTRAL STATION SOLICITOR.

The growing movement all over the country towards the organization of business getting developments by central stations is resulting in the rapid development of a class of salesmen almost unknown a few years ago outside of the largest cities, namely the solicitor for central station business. At present the demand for talent of this kind seems to be decidedly in excess of the supply. Much has been said about the qualities which go to make up a successful solicitor for a central station company. Stated briefly, they simmer down to these: Ability as a salesman and a knowledge of the things to be sold. While the most successful salesmen like the most successful members of any other calling are born rather than made, we find tolerably successful salesmen, who have merely through training become proficient We do not propose here to deal with the art of salesmanship, which is deservedly receiving an increasing amount of attention these days, but rather to point out some of the equipment which a central station solicitor must have in addition to the qualities of a salesman when he goes out to get business for central stations.

It may not be necessary for him to be posted on all the technical details of the appliance he is trying to place or installations he is trying to secure, but he should be thoroughly posted as to their advantages compared with what the customer uses at present. As to how much engineering and technical ability is required depends much on the kind of work for which he is soliciting. In power work, where it is a question of supplanting some other prime mover with electric motors, some engineering knowledge and ability to plan a new installation may be necessary. For this class of work in the smaller cities usually the manager himself is the only one fitted. In soliciting for electrical advertising by means of signs and window display or decorative lighting, the ability to help the customer originate schemes is of considerable value. In soliciting for residence and store lighting the solicitor is usually the customer's adviser as to the proper installation of lights to secure the best results. For this work a knowledge of illuminating engineering, or at least a knowledge of when to call for help of this kind from the manager or engineer of the company, is of first importance. Some specialist in this work should be included in the business organization of every large company and the more of this knowledge that can be acquired by those connected with the smaller companies the better. One large company employs the services of a consulting illuminating engineer outside of its organization to advise with and direct the study of a number of engineers in its new business department which specialize in this work.

In soliciting for various appliances which use electric current the first essential is an intimate knowledge of the advantages of the appliance which the solicitor is trying to place. In such cases general talk is of little avail. The solicitor must have at his fingers' ends the special points in which the electric device excels all others. It is time worse than wasted for a solicitor to attempt to place devices of which he has no knowledge unless he is willing to frankly admit to the customer that he has no knowledge and is willing to leave the entire matter with the customer. Some devices have enough merit to be sold in this way, but the chances are much better for placing the device if the customer has well impressed upon him its advantages and has created in his mind a dissatisfaction with the old inconvenient methods.

A pithy remark dropped by one of the speakers at the last Northwestern Convention was to the effect that a solicitor who is a new man or a stranger in a town will go into the town and get business which the central station manager who has been there for years would never dream of getting. There is undoubtedly a great deal of truth in this statement. A solicitor who is new in a town knows none of the objections which have been raised by various possible customers to installing motors in place of steam engines or to supplanting gas or kerosene by electric light. He simply forges ahead in blissful ignorance of the objections the manager of the plant has previously run against, and if armed with a salesman's ability and enthusiasm will land many a customer that the manager who has been on the ground for years will despair of. It is furthermore frequently the case that qualities which go to make a good central station manager are not combined with first-class ability as a salesman. A salesman must necessarily to a large extent be of the type of man known as a "special pleader." A successful manager is apt to have more of a judicial and executive mind which considers and weighs all sides of questions which come up daily for decision. Another point which frequently handicaps any man who has been in a town for a number of years is that opportunities for the use of central station service are usually not as apparent to one who has been walking the streets daily as to a stranger. He will go by opportunities daily without a thought of the possibilities because things which become familiar to us soon cease to receive thought or attention. The moral of all this is that it is a good thing to bring in some outside talent in the soliciting end of the business occasionally, and that it is not always safe for the manager to assume that he has worked the business for all that is in it.

CO-OPERATIVE WORTH OF SALESMEN WITH AND WITHOUT ADVERTISING.

If your salesman spends all his working hours hunting through his district for people who are possibly interested in electric light, you will often find him an exceedingly inefficient piece of apparatus, although he may personally be an able salesman. The reason for this seems obvious. Most of his time is spent in hunting for interviews, and the time is not consumed in the most useful manner, namely, face to face with prospective customers. If he could spend all his hours in laying the merits of electricity before the prospect, he would, of course, be from five to ten times as efficient. If the probable customers could be lined up and admitted to the salesman's office, one by one, we would have ideal conditions, but until the elements underlying commercial conditions are turned topsy-turvy, this roseate opportunity is not for our friend the electric light salesman or solicitor.

The best way of supplementing his efforts is by an intelligent method of following up every possible prospect by the direct form of mail solicitation.

If the amount of money to be spent is small and local conditions do not render necessary advertising in the local press, then by all means, throw all of the appropriation to supplementing the efforts of the salesman. Try to lighten his load, and (paradoxically) increase his efficiency by working up the prospects for him, and wherever possible, securing appointments for a definite day and hour to save the salesman's time. Even where this cannot be accomplished, the general education and enlightening of the mass by campaigns directed against the possible users, will surely prove potent, by "warming up" the prospective consumer, and getting him into a receptive mood when the solicitor calls upon him.

THE PAYMENT OF CENTRAL STATION SOLICITORS.

Owing to the fact that numerous central station companies are now starting new business departments and others are enlarging those previously established there seems to be considerable interest manifested in the subject of the basis which shall be adopted for the payment of central station solicitors. A description of some of the methods of large and small companies is, therefore, of interest.

We have already given an account of the organization for soliciting business of the Denver Gas & Electric Company, which maintains for its gas and electric business a force of about forty solicitors. We are indebted to Mr. C. N. Stannard, contract agent of that company, who has supervision of solicitors for further details relating to the plan of paying solicitors in Denver:

All business secured comes under some heading of the following classification:

Class	A	Additional consumption, either gas or electric (present consumers)	5 points
"	B	New contracts, gas or electric, where service is not previously in use	3 points
"	BB	Industrial fuel gas	7 points
"	C	Replacing service or equipment for old or new party where formerly in use	1½ points
"	D	Present users, changed to other address	1 points
"	E	Outlining on buildings	6 points
"	F	Outlining on present signs where flat against the building	5½ points
"	G	Outlining on present projecting signs	5 points

As an illustration of the application of this schedule, take, for instance, class A, additional consumption. Let us assume that a customer for illuminating gas is persuaded to put in a gas range, the estimated consumption of which is $20 per year. Figured at 5 points, the representative is entitled to 100 points for securing this business. All other classifications are figured similarly. A record is kept of the points secured by each representative, and at the end of the month it is determined what percentage each representative is entitled to as compared with the total business secured. As an illustration, let us assume that for the month of December there were 60,000 points of estimated business secured. We will further assume that one representative secured 10 per cent of that amount, or 6,000 points, that for the month of January the company had an increased gross revenue of $15,000, due to natural causes and to the work done by the representatives during the month of December. If it is agreed by the company that the representatives are to have 5 per cent of the increased gross revenue as a bonus, it gives them $750 of bonus money, to be divided among them according to their percentage of business secured. Thus the representative above mentioned, having secured 10 per cent of the business in December, would be entitled to 10 per cent of the bonus money secured in January, namely, $75, which would be paid him February 5. In addition to the bonus, representatives may be paid a flat salary of, say, $60 per month. Thus this man would receive for his December work a salary of $60 plus a bonus of $75, or a total of $135.

It will be observed that the work and business secured by the representatives in the month of December ought to show in the company's increased revenue during the following month of January, and between the first and fifth of February from the books the amount of increased revenue is determined. Therefore, by the fifth of February a settlement can be made as outlined.

The Brice Gas & Electric Company, of Mason City, Iowa, is a good example of a small central station company which is pushing actively for business and where the conditions are radically different from a large city. Mr. A. W. Zahm, general manager, writes as follows about the experience there:

"We have tried a number of schemes with our solicitors. Year before last we paid them $10 per week and $1 premium for every customer secured in excess of 20 per month. At this rate we could not secure a thoroughly first-class solicitor, as they did not care to take a chance at so small a salary, and this method was not very successful. Last year we engaged two solicitors—a man and a woman—at a salary of $75 per month without commission. They were both local people, well and favorably known, and we found this the most successful method. Aside from securing a large volume of new business, they induced a number of their friends to install services that could not have been secured in any other way. We are satisfied that this is the best system and we expect to follow it the coming year. We only employ solicitors for seven months, commencing April 1, and discontinuing October 1."

In Chicago the Chicago Edison Company and the Commonwealth Electric Company maintain a force of about forty solicitors. Most of these are on a salary, though a few are on commission.

At Kenosha, Wis., the solicitors are on a salary.

Some stations employ a professional solicitor for a term of several months, paying a salary and commission.

Central Station Business-Getting Methods in New Orleans.

Long before the recent general awakening to the importance of business-getting organization by central stations, the Electrical Department of the New Orleans Railway & Light Company had thoroughly systematized this branch of its business. As of particular interest through being a system which has been of all along natural lines, and not the mere application of a scheme worked out on paper, we give below a brief account of the various details.

GENERAL ORGANIZATION.

All solicitors and other employes connected with the contracting department report directly to the contracting agent, who is responsible for their acts, and whose duty it is to see that all possible efforts are put forth by his corps of men in the direction of following up and securing new business. He also, up to a certain point, settles questions of rates, guarantees, deposits, line extensions and many other minor matters connected with the wishes and requirements of the public. In the office are two trained assistants, whose knowledge of the business includes information as to the method of conducting the meter and auditing departments, together with a general idea as to service connections, location of pole lines, and also character of service which can be furnished at different points throughout the city. On the outside one or two of the solicitors whose aptness fits them for the duty, are picked out to attend to special work, or in other words to act as special assistants to the head of the department. One of these is entrusted with looking after the complaints on bills, which duty requires a man with some technical knowledge together with tact and patience.

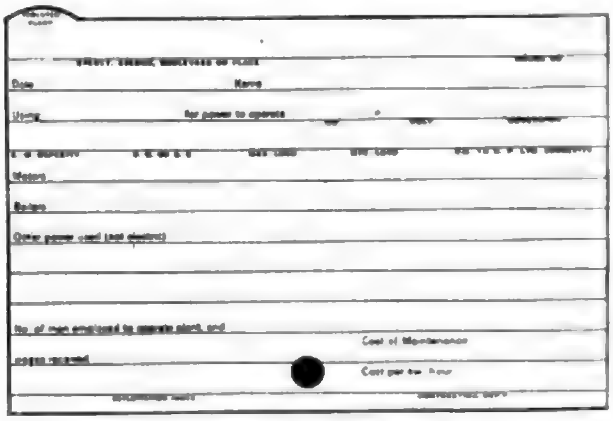


FIG. 1.—ISOLATED PLANT CARD.

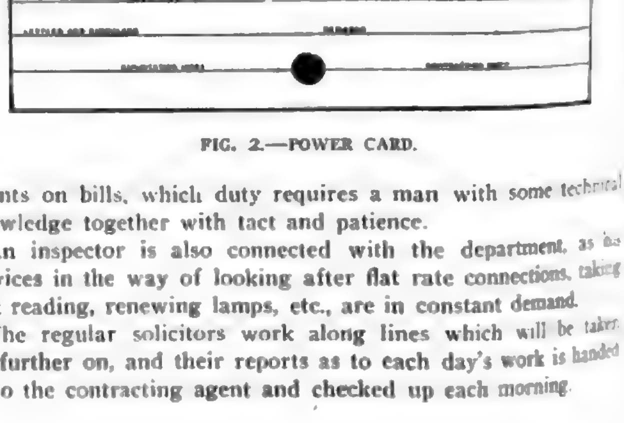


FIG. 2.—POWER CARD.

An inspector is also connected with the department, as his services in the way of looking after flat rate connections, taking volt reading, renewing lamps, etc., are in constant demand.

The regular solicitors work along lines which will be taken up further on, and their reports as to each day's work is handed in to the contracting agent and checked up each morning.

METHODS OF SECURING NEW BUSINESS.

In securing new business, first and most important are personal solicitation and house-to-house canvass, together with following up of all clues and hints, many of which are received each day at headquarters, some by mail, some by telephone and still others through friendly wiremen and contractors. In the power branch of the business a customer is often secured by inducing him to visit and examine the plant of some one in the same line of business, whose machines or other devices are being operated by electricity, and where the service is giving satisfaction.

Judicious advertising is employed, together with a continual circularizing of a specially prepared list. Special care is given to sending out a carefully drawn up letter to every one who obtains a building permit, with which is enclosed a stamped addressed return postal card, in order to encourage the prospective customer to send an inquiry as to the service.

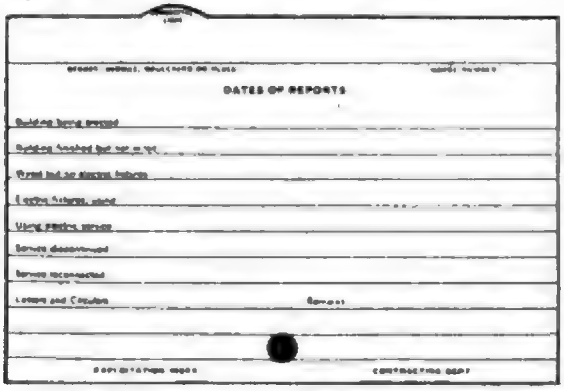

DATES OF REPORTS

FIG. 3.—COMMERCIAL LIGHT CARD.

METHOD OF RETAINING BUSINESS.

All complaints are filed with the contracting department and are given special attention by one of the solicitors. If it is a request for an examination of a meter, the matter is first referred to the engineering department for a "test report," when this is returned with the information requested, a representative makes a personal call and goes carefully into the matter of the result of the examination of the meter.

Whenever a notice is received requesting a discontinuance of service, a representative calls in order to find out if any dissatisfaction exists, the idea being to clear up any difference which may have arisen. This attention often results in holding business which would otherwise be lost, or gives the solicitor an opportunity to renew a contract from new occupants of the premises.

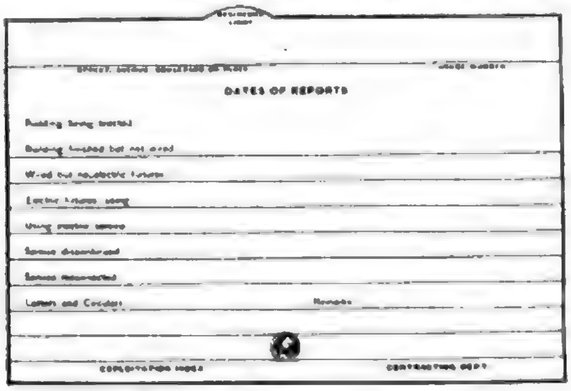

DATES OF REPORTS

FIG. 4.—RESIDENCE LIGHT CARD.

OFFICE SYSTEM.

The names of all new applicants for electric service are kept on file in the office of the contracting department, and as soon as the different requirements are met with an installation order is issued in duplicate. The original of this order is sent to the meter department, which sends a memorandum to the engineering and auditing departments for their records; the duplicate copy is kept by the contracting department in book form and a daily report made out in triplicate, a copy being sent to the president, vice-president and contracting agent, respectively. In this way increase or decrease in installations is readily kept track of, and good work of the solicitors brought to light.

At the end of each week all new contracts secured during that period are passed to the contracting agent, and after being signed by him are finally approved by the vice-president, each contract being accompanied by a rate card with data of the installation, date of contract, deposit, etc.; after being signed by the above-mentioned officers it is filed with the auditing department so as to be readily accessible to the bill clerk.

All notices to discontinue service are received and issued by the contracting department and are disposed of in the same manner as the installation order; these are issued in triplicate form, the triplicates being sent immediately to the auditing department. The reason for this is to enable a flat-rate customer to receive his bill up to date and assure him that he will not be charged for current after the date on which he ordered the service discontinued.

"Insurance approvals" of wiring installations are kept in a card system, which constitutes a very valuable record, as it is run by street locations instead of alphabetically and is a record which is referred to a great many times during the day.

Prospective business is also followed up by means of a card list, there being a special card for each class of business, such as commercial, power, residence and isolated plant. The obverse of a card from each of these files is shown herewith. The cards are in different colors, and on the reverse are spaces for the name of customer, date of application and remarks.

We are indebted to Mr. W. E. Clement, contracting agent of the Electrical Department of the New Orleans Railway & Light Company, for information on which the above account is based.

An Active Campaign for Business at Dayton, Ohio.

THE OPPORTUNITY.

UNDOUBTEDLY one of the most vigorous and enthusiastic campaigns for new business now being carried on by any central station company in the United States is that of the Dayton Lighting Company, at Dayton, Ohio. The company realizes that it has before it an opportunity such as probably does not exist in any other city of the size in the United States. At the time the present management took hold, January 1, 1905, there was in Dayton, a city of about 100,000 inhabitants, no electric lighting distribution system outside of the down-town business district. Such a condition of affairs is truly remarkable. It is an extreme case of how far central station companies sometimes fall short of developing the territories which naturally belong to them. The company is now extending an alternating current distribution system to all parts of the city and is pushing very actively for all classes of business, not only in the hitherto unworked outlying sections where there is a magnificent opportunity for electric lighting of residences and supplying power to manufacturers, but also in the down-town district where sign and display lighting and the displacement of isolated plants offer great opportunities.

THE SOLICITING ORGANIZATION.

The company's soliciting force consists of one chief solicitor assisted by ten district or ward solicitors. There is also one man who devotes his entire time to testing of steam plants, gas engine plants and the like, in places where the Dayton Lighting Company is figuring on supplying the power. The general manager of the company, Mr. F. M. Tait, is not only an engineer, but also an energetic business manager, with the ability to impart snap and enthusiasm to the members of his staff. In fact, there is no place in the company's organization for men who cannot be inspired with some of this enthusiasm. Just as in the operating departments of the company, men must be always vigilant, wide-awake, and ready to respond to instant calls, so in the soliciting department men are employed who are always awake to opportunities to put in electric service and talk electricity and its conveniences. Mr. Tait, the general manager, meets with the solicitors every morning from 8 to 8.30 that they may talk over questions which daily arise, and as they express it in Dayton, "to get filled up with enthusiasm for another day."

Mr. J. G. Barrett, chief of solicitors, is one who demonstrated his ability in this kind of work at Chicago, and later at New Albany, Ind., before going to Dayton. Besides having charge of the soliciting force, he acts as a kind of specialist on power for the new business department, and to help the district solicitors on especially difficult or important cases. Besides the chief solicitor, the ten district solicitors and one man working on isolated plant tests, there is one clerk in this department, who keeps all the records, and has ready for each solicitor every morning a memorandum of any requests for calls which may have come in during the previous day. Solicitors are paid a salary, which is increased according to the returns which they bring in, although no commission system has been worked out. Each solicitor is assigned to one ward of the city.

CHEAP
ELECTRIC LIGHT
AND
ELECTRIC POWER
ANYWHERE IN
DAYTON.

FIG. 1.—COPYRIGHTED SIGN.

Solicitors are all young men picked up from other lines of work in Dayton without previous electrical experience. Some of the best were formerly salesmen in other lines. Men selected must be of good character, entirely temperate, with clean records and with plenty of snap and vim.

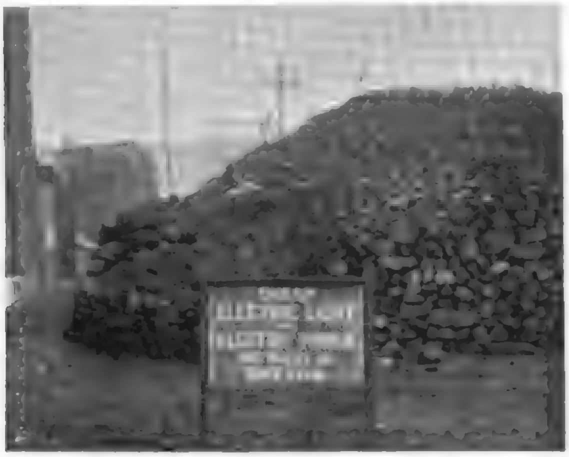


FIG. 2.—SIGN ON COAL PILE OPPOSITE CENTRAL STATION.

SIGNS AND TRADE MARKS.

While the company's solicitors have had the advantage of working in an almost undeveloped territory, they have also had the disadvantage that the general public in Dayton was not familiar with the advantages of electric service. Early in the campaign, a copyrighted sign was adopted, "Cheap Electric Light and Electric Power Anywhere in Dayton." This appears on the company's letter heads, envelopes, signs and wagons, in the form shown in Fig. 1, which is a reproduction from one of the company's large mailing envelopes. Fig. 2 shows the sign on the company's coal storage lot across the street from the power station. This style of sign is to be seen all over Dayton on vacant lots and other good advertising places.

PORTABLE ELECTRIC SIGN.

The company plans soon to have a portable electric flashed sign which can be hung on poles in different parts of the city to advertise the Dayton Lighting Company at night. Another sign which is used on all new buildings under construction for which the Dayton Lighting Company supplies power and light, is shown in Fig. 3. This particular sign, Fig. 3, was photographed on an old church building in the down-town district where a food show was held March 5 to 17. The Dayton Lighting Company had an exhibit at this show with several solicitors always in attendance. Next to this exhibit, baking was being done by another exhibitor by means of electric current and electric cooking dishes were being used by demonstrators of various food suppliers all over the building. Taken altogether, Dayton electric service was very prominent at the show.

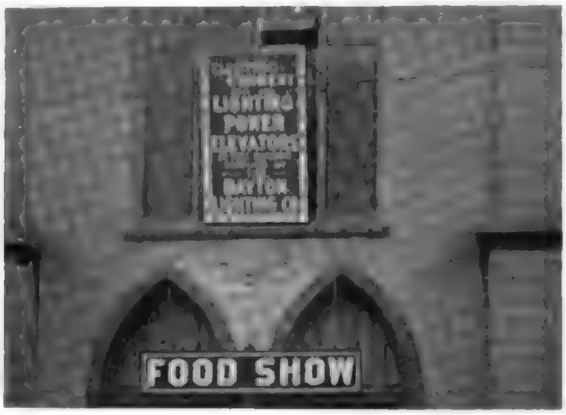


FIG. 3.—SIGN USED ON NEW BUILDINGS.

MONTHLY MAGAZINE.

A monthly magazine entitled *Dayton Electricity*, is published. Of this magazine, 5,000 copies are printed each month. These are circulated by mail. Fifteen thousand copies each month were formerly printed and distributed, but the loss and waste in distribution was found to be so great that it was thought best to print fewer copies and mail them where they would probably do some good.

NEWSPAPER ADVERTISING.

The company arranges its advertising among the Dayton papers so that there is an advertisement in one paper every morning and every evening. It advertises every other morning in two morning papers and every other evening in two evening papers. The usual space occupied is five inches, double column. Frequent illustrated articles in the daily papers tell of the company's construction work or of new motor installations.

TO PUSH HEATING DEVICES.

A campaign for the pushing of electric heating devices is about to be begun. Flatirons are being sold to customers at the wholesale cost to the company. The plan is to send out solicitors with a load of flatirons, chafing dishes and heating pads, leaving them at residences on two weeks' trial.

HOUSE WIRING.

The company does not do interior wiring, leaving this to Dayton contractors who are experiencing a prosperity never before known in Dayton, on account of the large amount of new work.

On the back cover page of the *Dayton Electricity*, is published free of charge a directory of reliable contractors, supply dealers and sign builders for the benefit of the company's present and prospective customers.

The company endeavors to have every house wired as far as possible with a heating circuit to the kitchen and dining-room independent of the lighting service. This can be heavy enough to carry any heating device desired without going over the 660-watt limitation of lighting circuits. It can also be used for operating the motor in the basement if necessary. It is hoped to develop some motor-driven washing machine business.

ATTENTION TO DETAILS.

The company makes a great point of responding immediately, not only to requests for electric service, or requests for solicitors to call, but also to trouble calls from customers. From the general manager down, great stress is laid on prompt and courteous treatment of the public and of seeing that electric service is satisfactory. The door of the general manager's office leading into the general office is always open, and there is no red tape when any customer wishes to step in and talk with the general manager.

A close watch is kept on gas engines and when they break down or give trouble to the owner, as they are sure to do sooner or later, a solicitor is promptly on the ground telling of the convenience and reliability of electric motors.

THE RESULTS.

At the close of 1904, the company had about as many meters installed as a good enterprising central station company should have in a town of 10,000 inhabitants, although Dayton is ten times that size. By virtue of pushing the business and extending into residence territory, the number of meters was increased 300 per cent. during the year 1905, and, of course, this is only a beginning.

Besides increasing the number of meters connected 300 per cent. during the first year of this campaign, seventeen isolated plants have been displaced. The connected light load has been increased from 22,000 to 37,000 50-watt lamps and 1,500 hp of new motors connected, to say nothing of 120 new electric signs.

Central Station Advertising.

By Converse D. Marsh.

Probably every central station in the United States realizes to the full that additional business means not simply better profits, but—to coin a term—accelerated profits. As a general proposition it can be stated that the additional fixed charges do not increase at the same ratio as do the gross profits, and in consequence the net profits per unit of energy sold are larger as the business grows larger. While this statement is true of any manufacturing business, it is particularly true in the manufacture of electricity. Moreover, there is a crying need in many of the smaller stations for a flatter peak and longer hours of use by consumers.

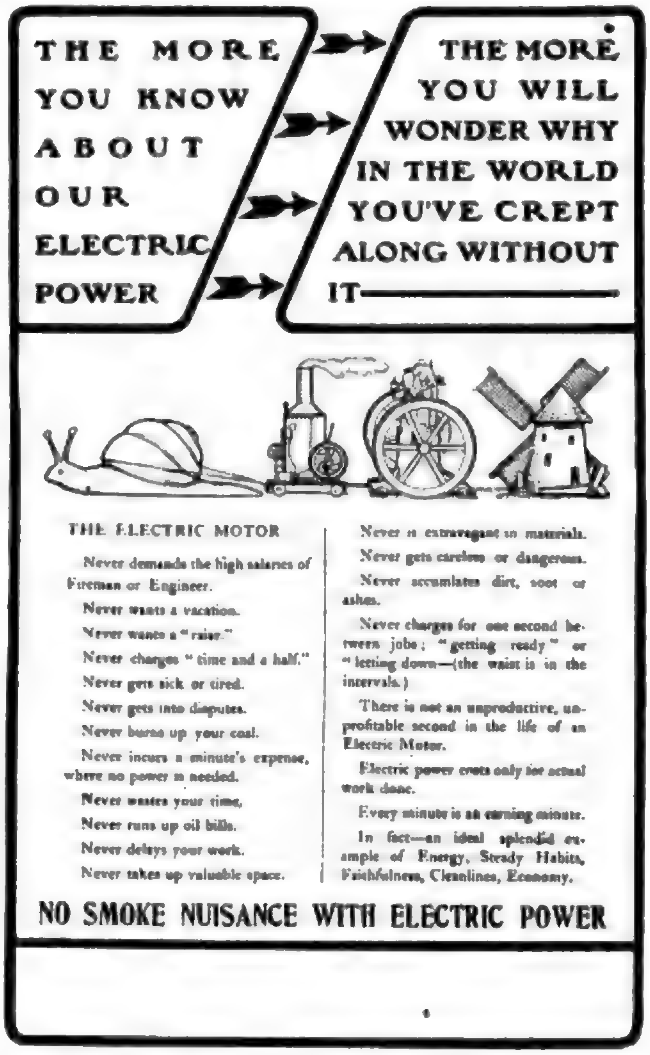
While advertising is a potent force for bringing about better conditions it should be buttressed and strengthened by direct solicitation with the best salesmen obtainable. Properly combined they can work wonders,—disunited neither will have one-half of the force of the two combined.

Not the least of the influences which have kept many stations in the rear is the lack of competition. Recently a central station manager in conversation with the sales manager for an electric lamp manufacturer spoke despondently of the keen competition of gas in his city. The latter listened with a scarcely suppressed smile, and when the central station man had finished spoke as follows:

"I don't believe you or central station managers in general really know what competition means. In my business I go out to solicit a customer and there are sometimes as many as from six to ten other lamp men in the same day to see the customer. That's the kind of competition that keeps me alive and awake. I am thinking how I can get the best of the other fellow night and day. But you, on the contrary, have no such competition to worry about, and as a consequence you don't stir up as much new business as though you had competition to worry you and keep you not just thinking, but keenly thinking and pushing to keep aggressively alive."

In order that a central station may get the best results for any single line of business-getting, there should be employed *every* method that will help in getting business.

First, there should be solicitors. Second, the solicitors' efforts should be backed up by direct mail solicitation. Third, there should be, if it is possible, an exhibition, or show room, easy of access, on the ground floor on a principal street. Fourth, illuminating bill board advertising should be used. It is a concrete example to others of sign advertising. Fifth, electric signs should be used as an illustration to merchants whom you are soliciting for just such work. Sixth, newspaper advertising can be employed.



THE MORE YOU KNOW ABOUT OUR ELECTRIC POWER THE MORE YOU WILL WONDER WHY IN THE WORLD YOU'VE CREPT ALONG WITHOUT IT——————

THE ELECTRIC MOTOR

Never demands the high salaries of Fireman or Engineer.

Never wants a vacation.

Never wants a "raise."

Never charges "time and a half."

Never gets sick or tired.

Never gets into disputes.

Never burns up your coal.

Never incurs a minute's expense, where no power is needed.

Never wastes your time.

Never runs up oil bills.

Never delays your work.

Never takes up valuable space.

Never is extravagant in materials.

Never gets careless or dangerous.

Never accumulates dirt, soot or ashes.

Never charges for one second between jobs; "getting ready" or "letting down—(the waist is in the intervals.)

There is not an unproductive, unprofitable second in the life of an Electric Motor.

Electric power costs only for actual work done.

Every minute is an earning minute.

In fact—an ideal splendid example of Energy, Steady Habits, Faithfulness, Cleanlines, Economy.

NO SMOKE NUISANCE WITH ELECTRIC POWER

If newspaper advertising is used, do not consider that you simply have space to fill and then put anything in that space, but try to make every word deliberately count. Do not try to fill any given amount of space with words, but express your idea and *then stop.* You must remember, however, that brevity, while the soul of wit, is not necessarily the essence of an advertisement. Disconnected facts can be put so coldly that they fail of intent. Make your newspaper advertising advance the common-sense every-day arguments that your salesman would use. Don't make a newspaper advertisement too formal, nor yet adopt sensational or "circus" methods.

One good plan is to try to see after writing if there are any words or sentences which could be eliminated without injuring the strength of your argument.

Remember that humorous advertising is a dangerous thing. You may set the reader to laughing, but he is liable to miss your point if you set him to laughing, or take your serious argument humorously. It is a dangerous thing to start your reader in the wrong direction.

Remember, too, that if you yourself go in to buy, say, a suit of clothes, there is nothing funny about it. It is a serious thing for you—you are going to spend your money and you don't joke while you are spending it.

Secure attention by forceful English and don't be afraid to "loosen" up and talk. If you talk to the point, and give strong arguments, you can get attention where you cannot secure it by the *outré* methods.

There should be just as much hard-headed logic in getting up a newspaper advertisement—or any other kind of advertisement—as you would employ in talking to a man yourself, in trying to induce him to do what you wanted him to do. There are no talismanic touches that you can safely indulge in.

And remember, that not one advertisement, or two advertisements are going to do the work. It is going to take a long procession of them to move any number of people out of the beaten track to which they have been accustomed in the past.

If goods could be profitably sold by just taking a flier now and then in the public press, every square foot of territory in the United States would be dotted with millionaires as thickly as they have been strewn around Pittsburg since the organization of United States Steel.

It takes times, patience and money to achieve success in any kind of advertising, and this is particularly true of general publicity.

The accompanying cut is an example of an advertisement for electric power suitable for any electric lighting company. As here reproduced, it is only of about one-half the size for most effective appearance.

Good Breeding in Advertising.

By Frank B. Rae, Jr.

The central station fraternity is entering upon an era of advertising. While the art of advertising has outgrown its swaddling-clothes and attained in certain quarters the dignity of a profession, so far as we in the electrical field are concerned it is still in an embryonic state. We are experimenting. We are feeling our way. We are casting about for knowledge.

Advertising, it is well agreed by those who have studied and practiced it as an art and profession, embraces every phase of our dealing and expression with and toward the public.

Employes who represent us to the public advertise us well or ill according to their discretion, tact and personality. It is good advertising to have courteous, upright employes.

Our place of business may well be termed advertising, influencing the public for or against us according as it is well-kept, attractive and convenient. This phase of the advertising problem is seen most fully developed in metropolitan department stores, where every convenience is placed at the free disposal of the public, whether a customer or not. It is finding expression among lighting companies in the display rooms which are now considered so essential to the progressive contract department. Such rooms are good advertising.

An honest and "above-board" policy, both to press and public, is a very vital form of advertising. Conciliation in the face of public complaint and equanimity towards newspaper clamor will bring their reward in time. Such policy is good advertising.

Finally, printed announcements, cards, folders, letters, posters and sign-boards are advertising. It is these which engross us just now.

If it be true, as the masters of advertising agree, that courtesy upon the part of employes, attractiveness in our places of business, and dignity and honesty of policy are elements in good advertising, it must follow that these same elements should pervade the more generally accepted forms of advertising—in other words, that our announcements, circulars, etc., should be courteous, attractive, dignified and honest. These, it seems, are the fundamental elements. But there are other elements and ways of combining these elements, which add to or take from the printed advertisements.

An advertisement must attract attention—stand out from the great mass of printed mediocrity—to secure a second glance. It must bear a forceful or catchy headline to rivet attention and awaken interest. It must be written in crisp, sparkling, clever style to insure a thorough reading. It must present our proposition logically and convincingly, soliciting an immediate favorable answer.

These are secondary elements, if you prefer, but essential to successful advertising. They are the structure erected upon foundation principles. To carry the simile further, the foundation principles are a matter solely of business engineering: the structure, of engineering plus art. A structure with false foundations soon topples of its own weight: a structure without art is a public eyesore.

It is here that the advertising man enters—to supply the art, graphic and literary.

To most of us, the advertising man is a somewhat incomprehensible being. Sometimes he is a youth with a diploma which certifies that he has paid forty dollars to a correspondence school. Again he may be the representative of a large firm. In either case he is likely to give the impression that he wishes to run our business for us, whereas we feel able and competent to continue without him. As evidence of his ability, he presents certain specimens of his craft. Study them well, but study the man even more. He is offering you something you need—the art of advertising. It is for you to decide whether this art is of a class and quality worthy of your business—whether it is *well bred.*

We have said that a good advertisement must attract attention—but the right sort of attention. If attention, *per se,* were paramount, a clown in his motley, going about the streets with our business card tacked to his back, would suffice. But the object of attracting attention is to keep our printed matter from going unread into the waste basket. Unfavorable attention will only accelerate its speed to its ultimate resting-place.

It is admitted that a good advertisement must bear a forceful or catchy headline. But there are kinds and degrees of forcefulness and catchiness. The yellow journals run "forceful" headlines. They are sometimes printed from types of six-inch face, in scarlet ink. Somehow, well-bred people do not approve of them, nor of similar endeavors applied to advertising.

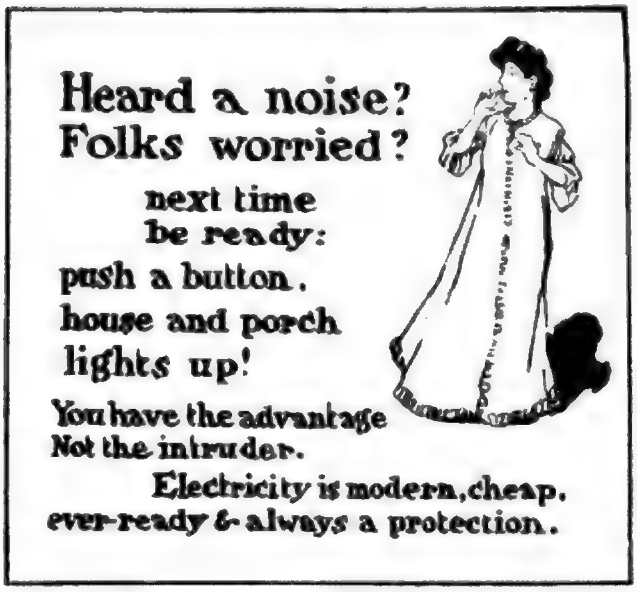
No one denies that a good advertisement must be written in crisp, sparkling and clever style. But abbreviations do not constitute crispness, nor does a habit of taking liberties with our mother tongue indicate cleverness. Sparkling English is first distinguished by its clearness and purity—it gains nothing by defilement in the gutter. The advertising writer who fails here, fails absolutely. He who cannot sustain interest in his argument without recourse to the vernacular, is a poor word-monger indeed. That he must needs shock the reader into reading, is evidence of his inability to hold attention by legitimate use of words and adherence to accepted customs in punctuation.

Finally, a good advertisement must present the proposition logically, and secure a favorable answer. This is the ultimate test of advertising, as of salesmanship. We judge the ad-man's ability to do this for us by the manner in which he does it for himself. Is he logical? Is he convincing? Does he impel us to answer him immediately and favorably? And if employed to handle our advertising, can he be depended upon to convince that class of the public with which we deal—the better class—of the substantial merits of central station service?

These are the questions that confront the electric light fraternity in the preparation of their printed advertising matter and their employment of an advertising man. Primarily they are questions of good breeding—good breeding in advertising.

Central Station Advertising

The preparation of central station newspaper advertisements not alone commands the attention of the so-called "experts" in the field, but is apparently enlisting the energy of other advertising specialists who have caught the point that such advertising, in order to arrest public notice, need not be technical, but should preferably be otherwise. Mr. B. Alten Block, of New York City, in sending out a broad sheet of nearly a score of central station "ads" remarks that it requires no more elaborate equipment of brain power to push electricity than it does any other commodity, such as gas or groceries, but that steady advertising all the time is the winning quality if the work be intelligently done. As he remarks, "All it requires is common-sense talk, attractively illustrated and lucidly presented; to be followed up by intelligent solicitation." We reproduce herewith, as an exemplar of Mr. Block's ideas and methods, one of his advertisements bringing out rather effectively the value of the porch light, the same idea being elaborated in one or two other attempts. The advertisements deal with the various subjects of signs, fans, electric heaters, electric motors, house lighting, show-window lighting, etc., and are avowedly addressed to the attention of the masses. These advertisements are intended to be used as complete appeals, or the name of the company can be added with other matter in regular display type by the local newspaper office.



Heard a noise?
Folks worried?
next time
be ready:
push a button.
house and porch
lights up!
You have the advantage
Not the intruder.
Electricity is modern, cheap.
ever-ready & always a protection.

◆

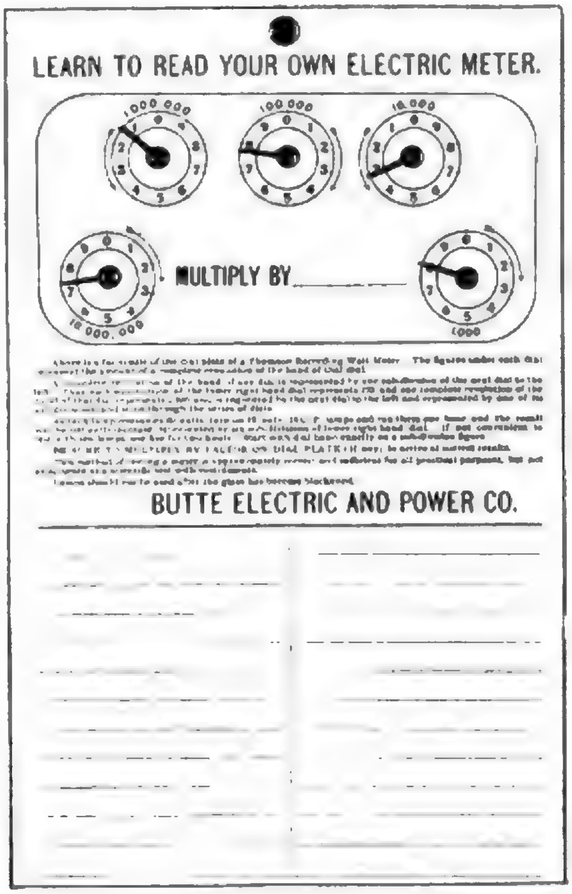
Meter Reading.

The Butte, Mont., Electric & Power Company supplies to all of its electric light and power customers a card, reproduced in the accompanying illustration, to enable them to check their bills for electric service. A heavy cardboard is used having an eye for hanging the card up on the wall. As will be seen, the five dials of a meter are reproduced on the card, with movable metallic pointers secured by eyelets. It will be noted that the card contains blank lines for recording the monthly readings. The size of the card is 5½ x 8 in. As in the reproduction the instructions on the card are illegible, they are reprinted below:

"Above is a fac-simile of the dial plate of a Thomson recording wattmeter. The figures under each dial represent the amount of a complete revolution of the hand of that dial.

"A complete revolution of the hand of any dial is represented by one sub-division of the next dial to the left. Thus, each sub-division of the lower right-hand dial represents 100, and one complete revolution of the hand of that dial represents 1,000, and is registered by the next dial to the left and represented by one of its sub-divisions, and so on through the series of dials.

As each lamp consumes 60 watts, turn on 10, only, 16-cp lamps and run them one hour, and the result will be 600 watts increase, represented by six sub-divisions of lower right hand dial. If not convenient to test with ten lamps, use five for two hours. Start with dial hand exactly on a sub-division figure.



LEARN TO READ YOUR OWN ELECTRIC METER.

BUTTE ELECTRIC AND POWER CO.

"Be sure to multiply by factor on dial plate (if any) to arrive at correct results.

"This method of testing a meter is approximately correct and sufficient for all practical purposes, but not as accurate as a scientific test with instruments.

"Lamps should not be used after the glass has become blackened."

◆

A Pointer for Sign Solicitors.

A very telling point in favor of electric signs and one that can doubtless be used to advantage in securing sign business in numerous cases, is made in the *Electric City*, published by the Chicago central station interests. The following short article accompanied a night photograph of the drug store sign in question:

HOW AN ELECTRIC SIGN MAY BE THE MEANS OF BETTERING AN INFERIOR LOCATION.

Drug stores are usually looked for on a corner.

In the present instance, that of the Grand Pacific pharmacy of Rogers & Diamond, the store is the second from the corner, on Clark Street. . . .

Before the electric sign was installed there was nothing to indicate to pedestrians that there was a drug store in the block. Strangers in the city, passing on Jackson Boulevard to the various railway stations, or pedestrians north or south of the location on Clark Street, would never have known that there was a pharmacy anywhere in that neighborhood.

With the electric sign in operation the Rogers & Diamond location is quite equal to a corner location without a sign, while the amount saved by reason of a lower rental for an inside location would probably pay for several electric signs, to say nothing of the added trade the sign will actually make, by suggestion, to the many passers-by.

File Wrapper Record for Solicitors.

We have received a number of communications relating to the file-wrapper system of keeping account of prospects, as outlined on page 236 of the issue of February 3.

One central station manager writes that while he has had no experience with the system, he has known it to be applied with much success by an attorney who made a business of making collections against the farmers, and who was considered the best collector in his section of a state. He had a complete history of each collection, what a man had in crops, what he owed others, when he would pay, and about everything else which would have any bearing on the question of pay. The writer considers that the system can be applied to "new business" getting with the most efficient results, as by the records the gist of a case can be acquired in a few minutes and by one who may have had no previous knowledge of the case, so that the work can be taken up by others with no loss of time or extra expense in ascertaining previous facts.

Another correspondent suggests a modification of the system outlined, as follows:

First, an alphabetically kept card index of prospects, the cards to be numbered across the top from 1 to 31 and containing no further information than the name and the address. By placing projecting metallic markers on these cards above the desired number, all prospects demanding attention on a given date can be at once located.

Second, an alphabetically kept series of manila folders such as suggested, but having printed on the front a blank for such general information as is desirable, including the record of form letters sent, visits made, etc. This plan presents the advantage of having all of the information regarding the prospects on or in the folder, while the card record is a simple index and "tickler."

New Telephone Patents.

TWO-WIRE MULTIPLE SWITCHBOARD.

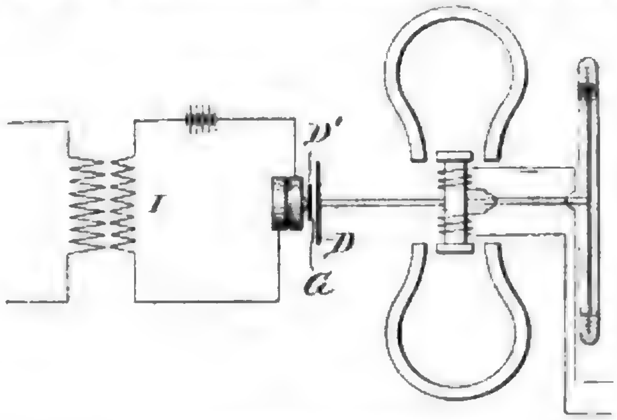
The early two-wire common-battery switchboard of the Kellogg Company was so arranged that in the normal or non-used condition the subscribers' lines were completely cut off from the jacks. In the used condition, on the other hand, the line signal apparatus was cut off from the line, and therefore it was impossible to test the line signal from the jacks. In order to accomplish such a test W. W. Dean connects the line relay side of the line permanently to the concealed spring of the jack. Thus through a plug inserted in the jack the line relay may be tested, the testing circuits being so arranged that the cut-off relay does not pull up. Mr. Dean has patented his circuit and assigned the patent to the Kellogg Company.

MULTIPLE SIGNAL TRUNKING SYSTEM.

Selective line signals have, of course, been used for years in connection with the divided multiple switchboard, but G. Lambert, of Charlottenburg, Germany, has now applied them with a new significance. Where there are in one exchange a number of different central offices, it is proposed to provide each line with a signal for each, the subscriber having selective control of his lamp. Thus, if he desires a connection with any particular exchange, he may indicate to his operator to connect him through and give the number of the desired subscriber direct to an operator of the distant exchange having access to the desired line.

TELEPHONIC REPEATER.

Another attempt has been made to solve the repeater problem, this in the shape of a refinement of a repeating device considered in this column some months since. The repeater in its present form is shown diagrammatically herewith. It will be seen at a glance that the repeater is of the telephone microphone type, the receiver having been modified to a special type, especially sensitive. The gist of the present invention lies in the relation of the transmitting to the receiving device. It will be seen that there is no mechanical connection. The motion of the receiving part is transferred to the transmitting part by the thin layer of air at G between the two plates, D and D'. In practice these will be secured to the same mounting, which will take the form of an annulous. Thus the two diaphragms will form the covers of a shallow circular box. This box is not closed, but is provided with air vents as in a drum. It is claimed that with such an arrangement a vibration of the transmitting diaphragm may be caused which approaches that of the receiving diaphragm in amplitude. The inventor of this repeater is Prof. John Trowbridge, of Harvard University.



TROWBRIDGE REPEATER.

SEMI-AUTOMATIC SYSTEM.

W. M. Marean, of Belvidere, Ill., has patented a semi-automatic system wherein the information as to a desired number is sent to the central visibly without conversation with the operator. Thus, a subscriber desiring to call sets his sending device and the number desired becoming displayed, his operator connects the jack of his line with that of the desired line.

LOCK-OUT SYSTEM.

G. Ritter, of Stuttgart, Germany, has invented a lock-out system to insure privacy on a party line. His idea is that the stations may all be grouped close together and a third line conductor strung between them controlling the lock-out device. Any subscriber may lock all stations if he has control of the line, by sending current over this third wire.

SEMI-SELECTIVE RINGING SYSTEM.

For the case where two or more stations are connected upon a rural or toll line terminating in two central offices, Mr. E. A. Terpening, of Geneseo, Ill., has invented a semi-selective system. He arranges his stations with bells legged on one or the other of the sides of the line to ground. These he operates with alternating current, while the switchboard signals are operated with direct current sent metallic, these being so polarized that distinction may be made between the two central offices.

LETTER TO THE EDITORS.

Central Station Cost.

To the Editors of Electrical World:

SIRS:—I have noted with much pleasure the increasing attention which your journal has during the past few years given to the business side of the central station. The growing keenness of competition from gas has brought about a situation which central station men can no longer ignore. The glamour which at one time was associated with the use of electric light is a thing of the past, and the sale of electric energy now differs little from the sale of any commodity, and involves the employment of the methods which in other branches of business have been found necessary to success.

I think, however, that in dealing with the subject of central station business there is at present a tendency to consider only mere business getting methods and details and to lose sight of important fundamentals. I refer particularly to central stations' costs, for until these are determined in their slightest detail and constantly kept track of in the same manner as any other lines of manufacture, the central station manager is working largely in the dark. The manager should know exactly what profit he is obtaining from every class of business, to the end that he may know what classes are to be discouraged, what are to be encouraged and what may be extended with profit by a lowering of rates. Again, central stations must look forward to the time, which seems approaching rapidly, when the present movement toward the publicity of the accounts of public utility corporations will lead to legislation requiring such publicity in every State. In this event when called upon for a statement, the central station should not only have it ready in proper form, but long previously should have placed its financial affairs in order for the critical public eye. By a close analysis of cost, many central stations will undoubtedly discover unexpected sources of direct losses through unprofitable business, and indirect losses through undue returns from certain classes of business which have retarded the growth of such classes, and which returns upon publication would, through comparison with data of other central stations, give rise to adverse comment and perhaps to hostile action.

One or more of the bodies representing the central station interests, such as the National Electric Light Association and the various electrical territorial organizations, would perform an excellent service by taking up this subject, and with the aid of experts formulate a system of cost determination and accounting for central stations; or better, a system for each class of stations from those in the smaller towns to those in ordinary cities. The larger central stations can perform this service for themselves, and in most cases have already done so.

Milwaukee, Wis. Jas. L. Beard.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Idle Currents.—Field.—A paper read before the Manchester section of the British Institution of Electrical Engineers. The term "idle currents" is employed as including all currents which do not perform any useful work and which consume power to the extent of their C^2R losses. Thus the term is used to include eddy currents. The paper is chiefly mathematical. The author gives a general discussion of the idle currents met with in the main conducting circuits and then examines with greater detail one particular effect which deserves consideration on the part of designers of electric machines. This point relates to the losses of heat occurring in the heavy conductors used with large alternating currents. The current flowing through the conductors in a slot causes a leakage of magnetic field across the slot, the density of which is greatest near the top and least towards the bottom of the slot. The eddy currents are, therefore, most serious in those conductors nearest the gap surface, and in some cases they cause an extra current density as much as 30 times that of the normal current density due to the load current in the main circuit. The copper losses may thus go up enormously. So much is this the case that where there are several conductors in a slot, the one nearest the armature surface may give rise to less heat loss if made thinner and of higher specific resistance than the other conductors. Of course, by so doing the heating due to the normal load current is increased, but the extra heating due to the eddy currents is so much more important that its reduction by these means results in a decided lessening of the heat losses. Similar considerations explain another apparent paradox pointed out by the author, namely, that it is possible to use too much copper in large machines, and that in some cases the dynamo efficiency can be increased by using conductors of smaller section with slots of lesser depth.—Lond. *Elec.*, March 9, 16.

Testing Three-Phase Motors.—Moser.—The curves of tests of a motor not only show how accurate has been its design, but also enable one to determine the behavior of the same type of motor under changed conditions, for instance with changed frequency and voltage. The author describes a useful method which he calls the method of "corresponding points of load"; for such calculations it essentially depends on the use of the Heyland diagram in its simplest form, while as "points of corresponding load," such points are designated which have the same phase difference between current and voltage. It is then easy to pass over from one frequency to another one or from one saturation to another one. For practical purposes it is correct to assume that with varying saturation the current consumption for "corresponding points" varies in direct proportion with the no-load current. The watt consumption for corresponding points at constant frequency but varying saturation is proportional to the product of saturation and no-load current. For constant frequency the slip is almost constant for corresponding points. The article is illustrated by diagrams and several numerical examples are given.—*Elek. Zeit.*, March 1.

Single-Phase Induction Motor.—Fynn.—The conclusion of his long article giving what is claimed to be a simplified theory of the single-phase induction motor. In this last installment his theory is summarized in form of a series of diagrams.—Lond. *Elec. Rev.*, March 16.

Automobile Motor.—Bary.—An illustrated article on the Betrine automobile motor which permits a change of speed within limits of 1 to 2 or 1 to 4 by varying the magnetic field. The author points out that the chief requirement is to design the magnetic field in such a way that the characteristic curve of the motor has its principal bending point at a low value of induction.—*L'Ind. Elec.*, March 10.

Lamps and Lighting.

Direct-Current Flame Arc.—Mehlke.—It has been impossible in practice to increase the proportion of the additions with which the flame arc carbons are impregnated above six per cent, since above that limit the light is no longer steady. The author claims the possibility of increasing the impregnating additions with a resulting higher efficiency if the two carbons of direct-current flame arcs are impregnated with different materials. For the positive carbon metals are suitable which form bases, like calcium, magnesium, barium, while the negative carbon should be impregnated with metals which form acids, like tungsten, chromium, molybdenum. Suitable additions for the positive carbon are fluorspar and magnesia and for the negative carbon tungstic acid and chromium fluoride. It is stated that the diameter of such carbons may be increased so as to increase the life with the same length of carbons.—*Zeit. f. Beleucht.*, March 10.

Waste in Incandescent Lighting.—A full account of the long discussion of the paper of Wilkinson which dealt mainly with the trouble from using incandescent lamps for too many hours and at a low efficiency. In the discussion free lamps, as largely adopted in the United States, was thought by various speakers to be the best solution of the difficulty. Since in most cases it is not financially possible to use separate circuits for lamps and motors it was thought by several speakers to become more difficult every day to keep the regulation of pressure within 2 per cent, owing to the demand for power at intermittent times. Automatic apparatus prevent fluctuation, but cannot equalize the pressure all over the network. If the supply companies make a point of renewing consumers' lamps and maintaining them—as gas companies do with their mantels—the cost to the consumer of electric light as a whole would be greatly reduced. Boot had tried Nernst, tantalum and osmium lamps on public lighting circuits and so far the most successful had been the osmium lamp when burning four in series on 220 volts. He believed vacuum tube lighting would prove a great boon for street lighting in future. Dickinson thought the value of the lighting load was not sufficiently appreciated; it is the lamp load that makes the profit and the companies should try to keep the rates for motor purposes up as much as possible. Emmott pointed out that exhibitions, prominent show rooms and advice on gas consuming appliances are at the service of a customer of a gas undertaking, and he strongly advocated something of this nature for central stations. It was the general opinion of the speakers that central stations should educate their customers. "It is a fault which must be laid entirely on the station engineer that the general public believe even to-day that a lamp must be made to last a thousand hours." Lamps obtained from consumers showed from 15 to 40 per cent loss in candle-power, according to the density of the blackening. Wilson spoke for the lamp manufacturers, and especially on grading the lamps. He recommended to arrange a standard voltage and to run, say, 60 per cent of all stations at this standard voltage and to grade the other 40 per cent below or above in steps of, say, 4 or 5 volts. These would help the lamp makers decidedly in grading their lamps and to keep down their stock of outfalls. In an editorial note the following table of the number of central stations in the United Kingdom using different voltages is given.

Declared voltage..........	100	102	104	105	107	110	115	120	150
Number of stations.......	48	3	1	7	1	8	3	1	2

Declared voltage	200	204	205	210	214	215	220	225	230	240	250
No. of stations.	77	1	4	28	1	1	81	8	125	60	10

It is thought that the variety in declared pressures shown in this list should be sufficient to afford a market for the outfall in 220-volt lamps.—Lond. *Elec.*, March 16.

Flame Arc Lamp.—An illustrated description of the "Juno" flame arc lamp of English make. The construction is shown in Fig. 1. A hot wire is made use of for striking the arc, but when this has once been struck the feeding of the carbons is done without the intervention of any clockwork or clutch mechanism. One of the two converging carbons, C_1, rests with its edge on a copper stop, *A*, and drops down by gravity as it burns away. Since the two carbons are mechanically connected at their upper ends by means of *S S*, however, the second carbon feeds with the first, so that the arc remains stationary and of the same length. The arc is blown out to a "flame" by a magnet in the usual manner, with the result that only the fringe of the arc just touches the copper stop, and this stop, the makers state, will last for three months when the lamp is in ordinary use. The magnetic flux to elongate the arc is created in the iron rods, *I*, which are wound with bare copper wire. This wire is insulated from the iron rod by a layer of mica and other insulators. *W* is a stout wire of a nickel-iron alloy, which also contains a little copper. When the lamp is not burning the tension of the wire, *W*, keeps the striker, *F* (whose fulcrum is at *G*), in the position shown, and the carbon, C_2, is pressed against the carbon, C_1, by the collar, *K*, which is rigidly fixed to the striker. *L* is a thumbscrew, by means of which the tension of the hot wire, *W*, can be adjusted. In order to assist cooling the middle portion of the hot wire is flattened out. If the lamp now be switched into circuit, current will enter by one of the terminals, *T T*, and, after flowing through the hot wire, the carbons and the blow magnets in series, will leave by the other terminal. The hot wire heats up very quickly and elongates, and the striker is free to rotate in a counter-clockwise direction about *G* by gravity. At the same time the collar, *K*, moves towards the right, and in doing so draws the carbon, C_2, away from C_1. In this way the arc is struck. When the lamp is fed by direct current the carbons are of different thicknesses. They are 18 in. long. With a thickness of two carbons of 8 and 9 mm., respectively, the lamp which consumes 8 to 10 amp. burns from 10 to 12 hours before it needs retrimming, while with carbons of 11 and 13 mm. the hours of burning are increased to about 20.—Lond. *Elec.*, March 16.

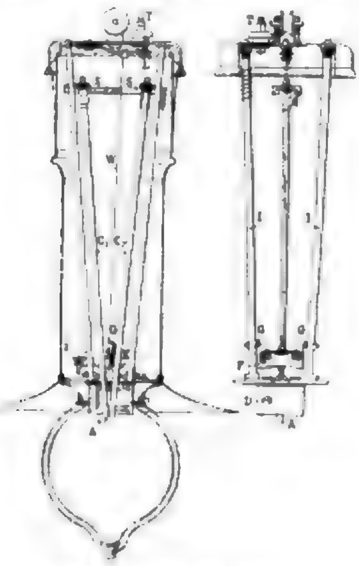


FIG. 1.—FLAME ARC LAMP.

Tube Illumination.—Thomas.—Any intense spot of light, however small, as for instance an arc lamp, or even the filament of an incandescent lamp, causes a contraction of the pupil of the eye in order to protect the sensitive portion of the eye. In the Cooper Hewitt mercury vapor lamp the source of light is distributed uniformly over a very large area and enables the pupil of the eye to remain wide open, so that a maximum use can be made of the actual amount of light. Furthermore, the normal intensity of the tube itself is so low that after looking steadily at the lamp the eye is not dazzled, and can readily see less brilliantly illuminated objects. The net result of these conditions is that the vapor lamp has a great advantage in effectiveness over arc and incandescent lamps, quite aside from the relatively small number of watts required per candle. In the matter of distribution the Cooper Hewitt lamp, especially the longer tube, has an advantage in that the law of inverse squares, stating that the intensity of the light is inversely proportional to the square of the distance from the source, holds only with sources mathematically a point. The length of the Cooper Hewitt tube is such as to cause the intensity of the light to decrease much less rapidly with distances from the lamp than with an arc, and for this reason no definite shadows will be found.—*Elec. Jour.*, March.

Metal Vapor Arc Lamp.—Vogel.—The first part of a more detailed description of his metallic vapor enclosed arc lamp which has been noticed in the Digest. The arc is produced between two carbon electrodes within a closed globe, filled with metal vapor. The lamp is intended to combine the advantages of the arc lamp with those of the mercury vapor lamp. The article is to be continued.—*Elek. Anz.*, March 15.

Power.

Electric Power for Rolling Mills.—Belsey.—A paper read before the Dublin section of the British Institution of Electrical Engineers on the use of electric power for various purposes, especially in spinning mills, weaving mills, for bleaching, finishing and textile printing, for calendering machines, dye jigs, in foundries, in iron and steel works, etc. In rolling mills the very great variations in power offer special problems. It is necessary to use some device for automatically storing and getting out energy whenever required. This can be done either by means of a storage battery or with the aid of a buffer machine for storing the energy in a heavy fly-wheel. The latter method is both cheaper and more effective. If for instance three mills are to be driven by a total power of 1,200 kw, the power will vary between that value and the amount required to drive the mills light; the mean power may equal only 300 kw, therefore the buffer machine will have to supply for the short periods the difference between these amounts, namely, 900 kw. This buffer machine consists of a dynamo having a variable speed from 250 r.p.m. to 500 r.p.m., and upon the shaft of which is fitted a fly-wheel having a weight of about 20 tons, and a peripheral velocity of 212 ft. per second when revolving at 500 r.p.m.; therefore, at that speed the storage energy is 14,000 foot-tons, and if the fly-wheel is reduced in a speed from 500 r.p.m. to 250 r.p.m. the capacity of the fly-wheel is 14,000 — 3,500 = 10,500 foot-tons. If we assume a total loss in this buffer machine of 15 per cent, including friction and all electrical losses, then the energy available in the fly-wheel equals 27,500 hp-seconds, or 21,000 kw-seconds. Therefore, it will be seen that the buffer dynamo will give 350 kw for one minute, 700 kw for half a minute, and so on. In actual practice, however, the pulsations of load will last only a few seconds, so that the speed of the fly-wheel will never be greatly reduced. The arrangement is illustrated in Fig. 2, which shows that a small motor-generator supplies the excitation for the buffer dynamo. The generator for this set is usually excited by part of the current flowing from the generating station to the rolling mill, or perhaps a better way to put it would be that it has a shunted series winding, so that as the load increases the voltage of the exciting generator increases. By this means the excitation of the buffer dynamo is changed, which, in its turn, causes a corresponding change in speed, and corresponding to this decrease or increase in speed the buffer dynamo runs as a generator or as a motor. A very interesting feature recently adopted in one of the largest steel works in Scotland has been the using of the exhaust steam from the mill engine and steam hammers etc. for driving a steam turbine. This is arranged by exhausting all the steam from the rolling mill engines, steam hammers, etc., into a calorific reservoir, which consists in some cases of a covered steel tank which is loosely filled with pig iron or some other substance which will readily absorb heat. From this the steam is passed through a turbine, and exhausts into a very high vacuum. This method has proved very successful in the utilizing of hitherto waste steam, for the steam which emerges under conditions of light load from rolling mill engines and steam hammers is practically live.—Lond. *Elec.*, March 2.

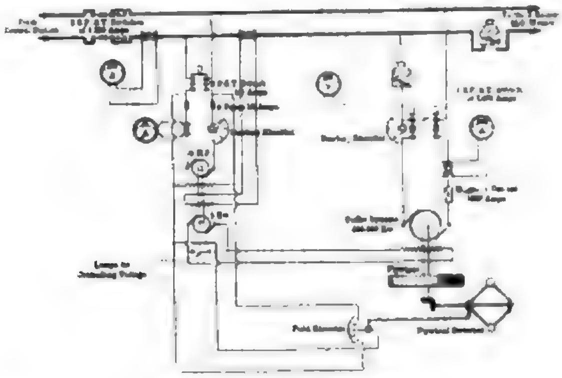


FIG. 2.—DIAGRAM OF CIRCUITS

Crane.—An illustrated description of an electrically-operated rotating tower crane for the Dublin docks. It is designed to deal with normal working loads of 100 tons. The motors are direct current and operate on 500-volt circuits. The main and auxiliary lifting motors for operating hoists are of 60 and 40 hp, respectively, with speeds of 650 r.p.m.; the motor for traveling the crab is 30 hp with a speed of 750 r.p.m. The operation of slewing is performed by a 15-hp motor with a speed of 570 r.p.m.—Lond. *Elec. Rev.*, March 16.

Power Plant Design.—CLARK.—A discussion of tendencies in power plant design, especially the increase of the size of units, the introduction of labor-saving devices and greater operating economy. In view of the very high efficiency of electrical generators the power plants of the future must endeavor to excel those of to-day in the generation of mechanical rather than electrical power.—*Cassier's Mag.*, March.

Traction.

Birmingham.—The first of several illustrated articles describing special features of the system of the Birmingham Railway, Light & Power Company upon which upwards of $3,000,000 are being expended for improvements. Power for the entire railway, lighting and steam heating business is supplied from one power house, which is being completely remodeled and extended.—*St. R'y Jour.*, March 24.

Automobile.—An illustrated description of the Pieper petrol-electric system of automobiles. Only one electric machine is employed, which operates either as dynamo or motor. A small battery supplies reserve power for starting the car and hill climbing, and it is also used for starting the engine, working the ignition, lighting the lamps and other auxiliary purposes.—Lond. *Elec.*, March 2.

Installations, Systems and Appliances.

Economy of Central Stations.—HOPPE.—The conclusion of an article discussing the quite unsatisfactory results which are obtained in various German central stations of smaller or medium size. The author thinks there are especially three reasons for the poor commercial results obtained. First, the lighting energy tariff is in general too high and the motor energy tariff too low; as a matter of fact, in most cases a decrease of the fundamental rate for lighting energy has resulted in an increase of the mean yearly receipts per connected kilowatt, while a decrease of the fundamental rate for motor energy generally results in a decrease of the mean receipt per kilowatt. Secondly, many German stations have been too elaborately built and look more like palaces than power stations. Thirdly, many German cities have several stations while the combination of the same in one single station would be far more economical. Some notes are given on a method for predetermining the commercial economy of a new central station.—*Jour. f. Gasbeleucht*, February 24.

Methods of Charging.—A note stating that the Wright maximum demand system has done much to educate central station engineers, although many central station men have now substituted for the maximum demand system flat rates of charging, with discounts which make sufficient allowance for the character of the load of individual consumers, and there are now comparatively few towns in which the Wright system is the only tariff in use. In some it has been abandoned altogether, while in others flat rates are offered as an alternative method of charging. Brighton, the town in which the maximum demand system was born, has hitherto been among those in which every consumer was charged on the maximum demand system, but the Brighton municipality has now decided to give every consumer the option of being charged at a flat rate of 8 cents instead of on the Wright system at 14 cents for the first hour and 2 cents after. As it requires a two-hours' use of the maximum demand per day at 14 cents and 2 cents to bring the average charge down to 8 cents per unit, it is probable that a large number of consumers will adopt the alternative.—Lond. *Elec.*, March 9.

Automatic Boosters.—SCHROEDER.—A paper read before the Berlin Elec. Soc. on the use of automatic boosters in electric power plants. They have been installed in the past only in a single instance in Germany, but are now beginning to attract more attention.—*Elek. Zeit.*, March 8.

Wires, Wiring and Conduits.

Electric Installations for Collieries.—PREECE AND MAURICE.—Two papers presented before the British National Association of Colliery Managers. The paper of Preece deals with the manufacture, application and distribution of electric cables for collieries. He first describes the various types of cables which are used in collieries. These types are: (1) Vulcanized rubber-insulated, taped and braided, sometimes lead-covered and armored; (2) vulcanized bitumen cable, braided or served over all with jute; (3) paper-insulated cables, further insulated with a sheathing of vulcanized bitumen and protected as No. 2; (4) paper-insulated cable, lead-covered and sometimes braided or served and armored. The first type is the oldest one, and, in the author's opinion, it is a moot point even now—especially as regards the highest grades—whether these cables are not the best. He knows of cables which have been working for over 15 years and are still running. Cheapness, however, should never be the determining factor in the choice of rubber cables. The use of the second type is increasing, especially for shaft work, and it might be considered a standard cable for voltages up to 600. Beyond that pressure paper bitumen cables of type No. 3 are superior. It is advisable to work bitumen cables at a current density not above 800 amp. per square inch. Bitumen cables of good design withstand the action of pit waters very well. An important point in the use of types 3 and 4 is the necessity of effectively sealing the ends to prevent the entry of moisture, sealing boxes filled with bitumen being the safest, though good protection is afforded by using bitumen tape and vulcanizing in bitumen for a few seconds. Type 4 might be the best cable from the electrical and permanence point of views, but unsatisfactory results have been obtained with it due to carelessness both in installation and in maintenance. The paper of Maurice suggests the general adoption of a set of conventional signs in order to systematize the drawing up of plants and to make it possible to read at a glance the arrangement of any given plant.—*Mining Mag.*, March.

Conduit Wiring.—A paper read before the British Electric Contractors' Association. The author, who is not named, remarks that the practice of electric wiring has passed from the stone age to the wood age and more recently to the metal age. He gives a review of the development of steel conduits for electric light installations. He calls attention to a risk in connection with the conduit wiring of buildings which will remain as long as it is permitted to use gas pipes of the "compo" description. Continuity and earthing are very advisable on high-voltage work from the point of view of protection from danger to life, but they provide little safeguard against fire risk, unless care is taken to keep metal conduits spaced apart from such gas pipes and, of course, from any metal work in connection with them. The author discusses whether it is desirable to use a brazed or solid drawn tube or whether it is not actually advantageous to use an open seam and socket fittings. The latter are recommended by various engineers for surface work, the seam being placed lowermost so as to effectively drain the tube, and produce good ventilation. In situations containing steam or vapor, such as in baths, laundries, boiler rooms, etc., the moisture from the outside is more to be feared than condensation, and here the use of the seamless screw tube is desirable. For concealed work, switch runs and the like, the open-seam conduit is unsuitable, wherever switch runs are buried in plaster or cement.—Lond. *Elec.*, March 2.

High-Tension Cable.—An article giving the results obtained with an underground three-phase cable of Geoffrey and Delore in a plant of the French Thomson-Houston Company. The cable withstood successfully in industrial operation an effective e.m.f. of 27,000 volts between the conductors and 15,000 to 16,000 volts between one conductor and earth.—*L'Ind. Elec.*, March 10.

Fuses.—HARVEY.—A paper giving characteristic curves of fuses, discussing their standardization and the different types of fuses. —*Elec. Jour.*, March.

Electrophysics and Magnetism.

Calibration of Gold Leaf Electrometers.—SCHMIDT.—The gold-leaf electroscope is being widely employed in measurements of ionization. It is calibrated by applying known potentials to it. The author points out that it is not as a rule used for measuring differences of potential, but for measuring currents by noting the variation of the potential. To obtain the best results, therefore, another principle of calibration should be employed. The relative difference of potential between two scale divisions may be obtained by exposure to the beta and gamma rays of a radium preparation fused into the glass wall, and noting the times taken by the leaf to traverse successive divisions. If there is a saturation current, these times are proportional to the differences of potential. If the shape of the electroscope causes a doubt as to whether there is a saturation current it is only necessary to connect the electroscope with an air condenser which is not too small, and to expose this alone to the radium rays. The author believes that with a well-calibrated leaf electrometer as good results may be obtained as with a quadrant electrometer. Moreover, it has the great advantages of simplicity, small capacity and independence of external disturbances.—Lond. *Elec.*, March 16; from *Phys. Zeit.*, March 1.

The Corpuscular Theory of Matter.—J. J. THOMSON.—A long abstract of his second lecture on this subject. He discussed the methods for determining the mass and charge of negative electrons (corpuscles) and of positive ions.—Lond. *Engineering*, March 16.

Electrochemistry and Batteries.

Asymmetrical Action of Alternating Currents on a Polarizable Electrode.—GUNDRY.—An account of experiments made to explain the action of the electrolytic coherer whose resistance is changed by the impact of electric waves. The object of the paper is to show that in a polarizable electrode in general, as soon as one passes beyond the stage of initial capacity, the alternating current gives rise to an asymmetry which would appear as a coherer effect. The experiments of the author consisted essentially in the sending of an alternating current of frequency varying between 80 and 5,000 periods per second through an electrolyte between two mercury electrodes, of which one was very small, the other more than a thousand times as large, so that the latter may be considered as unpolarizable in comparison with the former. The results obtained by the author show that a perfectly symmetrical alternating current acting at a polarizable electrode leads, according to Nernst's osmotic theory of polarization, to an asymmetry of the polarization; in other words, to a direct current. The product of the direct current and of the frequency is proportional to the square of the amplitude of the alternating current. The direction of the current corresponds with an effective diminution of the concentration in the neighborhood of the electrode. An explanation of the action of the electrolytic coherer is proposed.—*Phil. Mag.*, March.

Granulated Carbon as Resistor.—BROWN.—An account of experiments on the use of granulated carbon as heating material for electric resistance furnaces. The author has especially studied the changes which the resistance of such a material undergoes when it is first connected to the circuit. This material of granulated carbon is called kryptol by the author, while the same name now usually stands for a mixture of granulated carbon, graphite, sand, clay and other silicates, etc.—*Elek. Zeit.*, March 1.

Storage Battery.—ROSSET.—The first part of a discussion of the chemical and electrochemical requirements of the grid of a storage battery, and of the gain in capacity due to a decrease of the relative weight of grid.—*Centralblatt f. Accum.*, March 15

Units, Measurements and Instruments.

Oscilloscope.—JONES.—Some notes on the Ruhmer glow-light oscillograph which employs a special form of vacuum tube as a means for observing the wave forms of high potential discharges. It is based on the fact that in a vacuum tube the area covered by the glow upon the negative wire is proportional to the magnitude of the current through the tube. When a suitably exhausted tube is traversed by a high potential discharge the negative wire is partly covered by a violet glow, which seems to form a luminous sheath to the free extremity of the wire along which it also extends for a certain distance. With increase of current the area covered by the glow lengthens out, and with decrease of current it becomes shorter. If the current is alternating, then both wires show the negative glow, but to an unequal degree. To the eye the glow appears steady, but when viewed in a revolving mirror it is found to form upon each wire alternately and to rise and fall in time with the variations of the current, and so it traces out the contours of the wave impulses of which the discharge consists. The Ruhmer tube is shown in Fig. 3, being 55 cm. long and 4 cm. in diameter, with two slender rigid nickel wires arranged axially. The distance between their ends is about 2 mm. and a disc of thin porcelain or mica is fixed at this point. It is pierced by a small hole which corresponds with the ends of the electrodes. The degree of exhaustion corresponds to 6 mm. of mercury. Fig. 4 shows curves of the induction coil discharge. The curves below the zero line give the induction coil currents at make, and those above it at break, and show very clearly the gradual rise of the make e.m.f. and the sudden rise of the net break e.m.f. Some other curves obtained by the instrument are also given.—Lond. *Elec.*, March 16.

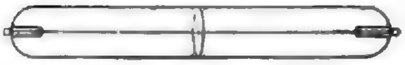


FIG. 3.—RUHMER TUBE.

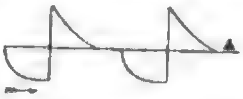


FIG. 4.—DISCHARGE CURVES.

Spherical Photometer.—A long illustrated description of the spherical photometer for measuring the mean spherical candle-power by a single observation, with abstracts of papers by Ulbricht and Bloch on the subject, which have been noticed in the Digest.—Lond. *Elec. Rev.*, March 16.

Telegraphy, Telephony and Signals.

Magnetic Detectors of Electric Waves.—Russell.—An account of experiments in which the author measured the effects of parallel and traverse oscillations upon the magnetic properties of iron, with a view to explain the action of the various patterns of magnetic detectors of electric waves. He finds that Marconi's second instrument detects the increase of induction which occurs when electric space waves are superposed upon the fields at or near a cyclic extreme, in precisely the same way as Rutherford's original apparatus detected, or rather measured, a decrease at another point of the cyclic process. The function of the moving band appears to be twofold: First, it supplies the hard iron or steel in a condition of lower permeability, in order that it may be raised to a condition of higher permeability when the signals are received from a distant station; and, second, it distorts the field in the direction of motion, the telephone thus tending to respond in a greater degree to signals received when the field is increasing near, but not at, the cyclic extreme. For low field this is the most sensitive part of the cycle. The Ewing-Walter form of detector is essentially different. It is based upon Ewing's hysteresis tester, which measures the drag between field and iron when one of these is revolving. The best speed is stated to be from five to eight revolutions per second, while Marconi obtained good results at a speed of only half a revolution per second. The reason for this great difference is obvious. The Marconi instruments detect instantaneous induction change, while the Ewing-Walter form integrates.—Lond. *Elec.*, March 2.

Miscellaneous.

Carbon Factory.—Illustrated descriptions of the Witton carbon factory of the British General Electric Company, making carbons for electrical purposes.—Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, March 16.

BOOK REVIEW.

Annuaire Pour L'An, 1906, Publié Par le Bureau des Longitudes. Paris: Gauthier-Villars. 940 pages. Price, 1.50 francs.

The present issue of this annual publication contains the usual astronomical, physical and chemical data together with two papers of timely interest on total eclipses of the sun with special reference to the eclipse of August 30, 1905. M. Bigourdan, member of the Bureau des Longitudes, writes at considerable length on the various observations to be made during the short period of totality, and shows the importance of adequate remote preparation as well as prolonged proximate drill. The paper is indeed a little treatise on the subject which will be read by all students of astrophysics with unusual interest. M. Bigourdan took an active part in observing the eclipse of last August, being stationed on the line of totality of Sfax in Africa, where he obtained numerous important results.

In enumerating the stations and observers, he states that Janssen, the dean of French astronomers, despite the weight of his 82 years, went to Alcosbre, in Spain, to observe his seventh eclipse, and was rewarded with valuable photographs of the corona as well as spectrograms of the corona, the chromosphere and the reversing layer. The *Annuaire* closes with a short account of these results from the pen of M. Janssen himself.

Some New Direct-Current Switchboard Instruments.

By A. O. Benecke.

Recently in designing a line of switchboard instruments for use on direct-current circuits the writer carefully analyzed the various causes of inaccuracy and failure of such instruments to operate properly under actual working conditions. He has reached the conclusion that everyone of these causes can be avoided and that it is possible to produce instruments which will effectively withstand transportation, the usual handling in erection and the most trying conditions of service on switchboards, and which will retain their accuracy and reliability almost indefinitely.

The movable coil permanent magnet type instruments have been in general use for years, and the principle employed in their construction is universally considered to be the most satisfactory for measurements on direct-current circuits. It is, however, generally known that these instruments do not remain equally reliable on switchboards as when used in laboratory work. The reason for this, of course, cannot be charged to a fault in the principle, but is due to the fact that the instruments have been constructed too delicately and are too fragile to withstand handling by inexperienced men, and the trying working conditions which exist in stations.

No one would ever attempt to mount a delicate chronometer on a vibrating switchboard, but would select for such a purpose a less sensitive clock. Nor would any chronometer maker recommend the use of one of his instruments where vibrations, excessive changes in temperature, etc., are unavoidable. In reference to electrical measuring instruments, however, it has been the custom to construct the same as delicately as possible, and to expect their accuracy to be as reliable under the conditions existing in a central station as if carefully erected and carefully handled by experienced men in the laboratory.

The large majority of cases in which instruments fail to indicate properly may be attributed to friction which is due either to damaged pivots or jewels or to an accumulation of dust or other small particles between the movable and stationary parts of the instruments. It seems to be self-evident that the cases protecting the instruments proper should be dust-proof, but a close inspection shows that very few of the so-called dust-proof cases really deserve this name.

The peculiar form of pivots and jewels generally employed in electrical measuring instruments cannot withstand the jarring in transportation or the vibrations found in central stations. It must be admitted that the conical pivots and conical jewels constitute the most frictionless bearing if perfect, but serious friction develops as soon as the microscopical point of the pivot is broken off. In instruments with a horizontal axis a considerable displacement of the movable coil takes place as soon as the pivot becomes damaged, or when the distance between the two jewels becomes slightly altered by expansion due to temperature changes, and it is not a rare case that this displacement brings the movable coil in direct contact with the core or pole pieces of the magnetic system. Instruments with conical pivots will seldom show any friction under the first laboratory tests and the manufacturer seems to be satisfied that this way of pivoting the movable coil is the easiest and has therefore adhered to it. The mechanical difficulties to be overcome in producing instruments with cylindrical pivots and journaled in watch jewels are undoubtedly greater, but when once accomplished an instrument of this kind will remain practically frictionless forever. There is no possibility of the pivots or jewels becoming damaged under any ordinary conditions.

Another defect found in instruments is the insufficient insulation of the current carrying parts. Connections are often made by thin wires not properly supported which can easily come in contact with each other or the case, causing not only inaccurate indications but frequently the complete burning out of the instruments.

Appreciating the above enumerated facts the writer has taken special care to insulate all parts of the instruments from their enclosing cases, to make these cases absolutely dust-proof by providing large contact surfaces where detachable parts are joined, and to employ highly polished cylindrical steel pivots and perforated jewels.

Besides these vital points other minor ones have been carefully considered. By the selection of a proper winding for the movable coils the instruments have a somewhat larger torque, which permits the use of stronger controlling springs. Zero errors so often noticeable in other instruments are completely avoided. All voltmeters are adjusted to the same resistance per volt and therefore multipliers can be interchanged. The same plan has been adopted for the shunts of ammeters. The scale opening in the front of the case is somewhat larger than usual; thus more light is admitted to the scale and it can be read more clearly.

Scales for the different ranges are divided in such a manner that the indications of the instruments are easily read without any mental calculations. The instruments are regularly provided with back connections, but can be converted into instruments with front connections if preferred. All instruments can be mounted flush with the switchboard by the mere addition of a special guard ring.

The American Instrument Company, of Newark, N. J., will shortly place on the market these instruments in different sizes and ranges to suit all the requirements of isolated plants and central stations.

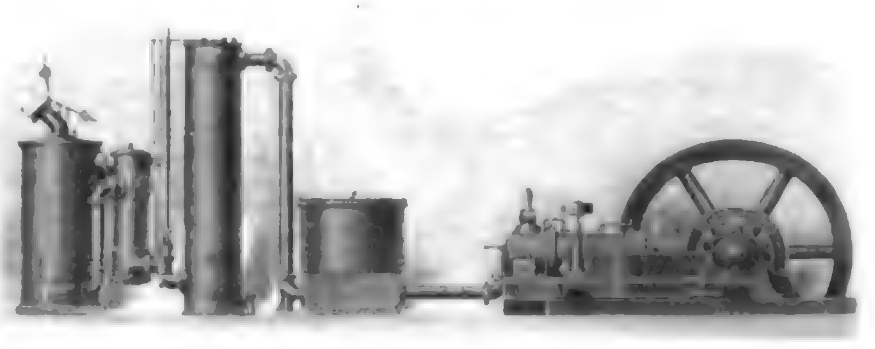
Producer-Gas Power in Electric Stations.

BY DR. OSKAR NAGEL.

In Germany and Austria a considerable number of gas engines and gas producers, especially of the Koerting type, are in successful use for municipal electric light plants and electric stations in public buildings, depots, post offices, etc. Several years of experience have shown that such a gas power plant is fully as reliable as the best steam plant and has the advantage of much greater economy. The slow speed and heavy construction of the Koerting engine make this machine absolutely reliable, the extremely sensitive governor gives close regulation and the Koerting mixing valve insures greatest economy.

Above are given some figures from actual practice of several German plants. It must be borne in mind, if comparison is made with steam plants, that the gas plants referred to below are of small size, are working only a relatively short time every day, so that the average load is rather low and the standby losses considerable. If all these points are taken into consideration it will be found that the total coal consumption per kw-hour is extremely low. The cost of lubricating oil is not higher than in a steam plant and the cost of attendance is considerably lower.

In Pressburg, Hungary, a 125-hp Koerting gas power plant is running in the electric central station according to a guarantee of 1.4 lb. of furnace coke per hp-hour at full load, and 1.7 lb at half load. During a test of 8 hours one kw-hour was developed from 0.25 lb. less coke than the guaranteed consumption.



GAS PRODUCER OUTFIT.

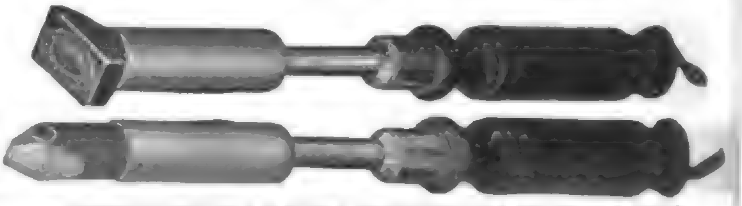
A complete Koerting suction gas producer outfit comprising producer, evaporator, wet scrubber, sawdust scrubber and engine, is shown in the accompanying cut. A plant of this kind is in continuous operation at the works of the De La Vergne Machine Company, New York.

GAS ENGINE PRODUCER CENTRAL STATIONS, 1902-3. KOERTING ENGINES AND PRODUCERS.

Place.	K.w.-hours, gen'd.	K.w.-hours, deliv'd.	K.w. per 1 lb. coal, gen'd.	K.w. per 1 lb. coal, deliv'd.	Lubricating oil, total (lbs.)	Lubricating oil, per k.w.-hour (grams)	Cotton waste, total.	Cotton waste, per k.w.-hr.	Coal lbs. per yr	H P capac
Clausthal	219150	195943	0.36	0.33	2708	5.60	514	—	599317	[illegible]
Gransee	51847	44748	0.36	0.31	640	5.62	67.1	0.558	144238	[illegible]
Neumarkt	125076	98711	0.37	0.3	1984	7.22	121	0.442	333830	[illegible]
Neurode	119800	94731	0.24	0.21	798	3.03	375	1.42	500280	[illegible]
Reichenbach	49437	45418	0.3	0.27	673	6.20	53.9	0.500	59534	[illegible]
Soberheim	95326	80000	0.36	—	1540	7.36	730	3.50	263005	[illegible]
Schoenberg	58514	46638	0.35	0.29	1654	12.80	163	1.3	168000	[illegible]
Schwetz	82112	67072	0.398	0.33	880	4.81	191	1.06	206817	[illegible]
Walserorde	60352	53940	0.32	0.29	1086	8.24	266	2.03	187413	[illegible]
Wienenden	71828	—	0.24	—	1102	6.07	312	1.98	287738	[illegible]
Post Office Karlsruhe	70766	61693	0.45	0.39	798	5.14	168	1.08	157874	[illegible]
Depot. Werdan	102716	92607	0.36	0.32	1375	6.07	673	2.99	286141	[illegible]

Electric Branding Apparatus.

An interesting exemplification is shown herewith of the use of electrical branding appliances. The engraving is from a photograph of an actual brand sold by L. P. Brown & Co., 71 West Jackson Boulevard, Chicago, to the Chicago Law Institute. The electrically-heated brand is quickly made ready by turning on the current, and it imprints permanently the name of the owner upon the book or other object upon which it is used. These branding devices may be used in a great many ways. Many thousands of tool handles are thus branded, and this work can be best done by electricity. The firm makes a large line of electric soldering and branding tools, which are interchangeable by simply changing the tips so that it is possible for one tool to do both classes of work. These are made in various sizes and shapes adopted to special use. The firm believes that this new line of branding appliances opens up a field for central station managers to increase



INTERCHANGEABLE ELECTRIC BRANDING AND SOLDERING IRONS.

the sale of electric energy which is well worth looking into. The company is well known as a manufacturer of electric soldering tools, but the electric branding iron is an addition to its product.

Lincoln Variable-Speed Motor.

The variable-speed motor illustrated herewith is unique in the method employed in obtaining the speed variations. The motor is an ordinary shunt-wound machine. The armature is similar to the armature of any shunt-wound motor.

The speed variation is obtained by withdrawing the armature from the influence of the field poles. As the armature is withdrawn the magnetic reluctance between the field poles and the armature increases, thereby decreasing the magnetic flux and increasing the speed.

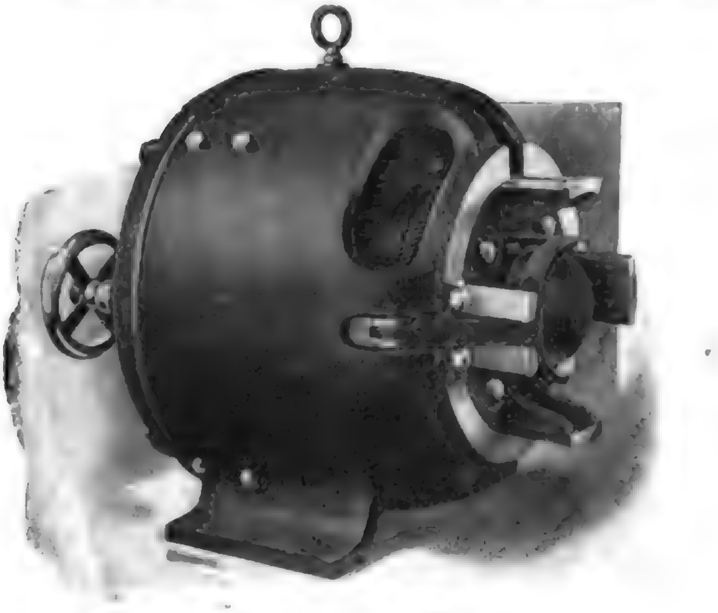


FIG. 1.—VARIABLE-SPEED MOTOR.

It is possible to obtain a more marked change in speed with a given lateral motion by making the armature slightly conical. When a conical armature is used, the withdrawal of the armature decreases the area of the air gap in the same proportion as it would if a cylindrical armature was used, but at the same time increases the length of the air gap which would not occur with the cylindrical armature. Thus the increase in the reluctance of the air gap is greater with a conical armature than with a cylindrical armature for a given movement.

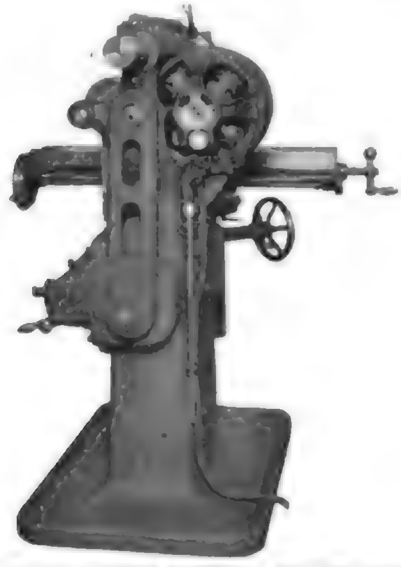


FIG. 2.—MOTOR DRIVING UNIVERSAL MILLING MACHINE.

As the armature is withdrawn, the speed increases. The machine is provided with special commutating poles, under the influence of which the armature comes as it is withdrawn into its positions of high speed. The special commutating poles produce sparkless commutation at all loads from no load to 100 per cent overload.

Exceptionally wide ranges of speed are secured with this construction. A variation of 10 to 1 is easily reached and wider variations can be obtained if there is a demand for them.

The reason why this motor permits so much wider variation in speed than are obtained by the ordinary methods of field weakening, is that there is less distortion of the main flux at high speeds than there is at the low speeds. This is due to the fact that the full field strength is used no matter what the [illegible] of the motor may be.

A hand wheel is used in connection with a screw mechanism to move the armature laterally and by means of this hand wheel it is possible to get an infinite variety of the speeds from the lowest to the highest. A simple reversing switch allows the motor to be run in either direction with equal results.

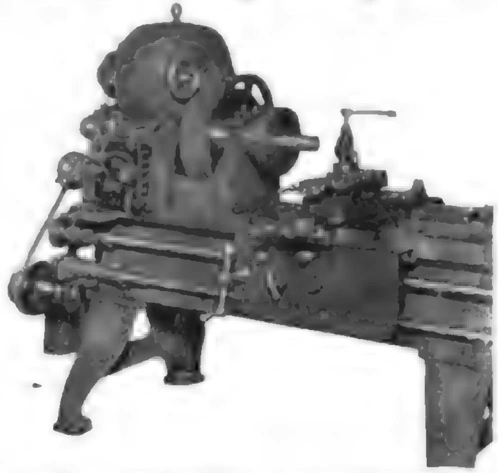


FIG. 3.—LATHE DRIVEN BY 5-TO-1-SPEED MOTOR.

The magnetic pull of the armature is carried on ball thrust bearings which minimize the friction. The brushes are mounted on the same structure as the thrust bearing and, as the thrust bearings, armature and commutator all move together, there is no relative lateral movement between the commutator and brushes. To accomplish this there has been designed a thrust bearing that supports the commutator end of the armature, carrying an annular ball bearing to take both the thrust and the radial loads. This thrust bearing is actuated by a split lever having a central pull on opposite sides of the thrust bearing, movement of the lever being accomplished by means of a screw mechanism and

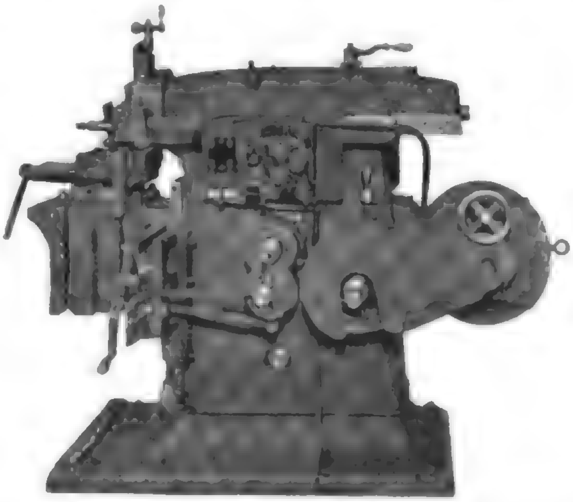


FIG. 4.—SHAPER CONNECTED THROUGH SILENT CHAIN TO VARIABLE-SPEED MOTOR.

hand wheel as illustrated in Fig. 1, a spring around the lever connecting rod being adjusted to balance up the magnetic pull of the armature.

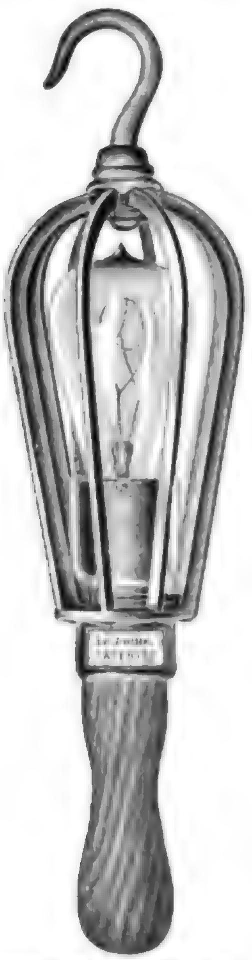
It is stated that the field and the armature coils are shaped and treated so as to provide the best ventilation and heat radiation, so that notwithstanding the exceptional small size and weight of the motor, the heating, even at very low speeds employed, is well within the margin of safety.

Three applications of these motors are indicated in Figs. 2, 3 and 4. Fig. 2 shows a No. 2 universal milling machine driven by a 2-hp motor having a speed range from 375 to 1,875 r.p.m. A 20-in. lathe driven by a 3.5-hp motor with a speed range from 350 to 1,750 r.p.m. is shown in Fig. 3, while Fig. 4 shows a similar motor driving a 16-in. shaper.

This type of motor has been designed by Mr. John C. Lincoln. It is being placed upon the market by the Lincoln Electric Manufacturing Company, Cleveland, Ohio.

Portable Lamp Guards.

The flexibility of incandescent lighting has led to the universal use of portable lamps, which can be carried around a room or a machine and be employed to throw a strong light temporarily on some particular object or part of it. The demand for improved and substantial forms of guards has led the old and progressive house of I. P. Frink, 551 Pearl Street, New York City, to develop the portable lamp guard herewith. It is of unusually heavy construction, experience having shown that lamps thus used get a lot of rough handling. The ribs of the guard are made from stout galvanized Bessemer steel. The hook being unscrewed at the top, the guard is easily unlocked for relamping; and the parts are so closely fitted there is no possibility of their suffering from jarring or vibration. Moreover, no strain whatever comes on the terminals or the socket. Although the ribs of the guard are so massive the strength lies in the depth rather than the thickness of the ribs, and hence there is a minimum obstruction of the light from the protected lamp. The guard has already had a thorough test around lighting plants, trolley roads, pressrooms, etc., and has been found an admirable new adjunct of illumination.



PORTABLE LAMP GUARD.

New Resistance Box and Wheatstone Bridge.

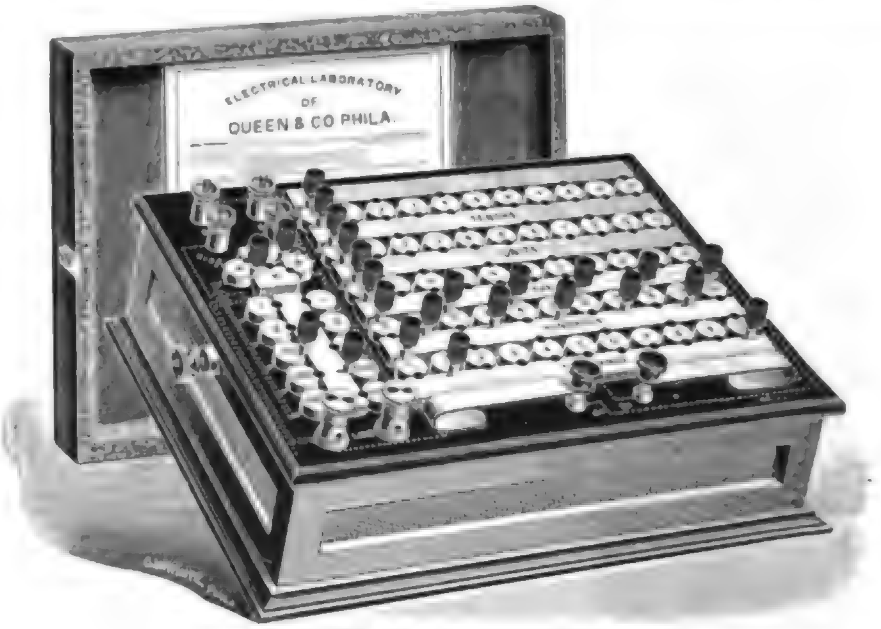
Queen & Co. have recently brought out a new universal Decade box and Wheatstone bridge with several novel features, and which is considerably smaller in size, but in arrangement very similar to the well-known Anthony form.

The rheostat proper consists of fifty coils, ten each of tenths, units, tens, hundreds and thousands, and so arranged that all the coils in any bank can be connected in series, multiple or various combinations of the two. This arrangement lends itself particularly well to the thorough and complete interchecking of the coils. For instance, the ten 100-ohm coils can be connected in multiple and compared with each 10-ohm coil, which latter in turn can be compared with the ten 1-ohm coils connected in series, and this interchecking can be extended to the other coils in the rheostat.

The bridge consists of a unit, 10, 100, 1,000 and 10,000-ohm coil in each arm, which latter by means of a commutator can be reversed and their equality determined to a nicety. Battery, galvanometer and line posts are provided and in the galvanometer and battery keys special care has been taken to use a gauge of metal which will not tire the operator and yet which will allow perfect electrical contact to be made. The connections are engraved in dotted lines on the hard rubber top, the double line indicating the heavy interior connections and the single lines showing the galvanometer and battery circuits. The lower edges of the metal blocks and bars facing each other are beveled slightly, and owing to the circular form of metal block much greater insulating space is secured than with the older form of rectangular block.

The coils are wound with manganin wire thoroughly shellaced, aged and baked. The accuracy of adjustment of the bridge coils is 1/50 per cent; that of the thousands, hundreds and tens in the rheostat 1/25 per cent, the units 1/10 per cent, and the tenths ⅕ per cent of their stamped values.

The perforated metallic sides allow a free circulation of air, which together with the zero temperature coefficient quality of the wire which is used, make the box practically independent of temperature. If requested a table of readings accurate to 1/50 per cent will be supplied with each set, showing the actual measured resistance of each coil. Twenty-four plugs and two travelers are supplied. When not in use a polished hardwood mahogany cover, similar to the box itself, fits over the hard rubber top



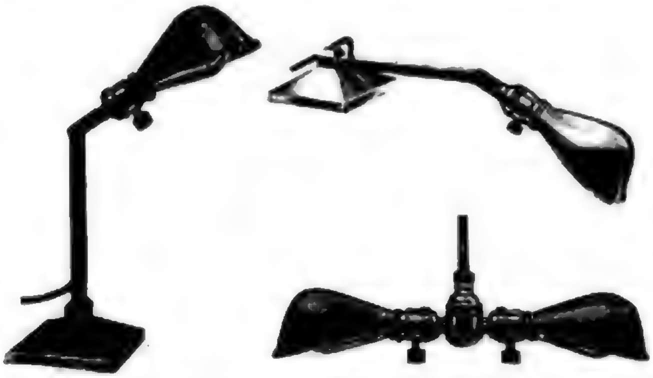
RESISTANCE BOX AND WHEATSTONE BRIDGE.

and plugs, effectually protecting them from dirt and the action of the light.

This set is particularly intended for use in the ordinary laboratory where accurate measurements are necessary and yet the expense of one of the large Anthony type bridges would not be justified.

Electric Lighting Specialties.

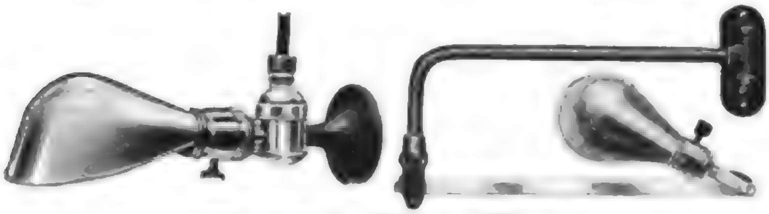
Among the first products of the H. C. K. Company, 45 Broadway, New York, which has been organized to manufacture high-grade electrical and mechanical appliances, are a number of new types of adjustable portable and bracket electric lamp fixtures. In the accompanying illustrations Figs. 1 and 2 show a portable lamp which may be adjusted at any angle and which includes a shade which may be rotated in its socket around the lamp. The double hinge which supports the socket is of a design which absolutely prevents sagging of the lamp, a common defect of other portables. Placing the lamp in the upright position makes it a portable suitable for the flat top desk or table. By placing the stem in a horizontal position relative to the base, as shown in Fig. 2, the portable is suitable for the illumination of roll top desks, pianos, filing cabinets, etc.



FIGS. 1, 2 AND 3.—LIGHTING SPECIALTIES.

Fig. 3 shows a pair of lamps mounted in a "horizontal" key socket. The key sockets swivel around the supporting cord or stem and the lamp shades may be rotated on the sockets around the lamp, thus permitting the light to be directed and concentrated wherever it is required. The top cap is threaded for ⅜-in. pipe thread so that the fixture can be screwed to a standard outlet. The swivel motion is limited to one full revolution, thus entirely obviating the use of collector rings, brushes or any working contacts. It is claimed that with this fixture 16-cp lamps may be satisfactorily displaced by 8-cp lamps, thus effecting a saving of 50 per cent in meter bill. Fig. 4 shows how one lamp socket may be removed and the fixture installed as a single lamp fixture; this latter may also be used upright, the effect of which may be seen by turning the engraving to 90 deg.

Fig. 6 shows a bracket adjustable in all directions and strong and durable as well as ornamental. The wall plate supports a swinging arm bent at one end, on which is screwed a rotatable head made in two parts held together by two thumbscrews. The inner sides of the head are provided with two friction discs which grip without cutting or scratching the ½-in. brass tube when under tension. The square tube can be moved in or out and set at any angle desired without any possibility of sag or wear. At the end of this tube is a double-sided hinge with two thumbnuts to hold it in place. The shade may be rotated around the socket directing the light to any point desired. When the light is not required, the bracket can be pushed out of the way against the wall, as shown in Fig. 5. Practically all the position adjustments can be made without tightening or loosening any screw, clamp or fitting. There is an entire absence of single-sided hinges, ball and socket joints or clutch grips, which are apt to loosen up and let the fixture and lamp sag if subjected to the ordinary vibration in a factory.



FIGS. 4 AND 5.—LIGHTING SPECIALTIES.

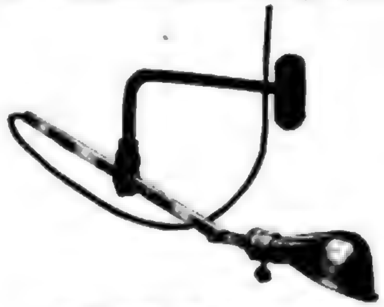
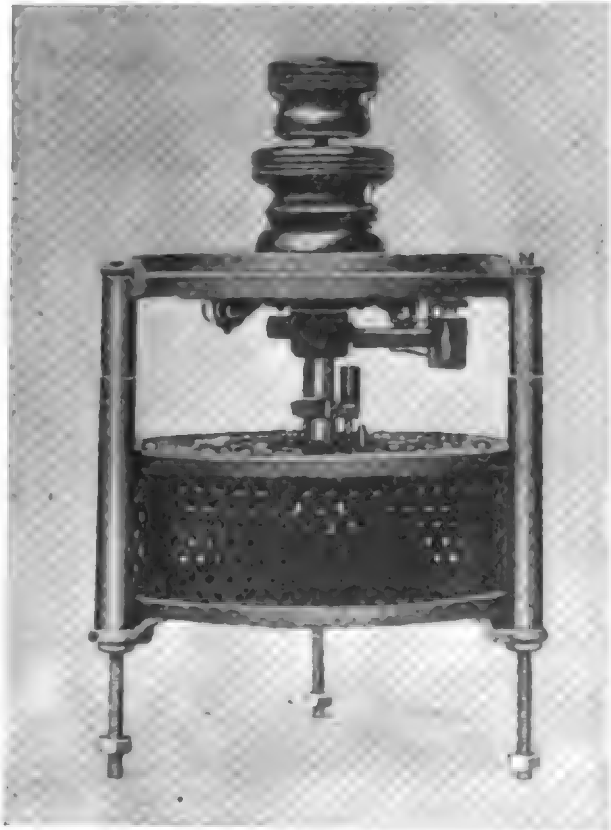


FIG. 6.—LIGHTING SPECIALTIES.

Concentric Shaft Field Rheostat.

A form of concentric shaft rheostat brought out recently by the Ward Leonard Electric Company, is 8 in. in diameter, and has no fewer than 900 steps for control purposes. There are two rheostat plates, the total resistance of one being equal to the resistance per step of the other. The plates are mounted upon concentric shafts. As will be seen, there are two handles, one of which controls the main rheostat, and the other the second rheostat, which is used to give regulation between the steps of the main member.



CONCENTRIC SHAFT RHEOSTAT.

The apparatus in the engraving is built up of standard Ward Leonard units. Any of the sizes of plates can be used, however, to obtain any desired resistance and ampere capacity.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports were somewhat irregular, owing to widely differing weather conditions and uneasiness regarding the labor situation. In some sections of the country spring trade is facilitated by satisfactory temperature, but at other points cold and storms retard distribution of seasonable merchandise. Manufacturing plants are not reducing output, statistics for March promising to establish new maximum records in many industries, but the future contains an element of disturbance in the numerous demands for higher wages. Beneath the surface happenings of the week are to be discerned the steady advance of spring trade, the continuance of the immense activity in building, with collateral heavy dealings in all kinds of lumber and material, and the underlying confidence in a heavy year's turnover in all lines. Money is strong and in active demand throughout the country, and railway earnings continue excellent. Favorable reports come from the winter wheat belt, assuring safety of the plant. Crop reports from all sections are satisfactory and preparations are being made for active planting. Few important price changes are noted, and maintained. Strength is a notable feature. Grain is steady and wheat and corn are a shade higher. All signs indicate heavy expenditure for building material, exceeding that of last year, which, according to the investigations of a prominent mercantile agency, aggregated $750,000,000. Lumber is active and high in price and there is a brisk demand in hardware all over the country. The strength of prices in most industrial lines is marked. Continued heavy buying of steel rails by railway and traction interests was the chief feature of the iron and steel markets, one order, that of 50,000 tons for the Grand Trunk Pacific Railroad, being most notable because of its source. Altogether, it is probable that orders for 150,000 tons of rails were booked within the week, and it is said that more business is pending. Contracts for structural material, though made up of small lots, for the most part, make a goodly aggregate. Coal and coke, owing to the troubled labor situation, are higher in price. Copper was active among sellers of domestic lake, electrolytic and casting stock. There were several large transactions for account of makers of electrical apparatus, and during the latter half of the week the volume of trading was heavy both for home and foreign account. The domestic and foreign wire drawers report work to the full capacities of their plants for a long period ahead, and in this country there is not an electrical apparatus firm or corporation that is not far behind in orders for power, lighting and telephone apparatus. Inability to get copper wire and ingots is greatly hindering the expansion of electric railway, lighting and telephone interests in the United States, Great Britain and Canada. Prices are firm at 18⅝c. to 18¾c. for lake, 18½c. to 18⅝c. for electrolytic, and 18c. to 18¼c. for prime casting grades. Aluminum is quoted at 35c. for No. 1 ingots. *Bradstreet* reports 109 business failures during the week ending March 29, as compared with 170 the previous week and 227 in the corresponding week last year.

SALES OF BALL ENGINES.—The Ball Engine Company, of Erie, Pa., reports the following recent sales: Atlanta Steel Hoop Co., Atlanta, Ga., one 150-hp single cylinder engine; Salt Lake Hardware Co., Salt Lake City, Utah, one 200-hp single cylinder engine; Union National Bank, Pittsburg, Pa., two 320-hp tandem compound engines, one 150-hp single cylinder engine; Cudahy Packing Co., Philadelphia, Pa., one 70-hp single cylinder engine; Pennsylvania Steel Co., Steelton, Pa., three 550 hp single cylinder engines; Massachusetts Cotton Mills, Lowell, Mass., one 500-hp single cylinder engine; Metropolitan Laundry, San Francisco, Cal., two 300 hp tandem compound engines; Edison Electric Illuminating Co., West Chester, Pa., one 400-hp Corliss engine; Hotel Savoy, Kansas City, Mo., one 175-hp tandem compound engine; First National Bank Building, Chicago, Ill., one 350 hp vertical cross compound engine; Pittsburg Plate Glass Co., Pittsburg, Pa., two 200 hp simple engines; Kilby Mfg. Co., Cleveland, O., one 300-hp single cylinder engine, one 200 hp single cylinder engine; Milwaukee Coke & Gas Co., Milwaukee, Wis., one 550-hp single cylinder engine; Grand Rapids Railway Co., Grand Rapids, Mich., two 150-hp engines; Wolvin Building, Duluth, Minn., one 150 hp single cylinder engine; New River & Pocahontas Coal Co., Gentry, W. Va., two 750-hp cross-compound engines; Negeler Bros., Danville, Ill., one 550-hp four-valve Corliss engine, one 400-hp four valve Corliss engine.

FEBRUARY FOREIGN TRADE.—Two-thirds of the fiscal year ending June 30, 1906, has presented its commercial record, and the growth of trade has been sufficient to justify the assertion that for the year both imports and exports will exceed those of any earlier like period. The exports of 1905 exceed those of any earlier year; yet the exports of that part of the fiscal year 1906 recorded are 190 million dollars in excess of those of the corresponding months of 1905. The imports of 1905 were also greater than in any earlier year, yet the import figures for the eight months ending with February, 1906, are 71 millon dollars greater than those of the corresponding period of last year. This growth in imports and exports is shown in detail in a statement just issued by the Department of Commerce and Labor through its Bureau of Statistics. It shows in exports a growth of $190,000,000, manufactures being $45,000,000 in excess and agricultural products $133,000,000 in excess of the total for the corresponding period of last year. Iron and steel manufactured exports showed an increase of $16,000,000.

CENTRAL LABORATORY SUPPLY.—The articles of incorporation of Central Laboratory Supply Company, of Lafayette, Ind., have been filed with the Secretary of State of Indiana. The company is capitalized at $50,000 to manufacture electrical, mechanical, and physical apparatus and machinery. The incorporators are J. W. Esterline, W. D. Pence, E. S. Ferry, W. Bent Wilson, S. C. Lank, C. C. Pyke, Geo. W. Switzer, W. J. Esterline. The present officers of the company are W. Bent Wilson, president; S. C. Lank, secretary, and Geo. W. Switzer, treasurer. The company has just issued the following bulletins: No. 102 describing its transmission dynamometer; No. 103 on direct reading magnetic testing apparatus; No. 105, terminal boards for testing rooms and experimental laboratories; No. 106, alternating current generators.

FOREIGN ELECTRIC CONTRACTS of a large size have recently been secured by the Westinghouse interests, aggregating $2,000,000. One of the principal contracts is that placed by the South Wales Electric Power Distribution Company, which plans to generate electric energy to operate a number of big Welsh iron, steel, and a tin-plate works. The London County Council has let an order worth about $250,000 for motor equipment for the electric cars to be run on the lines now being converted from horse to electric motive power in the northern part of London. The South African orders include one for electric machinery for the Rand water works.

ST. PAUL POWER PLANT.—Claussen, Burch and Pillsbury, consulting engineers, Minneapolis and St. Paul, have issued specifications for a new steam power plant for the West Side Power, Light & Heat Company, St. Paul, Minn. It will ultimately include four 400-hp boilers, with mechanical stokers, fuel economizers, induced draft system, three 540-hp engines or turbines, three 300-kw alternators, switchboards and induction motors. Plans will be prepared later for a fireproof building for the plant The cost complete is $100,000.

MORE ESCALATORS.—The Siegel Cooper Company of New York City has contracted with the Otis Elevator Company for two additional electric escalators. These new machines will be located respectively between the third and fourth and fourth and fifth floors. The first escalator placed in the Siegel Cooper store was installed several years ago, and the recent contract serves to indicate the satisfactory service rendered by the original machine.

CANADIAN PACIFIC TELEGRAPHS.—General Manager McNicoll, of the Canadian Pacific Railway, announces that the Canadian Pacific telegraph department the coming summer will construct 610 miles of new pole lines and 4,068 miles of wire, of which 1,966 will be copper. The system is already complete within itself from Halifax to Vancouver.

ORDERS FOR GENERATORS.—The B. F. Sturtevant Co., of Boston, Mass., has recently received orders for generating sets from A. M. Lockett & Co., Ltd., Alta Loma, Tex., and the Post Pipe Co., Texarkana, Tex.

EXTENSIONS TO THE WEST ALLIS WORKS.—The new extensions to the West Allis, Milwaukee, works of the Allis-Chalmers Company, which, when completed, will add 861,000 sq. ft. to the plant's present floor area of 652,000 sq. ft. and make the entire plant capable of affording employment to 11,000 persons, will place the West Allis works among the largest industrial plants of the country. The extended works, together with the capacities of the other works of the company in Milwaukee, Chicago, Cincinnati and Scranton, will be capable of affording employment to a total of approximately 18,000 persons. The extensions built are as follows: Three machine shops running east and west, parallel to the existing units, Nos. 1, 2 and 3, each 575 ft. long and 145 ft. wide for units Nos. 1 and 2 and 168 ft. wide for No. 3; an erecting shop, 1,136 ft. by 113 ft., running north and south as an extension of the existing erecting shop and adjoining the six machine shop units opening out into it; the extension of the existing foundry, north and south, which has a total length of 994 ft. over all and a width of 222 ft. and the extension of the pattern and pattern storage building which also has a length of 994 ft. over all and a width of 110 ft. The work of constructing these extensions involves an expenditure of over $3,000,000. The West Allis site, situated in the town of West Allis, on the outskirts of Milwaukee, has a frontage of 1,575 ft. and runs back 2,600 ft. The general plan of the West Allis works provides for two sets of building units, one composed of those in which the work is common to every class of product, like the pattern shops, erecting shops and foundry; the other group comprising the machine shop units where the work is specialized for various machine operations. The two groups of buildings lie at right angles to each other; those of general utility lengthwise of the plat, north and south. The machine shops, six units in all, run crosswise of the plat, adjoining the erecting shop at the east end. Facing the ends of the machine shop units Nos. 1 to 6, stands the foundry with its extensions, extending north and south. The pattern storage and shops stand farthest westward in the group and parallel to the foundry, with a span of 98 ft. between them. In connection with the building of these extensions it may be interesting to note that 19,000 bbls. of Portland cement are used for concrete work; seven million bricks go into the building of walls; 785,000 ft. of roof sheathing will help cover the shops and 850,000 ft. of yellow pine and white oak flooring will serve to support the massive equipment to be installed. Over 3½ acres of wire glass will be used for skylights and windows, while the new equipment for the various extensions will aggregate 3,080 tons.

NORTHERN CALIFORNIA POWER.—At the recent annual meeting in San Francisco of the Northern California Power Company, President H. H. Noble in his report showed that the company was in a flourishing condition. The company has been able to dispose of all of its developed power and is now making arrangements to double the capacity of its Volta plant, the work to be completed by December 1. Power is supplied to the smelting plant of the Mountain Copper Company and for gold dredgers at Horsetown. Twelve miles of line have been built from Orland to Hamilton to supply a large beet sugar factory. A new line 16 miles long has been built from De La Mar to Kennett, tying the two power plants together in another place. A contract for twenty years has been made with the Valley Counties Power Company, a subsidiary company of the California Gas & Electric Corporation, to deliver to it optionally 5,000 hp at Chico at 60,000 volts. This contract places the Northern California Power Company in the unique position of never having any power going to waste, as by the terms of the contract it can use it any portion of the time for its own customers, and any not being so used will be taken by the Valley Company. In order to do this it was necessary to build a new high-tension line from the Volta power house to Chico, erecting a large transformer station at Volta to raise the line voltage to 60,000 volts, and another transformer station at Molinos, where transformers will be installed to step down from 60,000 to 20,000 volts, tying the lines in with the old system at that point and insuring better service to the central portion of the territory. This work is being done by the Battle Creek Power Company, whose stock will be owned entirely by the Northern California Power Company. The Battle Creek company has secured water rights on Battle Creek capable of developing 10,000 hp. The company has made a very favorable contract with the Reading & Red Bluff Railway Company to supply it with all of its power for a term of 25 years, and from present indications construction work will be commenced within the very near future. From a point on the main line about two miles above Keswick a branch line has been built over into the Old Diggings district, where the company is now supplying two mines with power. The company's financial statement shows total assets of $1,777,016. The gross earnings for the year were $185,024, and total expenditures $113,549, leaving a balance of $7,475. Twelve dividends of $5,000 each were paid, or 10 per cent on the capital stock of $600,000. The surplus for the twelve months was $15,414, bringing the total surplus up to $131,596. The business for the year showed an increase of $6,452.

A NIAGARA POWER FIGHT.—According to a dispatch from Albany, the Niagara, Lockport & Ontario Power Company and the Niagara County Irrigation & Water Supply Company are preparing to wage war against the Foelker bills putting them out of business. The bills have been introduced in the Legislature and repeal outright the charters of these two companies. The Niagara, Lockport & Ontario Company's charter calls for unlimited water rights in Niagara River, while the Niagara County Irrigation & Water Supply Company has unlimited water power rights in the same water course for 50 years, beginning with 1891. The bills have been sent to the Assembly Judiciary Committee, with four bills formally repealing the charters of four Niagara power companies which did not avail themselves of their rights within the time limit. There is no fight on these four bills. The Niagara, Lockport & Ontario Power Company's charter has not yet taken any water from Niagara River, but it is acting as the transmission company for one of the Canadian power companies. It has already spent much money in building transmission lines in Niagara and other Western New York counties. All the power of land condemnation and other rights necessary to build a transmission line under which the company has been acting have been derived from the charter which Mr. Foelker now seeks to repeal.

DEVELOPMENT IN PITTSBURG.—The Electrical Equipment & Supply Company, of Pittsburg, has moved this week into larger quarters in that city, and is now occupying 341 Second Avenue. A number of new specialties have been added to its lines, and the price list is revised. The stock has been largely increased, and the capital invested multiplied by three. Mr. Thos. Watson has retired from the vice-presidency, being succeeded by Mr. J. McPrice, late manager of sales. Mr. C. G. Hussey has retired from the treasurership, his successor being Mr. F. S. Kaulback. The directors of the company are now these with Messrs. W. H. Waugh, R. T. Reineman, and J. H. Waugh.

LARGE WESTINGHOUSE ORDERS.—The Westinghouse Electric & Manufacturing Company has received through its Atlanta office a very large order for electric machinery from the Southern Power Company, Fort Lawn, S. C. The order includes eight 3000-kw., 3-phase, 2200-volt, 60-cycle generators for direct connection to water wheels and to operate at a speed of 225 r.p.m.; two 250-volt exciters, and twelve 2000-kw, oil-insulated, water-cooled transformers. Through the Philadelphia office an order has been received from the Wilkesbarre & Hazleton Railway for two turbine-type generators of 1,000 kw capacity, 3-phase, 25 cycles, to operate at 300 volts.

CENTRAL STATION DIESEL ENGINES.—Mr. W. A. Whittlesey, treasurer of the Pittsfield, Mass., Electric Company, writes us: "We have placed an order for two 225 hp American Diesel engines, and delivery is contracted for August 1st next. We plan to direct connect these two engines to one 350-kw, alternating current generator by means of magnetic clutches. We have, for over a year, been investigating the merits of this type of engine, and have satisfied ourselves, by personal visits and by correspondence with those using the engines, that they are economical and are reliable. We do not expect to purchase any more steam engines."

DUTY ON SCARF PINS.—General Appraiser Sharretts has written a decision for the Board of Appraisers in which it was held that electric scarf pins must pay duty as "jewelry," at the rate of 60 per cent. Austin Baldwin & Co., the importers, took the position that the merchandise should be admitted at only 45 per cent, on the plea that the pins were dutiable under the provision in the tariff law for "manufactures of metal."

GENERAL VEHICLE COMPANY.—We are advised that this company is the successor to the Vehicle Equipment Company, and that the manufacture of electric automobiles and other types, chiefly for industrial purposes, will be continued at the Long Island City shops.

IMPROVEMENTS IN HELENA.—A contract has been made between J. G. White & Co. and the Helena Light & Railway Company, of Helena, Mont., whereby the former company will undertake the reconstruction of the properties of the latter for $140,000. On September 11, 1905, the public service utilities of Helena were bought, reorganized and consolidated under the holding corporation known as the Helena Electric Light & Railway Company. The amount involved in the transaction was $2,350,000, which covered electric railway, electric light and gas lighting properties. Responsibility for operation was delegated by the corporation to the operating department of J. G. White & Co. During the month of February, 1906, the traffic on the railway was nearly quadruple that of the corresponding month of 1905, and the proceeds from the lighting service were also very materially augmented. Electric power is supplied the Helena Light & Railway Company by the Missouri River Power Company, and the organizations are united in the ownership of the central sub-station, from which power is distributed for the public service. The agreement for power calls for a rate at maximum of utilization of $25 per hp-year. Owing to the fact that the maximum is not at present utilized there is a large margin for increase of consumption by the light and railway company without increase of operating expense. There are about 18 miles of track in the railway system, a great deal of which will be reconstructed under the provisions of the contract just signed. Before the reorganization the annual income from the railway property was about $62,000, and from the lighting property, both gas and electric, about $151,000. The combined operating expenses were about $143,000, making the ratio of operating expense to gross receipts 67 per cent. A careful estimate of operating conditions after the contemplated improvement places the gross receipts at $255,000 and the operating expenses at $147,000, this reducing the ratio to 57 per cent. The estimate for improvement includes $115,000 to be devoted to reconstruction and extension in general, and $25,000 for the relaying of tracks and replacement of overhead construction on Main Street in Helena.

NEW YORK SAFETY STEAM POWER.—At the annual meeting of the stockholders of the Nichols & Langworthy Machine Company held at Hope Valley, on March 28, 1906, the officers and directors, who, with one or two exceptions, have been continuously in the management of the business since 1869, retired, and the following officers and directors were elected: Ernest J. Jochen, president; Willis G. Nichols, vice-president; John Stewart Thomson, treasurer; Ernest J. Crandall, secretary. These officers, together with James R. Burnet, counsel of the company, constitute the board of directors. At a meeting of the directors of the New York Safety Steam Power Company, which is controlled by the Nichols & Langworthy Machine Company, held on the same day, the following officers were elected. Ernest J. Jochen, president; John Stewart Thomson, treasurer; J. M. W. Shepherd, secretary. The retiring officers, Henry Clay Nichols and Albert L. Chester, retain a substantial interest in the business. The Nichols & Langworthy Machine Company also voted an issue of $125,000 of its first mortgage bonds secured by a mortgage or deed of trust to the Industrial Trust Company, of Providence, R. I., the proceeds to be used for additions and extensions to the existing plant, which is to be enlarged and improved. The present business was established in 1820, and has maintained a high reputation in the manufacture and sale of engines and boilers.

ELECTRIC RAILWAY EQUIPMENT.—In pursuance of its plans for electrifying the Camden and Atlantic City line, the West Jersey & Seashore Railroad has ordered ten General Electric 69 (200 hp) double-motor equipments with the Sprague-General Electric type and control. These motors with their controlling apparatus are duplicates of fifty-eight equipments previously ordered for this electrification project. Another company which has recently increased its rolling stock is the Brooklyn Rapid Transit Company, which has added 200 General Electric 80 (40 hp) motor equipments. Twenty-five four motor General Electric 54 (35 hp) equipments have been ordered by the Rochester Street Railway Company. The power station of the International Railway Company, Buffalo, N. Y., is being enlarged to meet the demand of the increased power for railway work. Two 1,000-kw, 25-cycle, three-phase rotary converters, complete with transformers, switchboards, etc., have been ordered from the General Electric Company for this purpose. These make a total of three such rotary converters used in this power station.

STEAM TURBINE FOR SIAM.—One of the most progressive of the independent principalities of Asia is the Kingdom of Siam on the Indo-Chinese Peninsula. In the principal city, Bangkok, is an electric railway power plant, operated by the Siam Electricity Company, and equipped with reciprocating engines and generators. Because of the increased demand for power an additional unit has become necessary, and a Curtis steam turbine has been selected. This is a 500-kw, 575-volt machine, built by the General Electric Company at Schenectady. The boiler plant for this station is unique in that paddy husks are burned in place of coal. The fuel is brought down the river from the rice fields in flat-bottomed boats to the power house and unloaded directly into the boiler room by an elevator and belt conveyor, built by the Link-Belt Engineering Company, and operated by several direct-current, 500-volt General Electric Company motors. This method of using rice husks for fuel is an economic utilization of a waste product similar to the use of the crushed sugar cane, or bagasse, on sugar plantations.

WESTINGHOUSE-FINZI IN ITALY.—We are advised by the well-known Finzi firm, of Milan, Italy, that a combination was effected last month between the Officine Elettro-Ferroviarie, with a capital of $7,500,000, and the Societe Anonyme Westinghouse, of Paris, with a capital of $5,000,000. Under this alliance or working arrangement, electrical installations will be carried out by the two organizations together. The installation of single-phase electric railways will bear the name Westinghouse-Finzi, under the patents of the Westinghouse Company and of Dr. George Finzi, who was the pioneer in Italy of the use of single-phase motors in traction. Dr. Finzi is at the head of the Officine Elettro-Ferroviarie, which has been erecting large factories at San Christoforo, near Milan. This new alliance is regarded in Italy as one of great significance, coming as it does at the moment of Italy's industrial renaissance, and at a time when electric railways, particularly those of the single-phase type, are making so deep an impression on the railroad industry.

ALLIS-CHALMERS IN CHICAGO.—Pettibone, Mulliken & Co., of Chicago, will install two new Allis-Chalmers cross-compound engines recently purchased from the Allis-Chalmers Company, Milwaukee. The new outfit consists of an 18-in. and 36-in. by 42-in. and 24-in. and 48-in. by 48-in. Reynolds heavy-duty, cross-compound Corliss unit. Swift & Co., of Chicago, purchased recently through the Chicago office of the Allis-Chalmers Company two 800-kw, 250-volt generators, 120 r.p.m., which will be built at the company's "Bullock" works, Cincinnati. The A. H. Andrews Company, of Chicago, is a recent purchaser of a 115-kw Allis-Chalmers alternator, wound for two-phase, 60 cycles, 440 volts, and a 4-kw, 120-volt belted exciter, to be used in conjunction with other units for light and power purposes. This apparatus will be built at the company's "Bullock" works, Cincinnati.

LIGHTING IN COSTA RICA.—Mr. W. F. Teller, P. O. Box 41, San Jose de Costa Rica, Central America, writes us that he has received the contract to light the city of Puntareanes, Costa Rica, with 45 arcs of 6.6 amp., 72 volts at the arc. He has the exclusive rights for 20 years for arc and incandescent lighting, the arcs at $0.30 per month and the incandescents at $1.40 per month for lamps of 16 cp. The plant will be run by steam using sea water for cooling the surface condensers.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., has been awarded through Takata & Co., of Wall Street, New York, the contract for furnishing 16,000 insulators to the Tokio Tramways in Japan. These insulators are the 15-in. type, constructed in four pieces and of 60,000 volts capacity. They are to be furnished complete with steel pins. This order is particularly gratifying as the contracts for most of the equipment of this road went to European manufacturers.

Financial Intelligence.

THE WEEK IN WALL STREET.—Prices of stocks suffered moderate declines on the announcement of an anthracite coal miners' strike, but rallied on support by large interests. Transactions were somewhat larger and general and advances were scored in various parts of the list. The United States Steel stocks improved at first with the general market, but the fear that a bituminous coal strike would have an adverse effect on the operation of its plant seemed to impose a check on bullishness in these issues. Electrics and tractions were stronger and all closed at advanced quotations. Allis-Chalmers common made a net gain of ¾ point, closing at 22, and preferred ½, the closing quotation being 58½. General Electric closed at 172¼, which is an advance of 3¼ points. Brooklyn Rapid Transit gained 5⅜ points, the closing quotation being 88⅛. The number of shares sold was 208,200. Metropolitan Street Railway, on a small business, advanced from 112 to 116, which latter was the last quotation, and a net gain of 4 points. United States Steel common closed at 41¼, a net advance of 1⅞, and preferred at 107¼, a gain of 1⅝. American Locomotive common and preferred are quoted at 69 and 115½, respectively, and Western Union closed at 92¼, which represents a decline of ¼ point. The last quotation of American Telephone & Telegraph was 138¾, a gain of ¼. The curb market was heavy and irregular during much of the week, with a small volume of business. Later there were partial recoveries, and transactions were on a larger scale. There were few features. Interborough-Metropolitan issues enjoyed a little spurt late in the week and closed at 53 for common and 90⅞ for 4½s, these prices being net gains of 1⅜ and ⅜ points, respectively. Mackay Companies closed at 61, this being an advance of 1½ points. The closing quotations on the stock market April 3 are given below:

NEW YORK

	Mar. 27	Apr. 3		Mar. 27	Apr. 3
Allis-Chalmers Co.	21¾	22⅝	General Electric	167	173
Allis-Chalmers Co. pfd.	57	60	Hudson River Tel	...	...
American Dist. Tel.	30	30	Interborough Rap. Tran.	228	222
American Locomotive	66	70¼	Mackay Cos	59½	62¾
American Locomotive pfd.	116	115	Mackay Cos pfd.	72½	73
American Tel. & Cable	92	93	Marconi Tel.	...	
American Tel. & Tel.	135	138¾	Metropolitan St. Ry	113	116
Brooklyn Rapid Transit	84	88⅝	N. Y. & N. J. Tel.		...
Electric Boat	27	27	Western Union Tel	92	92¼
Electric Boat pfd	65	65	Westinghouse com.	158	160
Electric Vehicle	12	12	Westinghouse pfd.	...	...
Electric Vehicle pfd.	16	15			

BOSTON

	Mar. 27	Apr. 3		Mar. 27	Apr. 3
American Tel. & Tel.	138⅝	138¾	Mass. Elec. Ry. pfd	69	68
Cumberland Telephone	...	...	Mexican Telephone	4½	4½
Edison Elec. Illum.	247½	248	New England Telephone	139	140½
General Electric	167¾	173⅛	Western Tel. & Tel	...	13½
Mass. Elec. Ry.	19½	19½	Western Tel. & Tel. pfd.	...	90

PHILADELPHIA

	Mar. 27	Apr. 3		Mar. 27	Apr. 3
American Railways	52	52	Phila. Electric	7½	8
Elec. Co. of America	11¾	11½	Phila. Rapid Trans	27⅝	29
Elec. Storage Battery	78	78	Phila. Traction	99¾	99½
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Mar. 27	Apr. 3†		Mar. 27	Apr. 3†
Chicago City Ry.	186	...	National Carbon	88	...
Chicago Edison	148¾	...	National Carbon pfd.	116	...
Chicago Subway	69	...	Union Traction	...	
Chicago Tel. Co.	117	.	Union Traction pfd.	...	.
Metropolitan Elev. com.	26¾	.			

† Election Day

DIVIDENDS.—The Manchester Traction Light & Power Company has declared a regular quarterly dividend of 1½ per cent, payable April 16. Directors of New Orleans Railway have declared the regular quarterly dividend of 1¼ per cent on preferred stock, payable April 14. The directors of the Chicago Pneumatic Tool Company have declared the regular quarterly dividend of 1 per cent, payable April 25. Directors of the E. W. Bliss Company have declared the regular quarterly dividend of 2½ per cent on the common stock and 2 per cent on the preferred stock, payable after April 2. The directors of the United Railways Investment Company of San Francisco have declared a dividend of 4¾ per cent on the preferred stock, payable on May 1. By this declaration, all cumulative dividends in arrears on the preferred stock at the rate of 5 per cent per annum are paid up to September 30, 1905. The directors of the New York & New Jersey Telegraph Company have declared the regular quarterly dividend of 1½ per cent, payable April 14. The Nebraska Telephone Company, of which the American Telephone & Telegraph Company owns 58.33 per cent, has declared a regularly quarterly dividend of 1½ per cent, payable April 10. The Pacific States Telephone & Telegraph Company, of which 50.1 per cent is owned by the American Telephone & Telegraph Company, has declared a regular quarterly dividend of 1¼ per cent, payable April 15. Directors of the United Railways Company of St. Louis have declared the regular 1¼ per cent preferred quarterly dividend, payable April 10. The Philadelphia Company directors have declared the regular quarterly dividend of 1½ per cent on the common stock, payable May 1.

STEAM AND TROLLEY.—Official notice has been given by the New York, New Haven & Hartford Railroad Company that the corporation offers to exchange one share of its capital stock for each $200 face value 4 per cent debenture of the Consolidated Railway Company of the issues of January 1, 1904, and January 2, 1905. The Consolidated Railway Company is the holding company of the larger corporation for the street railway system of the latter company. The offer will be open and exchange may be effected between May 1, 1906, and July 1, 1906, with exchange of accrued interest on the debentures for accrued dividends on the stock. Provision is made for the exchanges in New Haven, Boston and New York, and new stock certificates will be issued as soon after May 1 as is practicable. The outstanding Consolidated Railway debentures affected by that plan and in the hands of the public amount to between $7,000,000 and $8,000,000, which, if all are exchanged, will add about half that sum to the capital stock of the New Haven Steam Company. The proposed exchange of stock is of considerable importance, as being a new assumption of the holding company's liabilities by the parent steam corporation and suggesting a step toward the ultimate merger of the steam and electric railway companies.

FRANCHISE VALUATIONS INCREASED IN NEW YORK.—The final valuation for the current year of special franchises operated in New York City as announced by the State Board of Tax Commissioners shows an increase of $59,301,250, equal to approximately 20 per cent over the valuation of the year previous. The total valuation is placed at $361,479,300, against $302,178,050 for 1905. The valuations of the franchises of the companies entering into the Interborough-Metropolitan Company, as placed by the board, as compared with 1905, are as follows:

	1906.	1905.		Changes.
N. Y. City Ry. System	$70,470,000	$70,233,000	Inc.	$237,000
Manhattan Ry. Co.	62,700,000	59,700,000	Inc.	3,000,000
Interborough R. T. System	18,000,000	9,000,000	Inc.	9,000,000
Total	$160,170,000	$147,933,000		$12,237,000

The total percentage of increase is 8.25 per cent. The valuations of franchises of other of the large corporations compare as follows:

	1906.	1905.		Changes.
B. R. T. System	38,479,000	29,560,000	Inc.	8,919,000
Consolidated Gas Co.	82,921,000	69,710,000	Inc.	13,211,000
Brooklyn Un. Gas Co.	16,495,000	13,194,500	Inc.	3,300,500
N. Y. Telep. Co.	17,078,000	6,610,000	Inc.	10,468,000

ST. LOUIS TROLLEY MERGER.—A merger of traction lines in St. Louis is proposed by E. W. Clark & Co., of Philadelphia, who have prepared to manage the new system. Stockholders of the East St. Louis & Suburban Company and of the Alton, Granite & St. Louis Traction Company have been invited to deposit their stock under the merger plan before April 10, receiving in exchange stock in a new holding company, to be incorporated in New Jersey, with a capitalization of $14,000,000, of which one-half will be preferred stock. All but $425,000 of the new preferred and $360,000 of the new common will be paid in exchange for the stock of the traction companies. This stock Clark & Co. offer to buy at $425,000, paying cash to that amount into the treasury of the holding company, which will serve as working capital. The East St. Louis & Suburban Company is capitalized at $5,000,000. The Alton, Granite & St. Louis Traction Company has outstanding $500,000 of preferred and $2,150,000 of common stock. An extension between Alton and East St. Louis, which will be put in operation this year, is expected to add materially to the earnings available to the holding company.

NEW YORK ELECTRIC CABS.—At the stockholders' meeting of the New York Transportation Company the president of the company said in part: "The company is getting on its feet. Last year a moderate net surplus was shown." Replying to a question put by a stockholder as to how much salary the president was drawing it was stated that he gets $10,000 a year. H. P. Whitney was elected in the place of Samuel E. Morrow at the stockholders' meeting, and also Charles M. March in place of Arthur K. Wing. The other directors were re-elected. The electric cabs and hansoms of the company have been in large demand all winter and the open season has been very favorable for low operating expenses.

CHICAGO TELEPHONY.—A special dispatch from Chicago states that the Illinois Manufacturers' Association has decided to incorporate a $9,000,000 telephone company, which can be equipped within two years, or one year before the Chicago Telephone Company franchise expires. The rates offered the city include three-cent public calls and are 10 to 30 per cent below prices set by the existing company in its last reduction.

LONDON UNDERGROUND.—In London, on April 3, an extraordinary meeting of the shareholders of the Underground Electrical Railways under the presidency of Edgar Speyer, authorized the directors to raise $25,000,000 additional capital required for the purposes of the company.

ILLINOIS TROLLEY NETWORK.—A special dispatch from Chicago quotes James S. Hopkins, attorney for the Aurora, Elgin & Chicago, as authority for the report that 541 miles of Wisconsin and Illinois electric lines merged this week by Cleveland capitalists with capital of $20,000,000, will be taken over by the Aurora-Elgin combination recently effected by the Mandelbaum syndicate. With lines already in operation or contracted for the company will reach as far west as Dubuque, Ia., and as far north as Madison, Wis., and that it is planned to get into St. Louis. Working arrangements will be made with lines from Chicago through Indianapolis to Cincinnati. Mr. Hopkins says many connections will have to be built to complete this plan. The following lines are said to be included in the merger, aside from the three subsidiary lines of the Aurora, Elgin & Chicago; Elgin & Belvidere; Belvidere, Rockford & Freeport; Rockford, Beloit & Janesville; Janesville & Madison; Geneva & Freeport; Aurora & De Kalb; Aurora, Plainfield & Joliet; Yorkville & Plano; Carpentersville & Crystal Lake; Freeport & Dubuque. A possible later acquisition is the Chicago, Kenosha & Milwaukee Electric Railway. The syndicate has entrance to Chicago over the Metropolitan West Side Elevated.

TRI-CITY BONDS.—The bonds of the Tri-City Railway & Light Company to the amount of $6,000,000 are being offered by N. W. Halsey & Co. and Mackay & Co. They bear 5 per cent and may be redeemed at the option of the company on any interest date at 105 and accrued interest. A sinking fund provision will provide for the retirement of $2,250,000 of the bonds at maturity. The total authorized issue is $9,000,000, and $464,000 is reserved for the retirement of a like amount of underlying bonds maturing annually up to 1911, and $2,536,000 is reserved for additions and improvements. This issue is secured on practically all of the stocks and bonds of the public service corporations in Davenport, Ia.; Rock Island, Ill.; Moline, Ill., and East Moline. The plans of the companies in the consolidation are to be remodelled by J. G. White & Co. Of the bonds now coming on the market $2,000,000 are taken by local investors in Iowa and Illinois, and it is said that the larger part remaining has already been sold.

WESTERN TELEPHONE.—The Western Telephone & Telegraph Company, in its report for the year ended January 31, makes the following exhibit:

	1906.	1905.	Increase.
Gross earnings	$1,464,842	$1,408,215	$56,627
Operating expenses	577,415	533,123	44,292
Net earnings	$887,427	$875,092	$12,335
Dividends	800,000	800,000	......
Surplus	$87,427	$75,092	$12,335

The companies included in the Western are the Cleveland Telephone Company, Northwestern Telephone Exchange Company, Southwestern Telegraph & Telephone Company, and the Wisconsin Telephone Company.

SOUTHERN N. E. TELEPHONE.—At New Haven, Conn., on March 27, the board of directors of the Southern New England Telephone Company decided to issue $500,000 worth of new stock of the $10,000,000 issue that was voted in January. The other $500,000 will be issued about October of this year, making the present stock issue $6,000,000. The Legislature has authorized the company to issue up to $10,000,000. It was voted by the directors that stockholders would have to pay $120 a share for the new stock, although the par value is only $100. This is said to be the first time that a public service corporation in Connecticut has made its stockholders pay more than par for new stock.

VEHICLE EQUIPMENT RECEIVERSHIP.—As the result of a petition in involuntary bankruptcy a receiver has been appointed for the Vehicle Equipment Company, of Long Island City, of which Robert McA. Lloyd is president, Hector A. Havemeyer vice-president, and Arthur H. Havemeyer, a son of William F. Havemeyer, secretary. The company was incorporated under New Jersey laws in December, 1900, with a capital stock of $400,000, which has since been increased to $3,000,000, of which $2,000,000 is common and $1,000,000 preferred. There is also a bond issue of $1,000,000 The petition for a receiver declares that the liabilities of the company are from $250,000 to $300,000

NATIONAL ELECTRIC SALE.—The entire assets of the National Electric Company, of Milwaukee, were bought on March 26 for $500,000 by Mr. C. L. Sullivan, of Chicago, president of the Sullivan Machinery Company, of that city, acting in behalf, it is said, of Westinghouse interests Mr. John I. Beggs was the receiver and trustee and stated at the sale that there were orders on hand amounting to $37,528. The assets amounted to $1,350,691 and the liabilities to $1,242,000. Objections to the sale and its confirmation have been made by Mr. N. A. Christensen, one of the large creditors. Some of the above details were noted briefly last week.

LA CROSSE WATER POWER.—The La Crosse Hydro-Electric Light & Power Company, organized a few months ago with $1,000,000 capital to transmit current from Black River Falls to La Crosse, 50 miles, has increased its capital to $5,000,000. Mr. Samuel Insull, president of the Chicago Edison Company, has been elected president. The other officers are E. G. Boynton, La Crosse, vice-president, and Orlando Holmey, La Crosse, secretary. The name of the new company is the La Crosse Water Power Company. Work has begun on a dam that will give a head of 90 ft.

NORTHWESTERN KANSAS SCHEME.—Advices from Topeka state that there is a plan on foot in southeastern Kansas to connect all of the cities in that locality by an interurban system, to cost $4,000,000. This is in the oil, gas and mining regions. The power houses will be in the natural gas cities. W. D. Egolf, of Kansas City, and E. H. Abadie & Co., of St. Louis, are among the promoters. Mr. Abadie is well known in the electrical field through his former connection with the Wagner Electric and other interests.

KANSAS CITY EARNINGS.—Large gains are shown below by the Kansas City Railway & Light Company:

	1906.	1905.		
February gross	$385,019	$310,503	Inc.	$74,516
Expenses and taxes	245,069	215,557	Inc.	29,512
February net	$139,950	$94,946	Inc.	$45,004
Nine months' gross	3,850,206	3,267,490	Inc.	582,716
Expenses and taxes	2,204,931	1,888,893	Inc.	316,038
Nine months' net	$1,645,275	$1,378,597	Inc.	$266,678

CANADIAN WESTINGHOUSE.—The Canadian Westinghouse Company's profit and loss account for the year ending December 31, 1905, is as follows:

Net earnings for 1905	$220,545
Previous surplus	160,596
Total	$381,141
Dividends paid for year	149,100
Profit and loss surplus Dec. 31, 1905	$232,041

CONSOLIDATION IN PENNSYLVANIA.—The Union Heat & Light Company, of Grove City, has transferred its franchises and lines to a syndicate of Franklin and Pittsburg capitalists, with ex-Judge S. S. Mehard, of Pittsburg, and Senater Lee of Franklin, as the principals. Similar deals have been closed for the gas plants in Stoneboro and Shady Lake. The three towns will be connected with the Anderson field. The price paid for the plant is said to be $75,000.

MEXICAN TELEGRAPH STOCK.—The Mexican Telegraph Company has increased its capital stock from $2,000,000 to $3,000,000 The directors of the company have declared a stock dividend of 50 per cent on the present outstanding stock. This dividend amounts to $1,000,000 par value of stock as the outstanding stock is $2,000,000. The dividend is declared on account of expenditures made out of earnings for several years up to December 31, 1905.

STANDARD ELECTRIC SUPPLY.—A petition in bankruptcy has been filed against the Standard Electrical Supply Company at 37 Warren Street, New York City, by these creditors: Gerald W. Hart, $858; William Taylor, $9, and Joseph T. Harris, $11. Judge Adams appointed Robert G. Benedict receiver under a $10,000 bond. The assets are estimated at $30,000 and liabilities $40,000.

CHICAGO EDISON.—The City Council has approved the ordinance reducing electric light rates nearly 25 per cent and permitting the consolidation of the Chicago Edison and Commonwealth Electric Companies, the merger to occur within six years. The Arnold-Carroll report on the subject has been noted in these pages

BUFFALO BELL TELEPHONE reports for the year ending December 31, 1905, gross of $1,400,263, net of $555,118, dividends of $363,000, and a surplus of $192,118, all items showing a gain over 1904 The number of stations was 45,563, as compared with 36,611 in the previous year.

BELL STOCKHOLDERS.—President Fish states there are no fewer than 20,000 stockholders in the American Telephone & Telegraph Company.

KEYSTONE TELEPHONE COMPANY, of Philadelphia, reports a gross of $67,533 for February and $535,042 for eight months, the net being respectively $30,897 and $242,703.

GENERAL NEWS.

Construction News.

ENSLEY, ALA.—The Birmingham Railway, Light & Power Company, of which J. A. Emery is general manager, has decided to build a substation on Ninth Street, Ensley.

PELL CITY, ALA.—The Pell City Manufacturing Company has petitioned the Council for a franchise to furnish electric lighting for the city.

SEWARD, ALASKA.—The Seward Light & Power Company will install a 225-kw Allis-Chalmers water-wheel-type generator, a 9-kw belted exciter and a switchboard, recently ordered in the electric light station at Seward, for lighting and power service. The new outfit will be built at the company's works in Cincinnati, Ohio.

HOLBROOK, ARIZ.—F. W. Nelson is organizing a company for the purpose of constructing a telephone line from this city to Springerville.

DE QUEEN, ARK.—The De Queen Light, Ice & Cold Storage Company has purchased, through the St. Louis office of the Allis-Chalmers Company, a new steam and electric outfit consisting of an 85-kw belted generator wound for single phase, 60-cycles, 1,100 volts and a 35-kw direct-current exciter, both to be driven by a 14x24-in. Reliance engine, at a steam pressure of 100 lbs. The new outfit will be installed at De Queen for the purpose of lighting the city, the owners of the plant being large property holders.

EUREKA SPRINGS, ARK.—The City Council has granted G. U. Matthews and C. M. Barnes an electric light franchise for 99 years.

NAPA, CAL.—N. F. Grigsby has been awarded a franchise to construct and operate a telephone system in Napa County.

YREKA, CAL.—The Sunset Telephone Company is preparing to rebuild the Yreka telephone plant and will expend $5,000.

SAN BERNARDINO, CAL.—The Lytle Creek Power Company has secured a permit to erect a power house on South First Street, between C and D Streets, to cost $1000.

STOCKTON, CAL.—The American River Electric Company, of which B. C. Condit is superintendent, is considering the construction of an auxiliary steam power plant in the Northeastern part of the city.

OAKLAND, CAL.—The Ygnacio Valley Electric Railway Company has filed articles of incorporation, with a capital stock of $2,000,000. L. F. Winchell and L. B. Bishop, of San Francisco, are mentioned in connection with the project.

OAKLAND, CAL.—Reports state that the merchants of this city are strongly in favor of granting a franchise to the Oakland Traction Consolidated Company to operate a street railway along Second and Webster Streets in connection with its Alameda line.

REDWOOD CITY, CAL.—The Board of Supervisors of San Mateo County has granted C. F. Grandon a franchise to lay gas mains and to erect a line of poles and wires for the purpose of supplying gas and electricity to the inhabitants of Pescadero and vicinity.

UKIAH, CAL.—Perry Stanley, a Mendocino electrician, has bonded the water right of Alder Creek, near Point Arena, and the Stanley Electric Light & Power Company intends putting up a plant at once. The current is to be used to furnish Point Arena, Greenwood, Albion and Mendocino with light.

SANTA CRUZ, CAL.—The San Francisco Gas & Electric Company (S. L. Naphtaly, Superintendent), is reported to be surveying for a new power line from the Santa Clara Valley across the mountains to the plant of the Santa Cruz Portland Cement Company. The length of the line in Santa Cruz County will be 18 miles.

SAN FRANCISCO, CAL.—The administration announces that it has formulated a plan for a municipal street railroad system so attractive that private capital will readily take hold of it and construct the road under conditions that will permit the city to assume ownership after a stated period. The details of this plan for interesting capital are not made public.

SACRAMENTO, CAL.—The Central California Traction Company plans in the near future to install in Sacramento a complete system of street car lines that will reach every portion of the community. Franchises have been applied for. At a recent meeting of the directors in San Francisco it was decided to issue $1,500,000 of bonds for improvements and extensions.

SAN BERNARDINO, CAL.—At the recent annual meeting of the San Bernardino Valley Traction Company, A. C. Denman secured control of the property. The directors elected in his interest were A. C. Denman, Jr., George M. Coulley, E. D. Roberts, W. L. Brookeris and J. S. Wood. The following directors were chosen by the Fisher interests: Henry Fisher, E. S. Graham and O. Collins.

OAKLAND, CAL.—It is officially announced that the Martinez & Contra Costa Railroad Company, which has filed articles of incorporation at San Francisco, is to take over the franchise granted last February by the Trustees of Martinez to M. R. Jones, a local attorney, and is to begin the construction of an electric railway in that town. The new company was incorporated for $10,000. The directors are Purcell Rowe, W. A. Tolchard and Carl A. Johnson, of San Francisco; A. H. Flynn, of this city, and M. R. Jones, of Martinez.

SAN FRANCISCO, CAL.—It is reported that a new electric lighting and power company is about to enter the local field, and that contracts are being made for electrical machinery—motors, generators, dynamos, transformers, water wheels and copper wire for transmission. It is said that the company is backed by some of San Francisco's wealthy men, who have been quietly acquiring property in the mountains and doing the necessary construction work to impound water and develop power which can be converted into electricity. The company will begin operations, it is said, in the Chinese district of the city, and will light the Fairmont Hotel. It is also stated that the owners of the hotel, Herbert E. and Dr. Hartland Law, are interested in the new company.

FRESNO, CAL.—The San Joaquin Power Company has just completed its No. 3 plant between Crane Valley and the power house, and two more plants are to be started as soon as possible. The next plant will be built on the North Fork of the San Joaquin and will be known as No. 4. The other plant will be built on the Tule River, at the junction of the Middle and East Forks. Other improvements are also immediately contemplated, it is said. The present reservoir at Crane Valley will be raised ten feet so as to impound a larger quantity of the flood water. No. 1 ditch will be increased in size so as to carry 100 second-feet, corresponding in capacity with the ditch of the new power plant. This additional power is being developed to pump water for irrigation and to light every town in the valley.

HARTFORD, CONN.—After a report made by City Engineer Frederick L. Ford, the Board of Street Commissioners passed an order requiring all overhead electric wires within a half-mile of city hall to be taken down by October 1.

MERIDEN, CONN.—The Meriden Firearms Company, of this city, which is having plans drawn for the erection of another factory, will also install during the summer a large power plant. The boiler equipment will consist of two 500-hp boilers. The power developed will be used to operate electrical equipment in the factory and shops.

WATERBURY, CONN.—At the recent board meeting the Warden stated that last year no formal contract was entered into for the lighting of the streets, but that an agreement was made with the Torrington Electric Light Company. It was voted to renew this agreement by which the Torrington Electric Light Company is to furnish incandescent lamps of 25 cp for $25 each for the year, running an all-moonlight schedule.

WILMINGTON, DEL.—The Delaware & Atlantic Telephone & Telegraph Company is arranging to extend its conduit system.

WASHINGTON, D. C.—Bids will be received at the U. S. Engineer office, Washington Barracks, D. C., until May 1, for furnishing and installing an electric elevator, lighting fixture and Terrazzo floors. John Stephen Sewell, Corps Engineers, U. S. A.

WASHINGTON, D. C.—Bids will be received until April 17 at the Bureau Supplies and Accounts, Navy Department, to furnish at the navy yard, Washington, D. C., a quantity of naval supplies, including corundum wheels, electric supplies and white pine. Applications for proposals should refer to schedule 444. H. T. B. Harris, Paymaster General, U. S. N.

WASHINGTON, D. C.—Bids will be received until April 20 by the Commissioners of the District of Columbia (Henry B. F. MacFarland, Commissioner), for furnishing supplies for the use of the various branches of the government of the District of Columbia, for the fiscal year beginning July 1, 1906, and ending June 30, 1907, including electrical and plumbers' supplies.

MULBERRY, FLA.—The Prairie Pebble Phosphate Company, of Mulberry, Fla., has recently purchased seven 300-kw engine-type Bullock generators, seven 16-kw belted exciters and seven 75-hp induction motors.

ST. AUGUSTINE, FLA.—The new electric light service for St. Augustine has been inaugurated. The St. Johns Light & Power Company has completed the installation of the street lamps, and the service is giving entire satisfaction.

CHIPLEY, GA.—T. T. Murrah, of Chipley, writes that the company has not yet been fully organized to construct a water works and an electric light plant.

COLUMBUS, GA.—The Columbus Power Company recently completed arrangements for the issue of $4,000,000 of bonds. These will not, however, all be issued at once. Bonds aggregating $1,250,000 will be issued immediately and the proceeds used to provide for carrying out the company's plans for development and improvements.

ALBANY, GA.—The new power house of the Albany Power & Manufacturing Company, on the Muckafoonee Creek, just north of the city, has been completed. There are two generators, each with a capacity of 800 hp, and the plant has been so planned as to allow for the installation of two additional machines as the demands upon the plant may make them necessary.

POTLATCH, IDA.—C. Ferris White, architect, of Spokane, Wash., writes that the Potlatch Lumber Company is to construct a water works, and a heating plant, and an electric light plant at Potlatch to cost about $100,000. A. W. Laird, of Palouse, Wash., is manager.

SHOSHONE, IDA.—The Shoshone Falls Power Company, Limited, has finished its tunnel at Shoshone Falls, which has a fall of 241 ft. It is now concreting the tunnel. The company has floated a bond issue of $3,500,000. The plant will have 30,000 horse-power. One unit of 1,000 hp will be ready to utilize by May 15, and will be used in furnishing power to Twin Falls, Ida. One big generator, 6,000 hp, has already been ordered. There will be five at the plant in all. The company is now working on its canal at Auger Falls. This tunnel will be a mile and a half long, and there will be a fall of 147 ft. The company now has surveyors in the field surveying its transmission line to Salt Lake. This work started about three weeks ago, and will be completed within another month. Power will be furnished to Salt Lake within thirteen or fourteen months. The plants will have reserve power of about 6,000 hp each at Upper Salmon Falls, at Lower Salmon Falls and at the Malad River. The wires between Idaho and Salt Lake City will carry 100,000 volts. The insulators will weigh 65 lb. each and will be 20 in. in diameter.

MOUNT VERNON, ILL.—The Tri-County Telephone Company has increased its capital stock from $25,000 to $50,000.

CANTON, ILL.—The Central Union Telephone Company is planning to expend $15,000 in improving its local service.

FRUITVILLE, ILL.—H. G. Hogendobler and associates have incorporated the Fruitville Telephone Company, having a capital of $2500.

CHICAGO, ILL.—Reports state that the Illinois Manufacturers' Association is promoting a new telephone company, which promises a reduction of telephone charges to $60 per year and also proposes municipal ownership of the system after a certain number of years.

ROCKFORD, ILL.—Extensions of the Illinois Mutual Telephone Company, recently incorporated with headquarters at Seward, are planned for this season, which will connect the Home Telephone Company in this city directly with nine other towns in northern Illinois.

BLOOMINGTON, ILL.—The Kinloch-Bloomington Telephone Company is planning to install an entirely new equipment in its central exchange office. The company is also installing an $8000 switchboard in its office at Normal, and its overhead work, which was left uncompleted during the winter, will be finished during the next two or three months.

RICHMOND, IND.—City Engineer Fred Charles is preparing plans and estimates for the construction of a conduit system for all low-tension wires.

PETERSBURG, IND.—The Pike County Telephone Company has increased its capital stock to $40,000. A new switchboard and extensions will be put in.

HUNTINGBURG, IND.—The Dubois County Telephone Company has increased its capital stock to secure means to make improvements and install new apparatus.

INDIANAPOLIS, IND.—It is reported that the Laycock Power House Company contemplates the expenditure of about $80,000 in improving and enlarging its plant.

PERU, IND.—It is stated that Jerome Herff, Joseph Andrews and others, all of Peru, will this summer construct a power plant at the Shoals, to develop about 4000 hp.

EAST ENTERPRISE, IND.—The Farmers' Mutual Telephone Company, of East Enterprise, has been incorporated. Harvey Sedam, Wilson Oaks and Henry Kuhlman are the incorporators.

MARION, IND.—This city is to be made the starting point for a new electric railway to Chicago via Logansport. Steps have already been taken to get a line constructed between this city and Logansport.

GREENFIELD, IND.—The Peaceable Telephone Company of Jackson Township, Hancock County, has filed articles of incorporation. Fred E. Williams, A. E. Beaver, W. F. Kirkpatric and others are directors.

RICHMOND, IND.—The Mayor is reported to have stated that he can sell the municipal electric light and power plant at any time for $250,000. Opinions vary as to the advisability of selling the plant and the Council is considering the question.

TERRE HAUTE, IND.—It is understood that the Stone & Webster syndicate contemplates expending $750,000 in improvements to its system during the summer. These include the construction of a line from Shelburn to Sullivan.

VINCENNES, IND.—The Vincennes Traction & Light Company has filed articles of incorporation. The capital stock is $200,000. Benjamin G. Hudnut and Charles A. Gordon, of Terre Haute; George E. Henry, Vincennes, and William Foley, of St. Louis, are the incorporators.

TERRE HAUTE, IND.—It is understood that the citizens have voted in favor of establishing a municipal electric light plant, and that for this reason the city council refused to consider the bid of the Traction Company for a 5-year contract for lighting the streets and has asked for a one-year bid.

MICHIGAN CITY, IND.—A. E. Smith, of Kenosha, Wis., representing a syndicate of gas and electric plants and electric lines operating in Wisconsin, is negotiating for the purchase of the Michigan City Electric railway lines. It is thought Mr. Smith's interest is identical with the Chicago Air Line Company now building from South Bend to Chicago.

RICHMOND, IND.—The Richmond Light, Heat & Power Company will increase the capacity of its power plant to a considerable extent. Some of the machinery which has been in use for several years will be replaced by new and more modern apparatus. The intention is to improve the service by constructing additional lines in order to compete with the municipal plant.

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company will install a 1000-kw Allis-Chalmers turbine generator in its new power house in this city. The new unit will generate two-phase current at 2300 volts, 60 cycles. It is also proposed to install a 30-kw. direct-connected engine-type exciter set, a 35-kw motor generator set, switchboards and condenser. The power generated by the new unit will be utilized for lighting and power purposes along the company's line and extension to be built to Burlington.

MUSKOGEE, I. T.—W. L. Reeves, A. W. Robb and others, of Muskogee, have secured a franchise for an electric light plant.

SHENANDOAH, IA.—J. W. Wynick has purchased the City Telephone System from Bell Brothers.

CEDAR FALLS, IA.—The electric light and gas plant at this city has been destroyed by fire, with a loss of $50,000.

MEDIAPOLIS, IA.—The Mediapolis Mutual Telephone Company has decided to increase its capital stock from $10,000 to $20,000.

DECORAH, IA.—Engineers Roberts & Abbott Company, of Cleveland, Ohio, are preparing plans for the proposed power plant for the Decorah Electric Light Company, to cost about $70,000.

RIPLEY, KAN.—The Cimarron Valley Telephone Company has been incorporated with a capital of $5000 by W. E. Baker and others.

CALDWELL, KAN.—It is reported that the city will install a $15,000 lighting plant this spring. E. E. Rogers, of Wamego, Kan., is engineer.

WICHITA, KAN.—Henry C. Scott, of St. Louis, president and treasurer of the Wichita Electric Light & Power Company, is making arrangements for the erection of a new building on Wichita Street east of the present power house in Waco Avenue.

GARDEN CITY, KAN.—Bids will be received at the office of the U. S. Reclamation Service, 870 Federal Building, Chicago, Ill., until May 28, for furnishing and installing complete, ready for operation, an electric power plant of 450-kw, switchboard, etc., for pumping purposes, including boilers, engines, generators, switchboards, etc.

GRAYSON, KY.—Maggard & Woods write that the proposed electric light plant will cost $5,000.

KUTTAWA, KY.—The Kuttawa Water & Light Company has decided to construct an electric light plant.

MONTICELLO, KY.—An electric light plant is being installed here and will be equipped with direct-current apparatus.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company is installing new machinery in its plant in order to provide for the supply of new lines which it will build at once.

SOMERSET, KY.—The Somerset Water, Light & Traction Company has commenced grading for its street railway, and will also reconstruct its wiring system for furnishing electric light and power.

PRESQUE ISLE, ME.—The New Brunswick Electric Power Company is arranging to let the contract for the construction of the pole line from the Aroostook Falls to Houlton.

LEWISTON, ME.—In correction of an item which appeared recently in these columns to the effect that it had been voted at a town meeting to make a 5-year contract for lighting Lewiston, we are in receipt of the following from a correspondent in that city. The city owns the plant from which the arc lamps are operated and it is run by water power from the pumping station at a cost per arc lamp not to exceed $35 per year. The electric light company supplies Auburn, which is just across the river from Lewiston, with lights at $55 per arc lamp a year. As the city plant is being operated in a satisfactory manner, no immediate change is contemplated.

HYATTSVILLE, MD.—The citizens have voted in favor of issuing $12,000 bonds for a municipal electric light plant.

ANNAPOLIS, MD.—A bill has been introduced to repeal and re-enact the charter of the Patapsco Electric and Manufacturing Company. The incorporators are George W. Harris and Thomas Van Loan, of New York, and James Nowlin, of Maryland. The company is authorized to do a general electric business, manufacturing and selling electrical machinery and appliances and to operate electric-light plants in any part of Maryland.

TAUNTON, MASS.—The bill to establish a municipal light board in Taunton was rejected.

RANDOLPH, MASS.—It was recommended at the town meeting that the sum of $1,300 be raised and appropriated for lighting the streets by electricity.

BROCKTON, MASS.—An order has been introduced in the Common Council for municipal ownership of the gas and electric lighting plants in the city.

LAWRENCE, MASS.—The Washington mills are to erect a new power house, the plans for which are being drawn by Dean and Main, the mill engineers of Boston.

NORTH ATTLEBORO, MASS.—The town voted at the annual meeting recently to appropriate the sum of $35,000 for the enlargement of the municipal lighting plant.

ACTON, MASS.—A petition has been submitted to the Legislature to authorize the American Woolen Company of New Jersey to furnish electric light and power in Acton.

NORTH ADAMS, MASS.—It is stated that the right recently obtained by the North Adams Gas & Electric Light Company from the legislature to use power from the Deerfield River is to be employed in the manufacture of Portland cement.

TEMPLETON, MASS.—C. C. Spears, town clerk, of Templeton, post office Baldwinsville, writes that an election will be held in May to vote on issuing bonds for an electric light plant.

MANCHAUG, MASS.—At the financial town meeting held recently it was voted to light the streets of Manchaug by electricity, and this will be done as soon as arrangements can be made with the Electric Light Company.

FALL RIVER, MASS.—Ground has been broken for the foundation of the new electric power house which is to be built for the Fall River Electric Light Company at the foot of Hathaway Street. The contracting engineers are Hubbard & French, of Boston.

WINDSOR, MASS.—The Windsor print works, which were formerly lighted by gas and electricity, will hereafter be lighted with electric lamps throughout, and the changes are now being made. The company is installing dynamos and will generate its own power.

NEWBURYPORT, MASS.—An effort is being made to have West Newbury unite with Georgetown and Groveland to build an electric plant for the purpose of furnishing light for the residences in the various towns. The power station will probably be located in Byfield.

GREENFIELD, MASS.—The high-tension power line between Gardner Falls and Hadley, upon which the Connecticut Valley Street Railway has been working for the past three months, has been tested and put in operation. It delivers electricity at 10,000 volts to the Hadley power house.

PEABODY, MASS.—The special committee on the electric lighting plant finds that it will cost about $50,000 to properly equip the plant with the needed new machinery. The committee is considering whether to call for this appropriation or to submit a plan to buy energy delivered at the power station.

WORCESTER, MASS.—According to press reports a plan has been advanced, which proposes to obtain sufficient power to run an electric lighting plant from the water now used for family and other purposes as it falls from the reservoirs here down to the city. The proposition is made by a representative of the Albany Automatic Ram Pump Company, who states that this plan is followed in several western cities, where the grade is less than that in Worcester.

NORTH ABINGTON, MASS.—The Stone & Webster Company, of Boston, has assumed control of the Electric Light & Power Company, of Abington and Rockland. The company will be continued under the name of the Electric Light & Power Company, of Abington and Rockland, for the present at least. The plant and system will be improved and enlarged, and the system may be extended to West Hanover. Superintendent Frank N. Sanderson will continue in charge.

HANOVER, MICH.—The Council is reported to have decided to install water works and an electric light plant.

MARSHALL, MICH.—At Ceresco, west of this place, two dams belonging to the Commonwealth Power Company were carried away.

PONTIAC, MICH.—Farnum Brothers, of this city, are promoting an electric railway to connect St. Charles, Alma, St. Louis and Ithaca and then run south to Owosso.

IRON RIVER, MICH.—At the recent village election in this place the proposition to bond the municipality for $20,000 for the purpose of installing an electric light plant was carried.

GRAND RAPIDS, MICH.—A. Walker, of Walkerville, and Dr. G. H. Hale and E. L. Brooks, of Hesperia, are said to be the promoters of an interurban railway between Walkerville and this city.

HART, MICH.—The Village Council is considering the question of issuing $20,000 bonds for buying local power to operate the lighting plant, or to lease the present plant to a syndicate which has plans for a power plant on Peremarquetto River.

ALPENA, MICH.—The Common Council has granted a franchise for the construction of an electric railway between this city and Long Lake, a distance of 8 miles. Dayton W. Closser and Jackson and Monroe capitalists are interested in the project.

LAPEER, MICH.—F. J. Schlegel plans to install machinery at once in his new electric light plant. He had orders placed for the apparatus three years ago, but was unable to get a franchise. Now everything is ready but the installing of the machinery.

BIG RAPIDS, MICH.—The Grand Rapids-Muskegon Water Power Electric Company will furnish power to light the streets of this city at the rate of $55 per lamp per year for ten years. The company is also required to furnish power for manufacturing purposes.

RICHLAND, MICH.—William V. Jacobs, of Chicago, has asked the village board and the Richland Township board for a franchise to construct an electric railway from Kalamazoo to Richland and touch the Grand Rapids-Battle Creek line now being constructed.

PONTIAC, MICH.—The Pontiac Standard Lighting Company will install a new generator, switchboard and lights. It is believed that eventually power generated from the Huron River will be delivered to this place. Glenn D. Smith, of Jackson, is the new manager of the company.

DETROIT, MICH.—Matthew Slush, of this city, who up to the recent sale of that property to the Detroit United Railway was president and general manager of the Detroit, Monroe & Toledo Short Line, is considering a proposition to build an important interurban line in Pennsylvania.

CONSTANTINE, MICH.—Bids will probably be called for in May for the development of the water power of St. Joseph River at Constantine. The probable cost of the work is placed at $120,000. H. L. Hartenstein is the owner. H. von Schon, 34 W. Congress St., Detroit, is the engineer.

DETROIT, MICH.—The Detroit, Flint River & Saginaw Valley Railroad is securing the right of way for an electric railway to connect Detroit and Saginaw. The company agrees to begin the proposed road on or before October 30, 1907. The work of grading in the townships is to be done under the supervision of the commissioner of highways.

GRAND RAPIDS, MICH.—H. R. Wager, representing the Commonwealth Power Company of Jackson, Mich., has asked the Board of Supervisors of Ionia County for the privilege of constructing a power dam on Grand River in Lyons township. The company already owns and operates three dams on the Kalamazoo River, generating about 20,000 hp and supplying five cities and two interurban lines. With the new dam in Lyons Township, the company can easily convey power into Ionia, Muir, Pewamo, Portland, Belding, and other villages in that vicinity. The Commonwealth Company was organized under the laws in Maine and is capitalized at $4,000,000.

LEWISTON, MINN.—Lewiston Telephone Exchange Company has increased its capital from $10,000 to $25,000.

ST. PAUL, MINN.—Mr. Stickney and Mr. Crosby have formed a new corporation for the erection of their power plant, which will cost about $75,000, and will be located east of the Stickney foundry on Custer Street.

SAUK RAPIDS, MINN.—The Watab Pulp & Paper Company, of Sauk Rapids, Minn., has purchased additional Allis-Chalmers electrical machinery, consisting of an aggregate of 50 horse-power in small induction motors. The new mill, now nearing completion, is equipped completely with Allis-Chalmers apparatus.

ST. CLOUD, MINN.—Two dams instead of one are to be built across the Mississippi River south of St. Cloud, in order to develop the water power necessary for the proposed operations of the Mississippi River Power Company. One of the dams is to be built near Clearwater, the other at Monticello. Agents of the company have already bought flowage rights for both structures. It is estimated that the proposed works will involve an outlay of more than $1,000,000, but the company is said to have ample financial backing. Pulp mills are to be erected at Clearwater and Monticello, and electric power will be transmitted from the former place to St. Cloud.

LEXINGTON, MISS.—An election will probably soon be held to vote on issuing $22,500 bonds for an electric light plant. R. E. Wilburn is city clerk.

WATER VALLEY, MISS.—The city of Water Valley is a recent purchaser of Allis-Chalmers electrical machinery, consisting of a 115-kw belted generator and a 6-kw exciter for operation in conjunction with it.

HOUSTON, MISS.—The city of Houston, Miss., is a purchaser of new electrical apparatus from the Allis-Chalmers Company, Milwaukee. The new outfit consists of a 60-kw generator, a 3½-kw. direct-connected exciter, and nine transformers, built at the company's works at Cincinnati.

KANSAS CITY, MO.—The Jackson County Heat, Light & Power Company has been granted a franchise.

COLUMBIA, MO.—The citizens have voted to issue $30,000 bonds for extending the water works and electric light plant. John S. Bicknell is city clerk.

MACON, MO.—A move has been inaugurated at College Mound to build an interurban railway from Huntsville to Macon by way of that point. Captain C. J. DuBois is interested.

VERSAILLES, MO.—An election was held at Versailles, March 20, on the issue of city bonds in the amount of $5,000, to complete and extend the electric light system. The proposition was carried.

CHOUTEAU, MONT.—J. W. Jameson & Sons, of Stella, Neb., have decided to construct a flouring mill and electric light plant.

GRAND ISLAND, NEB.—The citizens have voted to issue $35,000 bonds for an electric light plant.

LINCOLN, NEB.—Bids will be received until April 21 by the Secretary of the Treasury (H. A. Taylor, assistant secretary), Washington, D. C., for furnishing and installing in the U. S. Court House and Post Office, at Lincoln, certain combination gas and electric lighting fixtures.

GRAND ISLAND, NEB.—Bids will be received by the city clerk at Grand Island, also by W. K. Palmer, consulting engineer, 718 Dwight Building, Kansas City, Mo., until April 23, for the equipment, material and supplies for the electric light plant and water works for Grand Island.

RENO, NEV.—All the officials of the Reno Electric Light & Power Company are being examined by the City Council in reference to a proposed ordinance of the city which will cut the present rate of the company in half. The company is financed by the Fleishhackers of San Francisco, who also operate the plant at Floriston, which supplies power to the Reno concern. The contention of the officials is that the Reno firm purchases power from Truckee, and as the latter is beyond the reach of municipal ordinances the rate to be imposed on Reno should not be made lower than it is, as the Truckee rate would produce a loss.

RAYMOND, N. H.—The contract for lighting the town by electric light has been renewed for the term of five years at a price not exceeding $1,000 per year.

TRENTON, N. J.—The bill which will empower the City of Camden to issue bonds for its own lighting plant has passed the House and is now in the Senate.

KEARNY, N. J.—The Public Service Corporation has secured the contract for lighting the town for five years at $85 per light per year, for arc lights, and $15 for incandescent lights.

RED BANK, N. J.—The Monmouth Traction Company, which operates between Red Bank and Long Branch, has applied for franchises from the Red Bank commissioners and from the Board of Freeholders. The plan of extension embraces a belt line in Red Bank.

JERSEY CITY, N. J.—There has been recorded in the Register's office a mortgage whereby the Whatcom County Railway & Light Company, a corporation of the State of New Jersey, pledges to the City Trust Company of Boston as trustee all its real and personal estate in the State of Washington, to secure an issue of bonds amounting to $2,500,000. Of this issue of bonds $1,400,000 are to be issued at once, $500,000 are to be retained for improvements, and the remaining $600,000 are reserved for permanent extensions and betterments.

PIKE, N. Y.—The citizens have voted to construct an electric light plant.

TROY, N. Y.—The Forest Park Railway Company has voted to increase the capital stock from $20,000 to $750,000.

WILLIAMSON, N. Y.—It is stated that the Sodus Gas & Electric Light Company, of Sodus, is to extend its system to Williamson.

DUNKIRK, N. Y.—The Bell Telephone Company has begun arrangements toward placing its wires and cables underground in Dunkirk.

UTICA, N. Y.—The Utica Gas & Electric Company has applied to the commission for authority to increase its capital stock from $2,000,000 to $3,500,000.

LOCKPORT, N. Y.—It is reported that the Ontario Power Company has voted $2,500,000 for the immediate completion of the company's power plant on the Canadian side.

CATSKILL, N. Y.—The Catskill Electric Railway Company contemplates a 6-mile extension to Cairo this spring. W. T. Seaman is superintendent.

POUGHKEEPSIE, N. Y.—Bids will be received by T. E. McGarr, Secretary State Commission in Lunacy, Albany, until April 11, for fire alarm system at the Hudson River State Hospital, Poughkeepsie.

ALBANY, N. Y.—The Home Telephone Company has increased its long-distance service by a combination of the independent telephone companies in Otsego County and the territory surrounding Oneonta.

ALBANY, N. Y.—The State Gas & Electricity Commission has given its permission to the Niagara Falls Electric Transmission Company to increase its capital stock from $100,000 to $3,500,000. The company asked to increase it to $5,000,000.

BUFFALO, N. Y.—It is stated that a bill will probably be introduced in the Legislature to empower the city of Buffalo to bond itself for the construction of a municipal lighting plant in conformity with the vote of the people at the last election.

GASTONIA, N. C.—The Piedmont Telephone & Telegraph Company increased its capital from $30,000 to $200,000. W. T. Love is president.

HICKORY, N. C.—The Water Power & Electric Company, of Hickory, is reported incorporated, with a capital of $250,000, to construct dams and power plants, and for lighting through Catawba, Caldwell, Alexander, Lincoln and Cleveland Counties. Incorporators, M. B. Thornton, C. F. Blalock and others, all of Hickory.

SPRINGFIELD, OHIO.—The Washington Traction Company has increased its capital from $10,000 to $800,000.

YOUNGSTOWN, OHIO.—The Central Union Telephone Company is planning to erect a new exchange building in Youngstown.

LAKEWOOD, OHIO.—The city administration favors spending $25,000 for a new generator and engine for the municipal lighting plant.

PAULDING, OHIO.—At a recent special election the citizens voted almost unanimously in favor of issuing $10,000 bonds to purchase the local lighting plant.

COVINGTON, OHIO.—The Covington Home Telephone Company has increased its capital stock from $25,000 to $75,000 and proposes to make important improvements.

AKRON, OHIO.—The County Commissioners of Summit County are having plans prepared for a lighting and heating plant to be installed in the new county court house.

WELLSBURG, OHIO.—The Tri-State Traction Company has applied for a franchise to enable it to enter Wellsburg. The company operates between Steubenville and Wheeling.

BROOKVILLE, OHIO.—The village will hold an election April 21 to vote on the matter of floating $7,000 bonds for the purpose of building a municipal electric lighting plant.

CLEVELAND, OHIO.—The contract for the establishment of a light and power plant at the garbage reduction works was awarded by the Board of Public Works to C. A. [illegible] & Co.

ASHTABULA, OHIO.—The Ashtabula Council has received a proposal from financial agents to build a new $[illegible] waterworks and electric lighting and power plant west of Ashtabula harbor.

CANTON, OHIO.—The Merchants Heat, Light & Power Company has started its lighting and heating systems. The company is pushing the Nernst lamp and has a number of contracts for these lamps.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Company is preparing plans for a new exchange building which will be erected at once, and it will make important improvements to its switchboard and system in general.

COLUMBUS, OHIO.—The municipal lighting plant is greatly overloaded, and it has been decided to throw 600 lights out of service until such time as new generating equipment can be installed. An ordinance to sell bonds to provide for additional machinery is now being considered by the council.

YOUNGSTOWN, OHIO.—Property owners of North Avenue and Belmont Park Cemetery have petitioned the Mahoning & Shenango Valley Railway Company to extend its North Avenue line to the cemetery, a distance of 2 miles. Mr. Randall Montgomery, general manager of the company, is considering the proposition.

STEUBENVILLE, OHIO.—The National Telephone Company has closed the options for the purchase of the Phoenix Telephone Company's exchange. The new company proposes to rebuild the lines and plant throughout. The acquisition of the plant by the National will give Steubenville greatly improved long-distance service.

LIMA, OHIO.—The City Council has appropriated $25,000 for the purpose of installing a new boiler, engine, pumps and electrical equipment in the water works station. The Lima Railways & Light Company offered to supply the necessary energy at 5 cents per kw-hour, but the city decided it could save money by installing its own machinery.

CLEVELAND, OHIO.—The Rockford, Beloit & Janesville Traction Company has been absorbed by the Rockford Interurban Company, and a new corporation known as the Rockford & Interurban Traction Company has taken over the combined properties. The lines consolidated are the Rockford, Beloit & Janesville, the Rockford Interurban and the Rockford & Freeport.

FREDERICKTOWN, OHIO.—Walter C. Ball, Mayor of this place and the chief promoter of the Galion Southern Railway, which will extend from Galion to Mt. Vernon by way of Fredericktown, states that the right of way has been secured and that Eastern capitalists have agreed to finance the proposition. It is thought that work on the line will probably begin this summer.

MARSEILLES, OHIO.—E. R. Hankey, of Detroit, Mich., and G. W. Meeker, of Columbus, president and secretary respectively of the Findlay, Forest & Marion Electric Railway Company, have arranged for a right of way through this district. The line will extend from Marion to Findlay by way of Marseilles and Forest, and it is thought that construction work will start this spring.

LANCASTER, OHIO.—Control of the Lancaster Telephone Company has passed from the Federal Telephone Company of Cleveland to Columbus interests headed by F. R. Beam and others who control the Columbus' Citizens' Telephone Company of that place. The capital stock of the company has been increased from $100,000 to $150,000 and the new money will be used to pay off floating debt and in improving the property.

COLUMBUS, OHIO.—At a recent annual meeting, the Columbus, Delaware & Marion Railway Company appropriated $300,000 to provide for a number of improvements, some of which are under way. The improvements include the extension of the line to Bucyrus and the purchase of 31 miles of rails, another 2000-kw turbo-generator for the Stratford power station and the completion of the Richwood-Greencamp spur line 6 miles long.

CINCINNATI, OHIO.—Bids will be received at the office of the Board of Trustees Commissioner of Water Works (Aug. Herrmann, president), for furnishing and installing four motor-driven centrifugal pumps, two having a capacity of 1,600 and two a capacity of 2,500 U. S. gallons per minute, for the filter plant on the water works grounds near California; also two steam-driven electric generating units, each of 75 kw. capacity for the Western Pumping station, Cincinnati.

TOLEDO, OHIO.—The Toleo Gas, Electric & Heating Company, a merger recently formed by independent lighting and heating companies, has asked the city that it be permitted to bid on street lighting in competition with the Toledo Railways & Light Company. Under the present laws the city can have no competitive bidding on street lighting, and Representative Hillenkamp has introduced a measure in the legislature giving the city the right to ask for bids from more than one concern. At present this can not be done without the vote of the people.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company will spend $30,000 in improvements within the next three months.

PORTLAND, ORE.—The Mount Hood Electric Light & Power Company is reported to have secured a franchise to lay wires and conduits and dispose of light and power in Portland.

PRAIRIE CITY, ORE.—The Consolidated Electric Light Company is considering the extension of its system to Prairie City. If the extension is constructed new machinery will be installed.

ROSEBURG, ORE.—J. Lindsay has filed notice of appropriation of [illegible] cubic inches of water right and a reservoir site on the Umpqua River. The water is to be diverted from the north bank of the river by a dam 10 feet high. The capacity of the proposed hydro-electric plant will be 10,874 hp.

SALEM, ORE.—The street railway lines of the Citizens' Light & Traction Company are said to have been sold to the Willamette Valley

Traction Company, which has in contemplation the construction of an extensive system to extend from Salem into the adjoining country. The company by the purchase secures entrance to the city.

PORTLAND, ORE.—In addition to other extensions recently announced the Portland General Electric Company has adopted plans for an immense power plant at Oregon City, which will involve a total expenditure of $2,000,000. It is to be situated at the east end of the Willamette River Falls, opposite the present plant, known as station B. Work preparatory to beginning the construction of the building will be carried on during the low water this summer and a portion of the plant will be erected next year. Additional sections will be added from time to time as the business of the company demands them, the plan being a comprehensive one, aimed to furnish facilities for providing the city with power and light for many years.

TURTLE CREEK, PA.—The Rose Hill Electric Light Company will increase its capital from $50,000 to $100,000.

CHAMBERSBURG, PA.—The entire system of the Pennsylvania Bell Telephone Company in this city is to be rebuilt.

HAZLETON, PA.—The Consumers Electric & Power Company will install as soon as plans and specifications are prepared a complete system for incandescent and arc lighting, turbine or Corliss engine and a three-phase, 60-cycle distribution system.

ALTOONA, PA.—It is stated that officials of the Pennsylvania Railroad Company are interested in a project to build an electric railway connecting this city with Pittsburg. It is also proposed to build a power plant capable of furnishing power to all the towns between Wilmerding and Derry.

ALTOONA, PA.—Preliminary steps have been taken for the construction of two hydro-electric power plants in Bedford County this summer. One will be located on Yellow Creek, at Loy's Gap in Hopewell Township; the other on the Raystown branch 4 miles east of Everett. The operating company is to be known as the Bedford Water Power & Electric Company.

STEELTON, PA.—This borough is now lighted by power supplie from the York Haven power plant. More than 100 arc lights and nearly 8,000 incandescents were lighted with power received from this source. The power is brought across the Susquehanna River near Middletown on cables, and a pole line is used from Middletown to Steelton, at a potential of 24,000 volts.

AVOCA, PA.—The Standard Electric Light, Heat & Power Company has under consideration plans for the enlargement of its plant, and the extension of lines to all the outlying territory, for the purpose of furnishing power and lighting to the mines and coal washeries in the vicinity. The connected load of this station is in excess of 10,000 16-cp equivalents, 135-hp motor load, 150 arc lamps, heating devices, etc. A contract was recently concluded with the Spring Brook Lumber Company to operate its entire mill by motor drive. The towns supplied from this station are Taylor, Moosic, Old Forge, Minooka, Hughestown, Smithville and Avoca. Mr. Frank Howard is superintendent and manager.

WILLIAMSPORT, PA.—The Eagles Mere Electric Light Company, in which a number of Williamsporters are interested, is preparing to enlarge its plant considerably and extend its service to both Picture Rocks and Hughesville. The capacity will be doubled—from 500 to 950 hp. The work has already been commenced, and it is expected to complete it in a month or more. The officers and directors of the company are as follows: C. LaRue Munson, Esq., president; John R. T. Ryan, William Emery, of Williamsport; H. L. Gyelin, H. S. Clay, of Philadelphia; H. S. Kirk, of Eagles Mere; Benjamin G. Welsh, of Sonestown, directors. Mr. Welsh is the general manager, and Raymond Carter of Williamsport, is secretary. The company was originally capitalized at $25,000.

McCONNELSBURG, PA.—It is reported that a project is now well under way for the establishment of an immense water power on the Raystown Branch of the Juniata River, near the well-known Juniata Crossings in Bedford County. At a point two miles west of the Crossings the ridge is about 500 feet high, and by a survey recently made it was ascertained that by a tunnel only 800 feet long through this ridge the river can be reached on the other side with a fall of about 35 feet. A dam five feet high will be constructed across the river, and it is proposed to divert the water from its natural channel and carry it through the tunnel. By the cut of 800 feet the course of the river will be shortened five miles. A company has been formed and has already obtained the right of way, and as soon as a charter is secured work will be commenced and pushed to completion, which must be within three years.

PROVIDENCE, R. I.—The Worcester & Providence Street Railway Company has been granted the right to increase its capital stock from $1,000,000 to $2,000,000.

PAWTUCKET, R. I.—At the next meeting of the Common Council the question of municipal lighting is likely to receive attention. At the last meeting Councilman Goldsmith presented a resolution appropriating $75,000 for this purpose. The money is to be expended under the direction of a committee of five elected from the floor. This resolution was referred to the committee on finance and that body has given it some consideration.

CLOVER, S. C.—The town is taking steps to light the city by electricity. Power will be obtained from the Catawba Power Company.

BAMBERG, S. C.—The Electric Supply Company, of Savannah, Ga., has secured the contract for constructing the municipal electric light plant for $15,000.

COLUMBIA, S. C.—Work is being started on the new $30,000 power house for the Columbia Railway, Light & Power Company. The new plant will furnish about 5,000 more hp.

CHARLESTON, S. C.—The Charleston & Summerville Electric Railway Company is asking for an extension of its franchise, which expires the first of June. The company claims that it will be prepared to start work shortly.

NASHVILLE, TENN.—The Nashville Railway & Light Company proposes, the County Court being willing, to extend the Woodland and Gallatin Pike line to Madison Station, a distance of seven miles from the city.

SHERMAN, TEX.—At a meeting of stockholders of the North Texas Telephone Company, it was decided to increase the capital stock of the company from $20,000 to $40,000.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company has filed an amendment to its articles of incorporation in the office of the Secretary of State, increasing its capital stock from $2,500,000 to $10,000,000.

GREEN RIVER, UTAH.—The Green River Land & Town Site Company proposes installing a power plant to raise water for irrigation purposes and electric power. E. T. Merritt, of Green River, is reported to be interested.

SANDY, UTAH.—The City Council has granted the Utah Light & Railway Company, R. S. Campbell, of Salt Lake City, manager, an electric light franchise in Sandy, under which the company will extend its line to Sandy and other towns.

SALT LAKE CITY, UTAH.—Specifications are on file at the office of THE ELECTRICAL WORLD, New York, N. Y., for installing in connection with the Strawberry Valley Reclamation project, a telephone system having four telephone stations and about 35 miles of pole line, bids for which will be received at the office of the U. S. Reclamation Service at Salt Lake City until May 2. Engineer, George L. Swendsen, of Salt Lake City.

FORT ETHAN ALLEN, VT.—The contract for operating the electric light system at the Post has been awarded to the Burlington Light & Power Company.

BELLOWS FALLS, VT.—The Fall Mountain Electric Light Company, which is controlled by William A. Russell of Lawrence, Mass., has recently bought the mill site at Gageville, a mile from here. It is understood that the company will at once build a dam and erect a power plant.

ALEXANDRIA, VA.—The Council has decided to call for bids for the city lighting franchise on a 30-year basis. A thoroughly modern plant is wanted.

NEWPORT, VA.—The Newport, Portsmouth & Newport News Electric Railway, it is said, may extend its lines from Portsmouth and Churchfield to Suffolk and Smithfield.

FRANKLIN, VA.—The Camp Manufacturing Company of Franklin, Va., is a recent purchaser of a 100-kw direct-current belted generator, a 12x36-in. Reynolds Reliance Corliss engine, and three 20-hp "Bullock" motors, from the Allis-Chalmers Company, Milwaukee.

WAITSBURG, WASH.—An electric railway is projected from Tukannon Creek. J. H. Morrow is interested.

ODESSA, WASH.—F. J. Holman and J. W. Smead, of Spokane, have petitioned the Council for a franchise for an electric light plant.

PORT TOWNSEND, WASH.—The Citizens Electric Company has been incorporated, with a capital of $30,000, by John Siebenbaum and others, to construct an electric light plant.

SEATTLE, WASH.—Fred E. Sanders has taken a contract to build two miles of electric road in connection with the system which he is constructing between Seattle and Everett.

WINONA, WASH.—Articles of incorporation have been filed for the Winona Telephone Company, of Winona, Whitman County, with a capital stock of $3000. The incorporators are: M. W. Fockler and F. J. Swane.

ABERDEEN, WASH.—The Grays Harbor Lighting Company has been organized under the name of the Grays Harbor Railroad & Lighting Company, with a capital of $500,000. Incorporators, George F. Stone and others.

NORTH YAKIMA, WASH.—George Weirle, of North Yakima, and Robert B. Hunter, of Seattle, are interested in the construction of a power plant on Yakima River at Union Gap for power and electric railway purposes.

TACOMA, WASH.—General Manager W. S. Dimmock, of the Tacoma Railway & Power Company has announced that the company will build a line to American Lake and the Tacoma Country Club this summer, construction work commencing as soon as the final surveys, now well under way, have been completed.

SHEBOYGAN, WIS.—The Sheboygan Light, Power & Railway Company is planning to spend large sums in improvements during the year.

MILWAUKEE, WIS.—The Milwaukee-Northern Railroad Company's franchise for its proposed Sheboygan line has been passed and signed by the Mayor.

WATERTOWN, WIS.—The City Council has granted the Wisconsin Light, Heat & Traction Company a 60-year franchise for an electric interurban railway which will pass through from Milwaukee to Madison, also making this city a junction point for two long trolley lines.

LA CROSSE, WIS.—The consolidation of the La Crosse Gas & Electric Company, the La Crosse Street Railway Company and the La Crosse Hydro-Electric Light & Power Company, under the style of the last-named concern, was recently announced. The company is reported to have filed amended articles of incorporation, increasing its capital stock to $5,000,000 and naming as its new president Samuel Insull; E. G. Boynton, vice-president, and Orlando Holway, secretary. The La Crosse Hydro-Electric Light & Power Company was originally incorporated a few months ago with a capital of $1,000,000 for the purpose of transmitting electric energy from Mormon Riffles, near Black River Falls, to La Crosse, a distance of something over fifty miles.

GRAND ENCAMPMENT, WYO.—Fire destroyed the plant of the power house of the Penn-Wyoming Company. Loss $500,000.

CARNDUFF, CAN.—A telephone company will be formed here with a capital of $10,000. W. T. Lockhart is interested.

WINNIPEG, MAN.—The Winnipeg Electric Company announces a large extension which will be built this summer to neighboring villages and settlements including the electrifying of the Winnipeg, Selkirk & Lake Winnipeg Railway recently purchased by the company and now operated by steam.

ZAMORA, MICH., MEXICO.—In this city there are three electric companies, the Guanajuanto Power & Electric Company, Verduzoo y Alvarez, and J. Bustamente. The first company lights Guanajuanto City and its power is employed in the mines of the same city; the second lights this city and has grain mills; the last is the smallest and has in this city only 500 incandescent lamps.

MEXICO CITY, MEXICO.—It is rumored that a company, organized in England, has purchased the Portezuelo waterfalls, in the state of Mexico, for the purpose of installing an electric power plant and transmitting the energy into Mexico City. These falls can develop at least 10,000 hp. The new company is to be known as the Compañia Electrica Anglo-Mexicana. The greater portion of the material for the plant and the equipment is to be brought from England, it is said, and the work is to be begun at an early date.

ST. JOHN, N. B.—The Safety Board on March 20, recommended that the offer of the St. John Street Railway Co. be accepted, to light the city for 10 years with 1,200 c.p. lamps at $70 per lamp per year.

CALGARY, N. W. TER. H. E. Gillis, city clerk, writes that it is proposed to expend $150,000 in extending the electric light plant and water works and for new sewers.

CAMPBELLFORD, ONT.—A movement is on foot, if power can be sold to new manufacturers, to develop 4000 hp at Crow Bay, 3 miles from Campbellford. It is proposed to sell energy at from $10 to $20 per hp-year. The municipality will furnish free sites.

BRANDON, ONT.—The Brandon Electric Light Company is making large extensions to its plant in order to supply the increasing demands for power from manufacturers. The company will increase its lighting and power plant by 600 hp and has made arrangements for the building of another power house. It is expected that the new plant will be in operation about August 1.

Company Elections.

SAN FRANCISCO, CAL. The annual meeting of the stockholders of United Railways of San Francisco was held March 15. The following directors of the company were re-elected: Patrick Calhoun, Charles Holbrook, George F. Chapman, B. S Guinness, J Henry Meyer, A. C. Kains, I. W. Hellman, Joseph S. Tobin, Thornwell Mullally, Tirey L. Ford and G. H. Davis.

MONMOUTH, IA.—The Keystone Telephone Company held its annual election of officers recently, resulting as follows: President, Dr. D. B. Stagg; secretary, L. B. Stuart, treasurer, B. R. Dye; directors, D. A. Bristol, Frank Ralston, Dr. Stagg.

ALMA, MICH. At the annual meeting of the Union Telephone Company held at Alma, the following officers were elected. President, Tod Kincaid, Owosso; vice-president, James T. Gibbs, Ithaca; secretary, John H. Fildew, St. Johns, treasurer, G. S. Ward, Alma, general manager, W. A. Melchers, Alma.

GRAND RAPIDS, MICH. The annual meeting of the Vincennes Light & Power Company, of Vincennes, Ind., was held in this city recently and the following board of directors was elected: Edward M. Deane, Dwight Smith, Benjamin P. Merrick and Harry B. Wales, of Grand Rapids; Henry W. [illegible], J. W. Emison, J. L. Bayard, Jr., R. E. Purcell, W. H. Vollmer and Charles Bierhaus, of Vincennes.

NEWARK, N. J.—Six of the subsidiary concerns of the Public Service Corporation held their annual elections recently in the offices of the Public Service on the ninth floor of the Prudential Building. The companies are: The United Electric Company, Orange; Passaic Valley Railway Company, Jersey City; Harrison & Kearny Railway Company, North Hudson Turnpike Company, and Bristol Electric Light Company. The directors in each instance re-elected Thomas N. McCarter, president; A. B. Carlton, vice-president; [illegible] T. [illegible], secretary, and James P. Dusenberry, treasurer. The United Electric Company, in addition to the foregoing, elected Charles A. Sterling, of East Orange, as second vice-president.

ALLIANCE, OHIO.—At a meeting held recently in Alliance the promoters of the Sandy Valley Traction Company organized as follows: William Pennock, president; W. W. Shidler, vice-president; E. F. Deford, treasurer; D. L. McIllravy, secretary. T. F. Hynes, of Cleveland, will have charge of the construction of the road which will extend from Alliance to Canal Dover.

COLUMBUS, OHIO.—The Columbus, Delaware & Marion Railway Company held its annual meeting recently. This is the holding and operating company of the Columbus, Delaware & Marion Electric Railway Company, the Columbus Northern Railway Power & Equipment Company, the Delaware Street Railway Company, the Marion Railway, Light & Power Company, and the Columbus, Marion & Bucyrus Railway Company. The following officers were re-elected: John G. Webb, Springfield, president; O. B. Gottschall, Dayton, vice-president; N. J. Catron, Columbus, secretary, and W. A. Black, Dayton, treasurer.

EASTON, PA.—The annual meeting of the stockholders of the Easton Gas & Electric Company was held a few days ago at the office of the attorneys, Smith and Brady, No. 4 Union Square, Phillipsburg. The following directors were elected: Uzal H. McCarter, F. W. Edgar, S. L. Shober, Jr., H. E. Mitchell, J. Madison Porter, Fred. R. Drake, H. A. Doan, T. W. Cramp, B. F. Cresson, S. C. Smith, E. J. Fox, Chester Snyder, A. D. Chidsey, W. J. Daub and F. S. Bixler. The directors organized by electing the following officers: President, Chester Snyder; first vice-president, Fred R. Drake; second vice-president, S. L. Shober, Jr.; secretary and treasurer, B. F. Cresson.

New Industrial Companies.

THE WACO ELECTRICAL SUPPLY COMPANY, Waco, Tex., has filed articles of incorporation, with a capital stock of $10,000. M. F. Wortham is among the incorporators.

THE ELECTRICAL PRODUCTS COMPANY has been formed at Ravenna, Ohio, to manufacture electrical appliances and supplies. It will begin the erection of a new plant in that place immediately.

THE A. RIEMANN ELECTRIC COMPANY, St. Louis, Mo., has filed application for articles of corporation, with a capital stock of $5,000. The incorporators are Anton Wind, George Riemann and Adam Riemann.

SYMPHONIC PHONE & NEEDLE COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital of $500, and the following directors: J. A. Monahan, A. C. Whitehead and J. W. Conway.

THE PATERSON LIGHT & EQUIPMENT COMPANY, of Paterson, N. J., has been incorporated by Muhlon Johnson, William N. Berdan and Donald Holmes. The company will deal in electric lighting equipment.

THE INTERNATIONAL CLARK WIRELESS TELEGRAPH COMPANY, Detroit, Mich., will capitalize with $2,000,000 for the purpose of covering the Great Lakes region with the Clark system of wireless telegraphy.

THE VIRGINIA ELECTROLYTIC COMPANY, New York, N. Y., has been incorporatd, with a capital stock of $100,000 by G. F. Seward, G. O. Seward and J. C. Walker. The company will establish a laboratory for the refining of metals.

THE JOPLIN ELECTRIC SUPPLY & CONSTRUCTION COMPANY, of Joplin, Mo., has been granted corporation papers. The capital stock is $5,000, all paid. The incorporators are W. L. Butts, A. S. Fowler and A. F. Hadden.

THE BECK FLAMING LAMP COMPANY, of Canton, N. Y., has been incorporated with a capital of $300,000. The company will manufacture electrical machines. The directors are C. J. Kiebere, L. J. Auerbacher and S. S. Newton, New York.

THE C. E. COOK ELECTRIC COMPANY has been organized at 530 South Spring Street, Los Angeles, Cal., with a capital stock of $25,000 to do all kinds of electrical construction business. Mr. C. E. Cook is president; A. St. C. Perry, vice-president; W. J. Shugart, secretary.

THE CONSOLIDATED ELECTRIC COMPANY, of Norfolk, Va., has just been granted a charter by the Virginia Corporation Commission, and the new firm will shortly establish a permanent place of business in Norfolk. The company is capitalized at $15,000, and the officers are as follows: H. Root Palmer, president; W. G. Duncan, vice-president; J. P. [illegible], second vice-president; J. M. Williams, secretary and treasurer, and C. W. Breedlove, general manager, all of whom are connected with the Norfolk Railway & Light Company. The company will establish a general supply business for railway lighting and power plants and telephone systems.

New Incorporations.

FORT SMITH, ARK.—A company has been organized with $250,000 capital stock to take over and operate the Pan Telephone Company's system.

WALDRON, ARK.—The Citizens' Telephone Company, with a capital of $[illegible], has been incorporated by W. A. Streator, W. L. Compere, H. C. Stanton and W. H. Plummer.

FLORA, ILL.—The Flora Telephone Company has been incorporated by E. C. Myers and others.

APPLETON, ILL.—Persifer Telephone Company, capital $1,200, has been incorporated by F. Reamer and others.

SEWARD, ILL.—The Illinois Mutual Telephone Company has been incorporated by Charles S. Thomas and others. The company has a capital of $2500.

FLAT BRANCH, ILL.—The Flat Branch Mutual Telephone Company, with a capital of $2000, has been incorporated. Among those interested is Thomas McKittrick.

BELLEVILLE, ILL.—Articles of incorporation for the Madison County Light & Power Company have been filed. The company is capitalized at $100,000 and the incorporators are Charles Zulley, George M. Mattis and B. E. Bramble.

ELGIN, ILL.—The Elgin & Bloomingdale Electric Railway Company has organized as follows: F. W. Kobusch, Bloomingdale, president; E. W. Fischer, Addison, vice-president; J. H. Koehler, Bloomingdale, secretary; C. F. Strauschild, Addison, treasurer.

VINCENNES, IND.—The Vincennes Traction & Light Company has filed articles of incorporation with the Secretary of State. The capital stock is placed at $200,000. Benjamin G. Hudnut, Charles A. Gordon, George E. Henry, William Foley and Morris Hudnut are the incorporators.

RINGSTEAD, IA.—The Farmers' Mutual Telephone Company has been organized at this city with Andrew Marsen, president.

ELDORA, IA.—Articles of incorporation have been filed for the Franklin-Hardin Telephone Company, with a capital stock of $3,500.

ACKLEY, IA.—The telephone exchange heretofore operated by Bruening & Symington has been sold to a stock company in which the citizens of this place, Iowa Falls, Des Moines, Waterloo and other places are interested. The new company is incorporated for $10,000. E. B. Smith, of Waterloo, is president of the new company; G. F. McFarland, of Des Moines, vice-president; F. J. Martin, of Ackley, secretary, and H. A. Miller, of the same place, treasurer.

CHANUTE, KAN.—The Kansas Railway, Light & Power Company has been incorporated, with a capital of $4,000,000 by L. Rosenthal, J. J. Jones, Frank Dixon and R. C. Rawlings, of Chanute, and J. W. Stephens, of New Orleans. The company plans to construct an extensive system of interurban lines in southeastern Kansas.

NEW IBERIA, LA.—The charter for the Bayou Teche Traction & Power Company, with a capital of $1,500,000, has been filed in the office of the District Clerk. The company is to build a system of electric railways from New Iberia to Berwick.

GARDINER, ME.—Articles of association have been filed with the railroad commissioners at Augusta for the Gardiner, Richmond & Topsham Street Railway. It is proposed to build an electric line from Gardiner through Richmond and Bowdoinham to Topsham, where it will meet the Lewiston, Brunswick & Bath road. The distance is 32 miles, the capital stock $180,000, and the directors as follows: Fred T. Bradstreet, Freeman Patten, Charles S. Whitney, Harry B. Lawrence and Fred S. Thorne, all of Gardiner; L. C. Ballard, of Farmingdale, and Noble Maxwell, of Richmond.

BELAIR, MD.—The Power & Light Company, of Harford County, has been incorporated with a capital of $50,000 by P. Leslie Hooper, Hollis Courtney, Jr., M. H. Fahey and others.

AUDUBON, MINN.—The Audubon Telephone Company has been incorporated with $15,000 capital.

MINNESOTA, MINN.—The Minnesota Telephone Company has been formed with $5,000 capital. F. C. Murray is secretary.

SANBORN, MINN.—The Sanborn Telephone Company, with a capital of $15,000, has been incorporated by Henry J. Fink, F. W. Slivers, George A. Dreblow, H. K. Schroeder, H. Schwerdtfeger, Sanborn; Emil Gerth, Germantown; Charles Goehring, Charlestown.

KANSAS CITY, MO.—The Lindsey Light Company of Illinois filed articles to show that it had been incorporated under the laws of that State, with a capital stock of $100,000, of which $2500 is to be used in Missouri, with an office in Kansas City.

ST. LOUIS, MO.—Articles of incorporation of the Orrville & Bellefontaine Mutual Telephone Company have been filed in Clayton, St. Louis County. The office of the company will be located at Gumbo. Its capitalization is placed at $4,000.

HELENA, MONT.—Articles of incorporation have been filed for the East Fork Telephone Company. The principal place of business is at Rogers. The directors for the first three months are: A. V. Rogers, J. D. Clark, S. F. Bowman, of Rogers, and J. W. Miller and Walter C. Dowing, of Lewiston. The capital stock of the company is $6000.

NEWARK, N. J.—The Atlantic City Light & Equipment Company has been incorporated, with a capital of $50,000, by Harry R. Harris, George B. Clemmer and James J. Farmer.

NEWARK, N. J.—The Great Falls Electric Properties, Newark, have been incorporated to construct and control street railways, amusement parks and water power in any part of the world. The concern has a capital of $1,000,000. Incorporators are Presley H. Bisland, William S. Brayton and Robert Randall.

OCEAN CITY, N. J.—The Atlantic City & Ocean City Railroad Company has filed articles of incorporation in Trenton. The company intends to construct a road from Somers Point to a point in Ocean City, a distance of about 2 miles. The directors are: John A. MacPeak, F. R. Hansell and Joseph F. Cotter, of Philadelphia; George A. Duval, J. H. Switer, Charles Riceman and George H. B. Martin, of Camden.

HANNIBAL, N. Y.—Bethel Telephone Company has been incorporated with a capital of $2000 by L. D. Harman and others.

WORCESTER, N. Y.—The Worcester Light & Equipment Company has been incorporated with a capital of $100,000, by A. M. Thompson and others.

PENN YAN, N. Y.—Yates County Telephone & Telegraph Company has been incorporated with a capital of $5,000. Incorporators: Frank E. Spencer, Benton, N. Y.; Fred Culver and M. L. Spooner, Penn Yan.

JAMESTOWN, N. D.—The Jamestown Traction Company has been formed to build an electric railway to Courtenay.

RICHARDTON, N. D.—The Richardton Telephone Company has been incorporated with a capital of $10,000. Incorporators, Joseph Kilzer, Fred Koesel, D. P. Abby, Fred Pathman, R. J. Fleck, John H. Breum, Lewis Davis, Richardton, N. D.

COLLINS, OHIO.—The Townsend Home Telephone Company is being formed by C. B. Canfield, A. D. Bargus, George E. Stacey, C. L. Moore and others of this place.

ROGERSVILLE, OHIO.—The Rogersville Telephone Company has been formed with a $5000 capital stock by George Weiss, T. B. Gerber, William Miller, Charles Lieser, Daniel Doll and others.

OTWAY, OHIO.—The Farmers' Union Telephone Company has been formed with a capital stock of $1000 by J. E. Faul, H. R. Dugan, Edgar Dugan, E. J. Ogden, J. A. Laylin and others.

COLUMBUS, OHIO.—The Townsend Telephone Company, with a capital of $10,000, was incorporated by C. B. Canfield, C. L. Moore, George W. Helling, A. D. Bargus and George E. Stacey.

BIRMINGHAM, OHIO.—The Henrietta Telephone Company has been formed at Henrietta; $5000 worth of stock has been sold and telephones will be put in throughout a wide farming community.

HENRIETTA, OHIO.—The Henrietta Rural Telephone Company, of Lorain County, has been formed with $4000 capital stock by G. T. Unger, John M. Unger, W. C. Porter, George Delifield, J. Wiedman and others.

EAST LIVERPOOL, OHIO.—By the incorporation of the Steubenville & East Liverpool Railway & Light Company, at Columbus, Ohio, the last step has been taken to insure a continuous electric interurban railway service between Pittsburg and Wheeling, W. Va.

YOUNGSTOWN, OHIO.—It is stated that Youngstown people are soon to incorporate a new company, with a capital of $100,000, to be known as the West Side Belt Line Company, with a view to building a belt line from Central Square in Youngstown over a number of city streets to the villages of Mineral Ridge, Austinburg and Four Mile Run.

MILTON, ORE.—The Milton Rural Telephone Company, with a capital stock of $5000, has been incorporated by C. E. Simonds, William Forsythe and J. B. Saylor.

PORTLAND, ORE.—Articles of incorporation have been filed for the Multnomah & Clackamas County Mutual Telephone Company. The capital stock is $5000 and the incorporators are Napoleon Davis, Eugene S. Jenne and Timothy-Brownhil.

REE HEIGHTS, S. D.—The Ree Hills Telephone Company has been incorporated with a capital of $2000 by B. S. Bell and others.

PIERRE, S. D.—Articles have been filed for another telephone company in the White Lake and Southern line, with a capital of $25,000 and headquarters at White Lake. The incorporators are William A. Bogenhagen, Henry Mossman and Herman Suelflorn.

MALLARD, TEX.—The Mallard Telephone Company has been incorporated with a capital of $8,600 by F. L. Snodgrass and others.

YANTIS, TEX.—Yantis Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of constructing a telephone system. Incorporators: B. L. Farr, C. E. Smith, L. C. Mapes, J. S. Flanagan and W. M. Camblin.

BLACKSBURG, VA.—The Blacksburg Power & Supply Company has been granted a charter to maintain a power plant for the generation of power by steam, gas or electricity. The company is capitalized at $50,000, and D. H. Keister is president.

WALLA WALLA, WASH.—The committee on incorporation for the Covello-Wallula Electric Railway is preparing papers of incorporation. The capital stock is to be $3,500,000 and when issued a majority of it is to be held among merchants of Walla Walla, Columbia, Garfield and Asotin counties.

SEATTLE, WASH.—Articles of incorporation have been filed of the Shore Line Electric Company, with a capital stock of $1,500,000. The object of the corporation is to construct an electric railway along the shore of Puget Sound from Seattle to Tacoma. The incorporators are Joseph Winship, Charles E. Adams, Fred J. Kerr, M. L. Hamilton, Conrad L. Hoska and C. E. Muckler.

BROWNTOWN, WIS.—The Browntown Telephone Company has filed articles of incorporation and applied for a charter in the office of the Secretary of State. The company is capitalized at $5500 and incorporated by O. M. Erickson and others.

Legal.

WATTMETER LITIGATION.—The United States Circuit Court for the Northern District of New York has filed a decree enjoining the defendant in the case of the General Electric Company vs. the Madison County Gas & Electric Company, from using alternating current integrating wattmeters or other motor devices embodying a provision for securing an approximate 90-phase adjustment by induced circuit. The infringement consisted in the use of Scheeffer wattmeters manufactured by the Diamond Meter Company of Peoria, Ill.

DESIGN PATENTS.—The Court of Appeals of the District of Columbia in the matter of the patent application of O. A. Mygatt, president of the Holophane Glass Company, has held that descriptive matter may be not only proper but necessary and allowable in design patents. A few years ago Congress passed a law apparently limiting design patents to a drawing without the rights of any further explanation, or specification, than the words: "A design as herewith shown." The present decision is held to be in consonance with the statutes relating to the grant of design patents. Reflectors are the subject matter.

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Obituary.

MR. GEORGE FARNSWORTH, superintendent of tariffs for the Michigan State Telephone Company, Detroit, Mich., died at his home, 488 Cass Avenue, on March 23, of neuralgia of the heart and Bright's disease.

MR. AXEL H. ENGSTROM, of Philadelphia, Pa., consulting engineer in electric railway and power plant work, died in that city on March 21. Mr. Engstrom was born in Sweden and was 49 years old. He had lived in America for twenty-five years.

MR. EDWARD BACKUS, commissioner of electric lines and lights of Somerville, Mass., died on March 26 at his home, aged 58 years. When, under the provisions of the new city charter adopted in 1900, the office of commissioner of electric lines and lights was created, Mr. Backus received the appointment and served in that capacity until his death. He is survived by a son and daughter.

MR. A. O. BOSTROM.—Mr. August O. Bostrom, well known as a chemist, mathematician and electrician, for many years a mechanical expert in the Navy Department and the inventor of the improved turrets now in use in the United States Navy, died at his home in Washington, recently, aged 50 years. He was a native of Sweden, came to the United States at an early age, was graduated from the Rensselaer Polytechnic Institute in civil engineering, and entered the Navy Department in 1877.

MR. JOHN C. KAFER, whose organization of the engineering firm of Kafer, Mattice & Warren, we announced only last week, died suddenly at Dumont, N. J., on March 30, aged 64. He was in the U. S. Navy from 1863 to 1885, and as an instructor in the Naval Academy had as students many men since prominent in the electrical and mechanical fields. He was president of the Engineers' Club 1901-4, had been active in its affairs until his death, and was a member and treasurer of the conference committee for the administration of the Carnegie gift of $1,500,000 for the United Engineering Building and the Engineers' Club. The engineering profession has lost one of its ornaments in this high-minded, public-spirited man.

MR. GEORGE L. BRADLEY, of Washington, D. C., died on March 26, of pneumonia, at his residence 1503 Twenty-third Street. He was one of the founder of the Bell Telephone Company of America, now the American Telephone & Telegraph Company, and at one time owned a majority of its stock. At the time of his death he was a member of the board of directors of the company, and also a director in the Mergenthaler Linotype Company. Mr. Bradley's industrial enterprise was the construction of the canal in Florida connecting the St. John River to the Biscayne Bay. The work is nearly completed and will cost when finished $1,500,000. He was a member of the Metropolitan, Alibi and Chevy Chase Clubs. Both he and Mrs. Bradley, who survives him, were for many years prominent in Washington society. Mr. Bradley was a native of Newburyport, Mass., and 60 years old at the time of his death.

MR G. MARTIN BRILL, president of the J. G. Brill Company, died suddenly on March 11 at his home in Merion, a suburb of Philadelphia. He was born in Hesse Cassel, Germany, in 1846, the eldest son of John George Brill, who came to this country in 1847, and settled in Philadelphia, where he was employed in the car building concern of Murphy & Allison. After his graduation from the public school, Mr. Brill obtained a position with that firm and was foreman of the woodworking department for several years. In 1868 the plant was destroyed by fire, and as the firm decided to discontinue street car building, Mr Brill and his father took up this branch of the business. A small shop was rented, and the new firm of J. G. Brill & Son commenced in a very modest manner. The quality of workmanship of the productions was quickly recognized, and year after year it was necessary to purchase additional ground and erect buildings, until all the available land in the vicinity (four and a half acres in extent) was covered. In 1890 the present plant, comprising eighteen and a half acres, covered with modern buildings, was occupied. Since the death of his father in 1888 Mr. Brill has been the president of the company and until recently was also its general manager. Finding it necessary to take care of an increasing volume of business, the Brill Company has purchased within the last few years the American Car Company of St. Louis, the G. C. Kuhlman Car Company of Cleveland, and the John Stephenson Company of Elizabeth, although each of these plants is operated separately. The Philadelphia plant has received important additions nearly each year of its history. Mr. Brill possessed a large frame and was large in mind and heart. In the business world he was regarded as an unusually able organizer and director of affairs. His business associates knew the man they were dealing with, for he spoke plainly and his methods were always governed by high principles. Nearly one hundred valuable patents issued to him on cars and trucks and parts of their equipment attest his wide knowledge of the requirements of modern railroading and his alertness toward improvement. Mr. Brill was a member of the Manufacturers' Club in Philadelphia, the New York Club, the Union Club of Cleveland, the St. Louis Club, director of the Merchants' National Bank of Philadelphia and a director of the Interstate Railway Company. He had a very wide acquaintance in the electrical field, and took a deep interest in the growth of the electric railway from the earliest days of Sprague and Van Depoele.

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Educational.

OHIO STATE UNIVERSITY.—Professors Magruder, Anderegg and Caldwell of the mechanical and electrical engineering department, accompanied by eighty students of that department, are making an inspection tour through the East. They will visit power stations at Pittsburg, Cleveland, Buffalo, Niagara Falls and other points in New York State.

THE TRI-STATE COLLEGE OF ENGINEERING, of Angola, Ind., has filed articles of incorporation. The capital stock is $10,000. The purpose is to establish, maintain and conduct a school of engineering. A course will be given in civil, in mechanical or electrical engineering, or a combined course in mechanical and electrical engineering. Littleton N. Sniff, L. W. Fairfield and W. O. Bailey are the incorporators.

UNIVERSITY OF WISCONSIN.—During the past year the enlargement of the shops of the college of engineering has resulted in the extension and development of the electrical engineering laboratories of the University of Wisconsin until now its equipment includes over sixty dynamos, motors, meters and transformers for the use of the students, as well as 200-kw polyphase alternator and 100-kw direct-current generator, power for which is furnished by a new 300-hp Filer and Stowell Corliss engine, and 150-hp Ideal high-speed engine. The space afforded for this laboratory by the west and south wings of the machine shop allows of much flexibility of arrangement, and makes it possible to accommodate a large number of students. The dynamos and motors are of both continuous and alternating current types, ranging in size from a fraction of a horse-power to 270 hp. A large number of these are of a capacity ranging from 6 to 12 hp. and are therefore particularly adapted for laboratory instruction of the 178 students of electrical engineering.

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Personal.

MR J. A. HUNNEWELL, superintendent of the Whitman, Mass., electric light plant, has been appointed to take charge of the Lowell lighting plant.

MR. H. J. MEYER has resigned his position as superintendent of the electrical department of the Shreveport, La., Gas, Electric Light & Power Company, and Mr. A. T. Lloyd has been appointed as his successor.

MR RAYMOND STEWART, an electrician of Bangor, Me., has been appointed superintendent of the Dexter Light & Power Company, Dexter, Me., which is owned by the United Illuminating Company, of Boston, Mass.

MR JAMES F. LARDNER, manager of the Tri-City Railway Company has been appointed general manager of the Tri-City Railway & Light Company, which has recently secured control of the public utility companies of Moline and Rock Island, Ill., and Davenport, Ia.

MR. FREDERIC NICHOLLS, rear commodore of the Royal Canadian Yacht Club, has prepared in very handsome lithograph, broadsheet form, and distributed among his friends, Nelson's famous "duty" signal at Trafalgar. It has a portrait of the hero, and as supporters, the Nelson column in Trafalgar Square, London, and Turner's beautiful painting of the fighting Temeraire. It was a happy thought of a patriotic Anglo-Canadian to do this.

MR. G. A. REDMAN.—A feature of the social life of DeLand, Volusia County, Florida, is the meetings of the Tourist Club, whose members represent almost every State in the Union. As in other cities of Florida, a large percentage of the residents are those who come from Northern States to spend the winter in their Southern homes. The president of the Tourist Club is George A. Redman, formerly general manager of the Rochester Gas & Electric Company. This gentleman with his family has lately spent a good deal of time in travel.

MR F. V. T. LEE, manager of the San Francisco office of the Stanley-G. I. Electric Manufacturing Company, has been appointed assistant manager of the Pacific Gas & Electric Company, taking effect April 1. In this position Mr Lee will be the active assistant of John R. Britton, president and general manager of the company. The position of manager of the San Francisco Gas & Electric Company, which Allan Pollok has recently resigned, is to be abolished, and the duties divided among other officials.

MR. GEORGE J. LOW started this week on an extensive foreign trip in the interests of the Atlas Engine Works, E. C. Atkins Co., Nordyke & Morman Co., the American Steam Pump Co., and the Ohio Valley Pulley Works. His itinerary includes Honolulu, Japan, China, Vladivostock, Manila, Australia, New Zealand, South Africa and the principal European centers. Mr. Low has been over the ground before in the interests of the Atlas Engine Works and has been eminently successful in building up their foreign business.

MR. GEORGE H. PATTEN has entered the service of the Chattanooga Electric Company, Chattanooga, Tenn., in the capacity of contract agent in charge of its "New Business-Getting and Advertising Department." Mr. Patten is an electrical engineer and has been connected with the General Electric Company for the past six years. He represented the General Electric Company at the St. Louis Exposition and at the Lewis and Clark Exposition, Portland, Ore. Mr. Patten will have on his staff Mr. Frank H. Hiner and Mr. Edgar H. Stegall.

MR. J. D. ZOOK has assumed the management of the machinery and repair department of the Northeastern Electric Equipment Company, of St. Paul, Minn. He was for eight years in the employ of the Gregory Electric Company, six as foreman of the armature department, one as general foreman and the last year as general superintendent. Previous to that time he was connected with the Northern Electric Company as foreman of the armature room, and prior to that, six years with the Rockford, Ill., Electric Company as foreman and superintendent. With seventeen years' experience in the management of the repair and machinery departments of large electrical concerns, Mr. Zook has mature qualifications for his present responsibilities.

MR. W. B. READ.—The executive officers and members of the engineering staff of the New York City Railway, together with a number of personal friends of Mr. W. Boardman Reed, who retires from the position of chief engineer of the company to go into business for himself, met in the ballroom of the Hotel Astor on March 11 to attend a dinner to Mr. Reed. President H. H. Vreeland of the New York City Railway Company, in his address, said of the guest of honor: "It is easy to take a well-oiled, smooth-running machine and operate, but it is quite another thing to create, build and carry to completion such a machine and hand it down to his successor. That is what Mr. Reed has done." Mr. Vreeland presented to Mr. Reed an engrossed set of resolutions and a four-hundred-dollar ring on behalf of those present. On behalf of the legal department of the company Mr. H. A. Robinson gave Mr. Reed a gold watch.

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Trade Publications.

ELECTRIC CAR BRAKES.—The Westinghouse Air Brake Company, Wilmerding, Pa., has just issued in very neat pamphlet form the excellent paper on "Air Brakes for Electric Cars," read by Mr. W. S. Bartholomew last November before the New England Street Railway Association.

ELECTRICAL EQUIPMENT OF A SHIP YARD.—Bulletin No. 1030 of the Allis-Chalmers Company, Cincinnati, Ohio, contains a well illustrated description of electrical power distribution and application in the ship-building plant of the Fore River Ship and Engine Company, at Quincy, Mass.

DIRECT-CURRENT MACHINES.—The details of construction of a complete line of direct-current motors and generators ranging in size from 1 hp to 50 hp, are outlined in an illustrated bulletin designated as No. 367, which has recently been issued by the National Electric Company, Milwaukee, Wis.

TELPHERAGE, as represented in the work of the United Telpherage Company, is the subject of a brochure in French by Guarini, brought out by H. Dunod and E. Pinot, of Paris. It is an interesting summary of the work done in this country in developing this aerial system of transporting material electrically.

LOCAL BATTERY TELEPHONES.—Bulletin No. 101 of the Dean Electric Company, Elyria, Ohio, which is devoted to local battery or magneto type telephones, in addition to giving an adequate description of the telephones themselves, contains numerous diagrams of telephone circuits which should prove of much interest to telephone engineers.

CEMENT MACHINERY.—The Allis-Chalmers Company, Milwaukee, Wis., has issued as catalogue No. 129, a treatise on the manufacture of cement which gives descriptions of cement-making machinery including rock breakers, crushers, dryers, kilns, ball mills, tube mills, elevators and conveyors. The machines are designed for each stage in cement making by either the wet or the dry process.

INDUCTOR ALTERNATOR.—In Bulletin No. 147, the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., gives an interesting discussion of the properties of the inductor alternator. This machine has absolutely no moving wire, collector rings or brushes. It is stated that it has high efficiency at partial as well as at full load, and that it can be built with any regulation desired.

GUY ANCHORS.—The 1906 catalogue of W. N. Matthews & Bro., 30 Cortlandt St., New York, is a neatly executed publication dealing with Stombaugh guy anchors and Kearney cable clamps. The catalogue contains a report of a test of the holding capacity of the anchor in both sandy and clay soils, and gives a formula for expressing the holding capacity in terms of the diameter of the helix and the depth to which it is buried.

HYDRAULIC TURBINES.—Bulletin No. 2 of the I. P. Morris Company, Philadelphia, Pa., is intended for the use of consulting hydraulic engineers and others desiring information concerning the variation in power and efficiency of a turbine wheel when run at a constant speed and operating under varying pressure heads. Numerous curves are shown of the calculations connected with a 13,500-hp turbine designed and built for the Shawinigan Water and Power Company.

"THE PRESERVATION OF SHIPS," a publication issued by the Long Arm System Co., of Cleveland, Ohio, represents a distinct departure in trade literature. The company manufactures electrically operated bulkhead doors and hatch-plates for ships, its system being in use on all the new vessels of the navy. Instead of the customary catalogue, it now puts out a series of "short talks" on the principles of safety at sea, and the conditions under which safety can best be procured, with special reference, of course, to the overwhelmingly important part of watertight bulkheads & their doors in producing the unsinkable ship.

DEPARTMENT STORE LIGHTING.—An artistic booklet devoted to electric lighting in the department store has just been received from the Nernst Lamp Company, Pittsburg, Pa. The keynote of the booklet is that "the store manager can no more afford to consider the question of lighting from the utility standpoint alone than he can afford to use shabby furniture and fixtures." Means are discussed for obtaining the proper quality, quantity and distribution of illumination so as to show up the merchandise to the best effect and, at the same time, to be attractive to the customer. It is stated that for the illumination of stores, the Nernst lamp gives twice the amount of light for the same power as does a carbon filament lamp, and that it is about 10 per cent. more efficient than the carbon arc lamp for interior illumination.

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News of the Trade.

STANLEY-G. I. offices in New York City have been moved to 42 Broadway. The stock room is on Washington Street.

MANUFACTURERS' ADVERTISING BUREAU announces its removal on April 2 from 126 Liberty Street, New York City, to 237 Broadway.

THE SUMTER TELEPHONE MFG. COMPANY, Sumter, S. C., whose plant already covers 140,000 feet of floor space, is now erecting an additional wing in order to keep up with the demand for its product.

THE W. S. HILL ELECTRIC COMPANY, New Bedford, Mass., at its recent annual meeting elected the following board of directors: Charles S. Mendell, F. A. Soule, George R. Stetson, A. P. Smith, N. P. Soule, W. R. West and R. A. Soule.

THE CAWOOD MICA COMPANY, 367 Ellicott Street, Buffalo, N. Y., is operating mines at Shawville, Quebec, and Shelby, N. C., and is doing a constantly increasing business with manufacturers of electrical apparatus. The amber mica from the Canadian mine is particularly well adapted to commutator work on account of its soft, even quality.

BANNER ELECTRIC COMPANY, manufacturer of incandescent lamps, Youngstown, O., has opened a Southern office at 12-16 Trinity Avenue, Atlanta, Ga., where it will carry a complete assortment of lamps. The office will be under the management of Mr. G. E. Watts, formerly of St. Louis, who has moved his family to Atlanta and will take up permanent residence there. Mr. Watts is a pioneer in the lamp business, having been engaged in the sale of incandescents for many years. He has traveled through the Southern States included in his territory and has a large acquaintance.

A CLEAN ENGINE ROOM is difficult when dozens of individual oil cups and oil holes must be given periodical attention by "the man with the can." A dirty, oil-soaked engine room is an eyesore to the engineer, an element of danger by fire, and an evidence of waste and loss to the man who pays the bills. This state of affairs is obviated by use of the White Star continuous oiling system because the lubrication of bearings is done by a steady flow of pure oil from a reservoir replenished only at long intervals—direct from the barrel. Appreciation of the value of this method of lubrication is shown by the following concerns which are among the recent purchasers of White Star oiling systems: The Pittsburgh Gage & Supply Co., Pittsburg, Pa.; Roland Park Elec. & Water Co., Baltimore, Md.; Jones & Laughlin Steel Co., Pittsburg, Pa.; Pennsylvania Railway Power Station, Allegheny, Pa.; Link-Belt Machinery Co., Chicago; Bullock Electric Manufacturing Co., E. Norwood, O.; International Paper Co., Glens Falls, N. Y.; C. A. Cambrill Manufacturing Co., Ellicott City, Md., and Hazard Manufacturing Co., Wilkesbarre, Pa.

THE VAN DORN & ELLIOTT ELECTRIC COMPANY, of Cleveland, Ohio, has gone into the manufacture of electric drills for various purposes on quite an extensive scale. It will have a line of breast drills for shipbuilding, boiler shop and structural iron work, taking the place of pneumatic drills for these purposes, and it will also build a light portable drill for drilling bolt and bond holes in railway tracks. The outfit is small and compact, weighing less than 60 pounds, so that it can be handled and removed from the track by one man, and it has the advantage of automatic feed and regulation. The Van Dorn & Dutton Company, with which the above mentioned company is affiliated, is erecting a new factory building 60 x 190 ft. and two stories high. A portion of the new factory will be occupied by the Van Dorn & Elliott Company. All machinery will be electrically driven with shafting sectionalized and the company will buy a generator, switchboard and about six or seven motors. A 100-hp gas engine has been contracted for.

INTERNATIONAL ELECTRIC COMPANY.—Several men in Salt Lake City, Utah, have purchased control of the International Electric Company from S. F. Fenton, and are preparing to go into electrical engineering on a large scale in addition to the contracting and supply business. The organizer of the company, who will be its president, is Murray C. Godbe, now electrical engineer for the Utah Light & Railway Company. Other officers of the concern are as follows: Vice-president, Joseph J. Daynes, Jr.; secretary and manager, C. B. Hawley; treasurer, W. S. McCornick. Mr. Godbe, Mr. Daynes, Mr. Hawley, Lafayette Hanchett and Hyrum Silver will constitute the board of directors. Other stockholders are W. S. McCornick, W. P. Read, L. S. Cates, J. Frank Elam and E. E. Jenkins.

THE CRESCENT ELECTRICAL MANUFACTURING COMPANY, Rochester, N. Y., has recently moved into larger and more commodious quarters at 187 N. Water Street—a change which was made absolutely necessary by its rapidly increasing business. It will occupy the entire second and [illegible] floors, with 10,000 sq. ft. of working space, in the new quarters. The offices, engineering and drafting departments are in the front of the second floor, the remainder of the space being devoted to assembling work, storing and shipping. The heavy machinery is located on the third floor and there all raw material is stored. It will be remembered that this company devotes special attention to panel board work and in this connection it is making all-steel cabinets for panel boards, which are attracting a great deal of favorable comment. Among recent orders are all the panels and cabinets for the New York State Commission at Flushing and Binghamton and the Custodio Asylum at Rome. A seven-panel board is just being completed for the Stecker Mfg. Company of Rochester.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, manufacturer of the Exide battery, has produced in the 1906 model of the "Exide" sparking battery one built to give satisfactory service with a minimum amount of attention. In this latest model it has provided against "sparking battery troubles." The plates are strongly burned to the connecting straps to insure against broken joints. Special care has been taken in designing the terminals, they being cast in lead pillar straps which extend through holes in the cover of the case, and the holes being fitted with rubber gaskets to prevent the acid from creeping up and corroding the terminals. The rubber jars are of the best quality to withstand breakage, and the sealing is tight and durable. These sparking batteries are supplied with either gelatinous or liquid electrolyte, as ordered. The cases are made of cherry, finished in either natural wood or in black, treated with an acid resisting composition. A sliding cover is used which gives ready access to the cells.

STANLEY-G. I. COMPANY.—Various changes will take place on the first of April in the personnel of the Stanley-G. I. Electric Mfg. Company's representation on the Pacific Coast. Mr. F. V. T. Lee has resigned the position of district manager to become assistant to the president, Mr. John A. Britton, of the Pacific Gas and Electric Company. Mr. H. C. Parker, who has been manager of the San Francisco office, will become acting district manager and Mr. G. I. Kinney, who has been manager of the Seattle office, will be associated with Mr. Parker with headquarters at San Francisco. Mr. Lee's connections with Stanley interests on the Pacific Coast date back to the organization of the firm of Jno. Martin & Co., who were for many years, especially during the time of the pioneer long-distance electric transmission work of that section, the Stanley Company's Pacific Coast representative. Messrs. Parker and Kinney were also associated with the Martin Company prior to the time of the company's establishing its own branch offices on the Pacific Coast.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York. Next meeting, Chattanooga, Tenn., May 1-4, 1906.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York. Next convention, Columbus, Ohio, Oct. 15-20, 1906.

Association of Edison Illuminating Companies. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting September, 1906.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, F. Fish, 123 Mill St., Rochester, N. Y. Next meeting, New York City, June 19, 1906.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings second and fourth Thursdays each month.

Electrical Trades Association of Canada. Secretary, Wm. R. Staveley, Royal Insurance Building, Montreal, Can. Next annual meeting, Jan. 14, 1907.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electric Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, New Haven, Conn., Aug. 16-18, 1906.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Des Moines, April 19 and 20, 1906.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia. Next meeting, Des Moines, April 18 and 19, 1906.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, March 13, 14 and 15, 1906.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., October, 1906.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electric Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

Missouri Independent Telephone Association. Secretary, James F. Barnett.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn. Next meeting, Chicago, June 26, 27 and 28, 1906.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

New York State Independent Telephone Association. Secretary, T. S. Lane, 536 Ellicott Square, N. Y. Next meeting, Elmira, N. Y., June, 1906.

Northwestern Electrical Association. Secretary, B. C. Adams, Madison, Wis.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, F. W. Bullard, Cleveland, O. Next meeting, Pittsburg, Pa., May 17, 1906.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, O.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore. Next annual meeting, June 19, 1906.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D.

Southwestern Electrical and Gas Association. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, May 16, 17 and 18, 1906.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchield, Jr., 114 Liberty St., New York.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt. Next meeting, July 10 and 11, 1906.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 27, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

815,942. METHOD OF ABSORBING GASES OR VAPORS AND THE PRODUCTION OF HIGH VACUUMS; James Dewar, Cambridge, England. App. filed Apr. 25, 1905. A method of absorbing gases or vapors by exposing to the gas charcoal cooled to a temperature comparable with that at which the gas to be absorbed boils, substantially as described.

815,961. ELECTRICAL DEVICE AND CIRCUIT; William H. Lane, Westfield, New Jersey. App. filed June 2, 1905. Aims to overcome a defect of present railroad signal systems due to the sticking of the relay armatures caused by the fact that the rails are short circuited by the trains at a point remote from the relays. Patentee cuts out one coil of the relay when the armature is in attracted position.

815,964. ELECTRIC FUSE; Benjamin Luther, Boston, Mass. App. filed Apr. 24, 1905. A device for securing the metallic caps to the fiber tubes of ordinary enclosed fuses. The patentee insets prongs or barbs in the caps to engage the fiber and hold the caps in place.

815,985. METHOD OF MAKING ARMOR PLATE; Joseph Strauss, Washington, D. C. App. filed Mar. 31, 1905. The method of making armor plate, which consists in electrically welding two metal plate-form members of different degrees of hardness.

815,991. TROLLEY-POLE; Andrus S. Weaver, Sodus, N. Y. App. filed January 7, 1905. An arrangement for causing the trolley pole to drop if the wheel leaves the wire. For this purpose the upper end of the pole is hinged to the body thereof, and the relative movement causes the pole drop when the wheel leaves the conductor.

815,993. TRANSFER-SWITCH FOR TESTING CIRCUITS; John S. Witaker, Portsmouth, N. H. Designed to supply current to a signaling system. The device is arranged to normally connect the usual power means to the circuit, but in case of failure of the power voltage, the signal circuit is automatically connected on to a battery source of potential.

815,996. RHEOSTAT; Charles Wirt, Germantown, Pa. App. filed January 10, 1905. A method of manufacturing resistance coils which consists in winding the coil and placing it in a suitable mold and then injecting plaster of paris into the mold, so as to solidly support the resistance wire.

816,000. COMBINED TELEPHONE AND WATCHMAN'S ALARM SYSTEM; John J. Berry, Indianapolis, Ind. App. filed Jan. 3, 1905. The combination, with an electrical-energy telephone, its service-circuit and switchboard connections, of a watchman's recording means normally electrically connected to said service-circuit, a central-recording means electrically connected to said service-circuit, an alarm-signal and its controlling circuit, means for intermittently operating the alarm-signal through its controlling circuit, and means controlled by the watchman's reporting means for preventing the normal operation of the alarm-signal.

816,014. SAFETY SYSTEM FOR ELECTRIC-ROAD CROSSINGS; Arthur H. Johnson, Rahway, N. J. App. filed December 5, 1892. Renewed Feb. 8, 1906. At either side of the crossing of a street and a steam railroad, the usual trolley forms a local insulated section, and the power is cut off from said section by an attendant when there is danger from a passing locomotive.

816,028. ELECTRICAL SWITCH; James F. McElroy, Albany, N. Y. App. filed April 30, 1903. Details of a circuit breaker or cut-out, the essential feature of which is the blade element of the switch which has a pair of spring contacts in its face adapted to yield in a direction transverse to the motion of the blade.

816,033. ROSETTE FOR ELECTRIC-LIGHT WIRES; John Henry Parker, Saugus, Mass. App. filed Feb. 20, 1905. Details of a rosette having a circular base from which depends an arch beneath which the connections are made and through which the wires extend to the lamp.

816,052. TELEPHONE EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Dec. 3, 1903. In a telephone-exchange system, the combination with a telephone-line extending from a substation to an exchange of cord connecting apparatus for connecting said line with another for conversation, a common source of current at the central exchange for supplying talking and signaling current to the cord-circuit and telephone lines, a circuit extending between one pole of said source of current and one cord strand, and including a supervisory lamp and an impedence coil, a second circuit extending from the same pole of said source to the other cord strand and including only the winding of the supervisory relay, connection of said cord circuit with the telephone line causing the circuit through said supervisory lamp to be completed, and actuation of sub-station apparatus upon connection of the cord circuit with the line causing the circuit through the supervisory relay to be completed and the circuit through the supervisory lamp open.

816,078. TELEPHONE EXCHANGE SYSTEM; William M. Davis, Chicago, Ill. App. filed Aug. 5, 1901. In a telephone exchange system, the combination with a telephone line extending from a subscriber's substation to a central exchange, a plurality of spring jacks of a multiple switchboard normally discontinued from the line limbs, a single common source of current at the central exchange, a line relay normally connected with the line limbs through said source of current, a cut-off relay having a single winding, one terminal of said cut-off relay being connected with one terminal of said source and normally with one line limb, the other terminal of the cut-off relay being connected with spring-jack contacts, a cord-circuit for connecting telephone lines together, actuation of substation apparatus causing energization of said line relay independently of the cut-off relay winding, and means upon connection of said cord circuit with one of said multiple sections for closing a local circuit containing said cut-off relay winding and said source of current whereby said cut-off relay is energized to disconnect said line relay from circuit, and to connect the spring-jack contacts with the line-limbs, said local circuit including one of the cord-circuit conductors and one limb of the telephone circuit.

816,100. ELECTRIC SWITCH; Montgomery H. Johnson, Utica, N. Y. App. filed April 20, 1903. The switch blade is operated by a compound lever which initially moves the blade into engaging relation with the contacts and subsequently presses it thereagainst.

816,111. REVERSE-RELAY DEVICE; Ralph D. Mershon, New York, N. Y. App. filed November 4, 1904. A system of connections including transformers and wattmeter coils for operating a circuit breaker when certain abnormal conditions occur in a line where two or more sources of current feed into the same circuit.

816,112. CIRCUIT-CONTROLLING APPARATUS; Ralph D. Mershon, New York, N. Y. App. filed December 27, 1904. In order to secure sufficient energy to operate a circuit breaker by a light vibrating lever which makes only a temporary contact, the patentee provides a local magnet which is capable of holding the lever permanently against the contact after it has once moved thereagainst.

816,131. TRANSFER-CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS; Charles A. Simpson, Chicago, Ill. App. filed Oct. 27, 1904. In a telephone system, the combination with subscribers' lines terminating upon different switchboard sections, of a transfer circuit extending between said sections, means at each said section to connect the subscribers' lines thereof with the said transfer circuit to establish a complete talking circuit between the subscribers, two signals permanently connected in parallel associated one with each end of the said transfer circuit, and means actuated in making and unmaking connections with the said transfer circuit for suitably controlling the circuit of said signals, substantially as described.

816,132. TELEPHONE SYSTEM; Charles B. Smith, New York, N. Y. App. filed Nov. 28, 1898. A telephone system comprising a central office and a party-line leading therefrom having a plurality of conductors, telephone and signaling instruments for connection with one conductor, and electrically operating devices adapted to operate one at a time and successively for selecting and placing in circuit the signaling instrument desired and for restoring the circuits to their normal conditions, means at central for sending the appropriate impulses over the conductors to select and operate the signaling instrument desired and for restoring the circuits, means at central for joining two of said conductors in a closed metallic circuit through the telephone instruments, and means corresponding with each telephone for signaling to central over such metallic circuit to notify central to disconnect the circuits.

816,135. TELEPHONE EXCHANGE SYSTEM; Harold B. Stroud, Chicago, Ill. App. filed March 25, 1901. The combination with telephone lines extending from subscribers' stations and passing serially through two boards at the exchange, each line having a switch connection with each board, of trunk circuit connecting means interposed between the boards, line indicators at one of the boards, test indicators associated with the telephone lines at the other board, a source of current for the trunk circuit, and means whereby the said test indicators are operated by said source when the trunk circuit is connected with the line at the first board, connection of said circuit also mechanically causing restoration of the line indicator.

816,139. RAILWAY CAR AND LOCOMOTIVE HEADLIGHT; Adolph Walter, Toledo, Ohio. App. filed Dec. 18, 1901. A switch arm is mechanically connected to the throttle of a locomotive so as to close the circuit through the locomotive headlight when the throttle is opened and thereby give an indication that the train is in motion.

816,142. PROCESS OF MAKING IRON FROM THE ORE.; Robert H. Aiken, Winthrop Harbor, Ill. App. filed June 1, 1903. The method of making iron from iron oxids which consists of dissolving the oxid in a molten silicate of one or more metals not less electropositive than iron, and passing through the solution a continuous current adapted to decompose said oxid.

816,148. TROLLEY-SHIELD; John W. Brown and Charles W. Jenkins, Washington, D. C. App. filed Apr. 29, 1905. A curved guard surrounds the trolley wheel in such a way as to prevent it from catching on the wire when it has escaped therefrom and is being repositioned by the retriever or other means.

816,172. ELECTRIC HEATER; Harmon N. Morse and Joseph C. W. Frazer, Baltimore, Md. App. filed Apr. 18, 1905. A form of resistance element comprising a block of soap stone which is painted with a layer of mixed graphite and clay. The current is conducted through this layer or coating.

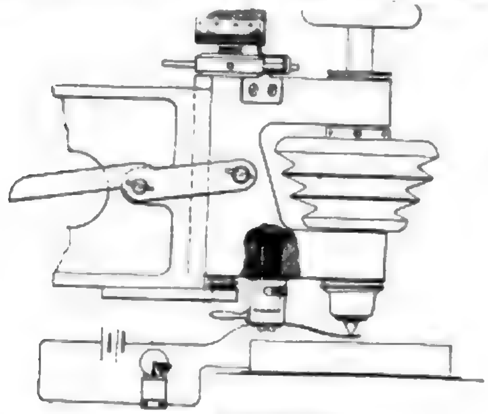
816,192. ELECTRICAL GENERATOR; William Stanley, Great Barrington, Mass. App. filed Feb. 17, 1904. Renewed Nov. 11, 1904. Has fields which are energized by an alternating current and a specially wound armature from which can be obtained alternating currents of different frequency.

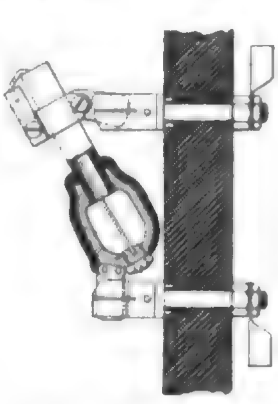
816,205. WIRELESS-TELEGRAPH RECEIVING APPARATUS; Allesandro Arton, Turin, Italy. App. filed Sept. 7, 1905. A pair of antenna are supported at an angle to one another and are so connected to the coherer as to respond to polarized but not unpolarized radiations.

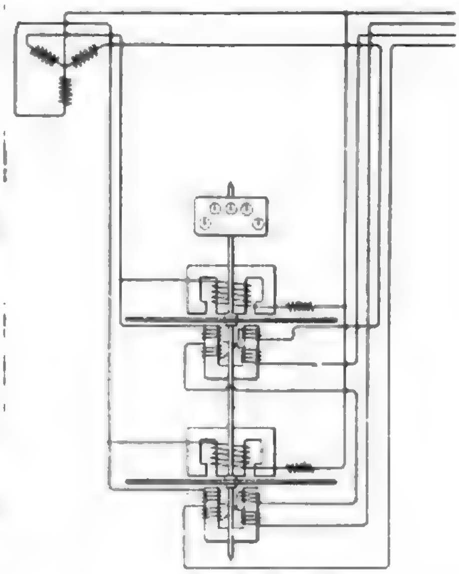
816,239. TROLLEY-HARP; Isaac H. Lunt, Barre, Vt. App. filed Sept. 6, 1905. The trolley harp is hinged at the upper end of the pole to have an independent transverse movement, the purpose of which is to facilitate rounding curves.

816,259. AUTOMATIC GEARING DEVICE; Judson Shoecraft, Eskridge, Kan. App. filed Nov. 9, 1905. Details of a semaphore operating mechanism in which the semaphore is raised by a motor driven gear train and falls by gravity when disengaged by a release magnet.

816,270. REFRACTORY MATERIAL FOR ELECTRIC INSULATION AND OTHER PURPOSES. Demetrius M. Steward, Chattanooga, Tenn. App. filed Feb. 25, 1903. An insulating and refractory material comprising the combination of water glass and steatite or their substantial equivalents, chemically converted practically to a complete extent by heat.


816,307. Engraving Machine.


816,443.—Expulsion Fuse.


816,375.—Electric Meter.

816,307. ENGRAVING MACHINE; William E. Eaton, Sag Harbor, N. Y. App. filed Aug. 23, 1905. In order to properly position a tool of an engraving machine with reference to the work the patentee interposes a strip of known thickness beneath the tool, and adjusts the elevation of the tool until an electric circuit is completed through the strip.

816,375. ELECTRIC METER; Wm. H. Pratt, Lynn, Mass. App. filed July 25, 1904. A system for measuring the energy of a three-phase system using a neutral return wire in which a single rotating element has two armatures rotating in separate fields and the connections are made in different branches so as to properly indicate the energy of the circuit.

816,383. MOTOR-STARTER; Ernest Schattner, Schenectady, N. Y. App. filed July 20, 1905. A system of contactors supported on a single base and adapted to be successively actuated by connections depending on the counter e.m.f. of the motor. Is adapted for small motors and small insulations as well as large ones.

816,384. BATTERY; Eugene W. Schneider, New York, N. Y. App. filed Aug. 11, 1905. A battery composed of a plurality of cells and means whereby one of said cells by an end-to-end reversal thereof may be thrown into or out of the generating circuit of the battery.

816,395. ALTERNATING CURRENT GENERATOR; Charles P. Steinmetz, Schenectady, N. Y. App. filed July 25, 1904. In an alternating current generator, a field structure provided with a distributed winding and a many part commutator connected thereto, brushes bearing on said commutator, means for supplying direct current to the field to magnetize the field structure on a line fixed relatively thereto, and means for supplying to said brushes a curent varying in magnitude and phase with the armature current.

816,406. FUSE-PLUG; August Weber, Sr., and August Weber, Jr., Schenectady, N. Y. App. filed March 8, 1904. A form of fuse plug formed of a single hollow block containing a ledge over which the fuse wire passes in its path from the threaded shell to the central stud.

816,407. ELECTRIC PRESSURE INDICATOR; Joseph H. Wertz, New Haven, Pa. App. filed March 21, 1905. A U-shaped tube contains mercury and a pair of circuit connections which establish separate alarm circuits by the rise of the mercury column in one tube or the other, depending on pressure variations.

816,415. TROLLEY; Henry Zander and Gustav Hahn, Wilmerding, Pa. App. filed Sept. 25, 1905. A pair of curved arms are hinged upon the sides of the harp as to normally close over the wheel and prevents its escape from the wire. The arms can be separated when desired by a cord connection.

816,428. ELECTRIC CABLE; Harold W. Buck, Niagara Falls, N. Y. App. filed July 27, 1904. In order to fire-proof telephone cables properly the patentee wraps them with asbestos tape which has been specially treated with silicated soda, after the cables are in position in the conduit.

816,429. DEVICE FOR SUPPORTING CABLES OF ELECTRIC LAMPS; James F. Burns, Albany, N. Y. App. filed July 12, 1905. The lamp cord is coiled upon a spring dam which can be held in any position by a magnet-operated detent. The detent is made operative whenever the light is turned on.

816,436. ELECTRIC-LIGHT SOCKET AND KEY; Owen C. Cover, Goshen, Ind. App. filed Nov. 12, 1904. An attachment for an ordinary lamp socket by means of which the lamp and another lamp can be thrown into series or multiple with one another, securing brilliant or dim illumination.

816,442. SYSTEM OF ELECTRICAL REGULATION; William L. R. Emmet, Schenectady, N. Y. App. filed July 1, 1904. The combination of an alternating current generator having alternating-current mains leading therefrom, and having a direct-current exciting circuit connected thereto, a source of exciting current connected to said exciting circuit, a booster interposed in the exciting circuit and a regulator for said booster responsive both to the voltage of the alternating-current mains and to the resultant voltage of said exciting source and booster.

816,443. EXPULSION FUSE; Charles E. Eveleth, Schenectady, N. Y. App. filed May 14, 1904. An enclosed fuse is formed with a large cavity at one end, the other end being open, so that the arc is blown out at the open end by the expansion of gases in the cavity.

816,444. ELECTRIC SWITCH; Augustine R. Everest and Ralph E. Baker, Lynn, Mass. App. filed Sept. 14, 1903. A snap switch for making a number of circuit connections. The switch arm and handle are spring-connected and the arm follows the handle by an abrupt movement in passing from one contact to another.

816,465. FIRE ALARM BOX; Stephen J. Heinrich, Bellevue, Pa. App. filed Apr. 26, 1904. Details of a fire-alarm system in which all the instruments of the line are cut out of action whenever an alarm is given from any station.

816,467. SYSTEM OF TROLLEY WIRE SUSPENSION; Paul E. Herkner, Berlin, Germany. App. filed Sept. 10, 1904. A trolley system for high-speed trains in which the hangers at the curves have short arms or rods connected with the trolley wire which permit a slight upward yielding thereof when the train passes.

416,468. MAKING AND BREAKING HIGH-POTENTIAL CIRCUITS; Edward M. Hewlett, Schenectady, N. Y. App. filed Dec. 14, 1898. In order to avoid the destructive oscillations of current which occur in high potential systems when the circuit is abruptly broken, the patentee provides a heavy inductance which is gradually varied in opening or closing the circuit, so as to avoid any sudden variation.

816,460. FUSE BOX; Edward M. Hewlett, Schenectady, N. Y. App. filed May 14, 1902. A fuse box comprising four corner studs which are vertically and horizontally channelled so as to receive mica plates.

816,482. APPARATUS FOR BLEACHING AND STERILIZING. Sidney Leetham, York, England. App. filed July 16, 1904. In apparatus for bleaching and similar operations the combinations of an ozonizer, a sparking discharge apparatus and a high-tension electric circuit including in series both the ozonizer and the sparking discharge apparatus.

816,483. HOLDER FOR ELECTRIC INCANDESCENT LAMPS; Peter Leonard and Charles Harold Jones, Great Crosby, near Liverpool, England. App. filed Feb. 17, 1904. An arrangement for securing lamps in outdoor positions so as to avoid exposure of any metallic parts to the weather. The socket has a rubber packing ring arranged to be closely pressed against the glass of the bulb and preclude any moisture entering the socket.

816,484. AUTOMATIC CARRIER; Sam H. Libby, East Orange, N. J. App. filed Sept. 1, 1904. A telpherage system in which the telpher cars have switches thereon which are received into forks or yokes at the stations so as to be actuated thereby for the purpose of obtaining a hoisting or lowering of the telpher buckets.

816,511. DYNAMO ELECTRIC MACHINE; Charles P. Steinmetz, Schenectady, N. Y. App. filed Jan. 28, 1905. In a dynamo-electric machine, a slotted armature, a winding in the slots, a commutator, and bifilar resistances supported in holes in the armature body independent of said slots and inserted in the connections between said windings and the commutator segments.

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NEW YORK, SATURDAY, APRIL 14, 1906.

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ELECTRICAL EXPORTS.

The encouraging figures of electrical export trade for January are sustained by those now available for February. The export of electrical appliances for February, including telegraph and telephone instruments, reached a value of $544,906, while for the same month last year the amount was but $418,483. The total for the eight months is $4,064,472 as compared with $3,110,943, a remarkable gain of nearly $1,000,000, or about 30 per cent. This is most gratifying. The showing for electrical machinery is not quite so good, but is nevertheless satisfactory. For the month of February it was $646,532, as compared with $637,479, while for the eight months it is $5,031,898, as compared with $4,669,595. Adding the electrical instrument values to those of the heavier machinery, we have for the eight months an excellent total of $9,096,370, as compared with $7,780,538 in the previous corresponding period. At this rate the grand total of last year will easily be beaten. We should like to see the heavy machinery holding up better, but the returns as to instruments indicate apparently a growing diversity of export in the smaller appliances. In the heavier class the demand has slackened perceptibly from Japan, Australasia, Argentina and the Philippines, but in each of these quarters we look for improvement in due time.

PROPOSED NEW A. I. E. E. CONSTITUTION.

The members of the American Institute of Electrical Engineers have now before them for their action a proposed new constitution for the government of that body. From an accompanying circular we learn that the proposed document is the work of the Committee on Law of the Institute; and upon reference to a printed list of committees we find that the five members of the Law Committee are all residents of New York or vicinity. Without in the least impugning the motives of these gentlemen or of the Board of Directors who have approved their work, we are constrained to say that the proposed document reflects, unconsciously, the spirit which would reserve to the members resident in New York City and vicinity—numbering less than 30 per cent of the total membership—the preponderating influence in the conduct of the Institute. In confirmation of this view we need only to point specifically to two changes which the proposed constitution would introduce into the present organic law of the Institute. In the present constitution any change of the organic law requires the affirmative vote of a majority of the qualified members and associates; according to the proposed constitution, such changes may be made at the annual meeting—which is required to be held in New York City by the law under which the Institute is incorporated—by a two-thirds majority of a quorum consisting of only 200 members and associates, present in person or by proxy. Again, the present constitution provides that no business affecting the organization or policy of the Institute shall be transacted at any other than the annual meeting, which provision was introduced to prevent the recurrence of conditions which at one time threatened to disrupt the Institute. According to the proposed constitution, special meetings of the Institute for the transaction of business may be called by the Board of Directors at any time; and interpreted in the light of a disclaimer in a following clause, at such meetings business affecting the organization or policy of the Institute may be transacted. As there are over 700 members of the Institute in New York City and Brooklyn alone, the facility with which a quorum may be obtained for the amendment of the constitution or change of Institute organization or policy, is apparent.

Still another safeguard to the interests of outlying members which the proposed constitution would remove is the clause in the present constitution requiring that the names on the official ballot for the office of vice-president shall be selected from the nominees' list with a view to maintaining a geographical distribution of the incumbents of this office, which clause has been omitted from the proposed constitution. Yet another point to be noted in this connection is that while the article which was introduced in the present constitution to secure attendance at the annual conventions of representatives of the various geographical sections of membership, has been retained in somewhat changed form, it lacks a clause whereby its execution may be secured. Such a clause is unfortunately absent in the present constitution, for which reason the article has remained a dead letter. It may be added that proposed additions to the by-laws and to the constitution to remedy the defect have in the past been uniformly rejected. The above points affect more particularly the 70 per cent or more of members not resident in New York or vicinity. A proposed clause which affects all members alike is one which makes a concession to "an engineer in an allied branch of engineering" with respect to eligibility to full membership. During the past ten years admission to full membership in the Institute has been so carefully guarded, and this grade has been kept to such small proportions, that great weight has become attached to membership in that grade. This, we believe, is well understood by engineers in other professions, but it is questionable whether such engineers should be allowed entrance to the grade under conditions notably less onerous than those which apply to an associate of the Institute desiring transfer to full membership.

Aside from the above considerations and other objections that could be adduced against the proposed constitution, the wisdom is questionable of changing the organic law of the Institute at this juncture, in view of the many unforeseen questions likely to come up in connection with its finances and policy upon the occupancy of the new Engineering Building. One point alone need be mentioned, and that is the probability of the future financial situation requiring the assessment of an extra fee on those members who will derive the greater share of benefit from the maintenance of an elaborate headquarters; and this contingency carries with it the issue of organizing the members in New York and vicinity into a local branch on the same basis as other local branches. In fact, indications point to a reorganization within a few years of the Institute on a truely national basis. And we believe no one will dispute that this work will call for a constitutional committee whose membership shall represent every section of the country.

The Niagara-Syracuse Transmission.

We are glad to be able to give a report of progress on this, by far the most important transmission on this side of the continent. Hitherto the great plants at Niagara have engaged in power transmission only in a rather modest way, attempting neither very high voltage nor very long distance. This plant at last rivals the great work done on the Pacific Coast. It is to be pretty nearly a sraightaway transmission for about 160 miles. The generating plant being on the Canadian side of the river, some international questions as to the exportation and importation of power were raised. These, however, being satisfactorily settled, the work is being pushed rapidly to completion. The river crossing with its long spans and great changes of level has involved some mechanical difficulties which seem to have been very well managed by the use of cantilever arms on the cliffs taking the weight of the downward sweeping cables to the crossing towers at the water's edge. The line itself is an interesting structure representing somewhat novel and advanced ideas. The western half of the line is carried upon steel towers spaced 550 ft. apart. These differ from the usual windmill type in having three legs instead of four, although the latter are to be used on some of the work. Each tower carries a top insulator and a single cross arm with the other two insulators, and the whole tower system is to be in duplicate, each tower line carrying a single circuit.

On the eastern half of the line rudimentary A-shaped towers of wood are being used spaced 220 ft. apart. The relative cost and reliability of these types of construction will prove an interesting study. One point in particular, the effect of lightning in the two cases, respectively, will well bear watching. The country is one in which Jupiter Tonans gets in good solid work nearly every summer, and the weak points of the line will be pretty thoroughly tested out. A line of 55-ft. steel towers is likely to catch everything that is due in the vicinity, and the interesting topic of inquiry is whether the lightning will dodge the insulators or take them along. Duplicate lines are a very important safeguard in this test, and they can be placed far enough apart on the ample right of way to be fairly independent of each other. The voltage is to be 60,000, the present limit with anything like a proper factor of safety on the insulator. Recent insulators are showing considerable improvement in design, so that one may reasonably expect the voltage limit to be raised again before long. A voltage of 60,000, however, is high enough to be satisfactorily economical even on so long a line as that proposed. We shall be exceedingly interested in watching the performance of this long circuit in point of regulation. It forms essentially a linear distribution, the most difficult type to regulate. Fortunately, much of the power will probably be used for railway and miscellaneous motor service and comparatively little for lighting. On account of the low frequency all the important lighting work is likely to be done by means of frequency changers which are capable of independent regulation and require merely constancy of periodicity, which is relatively easy to secure. Even so, regulation is a considerable problem on this circuit. None of the long Western lines has so difficult conditions to contend with, since in each case these circuits carry the main load at or near the end of the run. Even the long stretch between Oakland and San Francisco is reinforced at Mission San Jose by the circuits from Electra.

We are glad to note in the work of the Ontario Power Company the care that has been taken to avoid marring the scenic effects at the great cataract. Whether any concealment of causes can remedy the effect of withdrawing so great quantities of water from above the falls remains to be seen. The projects now authorized involve a material fraction of the flow, but what the actual effect will be depends, of course, on conditions yet to be disclosed. There is little likelihood that the cataract will be reduced to the ghastly dribble prophesied by some of the yellow journals. If, as we hope, the effect will be merely to reduce somewhat the depth of the tremendous sheet that plunges over the brink, the spectacular result will be hardly diminished at all. The dynamic importance of this to the greatest cataract in an inhabited portion of the world is so immense that it can hardly be overestimated. It can never be restored to its pristine majesty as a spectacle while the works of man crowd around its brink. The mere withdrawal of part of the prodigious volume of flow is from the æsthetic standpoint of far less malign significance than the garish structures that mar the sky line above the cliffs. The transmission work now in progress is a thing to be encouraged by those who honestly wish to preserve Niagara, for it places the structures of utilization miles away. Niagara could, if to-day unemployed, be industrially developed even to the half of its volume and still remain unique in splendor, for well-concealed power plants could distribute the energy over 10,000 square miles. As things now stand, the cataract should fear the hotel man and the advertising fiend far more than the electrical engineer. Niagara crowned with its perpetual aureole of spray and thundering through the dark aisles of the primeval forest, must have had a majesty that should have stayed forever the hand of the vandal; but Niagara fronted by a steel bridge and decked with a frowsy coronet of cheap hotels and factories does not even rise to the full dignity of enlightened utilitarianism.

The Parallel Operation of Synchronous Motor Generator Sets.

As abstracted in our issue of March 31, Mr. J. B. Taylor's paper, before the American Institute of Electrical Engineers March 23, gives a very clear description of some of the peculiarities presented by the service of paralleled synchronous motor-generator sets. The necessity for such motor-generator sets occurs at the interconnection of any two alternating-current systems employing different frequencies; as, for example, where a power-distributing system operating at 25 cycles-per-second, supplies a lighting system already installed for 60 cycles-per-second; or a lighting system with alternating arcs, which cannot operate at 25 cycles-per-second. Moreover, as electric systems continue to expand, they come into boundary contact with each other, and tend to consolidate by economical evolution. They may have originally been installed at different frequencies, and it may be much cheaper to tie them together for exchange of power by alternating-current motor-generators than to discard all the generator apparatus belonging to one frequency. Although the commonest synchronous motor-generator is that which transforms from 25 to 60 cycles-per-second, or vice-versa, yet the table of twenty types of machines in Mr. Taylor's paper include no less than 15 frequencies that are occasionally met with, namely, 16⅔, 24, 25, 30, 33⅓, 35, 40, 50, 58⅓, 60, 62½, 66⅔, 75, 100 and 125 cycles-per-second. The fact that any change of frequency in passing from one distributing circuit to another calls for a sub-station and one or more pairs of synchronous machines, each pair on a single shaft, shows how desirable it is to retain as few frequencies as possible in general service. In other words the unnecessary multiplication of frequencies breeds parasitic and wasteful distribution expenditure, in real estate, building, rotating machinery, switchboards, power-losses, oil, waste, attendance, inspection and administration. Moreover, when two different frequencies have to be introduced, to satisfy either physical or economical needs, the requirements of synchronous motor-generators are more easily met, when the frequencies selected bear a simple one-to-two ratio, such as 25 to 50; or 30 to 60 cycles-per-second. For this reason, our present frequencies of 25 to 60 place greater difficulties in the design of synchronous motor-generators than would otherwise be necessary. Nevertheless, it is much easier to criticise than to rectify; for so much capital has already been invested in machines of these frequencies, that to change to a simpler numerical ratio would be most difficult.

The paper shows very clearly that it is one thing to synchronize the motor-side of a motor-generator set, but quite a different thing to synchronize the generator-side, after the motor has fallen into step. If our standard frequencies were either 25 and 50, or 30 and 60, this difficulty would not arise. It would then only be necessary to synchronize the motor, and to close the switches of the generator. As it is, however, with standard frequencies of 25 and 60, when transforming up between these numbers, there is only one chance in five that, after synchronizing the motor side, the phases are right on the generator side for throwing in. If, on the other hand, the machine is transforming down from 60 to 25 cycles-per-second, it is only one chance in 24 that the phases are right on the generator side, after first synchronizing the motor. With the various types of motor-generator described in the paper, the chance of getting the generator in right phase at first motor synchronization is all the way from certainty to one in 2, 3, 5, 6, 7, 10, 16 and 24. From this point of view, the motor-generator may be regarded as the machine which introduces the doctrine of probabilities into the already complicated pathway of central-station practice. Even now, it is occasionally a matter of wager between switchboard attendants at motor-generator sub-stations, how many times they may have to slip magnetic cogs, or poles, on the motor side of a machine about to be thrown in, before the generator switches can be closed. Another very interesting point brought out in the paper is the degree of mechanical accuracy called for in the machining of key-ways in the rotors of synchronous motor-generator sets. Five degrees of phase displacement between the armatures of two bipolar alternator armatures; i. e., five magnetic degrees, may cause a very appreciable disparity between them when sharing loads in parallel. But in an alternator of, say, twelve pairs of poles, a usual number in the generator-field of one of these motor-generator sets, five degrees of magnetic displacement will be produced by five-twelfths of one degree of mechanical displacement, a very small deviation in adjusting a key-way. A case is described in which two similar sets differed 20 per cent from each other in load, when running together, until one rotor was taken off the shaft and a new key inserted, giving the rotor an offset of a few hundredths of an inch. This wonderful principle of magnetic vernier action in multipolar structures might prove useful in maintaining definite minute angular displacements between revolving systems for any desired purpose.

Incandescent Lamp Litigation.

Mr. George Campbell, president of the Germania Electric Lamp Company, has instituted suit in the United States Circuit Court of the Southern District of New York against the Edison Electric Light Company, making claim for the sum of $500,000 on the grounds that the defendant by its actions has destroyed the plaintiff's business and ruined him financially.

In the bill of complaint it is stated that the plaintiff had been doing business under the name of the Germania Electric Lamp Company at Harrison, N. J., in which business he had invested in actual cash the sum of over $50,000. The sales of lamps grew from a total of 35,000 in 1902 to a monthly output of 12,500 lamps, the latter representing a net profit of $750 per month; and it is contended that if the plaintiff had been permitted to continue his business, this output without any doubt would have increased within the next twelve months to 50,000 lamps per month, representing a net profit of $3,000 per month.

It is alleged that the defendant co-operated in organizing and associating manufacturers of incandescent lamps throughout the country into a combination having for a purpose to drive out of business all makers of lamps refusing to join the combination, and to establish and control prices and other trade conditions and thereby to stifle competition, both as to production and distribution, throughout the United States, and that the defendant, both by promises and threats of lawsuits against him and his customers, endeavored to force the plaintiff to join the combination, threatening that unless he did so and agreed to the terms offered, shipments of goods would be followed up and he and his customers would be sued; and upon the plaintiff's objection that the patent upon which they proposed to enter suit against him was worthless, it was replied that whether it was worthless or not, it nevertheless served them well enough and answered all of their purposes.

The patent referred to is the leading-in wire patent No. 444,530, granted to Thomas A. Edison, January 13, 1891, on an application dated September 15, 1890, and subsequently assigned to the defendants. On July 12, 1905, application for a reissue of the patent was made, which reissue was granted under date of October 10, 1905.

The plaintiff states that the improvement on which this patent was granted was continuously used and employed by all incandescent electric lamp manufacturers more than two years prior to the month of January, 1891, and as early as 1884. In the month of March, 1904, suit was instituted against the plaintiff on this patent. But, in spite of the fact that the evidence in this suit had all been taken and the case was virtually ready to be submitted to the court for final decision, the suit was discontinued by the defendant on December 4, 1905, and the court costs paid by it, for the reason, the defendant avers, that the effort to intimidate and coerce him by suit and otherwise had failed, and the defendant knew that if judgment were rendered in that suit it would disclose and establish the worthlessness of the said patent, knowledge of which worthlessness, moreover, it possessed prior to the institution of the suit. The plaintiff further charges that during the year 1904 the defendant, in order to destroy his lamp business, caused to be sent out many intimidating letters to his customers declaring that in using or selling Germania lamps they became infringers of the above-mentioned patent and liable to damages, and threatening to prosecute all such offenders to the full extent of the law.

Hydro-Electric Development in India.

The East Indian press has discussed lately the possibilities of utilizing the enormous quantities of water running to waste now year by year during the monsoon in the Ghats, near Bombay. It was the late Mr. J. N. Tate who first brought the idea of utilizing the Ghats into practical shape. The result of this investigation, continued by his sons, principally under the supervision of Mr. B. J. Padeshah, has been that an English company was formed last summer, consisting besides Messrs. Tate, of leading London financiers, called the Bombay Hydro-Electric Syndicate, Limited, for the purpose of completing and verifying the investigations made, and for bringing the project into effect.

Mr. R. B. Joyner, late superintending engineer to the Indian Government, who has very great experience in questions of water storage, has been busy on the Ghats during the past winter with the final investigations of the hydraulic part of the scheme, i. e., the problem of storing the water falling during the monsoon, which, when conducted through pipe lines down a fall of 1,700 ft., will give the power for supplying current to Bombay. Dr. John Mannheim, of the firm of Alfred Dickinson & Co., of London, the consulting engineers to the Bombay Hydro-Electric Syndicate, Limited, has been, for several months, busily engaged at Bombay, with the electrical part of the scheme. Dr. Mannheim is the electrical expert who visited India last year with Sir Thomas Higham, K. C. I. E., in connection with an important power scheme in the Punjab.

Central Station Commercial Statistics.

The co-operative Electrical Development Association, Cleveland, Ohio, is preparing a report blank which it is proposed to send to central stations in order to secure data relating to commercial methods employed and results secured therefrom. The data of the reports received will be classified in a number of tabulations corresponding to towns and cities of various sizes. It is thought that these tabulations will enable comparisons to be made as to methods and results, and that they will be of service to advertising agencies and others interested in the encouragement of the central station industry. Following is a schedule of the information it is proposed to compile:

Class of plant: Electric, gas and electric, electric in competition with gas or municipal gas or electric.
Sales of electric energy per capita of population in kw-hours.
System of rates: lighting maximum and minimum; power.
Are your mains located both in business and residence districts?
Do you operate 24 hours a day? If not, what hours?
Number of incandescent lamps in circuit.
Number of electric signs in circuit.
Number of buildings outlined.
Number of store windows illuminated.
Number of Nernst lamps in circuit.
Number of tube lamps in circuit.
Number of arc lamps in circuit; commercial; street.
Number of electric fans operated.
Number of power motors installed in shops and factories; in stores; in residences.
Horse-power output of such motors in shops and factories; in stores; in residences.
Number of heating devices in circuit, such as flat irons, chafing dishes, etc., in residences; in stores; in shops and factories.
Available kilowatt capacity above peak load.
If up to capacity when will you increase and how much?
How many isolated plants in your territory.
Do you advertise your services with your own electric sign.
Do you have a downtown office and display room and make a particular point of exhibiting electrical devices and appliances?
Have you an organized soliciting department? Give details as to organization and any special selling schemes used.
If no organized soliciting department, how do you reach prospective customers and handle inquiries?
Are you using any advertising or follow-up service in co-operation with your soliciting? If so describe briefly and send samples for friendly criticism.
Do you advertise in your local papers? If so, attach copies of recent advertisements.
What is the attitude of your local papers on the subject of municipal ownership?
Are you threatened with municipal ownership or rate legislation?
What specific policies besides good service have you adopted to secure good will of public?
What are you doing to secure the wiring of buildings not originally equipped.
What are you doing to secure the wiring of new construction work?
What relations have you established with local real estate dealers, architects, builders, electrical contractors, etc.?
Do you get helpful commercial information from the electrical journals?
What new business or more business subjects would you like to see treated in these journals?
In what ways if any are manufacturers co-operating with you in increasing the sale of current through their devices?
Have you developed any special or unusual applications of electric current other than the usual and well-known ones?
Is there any ordinance prohibiting your use of your kind of poles for advertising purposes?
What is your general attitude on the question of persistent advertising and aggressive personal solicitation in new business and more business getting?

U. S. Governmental Cables.

In addition to its large submarine cable systems in Alaska and the Philippines, it is now stated, in Washington, that the U. S. Government is in favor of operating telegraph and cable lines to Panama and favors the purchase, installation, operation, and maintenance of a submarine cable between Key West, Fla., Guantanamo, Cuba, and the Panama Canal Zone, costing $927,000. Secretary Taft says on the subject: "Experience has demonstrated the dangers of such cable communications being in the power of foreign governments to withdraw the rights of the companies in question, as was particularly emphasized in connection with the cable concessions at Panama. The opinions of these military experts as to the urgency and importance of the situation are strongly re-enforced by the following facts:

"First. That the direct cable from Jamaica to Colon has been interrupted for 14 months, with no prospect of its restoration.

"Second. Complications in connection with the French Cable Company in Venezuela, and violent earthquakes, caused such an interruption of the lines that within the past month no cablegram could reach the northern part of South America from Buenaventura to Para, Brazil, save through Europe.

"The war department is also informed, under date of February 9, by the Central and South American Telegraph Company, that the West Indies cable system, although duplicated, has been interrupted."

This argument is backed up by calling attention to the success that has attended the construction and operation of telegraph lines and cables to Alaska:

"The signal corps lines north of Seattle, known as the Alaskan system, would as an investment have been considered as exceedingly unpromising by commercial companies. The chief signal officer of the army was confident, before it was laid, of its great promise from a commercial point of view in addition to its acknowledged administrative value to the United States in general and to the army in particular. His views were considered somewhat visionary in 1901, but events have abundantly justified them by bringing in gross receipts from commercial sources alone at the rate of $180,000 for the current year, besides doing an unpaid official business of about $100,000 for the United States."

The Telegraphic Situation in England.

Hon. Robert P. Porter, formerly director of the United States Census Office, and now residing in England, has an interesting letter in the New York *Times* of April 9 on the effects of the recent political changes in that country as to government ownership and municipal socialism. He says:

"State control of telegraphs has not turned out a striking success from the commercial standpoint. When the telegraphs were transferred to the Government in 1870-71, the systems in that year showed a profit of $1,710,000, but under State control heavy annual deficits have been the rule ever since. The latest returns, published this week, for the year ending March 31, 1905, show that the excess of expenditure over receipts amounts to nearly $4,610,000, and that, exclusive of this, interest for the year to the amount of $1,358,500 has been paid on the capital expended for the telegraph undertakings, which is nearly $54,500,000.

"The introduction in 1885 of the sixpenny (12 cents) telegrams accounts for a big rise, since it added to the expenditure without increasing the receipts. The number of messages sent since 1903 has dwindled. On the ground of supplying superior service State control, even at a loss, may be justified as promoting the greatest good to the greatest number. But the superior efficiency of the telegraphs is not admitted, and their State control, when large annual deficits are the result, only works out for the greatest good to the least number at the expense of the greater.

"Another cause for the continued shrinkage in the telegraph returns is the greater use of the telephones, which are partly owned by the Government and partly by the National Telephone Company. Here one touches upon a curious position. The trunk lines are in possession of the Government, the company's areas of exclusive service being the large towns, except in the few instances where municipalities have set up opposition exchanges. In 1911 the lines of the National Telephone Company will pass into the hands of the Government Post Office Department, so that the State will then be competing with itself in controlling both the telegraph and telephone systems.

"This step will round off a condition of things under which the development of the telephone in Great Britain has almost been at a standstill. The company has been hampered and overshadowed by the Government monopoly of the trunk systems. Limited tenure and an exorbitant royalty tax have been exacted and the companies have also been at the mercy of periodic changes of Government policy, as well as of municipal opposition to the laying down of underground wires along the streets. The State, in fact, has not taken the telephone seriously, save as a mere auxiliary of the telegraph, a delusion, one may suppose, which is not now likely to last.

"The United States is constantly pointed to as showing the vast field of public usefulness to which the telephone can be applied on the central battery system (which is slowly being extended here) and on the economic basis of regarding a "call" as the unit, fixing the charge on the service rendered. The practice in England is to regard the telephone itself as the unit, and an annual charge for its use is made, whether the number of calls be great or few. This "flat" system of charging subscribers is obviously defective in discouraging the small user, who is charged the same sum as the large user.

"The future indicates that the neglect from which the telephone in this country has suffered will not continue. One may assume that the pending complete State control will be more advantageous to telephone development than the present awkward division of Government and private ownership, whereby the one stands in the way of the other, which meekly has to submit. On the other hand, the State, once in full possession, may stand in the way of itself, for it is known that States are open to the charge of affecting adversely the economic value of undertakings, which hitherto, when under private control, have secured a moderate success, even though hampered by legislative restrictions."

Government Fuel Investigation.

We have received from Mr. F. A. Holmes, fuel expert of the United States Geological Survey, a copy of the final report covering the investigations during 1904 at the fuel testing plant at St. Louis, Mo., under the United States Geological Survey, published by the Government and now ready for distribution. The report will appear in three volumes as Professional Paper No. 48, and will be distributed free of charge. Persons desiring copies of the report should apply for the same to a member of Congress from their district, or to a Senator from their State. Mr. Holmes says: "I am sending you herewith a brief report on certain investigations, submitted to Congress by the Secretary of the Interior, in which the secretary and the director of the Geological Survey recommend the continuance of the fuel investigations, and also the continuance, on a larger scale, of the investigations of structural materials, which during the past few years have been in progress at St. Louis and elsewhere, and in this report Congress is asked to make adequate appropriations for this work. I trust that these recommendations may have your approval. You are doubtless aware of the fact that during the past few years the Forestry Bureau, or Forest Service, of the Government has been conducting certain investigations concerning the strength of timbers and methods of timber preservation, for which work Congress has already made adequate provision.

"In order that all of this investigation work of fuels and structural materials may be brought into closer touch with both the users and the producers of fuels and structural materials, the officers of the national engineering and allied societies were asked to suggest the names of one or more of their members who might be appointed members of a national advisory board on fuels and structural materials, under the advice of which board these investigations by the Geological Survey, and also the timber and timber-treating investigations by the United States Forest Service, are to be conducted. The suggestion has met with hearty and general approval. The list of persons selected from the membership of these societies has been presented to President Roosevelt; he has formally approved the plan, and has appointed these persons as members of the National Advisory Board for Fuels and Structural Materials."

The list of members of the National Advisory Board includes from the American Institute of Electrical Engineers, Prof. F. B. Crocker, of the Department of Electrical Engineering, Columbia University, New York City, and Mr. H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company, New York.

Wireless Telegraph Litigation.

Judge Wheeler, of the United States Circuit Court for the Southern District of New York, rendered an opinion April 7 in a case involving a type of wireless telegraph receiver which has been subject to prior litigation between the National Electric Signaling Company and the American De Forest Wireless Telegraph Company. Our issue of October 21, 1905, gives an account of this previous litigation, in which it was held that the De Forest Company infringed a receiver of electromagnetic waves described in a Fessenden reissued patent (No. 12,115) owned by the National Electric Signaling Company. What was then held to be an infringement of this patent and specifically enjoined consisted of an extremely fine wire terminal connected with the aerial wire and entering a liquid solution of caustic potash in a liquid circuit between this fine terminal and a larger electrode connecting to ground. The question in the present suit is whether the use of a metal strip 1/32 of an inch wide, but enclosed in glass to the extreme edge, leaving an extremely fine area touching the surface of a similar liquid to that of the patent, is an infringement.

The court held that this so-called flush terminal is an infringement of the Fessenden patent. The defendant contended that a prior patent issued to De Forest and Smythe covered the form of receiver alleged to be infringed, but the court held that this patent does not show or hint at such a terminal in such an arrangement as that of the Fessenden patent; that the flat and extremely thin strip does not appear to operate any differently from the extremely fine wire of the Fessenden patent; that the shape whether flat or round is not material, nor does the touch of the fine strip to the surface of the liquid appear to act any differently from that of the extremity of the wire of the patent projecting such a short distance into the liquid; that not the form but only the fact of the contact is material. The decision was that the device was an infringement of the Fessenden patent and its use, therefore, a violation of the injunction granted in October of last year.

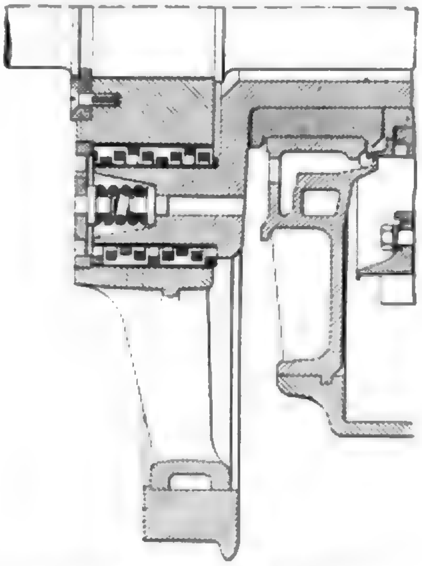
Sociological Effects of the Telephone.

The "oyster king" of New York City has just been "put out of business" and has lost his monopoly of the trade because of the telephone. The connection between cause and effect, and the bankruptcy of the bivalve monarch is thus explained. Instead of going over to the docks on the Hudson River to buy oysters nowadays, the big hotel and restaurant managers simply ring up the oyster planter on the telephone and order oysters direct, or give the order to the oyster agent, who telegraphs it to the planter. Then the oysters arrive by railroad train. That, they say, puts the oyster barge business "in bad," and forces many of the old-time barge captains to the wall. The telephones have wiped out the middle man or jobber. Consequently many of the old wholesalers have been driven out of business, and instead of twenty or thirty oyster barges lined up along the North River piers, there are now two or three at the foot of Bloomfield Street.

Another sociological or economic effect of the telephone is noted by the Boston *Herald* as follows: "Even the rural mail carrier is in a measure anticipated by the telephone in many country districts. Now the farmers on the circuit in the Western States, where enterprise is a 'hustler,' and innovations are welcomed instead of being fought, are to receive at least once a day, and perhaps twice, all the important news of the world. The system, it is said, 'is being installed in Minnesota, Iowa and South Dakota, and within six months will be in vogue wherever telephones are used in the rural districts. Not only this, but every schoolhouse will be connected, and while the service is being transmitted a recess will be had, after which the teacher will impart to her pupils the news of the forenoon. The farmers will have an added advantage, for they will get the news twice a day—at noon and at 7 o'clock in the evening.' At first it was thought this would injure the circulation of newspapers, but the reverse is proving true. The appetite for news grows by what it feeds on, and as the telephone operator can give in a twenty-minute talk only a mere bulletin of the news, the daily or weekly paper with 'the particulars' is eagerly waited for. 'The most notable result of the news service,' says the manager of a rural telephone line, 'is the increase in subscribers, and our merchants note a corresponding increase in telephone orders for goods to be sent by the rural mail carrier, while the farmer's visits to town have become less frequent, and are now seldom made when he is not going to market with his produce.'"

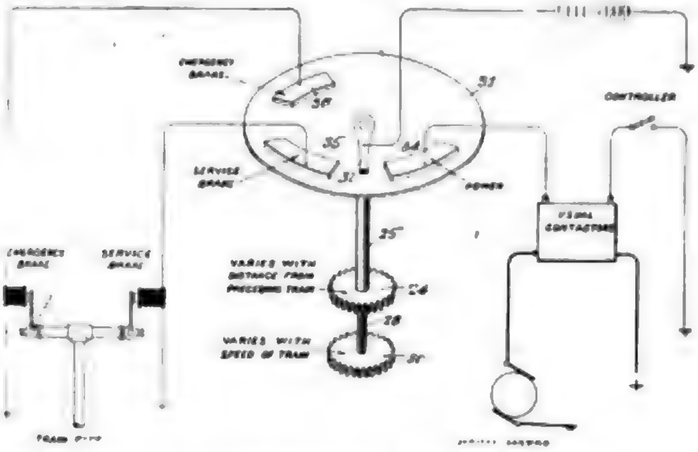
Flexible Connection for Gearless Motors.

A patent issued April 3 to Mr. R. Siegfried and assigned to the Westinghouse Electric & Manufacturing Company, is of special interest at the present time in view of the rapid development which is now taking place in the use of electric locomotives under steam railroad conditions. The invention relates specifically to means for resiliently opposing relative endwise movement of the propelling and the propelled members when an electric motor is mounted upon quills or sleeves that surround the driving axle of a locomotive. The illustration herewith shows that the driving wheel is provided with a set of annularly disposed chambers into which project a corresponding set of bosses from radial arms at the end of a quill. The bosses are surrounded by resilient and specially formed helical springs, no two consecutive turns of which are concentric. In the end of the bosses are recesses, from the bottom of which project the free ends of flanged pins. A corresponding set of flanged pins are secured in the endwalls of the chambers. A helical compression spring surrounds the free ends of the pins and serves to relieve the other parts from all shocks resulting from relative axial motion between the quill and the wheel.


SECTION THROUGH BOSS AND SPRINGS.

Control of Train Headway.

A patent recently issued to H. C. Ford, of Syracuse, N. Y., offers a plan for increasing to a maximum the interval between trains in the New York Subway during rush hours, or on other systems where traffic is dense, while at the same time reducing dangers to passengers. In Mr. Ford's system a track is so arranged with electrical devices that the train leaves behind it a zone of influence which is effective to reduce the speed of a following train in case such following train should penetrate the zone of influence. The important point is that the following train merely has its speed reduced, but is not actually stopped. The amount of reduction is proportional to the distance of the preceding train, so that each train is allowed to proceed with as much speed as conditions will permit, but no more. Mr. Ford claims that it is possible thus to make the movement of the trains entirely automatic, following one another in close succession. At all times the trains are, of course, under the independent control of the motorman. The accompanying sketch is a diagrammatic representation of the system.



SYSTEM OF SPEED CONTROL FOR ELECTRIC TRAINS.

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Electric Cooking Lectures in Indiana.

Three central station companies in Indiana recently engaged the services of Mrs. F. Violet Sanborn, the well-known lecturer and writer on domestic science, to give a course of lectures in each town on cooking by electricity. These companies were the Kokomo, Marion & Western Traction Company, of Kokomo, which operates the central station service in Kokomo, the Marion Light & Heating Company, and the Muncie Electric Light Company. The two latter companies are under the management of Mr. George N. Tidd, who, together with Mr. T. C. McReynolds, of the Kokomo Company, arranged for the lectures in these three neighboring towns. Seven lectures were given in each town, six in the daytime and one in the evening. At each lecture an attractive menu of electrically-cooked dishes was prepared. Mrs. Sanborn has for some time given cooking lectures in the interests of gas range business for gas companies, but has recently fallen so much in love with electric cooking that she proposes in the future to devote all of her time to the cleaner and more modern method. At Kokomo Mr. McReynolds, the general manager, was so well pleased with the results that he has arranged with Mrs. Sanborn to give some lectures at Crawfordsville, Ind., where he recently assumed control of the central station business.

At Muncie, which is a rapidly growing town of about 25,000 population, the attendance during the course of seven lectures was over 2,000 persons, and Mrs. Sanborn states that not over 300 were in attendance at more than one lecture. This was in spite of the fact that at Muncie the lectures were given in the Commercial Club Hall, which is on the third floor of a building not provided with elevator service. At Marion the lectures were held in the Carnegie Library. Neat invitations to the lectures were sent out in advance.

Municipal Lighting at South Brooklyn, Ohio.

The village of South Brooklyn, Ohio, was recently annexed to the city of Cleveland. The commissioners appointed to arrange the terms of the annexation made a report on the financial condition of the electric light plant owned and operated by South Brooklyn. This report is now a part of the published legal record of the annexation transaction. As this document was not compiled as an argument either for or against municipal ownership, and as it takes into account depreciation and a sinking fund it has a value in showing the true cost of street lighting from a small plant. Following is the commission's report in so far as it relates to the electric light plant:

Cost of plant to October 1st, 1905, approximately	$34,000
Number of arc street lamps operated:	
First year	79
Second year	84
Third year	100
Total	263

COST OF OPERATING.

	Sept., '02. to Sept., '03.	Sept., '03. to Sept., '04.	Sept., '04. to Sept., '05.	Combined.
Labor, fuel and supplies	$5,613.41	$6,504.20	$8,341.41	$20,459.02
Deduct income from consumers	1,080.51	2,352.96	4,627.34	8,060.81
	4,532.90	4,151.24	3,714.07	12,398.21
Interest on bonds	1,500.00	1,500.00	1,500.00	4,500.00
Interest on loan	......	......	300.00	300.00
	6,032.90	5,651.24	5,514.07	17,198.21
Cost per lamp	76.36	67.28	55.14	65.40
Depreciation 10 years basis	3,000.00	3,000.00	3,400.00	9,400.00
	9,032.90	8,651.24	8,914.07	26,598.21
Cost per lamp, inc'd depreciat'n	114.34	103.00	89.14	101.13
Sinking fund, 20-year basis	1,750.00	1,750.00	1,750.00	5,250.00
	$10,782.90	$10,401.24	$10,664.07	$31,848.21
Cost per lamp after providing for sinking fund	136.50	123.82	106.64	121.10

It seems impossible to derive much satisfaction from an exhibit of that kind, from the municipal plant point of view.

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Mr. A. O. Benecke.

Adelbert O. Benecke was born July 31, 1855, in Elbing, Germany. After graduating from the college in his native city he entered the University of Koenigsberg, Prussia, where he studied mathematics and natural philosophy from 1876 to 1879. During this period he was an assistant in the physical laboratory under Prof. W. Voigt and an assistant in the astronomical observatory under Prof. Luther, and also served an apprenticeship in a shop engaged in the manufacture of instruments of precision.

MR. A. O. BENECKE.

From 1879 to 1881 he continued his studies at the University of Berlin under Helmholtz, Kirchhoff, Weierstrass, Kummer and others, and afterward became identified with the manufacture of scientific instruments in Berlin. There were at that time very few men in Germany engaged in that class of work, who combined theoretical knowledge with mechanical ability, and consequently his advice was sought for by many scientists interested in research work for which special apparatus was required. The great variety of work and the continuous intercourse with men of world-wide fame served as a valuable addition to his education.

In 1889 Mr. Benecke came to the United States and soon obtained a position with the Weston Electrical Instrument Company, at Newark, N. J., where he remained for fourteen years as chief electrician and assistant to Dr. Edward Weston. Here he had charge of the laboratories and the designing and experimental work of the company, and participated in all the research work carried on by Dr. Weston, and also acted as expert in the numerous patent suits in which the Weston Electrical Instrument Company was involved. He is the patentee of several inventions relating to electrical measuring instruments and kindred objects.

From July, 1904, to April, 1905, Mr. Benecke traveled through Europe for the purpose of studying physical and electrical laboratory methods and equipments. He is at present chief engineer of the American Instrument Company.

CURRENT NEWS AND NOTES.

VESUVIUS IN ERUPTION.—Mount Vesuvius is in almost unprecedented eruption, 150,000 refugees from the vicinity are in Naples, and the city is stifling in an atmosphere of gases and lava dust. The electric light plant at the Mt. Vesuvius observatory has been destroyed, as well as the restaurant of the funicular railway, which is part of Cook & Sons trolley system up the mountain.

N. E. L. A. TRANSPORTATION.—Mr. G. F. Porter, master of transportation of the National Electric Light Association, advises that the arrangement for reduced rates for the Atlantic City convention in the first week of June has been completed, applying to almost every point in the United States. It is also expected that special train service will be afforded from Chicago, Boston, Buffalo, Philadelphia and New York. Mr. Porter has also issued a full circular on the subject of fares.

INDEPENDENT TELEPHONY IN CHICAGO.—A dispatch from Chicago states that the Illinois Manufacturers' Association has decided to incorporate a $9,000,000 telephone company. A plant sufficient to supply Chicago could be equipped, it is alleged, in two years, or one year before the Chicago Telephone Company's franchise expires. All the 900 members of the association will be given a chance to take shares. Rates have been discussed and it is agreed that $6 a year for a desk telephone will be enough, the instrument itself costing only $1.50. Three cents a call on measured service is thought to be sufficient, though not settled on, and for unlimited service in residences $65 a year with unlimited business service at $100 is proposed.

A FRANKLIN PORTRAIT is being restored to this country by Earl Grey, Governor-General of Canada. It was taken from Franklin's house in Philadelphia by General Sir Charles Grey during the British occupation in 1777, and, as stated by Lord Grey at the Pilgrim Society dinner in his honor in New York recently, has been hanging on the walls of Northumberland Castle for the last 100 years. Until this graceful act of restitution was announced, it had been supposed that Major Andre had carried away the picture, and there was a strong tradition to that effect. It is said to be an admirable portrait. Philadelphians are now discussing the disposal of it. Candidates for the honor of its custody are the Philosophical Society and the Historical Society, but it may go to Independence Hall.

CATARACT POWER POPULAR.—An attack was made recently on the Cataract Power & Conduit Company, of Buffalo, as to its power service from the falls, it being alleged that the prices were too high and were even driving industries away. Offsetting this, the Buffalo *Evening News* presents a very interesting batch of data in two full pages, consisting of a description and map of the system, and of a number of letters from customers. Many of the factories state that they not only find the power cheap but convenient, and much more advantageous than steam. The Great Eastern Elevator has taken 900 hp since 1901, and says that if building another elevator, it would again install electricity. The Urban flour mills state that the loss of time by shut-down has not been 1 per cent of what it would have been with a steam plant. And thus also scores of others.

TURNING ON THE SEARCHLIGHT.—Mr. J. C. Donnell, manager of the Maryville (Mo.) Electric Light & Power Company, whose clever use of his own special paper, the *Searchlight*, has been referred to in these pages, writes as follows: "At our recent election, April 3, the City Council submitted a proposition to our citizens to vote $35,000 bonds to build a municipal electric light plant. This required two-thirds majority. At the same election they submitted a proposition to grant Leeckband & House a 20-year franchise to install a gas plant. This required a majority vote. I proceeded to issue my paper, the *Searchlight*, and am able to report that both of these propositions were defeated; on municipal ownership of the light plant, the vote stood 325 for and 518 against. On the gas proposition it was 245 for and 485 against. This makes three propositions I have defeated them on and now with a new mayor and one in whom I have confidence as a good business man, I expect to contract with the city again."

INDIANA INDEPENDENT TELEPHONY.—The first meeting of the Second district of the Indiana Independent Telephone Association, composed of ten counties in northeast Indiana, was held in Indianapolis April 5. W. L. Mueller, vice-president, presided, and E. M. Popps acted as secretary. Nine new companies were taken into membership, making twenty-six companies represented in the meeting. After disposing of routine business Mr. W. S. Vivian, manager of the Independent Clearing House of the State of Michigan, was introduced, and made an interesting and instructive talk. He described the operations of the clearing house and enumerated the many advantages to be derived from such methods. The members of the association were so much pleased with the plan that it decided to introduce the system. The proposition to cut off from all companies having any connection with the Central Union (Bell) companies brought out a warm discussion and final action was deferred until after the State convention to be held in Indianapolis May 17 and 18.

INDEPENDENT TELEPHONE RATES.—The Indianapolis Telephone Company, successor to the "New Telephone Company," has asked for authority to increase its rates for business telephones from $40 to $52 a year and for residence telephones from $24 to $30. It also asks that the franchise which has seventeen years to run be extended forty years from next July, and that the terms be so modified that the franchise tax be $6,000 a year flat, instead of $6,000 and $2 a year for each telephone over 6,000 in use. The petition asks for the right to make an additional annual charge of $2 a telephone for each 1,000 telephones over 15,000 that may be installed and used. The company now has about 10,000 telephones in use. The petition alleges that the extension of lines and improvements necessary at the present time to provide an efficient service is not warranted by the present income or return on the investment. In consideration of the proposed grant the company proposes to increase the efficiency of the service and to build a half a million dollar fire-proof exchange building and equip it with the latest apparatus and switchboard facilities. The first hearing before the board will be held April 10.

HOTEL WIRELESS STATION.—It is stated that the new Hotel Belmont, at Forty-second Street and Park Avenue, New York City, will be the first hotel in the world to have a wireless station. Its roof is more than 300 ft. above the street level, and the staff to be erected on it by the wireless telegraph company is to be 150 ft. in height. It is said that the station will be available for guests in the hotel.

CHATTANOOGA MEETING OF A. S. M. E.—The American Society of Mechanical Engineers will hold its fifty-third meeting at Chattanooga, Tenn., May 1-4, when several interesting professional papers will be presented. Mr. W. H. Bristol will read one on low resistance thermoelectric pyrometers and compensators, Mr. T. E. Murray will discuss the Tennessee River power plant at Hale's Bar; and Mr. W. O. Webber will give data on efficiency tests of the turbine water wheels. The Hale's Bar power development will be visited, as well as the famous old battlefields in the vicinity.

DENSITY OF TRAFFIC.—It is hard to believe that public cars in New York carry far more passengers than in London, but such appears to be the case. The cheap cab and hansom service probably accounts for a large part of the difference. The omnibuses, trolleys and underground railways of London carried, in 1905, 604,834,000 passengers, as compared with 596,344,528 in 1904, an increase of 8,489,472. The New York State Commission's figures show that the elevated, surface and subway lines in New York City carried 1,442,347,122 during 1905 and 1,341,039,409 in 1904, an increase of 101,307,713, or more than twice the number carried by the transportation lines of London. It should be remembered that the State Railroad Commission's statistics include only the passenger traffic of those lines within the boundaries of Greater New York and do not take into account the immense travel over the vast trolley systems in the New Jersey and Westchester suburbs.

TRANSATLANTIC WIRELESS.—Mr. Abraham White, president of the American De Forest Wireless Telegraph Company, announced on April 7 that wireless telegrams were being sent across the Atlantic Ocean from Manhattan Beach to Glengariff Harbor, County Cork, Ireland, at the rate of twenty words a minute. He gave out a long message which he said was a copy of one sent from him to Dr. De Forest in Ireland, and said: "I wish to announce the successful transmission of aerographic communication across the Atlantic Ocean direct, without a single delay, from Manhattan Beach wireless station, employing 40 kw at the rate of 20 words a minute, to a point on the other side of the Atlantic in Glengariff Harbor, County of Cork, Ireland, where Dr. Lee De Forest received accurately and clearly the messages recently aerographed to him. The following confirmation was received by me on April 6 from Dr. Lee De Forest: 'Messages being read clearly; transatlantic wireless now assured.'" It will be remembered that a year or two ago the Marconi system was successfully employed in sending messages across the Atlantic for the London *Times*.

SUBWAY VENTILATION.—The ventilation of the modern underground electric road is found to be quite a problem, for the public expects much and everything of electricity. The New York Interborough is now to be taken in hand seriously and a system of louvres with automatic valves is to be introduced, if the recommendations of the chief engineer of the Rapid Transit Commission are carried out: Three ways of cooling the Subway by artificial means have been suggested. These are (1) evaporation of water, (2) refrigeration, and (3) the absorption of heat by disposing relatively cool water throughout the Subway. Before any method can be definitely chosen, experiments will have to be made in the summer. The engineer says that "to improve materially the conditions, the air must be renewed more frequently than at present throughout the whole Subway, and, at the same time, recourse must be had to some method of cooling it." The movement of the proposed automatic valves will be dependent upon the movement of the trains. Because the rushing trains increase the air pressure in the Subway and thereby cause the valves to open, as soon as a train has passed a valve the latter will close of itself.

SUBWAYS AND MOTOR BUSES.—The introduction of motor omnibuses in London is said to be having a bad effect on some of the new subways. A special cable dispatch from London of April 7 says: "The very loneliest place in London is the new Baker Street & Waterloo Tube Railway. Now that the novelty has worn off it would seem as if very few find that they want it, for the crowds who frequented it at first have disappeared and little more than fifty occupy the carriages, even at the busiest hours in the morning or evening, when people are scrambling for seats or straphanging on other lines. At other times of the day there is quite a peaceful air about the stations, and a traveler with exclusive tastes would find no great difficulty in getting an elevator which would take him up or down with no other companion save the attendant. From the statistics just published, whereas the number of passengers carried the first week on the Central London Tube was 1,512,176, and since then it has increased, there were only 243,001 on the Baker Street & Waterloo Railway, and that figure has decreased. For the week ended March 31 the receipts were only £1,518 ($7,590)." It is probable, however, that from this point the traffic will begin to build up and increase steadily.

NEW YORK CITY LIGHTING.—The incinerator plant for the electric lighting of Williamsburg Bridge by the city has been illustrated and described in these pages, and our readers will, therefore, be interested in some of the latest developments in connection with this municipal enterprise. An inquiry is now afoot with regard to the street cleaning department from which is obtained the material for the fuel of the plant, and the preliminary investigation opens up an alluring prospect of "graft." One of the things unearthed is in connection with the "trimming" contract held by the contractor, who pays the department $1,200 weekly for his privilege. This privilege of trimming the ashes and refuse generally is considered a gold mine, and the contractor is supposed to have made a fortune out of it. It is now alleged that he has a drawback through another contract for furnishing labor for the incinerator and lighting plant under the Williamsburg Bridge. The Italian laborers he furnished to the department under this contract, it is declared, are paid from $5 to $10 a week by the contractor, the average being $7. From the city he gets 25 cents an hour for the work of the men, and they work twelve hours a day generally. This means $18 a week for the employer. His average receipts from this source, it is said, have been $541 weekly since the first of the year. The rest can be imagined.

ENGLISH MUNICIPAL OBSTRUCTION as to developments and improvements is curiously exemplified in the subjoined cable dispatch from London of April 7: "The American Commission on Public Ownership is busily employed conducting its inquiry in various British towns. Mr. Sullivan is in Glasgow, Mr. Crawford working in Liverpool, Mr. Winchester has joined Mr. James and Mr. Klumff at Manchester and Mr. Maltbie returned to-day from Birmingham. These towns, with Sheffield and Leicester, have supplied thorough studies of the practical operation of tramways and gas and electric supplies by municipal or private corporations, and good tests for a comparison of the results of the preliminary survey have been made in Newcastle, but the ground has not yet been broken in Bristol, and other cities may be substituted for each as a subject of inquiry. The commissioners have been well received everywhere and have exceptional facilities for the systematic examination of the results of municipal ownership. The new motor buses are recognized as a menace to municipal investments in tramways. Some town councils refuse to license them, but competition is generally allowed. Experts assert that their day may be short in consequence of the wear and tear of the mechanism by sudden stoppages in crowded streets and the necessity for constant reconstruction. The motor buses are seriously reducing the receipts of the London underground railways. The new Baker Street tube lacks patronage and is retrenching expenses."

LIGHTING IN CHINA.—U. S. Consul Ragsdale reports a demand for electric lights, water works, etc., in the important Chinese city of Tientsin.

ELECTRICAL ENGINEERING AT CORNELL.—The electrical engineering class at Cornell which will graduate the present year contains 112 members. The total electrical engineering registration is between 500 and 600.

MAXIMUM DEMAND SYSTEM.—According to our English contemporaries the "maximum demand" system of charging for current has received a severe check in the home of its childhood—Brighton—that town having just adopted an alternative flat rate system.

FOUNDRYMEN IN PITTSBURG.—A foundrymen's convention was held in Pittsburg last week, when the local Foundrymen's Association were the hosts, and when special trips were made to the Westinghouse works, especially the large modern foundry plant at Trafford City. At the banquet in the evening the toastmaster was Mr. D. B. Fuller, of the Westinghouse Electric & Manufacturing Company, president of the Pittsburg Foundrymen's Association.

INTERDEPARTMENT TELEPHONE SYSTEM.—A dispatch from Washington states that the Federal Government is about to establish an interdepartmental telephone service in Washington in accordance with the recommendation of the Keep commission. The commission recommended the change as one which would not only provide better service, but would cost less than is at present paid for telephones. The President, it is stated, has approved the report. The service is apparently for departmental use only, and limited to that extent.

MONROE, MICH., MUNICIPALISM.—On April 2 for the third time, an attempt was made in vain to get something done with the municipal plant. The proposition to raise by loan the sum of $8,500 was defeated at the election on that day. This money was to have been spent in purchasing and installing a 250-hp water tube boiler, a 120-kw alternator, a 75-light tub transformer, and 118 arcs, etc. Just what will happen next is not known, but if the plant is not brought up to date with more money, that which has already been spent is virtually lost.

FRENCH WIRELESS TELEGRAPHY.—Advices from Paris state that for some time communication by wireless telegraphy has been possible between the Eiffel Tower, on the Champ de Mars, Paris, and Belfort, on the eastern frontier. At present the engineers are trying to discover in what degree their wireless messages can be intercepted or falsified. An apparatus fitted in the grounds of the Military Aerostatic School at Meudon has been communicating with the office of a divisional commander on the eastern frontier, and at the same time messages have been exchanged between the Eiffel Tower and an apparatus fitted in a captive balloon lying over one of the frontier fortresses. The tower makes an ideal wireless station in many respects.

ELECTRIC TRAIN LIGHTING.—In regard to a recent serious accident on the Great Western Railway, Mr. B. D. Butler, of the Minneapolis *News*, who sustained injuries, said: "There were but a few of us in the car. All of us were badly bruised and shaken up, but none seriously injured. The wreck smashed a gas tank at one end of our car and I was pretty nearly unconscious from the gas by the time some men came and helped me out of the car. The gas eventually caught fire, but the colored porter fought the flames with fire extinguishers and put them out before they had made any headway. He was a cool fellow and deserves credit for keeping his head. Throughout the ordeal the electric lights in the car kept burning, so that we could see everything in the car plainly."

ELECTRICITY IN MINING.—United States Consul McNally, of Liege, Belgium, notes that only 1 per cent of the coal product in that country is mechanical output. In England the machine work is more successful. The total coal production in 1902 was 227,084,871 tons, and the machine product 4,161,202 tons. In 1904 the total production was 232,411,784 tons and the machine products 6,743,744. The machine progress is steady, in 1902 being 1.83 per cent; 1903, 2.27 per cent, and in 1904, 2.90 per cent. The proportion of power used in operating the machinery was as follows: 1902, compressed air, 69.15 per cent; electricity, 30.85 per cent; 1903, compressed air, 64.08 per cent; electricity, 35.92 per cent; 1904, compressed air, 64.24 per cent; electricity, 35.76 per cent.

HOTEL FOR TELEPHONE GIRLS.—A special dispatch from Paris states that comparisons of telephone systems were made recently in debate in the Chamber of Deputies. M. Chastenet declared that there were more telephone subscribers in the city of New York alone than in all France. In Germany, he said, there were 500,000 subscribers, which is far in excess of the number in France. The extent of the urban telephone wires in Germany is 1,500,000 kilometres, and in France 500,000 kilometres. The telephone girls of Paris will soon be quartered in a new residential hotel which is being built for them by the postal authorities. They will be charged low rates for board, and it is expected that the institution will eventually become self-supporting, although it will be subsidized for the present. A receiving room, breakfast room and library are on the ground floor, and a large dining room, which will also be used for concerts and balls, is on the second floor.

ELECTRIC LOCOMOTIVES.—At a meeting on Wednesday, April 4, of the Electrical Engineering Society of Columbia University, at which the members of the New York Electrical Society were guests, Mr H. D. Hawks gave an illustrated lecture on electric locomotives. The lecture dealt with the compact mining locomotives, the light storage battery locomotives for industrial establishments and the heavy locomotives for service under steam railroad conditions. The advantageous features of the bipolar type of direct-current motor for the severe requirements of locomotives was discussed in great detail, and much information was given concerning the mounting of the motors on the electric locomotives of the New York Central Railroad. A complete description was given of the self-contained gas-driven electric locomotive. In this type of locomotive the gas engine drives a variable-voltage generator which supplies power to direct-current series motors, which propel the locomotive. Since there is no loss in resistances and the control is uniform and without complications, the locomotive shows a low watt-hour consumption per ton mile.

WEATHER PREDICTIONS.—Mr. Willis L. Moore, chief of the United States Weather Bureau, has made a spirited reply to criticisms on his department as to its methods and has defended the long range forecasts that the liberal use of telegraphy and telephony have enabled it to make. He says that during the winter some thirty of the local officers of the bureau in different cities explain in public lectures the work done and the practical science of meteorology, and he adds: "At the dinner of the Maritime Association I made the simple announcement that I believed we had, for the first time in the history of meteorological science, reached a definite basis on which the general character of the weather might be forecast for a considerable period in advance. This step has not been gained by neglecting short range forecasts in the slightest, because our studies in that line have been carried on independently of our other work. The new principle will not be adopted for official use until after it has been thoroughly tested, and in due time a complete public exposition will be made of it. I made my announcement because I though the public would be interested in knowing that science had at last gained a reasonably firm ground on which it might stand in taking up this important study, especially as astrologers and charlatans have for years been preying upon the credulity of the people and foisting upon them long range predictions that are based upon no rational principle, that are nothing but the merest guess work."

Electrical Equipment of Wanamaker's Philadelphia Store.

The modern department store has assumed such proportions as to require the output of a medium sized central station to supply it with the necessary power for the operation of motors and the lighting of lamps. This is especially true of the department store now building in Philadelphia for John Wanamaker, on the site of the old Wanamaker store, where the connected lighting load alone reaches 1,750 kilowatts. Moreover the isolated plant erected to supply this power follows modern central station design in its smallest detail. It is located a block distant from the store in order to eliminate the objectionable features of vibration, heat and odor, inevitable in power generation, and supplies in addition to power for lights and motors, steam, compressed air, water and refrigerating service. By thus isolating the power plant, the entire Wanamaker building may be utilized for purely department store work.

The new Wanamaker store, one quarter of which is already erected and in use, will occupy the plot bounded by Market, South Thirteenth, Chestnut and South Juniper streets, Philadelphia, making it the largest department store in the world. It will be twelve stories high, and will be built in three different sections—north, middle and south, divided from each other by substantial fireproof walls. It is connected with the power house on Ludlow street by a tunnel eight feet high and twelve feet wide, in which are located the steam heating pipes, supply pipes for the hydraulic elevators, high-pressure steam pipes, water pipes, brine pipes, ice water and hot water supply pipes, and above the tunnel and just below the surface of the street are the conduits for the electric feeders.

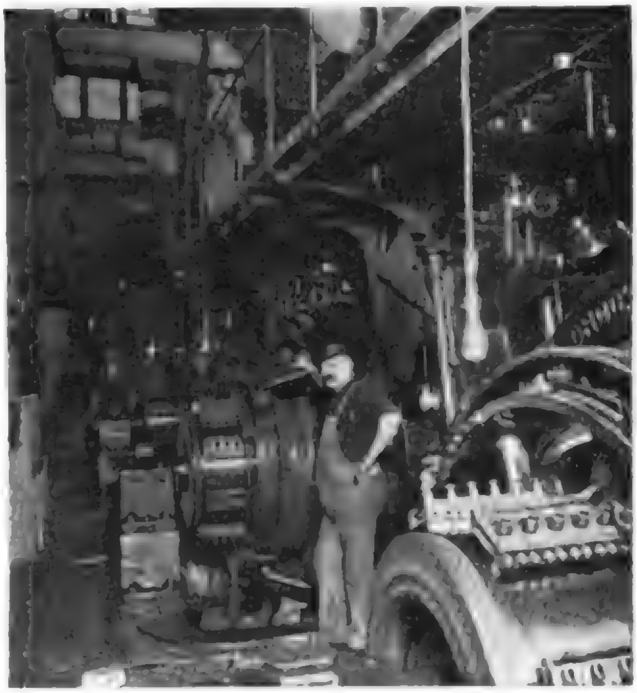
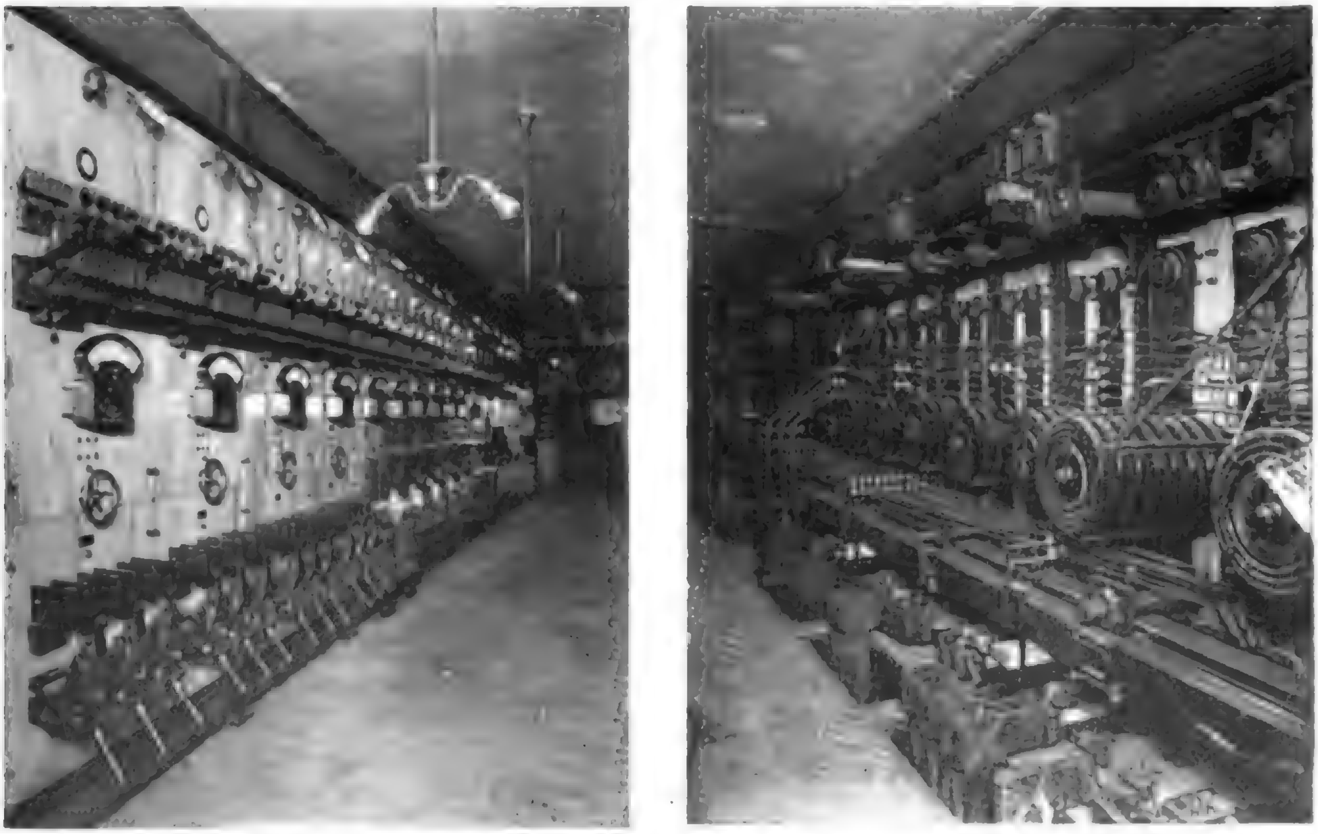


FIG. 1.—ONE SIDE OF ENGINE ROOM, SHOWING ONE-HALF OF THE ELECTRICAL GENERATING EQUIPMENT.



Figs. 2 and 3.—Front and Rear Views of Main Switchboard in Power House Supplying Wanamaker's Philadelphia Store.

The power house is a seven-story steel cage structure 165 ft. high. It is fireproof throughout and of remarkably heavy design to provide for the weights carried on the upper floors. The engine room is 62½ ft. high and is divided by a longitudinal wall from the pump room above which are two intermediate or mezzanine floors. The fourth floor, or the one immediately above the engine room proper is devoted to the boiler auxiliaries, and the fifth floor to the boilers. The floor above the boilers contains the coal and ash bins, while the top floor is devoted to refrigerating apparatus. On the first mezzanine floor, or second story proper, is the switchboard, and on the mezzanine floor above this is the high-pressure steam piping and steam headers feeding the main engines. Taking into consideration the fact that the power plant is erected in the very heart of the business section of Philadelphia and within a stone's throw from the City Hall, the reason for the design of the power house on the above lines is at once apparent.

There are eight Babcock & Wilcox water-tube boilers installed having an aggregate rating of 5,300 hp. The boilers are arranged in two rows, one on either side of the building and facing a firing aisle between them to which coal is delivered from the bunkers above by chutes. The boilers are designed for 200 lb. steam pressure, although the pressure of the supply used is 140 lb., and are fitted with hand-fired Treadkill shaking grates with extension furnaces for the economical combustion of anthracite coal. Each boiler is made up with three 42-in. steam drums and has a total heating surface of over 6,600 sq. ft., and a grate area of 100 sq. ft. Both forced and induced draft are provided. The four blowers supplying the forced draft are situated on the floor immediately below the boiler room and each blower is driven by a 40-hp direct-current motor. The horizontal outlets of the fans connect with the furnace delivery ducts carried on the ceiling of this room directly below the furnaces, so that short, direct connections to the outlets in the bridge walls are possible. The outlets are controlled by levers at the boiler fronts connecting with valves in the branches so that any desired amount of blast may be obtained. The induced draft equipment comprises four steel plate fans designed for a capacity of 51,000 cu. ft. of gas per minute at temperatures in the neighborhood of 555° F., and create a draft of 1½ in. of water when running at 288 r.p.m. Each fan is located directly over the union of the breechings at the rear of each pair of boilers, from which it discharges directly into a short stack. The fans are by-passed so that a direct discharge of the products of combustion may take place if it is desired to operate under natural draft. Each induced draft fan is driven by a 50-hp enclosed steam engine which is supplied with steam from an auxiliary steam header in the boiler room below.

Coal is stored in a 650-ton bin on the floor above the boiler room, and four hoppers set in the floor form the delivery outlets to which the spouts in the boiler room are connected. To the front of this bin is also a 75-ton ash pocket for the temporary storage of ashes. The coal and ash-handling system is very complete. The conveyor system encircles the boiler room and coal and ash bins, passing down the front of the building to a coal receiving pocket into which the coal is dumped directly from delivery wagons on the street. From the receiving pocket the conveyor passes upward 50 ft. to the floor below the boiler room and under the ash chutes. After traveling along this floor a distance

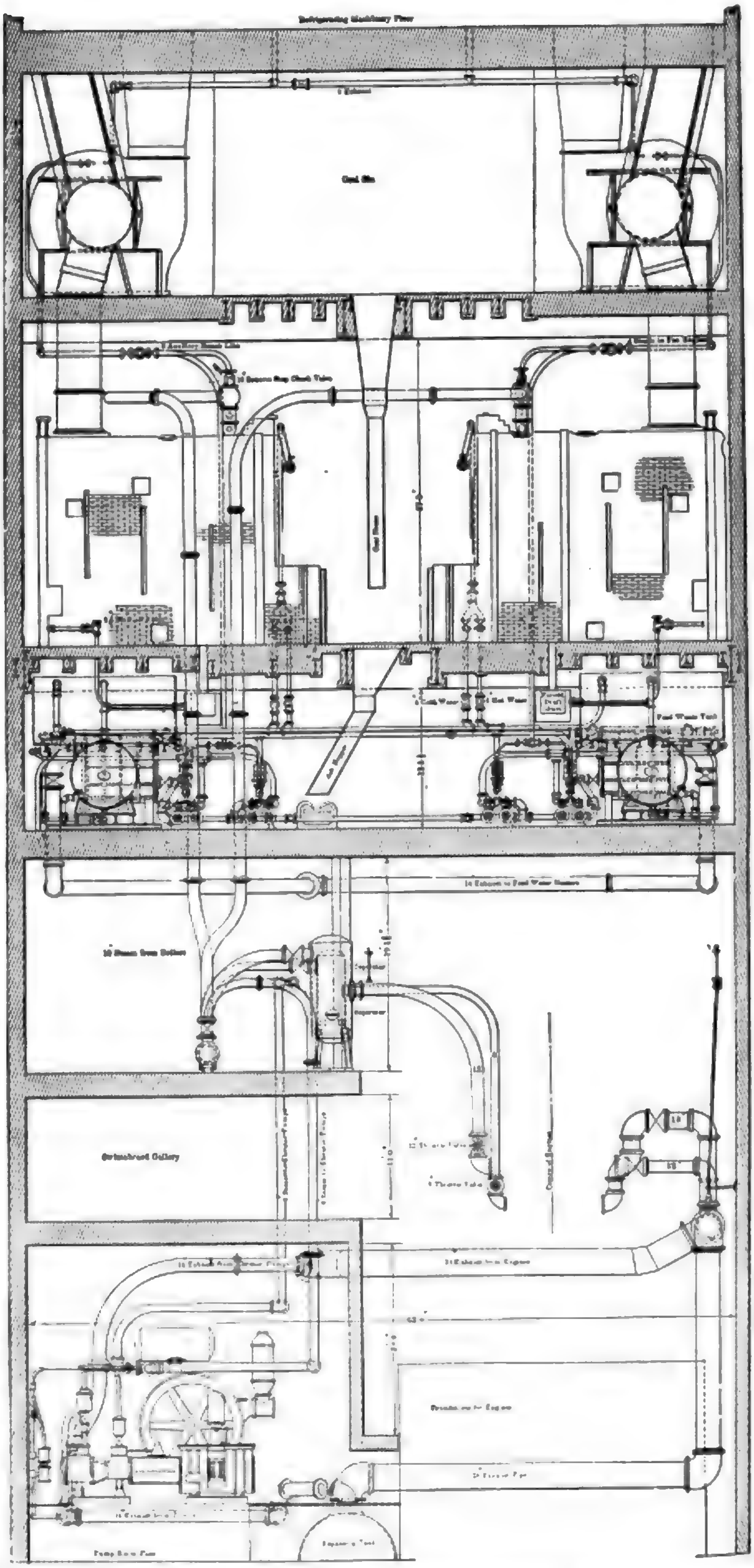


FIG. 4.—SECTIONAL ELEVATION OF WANAMAKER POWER HOUSE.

of 75 ft. to the northern wall it passes upward to the discharge track over the coal bunker a distance of 60 ft. By means of a movable dumper, the loaded buckets are tripped and emptied at any desired point in the bins. Equalizing gears driven by a 25-hp enclosed motor impart a smooth and uniform traveling speed to the conveyor of 45 ft. a minute at which speed the capacity of the conveyor system is 45 tons an hour. Ashes are raked from beneath the fires into floor hoppers and thence into the conveyor buckets to the ash storage bin. A steel spout extends from this bin to a rack and pinion gate at the street from which the ashes are discharged into carts for removal.

The boilers are fed by four duplex feed-water pumps located on the floor below, there being two ring feed mains of 4-in. pipe, one for cold and the other for hot water, with independent 3-in. branches to each boiler. The main feed water supply is maintained in two 6,500 gal. tanks suspended beneath the boiler room floor, and these receive the drips, condensation from the heating system, etc., the make-up water being taken from the city mains. Four open feed-water heaters are in use, each rated at 1,500 hp. The exhaust steam connections to the heaters are made under the floor by a 14-in. connection from the atmospheric riser of the exhaust system in the pipe shaft in the rear of the building. This riser is a 28-in. pipe leading from the engines and pumps to the roof and connects in the basement with the heating mains leading to the store, so that steam is taken inductively from the system as required. The feed-pump exhausts are led directly to the heaters into which they exhaust at all times. The cold water supply is made through a 6-in. connection from the suspended tanks already mentioned, and there is also a connection from the return tanks in the basement through which the hot condensation from the heating system is raised by two submerged centrifugal pumps, each having a capacity of 200 gals. per minute.

On this floor is also the blow-off piping systems consisting

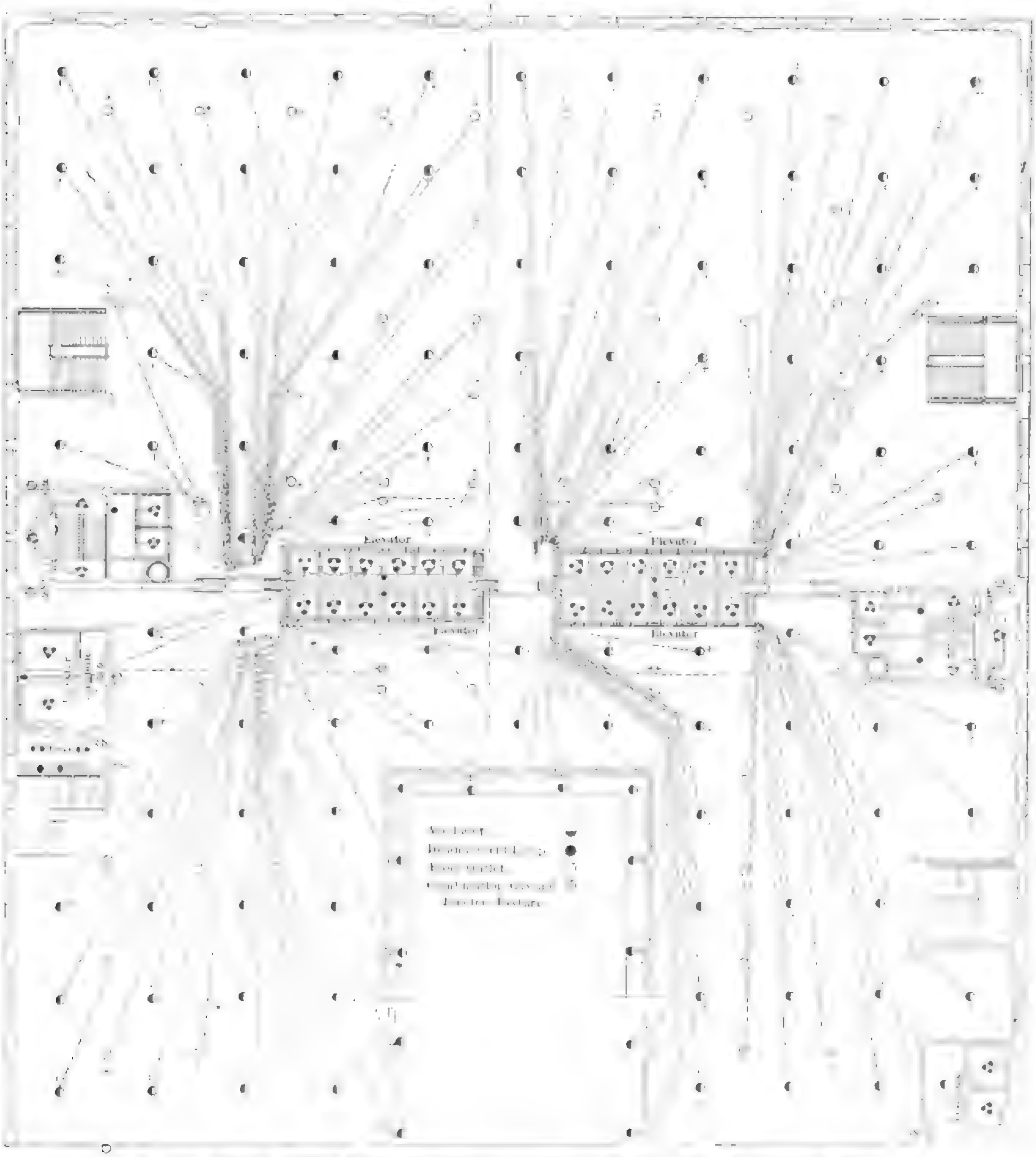


Fig. 5.—Typical Feeder Plan for One-half a Floor, Wanamaker Philadelphia Store.

of two 2½-in. blow-off connections leading from the rear of each boiler and delivering to a 6-in. blow-off main on either side of the building which ends in a cylindrical blow-off tank, connected with the sewer. The nucleus of the high-pressure steam system is an 18-in. header located on the second mezzanine floor, into which the boilers deliver from above, and from which the engines are fed through branches taken off at the side. The second mezzanine floor is not very much higher than the level of the engine cylinders and opens outward toward the engine room so that the engine connections are easily made and do not necessitate the passing of pipes through partition walls. The engine branches are of 12-in. pipe for the large units and 8-in. pipe for the three smaller units and lead to the engines through vertical separators. In addition two 8-in. branches are carried to an auxiliary pump-room header in the basement which feeds the various pumps for the elevators and other services. There is also an auxiliary 8-in. header above the boilers in the boiler room from which the boiler feed pumps, the engines driving the induced draft fans and the refrigerating apparatus on the top flor are fed. From this auxiliary header is also taken off an 8-in. live steam line which is carried over to the store building through the tunnel. The large main steam header is sub-divided by motor-driven valves which may be controlled from the valve itself or from the switchboard on the floor below.

Fig. 6 shows the small compressor plant on the second mezzanine floor. This consists of two Clayton air compressors driven through silent chain gear by 7½-hp Crocker-Wheeler motors. The motors are automatically controlled by a Cutler-Hammer starter and speed controller, which when the tank is full cuts out the motor. When the pressure in the tank falls a predetermined amount the motors are automatically started again. The compressed air is used for cleaning purposes and also in connection with the lubricating system of the engines. Adjacent to the compressor system is an oil tank from which the lubricating oil is fed by gravity to the engines. After passing through the bearings into the flywheel pits, the oil flows by gravity to filters and thence to a receiving tank in the basement. From this receiving tank it is forced by compressed air to the storage tank on the second mezzanine floor.

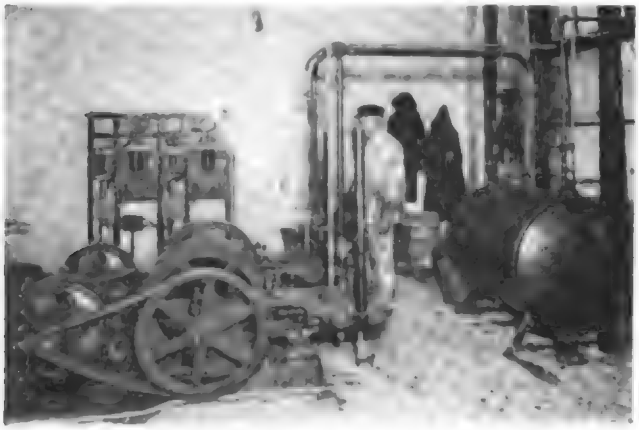


FIG. 6.—MOTOR-DRIVEN AIR COMPRESSORS.

The engine equipment consists of five vertical cross-compound Porter-Allen engines built by the Southwark Foundry & Machinery Co., of Philadelphia. Two of these are of 1,600 indicated horse-power and three of 575 indicated horse-power capacity. Each of the large engines has a maximum capacity of 2,200 hp and is direct connected to two 500-kw Crocker-Wheeler direct-current generators which it drives at 115 r.p.m. Each of the three smaller engines is designed to operate two 175-kw Crocker-Wheeler generators, one on each end of the main crank shaft, at a speed of 150 r.p.m. The maximum output of these engines is about 800 indicated horse-power. All of the engines operate non-condensing

The generators operate on the Edison three-wire system, lamps being fed with current at a potential of 115 volts and motors at a potential of 230 volts. The electrical circuits are controlled from a switchboard in the first mezzanine gallery from which all movements in the engine room are readily observed. Copper bars supported on slab-slate insulators in a trench in the engine room and carried behind a sheet-steel shield along the wall deliver energy from the generators to the switchboard. The connections between the terminals on the generator and the proper lead are made with flexible, rubber-covered cable sweated into the terminals of the generator and fastened by lugs to the copper bars.

Views of the switchboard are given in Figs. 2 and 3, the latter showing the heavy copper bus bars and leads. The switchboard was furnished by J. F. Buchanan & Co., of Philadelphia, for whom it was built by the H. O. S. Engineering Co., of Newark, N. J. It is 47 ft. long and contains 18 panels as follows: Four 500-kw generator panels; six 175-kw generator panels; one totalizing lighting panel; one totalizing power panel; three lighting feeder panels for store distribution; two panels for power-house lights and power, and one panel for power-house mains for store distribution. The feeders from the switchboard to the north section of the store building consist of nine 2,000,000 cir. mil. cables for lights and two cables of the same size for motor circuits. The middle section of the building will be, fed by twelve 2,000,000 cir. mil. cables for lights and four cables of the same size for motor circuits. The south section will have twelve 2,000,000 cir. mil. cables for lighting and two 2,000,000 cir. mil. cables for motors. These cables are all stranded, rubber and lead covered held by iron brackets and porcelain insulators and pass through vitrified underground conduit to the store building. In addition the following feeders are run in the power-house itself: One set to the north wall for lights on the first mezzanine floor, engine room, basement and tunnel; one set to the north wall for lights on the second mezzanine floor, engine room, basement and tunnel; one set to the north wall for lights on the second mezzanine floor and all floors above; one set of 10-hp capacity to motors driving the ammonia pumps in the refrigerating room; one set of 50-hp capacity for the motors driving the circulating pumps in the refrigerating room; one set of 75-hp capacity to the motor driving the coal conveyor; two sets of 100-hp capacity for motors driving the forced draft apparatus on the second mezzanine floor; one set of 10-hp capacity for motors driving the bilge pumps in the pump room; one set of 30-hp capacity for motors driving the centrifugal pumps in the pump room; one set of 20-hp capacity for motors driving the deep well pumps; two sets of 20-hp capacity to motors driving centrifugal pumps, and one set of 75-hp capacity for motors driving the house pumps. The situation of the various panel boards in use in the power-house and the number of circuits they control are as follows: Basement, 20 circuits; engine room, 22 circuits; boiler auxiliary, 6 circuits; boiler room, 10 circuits; coal storage, 6 circuits; refrigerating room, 8 circuits. The mains feeding the basement and engine room panels are of No. 0 wire encased in [illegible]-in. conduit; the other mains are of No. 2 wire encased in ¼-in. conduit.

In each of the three sections of the store building switchboards are provided for the lighting and motor circuits. All the feeders, mains and sub-mains to the cut-out cabinets are run on the three-wire system, the cross-section of the neutral being the same as that of the outers. The motors are fed on a two-wire system. Especial attention is paid to the proper balancing of the load on all mains and feeders of the lighting system. Fourteen wire shafts are provided in which all the mains, feeders and sub-feeders supplying the various floors and subcenters are run. The cables are secured by iron brackets and porcelain insulators securely fastened to the sides of the wire shafts. Galvanized iron turnbuckles are provided to securely anchor each feeder at centers and upper terminals. Porcelain bushings are installed where the cables pass through each floor and when the cables are drawn in place these bushings are cemented in place by Portland cement concrete not less than 6 ins. thick the full area of the wire shafts, thereby forming closets of these shafts on each floor.

A set of mains runs from each switch on the lighting switchboard to a load center in its respective wire shaft. From load centers a set of feeder risers supply energy to cut-out cabinets on each floor. From a cabinet for combination gas and electric light fixtures located near the tunnel entrance, a set of mains is run to a load center in the wire shaft nearest the center of the North section, and from this load center a set of feeder risers supplies energy to cut-outs controlling all gas and electric light fixtures in the North section of the building. In a similar manner two sets of feeders will be run in two shafts supplying all the combination gas and electric light fixtures in the Central section of the building and one set will feed the Southern section.

The building is wired for 16-cp incandescent lamps and 6-amp. 110-volt enclosed arc lamps. Each arc lamp is provided with a separate circuit and all vestibule and corridor lamps around the elevators are fed from a separate circuit from the surrounding lamps on the same floor. All circuits from cut-outs and cabinets are alternately positive and negative on the same side, instead of all positive circuits being on one side and all negative circuits on the other, so that the system will be well balanced. All lamps in the pipe, elevator and vent shafts are wired on separate circuits controlled from the cut-out cabinets in the sub-basement. Fig. 5 shows the arrangement of lamps and circuits on one half of a floor, the other half section being identical. The engraving also shows the situation of the wire shafts on either side of the fireproof partition wall separating the sections of the building. Owing to the fact that the portion of the building now in use ends at the shaft near the center, the portion beyond now being in process of construction, this wiring shaft could not be used, so that all feeders in the portion in use are fed through the two shafts in that section as shown.

No wire smaller than No. 14 is in use and all wire larger than No. 10 is stranded. The floor outlets terminate in watertight receptacles fitted with adjustable tops which set flush with the finished floor. From Fig. 5 it will be evident that each floor is plentifully supplied with floor outlets. All wires except the cables in the wire shafts, are run in conduit from the cut-out cabinet in each wire shaft on every floor. All of the outlets shown are for 12 incandescent lamps, although there are outlets for 25 lamps and others for 60 lamps. An elaborate system of conduit for low potential circuits is also installed on each floor for telephone, fire alarm, bell circuits, etc. The outlet boxes are all connected to the wire shafts so that after the instruments are located they may be readily connected to the nearest outlet box. This system is similar to the one in use in the New York store of John Wanamaker described in these pages last week. The total number of connected arc lamps will be 2,874, and the total number of incandescent lamps 12,251. 2,740 of which are used in the windows. About 40 motors are connected with an approximate horse-power of 900 There are in all 68 hydraulic elevators, 52 of which are for passengers, and in addition 10 electric dumbwaiters.

The architects and engineers for the power-house and store building are D. H. Burnham & Co., of Chicago, and it is to their superintendent, Mr. P. G. Chase, that we are indebted for information contained in this article.

The Survival of the British Electrical Manufacturer.

By R. A. Brown.

The directors and shareholders of electrical manufacturing companies domiciled in Great Britain have been taking very serious interest in the first parliamentary election for over half a century in which "Free Trade" has been called in question. The electrical industry has suffered somewhat cruelly from unrestricted foreign competition, not so much in respect of the actual volume of business secured by American, German and other manufacturers, which appears to have amounted to about £2,000,000 per annum, as of the depressing influence on prices. It is clear that competition has been much intensified by the free entry of foreign goods, so that the two largest works in England, which have a good deal of American capital in them, are both unable to pay dividends, with all their special advantages in having the technical and commercial assistance of their parent concerns in the United States.

When we reflect upon the succession of misfortunes which have in the past made electrical manufacturing not merely hazardous but apparently hopeless as a permanent industry in Great Britain, it is most interesting to observe in what courageous manner old-established firms have kept up a dogged struggle against the difficulties of the situation. If we take, for example, the oldest of them, the Brush Electrical Engineering Company, there are features in its history which are a remarkable testimonial to the endurance and adroitness of the British business man In the first place, when the Brush Company was founded, and began to look around for business, the British legislature closed the market effectually by passing a ridiculous Electric Lighting Act in 1882, which made it impossible for companies to supply electricity with any hope of financial success; and it was not until six years later that a more tolerant act was passed which made electric lighting commercially feasible. In those six years, British makers of electrical apparatus had to pick up a bare living as best they could, while American and German concerns were going ahead and getting a long lead; so that when business did begin to boom in England the foreigners were much better able to compete for it than the stunted and starved British manufacturers. All British electrical legislation was conceived in the interests of the municipalities that were slow to move, and consequently the country was much behindhand in electric traction as well as supply; and when tramways at last came to be constructed the Americans reaped a rich harvest.

Still the British firms managed to live. The Brush Company, for instance, made a really heroic effort, and in a year or two actually gained a notable position as the largest builder of electric rolling stock. Whereas, at first, nothing but American trucks were used on British street railways, the position is now reversed, and the Brush Company supplies about three-quarters of all the trucks in service. Supported by a prosperous rolling stock department, the Brush Company was then able to nurse and stimulate the growth of its electrical manufactures, and during the past three years has been greatly extending its business in generating plant, motors, transformers, etc. It has evolved a type of the Parsons turbine possessing some remarkable features, giving exceptional efficiency, and at the same time has gained a leading reputation for its reciprocating engines. The British Electric Traction Company, which controls about sixty traction and supply undertakings, has become invested largely in Brush shares, and purchases its requirements from that concern, so that the company is at present in a more flourishing condition than for many years past, and is at this moment making considerable additions to its premises and plant to cope with greatly increased business.

If a slight measure of protection were introduced by the British Parliament—and many shrewd political prophets believe that this will happen during the next five years—the Brush Company would receive a further stimulus, and there is no doubt that its prolonged but victorious struggle against overwhelming odds has developed a splendid fighting spirit in its directors and chief officials, whom necessity has compelled to exercise constantly ingenuity and vigilance.

Of course there are other examples of the "survival of the fittest," and among the British companies that by dint of sheer grit and power of endurance have managed to hang on and to grow may be mentioned such standard "old-timers" as Crompton & Co., Ltd., of Chelmsford, and the Electric Construction Company, of Wolverhampton, England. In addition to these specimens of well-seasoned "hearts of oak" are one or two other concerns of lesser magnitude, but equal toughness that have come safely through years of "battle and breeze." Amid the crop of new covers they are likely to be overlooked and forgotten, even here in England where we relish and favor so much anything that has a touch of antiquity about it; but the mere fact that they have endured is to their credit, and the point is now made on their behalf.

Hopkinson Test of Two-Phase Alternators.

In testing a large generator it is frequently inconvenient to supply to it the necessary mechanical power to correspond to its full-load rating or to dissipate the electrical power which the machine delivers under these conditions. Even where it is possible to obtain the required mechanical power, it is often extremely difficult to adjust the electrical load both with regard to its value and its power factor. Due to these facts recourse is frequently had to certain no-load tests made on the machine, from which the performance is determined.

For determining the performance of a generator the most familiar method is the one involving the use of the open-circuit and the short-circuit characteristics. The former characteristic is observed by noting the voltage generated in the armature at full speed for various values of the exciting current, the armature being on open circuit. The short-circuit characteristic is found by driving the rotor at full speed and observing the current in the armature on short-circuit as the field strength is varied. From these two sets of observations may be determined the synchronism impedance of the armature, and when the resistance of the armature circuit is known the electrical behavior under assumed loads can be determined with a fair accuracy.

The curves of Fig. 2 represent the open-circuit and short-circuit characteristics of a Siemens two-phase alternator built for the Johannesburg (South Africa) Municipality. This generator is rated at 3,300 volts and 275 amperes per phase, and, hence is a 1,800-kv.a. machine. It is intended to operate at a normal power factor of .75 and is designed for 1,350 kw. Its normal speed is 100 r.p.m., and being provided with 60 poles it delivers current at 50 cycles per second. There are 480 slots—four per pole per phase. The diameter of the stator core is 260 in. (660.4 cm.), and length 10 in. (25.4 cm.), there being no ventilation ducts. The air gap is 6.6 mm.

The specifications required that the rise in voltage on throwing off the full load at unity power factor and 3,300 volts should not exceed 5 per cent, and that the fall in voltage on throwing on full load at unity power factor and 3,100 volts should not exceed 6 per cent. It was specified that at full load with 75 per cent power-factor the excitation power at 230 volts should not exceed 20 kw. The no-load characteristics permit one to ascertain to what extent these requirements have been met, and by their use it is possible to determine the efficiency with sufficient exactness for all practical requirements. They are incomplete in one respect, however, in that they give no clue as to the probable temperature rise in the machine under load conditions.

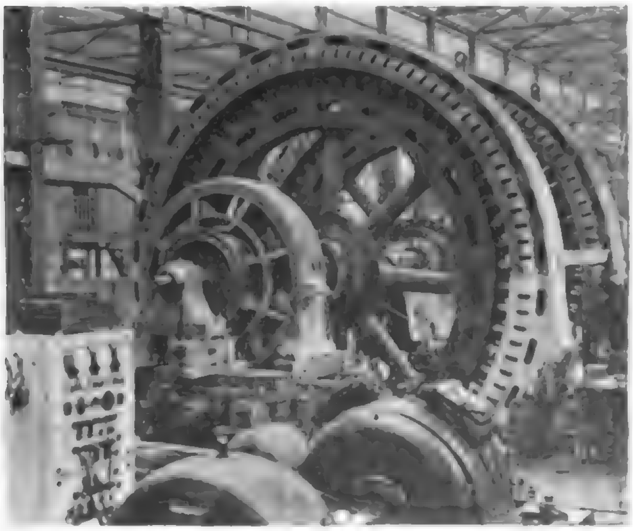


FIG. 1.—1,350-KW, TWO-PHASE ALTERNATOR.

For the purpose of ascertaining the temperature rise under various loads at different power-factors, two of these machines were connected together both mechanically and electrically and subjected to a Hopkinson "loading-back" test, a direct-current motor being used to supply the losses mechanically to the two machines. With the rotors joined directly together, the two frames were angularly shifted from their normal positions so as to cause the circulation of power between the two machines, the proper value of current at normal full load being obtained when there was a mechanical displacement corresponding to 25 electrical degrees—somewhat less than one mechanical degree.

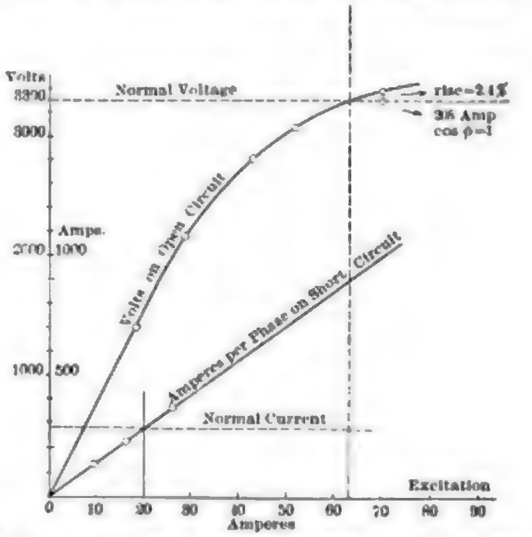


FIG. 2.—OPEN-CIRCUIT AND SHORT-CIRCUIT CHARACTERISTICS (TEST RESULTS).

The leading machine operated as a generator under actual working conditions with 1,350-kw, 205 amperes, and *cos* $\phi = 1$. while the lagging machine ran as a motor with slightly reduced flux. Without changing the mechanical displacement of the stators it was possible to operate the generator at normal full-load current (273 amp.) at *cos* $\phi = .75$ simply by giving the two machines different excitations. As was to be expected, the current circulating between the two armatures was absolutely steady, showing no signs of hunting or surging.

From the readings of the input to the direct-current generator and a knowledge of its internal losses, it was determined that the losses of one alternator amount to 93 kw at an output of 1,377 kw, giving an efficiency of 93.6 per cent at unity power-factor.

We have been informed that if a temperature rise of 70° F. had been allowed these machines could have been rated at 2,400 k.v.a., but they have been given the lower rating on account of the fact that the specifications limited the temperature rise to 50° F. under full load at unity power-factor.

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Leads for Alternating-Current Machines.

The accompanying illustrations show a method for placing the high-resistance leads in the armature core of an alternating-current commutator motor, as disclosed in a patent issued March 27 to C. P. Steinmetz. The resistance leads are placed in a second set of slots more remote from the periphery than the slots carrying the main armature conductors, so that the heat produced in the leads is conducted away by the armature core without affecting the main armature conductors. The leads are bifilar, so that they are non-inductive and the effect of all induced e.m.fs is avoided. The leads are connected to the armature coils at the end opposite from the commutator in order that they may be readily accessible for repairs.

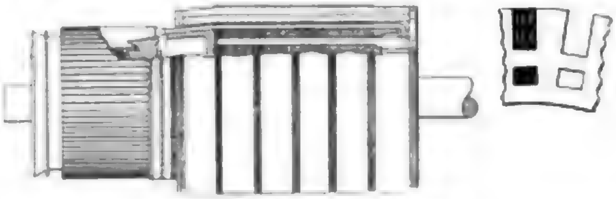


DIAGRAM OF RESISTANCE LEADS.

The Niagara-Syracuse Transmission Line.

By Orrin E. Dunlap.

The greatest power transmission line this side of the Rocky Mountains is being built between the Niagara border and the city of Syracuse by the Niagara, Lockport & Ontario Power Company, its length being about 160 miles. While the line has the above-mentioned length in New York State, there are also about four miles of towers and cables on the Canadian side of the river, for it is contemplated that power generated on the Canadian side shall supply the line. According to report, considerable of this transmitted Canadian Niagara energy is to be applied to the operation of present steam railroads in the western New York section, which are to be electrified. This includes portions of the New York Central and the old West Shore between the Niagara border and Syracuse, while electric roads in the cities referred to will be able to obtain power from the line if they so desire. In the map shown below transformer stations are indicated by the circles, transmission lines by the solid lines, and extensions by the broken lines.

The power house in which the electric current for transmission is to be generated is that of the Ontario Power Company. As this plant has been fully described in these pages, a mere résumé here is sufficient. It is located at the water's edge in the Niagara gorge right below where famous old Table Rock used to stand. The debris slope of the river bank has been cleared away to make room for the power station, which is a concrete building that stands very close to the foot of the Horseshoe Fall. There is no other building so close to the falling waters as they plunge from the higher to the lower level, and as the demand for power increases it is the company's intention to enlarge the power house and its equipment.

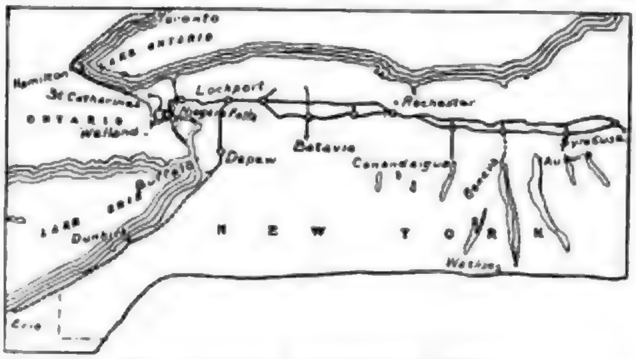


FIG. 1.—MAP OF TRANSMISSION SYSTEM.

The Ontario Power Company adopted a plan very similar to that of the Niagara Falls Hydraulic Power & Mfg. Company, the oldest power company on the New York side of the river, but instead of building a surface canal it built a great steel flume to carry the water from the forebays to the spillway over the power house. The company erected a great wing dam that diverted the water from a large area of the riverbed above the Horseshoe, and in this unwatered section it built its forebays, the intake works being located at the head of Dufferin Islands, at a deep indenture in the shore. The outer forebay has an area of eight acres, and the inner forebay an area of two acres. These ten acres of forebay area lie in the normal bed of the river, a concrete wall surrounding the outside. Considerable of the limestone riverbed had to be blasted away to give the required depth of water. The outer forebay is long and tapering and terminates at the lower end in a spillway enclosed on the river side by a submerged wall, while opposite the spillway is a screen house leading to the inner forebay. The gatehouse is located at the lower end of the inner forebay, and here electrically-operated Stoney headgates are located. The depth of water is 30 ft., and it is at this point that the big steel flume obtains its water supply.

No other feature of the power development at Niagara commanded quite so much attention as the big flume of this company. It is made of ½-in. riveted and reinforced steel, has a diameter of 18 ft. inside measurement, is 6,500 ft. long, and is sheeted with concrete. In order that it may not disfigure the park lands, a trench was excavated through the rock and soil of Victoria Park and the conduit buried from sight. The velocity of the water in the conduit is about 15 ft. per second. Each pipe of this kind is expected to deliver 3,900 cu. ft. of water per second, or enough to develop 60,000 electrical hp. At its end on the cliff above the power house the present flume turns into an outer relief or spillway, and it is here that the penstocks are connected.

Eight penstocks will connect with each big flume, and six of these penstocks, or three pairs, will have a diameter of 9 ft. and carry water to the wheels of six main generators. Before delivering its water to the wheels in the power station each of the 9-ft. penstocks divides into two branches, one for each wheel. There are also two smaller penstocks that deliver water to the wheels of the exciters. Twin turbine wheels mounted on horizontal shafts are direct-connected to the 10,000-hp generators installed in the station. Three generators have already been installed by the Westinghouse Company, and the fourth is now being erected. In passing from the spillway to the power house the penstocks run through tunnels driven through the cliff, in order that their presence may not mar the scenic spectacle at the face of the cliff. The power generated in the station will pass over concealed cables to a distributing station located on the bluff outside of Victoria Park, the distance back of the power house being 550 ft., while the height is 250 ft.

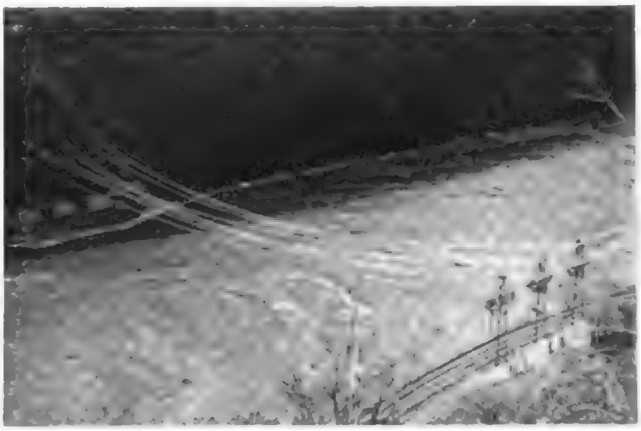


FIG. 2.—ALUMINUM TRANSMISSION LINE ACROSS NIAGARA GORGE.

In all agreements made between power companies and the commissioners of Victoria Park, it is specified that all of the power developed must be transmitted outside of the park boundaries for use and application, the agreements permitting the transmission of at least one-half of the power developed to be transmitted to the United States, but on demand one-half must be available for use in Canada at prices similar to those charged for the same power in the United States for similar uses. The Governments of the United States and the Dominion of Canada do not

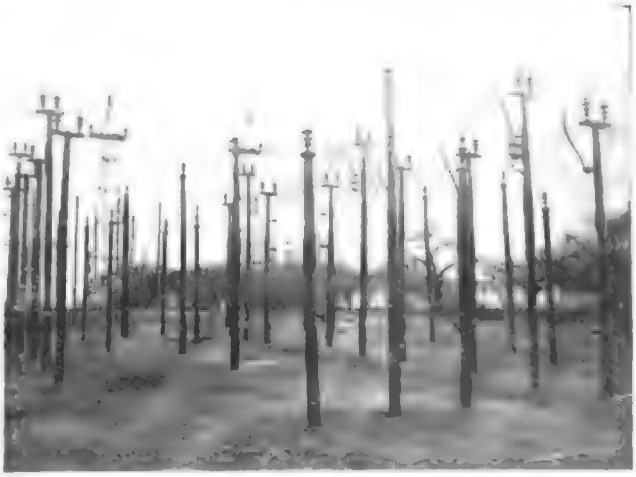


FIG. 3.—NEAR TRANSFORMER HOUSE, NIAGARA FALLS.

place an import or an export duty on electrically generated power.

From the distributing station on the bluff to the rear of Victoria Park a line of steel towers extends northward, a short distance back from the river, to a point four miles down the gorge, where the transmission line crosses the river. At the edge of the Canadian bank the cables, which are of aluminum, drop to cantilever arms projecting over the edge of the bank. There are nine cables, each having 19 strands of No. 5 wire, and from the cantilever arms the cables drop to steel towers erected close to the water's edge. From these towers they swing over the river, the span being about 600 ft., to similar towers erected on the New York shore. Then they pass up the bank to cantilever arms at the top of the cliff on the New York side, and then to poles and steel towers.

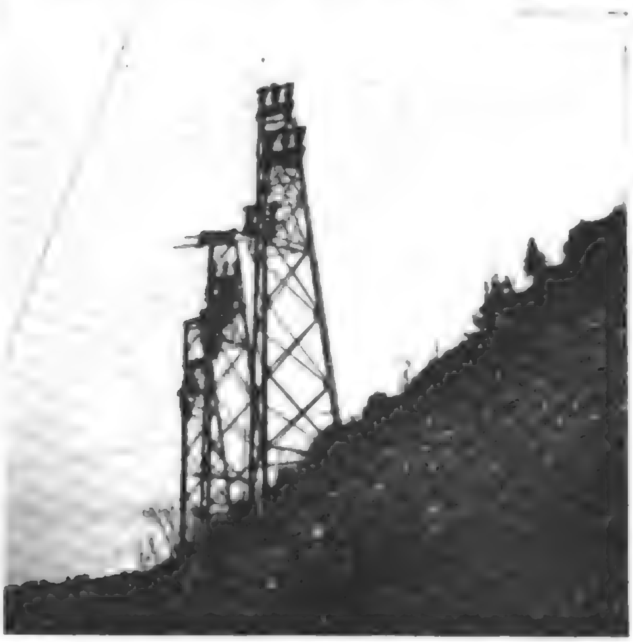


FIG. 4.—STEEL TOWERS ON NEW YORK SIDE.

From this point eastward to Lockport the right of way of the power transmission line is 300 ft. wide, and there is a double set of steel towers. From Lockport to Rochester the right of way has a width of 200 ft., and between Rochester and Syracuse the permanent right of way will be 100 ft. wide. Steel towers will carry the cables as far as Rochester, and from there to Syracuse wooden frames made in the shape of the letter A will support them, temporarily along the West Shore Railroad right of way. There will be about 1,500 steel towers and 2,500 A frames. The steel towers have a height of 55 ft., and at a height of 45 ft. there is an arm. Insulators are placed at each end of the arm and at the apex of the tower, each insulator being about 28 in. high and weighing about 75 lb. The insulators are the largest used in a Niagara transmission, and have two petticoats and a hood, the latter having a diameter of about 14 in. The steel towers are set 550 ft. apart, but the A frames will be placed 220 ft. apart. The height of the wooden frames is 49 ft.

Transformer stations will be erected at various points along the line. One will be located on the river bank on the New York side, where the transmision line crosses the gorge, and another will be in Lockport. These two stations will take care of the local distribution at the points referred to. It is expected that the transmission will be made at a voltage of 60,000 right from the distributing station on the bluff over the power house. From Lockport a branch transmission line has been built to Depew and the South Buffalo district, the right of way being 200 ft. wide, and the towers having four legs, whereas the towers between Niagara Falls and Lockport have but three legs.

In running through western New York this transmission line is being built south of one set of towns and cities and north of another section, so that it will be possible by running short branch lines to give an excellent service in either direction. The power will be applied to the operation of trolley lines, of industrial plants and for lighting purposes where needed. Between Lockport and Rochester there are many thriving places like Gasport, Middleport, Medina, Albion, Holley, Spencerport, etc., which will welcome the advent of Niagara power to their sections. It is expected that the transmission line will be ready to deliver its current some time during the coming summer, as the power house is now ready to supply the line, and the big distributing station is having its transformer equipment placed in position.

There is so much talk about the electrification of the steam railroads of New York State that the enterprise shown in the construction of this transmission line far into the interior of the State must be looked upon as possibly a part of the project of electrification. When in operation it will be the longest power transmission in the East, and its operation during the various seasons will interest engineers to a considerable extent, as it is well known that the longer transmissions in the West have advantages in climate and weather not possessed by this Eastern work. Up to this time the longest transmission of any great amount of power from Niagara is to the city of Buffalo, the distance being about 25 miles, so that carrying Niagara power to Syracuse, about 160 miles away from the generating station, will be quite a different accomplishment.

Proposed Niagara Power Transmission Lines.

In considering the future transmission of electric power generated in the new generating stations at Niagara, it is interesting to note that the Niagara Falls Electrical Transmission Company has just been granted authority by the State Gas and Electricity Commission to increase its capital stock from $100,000 to $5,000,000, and also permission to purchase the obligations of the Albion Power Company and the stock and obligations of the Niagara Falls Gas & Electric Light Company. By the contemplated purchase of the Albion and Niagara Falls companies referred to valuable franchise rights will be obtained. The Niagara Falls

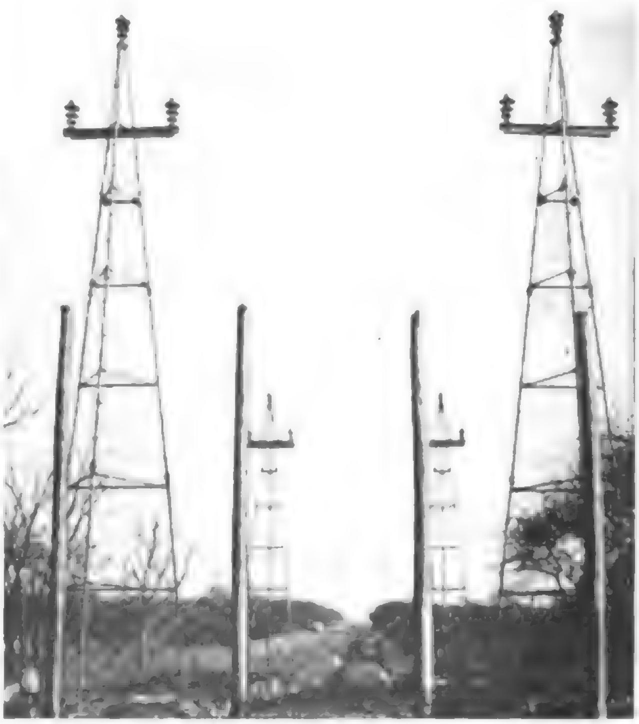


FIG. 5.—GENERAL VIEW OF TRANSMISSION LINE.

Electrical Transmission Company is a project backed by the Hon. Frank A. Dudley, of Niagara Falls, who is vice-president of the company, with Frederic Nicholls, of Toronto, Ont., as president. This company will act as the distributing agents in New York State for power developed in the plant of the Electrical Development Company, of Ontario, Limited, on the Canadian side of the river. So far as its plans are announced, the company's main transmission line will, if the franchises are allowed, cross the Niagara gorge on a new bridge to be erected by the Trans-Niagara Bridge Company at a point about 300 ft. below the present upper steel arch bridge, the new bridge to be wholly devoted to electric railway and power cable services across the gorge. From Niagara Falls, N. Y., the main transmission line of the transmission company will run to Tonawanda, where it will branch off, one branch going toward Buffalo, the other toward the interior of the State, where it may ultimately be the feeder for the proposed trolley line between Rochester and Niagara Falls, a $2,000,000 contract for which, it is reported, has just been awarded to the Transit Construction Company of New York.

It will be seen that all of the power to be transmitted into New York State by these companies is to be generated in stations located on the Canadian side at Niagara In the agreements between the various power companies and the commissioners of Victoria Park the following provision exists:

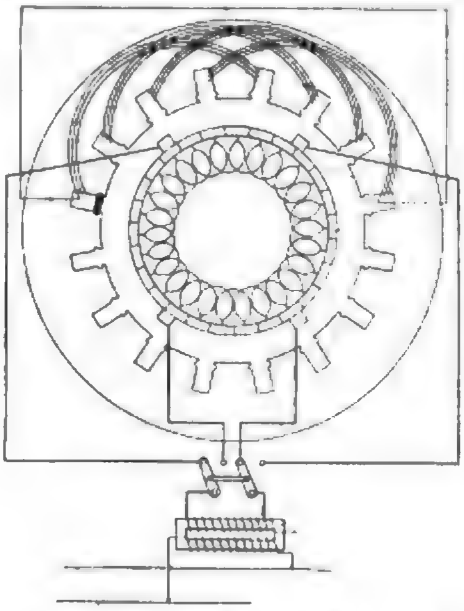
"The company whenever required shall from the electricity or pneumatic power generated under this agreement, supply the same in Canada to the extent of any quantity not less than one-half the quantity generated at prices not to exceed the prices charged to cities, towns and consumers in the United States at similar distances from the Falls of Niagara for equal amounts of power and for similar uses, and shall, whenever required by the Lieut.-Governor in Council, make a return of prices charged for such electricity or power verified under oath by any chief officer of the company, and if any question in dispute arises involving the non-supply or prices of electricity or power for consumption in Canada, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and enforce the facilities to be given or the prices to be charged."

This agreement was approved by the Ontario Government, but when it comes to the exportation of power from Canada to the United States the matter is one under federal control, and it would appear from a bill recently introduced in the House of Commons at Ottawa, Ont., that at least one of the companies generating electricity on the Canadian side does not feel that it is authorized under the agreement to export power, and for this reason the bill was introduced whereby the Dominion ratifies and confirms the agreement, as it is understood that a high constitutional authority has said the legislation making the exportation of Canadian power possible cannot be included in a private bill. Legislators in Ontario and the Dominion Governments are giving a vast amount of attention to the question of the exportation of Niagara power, and it is not yet clear what the exact future position of the provincial and federal governments is to be on the subject. At this writing, it may be assumed from the utterances of public men in Canada, that the position of the Dominion will be to have it understood that any permission given for the exportation of power will be revocable on short notice, as it is evident that Canadians are not yet prepared to utilize all of the power under development at Canadian Niagara.

In addition to the power that is to be brought to the American side of the Niagara River by the Niagara, Lockport & Ontario Power Company and the Niagara Falls Electrical Transmission Company, the Canadian Niagara Power Company, allied to the Niagara Falls Power Company, has had its power house on the Canadian side connected by cables with the two big power houses of the Niagara Falls Power Company on the New York side, and the new Canadian station can be operated in parallel with either or both of the stations referred to. The Canadian Niagara Power Company is also about to erect a power transmission line along the Canadian side of the river from the falls to Fort Erie, where the cables will cross high over the river to Buffalo, the Cataract Power & Conduit Company of Buffalo having planned a fine new station on the river front in Buffalo for the reception of power from the falls. It will thus be seen that while the power development on both sides of the river at Niagara is destined to be very extensive under present franchises, the transmission lines contemplate distributing the energy so that a wide section of territory will be benefited, for the transmission line of the Toronto & Niagara Power Company, the Canadian distributing agent of the Electrical Development Company of Ontario, Limited, will extend to Toronto, Ont., affording that city and the intervening places every facility to enjoy the transmitted energy of Niagara.

Series Induction Motor.

In a patent issued March 20 to A. S. McAllister a description is given of a motor which is stated to possess the characteristics of a compensated single-phase motor and to operate at a high power factor. As shown in the accompanying illustration, the line connecting the brushes makes a certain angle with the axial line of the field magnet coils. The current which enters the armature winding causes the formation of magnetic poles upon the armature core, and the alternation in these poles generates an electromotive force in the field coils. The current thus produced in the field coils causes the formation of magnetic poles in the stationary field cores. The armature current which flows in the neighborhood of the field poles thus produced gives to the rotor a torque in much the same way as with direct-current series motors. When the rotor is in motion there is generated at the commutator a counter e.m.f. which weakens the effective e.m.f., and therewith the armature current, the armature core magnetism, the field current and the field core magnetism. The generated counter e.m.f. is practically in phase with the current supplied, and therefore it acts as the insertion in the circuit of a resistance which varies with the speed. At negative speed the inserted apparent resistance is negative, and at a certain value of negative speed the total apparent resistance of the motor circuit is zero At higher negative speeds the total apparent resistance becomes negative, the interpretation of which is that the machine is now being operated as a generator and is supplying power to the line. The machine, therefore, may operate as either a motor or a generator. If during operation as a motor at a certain speed the connections to the rotor be so changed as to tend to drive the rotor in the opposite direction, not only will a braking effort be produced by such change, but power will be transmitted from the machine to the line. Two sets of brushes are employed, located at different angles with respect to the field coils, only one set of which is used at a given instant, in order to convert the motor to a generator so as to bring the rotor to rest.



M'ALLISTER SERIES INDUCTION MOTOR.

Electric Locomotive for the New York, New Haven & Hartford Railroad.

Our issues for March 24 and 31 contained abstracts of a paper by Mr. B. G. Lamme giving an outline of the plans of the New York, New Haven & Hartford Railroad Company in connection with the electrification of a portion of its main line and describing briefly the electrical equipment. We are able to give below a few more details relating specifically to the electric locomotive. Numerous interesting features relating to the motors are not, however, available for publication at the present time.

Each of the four motors used with the locomotive is of the conductively compensated type, the field winding being arranged in two circuits: the main field coils and the compensating field coils. The compensating coils are connected permanently in series with the armature and serve to neutralize the reactance of the armature circuit and thus to increase the operating power factor.

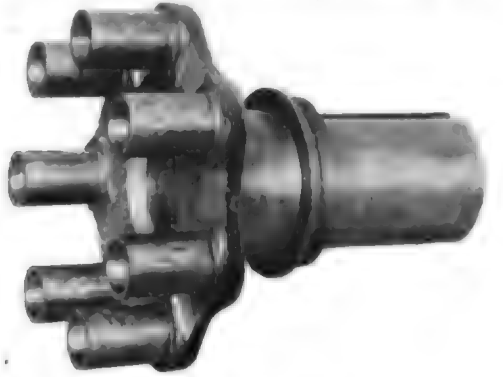


FIG. 1.—ONE OF THE DRIVING QUILLS.

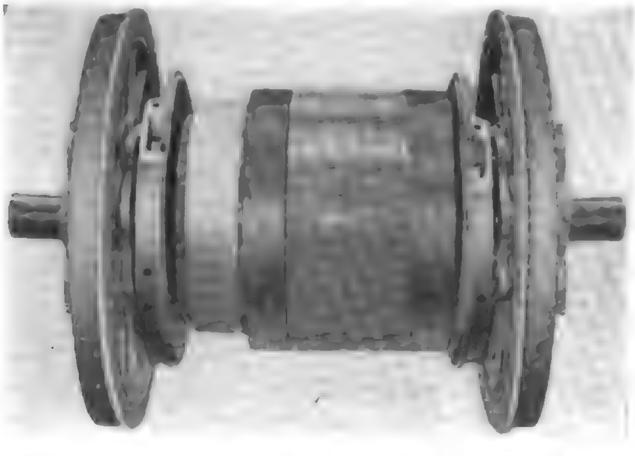


FIG. 3.—ARMATURE AND DRIVING QUILLS ON LOCOMOTIVE AXLE.

The active armature winding is one of the well-known direct-current types. However, the winding is closed on itself and is not directly connected to the commutator, but is indirectly connected to it through preventive leads of low conductivity material. These leads serve the same function as the well-known preventive coils used in alternating-current work when passing from one tap to another of a transformer. In fact, this armature, in one sense, may be considered as a transformer with a lead brought out from each coil to a contact piece, the various contact pieces being assembled together to form a commutator. The brush, in passing from one contact to another, short-circuits an intermediate coil, just as in the case of a transformer under similar conditions. The size and capacity of the preventive coils or leads in a motor are such that under continuous operation they will attain the same temperature as the active winding.

The function of the preventive coils or leads is to reduce the short-circuit, when passing from one commutator bar to the next, to a rather low value. For reducing the loss, due to this source, to the lowest possible value, the preventive action in the leads should be as high as possible. However, as the working current supplied to the motor must pass through the same leads, it is evident that for best results the preventive action, as regards the working current, should be as low as possible. It is, therefore, evident that there is some intermediate condition which gives the most efficient results, both as regards economy of power and commutation of the current. The preventive leads on these motors have been proportioned for this condition. Thus the losses are actually less when the preventive leads are used than when they are omitted, and the commutation is correspondingly better, especially at low speed and at start. Without these leads excessive current will be found, especially at start, this being indicated by glowing and spitting at the tips of the brushes. This action appears to be practically absent in the New Haven motors.

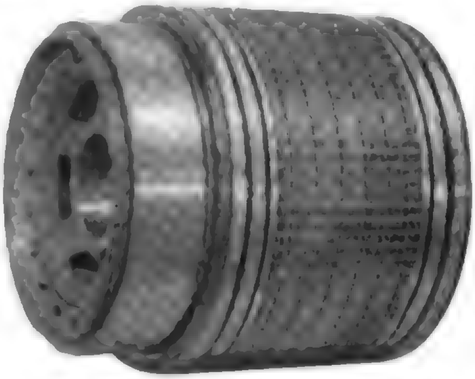


FIG. 2.—MOTOR ARMATURE UNMOUNTED.

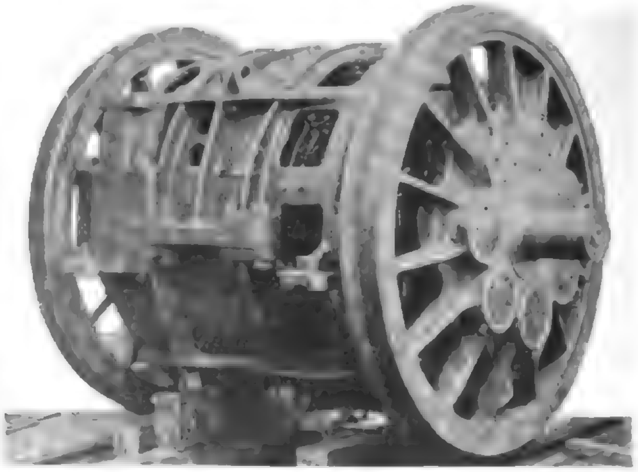


FIG. 4.—MOTOR COMPLETE, SHOWING OUTER FRAME WITH PERFORATIONS.

The active armature winding consists of several coils per slot, with one turn per coil. The coils are made of form-wound strap and are inserted in the slots from the top. Fibre wedges are used for holding the coils in place in the body of the armature, while binding wires serve for supporting the ends of the winding.

The commutator is so constructed and insulated that it wears evenly over the faces of the bars, and there is no tendency to form "high mica." In consequence the commutator takes a good polish and presents a smooth, glossy surface to the brushes. The very slight wear of the brushes indicates that commutating conditions are very good, and the commutators themselves remain in first-class condition. The total locomotive mileage is not yet sufficient to determine the life of the brushes, except by approximation from the present rate of wear, and this has been so small that an accurate estimate cannot yet be made.

There are several brushes per holder, and both the brushes and holders resemble closely those used in direct-current work. The brushes have a thickness of ½ in. and are pressed against the commutator by means of a coiled spring. A flexible copper jumper or shunt is used for carrying the current to the brush.

The major insulation, between the holder and the framework of the motor, is mica in the form of tubes which fit snugly over studs which are riveted to the body of the holder. Over each mica tube is placed a short porcelain sleeve and a long metallic cartridge. A clamp serves for squeezing the cartridge tightly against the mica tube and for retaining the brush holder in place on the framework of the motor. The porcelain sleeve furnishes a certain amount of mechanical protection to the mica tube, and it aids in insulating the holder from the frame, but its mechanical strength is not utilized in connecting the holder to the frame.

The hollow shaft of the armature is built up in two parts, one of which is shown in Fig. 1. Each part is provided with an end disc from which project seven pins. One of the parts is forced by hydraulic pressure into the commutator end of the hollow armature spider (Fig. 2) and securely keyed in place, while the other is similarly inserted in the opposite end. Fig. 1 shows the position of the bearing surface on the armature shaft mentioned above, and also the hollow projecting pins, the function of which is discussed below. The mounting of the armature and quills on the locomotive axle is indicated in Fig. 3. The discs shown at the two ends of the armature in this illustration are attached to the outer sections of the bearings on the quills and to them is rigidly clamped the outer field frame of the motor as represented in Fig. 4.

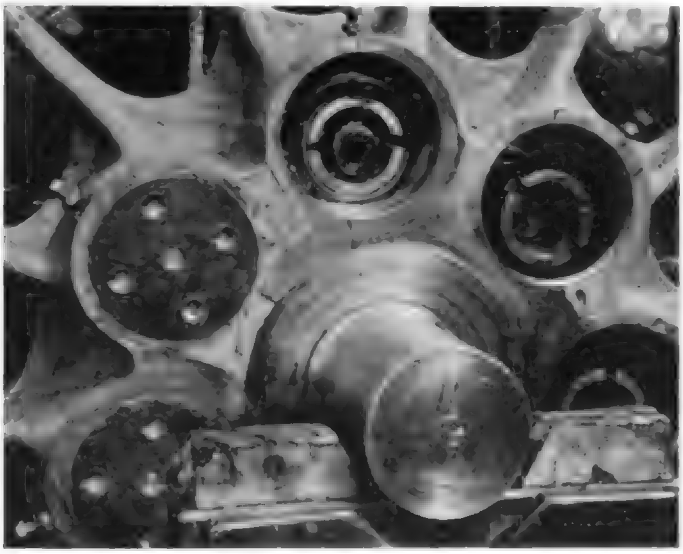


FIG. 5.—DETAILS OF POCKETS IN DRIVER.

Mechanically considered the motors are of the gearless type, and interest in the equipment is naturally centered in the methods employed for suspending the motors and for transmitting the torque to the drivers. Special precautions are taken to insure that both the gravitational force of the motor on the axle and the torsional force of the armature on the drivers are transmitted through elastic mediums, in order to minimize the effect which the great weight of the motor equipment would produce at the high speeds. The field structure of each motor is mechanically connected to its armature structure through two bearings, which insure that the armature will remain at all times concentric to the field poles. The weight of the motor, therefore, may be carried by the armature shaft or by the field structure, according to the relative values of the upward pressures exerted on these members. Through the hollow portion of the shaft of the armature passes the axle of the locomotive with a clearance of about ⅝ in. on all sides. On each end the locomotive axle is mounted on a 62-in. driving wheel, in the hub of which are formed seven circular pockets, which contain helical springs for assisting in carrying the weight of the motor and for transmitting the torque from the armature.

Separate means are employed for carrying the weight of the motor and for resisting the backward torque of the field structure against the truck. A steel frame entirely distinct from the truck is pivoted from the journal boxes of each locomotive axle, and from this frame the weight of the motor is carried by springs on which rest lugs of the field structure. The adjustment of the tension on these springs determines what portion of the weight of the motor is carried by them and just how much weight is carried through the pins on the armature quill.

In connection with the pulsating torque of the single-phase series motor, it is especially noteworthy that while the torque of the machine pulsates at twice the circuit frequency and the electrical torque varies from its maximum value to zero and even assumes a reversed value if the field flux is not in time phase with the armature current, such condition does not exist with reference to the mechanical torque which reaches the drivers. The pulsation in the value of this latter torque depends upon the inertia of the matter which may be moved by the electrical torque before the mechanical torque produces motion, and upon the elasticity of the medium which permits the movement. Thus with the locomotive in question, when the drivers are stationary each mechanical position which the field and armature structures of the motor assume causes to be transmitted through the springs to the drivers a certain definite value of mechanical torque. In order for the mechanical torque to reach zero 50 times per second, it would be necessary for the field and armature structures to be returned by the springs to the zero torque position an equal number of times in this period. The final result is that, unless the inertia of the moving mass and the elasticity of the springs happens to be adjusted for vibrational resonance at the circuit frequency, the armature and field structures will vibrate through very narrow limits and the torque which reaches the drivers will fluctuate in unison therewith, but will be almost constant at a value equal to about one-half of the maximum electrical torque. Observations have shown that the mechanical torque exerted by the locomotive drivers varies only slightly, although the torque of the motors as found under brake tests fluctuates through a considerable range.

The two armatures on each truck with their corresponding compensating field coils are joined permanently in series, and are operated at all times as a unit. For direct-current work the two motor units of each locomotive are connected in series at starting and in parallel at full speed, while for alternating-current work the two units are operated separately from the secondaries of the step-down transformers at variable voltage, so that they are practically joined in parallel at all times. During alternating-current operation each motor unit is fed at variable voltage from the secondary of a step-down transformer, there being two separate and distinct transformers on each locomotive. There were three objects in using two rather than one main transformer: one relates to the convenient disposal of the weight of the transformer on the locomotive; the second to the increased reliability of service in case a transformer circuit should be disabled, while the third has reference to the convenient arrangement and employment of the same unit switches for either direct-current or alternating-current work. The same master controllers are used for alternating current as for direct current. At each running point the motor circuits are joined directly to a certain tap on the transformer winding and no extra resistance is in circuit. In passing from one tap to one next higher in voltage a resistance is first inserted between the taps, then the connection to the lower voltage tap is broken, thereby placing the resistance in series with the motor at the higher voltage; then the resistance is short-circuited, leaving the motor joined directly to the higher

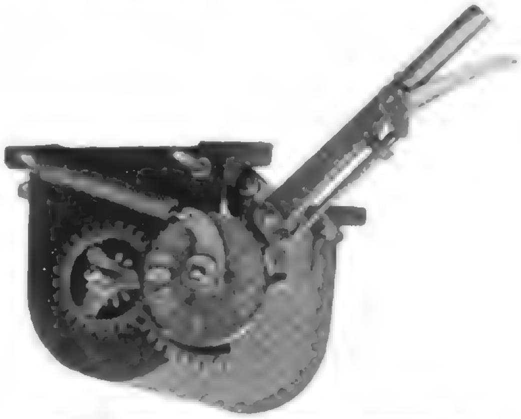


FIG. 6.—TOP VIEW OF MASTER CONTROLLER.

voltage tap. The "preventive resistance" used between the taps is exactly the same resistance unit used at a certain step in the direct-current control, while the same short-circuiting switch is used in each case.

Each switch used in the motor circuits is of the "Unit" type. The mechanical power for operating each switch is supplied by air under 80 lbs. pressure, while the admission of the air to the piston of each switch unit is controlled by an electromagnet which receives current from a 14-volt storage battery. There are, therefore, on the locomotive three electrically distinct systems of wiring; the 11,000-volt primary circuits to the step-down transformers; the lower-voltage motor circuits (corresponding to the secondary circuits from the transformers and the equivalent 600-volt, direct-current circuits) and the battery electromagnetic circuits.

The switches are similar to those used in direct-current work. They are arranged in groups for convenience, and the switches of each group have their magnetic blow-out coils placed mechanically in the same line so that they assist one another in producing the blow-out flux. Each blow-out coil consists of two complete turns built up of copper sheets insulated by Japan for the purpose of decreasing the losses from eddy currents. Precautions are taken also to minimize the eddy currents in the iron cores of the magnets; the pole faces are not laminated, however, but slots are cut across them in such direction as to prevent the production of excessive eddy currents. It is worthy of note in this connection that if a current of a certain value is to produce a given flux, the reactance is less when a magnetic core is used than when air alone is depended upon to convey the flux. For a certain frequency, the reactance is proportional to the product of the flux and the turns, and the less the number of turns required for the production of a certain flux, the less will be the reactance. It will be seen, therefore, that the magnetic core which is more or less desirable for direct-current is practically essential for alternating current. As is the practice with the unit switches, a powerful spring serves to open the switch rapidly when the air is released from the cylinder, the piston of which holds the switch closed, and this same spring holds the switch in the inactive position when either the air supply or the current to the control magnet is interrupted.

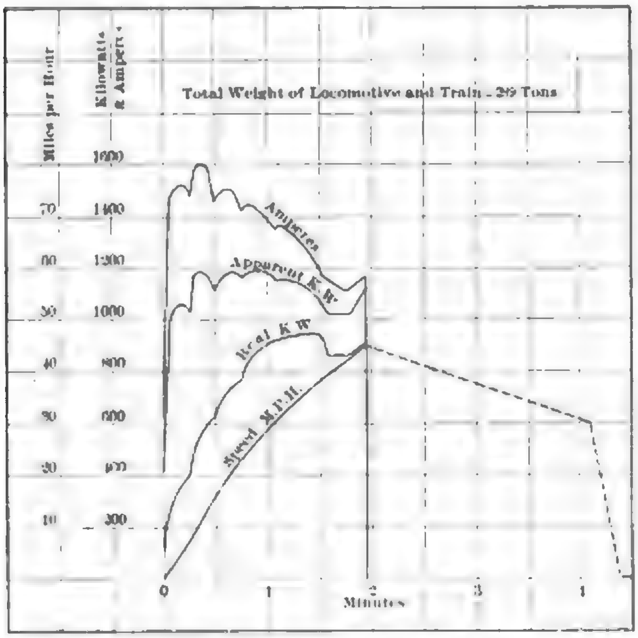


FIG. 7.—ACCELERATION TEST OF LOCOMOTIVE.

The locomotive may be controlled from either end by means of a master controller to which only the 14 volt battery circuits are led. The master controller is of the usual drum type, but its handle is somewhat different from that of the ordinary direct-current controller. The handle resembles somewhat the throttle lever of a steam locomotive; it is provided with a gear mechanism which allows the drum to be revolved through about twice the arc covered by the lever. The reverse lever is mounted immediately below the operating lever of the controller. The circuits which run to one master controller are directly in multiple with those to the other controller. A continuation of these circuits through flexible leads from one locomotive to another allows any number of locomotives to be operated simultaneously from one master controller.

There are two pantagraph bow trolleys for collecting the current from the 11,000-volt overhead conductor system. The upward pressure against the wire is supplied by springs in the base of the pantagraph equipment. Compressed air is admitted to a cylinder when it is desired to lower the collector. When the collector is in its lowest position, a catch engages the mechanism and holds it in place. The catch can be released by means of an electropneumatically operated lever when compressed air is on hand, or it can be released manually when desired. The framework of the pantagraph mechanism is built up of steel "bicycle" tubing; the collector bow is a broad strip of soft copper. It is intended to "zig-zag" the overhead wire so that the wear may be uniform over the bow. The trolley mechanism is mounted on massive porcelain insulators bolted to the roof of the locomotive.

For use over the New York Central portion of the route, there have been provided both an overhead direct-current pantagraph trolley and a system of third-rail contact shoes. The direct-current trolley is of the same general type as that used for the high-potential collectors, and it is mounted immediately over the center of the locomotive. There are two mechanically separate but electrically interconnected contact shoes on each side of each truck, so that there are a total of eight shoes per locomotive. These shoes are designed for use with either an over-running or an under-running rail, the mechanical pressure in each case being supplied by springs. On account of the fact that no third rail will be used over the high-potential portion of the route and the projecting shoes in their normal position would be liable to strike any small obstruction along the side paths, a device will be used for lifting the contact shoes out of the way when the locomotive is using alternating current. This device will be operated electropneumatically, and will be automatic so that when the alternating-current circuit is completed the shoes will be lifted from the rails.

All of the controlling mechanism of the locomotive is placed within the cab, no parts being carried below the floor except the electric cables and the air pipes. In addition to the various switch groups, and the two main transformers referred to above, the cab contains an air compressor driven by a compensated motor of the same general type as the main driving motors. The circuits to this motor are controlled automatically by the pressure of the air in the receiver, which is also placed within the cab. The four main traction motors, the high-potential transformers and the main circuit rheostats are cooled by air furnished at low pressure by means of a motor driven centrifugal blower, which obtains air from the inside of the cab itself. The low pressure air has two paths. One path passes first through the transformer then through the rheostats. The other path leads directly to the motors. It enters the armature near the shaft, passes around and between the armature laminations and flows outward through ventilating ducts in the field cores and reaches the outer air through perforated caps on the frame of the motor. Since a considerable volume of air is required for each motor, and it is undesirable to cause the air to assume a high velocity, it was necessary to provide a large flexible conduit between the air passages on the cab to those on the motors proper. The flexible conduit is made up of heavy canvas tubing, which is reinforced with wire and given an accordion plaiting. It is stated that by the use of the air blast the temperature of the motors under load has been so decreased that the continuous rating is almost equal to the one-hour rating. Tests which have been made on the first locomotive equipped show that it will, without difficulty, meet all the requirements for which it has been designed. Fig. 7 gives the observed acceleration curves for the locomotive with a train, the combined weight of which was 289 tons.

The Work of the Lewiston and Auburn Electric Light Company.

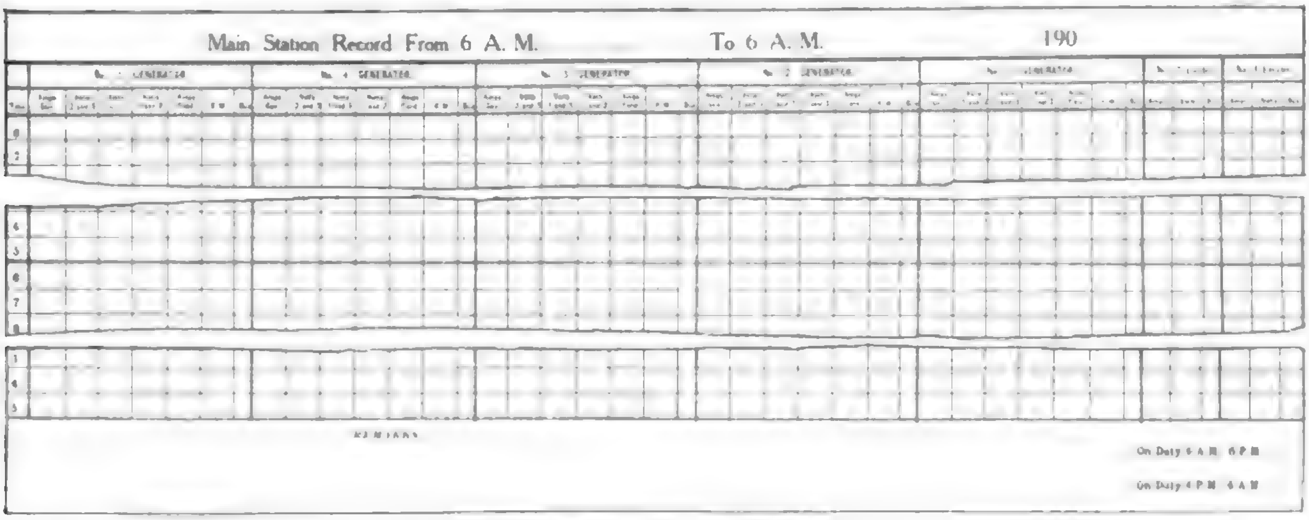
One of the most progressive central station organizations in the State of Maine is the Lewiston & Auburn Electric Light Company. The twin cities of Lewiston and Auburn are located one on each side of the Androscoggin River, about 40 miles from Portland, their sites being especially favorable to the utilization of one of the finest water powers in this country. In 1840 there were less than 2,000 people in Lewiston; then the era of manufacturing by machinery and the utilization of natural water powers began to develop on a large scale, so that to-day Lewiston is the second city of Maine in population, numbering about 28,000 people, while Auburn has a population of 14,000. Cheap power has been a marked factor in this increase of inhabitants and in the personal and real estate valuation, the latter having increased more than seven-fold in the six decades.

The Lewiston & Auburn Electric Light Company commenced operations in February, 1884. It was one of the pioneer electric light companies of Maine, and among the first in New England to introduce incandescent lighting. Four years later a competing company, the American Light & Power Company, was formed, and in October, 1901, the controlling interest in both properties was bought by Messrs. Libbey and Dingley, of Lewiston, and merged under the title of the older company. These gentlemen realized the future of electric power, and bought a water privilege at Deer Rips, on the Androscoggin River, about three miles from Lewiston, and in the spring of 1902 began development. A large power plant was built at this point, and at the present time every street car in Lewiston and Auburn, the local and interurban cars of the Lewiston, Brunswick & Bath Street Railway, the cars of the Auburn & Turner Railroad, every electric street lamp in Auburn, every commercial electric motor and every commercial or residence electric light in the two cities is operated from the main power house of the company at Deer Rapids. In all this territory, aggregating some 35 sq. miles and 42,000 people, there is not a single steam-driven isolated electric plant, and in but one or two instances have the mills upon the river bank equipped their turbine shafts with generators. The officers of the Lewiston & Auburn Electric Light Company are: President, H. M. Dingley; treasurer, H. S. Libbey, and superintendent, F. D. Gordon.

An interesting feature of the equipment is the entire absence of anything driven by steam. No reserve power is carried in the shape of boilers and engines, for the reason that the flow of the Androscoggin is never seriously diminished, even in times of great drought. The stability of the river is due to the famous Rangeley Lakes, which constitute its head waters. These lakes form enormous natural storage basins, so that there is very little chance of any falling off in the power supply farther down. The flow in the river averages 1,800 cu. ft. per second, and the head at the power house is about 29 ft. 6 in.

The main station at Deer Rips contains at present two 750-kw General Electric, three-phase, 11,000-volt, 60-cycle alternators, with a normal speed of 180 r.p.m., each direct-connected to a pair of horizontal 42-in. Stilwell-Bierce turbines equipped with draft tubes. The exciter plant consists of two 100-kw, 125-volt, General Electric direct-current generators, also direct-coupled to their respective water wheels. No transformers are installed between the generators and the line. The wheels are governed by the new governor of the Holyoke Machine Company, Worcester, Mass., and the resulting regulation comes close to 1.5 per cent with a combined railway and lighting load. A third 750-kw unit will soon be installed.

The company also has three auxiliary stations—one at he Lincoln Mills in Lewiston and the other two on the banks of the Little Androscoggin River in Auburn. The Lincoln Mills station is essentially a sub-station for distributing current to Lewiston. Power is transmitted to this station from Deer Rips over two three-phase aluminum circuits equivalent in cross-section to No. 1 copper. A lightning arrester outfit for the 10,000-volt line is installed in a separate brick building just outside the Lincoln Mills station, which occupies a portion of the basement of the factory of Messrs. Libbey and Dingley. At Lincoln Mills are four 500-kw General Electric air-cooled transformers and one extra 500-kw transformer, which is held in reserve as a spare unit. These reduce the line voltage to 2,200, two-phase, and at this potential current is supplied through Lewiston and Auburn. There are also several old belted generators at the Lincoln Mills formerly operated by water wheels, which can be pressed into service in case of need. One of these, a 180-kw set, is frequently employed as an auxiliary to the Deer Rips plant. The two generating plants at Auburn each contain a 180-kw belt-driven alternator, but only one of these plants is ordinarily used, and that only during the hours of 4 to 6 p.m., when the evening peak load comes on. These stations are multiplied on the busses at Lincoln Mills, and railway and lighting service fall upon the same machines at the Deer Rips power house. Two other transmission lines are run from the Deer Rips station, one to the rotary converter sub-station of the Auburn-Turner Railroad Company at Turner, and the other to the sub-station of the Lewiston, Brunswick & Bath Street Railway at Lewiston. A 200-kw rotary and a Gould storage battery are in service at Turner, and a 500-kw rotary and a 320-amp.-hour accumulator battery at Lewiston. No exciter battery is in use at the Deer Rips power house. The transmission from Deer Rips to Turner is 65 miles long and from Deer Rips to the Lewiston street railway sub-station it is about 5 miles.


Main Station Record From 6 A. M. To 6 A. M. 190

REMARKS

On Duty 6 A.M. 6 P.M.

On Duty 6 P.M. 6 A.M.

Fig. 1.—Main Station Record.

STATION RECORDS.

At Deer Rips recording wattmeters are used on the feeder panels, and hourly readings are taken of the current and voltage on generators and exciters, as shown in the accompanying chart entitled "Main Station Record" (Fig. 1). The shifts are 12 hours long. The chart is of interest chiefly on account of its simplicity, the columns for voltage records between different phases being especially well arranged. Synchronizing is accomplished by lamps and the synchroscope. At Lincoln Mills frequently indicators of the horizontal edgewise type are in service, and the records are taken hourly as outlined on the accompanying "Sub-station Record" (Fig. 2). The frequency records are useful in discussing motor speeds with customers in case of complaint, aside from their direct indicating value and check upon the governor performance. Recording voltmeters are used in the railway battery sub-stations, and power factor indicators are also in service at these points. The power house at Deer Rips is served by a 25-ton hand crane. This plant began operation in November, 1904.

DISTRIBUTION.

There is no conduit construction in either city. The poles used are mostly chestnut, varying from 35 ft. to 50 ft. in length. Oil transformers have almost entirely superseded air-cooled types on the distribution system, and small, scatered units are being replaced in groups by larger transformers. At present the largest outside transformers are of 50-kw rating. Seven of these are now in service, all being attached to poles.

The entire distribution system is on an alternating-current basis in each city. There are two street lighting circuits for Auburn, carrying 126 enclosed arc lamps, 6.6 amp., and four 25-cp series incandescents. There are two two-phase, 2,200-volt power circuits, one each for Lewiston and Auburn, and four single-phase, 2,200-volt lighting circuits, two going through each city. The transmission lines are not patrolled at night. In the two cities are 1,248 connected hp in induction motors, 116 in all, the largest being 75 hp; 32,000-cp incandescent lamps, 476 commercial arc lamps, small signs and electric flatirons. Small single-phase motors are being pushed rapidly into service; practically every grocery of note is equipped with a small motor for coffee grinding; every machine shop in the two cities is driven by induction motors and every printing press. Speed regulation when necessary is by cone pulleys. Sewing machine motors are also exploited by the company. The largest motor allowed on lighting circuits is 5 hp.

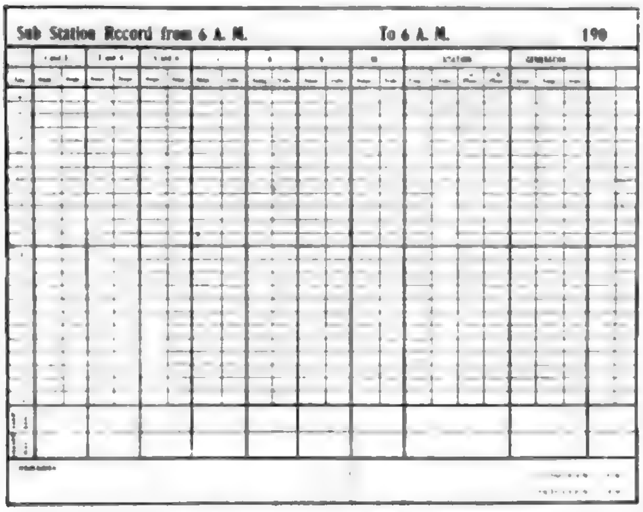

Sub Station Record from 6 A. M. To 6 A. M. 190

FIG. 2.—SUB-STATION RECORD.

In regard to connecting up remote customers, the company will construct its necessary line if assured of adequate financial return, but otherwise extensions are made slowly. Ordinarily the company does not like to install more than four poles and the necessary wire in order to bring a single consumer into its system. There are no farm customers on the system. The company has not had very much success in the use of creosoted poles.

RATES.

The rates for incandescent lamps are 9 cents per kw-hour by meter, with $1 per month minimum charge. Consumers using over $100 worth of current per month are given an 8-cent rate. Signs are operated at incandescent rates. The power rate is 7 cents per kw-hour as a basis and a sliding scale of discounts, with a minimum charge of $10 per hp per year. The following data are extracted from the power rate tariff sheet:

POWER RATE.

List price, 7c. per kw-hour or 5.22c. per hp-hour.

Meter reading, kw-hours per month.	Equivalent to to steady hp.	Discount, per cent.	Cents per kw-hour.	Cents per hp-hour.
100— 175	.53	10	6.3	4.71
475 — 650	2.53	30	4.9	3.67
1050— 1200	5.58	44	3.92	2.94
1600— 1800	8.48	53	3.29	2.46
2000 2400	11.66	60	2.80	2.1
3200— 3500	16.96	66	2.38	1.78
5000— 6500	26.25	69	2.17	1.62
10000 12000	53.00	72	1.96	1.47
16000—18000	84.80	75	1.75	1.31
20000 and above	106.00	77	1.61	1.2

Interior arc lighting is charged on the incandescent basis of meter records. The charge for the arcs for street service in Auburn is $55 per lamp per year, and incandescents of 25 cp cost $12 per year. Four commercial laundries use large electric flatirons at a rate of 4 cents per kw-hour.

The municipal plant in Lewiston supplies arc lamps only for street service. These are of the old open-arc direct-current style and are operated by several generators of ten or fifteen years ago located in the Lewiston Pumping Station, and driven by water wheels. There are estimates to the effect that the cost to the city is $35 per lamp per year, but as no report of this work is printed or prepared, the money being simply appropriated in a lump sum, it is pretty hard to say just what the actual cost is, including depreciation and lost taxes. The quality of light is certainly much inferior to that given by the modern enclosed arcs at Auburn.

BUSINESS GETTING.

Every employe of the Lewiston & Auburn Company is an active solicitor of new business whenever an opportunity is seen, although no regular organized force devotes its attention to such problems. The company does inside wiring for its consumers and by so doing feels that it can give a better service than if the customer supplied the installation. This work is done practically at cost, and it insures the consumer an adequate installation for the load proposed, makes certain reliable work and thus protects the company. In the prosecution of this work it is often the case that sound advice can be given to the consumers about their installations, and general satisfaction assured. Printed matter from the manufacturers is widely circulated, generally when the bills are presented, and the company maintains an exhibit of lighting and heating appliances at its offices. In the spring house-cleaning season the point is often made that then is a specially favorable time to have a house wired for electric lights.

The heating exhibit comprises a considerable variety of flatirons, ovens, broilers and chafing dishes, all wired for demonstration on the spot and connected to a recording wattmeter so that the prospective customer can see for himself just what the power consumption is going to be. In the superintendent's office is an especially fine display of lamps, shades and fixtures in different styles and colors. Some of these are installed in a glass cabinet and the illumination is very attractive. The offices are heated by electric radiators; electric cigar lighting equipment is in demonstrative service, and Meridian and high-efficiency lamps are displayed freely.

The company in the last two years has reduced the lighting rate from 15 cents to 9 cents—a reduction of 60 per cent. It does not renew lamps free on meter rates, but sells them to its customers at 15 cents each, net. A few customers are still on flat rates, and under these conditions three lamp renewals are made without charge. Blotters are often sent to customers with appropriate advertisements thereon. The newspapers are used somewhat, but not to any great degree. At a recent state fair held in Lewiston the company had a large exhibit of electrical apparatus which attracted a great deal of attention from the public. Electric flatirons are supplied free on 30-days' trial, and last year, out of 50 irons installed, only three came back. A fair average of the cost of operating an electric flatiron in these cities is 75 cents per month. The electric sign business has not been developed as yet to any great extent, but matters are moving in the right direction. The company has a small sign at its office in Auburn, but thus far has not employed one in Lewiston. Customers are encouraged to read their meters and are taught how to do it when an installation is made. The price of coal in Lewiston is about $5 per ton and the cost of gas $1.35 per thousand feet. Gas competition is met by alternating-current enclosed arc lamps, Meridian and graphitized carbon General Electric incandescents.

The results which have been attained have been largely due to the personal and aggressive work of the employes of the company, rather than to any highly systematized advertising scheme. Such a course has worked out well, but in a larger city routine methods of getting new business would probably have to be more extensively followed. At Lewiston and Auburn the personal touch has been the key to the situation, rather than elaborate canvassing and "follow-up" letters. On the physical side water power is the foundation of the prosperity of the community, and it is little short of remarkable that in a city the size of Lewiston a central station should be able to hold down the competition of isolated plants so well. The rates for power and light are naturally reasonable by virtue of the low cost of generation, but only effective work could have educated the community to such an extensive use of electricity on the central station plan. With the facilities for additional power which the river affords, there is little question that the commercial growth of Lewiston and Auburn will be continuous and gratifying, and electricity will doubtless be the principal means of bringing the community's chief material asset home to the average citizen's personal profit and advantage.

Recent Electrochemical Developments.

LEAD REDUCTION.

In the Salom process for electrolytic lead reduction, which has been worked on a large experimental scale at Niagara Falls, though it has not yet been reduced to commercial practice, finely ground galena is used as cathode with a sulphuric acid electrolyte. The cathodic reaction is the reduction of metallic lead with evolution of hydrogen sulphide.

A process recently patented by Mr. C. P. Townsend may be briefly characterized as a Salom process with fused electrolyte, since Townsend, like Salom, obtains the lead by cathodic reduction. In other respects there are, however, distinct differences. The fused bath of Townsend consists of a haloid salt of an alkali or alkaline-earth metal. The sodium liberated from the molten bath combines with the sulphur of the ore and sodium sulphide accumulates in the bath until it is sufficient in quantity to carry the current. By reason of the great difference in specific gravities the ore floats upon the surface of the lead beneath the electrolyte and remains therefore in the field of most active reduction until it is itself reduced. A high current density may be used and the reduction proceeds therefore with great rapidity. The process has undoubtedly distinct practical advantages.

BATTERY INVENTION.

E. L. Opperman claims that an exceedingly porous, and at the same time, hard and tenacious active material for storage battery plates may be obtained by making a mixture of the usual active oxide with ground or powdered animal hair or wool. The best results are obtained with a proportion of one-half to one and one-half per cent of hair in the mixture.

Two patents granted to F. Mouterde and to H. B. Hallock respectively refer to mechanical details of construction of storage batteries. The peculiarity of the latter patent is that only two plates are used, one above the other in horizontal positions.

A recent patent of H. J. Brewer refers to mechanical details of construction of a zinc electrode for primary batteries. E. W. Schneider proposes to arrange a battery of several dry cells in such a way that one of the same is kept separate from the others and is called upon to furnish current only to boost the voltage when the other cells have become somewhat exhausted. For this purpose he provides an end-to-end reversal by which the cell may be thrown into the generating circuit.

LETTER TO THE EDITORS.

Recharging Automobiles.

To the Editors of Electrical World:

Sirs:—In your issue of March 31, there appears in the Patent Record a brief allusion to a device, which it is stated, was patented by me. Allow me to quote:

"815,360. Device for Recharging Automobiles. A special type of induction motor having two commutators, is employed upon a vehicle and when the batteries are charged from an alternating-current circuit, the motor is arranged to be operated as a rotary transformer so that the batteries may be properly charged."

Induction motors with commutators are rare birds, and those having *two* commutators would be masterpieces of electrodynamic design; but when it is considered that this induction motor, in addition to these unusual features, may be run from a storage battery as the source of supply, and may also act as a rotary converter, it seems to me the most marvelous contraption in the whole range of the electrical art.

As a matter of fact, my invention consists simply in putting slip rings on the ordinary automobile motor, connecting them with the armature winding, and so arranging the field windings that the machine may be run in the usual fashion as a series motor, to propel the vehicle; or by mechanically disconnecting from the driving wheels, it may operate as a rotary converter to charge the batteries from alternating current, if this be the only available source of supply. It adds nothing to the weight of the vehicle, and the additional cost, as compared with the ordinary motor, is insignificant. It is always there when needed and ready for use, and therefore greatly increases the range of action and usefulness of the electric automobile. It has not, however, the extraordinary features recited in the notice quoted, and I must admit, reluctantly, that it bears no marks of genius, but is only a commercial machine for the purpose as stated above, and I trust of some future importance in the electric automobile field.

New York. Lamar Lyndon.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Unipolar Dynamo.—Huppert.—The author suggests the use of the unipolar machine for single-phase current. He first discusses the reaction of the rotor currents on the stator. The unipolar motor may be built either with direct supply of electric power into the rotor performing mechanical work or by inductive transmission of the power from the stator to the rotor. The unipolar series motor has properties similar to that of the bipolar series motor. The characteristic features of the repulsion motor may also be transferred to a unipolar machine.—*Elek. und Masch.*, March 4.

Design of Transformers.—Korndoerfer.—A paper on the best way of proceeding in the design of transformers. The proper choice of the maximum flux per square cm. of iron and of the maximum current density in the copper are of fundamental importance since these quantities determine efficiency and price. It is difficult to give exact rules concerning this choice since these quantities depend on the type of the design, the method of cooling and the quality of the iron. When these values have been selected, the author shows how to find by simple calculation the diameter of the core from which all further dimensions may be easily determined. Some numerical examples are given.—*Elek. Zeit.*, March 22.

Direct-Current Dynamo Design.—Breslauer.—The conclusion of his article. In the first part the author had given some details of a direct-current machine which, in spite of an unusually high reactance voltage and large armature reaction, was perfect with respect to commutation. This satisfactory behavior is primarily due to the shape of the pole horns which are shown in Fig. 1. It will be seen that the air gap varies between 4 mm. and 9 mm. and thus a strong commutating field is created just at the point where the short-circuit has to take place. The effect of this device is to prevent field distortion by creating an artificial distortion in the opposite direction at no load which will be partly or completely balanced at full or overload as may be desired. If, for instance, as in this case, the distorting ampere-turns of the armature are approximately equal to the ampere-turns for air, teeth and core, one would have to make the gap on the leading horn of the pole half as great as on the trailing horn. This has the same effect as if on the leading horn the field ampere-turns were doubled at no load. When the load comes on, half of these ampere-turns will be balanced, and the resultant field will be normal and just the same as if the air-gap had been equal all along the periphery of the pole face. In order to make proper use of this commutating field, a considerable lead of the brushes in the direction of rotation is required. This, on the other hand, would cause sparking at no load if the induced e.m.f. due to the commutating field were too strong. Given the reactance voltage, however, the counter e.m.f. is also fixed, and is bound to be about twice as great at no load as at full load owing to the inequality of the air-gap. Hence an additional well known artificial device was employed to keep down the current produced at no load by the outer commutating e.m.f. This consisted of resistances fixed in the commutator lugs in the form of manganin strips. The author discusses the losses and efficiency of this machine, and its mechanical construction, and gives some figures for the active material used in the construction.—Lond. *Elec.*, March 23.

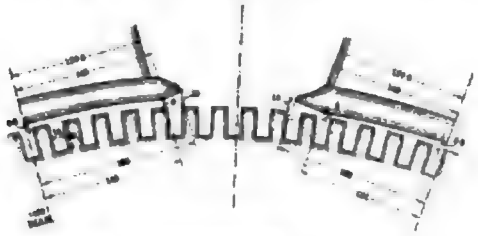


FIG. 1.—SHAPE OF POLE FACES.

Direct-Current Dynamos.—Gennimatas.—A highly mathematical papet on the mean voltage between two adjoining commutator segments.—*Elek. und Masch.*, March 25.

Direct-Current Dynamo.—An illustrated description of a Vickers 1,400-kw, shunt-wound, direct-current generator. It is designed for 460 volts at a speed of 100 revolutions per minute.—Lond. *Eng'ing*, March 9.

Commutation Poles.—Arnold.—A paper illustrated by diagrams discussing the path which the magnetic flux takes in a direct-current machine with special commutation poles (interpoles).—*Elek. Zeit.*, March 15.

Lamps and Lighting.

Combined Nernst and Welsbach Lamp.—Herz.—A Welsbach mantle of metallic oxides is a non-conductor at ordinary temperatures, but becomes a good conductor when heated. In order to increase the temperature of the Welsbach mantle and therefore its efficiency, the author proposes to heat the mantle by the gas flame as usual and to supply it also with an electric current. Nothing is stated concerning the methods of doing this.—*Zeit. f. Beleucht.*, March 10.

Power.

Induction Generators for Power Transmission.—A canal has been built in the upper valley of the Rhine (Switzerland) for conducting the waters, which sometimes accumulate here with surprising rapidity, in a safe and quick manner to the Lake of Constance. On its way to the lake, the canal drops in three steps of about 10 ft. each, and it was decided to utilize these falls for the generation of electric power. Accordingly, three generating staions were built, and they have been in regular service since the beginning of this year. The main station, which is situated at Montlingen, is equipped with 3 three-phase 250-hp alternators of the rotating-field type, while the two other stations, which are at Blatten (about 2½ miles from Montlingen) and at Lienz (about 3.1 miles from Montlingen) have each been provided with two 250-hp asynchronous generators. These are simply induction motors with short-circuited rotors driven above synchronous speed. They supply electric power to the network in much the same manner as a railway motor of the induction type returns power to the line when the train runs at an increased speed down hill. Such asynchronous generators, as is well-known, do not require a voltage regulation and they do not need to be synchronized. These stations generate at 10,000 volts between the phases, and supply power into a distribution network having a total length of about 35 miles. The voltage and frequency of the network is determined by the synchronous generators at the main station, and the power delivered by each of the asynchronous generators depends simply on the power of the turbine by which it is driven. If the power taken from the network decreases, the alternators at the Montlingen station show a tendency to race, and the normal state of affairs is reestablished by simply cutting out one or more of the asynchronous generators or by shutting down their turbines. In each of the two stations with the asynchronous generators there is only one man in attendance and the switchboard contains only ammeters and switches.—Lond. *Elec.*, March 23.

Danger from Electricity in Mines.—Beyling.—An abstract of a paper on the possible ignition of mine gases from the sparking of motors and other electrical machinery. Exhaustive experimental investigations have been made in Germany and the results of these experiments show that electrical machinery to be used in coal mines, in which the presence of explosive gases is possible, should be constructed with the greatest care, to reduce sparking to a minimum, and that such machines should then be enclosed in casings of sufficient strength to prevent the possibility of any bursting by the explosion of their contents, the castings being provided with openings of sufficient size to permit the escape of the products of explosion, and yet not large enough to allow the escape of flame. Further experience with the behavior of explosive gases will enable definite data for the design of motors and other appliances for coal mines to be determined.—*Eng'ing Mag.*, April.

Control of Electric Motors.—Scott.—A long illustrated paper on speed characteristics and the control of electric motors. In the present installment the author discusses direct-current motors, and deals first with speed control by field strength variation in the case of shunt, compound and series motors. He then discusses speed control by armature voltage variation, either by connecting a resistance in series with the armature, or by using a special generator giving variable voltage or by connecting the motor with several wires between which different voltages are available. The author points out that there are several points in favor of control by variation of the strength of the field when it is desired to obtain adjustable speeds which shall be constant and independent of load variations. The motor and control devices are simple. The supply circuit is of the simplest kind without special generators or additional wires. The current is always a minimum as no low voltages are used which would require a greater current for a given power. The author then discusses the limitations of the different methods of speed variation. The two elements which limit the range of field adjustment of a given motor are the saturation of its magnetic circuit and the heating of its field coils. In the method using the variation of the e.m.f. applied to the armature one cannot raise the voltage above a certain maximum limit which depends upon the winding and the commutator design. The armature current and consequently the motor output (under given conditions of field strength and armature voltage) has its limitations in sparking at the commutator and heating of the conductors. There is also a mechanical limit to the armature speed above which there is liability to accident.—*Eng'ing Mag.*, April.

Traction.

Single-Phase Railway Motors.—Schoepf.—A paper read before the Manchester Section of the (Brit.) Institution Elec. Eng., on single-phase railway motors and methods of controlling them. The author gave characteristic curves of various single-phase series motors of the Westinghouse Company. He remarked that the ideal method of voltage variation in the supply of power to single-phase motor is by means of an induction regulator which provides a uniformly increasing voltage without interruption of the supply. He finally referred to multiple-unit control. In the discussion the question of the repulsion motor versus the series motor was brought up. Cramp said that it is in commutation that the series motor scored, as salient poles could be used while a small air-gap and a resultant practically rotating field are essential for the repulsion motor. Lastly for different frequencies the repulsion motor is far better, since for anything like reasonable efficiency at full load the series motor must run well above synchronism, while the repulsion motor runs at about three-quarters synchronous speed. Thus repulsion motors can be built for frequencies of 40 periods per second, in which case series motors are almost out of the question. This is of special importance in England where they might wish to use alternating-current commutator motors in connection with ordinary lighting circuits. Almost any system of control suitable for one type of motor is suitable for the other, but with repulsion motors one has a choice of systems that does not exist with series machines, since the control may be effected by rotor resistance as is done in the Schueler motor and the ordinary induction motor. This enables putting a high voltage on the stator and getting rid of the bulky transformer. Schoepf said that the straight series motor is good at starting, but the repulsion motor is better while running.—Lond. *Elec.*, March 23.

Single-Phase Locomotive.—Solier.—An illustrated description of the new single-phase locomotive of the Oerlikon Company for use on the road from Seebach to Wettingen, which has already been noticed in the Digest.—*L'Eclairage Elec.*, February 17.

Double-Gauge Electric Locomotive.—A German machine factory is connected to the adjacent railway station by a system of tracks whose gauge is partly 1,435 mm. and partly 700 mm. Altogether, the connecting lines between the station and the works are about one mile in length. These lines are now to be electrified, and the same locomotive is to travel over both the standard-gauge and the narrow-gauge portions of the system. To this end the locomotive is equipped with four axles, of which the two outer ones correspond to the standard-gauge and the inner ones to the narrow-gauge. There are eight wheels, each of which is 650 mm. (25⅝ in.) in diameter, and the "standard-gauge" wheels are outside the locomotive frame, while the "narrow-gauge" wheels are inside the frame. Either pair of axles can be raised or lowered by the motorman in the cabin by a simple screw mechanism. The arrangement is as follows: Each of the outer axles is connected to the neighboring inner axle by two substantial levers, and these levers are pivoted at their centers to the frame, and extended beyond the inner axles towards the center of the locomotive, where they engage with a strong screw operated manually by the motorman. The two 6-hp continuous-current motors are bolted to the locomotive frame and drive the wheels by means of double-reduction gearing having the ratio of 11.5 to 1. The teeth are always in mesh, and either the one or the other pair of axles is running idle.—Lond. *Elec.*, March 23.

Energy Consumption of Electric Carriages.—In order to test the energy consumption of electric carriages under favorable conditions, a 100-km. (62-mile) test run was recently organized in Paris over dirty and slippery roads, fog prevailing at the time. A number of carriages carrying four passengers, and weighing complete over 2 tons, covered the entire distance at an average speed of nearly 15 miles an hour, and consumed less than 160 watt-hours per ton-mile. The first prize was gained by a carriage entered by Vedrine, which required 155 watt-hours per ton-mile. The energy consumption of this vehicle in ordinary conditions is from 110 to 120 watt-hours per ton-mile.—Lond. *Elec.*, March 23.

Car Wheel Acceleration.—An article giving formulas for calculating the energy expended on car wheels during acceleration, with figures from actual practice.—Lond. *Eng'ing*, March 9.

Installations, Systems and Appliances.

Regulating the Voltage in Alternating-Current Distributing Networks.—Buechi.—A description of an apparatus which consists essentially of a high voltage switch with an inductance in combination with an autotransformer. The autotransformer produces the additional adjustable voltage and may be used to advantage since the additional voltges required will probably never be more than 10 or 20 per cent of the whole tension. According to the position of the switch, more or less windings of the transformer are in series with the line. By the use of the autotransformer it is possible to transform only a small part of the total power in the line to another voltage. Fig. 2 shows the application of the system to a single-phase current network for four different regulation voltages. The bus-bars of the power house are connected to the line, *aa*, at which there exists a constant voltage. *T* is the autotransformer, the exciting windings of which are connected between the two conductors, *aa*, while the regulating windings are in series with one of the two conductors. The high-voltage switch is indicated by 1, 2, 3, 4 and is connected with the line, *bb* (the voltage of which is to be regulated), through two auxiliary bus-bars which may be short-circuited by means of 5. If 1 alone is closed, all regulating windings of the transformer, *T*, are in series with *aa* and the voltage is raised in *bb* to its maximum possible point. In order to decrease the voltage in *bb* it is necessary to close 2 instead of 1. If the auxiliary bus-bars, *c*, were not provided and if 1, 2, 3, 4 were connected to *b* by means of a single connection, it would not be possible to make the change from 1 to 2 directly, since in this case either a part of the regulating windings would be short-circuited or it would be necessary to interrupt the line. In order to prevent the necessity of interrupting the line or the short-circuiting of the windings, the auxiliary bus-bars, *cc*, are provided in combination with 5 and the inductance, *JW*. Before 1 is disconnected, 2 is connected to *cc*, since there is no longer any short-circuit between 1 and 2 as an inductance is provided which is of such a size that only the regular low current can flow through the closed regulating windings. 1 is then opened without interrupting the current, and 5 is closed in order to disconnect *JW* from the circuit. Assume that 3 is closed and that it is necessary to raise the voltage, then 2 is first closed, 3 is disconnected and short-circuited with 5. If 2 is closed and the voltage is to be raised still higher, 5 is first disconnected, 1 is closed and 2 is finally disconnected. Diagrams are given showing how modifications of this apparatus may be applied on two-phase and three-phase lines.—*Elek. Zeit.*, March 15.

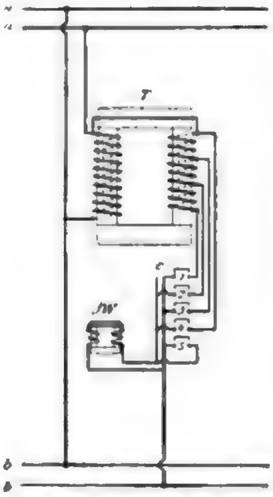


FIG. 2.—DIAGRAM OF VOLTAGE REGULATOR.

Electric Auxiliaries.—Mann.—An article on the betterment of power station economy by electric auxiliaries. The exhaust steam coming from steam driven auxiliaries is so valuable for heating feed water than the facts that such apparatus is rather inconvenient and uses rather more steam than it ought to do, are often condoned. As an alternative to this system there is the possibility of using electric auxiliaries. In order to heat the feed water in this case the author makes the following suggestion for steam turbine stations. The steam at about atmospheric pressure, either a little above or a little below, within a steam-turbine casing, is admirably suited for this feed-water heating. It has performed its mechanical work, and withdrawing it does not disarrange the performance of the turbine itself except in so far as a certain amount of steam does not pass through all the wheels. The use of electric auxiliaries has the great advantage of convenience and ease of operation, resulting in an appreciable saving in wages for attendance.—*Eng'ing Mag.*, April.

Central Station Advertising.—Chapin.—An article giving hints on methods for getting new business for central stations by bringing before the people the possibilities of electricity.—*Cassier's Mag.*, April.

Electrophysics and Magnetism.

Internal Energy of Elements.—Soddy.—A discussion of the possibilities of making available the unknown storage of energy contained in chemical elements. This energy gets free when the atom breaks up as in the case of a radium atom when being radioactive. It is probable that the elements as a class all possess great internal energy, and that their characteristics of stability and permanence, and the failure of all attempts to change them by artificial means, are due to the existence of this internal energy. The forces at our disposal compared to those which are exhibited when an atom suffers change, are of a different and lower order of magnitude, and it is not to be expected, therefore, that the transmutation will become possible until we can control more powerful agencies than are at present available. Suppose that a way were known in which the element uranium, for example, which disintegrates to the extent of a thousand-millionth part annually, could be made completely to disintegrate in the course of a year. From 1 gramme of the element more than a thousand million calories could be evolved, would be equivalent to more than 1,000 kw-hours, and would suffice to keep a 32-cp lamp burning continuously throughout the year. By the expenditure of about 1 ton yearly of uranium, costing less than $5,000 more energy would be derived than is supplied by all the electric supply stations of London put together.—Paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng.; abstracted in Lond. *Elec.*, March 23.

Electrons.—Holzmuller.—A résumé of the foundations on which the modern theories of electrons are based.—*L'Eclairage Elec.*, February 17, 24.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—Reyval.—Some notes on the successful application of the Birkeland-Eyde process in Norway. The fundamental idea is to move the air through an arc discharge which is magnetically deviated so as to form a flaming disc.—*L'Eclairage Elec.*, February 24.

Units, Measurements and Instruments.

Damping Device for Electromagnetic Instruments.—Dessauer.—An illustrated description of a new damping device specially suitable for electromagnetic alternating-current switchboard instruments. The construction is shown in Fig 3. A liquid used for damping is contained in a hermetically closed vessel so that any change of the damping liquid, due to evaporation, etc., is made impossible The vessel is of cylindrical form and closed on all sides, and is filled about one-half with liquid. The cylinder can revolve around its axle as is shown in the illustration, and the needle is firmly connected with the cylinder in such a way that the center of the side forms the starting point of the needle. If the needle is deviated, the cylinder revolves with it and the liquid in it must assume a new position of equilibrium. This gives a damping effect which may be adjusted by using more or less liquid and by using liquids of different specific gravities.—*Elek. Anz.*, March 1.

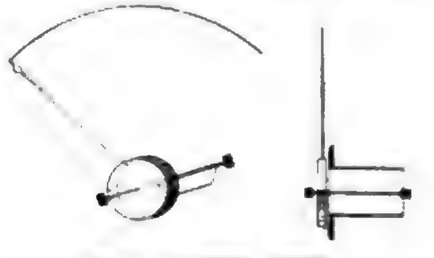


FIG. 3.—DAMPING DEVICE.

Connections of Three-Phase Meters.—Niethammer.—For measuring the power of a three-phase system double meters are now much used with the connections, as indicated in Fig. 4. In using such double meters in practice it is very important to take care that the connections of the voltage coils are made exactly as shown in Fig. 4, since otherwise the double meter does not properly measure the power consumed, but shows quite appreciable errors. Two wrong connections which the author has found in practice are shown in Fig. 5. It is very easy to find out whether the connections are right, at least if the power factor of the system is different from unity, which is always the case if induction motors are used. In this case the two meters must give essentially different readings. If they give the same readings there must be an error in the connections. Only when the power factor is unity do both meters (if properly connected) read alike. With a power factor of 0.87 the reading of the right-hand meter of Fig. 4 is only one-half of that of the left-hand meter. At a power factor of 0.5 the right-hand meter is at rest, and at a still lower power factor it reads backwards.—*Elek. und Masch.*, March 18.

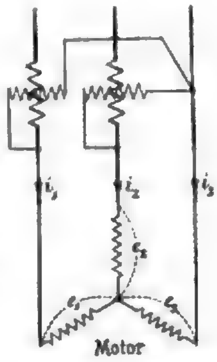


FIG. 4.—CONNECTIONS OF THREE-PHASE METERS.

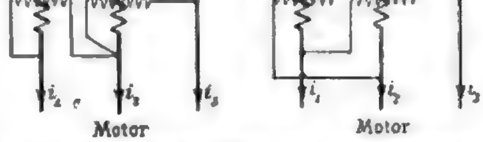


FIG. 5.—CONNECTIONS OF THREE-PHASE METERS.

Accelerometers.—Trotter.—A paper with illustrations on acceleration and accelerometers.—Lond. *Eng'ing*, March 9.

Electrochemical Equivalent of Silver.—Van Dijk.—A very full paper reviewing the results of previous investigators and giving his own work The following table gives the values (corrected) obtained by various physicists:

Mascart	0.011155	Kakle	0.011181
F and W. Kohlrausch	0.011182	Patterson and Guthe	0.01118
Rayleigh and Sidgwick	0.011176	Pellat and Leduc	0.011189
Pellat and Potier	0.011191	Van Dijk and Kunst	0.011180

Van Dijk devotes considerable space to a discussion of the corrections employed by Richards which led the latter to adopt the value 0.011175, and believes that his own result, $a = 0.011180$ is the true electrochemical equivalent of silver.—*Am. Jour. of Science*, April; from *Ann. d. Phys.*, No. 2, 1906.

System of Units.—Juppont.—An article suggesting a new system of units or rather a new system for determining the dimensions of physical quantities.—*L'Eclairage Elec.*, January 13.—Some criticisms of this article by Brylinski with replies by Juppont in *L'Eclairage Elec.*, February 17, 24, March 3.

Telegraphy, Telephony and Signals.

Measurement of Telephonic Currents.—Duddell.—A note on a lecture before the Royal Institution The speaker emphasized the necessity for measurements in telephonic research, and described various apparatus, such as the delicate micrometer of Shaw for measuring the amplitude of the motion of a telephonic diaphragm, the thermogalvanometer and the oscillograph.

For producing a pure sound he uses either Campbell's vibrating bar or his own toothed-wheel inductor alternator. The chief experiment of the lecture consisted in showing simultaneously on a screen four series of waves indicating respectively the motion of the transmitter diaphragm, the wave-form of the current entering the line, the wave-form of the current at the receiving end of the line and the motion of the received diaphragm. Various vowel sounds were spoken into a speaking tube connected to the transmitter, and the effect of adding inductance and capacity in the artificial line was demonstrated by the shape of the curves. A thread was fixed to the diaphragm in each case and transmitted the motion to a light mirror fastened to a wire round which the thread was wound once, and the time element was given by a moving mirror driven at a uniform speed by an electric motor.—Lond. *Elec.*, March 23.

Miscellaneous.

Electric Needle.—OWEN.—Experiments on fields of force due to electric charges suffer as compared with the corresponding measurements in magnetic fields by reason of the impracticability of obtaining an "electric needle" corresponding to the oscillating magnetic needle. But while it is true that a permanently electrified needle cannot be obtained, it is possible to have one that has equal charges of opposite sign induced by the field. The present paper contains an account of experiments on the use of such a needle for the measurement of electric fields, steady or alternating, and for the experimental illustration of some of the laws of electrostatics. After a presentation of the theory the author discusses the disturbances of the field due to the presence of the needle, and deals with the choice of the needle and with various applications, for instance, for measuring high voltages.—*Phil. Mag.*, March.

BOOK REVIEW.

DIE ABSTIMMUNG FUNKENTELGRAPHISCHER SENDER. I. Hälfte. By A. Slaby. Berlin: Julius Springer. 47 pages, 81 ill.

This pamphlet of 47 pages is a reprint of a series of articles upon the "Tuning of Wireless Telegraph Transmitters," published by Professor Slaby in the *Elektrotechnische Zeitschrift* during the year 1904. The series was continued during 1905, but the 1905 articles are not included in this pamphlet.

Professor Slaby is a professor in the Technical High School in Berlin, a personal friend of the German Emperor, and, after Mr. Marconi, has probably done more than any other man to bring wireless telegraphy to its present state of perfection. For several years past Professor Slaby has given a course in wireless telegraphy in the Technischen Hochschule in Charlottenburg.

In the present pamphlet the mathematical theory of different types of transmitter is worked out. He considers: (1) Transmitters with direct or ohmic linking of the oscillating circuit to the antenna, i. e., the oscillating circuit connected directly to the antenna. (2) Transmitters with inductive linking of the oscillating circuit to the antenna either through a condenser, or through a small electromagnetic transformer. (3) Transmitters in which the damping is made a minimum. No startling results are announced, the principles developed being those actually applied in the various commercial systems now in existence such as the Marconi, the Telefunken, the De Forest, etc.

BOOK RECEIVED.

CORSO DI ELETTROTECHNICA. Volume II. Motori, Convertitori, Accumulatori, Sistemi e Impianti di Distribuzione, Lampade Elettriche, Trazione. By Guido Grassi. Rome: Casa Editrice Nazionale. 547 pages, 319 illustrations. Price, 16 lire.

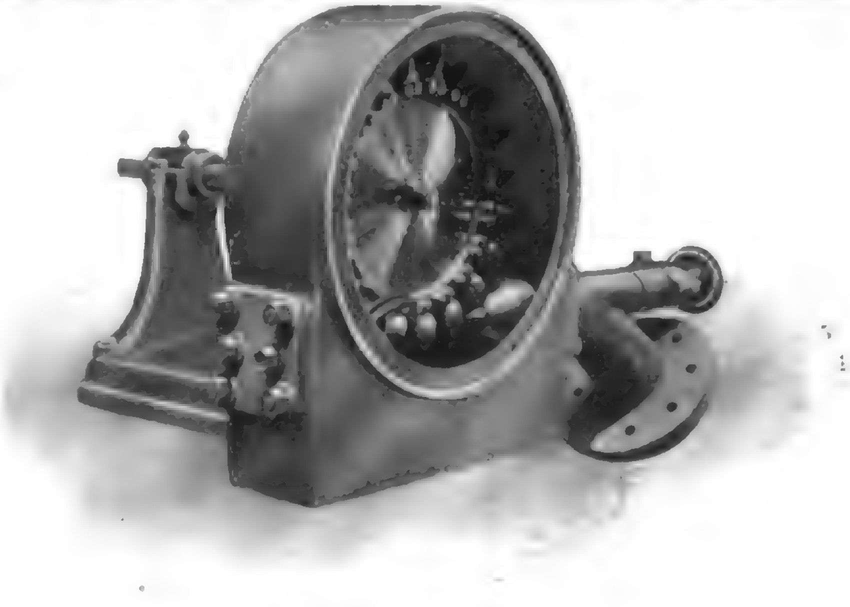
Doble Laboratory Water Motor.

The notable work that is being done in this country, especially in the Western States, in hydro-electric power development, is reflected in the increasing interest that is being taken by the engineering schools and technical colleges in electrical and hydraulic questions. Apparatus of the most improved types is being secured for the engineering laboratories for experimental and research work, as the faculties realize the necessity of having modern machinery for instruction purposes. In order to afford students means for studying the development of water power under high heads, the Abner Doble Company, of San Francisco, has designed a 12-in. water motor of the tangential type especially for laboratory use.

This small machine, which is illustrated herewith, is self-contained, and has the shaft extended far enough to carry a pulley or prony brake. The buckets are of the well-known Doble ellipsoidal type, of the same design as have been used so successfully on tangential water wheels up to 9,000 hp capacity. The water motor is provided with a Doble needle regulating nozzle for hand control, so that the jet may be varied to give the desired regulation in speed. The housing has plate glass sides in order that the students may easily observe the water acting on, and discharging from, the buckets.

These little Doble water motors embody the best workmanship that can be turned out, and are designed and finished exactly upon the same lines as the largest Doble wheels, the buckets being formed of independent gun metal castings, ground and polished on the hydraulic surfaces, and bolted to the wheel disc, each by two body-bound bolts fitted into reamed holes.

The motors are designed and constructed so as to operate under heads up to 1,000 ft., and are, therefore, admirably suited for experimental use in a hydraulic laboratory under all pressures that are commonly available. Laboratory wheels of this type have been furnished to Columbia University, Polytechnic Institute of Brooklyn, University of Iowa, University of Missouri, University of Illinois, University of Texas, Michigan School of Mines, University of Wisconsin, University of Toronto, University of Colorado, Lafayette College and University of Pennsylvania. Parts of Doble water wheels for experimental purposes have been furnished to the University of Michigan and Massachusetts Institute of Technology. The University of Michigan has also purchased, for its hydraulic laboratory, the 300-hp tangential wheel, which the Abner Doble Company exhibited at the St. Louis World's Fair, and for which it was awarded the grand prize.



LABORATORY WATER MOTOR.

American Electrical Machinery in Foreign Countries.

Japan within a comparatively few years has advanced rapidly in many phases of modern engineering. In the field of electric lighting Japan is particularly well advanced in the matter of equipment. The Nagoya Electric Lighting Company is about to install its second 500-kw Curtis steam turbine for this purpose. The additional equipment includes also a nine-panel switchboard and a small 25-kw horizontal Curtis turbo-exciter set made by the General Electric Company. The last-mentioned machine indicates how closely the Japanese engineers follow American practice even in details. Another country old in civilization is adopting American electrical apparatus for power, lighting and railway work. Note has already been made in these columns of the electrical transmission plans for the Kashmir Valley and another order from India illustrates a different line of work. The Rangoon Trams of Rangoon, Burmah, have 25 General Electric 80 (40 hp) two-motor railway equipments for service on their systems.

In the western hemisphere Mexico represents the same awakening in industrial enterprises, and is rapidly coming to the front. Many mining properties are being extended and electricity is one of the chief factors. In this connection the American Smelting & Securities Company has ordered power house equipment for its Velardena Mines. This apparatus includes two General Electric 450-kw, three-phase revolving-field generators complete with switchboards and exciters. Electricity from the famous Nacaxa Falls power development will be used in Mexico City for lighting, power and railway purposes. The railway lines are operated by the Mexico Electric Tramways, Limited, and this company will also use machinery and railway apparatus built in the United States. The entire equipment for the railway will be furnished by the General Electric Company and will consist of four complete sub-station equipments, generator sets, exciter sets and complete switchboards for each sub-station. The cars will be operated by two-motor and four-motor equipments.

Electrically Driven Grinding Tools.

The British Thomson-Houston Company, Limited, has devoted much attention to the application of the electric motor to machine tool work, and as a result of experience in its own workshops has recently perfected a line of motor-driven emery wheels adapted to any class of work, and suitable for use on any machine tool.

The frame of the motor is cylindrical in form, and is a steel casting with inwardly projecting poles, fitted with removable malleable-iron tips, which serve to hold the field spools in position. The field spools are form-wound and the armature is of the slotted drum-wound type. The brushes are of carbon, and are pressed forward by fingers controlled by springs so arranged as to maintain a constant pressure throughout the wear of the brush. Before leaving the works the motors are subjected to a high potential test by the application of an alternating pressure of 500 volts for one minute.

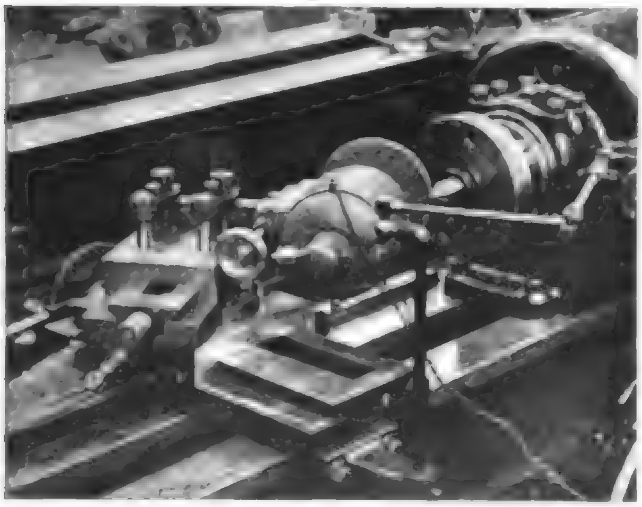


FIG. 1.—PORTABLE ELECTRIC GRINDER ON LATHE.

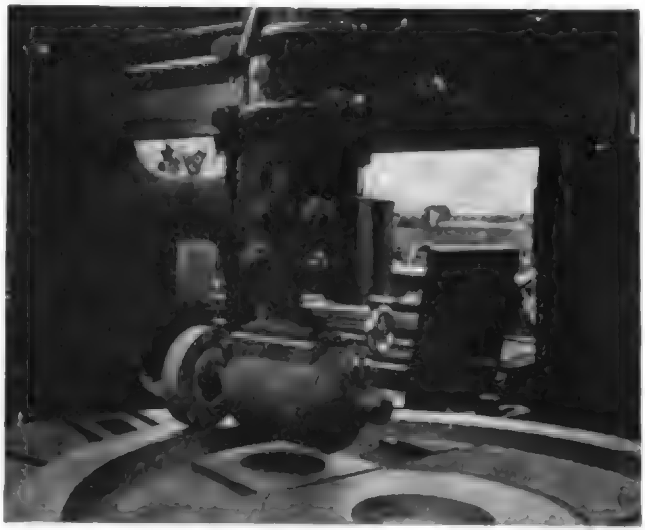


FIG. 2.—PORTABLE ELECTRIC GRINDER ON BORING MILL.

The motor is provided with a cross slide, the bed of which is cast solid with the frame. A fine feed is obtained by means of a left-hand worm operated by a small hand wheel, and gearing with a rack let into the bed of the slide. A removable tool post is secured in the slide and allows of the grinder being set with its axis at any angle. The slide is amply proportioned and adds greatly to the utility of the grinder, permitting its use with equal facility on any machine tool, either with or without compound head or slide rest.

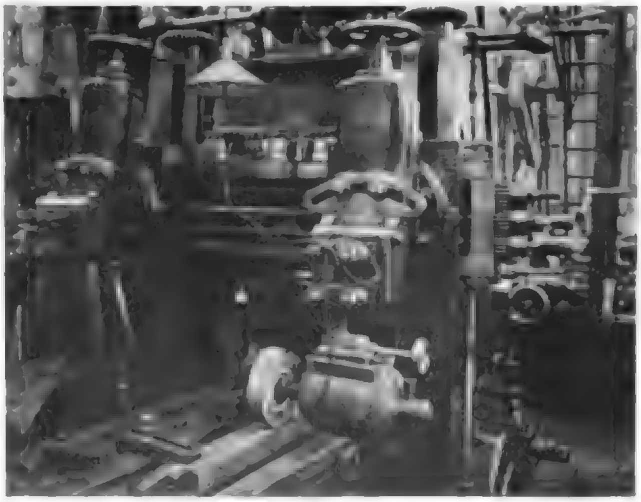


FIG. 3.—PORTABLE ELECTRIC GRINDER ON PLANING MACHINE.

The grinders are wound for use on circuits of 100 to 125 and 200 to 250 volts, and are made in two sizes. One is specially suitable for use with small machine tools and for light tool grinding, and is rated at ⅛ hp at 2,800 r.p.m. The other is designed for moderately heavy grinding, and is rated at ¼ hp at 2,200 r.p.m.

Compactness, strength and durability are special features of British Thomson-Houston electric grinders, and their general adaptability allows of their economical use on a wide range of work

Efficiency Test of Pelton Water Wheels.

A report recently received from a test made upon two Pelton water wheel units by the Nevada Power, Mining & Milling Company, of Bishop, Cal., is interesting as showing what efficiency may be expected from this type of prime-mover when properly designed and erected. The equipment tested consists of two 750-kw generators, each direct-connected to a Pelton water wheel operating at 450 r.p.m., under a static head of 1,065 ft., and transmitting power to the Goldfield and Tonopah districts of Nevada. The water wheels were sold under a rigid guarantee to develop an efficiency of 80 per cent, and a series of exhaustive tests were conducted by the engineers of the Nevada Power, Mining & Milling Company under the following conditions:

The station load was first carried by unit No. 2 and the test made on unit No. 1. The test load was carried by a water rheostat and measurements of the power were made by wattmeters. Readings were also taken by voltmeters and ammeters. The load was constant and the test extended over one and one-half hours. The electric, windage and friction losses of the generator were afterwards obtained by running the generator as a motor. The water pressure was measured by a gauge attached to the pipe just back of the gate, and an allowance was made for the velocity head, which was, however, small at this point. The water was measured by an accurately constructed weir in the tail race. Taking the readings of the wattmeter and adding to it the power necessary to run the generator as a motor, it was found that of the total theoretical power of the water as it entered the nozzle, the wheel delivered to the shaft of the generator 82.8 per cent. The test was made under the supervision of Engineer J. D. Galloway, assisted by the superintendent of the electric plant. A third Pelton wheel of 3,000 hp capacity is now being installed in the same station.

Freight Charges on Old Dynamos.

The Interstate Commerce Commission has sustained the railroads in a recent decision on the complaint of the National Machinery & Wrecking Company, as to charges for freight on an old dynamo; but has suggested changes in the scale or classification. The ruling is an important one as dealing with a large class of electrical apparatus, and is given in full below:

Two questions seem to be presented by this record. First, should the rate on second-hand dynamos be less than that on new dynamos? Second, should the rate on dynamos, when they are only valuable as junk, be the same as on new dynamos? We know of no instance where the rate on second-hand articles, as such, is less than the rate on the new article. There are cases where a lower rate is imposed when a machine is returned for repairs than would be imposed upon a single movement of the machine. The Western Classification provides that when goods which have been shipped to a given destination are for any reason returned, a rate one-half the going rate shall be applied. Under the Official Classification shipments of household furniture, when released to the value of $5 per 100 pounds, take a first-class rate, as against a rate of one and a half times first class when not so released. These instances, and others which might be cited, recognize to an extent the principle that the condition and value of the property may properly be taken into account in determining the classification.

It may also be noted that in the business of handling these second-hand dynamos, the dynamo when shipped from the electric light station to the factory is in the nature of a raw material which is to be converted into a manufactured product. Its value is very much less than that of a new dynamo, and that value depends largely upon the freight rate. In the case before us the complainant paid $85 for this machine and was charged $83.79 for its transportation to Cleveland. Much might be said in favor of a rule which would apply a lower rate to second-hand dynamos when shipped from the electric light station to the repair shop than is charged upon either a new or second-hand dynamo when sent to the station for use; but that is a question of policy for the railroads themselves. This commission cannot say that it is unjust or unreasonable to require the same charge for the transportation of the new and the second-hand dynamo.

The second question is an entirely different one. The dynamo is no longer valuable as such; it has ceased to be an electric machine and has become a combination of copper, brass and iron scrap. Should the same rating be applied to this as to the dynamo?

Under the Official Classification many iron articles in less than carload lots are rated as third class. Most kinds of machinery are second class. Dynamos are first class. Assuming, without expressing any opinion upon that subject, that this rating of dynamos is just and reasonable, it must be upon the ground that the dynamo is a valuable and delicate piece of mechanism which can afford to pay a high rate of carriage and which requires great care in handling. Neither of these things can be affirmed of that dynamo when it has become junk. Its value is no greater than the selling price by the pound of the metal which it contains, nor indeed as great, since a certain amount of labor must be expended before even that price can be obtained. It is apparent that there ought to be some way in which this scrap can be shipped at a less rate than would be applied to the dynamo.

The railroad witnesses state that this can be done; that the tariffs provide a fourth class rate upon iron scrap and a third class rate upon copper and brass scrap; but they further state that in order to obtain this rate the scrap must be presented for shipment in boxes or barrels. In other words, this dynamo must have been broken up at Marietta before it was offered for shipment. The application of such a rule would have prevented the complainant from handling this dynamo or from doing a similar business at other points, and we see no good reason for its enforcement. It was said by the same railroad witnesses that a steam engine, or the flywheel of an engine, or a steam boiler might be shipped at the scrap rate without being broken in pieces, provided it was manifestly of no further use for its original purpose. In the same way, we think it should be possible to ship as junk a dynamo which has been bought for that purpose and which has actually no other value. Such a dynamo need not be boxed nor otherwise prepared for shipment, and it should, of course, bear the rate applicable to the highest class metal used in its construction.

The defendants insist that the application of such a rule would open the door to fraud, and that dynamos which were in fact intended to be repaired and resold as second-hand dynamos would be shipped as scrap. While this objection has some force, we do not regard it as controlling. First, while it is true that railroads are forced to continually guard against misdescriptions of property, we still think that something should be left, in dealing between the carrier and the public, to the good faith of both parties. Second, a dynamo is a delicate piece of mechanism which requires ordinarily careful preparation for its safe transportation by rail. Few shippers would venture to offer a dynamo of much value without such preparation, since the railroad would be absolved from all care in its carriage. Third, the railroad has it in its power to make sure of the good faith of the shipper by requiring the dynamo to be mutilated before leaving the hands of the delivering carrier at destination. It appeared from the testimony that this requirement had on several occasions been imposed upon complainant as a condition of obtaining the scrap rate upon its shipment. Perhaps this might be done before delivery for shipment.

The shipment in question was boxed as a dynamo, and was, as far as could be seen by external inspection, in fact a dynamo. It was described by the Marietta Electric Light Company as "scrap iron," but that company understood that the machine was in fact bought by the complainant as a second-hand dynamo, and that this description was intended to secure a lower rate of freight. Under the circumstances, we think that the defendants were justified in applying to it the dynamo rate, and this complaint will be dismissed; but we also feel that the rules of the carriers should be so modified that the complainant could, had it elected, have shipped this dynamo for what it in fact was, namely, junk. We do not attempt to make any order, for we have no authority to do so, but call this to the attention of the defendants in the hope that they may give it consideration.

Millihour Stop-Watch.

The accompanying illustration shows a stop-watch designed for electrical meter testing work, which has proved to be a successful tool in the hands of the meterman, as it enables him to do away with many calculations and permits the use of testing methods of simplicity hitherto unknown. The watch is non-magnetic and has a running time of .01 of an hour for the complete revolution of the large hand. The dial is divided into ten divisions representing .001 of an hour or one millihour.

The object of this appliance is to get readings direct in decimal parts of an hour, since the watt-hour is the standard for the measurement of electrical energy.

If a watt-hour meter shows a certain number of watt-hours (revolutions × watt-hour disc constant) in a certain number of millihours, the quotient of both will give the load in kilowatts passing through the meter.

If a given load in watts is applied to the meter for a time of 10 millihours (100 divisions on the watch) it can be arranged so as to compel the disc of a correct meter to complete one, two, three, etc., revolutions in this space of time. The same meter if out of adjustment, for instance, slow, will, under the same load, make the same number of revolutions in a longer time, and the watch will show direct without calculation, in hundredths, the correction factor of the incorrect meter, thus saving time and cutting out all liability to error. This watch, it is said, has found acceptance by a number of California electric companies, and is sold by Mr. Kleinenbroich, Oakland, Cal., and has been brought to our attention by Mr. J. Van der Zande, of the United Railroads of San Francisco.

MILLIHOUR WATCH.

Round Pattern Direct-Current Switchboard Instruments.

The line of direct-current, round-pattern switchboard instruments made by the American Instrument Company, of Newark, N. J., of which the accompanying cut illustrates the form, are of the movable coil, permanent magnet type. As instruments of this type have been in general use for years, and are universally considered to be most satisfactory for measurements on direct-current circuits, it is not necessary here to dwell upon their principle, and reference will be confined to the specific construction and design of the instruments.

Long previous experience had indicated that the usual method of pivoting movable coils in instruments of this class is responsible for most of the troubles encountered in actual switchboard service; also that a large percentage of the causes which make such instruments defective after being installed and in daily use for any length of time, are due to the cases not being permanently dust-proof. That is, they allow the accumulation of dirt between movable and fixed parts, which tends to obstruct the free operation of the instruments.

Special care is given to pivoting the movable coils of the "American" instruments in such manner that if free of friction when new they will remain so always. This is accomplished by using highly polished cylindrical steel pivots, journaled in the best grade of watch jewels. The mechanical difficulties in producing in this way an instrument which does not show any noticeable friction are greater than if the method of placing conical pivots in conical jewels is used; but when once accomplished an instrument of this kind will remain practically frictionless for many years. In the case of conical pivots, an instrument will seldom show any friction under the first laboratory test, but will develop serious friction as soon as the microscopical point of the pivot is damaged by transportation, by handling in erection, or by the continuous vibration to which switchboards are usually subjected.

The cases of the switchboard instruments are designed so that ample surface is provided where detachable parts are joined, and are guaranteed to be perfectly dust-proof. In this way the vital parts of each instrument are protected efficiently from any accumulation of dirt, which, if present, would interfere seriously with satisfactory operation.

The permanent magnets are made of the best magnet steel obtainable, hardened and aged in accordance with the most improved methods. The movable systems combine lightness with extreme stiffness, and with the method of pivoting used it is claimed to be impossible for the moving coil to come in contact with the pole pieces or core of the magnetic system. By the selection of a proper winding for the movable coils, the instruments are given a somewhat larger torque, which permits the use of stronger controlling springs. Zero errors, so often noticeable in other instruments, are completed avoided. The power consumed in the instruments is stated to be not noticeably larger than that in the best of other makes.

The series resistance in the voltmeters is wound perfectly non-inductive, and all voltmeters have a negligible temperature coefficient. In the ammeters the combination of instrument and shunt is also compensated over a large, and for all practical purposes, a sufficient range of temperature. All voltmeters are adjusted to a uniform resistance per volt, and therefore multipliers can be interchanged. All ammeter shunts are adjusted to the same drop of potential and are also interchangeable. The shunts are constructed to dissipate the heat generated therein in a most satisfactory way, and will not overheat when run continuously.

SWITCHBOARD VOLTMETER.

The scale opening in the front of the case is considerably larger than the instruments of other manufacture. Thus, more light is admitted to the scale and it can be read more clearly. While back connections are preferable through obviating the necessity on the part of the buyer of drilling holes through the switchboard for leading-in wires, the instruments are also furnished with suitable binding posts. All instruments can be converted into the "flush type" by the mere addition of a special guard ring, easily attachable to a switchboard.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports show that retail trade has, in general, been stimulated by the spring weather conditions; that the winter wheat situation is excellent, and that there is continued activity in nearly all lines of industry. Railway earnings are heavy; bank clearings have increased and there is little adverse effect of the coal miner's partial shutdown. The rush of spring jobbing is now about over, but improved retail demand has already evoked some reorder business, and encouraging reports as to enlarged orders for fall delivery present themselves. *Bradstreet's* reports that the failures for the first quarter of 1906 number 2,791, a decrease of 5 per cent from 1905, and of 2.6 per cent from 1904. Liabilities, while 20 per cent larger than in 1905, are 26 per cent smaller than in 1904. The number of failures during the week ending April 5 was 151, against 169 in the week previous and 170 in the corresponding week last year. Clearings for March (ninety-four cities reporting) aggregate $12,911,071,121, a fraction of 1 per cent gain on March, 1905, despite a decrease of 4 per cent at New York. For the quarter clearings at all cities aggregate $41,535,590,466, a gain of 17.8 per cent over 1905 and of 63 per cent over 1904. The coal strike on April 1 did not cause a total shutdown, except in the anthracite field. In the Pittsburg district half the operators granted the 1903 scale immediately, and the same is true of central Pennsylvania. The Maryland and West Virginia non-union mines continued at work. In Ohio, Indiana and Illinois the shutdown was, however, more marked. Stocks of coal vary with the regions affected. Chicago stocks are said to equal 30 to 90 days' consumption for manufacture, and the railways are said to be well supplied and are handling a record tonnage. Price advances to those in need range from 50 to 75 cents. In anthracite the actual advance is 50 cents, but the failure of the usual spring cut to go in force makes the advance over a year ago $1 per ton. No real pinch is expected in supplies unless the strike lasts a long while, which, at present, does not seem likely. Electric lighting and street railway companies are understood to have taken good care of themselves. Thus the New York Edison Company is said to have 200,000 tons at its Shadyside depot on the Hudson River opposite Manhattan Island. Pig iron is a little more active so far as demand and inquiry go, but prices are probably lower. It is thought that the coal miners' disturbance will occasion little inconvenience unless protracted, as the strike is but partial and manufacturers' stocks are ample, though anthracite furnaces in the East may be affected later on. New business in steel rails is of moderate volume. A heavy business in structural material is in sight. Demand for plates is not so good, but deliveries are heavy. Sheet bars are scarce. Cast-iron pipe is more active and some good business is in sight. In some sections demand for old material has improved, but in others prices are weaker. Copper is steady, but domestic business slightly declined, though over-sea interests purchased more freely. The machinery trade is active, and while the coal miners' trouble does not go unnoticed, it has not interfered with business.

ELECTRIC SERVICE SUPPLIES.—The new Electric Service Supplies Company is a consolidation of the Mayer & Englund Company, of Philadelphia, the Garton-Daniels Company, of Keokuk, Ia.; the Electric Devices Company, also of that place; and Porter & Berg, of Chicago. The new company has been formed with the following officers: President, C. J. Mayer; first vice-president, J. W. Porter; second vice-president, J. V. E. Titus; secretary, Max A. Berg, and treasurer, A. H. Englund. Sales offices will be maintained in Boston, New York, Philadelphia, Pittsburg, Cleveland, Chicago, Atlanta, Birmingham, New Orleans, St. Louis, Keokuk, Kansas City, San Francisco and Los Angeles. The Mayer & Englund Company, of Philadelphia, has been one of the largest concerns in the world devoted to the electric railway supply business exclusively. When the firm was founded in December, 1895, by Chas. J. Mayer and A. H. Englund, it began business by handling the manufactures of the R. D. Nuttall Company and the International Register Company. Shortly afterward the line insulation of the Macallen Company was taken up. At that time the company had two small offices in the Betz Building. To-day the company is the sole occupant of a splendidly equipped nine-story structure, having a 60-ft. front on Filbert Street and a depth of 80 ft. extending through to Commerce Street. The line of materials handled by this company has grown so extensive that only brief mention can be made here of its specialties. These comprise "Protected" rail-bonds; Nuttall gears, pinions and trolleys; Brady bearings, journal boxes, etc.; International registers; Macallen insulation; Sterling varnishes and paints; Lyon sheet steel gear cases, Packard incandescent lamps, and many others. The firm of Porter & Berg was organized by J. W. Porter and Max A. Berg, in 1899, to conduct a general electrical supply business, with headquarters in the Manhattan Building, Chicago. In 1902 larger quarters were taken at 305 Dearborn Street, the entire second floor of which serves for the offices of the company, while the warehouses are located at 45 Plymouth Place, directly opposite. Under the new arrangement these offices and warerooms will now handle all of the Mayer & Englund devices besides the products of the two Keokuk companies mentioned below. These are the Garton-Daniels Company, of Keokuk, Ia., which has done so much valuable work in the development of lighting apparatus and other protective devices, was founded in 1892, and since 1895 has been managed by J. V. E. Titus. In 1901 the Electrical Devices Company was formed in Keokuk by the same interests to push the "Automotoneer," a mechanical device for regulating the speed of controller application. It is intended to use the Keokuk plant of these companies for the manufacture of other products handled by the Electric Service Supplies Company.

NIAGARA TROLLEY BRIDGE.—The Trans-Niagara Bridge Company has been incorporated at Albany for the construction of a bridge to cost $800,000 for trolley service across the river at Niagara Falls 300 feet below the present upper steel arch bridge and connecting the International Railway system on the American side with the McKenzie-Mann-Nicholls system of electric roads in Canada. This will permit the running of through electric cars between Buffalo and Toronto, Hamilton and other Canadian cities and between Rochester and Lockport through Niagara Falls to Hamilton and Toronto. When the new bridge is finished the present upper bridge will be reserved for carriages and pedestrians.

MAGNETITE IRON ORE.—Witherbee, Sherman & Company, Inc., operating the well-known magnetite mines at Mineville, N. Y., have recently shipped carload lots of concentrated iron of over 71 per cent purity to the General Electric Company, Schenectady, N. Y., and to the Monsanto Chemical Works, St. Louis, Mo. Only once have these figures been surpassed when a carload analyzing 71.85 per cent iron was shipped to the General Electric Company. The average iron in the daily output is from 66 to 67 per cent for the purest grade, none falling below 60 to 61 per cent for the lowest grade, with the output of the mines approaching the 900,000 ton per year mark.

TURBINES FOR PARIS.—Ten American turbines and other machines are to be installed in Paris for the purpose of generating electricity to operate a network of street railways in that city. The French Thomson-Houston Company representative of the General Electric Company has secured the contract for all the electrical equipment of these roads. The work involves the installation of the largest steam turbines ever used in France. The contract is worth about $3,000,000. The capacity of the plant will be 80,000 hp.

BELFAST, IRELAND, PLANT.—The fine plant at Belfast, to which special attention was directed recently in these pages, was carried out by the J. G. White & Company, of London, England, who were entrusted with the whole contract. This is one of the largest contracts of the kind done of late in Great Britain, the amount involved being no less than $2,200,000, and the work including power station, track, overhead construction, and other details.

ORDER FOR JAPAN.—The American Trading Company, of New York, recently purchased another 18-in. by 42-in. Reynolds heavy-duty engine from the Allis-Chalmers Company for shipment to Japan.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having just closed a contract with the Kinloch Long-Distance Telephone Company, of St. Louis, Mo., for 10,000 central energy telephones. This is the first order the Kinloch Company placed for new telephones to be used in conjunction with the 17,000-line switchboard now being installed by the Stromberg-Carlson Company. This is one of the very largest installations in the independent field.

KOERTING GAS ENGINE ORDERS.—Since last October the Koerting Bros. Co., Koertingsdorf, Germany, have closed contracts for 17 two-cycle gas engines ranging in size from 300 to 2,200 hp to be installed in various parts of Europe. Several of these are repeat orders, showing the success with which the large gas engine is meeting in Europe.

WIRELESS EQUIPMENT.—The Standard Oil Company has given an order to the Atlantic De Forest Wireless Company to equip the tug *Standard* with De Forest wireless instruments. The *Standard* is engaged in coastwise towing for the Standard Oil Company.

BROOKLYN EDISON IMPROVEMENTS.—The Brooklyn Edison Company proposes to spend this year $3,000,000 in new work and in putting more of its wires underground.

Financial Intelligence.

THE WEEK IN WALL STREET.—Stock prices developed irregular tendencies on the unexpected firmness of money and uncertainty about the negotiations between the coal miners and operators. Manipulative advances were partially successful, but public interest and participation were slight. Stress continues to be laid upon the favorable crop prospects, the activity of business and the excellent earnings of both railroad and industrial properties, yet the condition of the money market is calculated to create conservatism, and it is presumable that large financial interests are not in sympathy with the attempt to mark up stock prices in the face of call loan rates ranging from 6 to 30 per cent. The action of the money market is directly attributable to the enlarged employment and demand for money all over the country, not only in legitimate business channels, but in connection with speculative operations in real estate, which have assumed considerable dimensions and activity at various cities. The United States Steel stocks developed considerable strength, the support given to them being based on assurances that the company will not be placed at any disadvantage as regards its coal supplies by the strike. Amalgamated Copper was more or less of a feature, its advance being accompanied by talk of an increase in the dividend rate. The market for electric securities was weak in the main and most of these stocks are lower. Allis-Chalmers common closed at 21⅝ and preferred at 57⅞, these quotations representing a net decline of ¾ point in each case. General Electric gained ¾ of a point, closing at 173, and Westinghouse closed at 160, an advance of 1½. The tractions are lower, Brooklyn Rapid Transit closing at 86½, a decline of 1⅞, and Metropolitan Street Railway at 115⅝, a net loss of 2⅜. American Telephone & Telegraph lost ½ point, the last quotation being 139¼; New York & New Jersey Telephone closed at 150, ex.-div., which is a decline of 3¾, and Western Union at 92⅝, this being a gain of ⅛ point. The closing quotations of American Locomotive were 68½ for common and 115 for preferred. On the curb Interborough Rapid Transit closed at 232½, a gain of 3½ points; Interborough-Metropolitan common at 53⅝ and preferred at 89¼, these latter figures being net declines of ⅝ and 1⅝ points, respectively. Mackay Companies advanced 1½ points net, the closing price being 62½. The closing quotations of April 10 are given in the accompanying table.

NEW YORK

	Apr 3	Apr. 10		Apr. 3	Apr. 10
Allis-Chalmers Co.	22⅜	21⅝	General Electric	173	[illegible]
Allis-Chalmers Co. pfd.	58⅝	57⅞	Hudson River Tel.	...	...
American Dist. Tel.	30	...	Interborough Rap. Tran.	232	236
American Locomotive	70⅛	67⅛	Mackay Cos	63⅝	61⅝
American Locomotive pfd.	116	114¾	Mackay Cos pfd.	73	72⅝
American Tel. & Cable	92	91	Marconi Tel.	...	...
American Tel. & Tel.	137⅝	138	Metropolitan St. Ry.	118	115⅝
Brooklyn Rapid Transit	88⅜	86½	N. Y. & N. J. Tel.	...	...
Electric Boat	27	27	Western Union Tel	91⅛	91⅝
Electric Boat pfd	66	66	Westinghouse com.	160	160
Electric Vehicle	12	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	15	16			

BOSTON

	Apr. 3	Apr. 10		Apr. 3	Apr. 10
American Tel. & Tel.	139¾	139	Mass. Elec. Ry. pfd	68	68
Cumberland Telephone	..	...	Mexican Telephone	4⅜	4⅜
Edison Elec. Illum.	248	...	New England Telephone	140½	141
General Electric	173¾	...	Western Tel. & Tel.	13⅝	...
Mass. Elec. Ry.	19½	19	Western Tel. & Tel. pfd.	80	...

PHILADELPHIA

	Apr. 3	Apr. 10		Apr. 3	Apr. 10
American Railways	52	53⅜	Phila. Electric	8	7⅞
Elec. Co. of America	11⅝	11⅝	Phila. Rapid Trans.	29	27⅞
Elec. Storage Battery	78	78	Phila. Traction	90¼	90
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Apr. 3†	Apr. 10		Apr. 3†	Apr. 10
Chicago City Ry.	...	150	National Carbon	...	90
Chicago Edison	..	...	National Carbon pfd	..	120
Chicago Subway	...	63⅝	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	..	..
Metropolitan Elev. com.	..	26			

† Election Day

HUDSON RIVER TROLLEY TUNNELS.—According to an official statement of the Hudson and Manhattan Railroad Company, the total issue of securities of this company will be $250,000,000. The Hudson and Manhattan Railroad Company will be the operating and holding company of the stocks of the various tunnel and railway enterprises of what are commonly known as the McAdoo tunnel projects. There are two tunnels under the North River nearing completion, the large terminals to be constructed and the connecting railroad in New Jersey and other enterprises which will be directed by this company. There is to be authorized $100,000,000 of four and one-half per cent bonds of which $50,000,000 is to be issued. The bonds are convertible into common stock. This convertible clause necessitates an issue of $100,000,000 common stock to provide for the bonds. In addition, there is to be $10,000,000 five per cent preferred stock, and $40,000,000 of common stock additional.

CHANGE IN WESTINGHOUSE OFFICERS.—At a meeting of the Board of Directors of the Westinghouse Electric & Manufacturing Company held Tuesday, April 10, Mr. L. A. Osborne, formerly third vice-president of the company, was elected second vice-president to succeed Mr. Frank H. Taylor, resigned. Mr. Taylor will retain his seat on the Board of Directors of the company. Mr. Osborne's duties as third vice-president comprised the direction of the engineering and manufacturing activities of the company. As second vice-president he will assume the direction of the commercial branch while retaining those of the engineering department. Mr. Osborne is a graduate of Cornell University and entered the employ of the Westinghouse Electric & Manufacturing Company in 1891, and has successively held the positions of assistant superintendent, assistant to the vice-president, manager of works, fourth vice-president and third vice-president.

TELEPHONE BONDS.—The syndicate which underwrote $25,800,000 of the 4 per cent collateral trust bonds of the American Telephone & Telegraph Company has been dissolved by limitation of time. Delivery of the last $5,000,000 of the bonds was made to it since January 1, of the present year. The syndicate which has underwritten the first $100,000,000 of the new convertible bonds of the company has not as yet placed its holdings. The underwriters are waiting for lower money rates and a better bond market before they bring out the new bond issue.

MARCONI WIRELESS.—The Marconi Wireless Telegraph Company of America issued its annual report recently. It shows $6,190,000 stock issued, and $5,473,364 patent rights, good will and contracts. The report does not show it, but it is understood that the message business during the year was double that of 1904. Over 70 ships are equipped for communication with the Marconi stations, and recent arrangements include 13 steamers of the Cunard, Hamburg-American, North German Lloyd, and French lines. The business in apparatus, etc., is reported as being three times what it was in 1904. During the year one or two of the experimental stations were closed up and written off.

CANADIAN ELECTRIC ROADS.—President Dornville of the Canada Central Railway Company announces that his company has purchased the Irondale, Bancroft & Ottawa Railway Company and the Ottawa River Navigation Company. The Canada Central Railway intends to build an electric line from Montreal to Georgian Bay by way of Ottawa, and the two companies secured will give it valuable franchises.

GERMAN SUBMARINE CABLES.—The annual reports of the German Atlantic Telegraph Company show a profit of nearly two million marks for the year. A dividend of 6¼ per cent has been declared.

DIVIDENDS.—The directors of the Bell Telephone Company. of Philadelphia, have declared a regular quarterly dividend of 1½ per cent, payable April 16, as registered April 5.

GENERAL NEWS.

Construction Notes.

TUSCALOOSA, ALA.—The City Council has granted Robert Jemison and associates a franchise for water works, electric light plant, gas plant and a street railway.

MONTGOMERY, ALA.—Charles B. Stark, of St. Louis, Mo., is petitioning for a franchise for the operation of an independent telephone system in Montgomery. The City Council has the matter under advisement.

BIRMINGHAM, ALA.—The stockholders of the Birmingham Railway, Light & Power Company have ratified the action of the directors in deciding to increase the capital stock of the company from $6,000,000 to $7,000,000, so as to provide funds for extensions and improvements.

EUREKA SPRINGS, ARK.—An electric light franchise for ninety-nine years was granted to G. U. Matthews and C. M. Barnes, of this city, by the City Council. In the franchise is a contract fixing maximum rates for lights, which provides a sweeping reduction in prices charged by the Citizens' Electric Company, which has had a monopoly for the past seven years.

PALO ALTO, CAL.—It is stated that bids will be received until April 19 for improving the light and water works plants. J. J. Lewin is superintendent.

ANAHEIM, CAL.—A special election will be held April 14 to vote on a $69,000 bond issue, of which $25,000 will be used for an electric light plant and distributing system.

PASADENA, CAL.—The Pacific Electric Railway Company is planning an extension of its line north on Fair Oaks Avenue, from Montana Street to Mariposa Street, comprising a new route to Altadena.

OAKLAND, CAL.—The capital stock of the Home Telephone Company, of Alamada County, has been increased from $3,000,000 to $7,000,000, according to amended articles of incorporation recently filed.

VALLEJO, CAL.—The California Gas & Electric Corporation is building a power line to supply this city and the Government Navy shops on Mare Island direct from its present trunk system at Cordelia.

SAN FRANCISCO, CAL.—Chief Hewitt, of the Department of Electricity, in his annual report to the Board of Supervisors, estimates the cost of work in connection with underground district No. 4 at $46,409.

SAN BERNARDINO, CAL.—The Sunset Telephone & Telegraph Company will at once build a modern exchange building, place wires underground and make other improvements in the service at a cost of more than $30,000. The new switchboard will have a capacity of 2,000 subscribers.

SAN DIEGO, CAL.—An important transfer of railway and electric lines, involving $546,000 was recorded here recently. All the interests of E. S. Babcock in this city, consisting of trolley lines and a steam railway to La Jolla, were made over to the Los Angeles & San Diego Beach Railway Company.

BERKELEY, CAL.—The town trustees have awarded the contract for the furnishing of electricity for the street lamps and for the town buildings to the Berkeley Electric Light Company (subsidiary to the California Gas & Electric Corporation) at the rate of $6 per street lamp on an all-night schedule, and 50 cents per each interior lamp, with no charge for the lighting of the Town Hall.

SAN FRANCISCO, CAL.—A railroad is to be built from Santa Rosa to Healdsburg and thence up the Dry Creek Valley to the Geyserville and Skaggs Springs wagon road, an estimated distance of 23 miles. The company which has been formed to carry out this project is known as the Santa Rosa & Northern Railroad, and the directors are William A. Cattell, Edwin T. McMurray, J. H. Sandford, P. S. Scales and W. G. Taylor, all of this city. The capital stock is $500,000.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Light Company, owing to the recent disastrous fire in its Station C building on Jessie Street, is spending about $400,000 on a new building and machinery. The building will contain eight 1,000-kw motor-generators, 12 transformers of corresponding capacity, 176 bus-bar compartments, 194 20,000-volt high-tension switches and 173 feet of switchboards, which control all the lights in the downtown district. The building proper will represent an outlay of $100,000 and the machinery about $300,000.

PLACERVILLE, CAL.—The Eldorado Water & Power Company has bonded the property of the El Dorado Water & Deep Gravel Mining Company, and has made the first payment thereon. The company owns exceedingly valuable water rights on the American River, Echo Lake and Sliver Lake, besides minor sources of supply, and a canal 35 miles in length from the American River to Placerville. The purchasing company proposes to combine this system with water rights on the Cosumnes River and crown the undertaking with a large dam on the Cosumnes River at Buck's Bar, seven miles from Placerville with an immense masonry dam which will give 1,100 feet of fall for electric power purposes. Canals will then be extended into Western El Dorado County and Eastern Sacramento County to distribute the water for irrigation purposes.

STOCKTON, CAL.—It is stated that arrangements are being made by the American River Electric Company to construct a large steam power plant in this city to supply customers with power when there is a break in the line between here and the hydro-electric plant near Placerville. The company has had much trouble owing to heavy rains washing out a portion of the flume or other portions of the plant. With an auxiliary plant here there would not be much interruption in the service. A second pole line from the power-house on the American River is also being constructed. Should both lines be useless the plant in Stockton will furnish the power for the entire circuit. The machinery has been ordered and it is estimated that the total cost will be about $250,000. The aggregate cost of all the changes outlined, including the steam system, will be $400,000.

LOS ANGELES, CAL.—A $1,000,000 contract was awarded in Los Angeles recently for the erection at Redondo of one of the largest steam power plants west of New York. The increasing need of the Los Angeles Railway Company for more power to operate its lines is one of the main reasons for the enterprise. Sufficient power will be generated, however, to supply an enormous demand aside from that of the Los Angeles Railway Company. The parties to the big contract are the Pacific Light & Power Company. The power to be generated is placed at 25,000 hp. and the amount named for steam and electric equipment is something more than $1,000,000. Added to this will be the cost of the building that is to house the machinery. This figure is placed at $250,000, making the total cost of the plant about $1,250,000. Work on the plant will begin within sixty days, and it is hoped that the plant may be placed in operation in a year.

DENVER, COLO.—Work on the construction of the Denver-Southeastern Railway Company will possibly begin on or about April 15.

COLORADO SPRINGS, COLO.—The city of Colorado Springs will soon be asked to grant a franchise to the Colorado Springs & Interurban Company for a line on Kiowa Street to connect the Wahsatch Avenue and Institute Street lines. Citizens have signed a petition, but action on it will be delayed pending an agreement with the Santa Fe Railway Company and the street car company for the construction of a loop on railroad ground. The street car company has offered to pay one-third the cost of constructing the Costilla Street conduit, work upon which has already begun.

WALLINGFORD, CONN.—Plans are under consideration for extending the present electric plant of the borough. An appropriation will be voted from the accumulated surplus earnings from the operation of the Borough Electric Works to meet the cost of the proposed improvements.

BROOKLYN, CONN.—The Connecticut Railway & Lighting Company has submitted an agreement to extend its railway to this town and Town Plot, but the terms were not altogether satisfactory to the town committees, and the matter has been held over for further consideration.

BRIDGEPORT, CONN.—Plans are being prepared for the construction of a large new power plant for the Wheeler & Wilson Manufacturing Company. The object is to concentrate the power used in the various buildings of the extensive plant. The new power station will be equipped with vertical direct-connected engines, having a combined capacity of 1,200 hp. The new station will be so constructed that the output can be increased at any time it is deemed necessary.

MIDDLETOWN, CONN.—The contract recently made by the city with the Middletown Electric Light Company to furnish the city with electric lights for a term of three years, went into effect April 2. By its terms the company is to furnish 105 arc lamps and 11 series lamps. The contract price for the arc lamps is $92 a year for each lamp and $18 a year each for the series lamps. This means a saving to the city of approximately $1,000 a year over the price paid under the old system.

GROTON, CONN.—The new power plant of the borough of Groton is nearing completion. In view of the early completion of the building the contract has been let for moving some of the equipment at the old power house to Groton borough. The smoke stack and boilers are included. The contract has been awarded to John Woodmansee of Norwich. The Poquonoc plant will be run by water power and the old gasoline engine during the remainder of its life. Unless some unforeseen accident should cripple both sources of power there will be no lessening of the efficiency of the service.

MANCHESTER, CONN.—The matter of the unsatisfactory system of lighting in the places of business and residences at the north end of the town has been brought to the attention of the officials of the Manchester Light & Power Company, who have charge of the lighting system in that section, and it is understood that they have plans under consideration whereby the situation is soon to be relieved. If their plan is carried out it will mean that a large number of meters will have to be installed. The power for the local company is now generated at the station of the tramway company, and should any of the talked of changes there take place it is quite likely that the Manchester Light & Power Company would arrange to supply its own power.

WILMINGTON, DEL.—The Brandywine Gas & Electric Company, to supply gas and electric currents in Wilmington, Del., has applied to the Street and Sewer Department of that city for the right to do business there. The incorporators are Messrs. William H. Fuhr, Jr., William L. Hahn, John M. Patterson, William H. Sutton and John Herbert. The concern is capitalized in $100,000.

DOVER, DEL.—The Middletown & Odessa Trolley Company, running a line between Middletown and Odessa, is negotiating for a right of way for the extension from Odessa to Delaware City, the present terminus of the New Castle & Delaware City Company. If this line is extended to Delaware City, it is probable that the Smyrna & Delaware Bay Traction Company will extend its line to Middletown, thus giving a continuous service from Wilmington to Smyrna and then to Dover.

MACON, GA.—The Macon Railway & Light Company has decided to build a three-mile extension to Summerfield.

ALBANY, GA.—At a meeting of the Albany Business League a resolution was adopted that a committee immediately take up the matter of the city ownership of an electric railway system, the power to be brought from Big Shoals.

WAYCROSS, GA.—J. E. Dempsey will apply for a franchise for the Waycross Electric Street Railway, Light & Power Company, and if the franchise is granted the company agrees to begin work on an electric line during the present year.

COLUMBUS, GA.—The new Columbus Power Company has acquired all the property lying along the river nearly to West Point, and now practically controls the river front for a distance of 26 miles. Important developments are looked for in the near future.

CHICAGO, ILL.—The Chicago Edison Company and the Commonwealth Electric Company have decided to expend about $4,500,000 in improvements. Samuel Insull, of Chicago, is president of both companies.

WAUKEGAN, ILL.—Wetherson, Eglar & Co., of Chicago, have secured the contract for constructing the central power plant of the North Shore Electric Company, Samuel Insull, of Chicago, president. It is stated that a substation will be erected at Lake Bluff, at a cost of $25,000.

CRISMAN, IND.—The Portage Telephone Company has increased its capital from $10,000 to $30,000.

HUNTINGBURG, IND.—The Dubois County Telephone Company will increase its capital stock from $20,000 to $25,000.

INDIANAPOLIS, IND.—The Pike County Telephone Company will increase its capital stock from $25,000 to $40,000.

SOUTH BEND, IND.—The St. Joseph County Commissioners have granted a ninety-nine year franchise to the Kalamazoo, Elkhart & South Bend Traction Company.

WAVELAND, IND.—A company, headed by A. P. Hanna, will soon ask for bids for the furnishing of a switchboard, wire and the construction of a telephone plant in this place.

KOKOMO, IND.—C. A. Jay, general manager of the Citizens' Telephone Company, is asking for bids for the furnishing and putting in of about $15,000 worth of underground and overhead cables.

EVANSVILLE, IND.—The City Council has voted to create a city ownership fund. The ordinance provides that the $12,500 recently received from the Cumberland Telephone Company should be used in starting the fund.

WABASH, IND.—The Home Telephone Company is preparing to construct a new business block to be used for the company's exchange. The company will soon be in the market for a new multiple switchboard of the latest type.

TERRE HAUTE, IND.—The Board of Public Works and City Council have made a five years' contract with the Terre Haute Light and Traction Company for street lighting. The price is $70 per lamp per year. This action puts an end to the municipal lighting scheme that has been advocated for a year or more.

EVANSVILLE, IND.—A mortgage for $550,000 has been signed by the directors of the Evansville & Eastern Traction Company to cover a bond issue for that amount to the Pittsburg Bond Company, which will furnish the necessary capital for building the road from Newburg to Rockport. The road is capitalized at $1,500,000.

HARTFORD CITY, IND.—A. B. Trentman, of Ft. Wayne, is asking the City Council for a franchise to supply electric light and power to business houses of this city. Mr. Trentman is building paper mills in this city and it is his plan to make the plant generate sufficient power to operate the mill and give merchants power for both day and night service.

RICHMOND, IND.—The proposition to sell the municipal electric light plant has aroused considerable feeling in this city and an intimation of graft. The Council has appointed a committee to investigate and bring in a report as to the actual cost of the plant to date. It is understood that the Light, Heat & Power Company, which has operated in Richmond for a long time, is to be the purchaser. The proposition embodies an agreement to organize a new company under the laws of Indiana, which shall not only take over and absorb the municipal plant at cost, but which shall take over the holdings of the private company. The matter will be referred to a vote of the people. Richmond's municipal ownership experiment has been an interesting one from many standpoints. Mayor Zimmerman has been an enthusiastic advocate of municipal ownership of lighting from the start, but he now says that the competition has cheapened the service, nothing more can be gained, and therefore he is equally enthusiastic for the sale of the plant. The report of the committee is awaited with interest.

MARIETTA, I. T.—G. Saeger, of Rich Hill, Mo., has secured the contract for constructing water works and an electric light plant in this place for $25,144.

NOWATA, I. T.—The City Council has granted a 20-year electric light and power franchise to H. I. Strother of this city. Mr. Strother has agreed to have the plant completed within six months.

MUSKOGEE, I. T.—W. L. Reeves, of Muskogee, writes that he has just received a franchise for an electric light plant. A company is being organized and it is expected to be ready to construct light and power plant within a year.

DECORAH, IA.—The citizens have voted to grant a franchise to the Upper Iowa Power Company.

DES MOINES, IA.—The Des Moines, Winterset & Creston Interurban Railway has been granted a franchise in both Creston and Macksburg. The town of Winterset voted on a franchise to this company at a special election held the latter part of February and defeated it. The company has arranged to go around Winterset, running a spur into the town from the northeast corner of the city limits, and having its own right of way around the north and east of town. The surveys have been made and the plans are now being figured out. The line contemplated is but little more than sixty miles in length and is one of the shortest possible routes between this city and Creston.

FRANKFORT, KAN.—E. C. Dunham has installed an electric lighting plant operated by a gasoline engine.

TOPEKA, KAN.—The City Council has passed a resolution providing for enlarging and rebuilding the electric light plant.

TROY, KAN.—Louis Bender, who has secured a franchise in Highland, will also ask for an electric light franchise in Severance, Troy and Wathena.

ARKANSAS CITY, KAN.—James Tuttle, of Geuda Springs, is preparing to make some extensive improvements at the springs this summer. Among the improvements planned are the installation of a 15-hp engine that will supply 200 electric lamps.

BELLEVILLE, KAN.—John B. Peach, City Clerk, writes that the citizens voted on April 3 to construct an electric light plant at a probable cost of $20,000. Bids for construction will be received about May 1. Engineer, W. K. Palmer, of Kansas City, Mo. J. E. Caswell, Mayor, either of whom may be addressed.

SCAMMON, KAN.—A franchise has been granted to the Weisbach Light Company. The company is to maintain an all-night light service of 50 lamps in the city for a period of ten years commencing May 1, 1906. The cost of the service, it is stated, will be $22 per year for each lamp.

HUTCHINSON, KAN.—The machinery, lights, etc., contracted for by the new electric company, are said to have amounted to about $40,000 all together. The dynamos and much of the machinery was purchased from the Allis-Chalmers Company, of Milwaukee. The lamps were purchased from the Fort Wayne Electric Company.

ELDORADO, KAN.—Eldorado will soon be lighted by electricity. The City Council has granted a franchise to a home company which will put in the plant together with a cold storage and ice factory. The franchise granted to C. D. Resler and assigns conveys the right to erect, maintain and operate a gas and electric lighting plant in the city for a term of twenty years.

WICHITA, KAN.—The Wichita Light & Power Company is soon to make some improvements in its plant on Waco Avenue. Henry C. Scott, a St. Louis capitalist and the owner of the gas and electric plant, has been in the city recently looking after his interests and preparing to make certain changes. The company has secured a plot of ground 140x200 feet just north of the Missouri Pacific depot and just east of the gas plant, where it is planned to erect several new buildings. However, the plans of but one are finished. It will be a fireproof stone building, with a tile roof and will be 140x40 feet.

GARDEN CITY, KAN.—Specifications are on file at the office of The Electrical World, 114 Liberty Street, New York, N. Y., for furnishing and installing near Garden City, an electric power plant of 450-kw switchboard output for pumping purposes, including boilers, engines, generators, switchboards, etc., bids for which will be received at the office of the U. S. Reclamation Service, 876 Federal Building, Chicago, Ill., until May 28. O. H. Ensign, electrical engineer, 321 Merchants' Trust Building, Los Angeles, Cal.

MADISONVILLE, KY.—Bids are wanted until May 1 for constructing an electric light plant for this city, at a cost of $25,000 to $30,000. Address W. C. Morton.

LOUISVILLE, KY.—The Louisville Lighting Company has decided to expend about $300,000 in improvements in its plant at 14th and Magazine Streets. It is proposed to install a turbo-generator capable of generating 3,000 kw.

LOUISVILLE, KY.—The Board of Public Works has been empowered to draft a contract with the Louisville Lighting Company to light the city at a reduction of $10 per light less than the rate in force heretofore. The contract is invalidated if the city grants privileges to any other company.

CHARLESTON, KY.—Clarence R. Hay, owner of the electric light plant at Charlestown, has transferred the lot on which his plant is located to the Louisville and Northern Railway & Lighting Company for a nominal consideration of $1. With the lot goes a franchise for street lights and service with private individuals. Only the favorable weather is now awaited before actual construction work on the line is begun. The line to Charlestown will leave the Sellersburg line at Watson, from which point there is a natural roadbed to Charlestown. The Charlestown electric plant, will be very much improved, it being the intention to increase the capacity sufficiently to furnish operating power for the extension of the interurban.

NEW ORLEANS, LA.—Surveys have been made for an electric railway that it is proposed to build from New Orleans to Brookhaven, Miss., a distance of about 100 miles. The line, as surveyed, parallels the Illinois Central. It is said that the purpose is eventually to extend the line to Jackson, Miss., and that it is one of a system of interurban electric lines that are projected in Louisiana and Mississippi. Attorney Ray, of Ponchatoula, is representing the promoters.

WESTBROOK, ME.—The Westbrook Electric Light & Power Company has completed the extensive alterations in its plant and system, which have been under way during the past three years, and has a thoroughly equipped and modern plant.

BRUNSWICK, ME.—The new directors of the Lewiston, Brunswick & Bath Electric Railway, the control of which recently passed to a syndicate headed by John R. Graham, of Bangor, have voted $125,000 for improvements and extension.

PEMBROKE, ME.—C. F. Gardner, Box 603, Belfast, England, of the Pembroke Power Company, writes that it is proposed to construct a power plant at Pembroke, to supply power to the Eastport Electric Light Company to include 15 miles of transmission line and two 150-kw units. Bids for construction will be received about May 15; the cost complete is estimated at $35,000.

HYATTSVILLE, MD.—The Council has authorized the City Treasurer to procure bids for the purchase of $12,000 bonds, to be used for the installation of the proposed municipal electric light plant.

HYATTSVILLE, MD.—An election will be held April 21 to vote on granting the Hyattsville Gas & Electric Lighting Company, a franchise for a gas plant.

MANSFIELD, MASS.—Plans for an extensive addition to the municipal electric light plant, which will almost double its capacity, are about completed.

ORANGE, MASS.—It was erroneously stated in a recent issue that Mr. E. O. Horton is manager of the Orange Electric Light Company. Mr. A. W. Hubbard is filling this position.

BYFIELD, MASS.—It is said that a system of electric lighting is to be inaugurated here in Byfield by which places of business, homes, etc., may be lighted at a low cost. Private capital is said to be behind the enterprise.

PEABODY, MASS.—At a recent town meeting it was voted to indefinitely postpone action on the proposition to appropriate $27,000 for improving the electric light plant, as it was not believed that sum would be sufficient for the purpose. An appropriation of $200 was made to employ an expert to report upon the condition and needs of the plant.

MIDDLEBORO, MASS.—At the recent special town meeting, the special committee appointed one year ago to investigate the municipal electric and gas plants made its report, recommending new machinery to cost $18,000 for the electric plant, new gas mains to cost $2,750, and new gas meters to cost $1,250, involving a total expenditure of $22,000 by the town.

MAYNARD, MASS.—The residents of South Acton have sent a petition to the American Woolen Company, asking that a charter be secured which will allow the company to extend its electric lighting service from Maynard to South Acton, so that electric lights may be put in operation there. If that is done, the South Acton people have a proposition to make to the woolen company for furnishing electric lights for a term of years.

MEDWAY, MASS.—It is understood that the Edison Electric Illuminating Company will commence work in a few weeks stringing high-tension wires from Dover to the power plant at Medfield Junction, which now furnishes power for the towns in this section, including Walpole and Sharon. The manufacture of electricity will then be discontinued at the Medfield plant, and the machinery there will be removed. However the power plant will be used as a sub-station and a number of converters will be installed.

WESTFIELD, MASS.—Work on the new dam and power house at Russell that is to supply power for the Western Massachusetts Street Railway, is nearing completion and it is planned to have it ready for use about May 1. The generators are in the center of the dam, in a small enclosure that has been built in the concrete. The generator room is reached by an alley way directly under the dam, so that those who have occasion to go to it have to go directly under this body of water. It is estimated that there will be about 600 hp developed.

SOUTH DARTMOUTH, MASS.—At a regular meeting of the Improvement Society, H. K. Wilson presented plans for establishing an electric lighting plant. Mr. Wilson estimated that it would cost about $20,000 for a building, dynamos and machinery. The proposed system was to light the houses and streets from the head of Apponegansett River to Salters Point. Mr. Wilson proposed a stock company be incorporated, consisting of the inhabitants of this vicinity. The proposed plant is under consideration by the society and the matter will be acted upon in the near future.

LEOMINSTER, MASS.—The Fitchburg & Leominster Street Railway Company has purchased from B. P. Cheney, George H. Richardson and others the Mordant chemical works in Shirley. The purchase includes 14 acres of land, a one-story brick building and chimney, and a water privilege with 11 feet of fall and an inexhaustible supply, and large flowage privileges. Two turbine water wheels are now installed. Engineers are at work on plans for developing the water power and the street railway officials expect to get 200 hp from the privilege. The present power station at South Fitchburg will not be disturbed for some time, not until the completion of the new power station at Mitchellville, if at all. It may be kept intact, as an emergency station. The car barns at South Fitchburg will not be disturbed.

CHARLEVOIX, MICH.—The citizens have voted to issue $16,000 bonds for the extension of the light and water plant.

SAGINAW, MICH.—The electors on the tax rolls are to vote on the question of bonding for $150,000 to establish a municipal electric lighting plant.

HANCOCK, MICH.—The Keweenaw Copper Company has decided to developed the water power of Mosquito Lake, and construct a dam and power plant.

SAGINAW, MICH.—The proposed power plant to be constructed by the Rifle River Power Company will cost about $250,000. H. von Schon, of Detroit, is engineer.

PONTIAC, MICH.—The proposed power plant to be constructed by the Clinton River Power Company at Pontiac will cost about $120,000. H. von Schon, of Detroit, is engineer.

GRAND RAPIDS, MICH.—The Grand Rapids, Grand Haven & Muskegon Railway Company is receiving current from the Grand Rapids-Muskegon Water Power Electric Company at the power house at Fruitport.

JACKSON, MICH.—Within the next few weeks the Michigan State Telephone Company will begin extension and improvement of the local service. This spring and summer 26,650 feet of aerial lines are to be added to the overhead system and 6,835 feet of additional cable placed in conduits. In all the company will spend $15,000 on local improvements.

YPSILANTI, MICH.—Work on the improvements of the Michigan Telephone Company will soon begin. Seven cars of material have arrived, two double cars and one single car of poles and two cars of cable. The cable will be used for underground work and as the ground is in good shape to start it is expected that the company will begin work soon. The improvement will include not only a new up-to-date switch board, but also the laying of a great deal of cable and the setting of many poles. The work, when completed, will have cost in the neighborhood of $40,000.

TYLER, MINN.—John Anderson and Wm. Holmes, of Tyler, are interested in the construction of an electric light plant.

TWO HARBORS, MINN.—F. E. Evans, City Recorder, writes that it is proposed to install a 40 to 50-kw, 60-cycle, single-phase alternator.

ST. CLOUD, MINN.—The Granite City Railway Company, the only bidder at the sheriff's auction, bought out what was known as the Benton Power & Traction Company for $35,748.47.

CANNON FALLS, MINN.—We are informed that the date of receiving bids for the proposed power plant on Cannon River, has been postponed from April to June 1. H. von Schon, 34 W. Congress Street, Detroit, Mich., is the engineer.

BIWALIK, MINN.—F. M. Butler, City Recorder, writes that it is proposed to construct new sewers and purchase new dynamo, etc., for the electric light plant, at a total cost of $25,000. McGilvray & Patton, of Duluth, are the engineers. Bids will be received until May 1 for $5,000 bonds for making the additions to the electric light plant.

CARROLLTON MISS.—The Carrollton Electric Light Plant was sold here recently by the Bank of Carrollton to satisfy a mortgage held by the bank for $8,500. The plant was erected some three years ago at a cost of about $18,000.

YAZOO, MISS.—Plans are making to build a street railway at Yazoo. Mayor E. R. Holmes and Messrs. W. F. Cummings and E. P. Swain, who were appointed as a special committee by the City Council, were in Jackson a few days since and made an inspection of the local street railway system, going from here to New Orleans, where they gathered additional information on the subject.

ST. LOUIS, MO.—A deed transferring the holding of the Malvern Water & Improvement Company, of Greenwood, to the West St. Louis Water & Light Company, was filed for record at Clayton, St. Louis County, April 5. The consideration named was $1,400. The Malvern Company was organized for the purpose of supplying Greenwood with water from the city of St. Louis. The purchasing company, it is said, will connect its mains with those of the Malvern Company and supply Missouri River water.

JEFFERSON CITY, MO.—At a conference held April 2 between J. W. Mellor, of Sedalia; W. B. Kerns, of Bunceton; Henry Fricke, of Prairie Home; W. C. Fink, of California, and C. W. Thomas, of Jefferson City, representing the cities along the route of the proposed interurban railway from Jefferson City to Sedalia and H. B. Colby and H. H. Humphrey, of St. Louis, a contract was entered into with Messrs. Colby and Humphrey to make the preliminary survey for the line. It was stipulated that the survey must be completed and the profiles and blue prints submitted within sixty days. Messrs. Colby and Humphrey say that a survey party will be placed in the field at once. The length of the proposed line is about eighty miles.

TWIN BRIDGES, MONT.—Electrical power will be used for operating the great dredge which is now being constructed by the Conrey Placer Mining Company. A power line is now being erected across the range from the plant of the Madison River Power Company, in the Madison Valley, and will be in readiness to transmit power before the first of June.

KEENE, N. H.—To further increase the capacity of its power plant, the Citizens Electric Company recently ordered another producer of 250-hp, a gas engine of 165-hp, together with an electrical generator of 110 kw. When the work of installing these machines is completed, the capacity of the plant will be 500-hp for the producers, and 415-hp for the generators and engines. The company has recently installed two 75-light constant current tub transformers for the street light circuit. Previous to this two 50-light transformers had been operated continually since last November on a 20 per cent. overload, and while giving satisfactory results, it was deemed expedient to put in additional transformers now, rather than later.

BORDENTOWN, N. J.—The City Council has decided to procure new bids for lighting the city for one, three and five years.

HARRISON, N. J.—The Public Service Corporation has secured the contract for lighting the town for five years at $85 per lamp per year.

ELIZABETH, N. J.—The Aldermen have granted an amended franchise to the Essex Cross Railway Company to enter the city and connect with the Public Service Corporation's lines. The new road will run through part of Union and Essex Counties to Irvington.

ATLANTIC HIGHLANDS, N. J.—The Borough is preparing to advertise for bids for furnishing equipment for the remodeling of the electric light and water plant of the municipality. The bids are to be received for the entire work or any part of the alterations, and specifications can be seen as soon as the advertisement of the bids is arranged for, either at the office of the borough clerk at Atlantic Highlands or at the office of Alexander Potter, 143 Liberty Street, New York, who is the consulting engineer. The equipment needed includes one 150-hp cylinder engine for direct-connection to a 100-kw alternating-current generator not to exceed 277 r.p.m.; two 150-hp single-cylinder engines for direct-connection to two 100-kw alternating-current generators; two compound 150-hp engines direct-connected to two 100-kw generators; one 100-kw revolving field or induction type belted generator, to be used on an engine now installed; two 100-kw generators direct-connected to one 125-hp horizontal return tubular boiler and one air compressor capable of delivering 175 cubic feet of free air per minute at a working pressure of 60 pounds to the square inch.

LITTLE FALLS, N. Y.—The Hudson River Electric Power Company, of which Bryce E. Morrow, of Glens Falls, is manager, has made application to the City Council for permission to enter Little Falls.

BROOKLYN, N. Y.—The Edison Electric Company, of Brooklyn, of which W. W. Freeman is manager, has decided to expend $1,000,000 this year in placing its wires underground, and extending the underground system.

TROY, N. Y.—A hearing will be given before the Cities Committee of the Senate on the bill which permits the city to issue bonds to the amount of $500,000 for the purpose of establishing a municipal electric lighting plant.

FULTON, N. Y.—The Fulton Light, Heat & Power Company, of which Louis W. Emerick is superintendent, has decided to install a 600-hp horizontal turbine, a 300-kw generator and a complete outfit of switchboards, exciters, etc.

RHINEBECK, N. Y.—The Governor has signed the bill extending for one year the corporate existence of the Rhinebeck-Rhinecliff Railway. This is the concern in which Robert H. Hunter, deputy insurance superintendent, is interested.

SYRACUSE, N. Y.—At the meeting of the Board of Directors of the Independent Telephone Company a budget involving the expenditure of between $200,000 and $300,000 in spring and summer development work in this city and in the Central and Northern New York territory was adopted.

PHŒNIX, N. Y.—The Phœnix Fuel, Light and Water plant of Phœnix has been purchased by New York capitalists at a price said to be about $150,000. It has been suggested that power will be obtained from the new owners for the proposed trolley extension of the Lakeside line from Baldwinsville to Fulton.

LOCKPORT, N. Y.—The Economy Light, Heat, Power and Fuel Company is soliciting contracts for electric light, heat and power at rates about 25 per cent. below those of the Lockport Gas and Electric Light Company, which at present has the local field to itself. The new company was granted a franchise some time ago. The contracts state that power will be furnished to consumers about September 15. Charles R. Bishop, an officer and director, states that he expected the company would be ready for operation before that time. A large electric station will be erected on the west side of Elm Street on the site of the old steam company heating plant.

FARGO, N. D.—The Northwestern Telephone Exchange has purchased the telephone lines of the Red River Telephone Company, of Moorhead, Minn. The new additional line has over one hundred subscribers and will be considerably improved. There are now 176 miles of poles with 600 miles of wire. With the farm telephones installed by the company and their connections with farm lines, 1,000 subscribers are added to the Fargo exchange.

PAULDING, OHIO.—The City Clerk writes that it is proposed to construct an electric light plant, at a cost of $10,000.

LIMA, OHIO.—The Lima Telephone & Telegraph Company has increased its capital stock from $250,000 to $300,000.

HUNTINGBURG, OHIO.—Dubois County Telephone Company, of Huntingburg, has increased its capital stock from $20,000 to $35,000.

LIMA, OHIO.—The Lima Railway, Light & Power Company has agreed to furnish the city with power at 3 cts. per kw-hour until such time as the city plant can be installed.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Company held its annual meeting recently. During the year the company installed 700 new telephones and it is now planning to make important improvements.

CLEVELAND, OHIO.—At a meeting of the shareholders of the Aurora, Elgin & Chicago Railway Company at Chicago, it was voted to issue bonds in the amount of $25,000,000 for the purpose of completing, improving and operating its existing lines.

COLUMBUS, OHIO.—The Council is considering a proposed bond issue of $140,000 for the purpose of improving the municipal lighting plant. The plant may have to remove 500 arc lamps unless the additional equipment is secured, as it is heavily overloaded.

UPPER SANDUSKY, OHIO.—A franchise was granted by the Council to J. J. Barber, of Toledo, representating the Findlay, Carey, Upper Sandusky & Marion Electric Railway Company, to construct a line through this city connecting with the Marion-Columbus line at Marion and the Toledo-Findlay line at Findlay.

AKRON, OHIO.—The Stark County Commissioners are having estimates prepared on the cost of installing a lighting and heating plant in the court house to supply the county buildings. Under the present arrangement it costs $3,000 to light and heat the buildings and it is believed this could be greatly reduced if the county had its own plant.

MARION, OHIO.—The Erie Railroad is preparing to erect large repair shops at Marion, and it will install a large electric power plant which will furnish power and light for all the machinery in the various buildings, operate all switch lights and block signals within the yards and operate the fuel and ash conveying outfits for the roundhouses.

CANTON, OHIO.—A ten-year contract for electric lights has been let by the Board of Public Service to the Canton Light, Heat & Power Company. The contract is for 54 lamps, to burn every night, at $64 per lamp per year, and 267 lamps by the moonlight schedule at $44 per lamp per year. The Merchants' Heat, Light & Power Company intimated that it would make a bid, but it did not do so.

DAYTON, OHIO.—The ordinance granting the Dayton Citizens' Electric Company a franchise has been passed in its amended form. Plans for the company's plant are already being prepared, it is said. Several sites are being considered, but none has been definitely decided upon as yet. The plant will be erected, no doubt, where railroad facilities are easily accessible, and it is said that the work will be pushed rapidly to completion when a location is determined upon.

BLACKWELL, OKLA.—Blackwell Electric Light & Power Company will begin operating a power and fan circuit this season. Garrett Waite is president.

ROGER MILLS, OKLA.—The Western Oklahoma Telephone Extension Company has sold all of its interests to the Pioneer Telephone & Telegraph Company.

BAKER CITY, ORE.—H. H. Andrews is making contracts for the Oregon Electric Company for the installation of a 6,000-hp electric power plant in the Eagle Valley during the coming summer. He is considering the matter of using electric power for pumping for irrigation purposes.

PORTLAND, ORE.—A. M. Drake reports that California capital will interest itself in power development along the Deschutes River from Bend to Benham Falls. The plans are said to include the installation of power-houses at Bend, Benham Falls and other points along the Deschutes, and the operation of electric railways and manufacturing plants on both sides of the Cascade Mountains. F. S. Stanley is secretary and treasurer of the Deschutes Irrigation & Power Company.

PORTLAND, ORE.—The Portland General Electric Company will expend $2,000,000 in a new office building in Portland, the reconstruction of the city's lighting equipment, new arc lamps, and the installation of an additional power plant to be known as Station A at Oregon City. When the plans now forming are carried out the company will control upward of 90,000 hp, including output at its Portland steam plant, the present plant at Oregon City and the new plant to be built there, and the surplus of 7,000 hp to be delivered to the company by the Oregon Water Power & Railway Company.

SANGER, ORE.—The Eagle River Electric Power Company, of which J. K. Romig, of Baker City, Ore., is manager, will erect a 1,200-kw hydro-electric power plant on the Eagle River, near Sanger, to supply power to mines.

PORTLAND, ORE.—The Oregon Water Power & Railway Company, Portland, Ore., intends to construct additional shops, which will be operated by electricity. The equipment has been secured.

TOLO, ORE.—Condor Water & Power Company is installing new units, a [illegible]-kw machine having just been put to work with the one already in. It is a machine of the G. E. revolving field type. The plant is operated by water power. F. P. Loder is foreman of the sub-station.

NEW HAVEN, PA.—The Town Council is considering the question of constructing an electric light plant.

DARBY, PA.—The Philadelphia Suburban Electric Light Company has secured the contract for constructing an electric light and power plant.

SUNBURY, PA.—It is stated that bids are about to be received by the Middlecreek Electric Company for the construction of a dam and power house.

GIRARDVILLE, PA.—Fire destroyed the power house and barn of the Schuylkill Railway Company, April 3, entailing a loss of $50,000. Thirteen cars were consumed.

ALTOONA, PA.—Charles F. Vogel, 1515 First National Bank Building, Chicago, Ill., is secretary of the Bedford Water & Electric Company, which proposes constructing a power plant in Bedford County, to cost about $150,000.

PITTSTON, PA.—Edward J. Rutledge, representing the Pittston Light, Heat & Power Company, about to be incorporated, is stated to have secured the contract for lighting the city for five years at $50 per year for enclosed arc lamps, and $17 per year for incandescent lamps.

YORK, PA.—The franchises and property of the York Street Railway Company have been sold to Brown Brothers, bankers, of Philadelphia. Under the new ownership the trolley system will be extended throughout the county connecting all the towns, boroughs and villages of any importance. In addition to the railway lines the Edison Electric Company, the Westinghouse Electric Light Company and the York Steam Heating Company are owned by the York County Traction Company, which has also been acquired recently by the new interests.

SALT LAKE CITY, UTAH. Part, if not all, of the electrical equipment for the three complete hydro-electric plants, to be installed by the Inter-Mountain Power Company, Salt Lake City, will be purchased in New York City. James J. Chambers, president of the company, will be at 912 Harrison Building, Columbus, Ohio, during the month of April, and will also visit New York for the purpose of purchasing the electrical equipment. One station will consist of four 750-kw units, another station will consist of two 600-kw units and a third station will consist of a 500-kw unit. Impulse wheels will be used. A fourth unit of 750-kw capacity will be installed next year, and work will be begun during the fall on a steam plant to comprise two 500-kw units.

SOUTH RYEGATE, VT.—A local electric company is soon to be organized in town, M. F. Sargent and R. Farquharson being the chief promoters in the scheme. One portion of the water power at the Boltonville Falls has been secured already and an option obtained on the remainder, so it is expected that before many months a fully equipped plant will be in operation with power enough to supply the entire Wells River Valley.

PULASKI CITY, VA. The Town Council has employed an engineer to investigate water sites around the city, with a view to constructing an electric plant to light the town and run the water pumping station.

RICHMOND, VA.—At a meeting of the city committees on finance and electricity, M. H. Trafford, who had been appointed to investigate the question, reported strongly in favor of municipal ownership of a lighting plant.

RICHMOND, VA.—The Southern Bell Telephone Company will spend $100,000 in the construction of a new system between Richmond and Danville, taking in the towns of Keysville, Charlotte Courthouse and Chase City, along the Southern Railway.

NORFOLK, VA.—It is rumored that all of the electric street railway and lighting concerns are to be taken over by a new company which represents the interests of the Middendorfs, John L. Williams & Sons, and others. It is said that the plants at Norfolk, Berkeley and Portsmouth will be included in the deal; also that a $1,000,000 power station will be erected, together with about $1,000,000 worth of additional improvements. The power plant will develop 15,000 hp. The title of the new organization will probably be the Norfolk & Portsmouth Traction Company. If the deal is consummated the company will control 112 miles of lines besides other properties.

EVERETT, WASH.—The Seattle-Tacoma Power Company, of which O. D. Colvin, of Seattle, is manager, has decided to erect a substation at Everett.

BREMERTON, WASH.—The City Council has under consideration the installation of a municipal lighting plant and will take definite action upon the matter in the near future.

SPOKANE, WASH.—The Pacific States Telephone & Telegraph Company plans to spend $500,000 in extending and improving its system in the Spokane country, with the idea of securing greater business among the farmers of the Inland Empire.

SEATTLE, WASH.—Ground has been broken for the new power station of the Seattle Electric Company at Georgetown, which will cost when finished and equipped with machinery upwards of $250,000. The company, moreover, has plans drawn for the construction of large car barns, the total investment being upwards of $400,000.

OROVILLE, WASH.—Work has begun on the big power plant at Similkameen Falls. The project is owned by the Similkameen Falls Power & Development Company. With the machinery now being put in the plant will have a capacity of 1,000 hp, and it is so arranged that another 1,000 hp can readily be installed. With the entire falls utilized many thousand horse-power can be secured. Practically all the power to be produced at present has been contracted for and will be used in the mines and in lighting the town of Oroville.

SPOKANE, WASH.—C. Lunceford and associates, who recently incorporated the Inland Power & Electric Company, have opened offices in the Mohawk Building. The company has secured water rights from Idaho for Albani Falls, on the Pend d'Oreille River, near Newport. The capacity of Albani Falls is estimated at 20,000 hp. The company also has Hell Gate, in the Columbia River, between Spokane and the Okanogan Rivers, with about 20,000 hp, and the Metalline Falls of Pend d'Oreille River, in Stevens County, between Newport and the Canadian line. The company has been incorporated for $1,000,000.

SEATTLE, WASH.—Fred E. Sander has taken a contract to build two miles of electric railway in connection with the system which he is constructing between Seattle and Everett, to extend from the corner of Brig Street and Second Avenue in Ballard to Loyal Heights. This branch of the electric railway being constructed by Mr. Sander will be operated by the same power as the line to Everett and the cars of the Sander Interurban will be used in its operation, but the control of the trackage will be in the hands of a few Seattle men who have summer homes at Loyal Heights. A separate company is being formed, to be known as the Loyal Heights Electric Company, to control this branch line. H. W. Preat, Moritz Thomsen and J. G. Trenholme are interested in the project.

WINONA, WIS.—An effort is being made by the La Crosse Water Company to obtain a franchise in this city to furnish light and power. The company will expend about $1,000,000 in developing the water power.

GREEN BAY, WIS.—The lines of the Brown County Telephone Company, operating in rural districts of Brown and Manitowoc Counties, are to be considerably extended and the capital stock of the company will be increased soon from $10,000 to $20,000. Charles A. Straubel is president, and F. J. B. Duchateau is secretary and treasurer.

MILWAUKEE, WIS.—The Common Council has passed the franchise giving to the West Shore Telephone & Telegraph Company the right to build an independent system of telephones in Milwaukee. According to the ordinance, the company must begin business within four months from the present time, must expend $100,000 within six months after it starts to build, and must install 5,000 telephones within three years. The city offices are to have free service. The company is required to connect with all State independent lines which demand connection at the city limits.

SAN JUAN, PORTO RICO.—Bids will be received until May 1 by Capt. Frank C. Wood, Quartermaster, U. S. A., for supplying the electricity required for lighting the public buildings, grounds and fortifications under the control of the quartermaster's department at San Juan during the fiscal year ending June 30, 1907.

ST. JOHN, N. B.—The St. John Street Railway Company has secured the contract to light the city for ten years with 2,000-cp lamps at $75 per lamp per year.

PETERBOROUGH, ONT.—The city, which has, in its private bill to the Ontario Legislature applied for permission to acquire water-power and supply electricity to manufacturing concerns, has just received an order from the Peterborough Light & Power Company to furnish any factories with power up to 2,000 horse-power for a period of ten years at the rate of $20 per horse-power per year. The offer is under consideration.

TORONTO, ONT.—North Toronto will be permitted to go into the business of developing electric energy for the purpose of supplying street lights and heat to public buildings, and of selling light, heat and power to corporations or individuals. This permission was accorded by the Private Bill Committee.

WESTBURY, ONT.—The Westbury Electric Power & Light Company has recently installed a 75-kw, 3-phase, 60-cycle, 3,300-volt generator, belted to a water wheel. Mr. H. A. Worby, of East Angus, Que., is the proprietor.

New Industrial Companies.

STURGEON BAY, WIS.—The Sturgeon Bay & Northern Traction Company has been incorporated with a capital of $25,000, by Joseph A. Becker and others.

UNITED ELECTRIC SIGNAL COMPANY, Attleboro, Mass., has been incorporated with a capital of $200,000, by Stephen A. Wood, Joseph C. Estes, Louise R. Barrett.

WISCONSIN BRAKE & ELECTRIC COMPANY, Milwaukee, Wis., with a capital of $5,000, has been incorporated by W. D. Hickman, J. A. McCormick and P. W. Boehm.

AUTOMATIC SWITCH COMPANY, New York, has been incorporated, with a capital of $100,000 and the following directors: O. R. Denman, F. M. Coffin, William Sorrell, New York.

EGAN ELECTRIC MASSAGE VIBRATOR COMPANY, Petersburg, Ill., having a capital of $2,400, has filed articles of incorporation. The incorporators are Charles E. Egan, John Shurie and T. W. McNealy.

AVERY PORTABLE LIGHTING COMPANY, Milwaukee, Wis., has filed articles of incorporation with a capital stock of $10,000. Edgar C. Avery, George E. Burnham and E. G. Comstock are the incorporators.

THE UNITED MULTI-PHONE COMPANY, Wilmington, Del., composed of manufacturers of talking machines and of phonographs and phonograph records, was incorporated by Wilmington incorporating agents, with a capital stock of $1,000,000.

THE ELECTRICAL PRODUCTS COMPANY, Ravenna, Ohio, has been incorporated with $250,000 capital stock. W. B. Marshall, superintendent, states that the company will erect a plant for the manufacture of carbons and other electrical products.

VIELE, COOPER & BLACKWELL, New York, have organized with the following directors: Maurice A. Viele, New York; Hugh L. Cooper, Stamford, Conn., and Francis O. Blackwell, Englewood, N. J. The company will do mechanical, electrical and hydraulic engineering and contracting. Its capital is $1,500,000.

THE AMERICAN ENGINEERING & CONSTRUCTION COMPANY, 213 Eagle Building, Brooklyn, N. Y., has just been incorporated by R. C. Taylor, Edward Taylor and J. J. Sides, practical electric railway and power plant engineers. The company is prepared to handle any class of mechanical, electrical and construction work, and will also act as consulting engineers in drawing up or reviewing designs and specifications of complete plants, or apparatus to fulfil standard or special requirements.

New Incorporations.

JUNCTION, ARK.—The Junction City Light & Water Company has been incorporated, with a capital of $10,000.

SALINAS, CAL.—The Greenfield Light and Water Company has been incorporated with a capital stock of $25,000. The directors of the company are: A. Parker, J. B. Clark, J. G. Yoeman, G. W. Crandall, L. T. Odell, H. P. Lehr, of Greenfield, and J. A. Brock, of Los Angeles.

HARTFORD, CONN.—The Tri-City Railway & Light Company, of this city, has filed a certificate of incorporation with the Secretary of State. The amount of the authorized capital stock is $12,000,000.

WILMINGTON, DEL.—The Delmarvia Telephone Company and the Wilmington Electric Light & Power Company, which was recently granted a franchise by the Street and Sewer Department, have been merged. The new company will be known under the corporate title of the Wilmington Light, Power & Telephone Company. The Delmarvia Telephone Company had a capitalization of $300,000 and the Wilmington Electric Light & Power Company was capitalized at $1,000,000, and the merged corporation will have a capital of $1,250,00. The same men were interested in both companies, and they comprise the officers and directors of the new concern. The officers of the Wilmington Light, Power & Telephone Company are: President, Charles C. Kurtz, of Wilmington; vice-president, George R. Webb, of Baltimore; secretary and treasurer, Stanley Baker, of Wilmington; directors, Mr. Kurtz, Mr. Webb, Horace W. Gause, Samuel K. Smith, Alfred I. du Pont, Pierre S. du Pont and Henry P. Scott. The Wilmington Electric Light & Power Company, after it was granted a franchise, bought the old Jessup & Moore warehouse on the north side of the Brandywine, west of Pine Street, where a power plant will be erected.

CAPRON, ILL.—Capron Home Telephone Company, Capron; capital, $800; operate a telephone system; incorporators, F. D. Cornwall, E. W. Dimond, George H. Olson.

PEORIA, ILL.—The Peoria, Pekin & Tremont Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are A. J. Davis, Walter H. Ames and S. A. Hayward, of Tremont.

NORTH McDONOUGH, ILL.—North McDonough Telephone Line, with a capital of $800, has been incorporated and will operate a farmers' telephone line; incorporators J. Geltmacher, Charles Edie and Frank Wille.

LA FAYETTE, IND.—The Lafayette & Logansport Traction Company, with a capital of $500,000, has been incorporated by Frank H. Cutshall and others, and will build an interurban line between Lafayette and Logansport.

DES MOINES, IA.—The Iowa Gas-Electric Railway Company was organized at this city for the purpose of building the connecting link in the proposed chain of interurban lines from Sioux Falls to Kansas City.

LONG LAKE, MINN.—The Hennepin Telephone Company has been formed with $25,000 capital and will extend lines to neighboring villages.

HAWK CREEK, MINN.—Hawk Creek Telephone Company, with a capital of $5,000, has been incorporated by P. E. Symes, G. P. Mangerud, E. O. Oppegaard, Steve Odegard, O. M. Agre.

HERMAN, MINN.—Herman Telephone Company, with a capital of $50,000, has been incorporated by C. J. Bacon, H. A. Hanson, G. F. Houston, J. D. Houston, A. W. Wells, John F. Lenden, K. C. Helgeson, E. E. Peck, Houston.

TRUXTON, N. Y.—Papers of incorporation of the Truxton & Cuyler Telephone Company have been forwarded to the Secretary of State. The company is incorporated for $10,000. The directors for the first year are: Frank L. Hilton, Fred R. Bryant and Fred J. Woodward of this village; H. D. Theobald, M. B. Dunbar and J. B. Whitmarsh, of Cuyler, and Randolph Hibbard, of Cortland.

CHATTANOOGA, TENN.—The Chattanooga Railway Company is the title of the new company recently incorporated by Graham & Co., of Philadelphia, who have purchased all the street railways of Chattanooga, including the Chattanooga Electric Railway and the Chattanooga Rapid Transit Company. The capitalization of the consolidated companies comprises a slight reduction in fixed charges and is based on conservative lines. A considerable sum has been provided for extensions and improvements.

Legal.

TELEPHONE PROTECTOR LITIGATION.—A decision has been rendered by Judge Anderson, in the U. S. Circuit Court for the District of Indiana, which disposes of eleven suits brought by Frank B. Cook against the Sterling Electric Company, of Lafayette, Ind. The decision did not involve an adjudication on the validity of the patents involved, that not being in question, but affected the ownership of the patents. It appears that Cook instituted the several suits for an injunction and an accounting, and claimed infringement, these patents taken out by him covering important features of protectors for telephone exchanges and instruments, cables, cable terminals, line fuses, and other important details. The Sterling Company instead of filing an answer to the complaint filed a plea in which it asserted ownership itself of all the patents at stake, and denied any possible infringement. The case was fought out on these lines, testimony being taken by the master in chancery. The master sustained the Sterling ownership pleading, and on March 21 Judge Anderson affirmed and sustained the master's report.

Personal.

MR. AUGUSTUS SPIES, president of the Menominee & Marinette Light & Traction Company, of Menominee, Mich., has been elected Mayor of Menominee.

MR. J. C. SLIPPY, of Waterloo, Ia., has accepted a position with the engineering department of the Central District and Printing Telegraph Company, of Pittsburgh.

MR. W. S. BARSTOW has returned to New York City from a trip of some two months through the Northwest, where he has been engaged on some large electrical consulting work.

MR. C. A. LAMBACH, formerly construction superintendent of the Independent Telephone Company, Council Bluffs, Ia., has been made manager of the new exchange, now being installed.

MR. CLOYD MARSHALL, who is actively identified with the American De Forest wireless interests in St. Louis, has been a visitor in New York the past week, and reports great progress in the work there.

MR. F. V. T. LEE has been appointed assistant manager of the San Francisco Gas & Electric Company, which has consolidated so large a portion of the electric lighting and gas interests in that city.

MR. LESTER G. SCOTT has severed his connection with the Westbrook (Me.) Electric Light & Power Company, to accept a position with the Consolidated Electric Light Company, of Portland, Me. Mr. George A. Brown will succeed him.

MR. ALBERT SCHEIBLE, who has been secretary and treasurer of the George Cutter Company ever since its organization 16 years ago, and whose work is well known to all users of that company's specialties, has resigned to head a new manufacturing company with headquarters at Chicago.

MR. GEORGE H. CLIFFORD, secretary of the Northern Texas Traction Company, has been appointed general superintendent of the operating department of the company and will look after all details of the operation of cars, etc., on the Interurban, the Dallas and Fort Worth lines. Mr. Clifford has been with the company five years.

MR. HERBERT A. WAGNER, the consulting electrical and mechanical engineer, has removed his New York offices to 60 Wall Street, which has already become quite an electrical engineering center. As a pioneer in single-phase motor work some 15 years ago, Mr. Wagner finds himself now very distinctly in the forefront of affairs.

PROF. C. A. ADAMS, of the electrical engineering laboratory, Pierce Hall, Harvard University, has gone through a prolonged siege of sickness, but is convalescent and has just returned from a trip of recuperation in the South. He is gradually getting back into harness, but for some time it will be necessary for him to take things rather easily.

MR. E. R. WEEKS, consulting engineer at Kansas City, has been selected by Waddell and Heidrick, engineers of the Great Intercity viaduct at that place to design the electric lighting and lighting plant for this structure. This viaduct which is to connect Kansas City, Mo., with Kansas City, Kan., will be about two miles in length.

MR. BANCROFT GHERARDI, assistant chief engineer of the Consolidated New York Telephone Company, is the subject of an illustrated biography in the *Sibley Journal of Engineering*. He graduated from Cornell University in 1893 and since then has had a useful career in the telephone field and as an active member and officer of the American Institute of Electrical Engineers.

MR. W. M. McFARLAND, vice-president of the Westinghouse Electric & Manufacturing Company has an interesting article in the *Engineering Magazine* for April, on the efficiency of the engineering personnel of the Navy. Mr. McFarland is a graduate of the Naval Academy and takes a deep interest in its professional questions, although it is now some years since he left the service.

MR. E. N. FOSS, general manager of the B. F. Sturtevant Company, of Boston, Mass., and prominently identified with many other large interests throughout the country, sailed for the Mediterranean, to be absent two or three months. Primarily the trip is for a much needed rest, but

Mr. Foss will, during his absence, make a careful study of foreign industrial and commercial conditions as related to trade with the United States.

MR. E. G. WATERS.—Mr. Edward G. Waters, formerly private secretary to Gen. Eugene Griffin, first vice-president of the General Electric Company, has returned to this country recently and has been appointed assistant to the first vice-president, with headquarters at Schenectady. Mr. Waters has had a long and useful connection with General Electric interests, including three years just past at the British Thomson-Houston works at Rugby in a managerial capacity.

MR. I. A. TAYLOR.—Note has not before been made in these pages of the death of Mr. Irving A. Taylor, on February 27, at the Montreal General Hospital, following an operation for hernia. He was only 32 years of age, and at the time of his decease was general superintendent of the St. Lawrence River Power Company, Massena, N. Y. He leaves a widow. Mr. Taylor was an associate member of the American Institute of Electrical Engineers, which he joined in 1898.

MR. F. A. PERRET.—Mrs. Charles Perret, of Brooklyn, was greatly relieved early last evening when she received a cable message from her son, Frank Alvord Perret, assistant director of the Royal Observatory on Mount Vesuvius, saying that he was safe. The press dispatches telling of the destruction of the observatory had caused Mrs. Perret great anxiety. Mr. Perret is an electrical engineer. About eighteen months ago he went to Naples for the benefit of his health, and while there made the acquaintance of Dr. Matteucci, the director of the Royal Observatory. Mr. Perret took an interest in Dr. Matteucci's work and became an assistant to him.

MR. EDWARD T. WALSH, who has for five years past been connected with the Interborough Company in the general design of the 50th Street power plant of the Subway Division, has resigned to accept the position of assistant engineer of construction of the National Cash Register Company, Dayton, Ohio. Mr. Walsh has had an extensive experience in power plant and structural steel design. His early experience consisted of a number of years upon the cable railway system of the Brooklyn Bridge, during which he secured his education at Pratt Institute. Subsequently he was employed three years by the Atlas Portland Cement Company in power plant and building design from which position he came to the Rapid Transit Subway Construction Company.

MR. G. W. W. KITTREDGE.—Mr. George W. W. Kittredge, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway, has been appointed chief engineer of the New York Central and Hudson River Railroad Company, with offices in New York. His appointment took effect April 9. He will be chief engineer not only of the New York Central, but also of the West Shore. Mr. Kittredge succeeds Mr. H. Fernstrom, who resigned some months ago. He is 50 years old, and was born in North Andover, Mass. Graduated from the Massachusetts Institute of Technology in 1877, he entered the employ of the Pittsburg, Cincinnati & St. Louis Railway. Until 1890 he was connected with the Pennsylvania lines west of Pittsburg.

MR. VAN RENSSELAER LANSINGH, illuminating engineer and general manager of the Holophane Glass Company's sales department, has recently lectured on illuminating engineering at a number of cities in the far West. At Portland, Ore., he lectured before the electric lighting fraternity of the city at the rooms of the Portland General Electric Company. He also lectured before the electric light interests at Seattle and Butte. At Salt Lake City he lectured on illuminating engineering before the Commercial Club and made an address on street lighting before the Real Estate Association and later before the city council. At Denver, he gave three lectures before the engineering and new business departments of the Denver Gas and Electric Company.

PROF. F. R. HUTTON, secretary of the American Society of Mechanical Engineers for nearly 25 years, presented to the council at its meeting in January his letter of resignation, believing that the work of the society now requires a secretary who can devote his whole time to the office. Professor Hutton's position as head of the department of mechanical engineering of Columbia University makes it impracticable for him to do this. The resignation was not accepted, and it is hoped that some compromise may be effected. It is suggested that Professor Hutton be made honorary secretary, with an active associate in the office. At the meeting of the council on March 27 this general plan was approved and a special committee was appointed to select a new man and arrange the details.

News of the Trade.

THE BERKSHIRE ELECTRIC COMPANY, of Pittsfield, Mass., has sold its Lenox branch to Benjamin Rodgers, formerly local manager at that place, who will continue the business under the style of B. H. Rodgers & Co.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received orders from the Southern Power Company, of South Carolina, for eight 4,000-hp electric generators and twelve 2,500-hp oil-insulated water-cooled transformers and auxiliary apparatus.

HABIRSHAW.—The sales department of the India Rubber & Gutta Percha Insulating Company, of Yonkers, N. Y., will be removed from 15 Cortlandt Street, New York, on May 1, to the Postal Building, 253 Broadway, where Mr. J. B. Olson, manager of the department, will continue his successful work for the well known Habirshaw wires and cables.

THE MARINE ENGINE & MACHINE COMPANY has outgrown its present quarters, and the increase in its elevator business having necessitated larger premises, it has taken a new building at 230-232 West 13th Street, New York. The headquarters and the elevator construction department will be located here, where it will have the benefit of up-to-date conditions and facilities.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., manufacturer of electrical apparatus, has increased its capital stock from $100,000 to $150,000. The company has recently been erecting a new plant at 133 Stewart Street and is now occupying a part of it and increasing its output materially. About 100 men are employed in the manufacture of small electric motors and generators. Louis Allis is president and F. H. Petrie, secretary.

THE CONSOLIDATED ENGINE STOP COMPANY has recently moved its offices and factory to 130 East Twelfth Street, New York. It has secured excellent facilities in a new building for its offices and machine shop. An entire floor comprising 4,500 sq. ft. has been leased. There are well-furnished offices in the front part and a machine shop back of the offices. In this way it was felt that a more thorough supervision could be secured over the manufacturing of the various types of engine stop produced by the company.

THE PITTSBURG PIPING & EQUIPMENT COMPANY, Pittsburg, Pa., announces that on March 30, 1906, the general offices were moved from the Westinghouse building to its own office building at the shops, No. 3422-28 Smallman Street. Additional property has been purchased to provide for the accommodation of the offices and for a much needed shop extension. The Cleveland office has also been moved from the Rose Building to new and larger quarters at No. 53 Public Square. The company is better prepared than ever before to give prompt and careful attention to any business with which it may be favored, and trusts that its work in the past will warrant the sending to it of future inquiries and orders.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 3, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

816,554.—ELECTRIC FURNACE; Anson G. Betts, Troy, N. Y. App. filed May 20, 1904. In combination, an electric furnace comprising a furnace-chamber adapted to contain on its hearth a bath of liquid conductor; a channel leading into said chamber, and adapted to contain liquid conductor; electrodes arranged to supply electric current to pass through the liquid conductor in the channel; and means for causing motion of liquid conductor through the channel to the bath on the hearth.

816,612. FLEXIBLE CONNECTION FOR GEARLESS MOTORS; Robert Siegfried, Pittsburg, Pa. App. filed Dec. 18, 1905. The combination with an axle having a wheel provided with a set of chambers, a quill or sleeve surrounding the axle and provided with bosses that project into the chambers, and resilient cushioning means that surround the bosses within the chambers of resilient cushioning means between the ends of the bosses and the wheel.

816,619. TELEPHONE DESK-STAND; Henry Tideman, Menominee, Mich. App. filed Sept. 14, 1905. In a telephone desk-stand, a base, a cap, a web attached to said base and said cap and forming a part of the shaft connecting them, and a detachable plate forming the completing portion of the shaft between base and cap, substantially as described.

816,636.—ADJUSTABLE SUPPORT FOR INCANDESCENT ELECTRIC LAMPS; Oscar T. Banks, London, England. App. filed Oct. 6, 1904. A support for incandescent lamps which is adjustable to varying lengths so as to be received within porcelain casings or candles of different lengths. The receptacle is so formed as to receive a considerable amount of slack cord so as to accommodate different lengths thereof.

816,676. MECHANISM FOR OPERATING RAILWAY SIGNALS; William V. Moak, Utica, N. Y. App. filed July 13, 1905. The danger and the caution semaphore signals have rod connections extending to separate crank arms which can be clutched into engagement with a motor by a pair of spring operated clutches. Pneumatic cylinders are provided for cushioning the movement.

816,733. CEMENT-BURNING FURNACE; Willoughby E. Snyder, Nazareth, Pa. App. filed July 20, 1904. In a cement-burning furnace the combination with a movable hearth provided with a reverberatory hood, of a series of pairs of arc electrodes operatively disposed within the hood above the hearth, and draft-compelling means adapted to produce a current of air in opposition to the direction of movement of the hearth

816,762. APPARATUS FOR CONTROLLING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; Louis H. Thullen, Edgewood, Pa. App. filed Jan. 18, 1905. The switch point is connected to a continuously rotating motor through a magnetic clutch which is normally inoperative, but which can be energized by the signal or pilot circuit. An interlocking means is provided for insuring a proper setting of the signals determined by the movement of the switch point.

816,764.—PROCESS OF SMELTING LEAD ORES; William Valentine and Anson G. Betts, Troy, N. Y. App. filed June 15, 1904. The process of recovering lead from lead-sulfid ores which consists in fusing the ore and accompanying gangue into a matte and a slag, and electrolytically separating lead from the matte by bringing the matte into contact with a cathode in a fused electrolyte in which lead sulfid is substantially insoluble.

816,792.—LOCK; Oliver H. P. Green and Delos Carpenter, Ohion, Mich. App. filed Sept. 6, 1904. Mechanical construction of an electric lock having a bell-crank lever connected to the usual bolt, and an electromagnet acting on the free arm of such lever.

816,804. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed Jan. 18, 1905. Relates to a complete system of motor control especially designed for elevator installations in which the motors works on a three-wire alternating current circuit. Has a generator connected to the motor and arranged to control the resistance in proportion to the speed of the motor on starting.

816,805. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed June 14, 1905. Additional details of the above system relating particularly to the starting switch and a single magnet energized by pulsating and direct currents for operating said switch.

816,806. ELECTRIC TRACTION ELEVATOR; Axel Magnuson, New York, N. Y. App. filed Nov. 17, 1905. A special form of magnetic clutch in which a series of magnets are inset around the periphery of a revolving part and have their poles grooved to constitute a sheeve or pulley for the reception of a wire cable which is grasped when the magnets are energized.

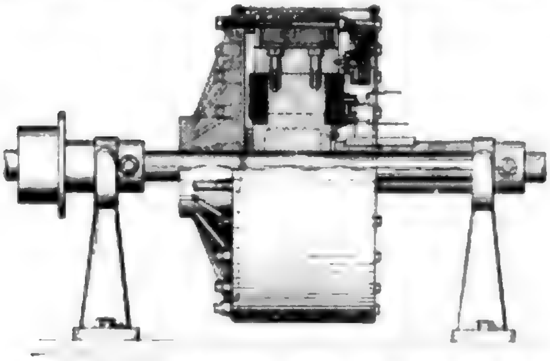
816,819. TWO-DIVISION TELEPHONE SYSTEM; Howard M. Post, Chicago, Ill. App. filed Oct. 24, 1902. In a telephone system, the combination with a telephone-line, of a plurality of relays therefor, at the central office, parts controlled by said relays and means for causing the operation of said relays singly from the substation and simultaneously from the central office, substantially as described.

816,847. IRON-FRAMED DISTRIBUTING-BOARD FOR TELEPHONE EXCHANGES; Frank B. Cook, Chicago, Ill. App. filed Feb. 2, 1903. In a distributing-board, the combination of a supporting-frame having rearwardly-extending arms a terminal block secured to the rear end of each of said arms, said blocks being arranged in rows both vertically and horizontally, and a conductor-supporting ring associated with each block.

816,869. ELECTRIC ELEVATOR SYSTEM; Axel Magnuson, New York, N. Y. App. filed May 23, 1905. Construction of an elevator brake in which a strong spiral spring is mounted to normally apply the brake through a toggle lever, and a pair of magnets having two windings, one for alternating currents to release the brake, and the other for direct currents to hold it in released relation.

816,875. TROLLEY HARP; Barney Murphy, New Haven, Conn. App. filed Aug. 24, 1905. A form of trolley harp swiveled to the extremity of the pole so as to be movable on a vertical axis. A projecting bail engages a hook on the pole to limit the movement.

816,894. APPARATUS FOR TELEPHONE SWITCHBOARDS; Henri E. A. Andre, Paris, France. App. filed Apr. 27, 1904. The combination with a number of telephone lines each provided with multiple connection-terminals at a central switchboard, of an answering and a calling plug, a link conductor connecting said plugs for uniting any two of said lines at the connection-terminals thereof, a central-office telephone apparatus adapted to be connected with said link conductor, a local circuit established in the act of making connection from either plug to the terminal of any busy line, a relay in said local circuit, blocking mechanism controlled by said relay for rendering the central-office telephone apparatus inoperative for communication over said link conductor, and means actuated in making connection with any line for establishing at the several multiple terminals of such line a peculiar electrical condition to which the said relay is responsive when the circuit of said relay is established at another multiple terminal of the same line, whereby the central-office telephone apparatus is automatically blocked when it is attempted to make connection with a busy line.


816,912.—Dynamo Magnetic Power Transmission Device.

816,903. COMBINATION BLOCK AND FAN; Spencer D. Earl, Norristown, Pa. App. filed May 5, 1905. A small fan motor is permanently attached to the frame of an ordinary clock and is operated by a circuit which is intermittently interrupted by the clock mechanism so that the fan is driven intermittently.

816,912. DYNAMO MAGNETIC POWER TRANSMISSION DEVICE; John O. Heinze, Jr., Lowell, Mass. The patentee secures upon the engine shaft a special form of generator or clutch which has circuits controllable by the operator. The purpose is to vary the effective speed and torque of the generator without varying the rotation of the engine.

816,922. ELECTRIC METER; Robert C. Lanphier, Springfield, Ill. App. filed Mar. 9, 1904. Relates to a type of wattmeter in which a metallic disc floats in a mercury bath. The series circuit passes through the disc and the shunt circuit through the fields in which the disc revolves. Means are provided for passing a part of the shunt circuit through the armature in starting so as to give a sufficient starting torque on light loads.

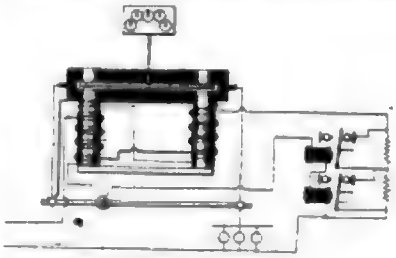
816,9[illegible]. PROCESS OF PRODUCING AMMONIA; John A. Lyons and Edward C. Broadwell, Chicago, Ill. App. filed Sept. 2, 1904. The process of subjecting a fused bath of the borates of electropositive metals to electrolytic action and subjecting the anion produced thereby to a reducing agent at the anode in the presence of an intense heat and introducing nitrogen to said bath at the anode and then subjecting the boron nitrid thus produced to steam.

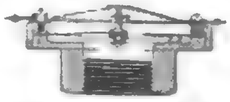
816,930. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed June 13, 1905. Relates to the operation of elevator motors having a generator connected to run with the motor, and having means dependent upon the action of the generator for causing the movement of the motor to actuate a controlling device.

816,931. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed Nov. 16, 1905. Relates to modifications of the above, and features of the various circuits by which the generator current is controlled through the operating device.

816,948. CONTROLLER FOR AUTOMATIC TELEPHONE SYSTEMS; Alton E. Stevens, Fall River, Mass. App. filed July 12, 1905. A shaft; a cam mounted thereon; a contact-arm; a series of contacts with which the contact-arm may be moved successively into engagement; a series of manually-operated parts operatively connected with said cam, whereby said contact arm may be moved into engagement with one or more of said series of contacts.

816,981. CROSS ARM FOR ELECTRIC OR SIGNAL WIRES; Anthony H. Iliohan, Oakland, Cal. App. filed Mar. 21, 1905. In order to prevent creepage of currents over the surface of the insulator in wet or foggy weather, the patentee makes the usual cross arms in the form of an inverted box, and the conductors are held by insulated arms depending from the interior of such box.


816,922.—Electric Meter.


817,009.—Automatic Alarm for Gas Pipes.

816,991. ART OF SUSPENDING AERIAL CABLES; Lenard A. McNeil, Maywood, Ill. App. filed Sept. 2, 1904. A pair of star wheels form a permanent part of the supporting fixture or bracket for the cable and are so arranged as to permit the cable to be stretched tight, and subsequently locked in such stretched relation.

817,009. AUTOMATIC ALARM FOR GAS PIPES; August L. Schultz, Cleveland, O. App. filed Nov. 28, 1904. A plug is inserted at the end of an ordinary gas pipe which has a diaphragm therein, the movements of which open and close an alarm circuit so as to indicate any dangerous drop of pressure in the pipe.

817,031. CONTROLLER; Thorsten Von Zweigbergk, Preston, England. App. filed May 15, 1903. A motor starting device having a rheostat arm moved over contacts by a Geneva stop motion. The Geneva stop motion is driven by an electric motor differentially wound with shunt and series coils.

817,036. AUTOMATIC BLOCK SIGNAL SYSTEM; Abram L. Bower, Boyertown, Pa. App. filed Jan. 31, 1903. Discs at the various stations have spaced contacts therein and are stepped around by pawl and ratchet devices so as to alternately illuminate and extinguish certain signal lamps.

817,057. FLEXIBLE METALLIC TUBE; Edwin T. Greenfield, Monticello, N. Y. App. filed Oct. 24, 1904. A construction of sheet metal armor for flexible cables of large diameter in which a convex and a concave strip are wound so as to interlock together, and are corrugated to give greater rigidity.

817,082. APPARATUS FOR SUBJECTING AIR TO ELECTRIC DISCHARGES; John E. Mitchell and Dennis Parks, St. Louis, Mo. App. filed Jan. 3, 1906. In an apparatus for modifying air by the electric discharge, in combination with a yieldably-mounted electrode, a pair of electrodes reciprocable into and out of contact with opposide ends thereof, said electrodes being connected with a suitable source of electricity.

817,086. CONDUIT FOR ELECTRIC WIRES; Daniel H. Murphy, Milwaukee, Wis. App. filed June 9, 1902. An iron pipe is galvanized with zinc on its exterior surface and is furnished with an enamel coating on its inside including varnish and linseed oil as ingredients.

817,131. AUTOMATIC RAILWAY SIGNAL; John Neumaier, Milwaukee, Wis. App. filed July 8, 1905. A metallic box is secured beneath the usual track rails and has an upwardly projecting finger in the path of the wheel flanges of the train. The finger completes special alarm circuits, and is adapted to be reset after depression by a train, by means of an electro-magnet within the box.

817,132. STORAGE BATTERY; William H. Palmer, Jr., New York, N. Y. App. filed Feb. 14, 1905. A storage-battery cell comprising a containing-jar, a series of positive and negative plates alternately disposed therein, the two groups supported from opposite ends of the jar, and means at the upper edges of the plates constructed to provide additional mutual supporting means, substantially as described.

817,137. APPARATUS FOR PRODUCING ELECTRIC WAVES; Alessandro Artom, Turin, Italy. App. filed Jan. 3, 1903. The combination with means to produce electrical current; of two discharge-terminals supplied with current therefrom and a third discharge terminal arranged with respect to the other two at the vertex of a triangle, means to electrically connect said terminal in parallel with one of the other terminals and means to produce capacity in the electrical connection of the third terminal.

817,140. TELEPHONE-TRANSMITTER; William W. Dean, Chicago, Ill. App. filed Jan. 27, 1902. A telephone-transmitter comprising a flat main diaphragm, a ring secured to the back of said main diaphragm, a supplemental diaphragm secured to the back of said ring, said ring constituting a medium of non-yielding connection between the two diaphragms, a solid backing and non-yielding connection between said back and the middle portion of said supplemental diaphragm, front and back electrode surfaces within the chamber provided between the two diaphragms, the front electrode-surface being movable with the main diaphragm, and the back electrode-surface being stationary and rigidly connected with said backing, and granular carbon interposed between said electrode-surfaces, substantially as described.

817,1[illegible]. SWITCHING DEVICE FOR ELECTRIC LAMPS; John McCullough, Newark, N. J. App. filed June 23, 1903. An incandescent lamp of the type having a long and a short filament for normal and dim illumination. A cord passes through the socket and has a button thereon which presses a spring and throws the short filament into circuit whenever the cord is pulled.

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NEW YORK, SATURDAY, APRIL 21, 1906.

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PROPOSED RULES OF THE INTERNATIONAL COMMISSION FOR THE STANDARDIZATION OF ELECTRICAL MACHINERY.

In pursuance of the resolution of the Chamber of Delegates of the International Electrical Congress at St. Louis in 1904, to the effect that an international commission from the technical societies of the world should take up the standardization of the nomenclature and ratings of electric machinery, it is proposed that a meeting of delegates from the various national electrical engineering societies shall be held in London on the 26th of June next. The rules proposed for discussion at the meeting have already been drafted and printed. These rules relate entirely to the organization of the commission and do not touch upon the electrotechnical subjects to be considered. The proposed rules are fourteen in number, and while evidently prepared with the hope and intention of facilitating business, they appear to be unnecessarily complex. The main object at present to be sought for is a meeting of delegates from the various national electrical engineering societies. If this can be brought about, it is highly probable that the delegates will proceed to business upon the simplest and most natural lines of action. Attempts to stereotype the action of the meeting in advance are likely to hamper the proceedings and defeat the unanimity of purpose and resolution that may be hoped for.

THE MAXIMUM EFFICIENCY OF A STORAGE BATTERY.

Since storage cells were first introduced, the demands upon their electrical capabilities have steadily increased. The early storage cells of Planté were electrolytically formed from plain parallel leaden sheets in the course of weeks and months of preliminary charging and discharging, before they were regarded as fit for duty. When on duty they were not allowed to discharge to the practical low-voltage limit in less than six hours, and the period of recharging was not less than 24 hours. It would have been regarded as highly insulting to a storage cell of that day, not to say injurious, to ask from it a full charge and discharge in one and the same day. At the present time, however, central station storage batteries are commonly charged in six hours, and discharged in two. Although it is admitted that the efficiency of such a battery would be greater if it had a more leisurely day's work, yet the necessities of central station distribution prohibit the eight-hour-day working rule for storage batteries, and require three-hour working days, two-hour working days and even one-hour working days.

In any moderate or leisurely cycle of charge and discharge, it is known that the quantity efficiency, or ampere-hour efficiency, of a storage cell is nearly 100 per cent, and that even under hand labor the ampere-hour efficiency does not fall greatly below 100 per cent. It is the watt-hour or energy efficiency which suffers under stress. Under laboratory conditions of most careful and light loading, the watt-hour efficiency can be brought up to nearly 100 per cent, while under heavy and severe loading in practical service this efficiency may fall to about 70 per cent. In some experiments described by Prof. B. F. Bailey on page

829, two storage cells, each of 160 ampere-hours capacity, were allowed to charge and discharge 60 times per second, at 20 amperes effective current. That is, the normal eight-hour discharge rate was reduced to the 1/60th of a second, or 1/216,000th of an hour, a period 1,728,000 times shorter than the normal. The experiments showed a quantity efficiency of almost 100 per cent, and a watt-hour efficiency of 98.1 per cent under these conditions. The loss of charge in the cell subjected to this short but merry cyclic activity appears to have been less than when the cell was allowed to remain idle, on open circuit.

COVERING HIGH-TENSION LINE WIRES.

There appears to be some ground for a profitable discussion of the question whether the so-called insulating covering of moderately high-tension lines in cities might not better be abolished. In the case of low-tension wires at voltages of 50 to 500, even a weather-proof insulation offers considerable protection against accidental short circuits, but by many it is held that there is also no question but that any practicable insulation that can be placed on overhead lines of 10,000 volts and up is worthless and a waste of money. There is left a large middle range of voltages in which the advisability of an insulating covering of overhead lines is open to question. At voltages of 1100-2200, which are so common, the ordinary insulating coverings may offer a slight protection. At voltages of 4000, 4600 and 6600 it is generally considered that a covering is more a matter of form than a really substantnal protection. The chief use for the covering in such cases seems to be to conform to the preconceived ideas of a non-technical public and the city authorities. Against the covering of such wires it is urged that it involves unnecessary cost, that the coverings deteriorate rapidly, that they cause a feeling of false security by linemen and others, and that in some cases the insulating covering would offer enough resistance to what would otherwise be a short-circuit to prevent circuit-breakers on a high-tension line from opening when it would be best that they should. It has been fairly well proven that the best protection telephone and telegraph wires have against high-tension lines lies in the fact that the falling of such wires across a high-tension line causes such a positive and immediate short circuit that the circuit-breakers in the latter immediately open before much damage is done to the telephone or telegraph system. The insulating covering on a moderately high-tension line may delay the opening of the circuit-breaker, although a dangerous current may be flowing. This whole subject is one which deserves thoughtful consideration.

THE FULL UTILIZATION OF WATER POWER.

We tell the story this week of a hydro-electric plant which is notable, not from magnitude, length or voltage of transmission line, or indeed any details of technical design, but from its bearing on the proper and complete utilization of natural energy. The greatest problem of hydraulics is the full employment of the power that nature has bestowed, bountifully, it is true, but without the least reference to the wishes and present welfare of mankind. The rivers flow without ceasing, while the amount of steady flow upon which mankind ordinarily depends bears no particular relation to the aggregate. The work upon the Raquette River which we here describe involves a particular solution of this problem by providing a load variable at will and able to take up in large measure both the variations of flow and of electrical demand. A pulp grinding plant and an electrical transmission plant are here operated in conjunction under the same roof. Pulp can be ground at any time when the power is available, and by storing the product the output can be made commercially uniform even though the original power is very variable. From the simple nature of the industry, the ample demand for the product, and the large proportion of the cost due to power, pulp grinding is especially well adapted for collateral work in a hydro-electric development in a forest country. With the help of some storage of water in the lakes up stream it should be possible to utilize a considerable proportion of the total annual energy.

This is very unusual in hydraulic plants of any kind, which are generally at the most intended to take care of the average flow, with the result that a third or a half of the total available power runs over the dam. The first great step toward the prevention of waste is the storage of water as such. When this can be carried out in full, as is now and then possible, a comparatively insignificant stream can be converted into a valuable and reliable source of power. In the larger streams the lake space required for storage of the full run-off over the drainage area becomes, for present conditions, prohibitively large. Some day, when fuel shall have become scarcer, great artificial lakes will become commoner. As things now are, there is a large amount of storage done for the purpose of covering the ordinary variations of flow, but very little with the view of saving the energy lost in the maxima. The power required in hydro-electric stations is a very variable quantity. The peak load is commonly more than twice the maximum, and at times of low load there is very often great waste of water, either from lack of suitable storage capacity or from inability to utilize storage on account of the demands of plants lower down on the stream. This condition of necessarily limited storage is a very common one, since a well-developed river is covered by successive plants, between some of which very inadequate storage facilities exist. The result is that perhaps half the hydraulic energy in one fall may have to be wasted to meet the needs of a really less valuable fall just below, but having a different distribution of load.

The value of an auxiliary load such as is secured in this Raquette River plant by the addition of pulp-grinding machinery is very obvious. The load on this auxiliary is fully controllable, so that at times of low electrical demand the full normal output of the fall can still be secured. At periods of unusually great flow the pulp load can be carried day and night up to the capacity of the plant. The same principle can be carried out with other industries where wood for grinding is not easily available. Of course, only a small proportion of hydraulic privileges are so favorably situated as that on the Raquette, but in general cheap energy being necessary to the pulp industry, wood will have to be carried to the plant, and whenever the hydraulic conditions are favorable there is advantage in working the electric plant and the pulp mill together. By so doing very cheap energy can often be obtained, and both branches of the industry can be made to pay handsomely. There are divers electrochemical industries—alumina reduction for example, which can be worked on a larger scale in similar fashion—in fact any energy consuming industry that can be varied in output of product within reasonable limits, can be thus made auxiliary to general power distribution. The electrochemical industries in the measure that they are conveniently more continuous than pulp grinding, can be less freely varied in output, but with proper tact in management a very steady total load could be obtained. There is every reason for a general investigation of such opportunities, for they give an admirable chance for largely increasing the ultimate profits for a given investment. And the auxiliary industry need not be under the same roof with the power plant, as in the example here discussed, but may be anywhere within easy radius of transmission. In other words, an electric transmission project may profitably be combined with an energy using industry of such nature that it can fully utilize a variable power.

Graphic Representation of Induction Motor Phenomena.

The variations in the several methods which have been used by different writers when discussing the phenomena connected with the operation of an induction motor can be attributed to the simultaneous similarity of the machine to a stationary transformer and to a shunt-wound, direct-current motor. Electrically considered, the induction motor is the equivalent of a stationary transformer possessing a core of high reluctance and coils of large reactance, and all of its electrical characteristics can be studied by treating the input side of the machine solely as a transformer. The mechanical equivalent of the machine is found in the direct-current shunt motor, and its output and mechanical performance may easily be investigated when this fact is kept in mind. It is possible to consider the secondary winding of the induction motor as a circuit of constant resistance and constant self-induction and subjected to a variable e.m.f. at a variable frequency. It is possible also to consider that the secondary winding is subjected to a constant voltage, a portion of which is used up in the winding itself and the remainder of which, the counter electromotive force of rotation, is useful in producing mechanical work. Owing to the fact that the current which flows in the secondary winding at the frequency corresponding to the slip produces a secondary magnetic field which revolves at the slip frequency and in a direction opposite to the slip, the secondary field reacts upon the primary field with the primary frequency. It is possible, therefore, to treat both the primary and secondary circuits as though they belonged to a stationary transformer operated at constant frequency.

In view of the facts stated above, it would seem that the simplest method for dealing with induction motor phenomena is one treating the machine as a stationary transformer, its output characteristics being determined from the input performance of the motor modified by the internal behavior of the machine. An advantage possessed by the graphic over the algebraic method of treating the induction motor as a transformer is found in the fact that by the use of the former method one is able to follow the changes in the variables connected with the phenomena during operation and can thus determine at once the dependance one upon the other of the numerous characteristics, and thereby can predict the effect of altering any constant of construction, while with the latter method these changes and their effects are more or less hidden. The possibility of obtaining from algebraic equations that clear conception of the performance of the induction motor which is readily acquired from the use of the graphic diagrams is seriously to be doubted. It is believed that the graphic method which involves the use of the circle diagram possesses peculiar merit with reference to simplicity in application and practical accuracy in results. On page 825 of this issue there is given a brief discussion of the facts upon which the construction of the simple circle diagram depends, and mention is made of the uses to which the diagram may be put. The article serves to emphasize the fact that the true primary current locus is not a circle, but that the secondary current follows a true circular locus.

Just as there are numerous methods for representing the performance of an induction motor, so are there many methods for explaining the shape assumed by the locus showing the value and phase position of the primary current. Perhaps the simplest method is the one based on the assumption that the wattless and the power components of the no-load primary current remain constant, and that the actual primary current is the resultant of these two components and a third component equal and opposite in magnetomotive force to the secondary current, which latter components can be represented by a circular locus. Another simple explanation is based on the assumption that the actual flux in the primary core is constant, and that the primary leakage lines and secondary leakage lines are proportional to the respective currents. It is evident that the assumptions made in each of these methods are not strictly in accord with the facts, since both the core flux and the magnetizing ampere-turns to produce this flux decrease with the drop in pressure through the primary coil. It is worthy of note, however, that even with the simplest possible diagram the results are sufficiently exact for all practical purposes. The whole problem resolves itself into one of choosing the simple circular current locus with its well-known and easily-corrected inaccuracies, or selecting the more complicated modifications with inter-involved approximations to the true results.

In the actual test of an induction motor observations made of the primary quantities with the rotor stationary serve to place accurately one point on the true primary current locus, while the no-load synchronous readings allow another point to be found on the true locus. If a circle is drawn through these two points with its center approximately near the mean center of the true current locus, it cannot fail to pass so near the true locus that the components of the primary current and the corresponding secondary current for each point on this curve will give results in the final computations very closely the same as found in a complete commercial test of the machine. The circular current locus is frequently referred to as the "Heyland diagram." It is not correct, however, to assign to any one man the exclusive credit for having developed this most simple and complete method of treating induction motor phenomena, because numerous workers have independently developed practically the same method, and strangely enough almost simultaneously. It should be mentioned, however, that Mr. B. A. Behrend in a series of articles which appeared in the Electrical World and Engineer during the year 1900 was the first writer to point out the advantages of the diagram to American readers, and that his first publications in Germany were contemporaneous with those of Mr. Heyland. It is noteworthy also that as early as the year 1893 Dr. F. Bedell and Dr. A. C. Crehore, in a series of articles which appeared in the Electrical World, showed that the current locus of a constant-potential stationary transformer is the arc of a circle.

Annual A. I. E. E. Convention.

The following programme has been prepared for the twenty-third annual convention of the American Institute of Electrical Engineers, to be held at Milwaukee, May 28 to June 1:

"The Repulsion Induction Motor," by Mr. Maurice Milch; "Direct-Current Motor Design as Influenced by the Interpole," by Mr. Charles H. Bedell; "Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems," by Mr. Farley Osgood; "Cell Type Lightning Arrester," by Prof. E. E. F. Creighton; "Protective Apparatus for Lightning and Static Strains," by Mr. H. C. Wirt; "Short-Circuit and Ground Currents in Alternating-Current Systems," by Dr. C. P. Steinmetz; "Magnetic Properties of Electrolytic Iron," by Prof. C. F. Burgess; "Measurement of Temperature by Electrical Means," by Mr. Edwin F. Northrup; "The Educational Value of an Electric Test Car," by Prof. T. F. Morgan; "The Art of Inventing," by Edwin J. Prindle, Esq.; "Shunt and Compound-Wound Converters," by Mr. W. L. Waters; "Economics Derivable from the Use of Relatively Small Water Powers of Low Head in the Middle West," by Prof. D. C. Jackson; "Oscillations and Surges Against Ground in Alternating-Current Systems," by Dr. C. P. Steinmetz; "Relative Merits of Various Types of Booster Control," by Mr. Joseph Bijur; "Safety Devices for Steam Engines, Turbines and Motors," by Mr. Charles M. Heminway.

Franklin Bicentenary Exercises at Philadelphia.

One of the most notable gatherings which we have ever had occasion to record was that which has been doing honor to the memory of Benjamin Franklin during the present week at Philadelphia. The occasion is the bicentenary exercises of the American Philosophical Society in celebration of the birth of Franklin, its founder and first president. Elaborate receptions were planned by the Society for delegates from the great institutions of learning of the world, and from the national legislature.

The city presented a holiday appearance, the various public and private buildings being decorated with the colors of the city, blue and gold, United States flags and flags of all nations. The City Hall was outlined with streamers of incandescent electric lamps, crowned with a wreath of brilliant arc lamps, and surrounded by brilliant rows of red, white and blue lamps. On each side of the building immediately over the four main archways was placed a huge kite whose prominent features were studded with incandescent lamps. The tail of the kite was formed by a row of lamps while a similar row served for the string, at the end of which was attached a key outlined with incandescents. The statue of Franklin at the *Public Ledger* building was decorated with streamers of incandescent lamps, to which was attached an illuminated kite, a key built up of electric lamps being suspended from Franklin's hand. Busts of Franklin formed the central figures in the interior decorations of the buildings used for the meetings.

The official opening of the celebration was on Tuesday evening, when the delegates, invited guests and members of the Society assembled at Witherspoon Hall to listen to the address of the president of the American Philosophical Society, vice-provost Edgar F. Smith, of the University of Pennsylvania. The address by Dr. Smith was primarily one of welcome to the delegates, but it dealt to a large extent with the many-sided career of Franklin, the first president of the Society. After outlining the numerous electrical experiments performed by Franklin, Dr. Smith stated that he had given certain explanations of electrical phenomena which have been modified only slightly during the past 200 years, and that Franklin was the first investigator to understand static electricity. He appreciated the oscillatory nature of the spark discharge, and he had entered upon some work of the nature of that subsequently brought to completion by Hertz. Dr. Smith mentioned also the fact that Joseph Henry had been a member of the Society. The second president of the Society was David Rittenhouse, whose theory of the magnetism of iron propounded in 1781 continues to be viewed by scientists as representing the facts. Among other members of the Society who became distinguished through their work with electricity may be noted Robert Hare, who gave an account of galvanic apparatus in 1821, and John W. Draper and Samuel F. B. Morse, who developed the electromagnetic telegraph.

At the conclusion of the presidential address, the names of the delegates were called in the order of the foundation of the various learned societies or institutions of learning which they represented, beginning with the University of Oxford (twelfth century) and ending with the Sociedad Aragonesa de Ciencias Naturales, which has recently been formed. There were 126 institutions represented on the list, and it is estimated that there were 200 delegates present. With only few exceptions, each institution represented had sent a formal address printed on parchment and bearing the official signatures. The addresses from those institutions founded before the year 1800 were read in full, but the other addresses were presented without being read.

The event of the evening on which the major portion of the interest seemed to have been centered, was the conferring on Miss Agnes Irwin, dean of Radcliff College, who is a great-granddaughter of Franklin, of the honorary degree of Doctor of Laws by Mr. Andrew Carnegie as Lord Rector of the University of St. Andrews. Mr. Carnegie remarked that, although St. Andrews had in 1759 bestowed upon Franklin the degree of LL.D., Franklin was at that time a British subject, and that the present recipient was the first American to whom such an honor had thus been given, and that the present Lord Rector is the first American to occupy such a position connected with the university during its 500 years of existence. At the conclusion of the official exercises of the University of St. Andrews the delegates were given an informal reception by the members of the American Philosophical Society.

The exercises extended from Tuesday until Friday, an outline of the programme for the last three days being as follows: Practically the whole of Wednesday was devoted to the presentation of papers on subjects of science. Of the 16 papers three dealt directly with electricity: "On Positive and Negative Retrons," by Prof. H. A. Lorenz, of Amsterdam; "Franklin's Researches in Electricity," by Prof. E. L. Nichols, of Ithaca; "The Modern Theories of Electricity and their Relation to the Franklinian Theory," by Prof. Ernest Rutherford, of Montreal. The programme for Thursday included the conferring of honorary degrees by the University of Pennsylvania and an oration by Hon. Hampton L. Carson, attorney-general of Pennsylvania, in the forenoon, and ceremonies at the grave of Franklin under the auspices of F. & A. M. of Pennsylvania in the afternoon, with a formal reception at the Bellevue-Stratford in the evening.

The programme for the forenoon of Friday included addresses in commemoration of Franklin as citizen and philanthropist by Horace H. Furness; as printer and philosopher, by President C. W. Eliot; as statesman and diplomatist, by the Hon. J. H. Choate. The programme included the presentation of the Franklin medal to the Republic of France by the Hon. Elihu Root, while the afternoon was occupied in the reading of papers on subjects of science. The closing exercise was a dinner served at the Bellevue-Stratford.

In the printed list of delegates to the celebration, issued by the Society, almost 60 foreign scientific bodies and universities are represented, and somewhat more than that number of similar American bodies. The name of the American Institute of Electrical Engineers is singularly absent from the list, and owing it is understood to the indisposition of Dr. Wheeler it was not represented at the formalities on Tuesday evening. Among the more notable foreign bodies on the list are the Royal Society, Academie des Sciences de Paris, Universities of Oxford, Pavia, Cambridge, St. Andrews, Glasgow and Edinburgh; Academies of Science of Padua, Rome, Caen, Prussia, Gottingen, Barcelona and Rotterdam; Philosophical Societies of Manchester and Glasgow; Royal Institution, British Association for the Advancement of Sciences.

Among engineering bodies represented are the British Institution of Electrical Engineers, Société Internationale des Electriciens, Physical Society of London, British Institution of Mechanical Engineers, Institution of Engineers and Shipbuilders, North of England Institute of Mining and Mechanical Engineers and West of Scotland Iron and Steel Institute.

The Magnetic Club and Franklin.

The Magnetic Club held its spring dinner at the Hotel Astor, New York City, on Tuesday, April 17, this being the day selected for the joint celebration of the two great Franklin anniversaries—January 17, the day of his birth in 1706, and April 17, the day of his death in 1790. The dinner was as usual with these functions a delightful affair and was well attended by representative men and leaders in the telegraphic and other fields of electrical industry. Mr. A. B. Chandler, the president, was in the chair and acted also as toastmaster. Before the speaking began and while dinner was being served a long and excellent programme of vocal and instrumental music was executed. Mr. T. C. Martin as the first speaker of the evening congratulated the club upon associating itself with the great anniversaries that were now being celebrated in an adjoining city with the co-operation of the scientific and electrical bodies of the whole world. While Franklin was a universal genius, they were glad to claim him specifically as their own and as the first American electrician. As a man's rank in future time might often be judged from the merit accorded him among other nations in his life, it was significant that Franklin in his own day had been received and acclaimed as a philosopher, statesman and genius of the highest rank. Long before an ignorant English critic had inquired with a sneer, "Who ever reads an American book?" the collected papers of Franklin on electricity had been universally circulated and had even been done into Latin for the benefit of the ancients. In France, as our minister, as many as 150 separate portraits of him were printed, several medals were stamped in his honor and, as John Hay had said, his benevolent face, his fur cap and his spectacles were as familiar to the Frenchman as the head of the king on the louis d'or. Franklin had not only been an electrical philosopher, but a practical telegrapher, for he had discussed the sending of signals across the Schuylkill River and there was every reason to believe that he had done it, as it was his rule to put all suggestions to a practical test, like any later Faraday or Edison. None better than that audience could appreciate the tremendous growth of electricity since his day, when not a single man earned his living by the electrical arts; when not a single dollar was invested in electricity, and when the fundamental apparatus of the industry was so utterly unknown that Franklin himself coming into the banquet hall that night would not have recognized the electromagnet that was the badge of the club. Yet to-day the electrical bill of the American public annually was a billion dollars, so that every American was spending more for electricity than for daily bread, although not perhaps as much as he spent for whisky and cigars. Yet the present realization of that which Franklin had forecast would appear puny and insignificant a hundred years hence when the whole world had been electrified and every public function and service was performed through electrical means.

Mr. C. A. Coffin, president of the General Electric Company, was introduced as the head of the largest electrical manufacturing industry that the world had ever seen and was most enthusiastically received. He made a happy and impressive speech, expressing his pleasure at seeing the oldest electrical art so full of young men of vigor and ability, and congratulating the club also upon the fact that within its boundaries the officials of two great competing organizations in the telegraphic field were able to meet together on the basis of amity and in the closest and most harmonious relations. This was a consummation to be desired throughout the electrical field, where as each great electrical development shook itself free of its own internal and internecine warfare it was able to present a firmer front to outer, opposing forces and to make the swifter conquest of the great domains of public service awaiting attention and fruition. Mr. Coffin as one who had seen an active and strenuous life in the building up of electrical industries emphasized to his younger auditors the desirability of that patient and persistent labor that had been so marked in Franklin's own life, and without which nothing worth having or doing could be accomplished. He was glad to note that in the telegraphic field constant and steady advances were being made showing that the men in it were as acute, alert and industrious as ever; and incidentally he made a very interesting allusion to a recent experience in connection with wireless telegraphy. While in Egypt this winter he had had occasion from time to time to send cable messages to the United States. On returning home to this country a week or two ago he found that the cost of the wireless telegraph messages sent from the steamer off Nantucket, only a few hundred miles, was at least as great as for the cablegrams from the banks of the Nile. Whence he was led to infer that the days of wire telegraphy and of submarine cables were not immediately over, and that a good deal of work remained to be done in the cheapening and perfection of the latest wonderful art added to the resources of electricity.

Mr. A. R. Brewer, secretary of the Western Union Telegraph Company, made a brief address full of reminiscences of the earlier telegraphic days in which he had been associated with Mr. Chandler and General Eckert, and recalling the intimate association of those two men with Abraham Lincoln, Edwin M. Stanton and the other heroes of the Civil War. This characterization of the men and events of that period was extremely happy and was listened to very intently. He was followed by Mr. C. C. Adams, of the Postal Telegraph Company, who was recently brought on to New York from Philadelphia, a city which he eulogized eloquently in connection with the Franklin festivities. The proceedings closed with the dispatch of a telegram from the Magnetic Club, signed by President Chandler, addressed to the American Philosophical Society, the University of Pennsylvania and the City of Philadelphia, congratulating them upon the celebration and the great and glorious memory which was thus cherished. The message was entrusted to Mr. Andrew Carnegie as an old telegrapher, and as one active in the exercises of the Franklin Bicentennial, as Lord Rector of St. Andrews University, Scotland

Gift of International Electrical Congress to American Institute of Electrical Engineers.

Following is a copy of the letter of President Elihu Thomson, of the International Electrical Congress of St. Louis, 1904, transmitting to the American Institute of Electrical Engineers a check representing the balance of money remaining on hand after discharging all of the obligations of the congress:

"I beg to enclose a copy of the treasurer's statement which is being forwarded to all of the members of the International Electrical Congress of St. Louis, 1904. The balance in the treasurer's hands at his date is $2,052.67, a check for which is also enclosed. After consultation by correspondence with all of the members of the executive committee of the congress, it has been decided to offer this sum as a gift to the American Institute of Electrical Engineers for its library. The offer is that the gift shall form a separate perpetual fund to be invested by the Institute in such a manner as it shall deem proper, the annual proceeds of the fund to be expended in the purchase of international electrical literature for its library. By courtesy the American Institute of Electrical Engineers would probably apply the proceeds to foreign or non-American electrical literature.

"Since the American Institute of Electrical Engineers was so closely associated with the International St. Louis Congress in formation, membership, attendance, papers and success, it is hoped that your acceptance of this residual fund may constitute a suitable permanent memorial of the International Electrical Congress of St. Louis, and may also serve as an indication of the perpetuation of that friendly feeling between international electrical workers, that he congress evinced."

At the last meeting of the Board of Directors of the American Institute of Electrical Engineers, the gift of the congress was formally accepted, and resolutions adopted to the effect that the fund shall be known as the "International Electrical Congress of St. Louis, 1904, Library Fund," and that the annual income shall be expended in the purchase of foreign or non-American electrical literature for the Institute library. The fund which now amounts to $2,067.06, has been deposited in a trust company under the conditions indicated above.

Legislation to Limit Niagara Power.

The Burton bill now before the House of Representatives imposes a sharp check on the utilization of the Niagara River by new companies and would submit existing enterprises to the operation of revocable permits. It has been introduced by Mr. T. E. Burton, chairman of the committee on rivers and harbors. At Washington on April 16, a plan to retain the beauty of Niagara Falls and yet permit great power to be taken from the Niagara River, was presented before this committee on behalf of the Niagara County Irrigation and Water Supply Company. The occasion was a hearing on the Burton bill to preserve the falls. The Niagara Company has a State charter, authorizing it to take an unlimited quantity of water from the river for the development of power.

Mr. H. L. Cooper, in charge of the engineering features of its plant, presented a plan to increase the amount of water going over the American side of the falls, and at the same time permit the use of such water as his company would need. This plan was to lower the bed of the river for a short distance above the falls, and so draw water from the Canadian side. He said there could be no objection from Canada, as the treaty now in force provides for an equal division of the water, and the Canadian side now has greatly over half the flow.

Mr. M. A. Viele explained that while his company had a right to unlimited use of the water, it contemplated using only 17,000 cu. ft. per second. From this 450,000 horse-power could be developed. Industries which would depend on this power, he said, would furnish employment to 228,000 men and yield in gross annual products $514,000,000.

Mr. W. J. Clark, in this connection, has also addressed to Mr. Burton an open letter in regard to the value and importance of the power, and its bearing upon the industries of the country. He points out that the 2,000,000 horse-power estimated as possible of development, in the report of the American section of the International Waterways Commission, could be shown by available figures to have a prospective value of $900,000,000 as the saving over equivalent production by steam. This is nearly equal to the value of all the farms in the State. The value of the coal produced annually in Pennsylvania is $121,832,539. It reduced to that extent the value of the resources of the State and marred the landscape of some of the best American scenery. "Would it not, therefore, be as proper to agitate the abandonment of mining in these localities as to refrain from utilizing nature's gift of more than the equivalent of coal at Niagara." Mr. Clark pointed out that the "scenic agitation" was proving very helpful to the commercial interests of the Dominion, as against those of the United States, and that the concession of 17,500 cu. ft. more of water withdrawal to Canada than is granted to America, at $22.50 per hp-year, already meant an annual concession of $4,725,000. Mr. Clark's letter contains a variety of other interesting and striking data.

Directed Wireless Telegraphy.

At a recent meeting of the Royal Society (London) Dr. J. A. Fleming communicated a paper by G. Marconi dealing with methods whereby the radiation of electric waves may be confined mainly to certain directions, and whereby the receptivity of a receiver may be restricted to electric waves emanating from certain directions. For the usual vertical antenna there was substituted a straight horizontal conductor placed at a comparatively small distance above the surface of the ground or water. In some of the tests the transmitting conductors consisted of horizontal wires, the radiations being received at a distance by means of the usual vertical wires suitably attuned. In other tests both the transmitting and the receiving conductors consisted of horizontal wires, while in additional tests the transmitting conductors were vertical and the receiving conductors horizontal. In each case the signals were inaudible when the horizontal conductor was placed at right angles to a line joining the transmitting and receiving stations, and they reached a maximum when the horizontal conductor was placed directly in this line.

Patents on the Tantalum Lamp.

Three United States patents issued April 10 to W. Von Bolton, of Berlin, Germany, deal with tantalum lamps, and are of exceptional interest on account of the information which they contain and of the seeming broadness of the claims. Two of the patents, the applications for which were filed on May 31, 1902, relate to the use of a ductile metal of the vanadium group as a filament for an incandescent lamp, while the third patent, the application for which was filed on January 5, 1904, relates to a special form of substantially pure tantalum.

In order to obtain a coherent metallic body of metal of the vanadium group, the amorphous powder of the impure metal is mixed with paraffin as a binding substance. The plastic mass is then pressed into the desired shape. The resulting body is placed in an oven to drive out the binding substance. The body is then heated by means of the electric current in the absence of air, in order to form a homogeneous ductile metallic body. It is stated that the use of a binding substance may conveniently be avoided by condensing the amorphous powder under sufficient pressure.

For the purpose of obtaining tantalum in a ductile state, the compressed powder of the metal is secured between clamps of tantalum which are connected to the terminals of a source of electrical energy. The metal commences to fuse as soon as an electric current of sufficient intensity is passed through the compressed powder, and molten beads drop off as the fusing proceeds. The fusing process is conducted in a vacuum as perfect as can be obtained. It is stated that if pure raw material is used for the purpose and if all impurities are kept away during the fusing process, the tantalum metal so obtained will have such a high degree of ductility that it can be rolled into very fine sheets and drawn into the finest of wires.

The strength of the patents may be learned from two of the claims, which read as follows: "An incandescing body for electric glow lamps, consisting of a drawn wire of metallic tantalum." "Substantially pure metallic tantalum possessing the qualifications of homogeneousness and ductility."

Development of Wireless Telegraphy.

Some interesting data were given as to the growth of wireless telegraphy by Mr. John Bottomley this week, to the Marconi stockholders at their annual meeting. During the twelve months ending January 31, 15,076 messages, comprising 203,276 words, were sent and received by the American company alone and through its ship and shore stations. During the same period, 1904-1905, 8,314 messages containing 122,424 words were sent and received. These figures do not include the operations of the stations controlled by the English, Belgian, French, Canadian and Italian allied companies.

The completion of the new station at Sea Gate in January last gives an unbroken chain of stations owned and controlled by the Marconi system from New York harbor to Cape Race, N. F., by means of which vessels entering or leaving New York harbor are in constant communication day and night for about seventy hours. Thus, a vessel outgoing, on leaving her dock, takes up Sea Gate, carries this station until communication is established with Babylon, carries Babylon to Sagaponack, Sagaponack to Nantucket, Nantucket to Sable Island, Sable Island to Cape Race. Each of these stations is connected with the land lines so that messages are sent to or received from every part of the United States, Canada, and, indeed, the world.

The long-distance station at Cape Cod has transmitted and received many messages across the ocean without any relay whatsoever. News and commercial messages are constantly transmitted from this station to vessels, 1,700 miles away. At present out of about 70 vessels trading regularly across the Atlantic, which are equipped with Marconi instruments, thirteen are fitted with long-distance receiving apparatus. It is predicted that in a very short time these vessels will be in constant communication with land during the entire trip across the ocean.

Mr. Bottomley referred to the success which Mr. Marconi has had in transmitting wireless telegraph signals in a predetermined direction. Recently at Clifden, Connemara, a horizontal wire 230 metres in length was laid on the ground and connected at one end to a magnetic detector and to earth. With this wire it was possible to receive with clearness all the signals transmitted from the Poldhu station (about 300 miles away), provided that the free end of the conductor pointed directly away from Poldhu. No signals could be received if the horizontal wire made an angle of more than 36 degrees with the line of direction of Poldhu. Other important tests were carried out with the co-operation of His Majesty's ship Furious. At Poldhu eight horizontal wires 60 metres in length were disposed radially at about two metres above the ground. By means of a switch any one of these wires, which divided a circle into eight equal parts, could be connected to a magnetic receiver.

The Furious, which was fitted with the usual vertical aerial, followed a course describing an arc of about 180 degrees round Poldhu, at distances up to sixteen miles. By means of a horizontal wire arrangement the bearing of the ship from Poldhu could be determined at any time by noting on which particular wire or wires the reception of signals was strongest, and also by observing which wires were non-receptive. It was also found possible to receive simultaneously, and without mutual interference, different signals sent by means of oscillations of the same wave length coming from the ship and from the Lizard wireless station whenever the position of the ship was such that a line drawn from it to Poldhu made an angle of at least 50 degrees with the bearing of the Lizard station.

Undeveloped Water Powers in Newfoundland.

We have received from Rev. P. J. O'Brien, of Mobile, Newfoundland, a communication pointing out the great opportunities for water power electrical generation in the district in which Mobile is situated.

In the neighborhood of Mobile there is a water shed of about 100 square miles with three outlets, two being immediately into the sea, and one about 1½ miles, passing through the village of Mobile. The water pocket or reservoir of the latter is at least 15 square miles. A comparatively small outlay would double the quantity of reserve water, while a small dam would give an immediate drop of 100 ft. if an angle of 45° or less. From the power site to the settlement is a plain inclined about 50 ft. for 1½ miles to the harbor. The second outlet could be developed at a small outlay, and though the watershed is not more than ten square miles, the reserve water is considerable and would be capable of doing much work. The third outlet drains an area of about 35 or 40 square miles, 20 square miles of which could be converted into a reservoir. The outlet here is immediately into the sea through a narrow chasm in a cliff which is at least 150 ft. high. There is abundant material on the spot for damming the outlet. The greatest drop here would be about 100 ft. and the least 50. The basin would give an average depth of 80 or 90 ft. of water.

At the very outlet of this last watershed there is a large slate quarry of superior quality. Experts have pronounced it the right material for marbleizing purposes. Current could be generated for the lighting of the coast by electricity instead of oil lamps, the lighting of the city of St. Johns, as well as the running of all its machinery. The Reid Railroad Company now runs electric cars and does a little lighting, but its power cannot do more. A competitor with the water power above referred to in his possession would soon control the situation. The day is fast approaching when a railway must run from St. Johns to Trepassy and St. Marys. Trepassy is about 70 miles from St. Johns and St. Marys about 15 miles further on, the principal town of a bay of the same name. All this 1,000 square miles of country is between St. Johns, the capital, and Bay Bulls, a seaport town about 18 miles in a southern direction and the nearest port to St. Johns, while Trepassy is a magnificent seaport on the most southwesterly extremity and capable of holding the entire British navy. St. Marys lies in a northwesterly direction about 15 miles. An oblong about 16 by 70 miles would embrace the whole area. The harbor of Trepassy is the nearest post of call for transatlantic shipping, is accessible at all seasons and in all weathers, while St. Johns is often blocked with ice and is not always accessible. It would shorten the time considerably for freight and passengers to go through the island while avoiding the dangers of Cape Race.

A railway to Trepassy is a matter the government will have to tackle in the near future. This prospective line would run through a picturesque country, while the numerous lakes would suggest sites unequalled for private residences. Travelers who have visited this country in summer time have been lavish of praise for the abundance of hunting and fishing opportunities, while the climate (heretofore so grossly misrepresented) is among the most bracing and enjoyable on earth.

Father O'Brien states that he has applied to the government for rights to control the use of the water powers noted. Bog and stone grants can be obtained when the time is opportune.

Motors in Rolling Mills.

In a paper on "Electric Motors and Their Applications," read before the Engineers' Society of Western Pennsylvania, W. Edgar Reed refers to the progress made in the introduction of electric drives in rolling mills. He stated that in addition to the auxiliary apparatus, motors are now also being used to drive some of the rolls of steel and iron mills. Eight and a quarter-inch rolls at the Remschied Works are driven by 100 hp 225 to 350 revolutions per minute motors for rolling tool steel from 1½-in. section bars. Compound motors of 1,200 hp are now being installed at the Phœnix Mills, also in Germany, for reversing rolls. A 1,500-hp motor has been in use at the Pittsburg Reduction Company's works for several months for driving rolls. Two 1,500-hp, compound-wound, 100-r.p.m. motors, suitable for 25 per cent increase in speed, are now being installed at the Edgar Thomson Works of the Carnegie Steel Company for the driving of rolling mills.

In cases where the voltage regulation must be fairly good a system similar to the Ilgner system, which has been used in Germany, can be applied. This is also applicable to hoisting and similar work. The Ilgner system is somewhat similar to the Ward Leonard system, with the addition of a flywheel, and consists of a motor generator set, with a heavy fly wheel mounted on their common shaft. The motor can be either alternating or continuous current, having the compound characteristics so that the flywheel will take the overload. The motor is connected directly to the supply circuit. The generator is a compound-wound continuous-current machine, the field coil receiving current separately from a machine mounted on the motor-generator shaft. The generator current is used for operating a continuous current motor which is connected to the rolls and is excited from the generator exciter. The speed of the motor can be changed by varying the exciting current of the generator. The efficiency of this system even at low speeds is very good. It can be applied when it is necessary to reverse the rolls, as it is only necessary to reverse the generator field to reverse the direction of the roll driving motor. The above system is now used for operating 18-in. rolls at the blooming mill of the Bethlen-Falva Iron Works (Germany). The motor has a capacity of 600 hp at 5,800 volts, 50 cycles, 16 poles. The generator (good for 100 per cent. overload) has a capacity of 500 kw at 510 volts, 300 to 365 r.p.m. The flywheel weighs 20 tons and it absorbs 16,000 hp seconds when the speed changes from 300 to 365 revolutions. The roll driving compound motor has 200 hp normal and 600 hp overload capacity and runs at 60 to 110 revolutions. A 12-ton flywheel is mounted on this motor shaft. The roughing mill has 14-in. rolls and is driven by a motor having the same capacity as the blooming mill motor, but runs at 150 to 230 r.p.m. approximately, and has an 8-ton flywheel. It is stated that the load fluctuations at this plant are very small, and constant power is taken from the supply mains.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL CLUB.—To mark the opening of the New York Electrical Club, a reception will be held in the handsome club rooms at 16 Park Place, on Saturday, April 21, between 2 and 4 p.m.

ONE THOUSAND STRONG.—The National Electric Light Association expects to have a full thousand names on its membership list at the time of the Atlantic City meeting, June 5 to 8. Only thirty more are needed to make up this number, and at the rate applications are coming in there is no doubt of the full number being reached. The growth of the Association has been extremely rapid during the last four years.

APRIL A. I. E. E. MEETING.—At the regular monthly meeting of the American Institute of Electrical Engineers, to be held April 27, two papers will be presented dealing with high-tension underground cables as follows: "Standard Dies, Rubber-Covered Wires and Cables," by Mr. John Langen; "Comments on Present Practice in Underground Cable Work," by Mr. Wallace Clark. The annual business meeting of the Institute will be held May 15, but no papers will be presented at this meeting.

GREAT INVENTIONS FOR SALE.—Mr. C. L. Staub, architect, of Omaha, Neb., has issued a circular to all and sundry offering "four great inventions for sale." One of them is a steam boiler with a fuel saving of 400 per cent. Another is "a new motor to produce electricity or run dynamos by reharnessing the lost 85 per cent of coal power that now goes out of the chimney." The others are not less important. Original drawings of these revolutionary improvements can be had for from $100 to $300, and the whole thing, lock, stock and barrel, can be had for the absurdly cheap price of $150,000. The inventor gives highly adequate reasons, however, for his willingness to accept this paltry sum. He says that he wrote to Mr. Edison on the subject some weeks ago, but got no reply; "and now I am going to make him look small." God speed the day!

PAINTING INSULATORS RED.—The subjoined extraordinary bill has been introduced in the New York State Assembly by Mr. A. E. Smith and referred to the Committee on General Laws: "An act to provide for better security of life, in erecting electric light wires. Section 1. Every person, company or corporation owning, controlling, maintaining, erecting or repairing any wire used for electric light purposes, or for the purpose of conducting electricity, where such wire is suspended from poles or strung from cross arms upon poles, shall attach such wire to such poles or cross arms by insulators made of glass distinctly red in color. Section 2. Every person, company or corporation, its agents or employes, not complying with the provisions of this act shall be deemed guilty of a misdemeanor, and liable to a fine of not to exceed two hundred and fifty dollars for each offense. Section 3. This act shall take effect immediately."

THE GREENWICH MERIDIAN.—A special dispatch from London of April 9 says: "The electrification of London, which is progressing rapidly under the County Council's direction, threatens to interfere with the accuracy of the world's chronometers. At Greenwich the council has erected a huge generating station, and one of the smokestacks is placed right in the plane of the meridian of Greenwich, by which the clocks of the world are set. It is feared that smoke from the stack will obscure the view of the great telescope by which the observatory staff observe the stars as they cross the hair line drawn on the lens and thus fix the universal standard of time. In another way the electrical installation which runs the street cars at Kew, in the other extremity of London, has so seriously affected the instruments at the observatory in Kew Gardens, that it has been decided to remove it to a spot less influenced by electricity. Greenwich observatory, however, will remain where it is, and if the smoke proves an insuperable obstacle the smokestack will be removed, for it can be imagined that the abandonment of the Greenwich meridian as a standard of time would lead to incalculable confusion throughout the world."

FRANKLIN DAY HONORS.—In connection with the celebration of Franklin day in Philadelphia on April 17—the day of Franklin's death—commemorating also January 17, the day of his birth, the University of Pennsylvania is conferring several degrees this week. King Edward, through Sir Mortimer Durand, the English Ambassador, will receive the degree of Doctor of Laws from the University on Thursday, and the university, of which Franklin was one of the founders, will also confer other honorary degrees upon the following persons, among others: Andrew Carnegie, Sir George Howard Darwin, Plumian Professor of Astronomy and Experimental Philosophy, University of Cambridge, England; Gughelemo Marconi, inventor of wireless telegraphy; Ernest Rutherford, Professor of Physics, McGill University, Montreal; John William Mallet, chief chemist, University of Virginia; James Gayley, New York, metallurgist and first vice-president of the United States Steel Corporation; Edward Charles L. Pickering, Professor of Astronomy, Harvard University; Alois Brandt, Royal Academy of Science, Berlin; H. A. Lorentz, a distinguished physicist of Holland; Dr. Edgar F. Smith, president of the American Philosophical Society. As noted elsewhere, Mr. Andrew Carnegie, acting in his official capacity as Lord Rector of the University of St Andrews, in Scotland, conferred the degree of Doctor of Laws upon Miss Agnes Irwin. Miss Irwin is a dean of Radcliffe College, the woman's annex to Harvard University. She is a great granddaughter of Benjamin Franklin. Her mother was Sophie A. Bache, a daughter of Richard Bache, who was a son of Sallie Franklin.

PUBLIC SERVICE COMMISSIONS.—President A. C. Humphreys, of the Stevens Institute of Technology, took occasion at the annual dinner in New York City of the civil engineering graduates of Columbia University to animadvert on the manner in which the New York State Commission on Gas and Electricity was formed, and the treatment accorded the Consolidated Gas Company. "First, an investigation was had by a committee from Albany. This is generally spoken of as a 'most thorough investigation.' The thoroughness is seen when we find that upon the recommendation of this committee a law was passed requiring the company to distribute its product under conditions that would in the effort to conform thereto unnecessarily deprive the consumer of a satisfactory supply. The company would even be subject to $1,000 fines as often almost as the authorities cared to make the inspections. As a result of this investigation, which was so remarkable for its completeness, a law was passed to place this industry under the control of a commission. The business being one of much complexity, it was reasonable to expect that the Governor would try to appoint, not only able and reputable men, but men already qualified to deal with problems to be presented—men not subject to political pressure. The undertaking was a difficult one even for a competent board—competent, I mean, by reason of past training along specific lines. As nearly every branch of engineering is involved, should we not expect that on such a board there should be at least one engineer? As many questions of business policy and management are involved, should we not expect that there should be at least one member with broad business experience? No, all three appointees were lawyers, and all three, apparently, subject to political pressure. Speaking from a fairly full and broad experience in such matters, I deliberately express the opinion that if such a board is to be recruited from one class or profession only (though there is no necessity for such a course), a better result could be obtained from a board composed of three engineers than from one composed of three lawyers, and especially if these engineers were acountant engineers. In this case the course pursued was the more definitely open to criticism by the Legislature which passed the law and the Governor who appointed the members of the board put pressure upon the board to render a decision while the investigation was not yet completed. Finally, the Legislature took the matter out of the board's hands by passing a bill to cover some of the cases still under advisement."

AN ELECTRICAL SHOW has been given this month in Salt Lake City and the display is spoken of by the local press as large and interesting. A system of colored incandescent lamps was employed to show the telephone system through the intermountain country. Electric heating and cooking were also very much in evidence.

RUSSIAN ELECTRICAL ENTERPRISES.—Permission to use waterfalls in the rivers Narova and Vouchsa in Finland for power purposes has been granted to a company formed with $15,000,000 capital. The plan is to supply St. Pettersburg with electric power. A concession has been sought for an electric railway between St. Petersburg and Moscow.

SALE OF GOVERNMENT LINE.—Bids have been asked for by Lieut. J. S. McCleery, chief signal officer of the Department of the Colorado, for the sale of seventy-three miles of Government telegraph line between Price and Mytton, rendered unnecessary by the building of the Mack-Dragon Railroad. All Government stores are now diverted from the old wagon road to the railroad, which also has a telegraph line to Duchesne.

OWNERSHIP IN ENGLAND.—Hon. R. P. Porter states as to the values of public service systems in England that in the case of gas undertakings the capital invested in them is in the proportion of $192,500,000 municipal and $345,000,000 private enterprise, ascending and diminishing figures, respectively; in the case of electric lighting undertakings, $178,500,000 represents municipal and $159,500,000 private capital, while in the case of the street railways or tramways the division of capital is $155,740,000 municipal and $464,300,000 private companies.

ELECTRICAL REFRIGERATION.—Mr. J. T. Matthias, who is in charge of the electrical refrigeration branch of the Philadelphia Electric Company, as already noted in these pages, makes an encouraging report as to new business in that field. He has added to the circuits since January three 30-hp, two 15-hp, one 10-hp, one 5-hp, one 3-hp motors for this service and has good prospects of closing one 50 and one 20. These figures are a good indication of the possibilities in a new department of energy consumption.

LICENSING ELECTRICAL CONTRACTORS.—A bill has been passed by the last Maryland Legislature requiring all electrical contractors in Baltimore to be licensed. The bill further provides for the creation of a State Electrical Board, consisting of three members, one to be appointed by the Electrical Association, one by the building inspector of the city and one by the Governor. This board is to have the power of issuing to all electrical contractors a license to carry on business in the city of Baltimore after their qualifications have been passed upon.

CANADIAN NIAGARA POWER.—The Canadian section of the International Waterways Commission states that to the 415,000 hp to be developed by the works of the three companies now in progress on the Canadian side, from 200,000 to 400,000 additional horse-power can be developed without in any way impairing the beauty of the falls. It is recommended that until the consequences of the works actually under construction are known no arrangement whatever be made with the United States Government; and the assertion is made that if the falls are impaired in beauty to-day the mischief is done on the American side, as the power companies on the New York side have their intakes above the rapids at which the falls commence. On the other hand, not one of the three Canadian companies has an intake above the rapids. It is also recommended that as the demand for power from the Canadian companies will be limited for some time, it would be good policy not to permit any other companies holding Canadian charters which have not yet begun operations to proceed with their work, but that their charters be cancelled and none others be granted until the actual condition of affairs as shown by the completed works of the present companies is known.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The regular monthly meeting of the American Institute of Electrical Engineers will be held in the assembly room of the New York Edison Company, No. 44 West Twenty-seventh Street, New York City, on Friday, April 27, at 8.15 p.m. The following papers will be presented and discussed: "Standardizing Rubber-covered Wires and Cables," by John Langan, New York; "Comments on Present Underground Cable Practice," by Wallace S. Clark, Schenectady, New York.

FIVE THOUSAND BATTERIES GONE.—The Western Union Telegraph Company is overhauling its office and system in Salt Lake City, and one of the changes is that of throwing out 5,000 cells of good old crowfoot battery and substituting the now familiar dynamo and motor-generator equipment, connected into the local supply circuits with a gas engine as reserve. All the new circuits are of copper, 210 lb. to the mile. It is stated that the battery maintenance was $1 per cell, whereas the energy from the Utah Light & Railway Company will cost only $1,500 to $2,000 a year.

THE WORD "ELECTROCUTE."—A rather strenuous letter has been contributed to that great national cloaca of complaints, the London *Times*, by Prof. Churton Collins, objecting to the sweet word "electrocute," which he accredits or discredits to American journalism. He says: "May I venture to enter a protest against the latest hideous importation from American journalism? The monstrous word 'electrocute,' for kill by electricity, is now of regular occurrence, and bids fair to become part of our language. When we have the legitimately formed word 'electrocide' at our service why should it not be adopted and so detestable a solecism as the word referred to be repudiated?" But other correspondents did not agree with him at all. "Is it not surprising," asks one, "to find Prof. Churton Collins recommending to us as a legitimately formed word of such a barbarous Greek-Latin hybrid as 'electrocide' would be? It would be as bad as 'automobile.'" *"Quis custodiet?"* cries another. "'Electrocute' may be a detestable solecism, 'electrocide' may be a legitimately formed word, but 'electrocide' could not carry legitimately the desired meaning. 'Electrum' meant to the Roman simply 'amber' or 'a mixed metal resembling amber in color.' Even if 'electrum' has been used as the foundation of the word 'electricity,' 'electrocide' would, on the analogy of 'parricide,' be a person who kills electricity." In America, as the practice was first recommended by Mr. E. T. Gerry, there is an idea that "gerricide" would meet the needs of the situation.

TELEPHONY IN NEW YORK.—If the plans of the Atlantic Telephone Company go through, New York City will have presently an automatic telephone exchange service. After six months of proposal and counter proposal, franchise terms have been agreed on between the legal representatives of the Atlantic Telephone Company and Harry P. Nichols, chief of the Bureau of Franchises of the Board of Estimate. Under the agreement the company will pay to the city an aggregate of $3,000,000 as a minimum for a twenty-five-year grant. The matter will be laid before the Board of Estimate on April 20 for its action. In addition to the cash compensation for the franchise the Atlantic Telephone Company agrees to furnish to the city free telephone service for all departments in all boroughs, exclusive of long-distance calls. This, it is agreed, is to go in the contract. The company also guarantees a five-cent interborough rate to all pay station users and to private subscribers. Connection with the independent exchange at Elizabeth and thence with the Keystone Telephone Company in Philadelphia also is a part of the contract guarantee. The backers of the Atlantic Company are Joshua D. Powers, president of the United States Trust Company, of Louisville; Edward L. Barber, of the banking firm of Barber & Brailey; L. T. Watson, of the banking firm of Watson & Co.; James R. Branch, secretary of the American Bankers' Association, and John M. Shaw, of the banking firm of J. B. Russell & Co., of New York City, which house acts as fiscal agent for the company. It is incorporated for $5,000,000 and an increase of stock to $25,000,000 has been authorized.

NATURAL GAS COMPETITION.—Mr. F. L. Bradley, secretary of the New Cumberland, W. Va., Light, Heat & Power Company, writes us that the company has discontinued business and has dismantled its plant, for the reason that it could not compete with the natural gas which is at present so abundant and cheap in that vicinity.

COPPER AND IRON.—Dr. James Douglas, the well-known metallurgical authority, gives data to show that through a long period of years the consumption of iron and copper in the United States has maintained a standard relativity. In other words, for the last decade the consumption has been at the rate of one ton of copper to 83 tons of iron. It has never fallen below 1 to 80 or risen above 1 to 87. In 1905 the amount of copper consumed in the United States reached the gross total of 262,678 tons.

TUNNELS AND TRAFFIC.—The directors of the Pennsylvania Railroad Company have authorized President Cassatt to enter into an agreement with the Hudson River Tunnel Company for the joint use of the railroad company's right of way between Jersey City and Newark. It is the initial step toward an extensive electric rapid transit system between the two cities. Under the terms of the contract to be entered into by the two corporations, the Hudson River Company is to build an electric railway between Newark and Jersey City. The tracks will parallel the Pennsylvania's tracks into Jersey City. They will then descend into the McAdoo tunnels to New York.

TROUBLES AT BAY CITY, MICH.—The superintendent of the Bay City, Mich., municipal lighting plant has filed a report with the City Council stating that 120 arc lamps are out of service on the east side of the river and that "this condition is liable to exist for a period of four to six weeks, due partially to the red tape methods we are compelled to pursue and to the condition of the dynamos." The superintendent proposes that all this plant should be scrapped and new bought. On the west side the commercial service is in bad shape, as the dynamo on it heats up badly and will not carry its load. "To attempt to operate the plants and do it successfully is an impossibility as they are."

STEAM TURBINE UNDER EXHAUST PRESSURE.—The Home Lighting & Heating Company, of Springfield, Ohio, which has a plant in the business district of that city, and does exhaust steam heating, completed recently the installation of a 500-kw Westinghouse steam turbine. This turbine operates under from 3 to 7 lb. exhaust pressure during the heating season. Although steam turbines have been considered very uneconomical under such conditions, the Springfield company regards this use fully justified because of the economy in room and the absence of necessity for cylinder oil. The plant is in a location where room is very valuable, and extensions of the building are not possible on the present property.

NEW LAWS IN OHIO.—Several measures of importance to Ohio lighting companies were passed by the recent Ohio Legislature. The most important of these was the Hillenkamp bill which gives a city council the right to grant a franchise to a competing company and rendering it unnecessary to secure a two-thirds majority vote of the people before such a grant could be made, as has been the rule in the past. This measure was instituted in the interests of a company which for some time has been seeking a grant in Toledo to compete with the Toledo Railways & Light Company. It will also work to the advantage of several competing companies in Cleveland. The Bradley Light, Heat & Power Company and the Cuyahoga Light & Power Company of that city last year made application for franchises, but they failed to get the necessary two-thirds majority vote of the people. Now they will go after the council with their propositions. Another measure authorizes the levy of a five-mill tax to aid in supporting municipal lighting plants where the receipts of these plants are insufficient to pay expenses. The Smith bill provides that councils granting franchises to lighting companies may stipulate that meters shall be furnished free of charge.

LONG ISLAND ELECTRIFICATION.—In the Long Island Railroad Company's annual report, just published, President Peters calls attention to capital expenditures during 1905 aggregating $6,737,568, of which the principal item was $3,545,583 for electrification of steam lines. President Peters says: "Your company has largely completed the electrification of its lines in and adjacent to the boroughs of Brooklyn and Queens, and at the close of the year had in operation electric train service between Flatbush Avenue and Belmont Park, Woodhaven Junction, Rockaway Park, Hammels, Valley Stream and Far Rockaway, and Jamaica and Springfield Junction, a total of 96 miles of single track, with 172 scheduled trains daily. The operation has been carried on very successfully, but is not as yet on an economical basis."

CELEBRATION AT CHARLOTTE.—The city of Charlotte, N. C., is to celebrate on May 20, being the anniversary of the famous Mecklenburg Declaration of Independence. An elaborate electrical display is to be given May 21-26, and Mr. C. E. Bradshaw, the city electrician, invites co-operation on behalf of the electrical committee. He says: "We expect to have a big demand for lighting novelties, etc., and cordially invite the electrical trade to enter their goods, such as fittings, lamps, etc., and we can probably furnish quarters free. The electrical committee will take care of them if the owners do not care to send a representative, receiving the goods, storing, setting up and running and returning them to the owners. All current will be furnished free in reasonable quantity. As this will be of benefit to the electrical trade in general it will be to the advantage of all the manufacturers and dealers to make as good a show as possible."

DEFECTIVE FIRE ALARM SYSTEM.—None too soon an appropriation of $1,625,000 to be secured from city stock is asked for the fire alarm system of New York City. Fire Commissioner O'Brien calls attention to an investigation made by the Board of Fire Underwriters, whose experts, Messrs. Kempster B. Miller and J. J. Carty, "reached the conclusion that the total cost of an adequate system of fire alarm telegraph protection for the Borough of Manhattan would be about $1,625,000, exclusive of the ground for the central office." No estimate for the central office was submitted, for the reason that the price would be subject to variation, depending upon location. The Commissioner's letter to the Board of Estimate concludes: "After giving to the matter careful consideration, I have come to the conclusion that the issue is of such vital importance to the public welfare that immediate action should be taken, looking to the replacing of the present fire alarm telegraph system in the Borough of Manhattan with a modern and up-to-date system commensurate with the requirements of the situation."

TELEPHONE COMPETITION.—The New York Telephone Company has just issued for general circulation a pamphlet based chiefly on data collected by the Merchants' Association of New York and dealing with the practical results of telephone competition in various American cities. A large amount of other data is also given bearing upon the same question, i. e., the operation of two competing telephone systems in any city, and there are tables and diagrams relative to this important matter. The case is thus summed up: "These are cases in which an almost nominal increase in the total number of telephone users has afflicted the business community with a heavy burden of double charges. Although in many other cases the body of exclusive users of independent systems is a larger proportion of the whole, and in some instances the majority, the duplications, representing payment of double charges in order to obtain communication with two isolated groups of telephone users, are in all instances a large proportion of the whole, and in most cases represent payment of the maximum charge. Although the amount of wasteful outlay thus entailed by compulsory duplication of telephone systems can only be conjectured, it is probably more than one-half of the entire amount paid annually for the service of the independent companies. Evidence is abundant to show that where rival systems exist the use of both by the business community is compulsory."

Hydroelectric Development in the Adirondacks.

RAQUETTE RIVER falls 385 ft. along its course of five miles below Colton Village, N. Y., and at the foot of this descent the combined electric power house and pulp mill of the Hannawa Falls Water Power Company is located. At this power house spruce logs are ground into wood pulp, and electric energy is developed for transmission to Ogdensburg and other points more than thirty miles distant. When the water is not wanted to drive the electric generators, it is turned into the wheels that operate the pulp grinders, and the problem of a variable load factor is solved.

The importance of this plan for the double use of water power may be gathered from the fact that the power house named is designed to utilize 84 ft. of the fall in the river, that the rate of river discharge sometimes falls as low as 1,000 cu. ft. of water per second, and that the total rating of turbine wheels used to operate the electric generators and pulp making machinery is fully twice as great as the net power that this quantity of water will develop. Managers of electric power stations in regions where wood pulp can be made to advantage may perhaps draw a valuable lesson from this example.

Above the dam at Hannawa Falls, the drainage area of the Raquette River is 953 square miles, and most of this lies in the great lake and swamp region of the Adirondack Mountains, at elevations of 1,000 to 1,700 ft. above sea level. In this region and forming a great storage reservoir from which the Raquette River flows, are the Tupper lakes, Long Lake, Raquette Lake, Brandreth Lake, and a score or more of small lakes and ponds.

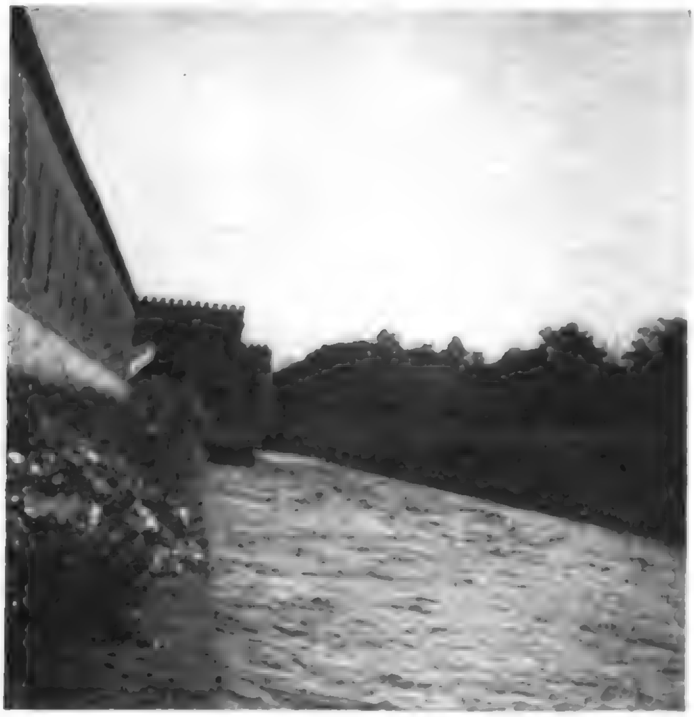


FIG. 1.—TAILRACE.

Having left this region of swamps, lakes and mountains some miles behind, the Raquette River reaches the head of the great falls at Colton with a surface elevation of 800 ft. above sea level, and from this point its descent of 385 ft. in five miles begins. Along this part of the Raquette the water rights have been acquired by the Hannawa Falls Water Power Co., but only the lower 85 ft. of the total fall in this five miles of the river has thus far been developed.

The present hydraulic development begins with a dam at the village of Hannawa Falls, which sets the water back for a distance of 2.5 miles, and forms a pond with an area of about 200 acres. From this dam a canal some 2,700 ft. long carries the water down stream to a forebay above the power house on the river bank. The head wall of this forebay is pierced by four steel penstocks that run underneath the power house, and rise to its several sets of turbine wheels.

At Hannawa Falls, the dam across the Raquette River is built where the bed and perpendicular banks were of sandstone, and the distance between the latter was about 375 ft. Between its main abutments or wing walls the river section of the dam is 258 ft. long and rises to a maximum height of 40 ft. above the bedrock. Of this river section of the dam, a length of 234½ ft. forms the overflow portion, 8 ft. are taken up by an abutment at one end of a waste gate, and the opening of this gate is 15.5 feet wide.

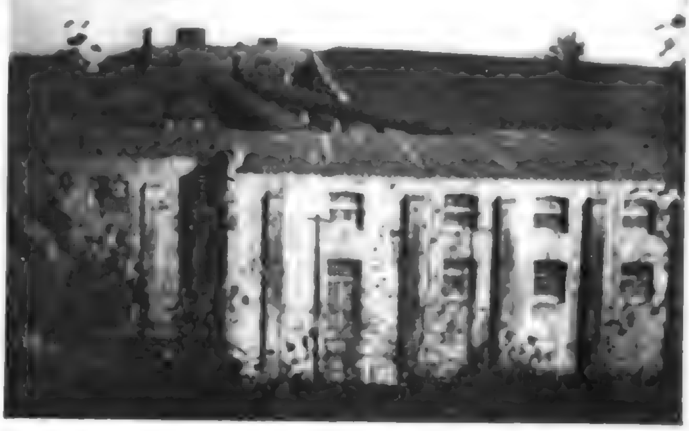


FIG. 2.—FOREBAY, PENSTOCK AND POWER HOUSE.

Adjoining the main abutment that supports one end of the waste gate is the entrance to the canal, 80 ft. in the clear, which is spanned by a stone bridge of five arches with four piers, each 4 ft. thick, underneath. The combined width of these openings between the piers and abutments at the head of the canal is thus 66 ft., and the standard width of the canal below its head is 30 ft. at the bottom and 110 ft. at the top, with side slopes of two to one. From the top of its banks to its bottom the canal is 20 ft. deep, and the bottom is 14 ft. below the crest of the overflow section of the dam.

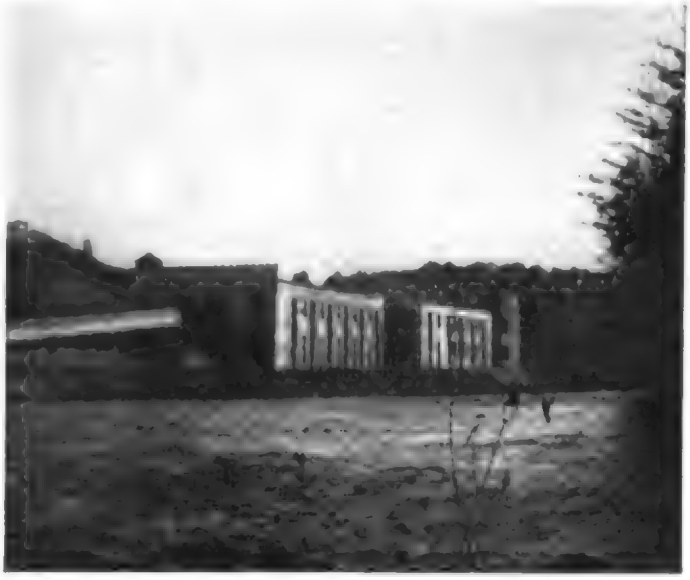


FIG. 3.—POWER HOUSE AND PULP MILL.

A few feet below the entrance to the canal there is a waste gate and weir, by which the water may be discharged into the river. The 15.5-ft. opening in the river section of the dam is closed by four steel waste gates set in a steel frame, and the sill of this frame is 30 ft. below the crest of the dam. Each of the four gates measures 6 by 8 ft., two of the gates being at the bottom and two at the top of the opening. The two lower gates are operated by hydraulic cylinders, and the two upper gates are opened by lowering them, so that any desired depth of water may flow over their tops. These large gates were made desirable by the necessity of providing for the passage of logs down stream, and for the purpose of controlling the level of water in the pond.

Beneath the dam very little excavation was necessary, as the beds of sandstone have a large dip down stream, and thus presented a toothed surface of excellent character for a foundation. The thickness of the dam at its base is 25 ft., and a little below the crest it is 7 ft. From base to crest the dam consists of Potsdam red sandstone and cement. On the upstream and downstream faces of the dam a rubble wall at least 3 ft. thick was laid and between these walls the center of the dam was filled with large irregular pieces of sandstone packed with cement concrete. On the downstream side the stones in the dam are laid in Portland cement, and for the remainder of its masonry natural cement was used. The concrete used in the center of the dam was composed of one part natural cement, two parts sand, and four parts broken sandstone.

At its head the canal may be closed by means of stop-gates between the stone piers named above. From these gates to the forebay, on the high bank above the power house, the length of the canal is about 27 ft., and it is designed to deliver 2,500 cu. ft. of water per second, at a velocity of 3 ft. per second. It is expected that when storage reservoirs at the head of the Raquette have been constructed, the river will have a constant discharge of not less than 2,500 cu. ft. per second.

In its general course the canal follows the river, and lies partly in excavation and partly in embankment, with a bed of gravelly loam, sandstone chips, sand and clay. These materials have been so compacted that the canal shows no leakage. At the forebay and along 50 ft. of the canal above it, the bottom is formed with a layer of concrete in which expanded metal is embedded. Beneath this layer of concrete, which is 4 in. thick, there is a layer of clay that has been packed with water, in the forebay. Retaining walls of masonry support the ends of the canal banks at the forebay, and connect with the forebay head walls that receive the steel penstocks. From these retaining walls, core walls of masonry run back some 50 ft. into the banks. The head wall of the forebay is built with two faces that unite at a large angle, and one of these faces receives three and the other four, steel penstocks. Concrete with embedded sandstone forms the basis of these forebay walls, their outside is faced with sandstone blocks, and between each two penstocks there is a buttress of stone masonry 4 ft. wide and 2 ft. thick.

FIG. 4.—ELEVATION OF POWER HOUSE, STOREHOUSE AND PULP CONVEYOR.

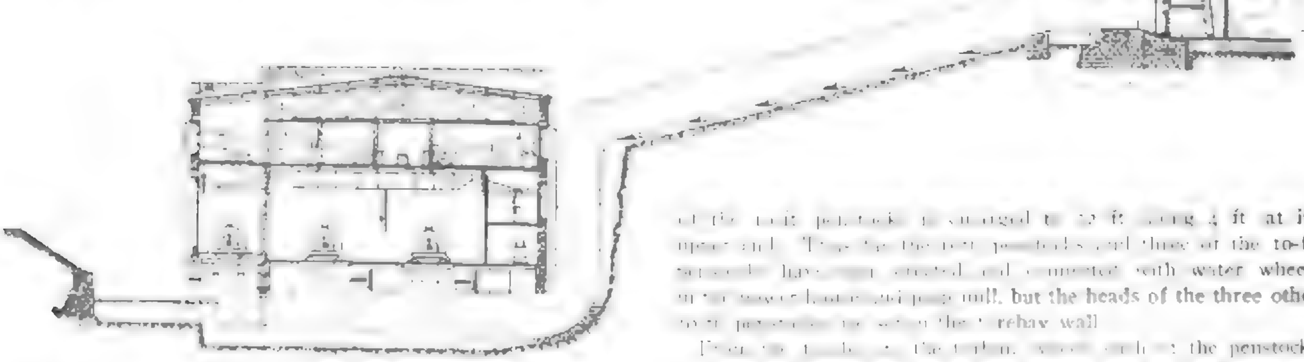


FIG. 5.—CROSS-SECTION OF POWER HOUSE ALONG PENSTOCK NO. 2.

At the corners of the buttresses 6 in. x 6-in. angle irons are secured, and serve as guides for the head gates. These gates are of wood and are operated by racks and pinions that connect with a common main shaft driven by an electric motor. In front of the head gates is a steel rack, and all are covered by a wooden building. One of the seven penstocks is 6 ft. in diameter, and each of the others is 10 ft., and all are spaced with 18 ft. between centers where they enter the head wall. Each of the 10-ft. penstocks is enlarged to 12 ft. along 4 ft. at its upper end. Thus far the 6-ft. penstock and three of the 10-ft. penstocks have been erected and connected with water wheels in the power house and pulp mill, but the heads of the three other 10-ft. penstocks are set in the forebay wall.

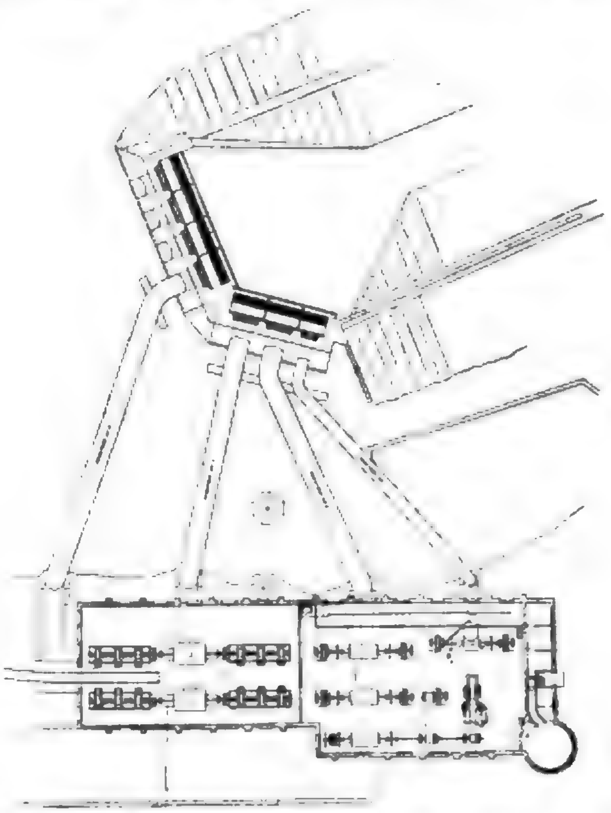


FIG. 6.—PLAN OF LOWER FLOOR OF POWER HOUSE AND PULP MILL, SHOWING ALSO PENSTOCKS AND FOREBAY.

From the forebay to the turbine wheels each of the penstocks has a length of about 200 ft. At the site of the electric station and pulp mill the surface of the Raquette River is about 75 ft. below the crest of the dam. To take advantage of this condition, a tailrace was excavated from the electric station to a point about 1,100 ft. down stream, and this gives a tailwater level at the station that is about 9 ft. lower than that of the river, just outside of the tailrace wall.

The electric generating station is located over the tailrace, and at the foot of the high bank that carries the forebay.

At its first floor level the station is 72 ft. below the crest of the dam, and 12 ft. above the water level of the tailraces, so that the head on the turbine wheels is 84 ft. The building in which the generating equipment is located measures 250 ft. in length, 60 ft. in width along one-half of this length, and 75 ft. in width for the other 125 ft. The building is two stories in height. Its walls are of Potsdam red sandstone, its floors of concrete with expanded metal, and its roof of sandstone flags, two inches thick and laid on T irons. That part of the building which is 75 ft. wide, being the up-stream end, contains the electric generating equipment on the first floor. Across the upper end of the building a space 12 ft. wide, and including the tower, is separated from the remainder by a sandstone wall, and used for offices.

The generator room, where the water wheels and dynamos are located, is 115 ft. long, 75 ft. wide, and 22 ft. from floor to ceiling. Over the central part of this floor space travels a hand crane of 48-ft. span and 16 tons capacity, supported by steel columns. All of the second floor of the power house except the office space, and the down-stream half of the first floor, are occupied by machinery for the production of ground wood pulp.

Beneath the floor of the generator room the bedrock is distant some 21 ft., and over this the tail water is 9 ft. deep. Into this space between the station floor and the bedrock of the tailrace come one penstock of 6 ft. diameter and one of 10 ft. diameter, from the forebay above the high bank. The 6-ft. penstock rises to the case of a pair of Samson type, outward-discharge turbine wheels mounted on a horizontal shaft and located on the floor of the generator room. Under the working head of 84 ft. of water this pair of wheels operates at a speed which is regulated at about 300 revolutions per minute by a Lombard governor geared to the gate rigging. To each end of the shaft of this pair of turbine wheels a 350-kw, three-phase, 4,400-volt alternator is direct connected. For the pair of wheels the rating is 1,250 horse-power, and the combined rating of the two connected generators is 700 kw., on about 930 hp. The pair of generators just named have been in use several years for the supply of electricity to lamps and motors about Potsdam.

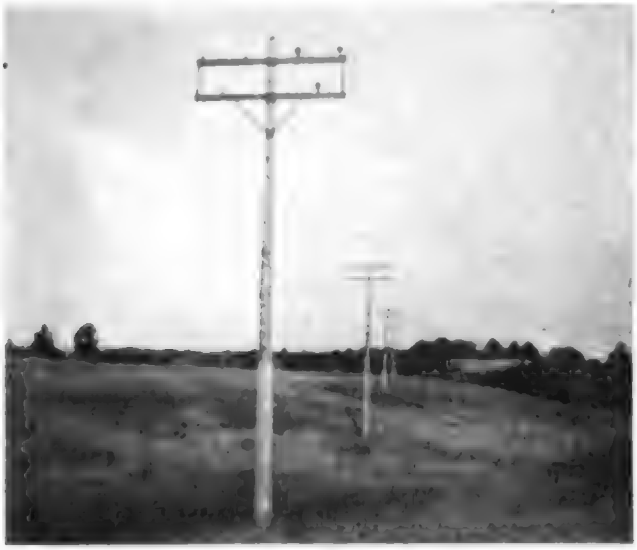


FIG. 7.—20,000-VOLT LINE HANNAWA FALLS TO OGDENSBURG.

Along that side of the generator room which is nearer to the forebay runs a switchboard gallery 12 ft. wide, and beneath this gallery the transformers for the 201,000-volt transmission line to Ogdensburg and other points are located. The other steel penstock that runs beneath the floor of the generator room has a diameter of 10 ft., and its connections rise to three pairs of horizontal turbine wheels with a rating of 1,500 hp each. One pair of these turbines is belted to an exciting dynamo and an air compressor, and to pulp making machinery on the second floor. Each of the other two pairs of turbine wheels is direct connected to a pair of 350-kw, 4,400-volt, three-phase, 60-cycle General Electric alternators, which have just been installed.

From the 4,400-volt alternators the current goes in part to the transformers beneath the switchboard that raise the pressure to 20,000 volts for the transmission to Ogdensburg and Gouverneur. A part of the energy is transmitted at the generator voltage to Potsdam.

FIG. 8.—DAM AT HANNAWA FALLS.

On leaving the water power station at Hannawa Falls, the 20,000-volt transmission line crosses the Raquette River, which is some 240 ft. wide at this point. The line then runs to Canton village, a distance of 10.5 miles, and on thence to the city of Ogdensburg, over an additional distance of 19 miles, so that the total length of the transmission in this direction is 29.5 miles. At a distance of about six miles from Hannawa Falls, a branch from the transmission line goes to Gouverneur village, which is some 25 miles from the junction point, so that the length of line from the water power station to this village is nearly 31 miles.

The line to Ogdensburg is now completed, and the branch to Gouverneur is under construction. On the run to Ogdensburg the transmission line is made up of two three-phase circuits on the same line of poles. Each circuit has three aluminum conductors formed individually of seven strands of No. 8 B. & S. gauge wire.

The cables are mounted on Locke porcelain insulators, each of which has three petticoats, is 5⅜ in. high, and has a maximum diameter of 5.75 inches. From the plane of the highest to that of the lowest petticoat the distance is 2.5 in., and the diameter of this lowest petticoat is 2.75 inches. These insulators are mounted on locust pins of 1 7-16 in. diameter in the shank, that have been boiled in paraffin.

FIG. 9.—VIEW ALONG THE CANAL.

Cedar poles with not less than 8-in. tops and 12-in. butts are used for the 20,000-volt line. Each pole carries two crossarms set with centers 23 in. apart, the upper arm having its center 10 in. from the top of the pole. Each arm measures 8 ft. by 3¼ by 4¼ in., and is secured to its pole by a 12-in. by ⅝-in. through bolt with a 2¼ by 2¼ washer at each end. The lower of the two arms on each pole is braced with a pair of steel L sections each 1½ in. by 1 in. by 3-16 in., and 3 ft. long. These two braces are secured to the crossarm at points 2 ft. each side of its center by ½-in. carriage bolts, and to the pole by a single lag bolt 2 ft. below the center of the arm.

At the ends of the crossarms, on each side of the pole, there is a vertical brace of 1¼-in. by ¼-in. iron 28 in. long secured to them by ½-in. carriage bolts. Before they are put in position all of the braces are dipped in tar. On the top of each pole a ⅜ by 5-in. lag screw enters the wood in a nearly vertical direction, and beneath the head of this screw a No. 6 B. & S. gauge galvanized iron wire is secured. This wire runs down the pole a few feet and is then connected to a No. 12 copper wire that runs to the bottom of the pole and is there formed into a grounding coil of five turns.

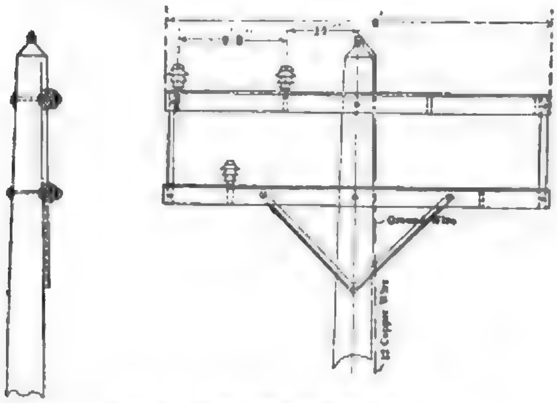


FIG. 10.—DETAILS OF POLE TOP.

From the electric generating station at Hannawa Falls to the sub-station in the village of Potsdam, a distance of 4.5 miles, there are two circuits of aluminum cables, each cable consisting of seven No. 10 B. & S. gauge wires. These circuits are designed to deliver 375 kilowatts at 4,000 volts in the Potsdam sub-station, when the voltage at the generating plant is 4,400, which is supplied direct by the alternators there. Electric lamp and motor supply in Potsdam is carried out with the energy thus transmitted from Hannawa Falls at 4,400 volts, after the pressure has been lowered by stationary transformers at the former place.

On reaching Ogdensburg the 20,000-volt transmission line remains on poles until it reaches the generating station of the Ogdensburg Power and Light Co. and the Ogdensburg Street Railway Co. This station is located at the corner of Lake and River streets near the Oswegatchie River, at about one-quarter of a mile from the center of the business district. This station is a one-story stone building, 77 by 75 ft. on the ground. In this station there are three rooms, one for the steam engine and electric generators, one for the boilers, and one for the 20,000-volt transformers.

Concrete has been used to give the transformer room a fireproof floor. On entering this transformer room the two 20,000-volt circuits are connected with lightning arresters, and then pass to the oil switches and transformers. These latter are in two groups, one consisting of three 100-kw units, and the other group of two 150-kw transformers, all of the Westinghouse make. In the three 100-kw transformers the electromotive force is lowered to about 360 volts for delivery to a 300-kw rotary converter that supplies the railway feeders. By the two 150-kw units the three-phase current of the transmission line is transformed to 2,000-volt, two phase current, for distribution to lamps and stationary motors.

In the engine room there is one horizontal tandem-compound steam engine, a long main shaft direct coupled to a 200-kw, 550-volt, direct-current generator, and belted to a 2,000-volt, two-phase, 60-cycle alternator of the same capacity, two 75-kw dynamos and a 300 kw, 550-volt rotary converter. From the engine shaft to the main shaft there is a belt connection, and a like connection to the two 75-kw dynamos. Connected to the long main shaft are four 100-hp turbine wheels. A canal from the Oswegatchie River supplies water at a head of 11 ft. for these turbines.

By means of the connections and belting just named, the four water wheels may drive the 200-kw generator for the railway load, and the 200-kw, two-phase alternator for general lighting and power purposes. With the belt from the engine shaft to the main shaft, both of the 200-kw generators just named, as well as the two 75-kw dynamos, may be operated with steam power. The 300-kw, 550-volt rotary is necessary only when energy from the transmission line is being used for the railway.

In addition to the foregoing apparatus, the engine room contains two tub transformers, each of which is designed to supply 6.6 amperes to 85 lamps, and the switchboard. Steam for the engine is produced by a pair of 250-hp boilers, in a room 57 by 59 ft. and separated from the engine room by a stone partition.

The general plan of operation is to carry as much as possible of the load with the four turbine wheels that use the water of the Oswegatchie River. Additional power is, as a rule, drawn from the transmission line, but at certain times, or when necessary, the 600-hp engine is operated. Steam coal brought by water costs $3.50 per ton in Ogdensburg, and it is delivered to the boiler room of the electric plant by carts.

The electric supply load of the station just described is used for 140 alternating-current, 6.6-amp. enclosed arc lamps, 8,000 16-cp incandescent lamps and 60 hp in induction motors. The 60 hp of motor capacity was the amount connected to the 2,000-volt, two-phase lines before the introduction of the transmitted energy from Hannawa Falls at Ogdensburg, and from plans then under way it is probable that the present stationary motor load there is much larger. Among the possible motor loads for the Ogdensburg system to take up is that of 250 hp at the elevator and conveyor of the Rutland railroad docks. To this figure may be added some 350 hp in flour mills, and another 200 hp in smaller industrial plants.

In addition to the above electric supply load, the station named operate the entire street railway system at Ogdensburg, which includes ten miles of single track and not less than fifteen motor cars and a sweeper, besides two cars without motors. The gauge of track is 4 ft. 8½ in., the rails are of 48 and 52 pounds per yard, and the length of paved street covered is not more than 1,000 ft. The line has a maximum grade of 6 per cent., and it crosses three iron bridges with an aggregate length of 174 ft. Motor cars vary from 18 to 22 ft. in length, and each is of the single-truck type with 6.5 ft. wheel base. The motors are 12-A Westinghouse. Closed cars have electric heaters. No connection exists between the street railway tracks and those of any steam road, and the street railway carries mail but no express or freight.

During the year ending June 30, 1904, the gross earnings of this road were $27,862.15. In the same year the expense of fuel for power was $287.25, which seems to indicate that most of the work was done with the local water power.

All of the new electric work at Ogdensburg has been done under the supervision of Mr. Edward F. Hawkins, manager and electrical engineer of the Ogdensburg Light & Power Co., and of the Ogdensburg Street Railway Co.

Plans for all of the hydraulic and electric developments about Hannawa Falls, and for the transmission lines to Ogdensburg and other points were from the office of Mr. Wallace C. Johnson, of Niagara Falls, consulting engineer for the Hannawa Falls Water Power Co., and the work was carried on under his general supervision. Mr. Wm. B. Cogswell, of Syracuse, a director of the Water Power Co., has given the electric development of Hannawa Falls a large share of attention. To Mr. O. H. Tappan, secretary and treasurer of the Water Power Co., more perhaps than to any other man, is due the present success of the Hannawa Falls plant. Mr. Tappan has watched over both the financial and technical details of the enterprise, and his aim has been to sell wood pulp and electric energy, rather than stocks and bonds.

The office of the Hannawa Falls Water Power Co. is at Potsdam, N. Y.

Method of Design for Magnet Windings.

By F. Albert Willard.

In the design of magnet windings there are two principal classes or styles of winding which should be first considered in drawing up a method of design which shall be general and applicable to all.

By reference to Figs. 1 and 2, the points of difference between the two different classes are seen. Fig. 1 illustrates the type of coil which is embedded in metal and will depend on the metal to carry away its heat. In this style of winding the size of slot and the ampere-turns are generally known, and it becomes necessary to design a winding having the required number of ampere-turns that will exactly fill the winding space or slot. The heating which this coil will stand continuously is approximately .7 of a watt per square inch of radiating surface, which is the three sides of the coil surrounded by metal. This heating will vary to some extent, depending on the amount of metal adjacent to the winding. In referring to this winding in the future it will be called the "iron clad" type.

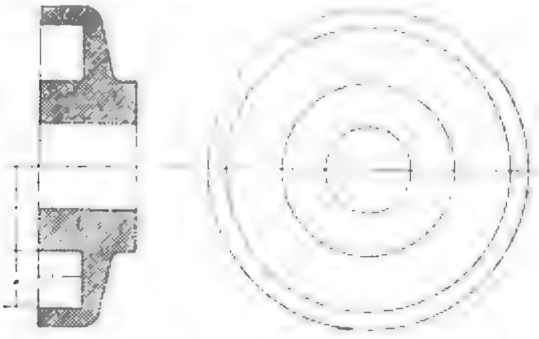


FIG. 1.—PART SECTION AND PLAN OF METAL-EMBEDDED COIL.

Fig. 2 illustrates the most common type of winding, which is known as the "open type," and depends on the three surfaces exposed to the air to radiate its heat. The heating allowable on this type of coil should not exceed .45 watt per square inch of radiating surface. As a general thing the winding space for this type of coil is not limited, and the conditions of design will balance between the cost of copper, depending on the size of wire used and the watts lost. In case the winding space is limited we must assume a maximum allowable loss in watts per square inch and proceed with the design, letting the size wire come what it will.

FIG. 2.—DIAGRAM OF OPEN-TYPE WINDING.

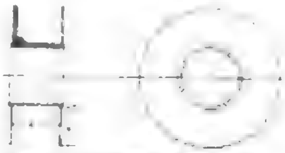


FIG. 3.—DIAGRAM OF LAYER WINDING.

Before we proceed to the design of a winding there is one more point that should be considered, namely, the relation between the cross-section of copper in a winding and the cross-section of the winding outside of the insulation. Giving to this ratio the term "activity," we have

$$\textit{Activity} = \frac{\textit{total cross-section of copper}}{\textit{total cross-section of winding space}}.$$

This quantity will change with every size of wire, and to avoid trouble should not be lost sight of. In Fig. 4 the curve gives the activity of each size wire for the haphazard winding generally used on all open type coils for wire smaller than No. 18; above this a layer winding is used.

The layer winding is generally used on iron-clad coils in order to economize space. The space factor for this style of winding should be figured according to Fig. 3 as follows:

D = depth of winding in inches.
L = length " "
d = diameter of wire used in inches (over insulation).
N = total number of turns.
S = section of wire in square inches.

$$\textit{Activity} = \frac{S\,N}{D\,L} \text{ (for haphazard winding).}$$

$$N = \frac{D\,L}{d^2} \text{ (for layer winding).}$$

By using the layer winding, the winding space will come a little larger than is actually needed for the wire alone; since this surplus space is used for insulation outside of the coil, it will be found that the finished dimensions will run very close to the calculated results.

As an example of the design of a winding, assume an iron-clad magnet having 2,300 amp.-turns and which is to operate on a 220-volt circuit. Referring to Fig. 1, let $L = 1.5$ in.; $D = 2$ in.; $r = 3$ in.

The area of the coil radiating surface will be $= 2\pi\,r\,L + 2\pi\,(r + D)\,L + \pi\,(2\,r + D)\,D = 125.7$ sq. in.

Ampere-turns $= I\,N = 2{,}300$.

$$\text{Mean length of a turn in feet} = M.l.t. = \frac{\pi\,(2r+D)}{12} = 2.095 \text{ ft.}$$

$$\text{Resistance of wire in ohms per 1,000 ft.} = \frac{1{,}000 \times E}{I\,N \times M.l.t.} = 45.6.$$

By referring to the accompanying copper wire table, it will be found that under ohms per 1,000 ft. at 65° C. the nearest standard size is a wire having a resistance of 48.3 ohms per 1,000 ft.

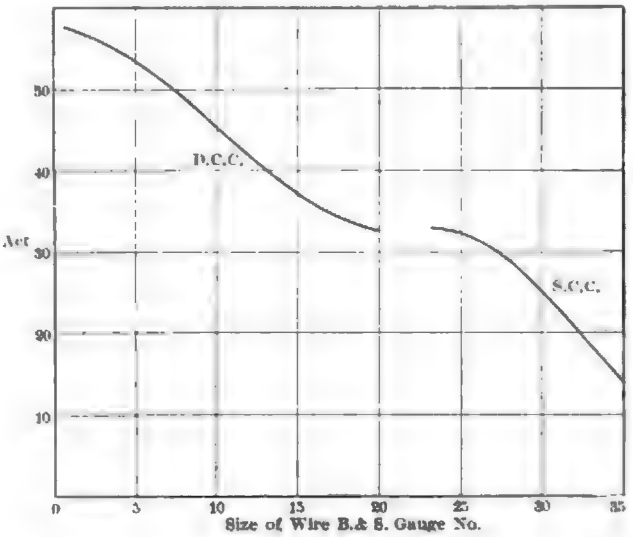


FIG. 4.—ACTIVITY CURVE.

$$\text{Number of turns} = N = \frac{L\,D}{d^2} = \frac{2 \times 1.5}{.024 \times .024} = 5{,}200.$$

$$\text{Ohms resistance} = R = \frac{N \times M.l.t \times 48.3}{1{,}000} =$$

$$\frac{5{,}200 \times 2.095 \times 48.3}{1{,}000} = 528.$$

$$\text{Current} = I = \frac{W}{E} = \frac{E}{R} = \frac{220}{525} = .42 \text{ ampere.}$$

$$\text{Total watts lost} = W = I^2R = 92.5$$

$$\text{Watts lost per sq. in.} = \frac{92.5}{125.7} = .735.$$

Available winding area $= L \times D = 3$ sq. in.

Winding area necessary $= N \times d^2 = 3$ sq. in.

The change in size of wire will necessitate an increase in the total resistance of the coil, and consequently will reduce the ampere-turns from 2,300 to 2,183, a decrease of 5 per cent. The object in making this change was to get a winding that would have but one size of wire. Where a change in the number of ampere-turns is objectionable and the calculations show that the proper size comes between two standard sizes, it will be necessary to design a winding using two sizes of wire. This may be done as follows:

Taking for example the above coil, the calculations show that the proper wire is one having a resistance of 45.6 ohms per 1,000 ft. By reference to the wire table it will be seen that this calls for a wire having a resistance between 48.3 and 38.1 ohms per 1,000 ft., and the number of turns for each size of wire will be inversely proportional to the difference between the required resistance and that of the adjacent sizes. For example:

$$48.2 - 45.6 = 2.7$$
$$45.6 - 38.1 = 7.5$$
$$2.7 + 7.5 = 10.2$$

Number of turns of 48.3-ohm wire equals

$$\frac{7.5}{10.2} \times 5{,}200 = 3{,}820.$$

Number of turns of 38.1-ohm wire equals

$$\frac{2.7}{10.2} \times 5{,}200 = 1{,}380.$$

In making up a coil which has two sizes of wire in its winding it is customary to place the large wire at the bottom. This is done for two reasons: First, the coil will build up better and easier, and, second, the small wire coil, having a higher resistance, has a greater loss, and being nearer the surface allows the heat to escape much more readily.

The depth of the wire in the slot $= D = 2$ in.; $r = 3$ in.

In order to determine the resistance of the two-wire coil it will first be necessary to find a mean length of turn for each size of wire. To do this we must have the depth of winding for each size wire, which can be found as follows:

Depth for the 38.1-ohm wire:

$$\frac{2.7}{10.2} \times 2 = .53.$$

$$M.l.t. = \frac{\pi\,(2r + .53)}{12} = 1.71 \text{ ft.}$$

Number of turns $= 1{,}380$.

$$\text{Resistance} = R_1 = \frac{1{,}380 \times 1.71 \times 38.1}{1{,}000} = 90.$$

Depth for 48.3-ohm wire equals

$$\frac{7.5}{10.2} \times 2 = 1.47 \text{ in.}$$

$$M.l.t. = \frac{\pi\,(2r + .53) + 1.47}{12} = 2.23 \text{ ft.}$$

Number of turns $= 3{,}820$.

$$\text{Resistance} = R_1 = \frac{3{,}820 \times 2.23 \times 48.3}{1{,}000} = 412.$$

Total resistance $= R = 412 + 90 = 502$.

$$\text{Amperes} = \frac{E}{R} = \frac{220}{502} = .438.$$

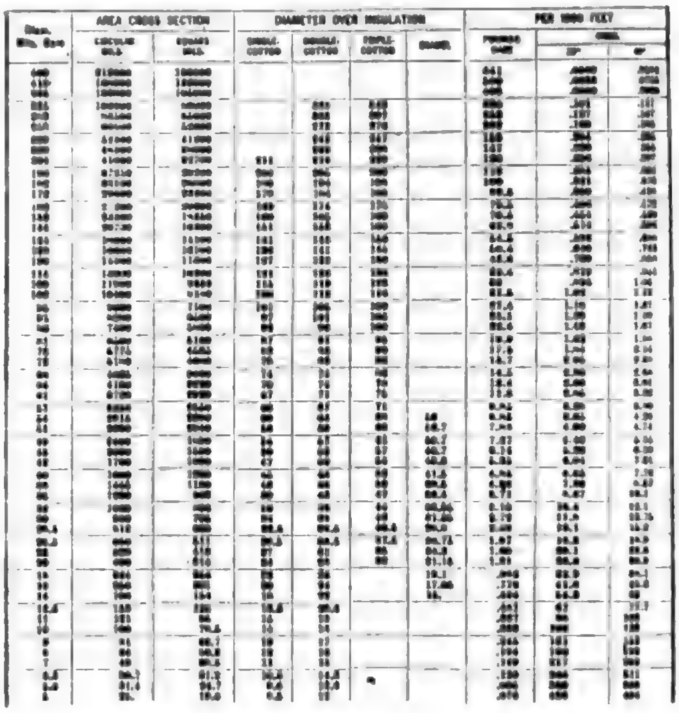
Ampere-turns $= .438 \times 5{,}200 = 2{,}280$.

This winding brings the coil within one per cent of the required number of ampere-turns and is close enough for all practical purposes.

The methods outlined may be used in the design of any winding, and if followed closely will give accurate results.

In the activity curve of Fig. 4 the flat section in the center of the curve arises from changing the insulation on the wire from double cotton-covered to single cotton-covered. This curve should always be used in determining the activity of wire for haphazard windings.

Wherever it is necessary to wind up a number of these coils it would be a very good plan to make up a schedule as given below, to be used as a record and reference; or better still to have it printed on cards and to keep a card index.


AREA CROSS SECTION
DIAMETER OVER INSULATION

CALCULATION OF WINDING.

Sheet No. —. Specification No. —.
Coil area $= A$ .... sq. in.
Ampere-turns $= IN =$ ....
Mean length of turn $= M.l.t. =$ ....

Size of wire $= \dfrac{E}{IN \times M.l.t.} =$ .... (ohms per foot.)

Turns $= N =$ ....
Length of winding in feet $=$ ....

Resistance $= \dfrac{E}{I} =$ ....

Current $= \dfrac{W}{E} = I =$ ....

Total watts radiated $= W =$ ....
Heating allowable (watts per sq. in.) $=$ ....

Gauge.	Res.	Ratio.	Turns.	M.l.t.	Feet.	Res.	Wt.

Available winding area $=$ ....

Winding area necessary $= \dfrac{N \times sect.\ sq.\ mils}{Activity} =$ ....

Graphic Representation of Induction Motor Phenomena.

By A. S. M'Allister.

As is well known, the simplest method which has yet been devised for representing the electrical characteristics of the induction motor is the one involving the use of the so-called circle diagram of the primary and secondary currents. It is equally well known that the diagram as ordinarily constructed gives results which, although sufficiently exact for most practical requirements, are only approximately correct. Numerous modifications of the simple circle diagram have been proposed from time to time in order to render the representation more nearly in accord with facts. Most of the modifications are based on the assumption that the primary current locus would be a true circle if the primary resistance could be neglected, and they include some approximate proof as to the modified location of the center of the circle when the primary resistance is taken into consideration. The treatment below is intended to show that the primary current cannot be accurately represented by any circle howsoever located, even if the primary resistance were negligible, but that in any event the secondary current locus is a true circle.

Although in the secondary circuit the frequency varies directly with the slip, and, therefore, for constant coefficient of self-induction, the secondary reactance varies in direct proportion with the slip, and in general the secondary resistance is more or less constant, it is convenient and helpful to treat the machine as a stationary transformer in which the secondary reactance is constant and the resistance varies with the load. That is to say, the performance of the secondary of the motor will be faithfully represented if all the power received from the primary be considered as dissipated in resistance in the secondary circuit, the slip at all times being taken as unity, and the total secondary resistance (conductance) being assumed to be varied according to the secondary load, or, briefly, the induction motor may be treated in all respects like a stationary transformer. The effect upon the transformer quantities of increasing the speed from zero to synchronism is the same in all respects as increasing the external resistance in the secondary circuit from zero to infinite value, the output from the motor being represented in any case as the power lost in the fictitious external resistance.

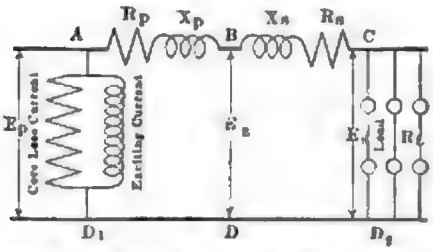


Fig. 3.—Practically Exact Primary and Secondary Current Locus.

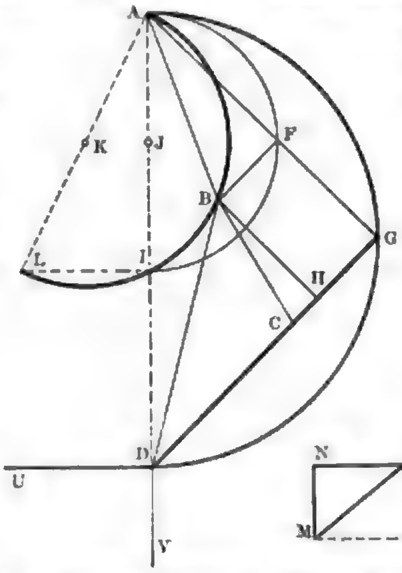


Fig. 1.—Practically Exact Representation of Circuits of an Induction Motor.

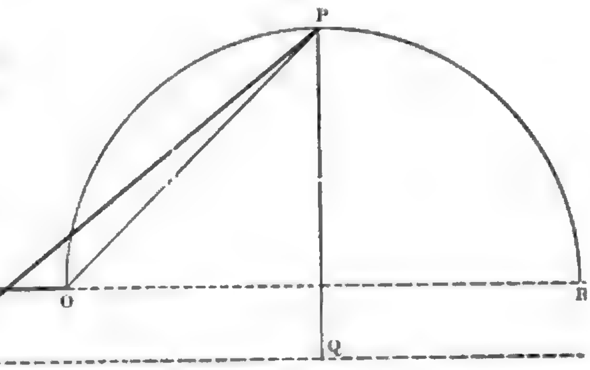


Fig. 2.—Circle Diagrams of Electromotive Forces of an Induction Motor.

Fig. 4 shows the conventional method of representing the electric circuits of a transformer which has an equal number of turns in the primary and secondary windings. This diagram is based on the assumptions that the reluctance of the core is constant for all densities of magnetisms and that the iron losses vary with the square of the magnetic density in the core. It is obvious that neither of these assumptions is absolutely correct with reference to any commercial stationary transformer, but it is true that the errors involved in any calculations depending upon these assumptions are practically negligible. It is evident that in an induction motor the reluctance of the total magnetic path is much more nearly constant than that in an induction motor, and that if the frictional and windage losses be included with the iron losses, the circuits shown in Fig. 4 will serve admirably for all calculations connected with this machine.

In the diagram of Fig. 4 Rp and Xp are the primary resistance and local leakage reactance, while Rs and Xs are the secondary resistance and local leakage reactance, respectively.

An examination of Fig. 4 will show that the primary current is made up of three components: the quadrature exciting current, the core loss current and the load current, of which it is the vector sum. Under operating conditions the current which flows through the primary coil causes a drop in voltage across the local primary impedance and hence the internal counter e.m.f. decreases with increase of load, and there is a decrease in both the exciting current and the core loss current. If it be assumed initially that the variation in the values of these currents is negligible in comparison to the load current of the machine, the treatment becomes much simplified and yet the true conditions are fairly well represented.

Fig. 1 shows the circuits as they could be represented on the basis of the latter assumptions. The current taken by each of the three circuits will flow independently of the currents in the other two circuits, while the total measurable primary current will be the vector sum of the three components. Only one of the component currents varies with the change in load, and its value can easily be determined when the resistance of the load circuit is known. It will be noted that the load circuit contains a constant reactance $(Xp + Xs)$ in series with a variable resistance $(Rp + Rs + Rt)$, where Rt is the fictitious resistance of the load. It will be seen, therefore, that the current which flows through this circuit under a constant impressed e.m.f., E, can be represented by a vector whose extremity describes the arc of a circle having a diameter equal to $E \div (Xp + Xs)$.

The arc $O P R$ of Fig. 3 indicates a section of such a secondary current locus. At any point, P, on this arc, $O P$ represents the secondary current both in value and phase position. The quadrature exciting current is represented by $O N$, while $N M$ shows the core loss current (to supply all of the no-load losses). The vector sum of these three currents, $M P$, in Fig. 3, is the primary current, while the angle of lag of the current behind the circuit e.m.f. is shown by $N M P$, the cosine of which is the power factor. The power component of the primary current is indicated by the line, $P Q$, and the product of this with the circuit e.m.f. gives the input to the motor.

By means of this simple circle diagram, the construction of which is based on somewhat erroneous assumptions, the complete performance of the motor may be determined with a degree of accuracy which seldom need be exceeded for any purpose of designing or testing, since the errors introduced are of small moment, and are not misleading; moreover, they tend to disappear in the final composite results. Thus the input to the secondary at any chosen current may be found as the difference between the primary input and the sum of the primary losses, which latter include the easily calculated copper loss and the approximated "constant" losses. The secondary input is at once the torque in "synchronous watts"; the ratio of the secondary copper loss to the secondary input is the slip, while the output is the secondary input minus the secondary copper loss. It is possible also to represent the various quantities graphically by simple circular arcs and straight lines.

In comparing Fig. 1, on which the simple circle diagram of Fig. 3 is based, with Fig. 4, on which a true diagram should be based, it will be observed that the errors involved relate merely to the quadrature exciting current circuit and the core loss current circuit; the voltage across these circuits is not constant, but it varies with the load current. Since that portion of the drop of voltage across the primary impedance, which is due solely to the core loss current and the exciting current, is quite negligible in comparison to that due to the load current, it is permissible to assume that the voltage at *B D* in Fig. 4 depends entirely upon the load current. This assumption is equivalent to neglecting terms of higher order. These may be taken into consideration graphically without difficulty, but the gain by so doing is not sufficient to justify the added complications.

The internal voltage diagram of an induction motor is represented in Fig. 2, where *A D* is the impressed primary e.m.f., *A F* is the drop through the primary reactance, *B F* is the drop through the primary resistance, and, hence, *A B* is the primary impedance drop. The secondary reactance drop is *B H*, *C H* is the secondary resistance drop, and *B C* is the secondary impedance drop. *C D* is the voltage consumed in the fictitious external load resistance, and, hence, is the secondary e.m.f.; *Es* in Fig. 1 or Fig. 4. The line *B D* in Fig. 2 is the e.m.f., *Ee* in Fig. 1 or the voltage across *B D* in Fig. 4.

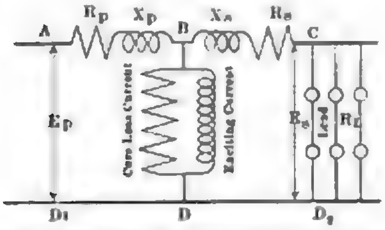


FIG. 4.—EXACT REPRESENTATION OF CIRCUITS OF AN INDUCTION MOTOR.

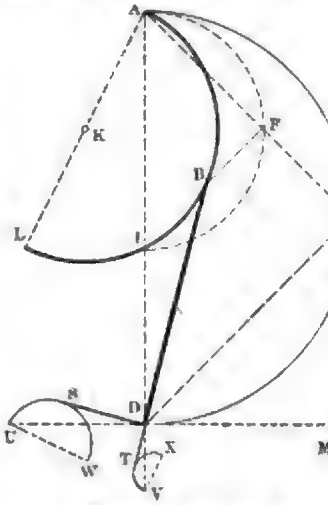


FIG. 5.—CIRCLE DIAGRAMS OF ELECTROMOTIVE FORCES AND CURRENTS.

The current in the secondary is in phase with *G D*, and in quadrature with *A G*. The angle, *A G D*, is a right angle, so that the point, *G*, describes a circle with its center on the line, *A D*. The point, *F*, describes a circle, *A F I*, with its center at point, J, on line, *A I D*. The distance, *A I*, bears to the distance, *A D*, the ratio of the primary leakage reactance to the total leakage reactance of the machine. The point, *B*, describes a circle, *A B I L*, having its center, *K*, on the line, *A L*. The angle, *T A L*, has a tangent equal to the ratio of the primary resistance to the primary leakage reactance.

It will be noted from Fig. 4 that the three component currents may be determined at once when the secondary load current is known and the voltage across *B D* has been found. Referring now to Fig. 5, and remembering that the core loss current is in phase with *B D* and proportional to it, it will be seen that this current can be represented by the line, *D T*, where *T* describes a circle having its center on the line, *V X*, the angle, *D V X*, being equal to the angle *I A L*. Similarly, the exciting current, which is in quadrature with *B D*, can be represented by the line, *D S*, where S describes a circle having its center on the line, *U W*, the angle, *D U W*, being equal to the angle, *I A L*. *D U* and *D V*, of Fig. 5, are respectively equal to *D U* and *D V* of Fig 2, or to *O N* and *N M* of Fig 3.

The corrected current locus of the induction motor is shown in Fig. 6, where the arc, *O P R*, is in all respects the same as the semicircle, *O P R*, in Fig. 3. The line *O P* in Fig 6 is parallel to the line, *D G*, in Fig 5, but it varies in length directly with the line, *A G* of Fig 5. *N M* of Fig 6 is equal to *D T*, and is parallel and proportional to *B D* of Fig 5. *O N* is equal to *D S*, is in quadrature to and proportional to *B D* of Fig 5. The primary current is represented by the line, *M P*, as the vector sum of *O P*, *O N* and *N M*, that is as the resultant of the load current, the quadrature exciting current and the core loss current.

In Fig. 6 the line *P Q* is the proper component of the primary current, the product of which with the impressed e.m.f. gives the input to the motor. The complete performance of the machine can be determined in a manner exactly similar to that outlined for the simple circular locus of Fig. 3.

The current locus in Fig. 6 is based primarily on the transformer features of the induction motor, and it is inexact only to the extent to which the motor differs from a transformer in its electrical behavior. The frictional loss is treated as a core loss, and hence it is tacitly assumed that this loss necessitates a power component of current in only the primary winding. This treatment involves no error with reference to the primary current, but it neglects a certain component of secondary current, which, however, is too small to need consideration.

It will be noted from Fig. 2, that the secondary resistance has no effect whatsoever on either the current locus shown in Fig. 3 or that shown in Fig. 6. The primary resistance has no effect on the secondary current, although the primary current depends somewhat on this resistance. If the primary resistance were negligible, the point *B* in Fig. 5 would follow the circular arc, *A F I*, and both the angle, *D U W*, and the angle, *D V X*, would reduce to zero; the general form of the locus of Fig. 6 would be changed only slightly.

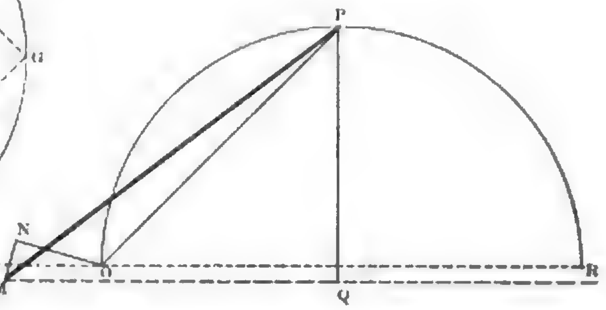


FIG. 6.—CORRECTED CURRENT LOCUS OF AN INDUCTION MOTOR.

* * *

Worcester Polytechnic Institute.

Brief mention was recently made in these columns of the decision of the trustees of the Worcester Polytechnic Institute to erect a new building for the use of the Department of Electrical Engineering. As the plans for the building are nearing completion, it may be well to mention some of the features.

The building will be of the general shape of a quarter-inverted block letter— ┏┳┓ —a main portion, some two hundred feet in length and seventy feet in width, containing the principal laboratories, and a wing at each end about fifty-five feet square containing lecture rooms, design rooms, class rooms and special laboratories, the entrance forming the projection between the two wings.

The feature of the building which will strike the visitor most particularly at first sight will be the large general laboratory, with a ground floor space of fifty-five by two hundred feet. Galleries, fourteen feet in width will extend down each side of this room, leaving a space down the center, twenty-six feet wide, extending to the roof, forty-five feet above. An electric traveling crane will serve this central portion, while the galleries and the ground floor space under them will be served by I-beam trolley travelers. The heavier apparatus will be located in the central portion of the room, while experiments involving lighter apparatus will be assigned to the gallery spaces. Arrangements will be made to transfer loads from the traveling cranes to the trolley travelers serving the galleries.

No part of this building will be devoted to primary power generation, as the Institute has available an ample supply of two-phase alternating current from its service power plant which is located in a separate building. Current will be brought into the laboratory from the power plant through underground conduits, at 2,200 volts, to the switchboard and step down transformers, located under the gallery at one side of, and about midway of the general laboratory. This switchboard will control, in addition to the supply circuits, all of the distribution and transformation of the power for the entire laboratory.

For transformation of the current for various experimental purposes, there will be a 200-kw double-current generator, driven by an induction motor, and supplying 500-volt direct-current and 25 cycle alternating current for the railway laboratory; a smaller 500-volt motor-driven generator; two 60-cycle motor-driven alternating-current generators; two 110-volt rotary converters; two 110-volt motor-driven generators; besides the large number of smaller generators and motors which now form the already fine equipment of the Institute's electrical laboratory.

A notable feature will be the electric railway engineering laboratory, a part of the equipment for which will be a twenty-five ton double-truck four-motor electric car, the exterior of which will closely resemble an ordinary interurban car; but instead of seating capacity, the interior will be occupied by automatic recording instruments for the purpose of indicating not only the performance of the car in operation, but also the electrical and physical conditions of the track and electrical circuits over which it is operated. Double doors at one end of the building and two tracks connecting with the local electric railway system will afford an entrance for this or other cars into the laboratory. Inside the building, one of these tracks will be over a pit for inspection and repair purposes, while the other will terminate in a testing stand, arranged for the reception of the Institute car or any other car. While on the testing stand, the car will rest on supporting wheels, which, as they revolve, will give the effect of a moving track, the car being held in a stationary position. Suitable arrangements have been designed for applying a load to the supporting wheels in such a way as to perfectly imitate the losses in rolling friction, wind resistance, etc., as well as the acceleration and retardation momentum of the equipment under test. The power consumed by the car during any given run will be measured by the power input, and by the power absorbed in the loading apparatus, as well as by a traction dynamometer, all of the instruments being autographic. A very complete equipment of the various forms of controlling, braking, heating, signalling and other accessory electric railway apparatus will be installed, as well as both alternating and direct-current railway motors for "stand tests." The Institute, the first technical school to establish a department of electric railway engineering, will also be the first to equip a complete laboratory for the study of the subject.

A separate small building, adjacent to the laboratory, will house a special 750,000-volt transformer and a 200,000-volt transformer. Circuits from the transformer house will terminate in the third floor of one of the large wings of the main building, which will be used as a high potentials and insulations laboratory.

The first two floors of this wing will be occupied by a lecture room, seating 300 persons, and provided with ample circuits, switchboard and traveling crane facilities, so that apparatus of any character and current of whatever nature required for its operation may be readily brought from any of the various laboratories.

The opposite wing of the building will be occupied by smaller lecture and recitation rooms, department offices, design rooms and the department library. Provisions are made for a storage battery, instrument room, work-shop, standards laboratory, wash-room and locker-room, all of which will be fully equipped. The building will be heated by an indirect system, the primary heat being steam from the Institute power plant. The lighting of the building has been made the subject of special study, and an endeavor will be made to represent every present commercial form of electric illuminant by applying each to one or more rooms, assigning in each case the form particularly adapted.

Yonkers Electric Light and Power Company.

The City of Yonkers has a population of about 60,000 people and covers an area of about 18½ square miles. The Yonkers Electric Light & Power Company supplies the city with electric energy which is now being transmitted from the Bronx station of the New York Edison Company and distributed from the old Elm Street station of the Yonkers Electric Light & Power Company. The equipment in this latter station consisting of two 150-kw, 2,200-volt, three-phase, belt-driven generators is held for emergency use or to carry the day load when repairs are being made on the transmission line from New York City.

The equipment in the Bronx station of the New York Edison Company consists of three 300-hp and one 550-hp Stirling water-tube boilers and three 650-hp Babcock and Wilcox boilers which supply steam to the following engine equipment: Two 500-hp Greene engines, one 1,200-hp Greene engine, one 250-hp McIntosh and Seymour engine and one 500-hp Fitchburg engine. In addition there is now being installed a 1500-kw Allis-Chalmers turbo-generator set. The electrical supply consists of 2200-volt, two-phase, 60-cycle currents.

Two high-tension three-phase lines carrying current at a potential of 6600 volts run direct from the Bronx station to the Elm Street station at Yonkers, 12 miles distant. These lines are on a single pole line and come in at Yonkers through General Electric lighting arresters to a high tension panel which is equipped with polyphase watt-hour meters. Two triple-pole double-throw switches connect either line to step-down transformers, and a third switch is arranged to throw both lines in multiple. From the transformers the current passes to a receiving panel which connects the 2200-volt current to the bus-bars. From this point feeder panels provide for power circuits for lamps and motors, the lighting load being carried on single-phase circuits. The load transmitted from the Bronx station is about 750 kilowatts. The company contemplates shortly to change over the system to four-wire two-phase.

The company has a contract with the city to light the streets with 304 6.6-ampere alternating-current series enclosed-arc lamps and 522 25-cp series incandescent lamps. Most of the commercial lighting is by Nernst lamps and incandescent lamps, the total number of the latter connected being 42,220. The first Nernst lamp installed by the company was connected in January, 1903, and one of the most notable instances of its successful employment to win over the shopkeepers of a small city to the cause of electric lighting has been at Yonkers. Gas here sells at $1.00 per thousand cubic feet, but so successful has the electric light company pushed the Nernst lamp, that gas and gasoline arc lamps have almost entirely disappeared. Many shops, although still equipped with ordinary Welsbach mantle gas lamps and gas arc lamps, use the Nernst lamps in preference. The company supplies the Nernst lamp free of charge and looks after its maintenance, with the result that the lighting business has grown enormously. On June 1, 1905, the number of Nernst lamps installed was as follows: 196 one-glower lamps; 382 three-glower lamps, and 13 six-glower lamps, a total of 591 lamps with 1420 glowers. The growth since then may be gauged from the number in use on March 1 of this year, which is as follows: 638 one-glower lamps, 571 three-glower lamps and 10 six-glower lamps, a total of 1219 lamps with 2411 glowers, making an increase of over 100 per cent in the number of lamps connected in nine months.

By an agreement among the storekeepers, shops are kept open on Monday, Tuesday and Wednesday nights until 7 p. m.; on Thursday until 6 p. m.; on Friday until 10 p. m., and on Saturday until 11 p. m.; so that the bill for lighting is not very high. All the Nernst lamps have a special name plate on which is a number and the legend, "Property of the Yonkers Electric Light & Power Company." The lamps are all tested before being installed and when a glower burns out a new one is quickly put in place, this method having been found very satisfactory to customers as it does not leave them in darkness while repairs are being made. The general plan is to inspect lamps on Friday night so as to have all the lamps in perfect condition for Saturday, on which night most business is transacted. An inspector attends to all troubles reported to the office as well as any he may locate himself. If for any reason he cannot attend to the lamps on a customer's premises, a note is made of this fact and the day repair man who looks after the delivery of incandescent lamps and attends to general complaints, sees that the lamps are put in perfect condition. Any hurry complaints are attended to by any wireman at hand, all wiremen being instructed in the troubles of Nernst lamps and their remedy.

Globes are cleaned only during the day, one man devoting his entire time to going over the district for this purpose and any globes found in improper condition or which are dirty are quickly reported by the night inspector. The night inspector carries a tin case suspended from a strap around his shoulder, containing a supply of one, three and six-glower holders, and also pliers, tweezers, glower-holder extractor and a woolen cloth for handling hot shades, etc. These cases are filled during the day at the station by the man looking after the day repairs and are furnished complete to the night inspector before he makes his rounds. The average life of glowers has been found to be 590 glower hours, although some single glowers have an average life of 1000 hours; but it is the policy of the company to change these glowers at the end of 600 hours' burning so as to avoid the decreased candle-power from the lamp and the attendant dissatisfaction on the part of the customer. The pressure conditions are such that 3.1 watt lamps may be used on the same circuits with an average life of about 575 hours. This life is based on the policy of the company to renew gratis any lamps that have become black or deficient in candle-power.

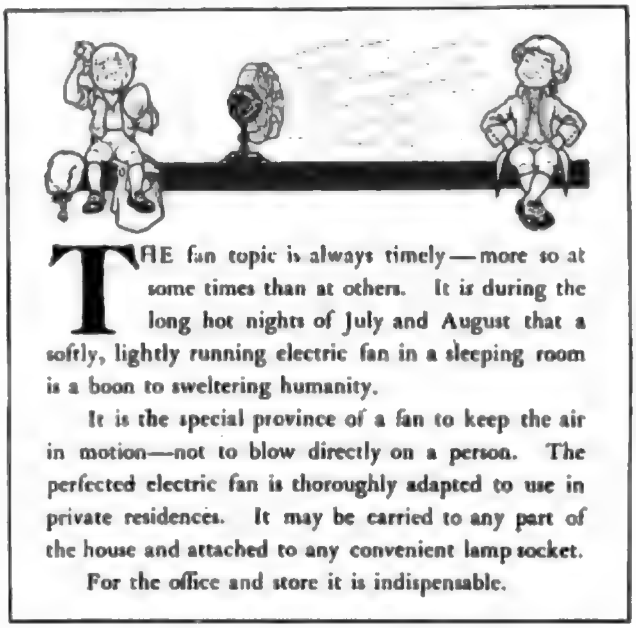
All power is sold by meter, the rate being 15 cents per kilowatt-hour for the first and second hour of burning; 10 cents for the third and fourth hour, and five cents per kw-hour for any lamps burning after four hours. Advertising circulars are sent out to prospective customers, or users of any particular electrical devices. In addition the company sends out regularly a large number of the monthly bulletins of the New York Edison Company marked "Compliments of the Yonkers Electric Light & Power Company." Specific "follow-up letters" on different subjects are also written and mailed at periods varying from 10 days to two weeks or more until some reply is obtained. The attention of the public toward the use of electric light and electric appliances is one of the subjects and also the diffusion of the idea that electric light is a luxury, the price of which is within the reach of all.

The office of the company, which is located at 14 North Broadway, is a well-equipped showroom of electrical appliances and methods of lighting. A feature is not the size of the display, but rather the fact that each sets prominently by itself and is distinctively illustrative of its application. The office walls are decorated with enlarged photographs of various applications of the electric light in the home, office, store and even in church. Electric signs and other electrical devices are also installed.

The company prides itself on the manner of handling complaints. If a claim is made that a bill is excessive, a thorough investigation is made and if no error is found and in the judgment of the company the meter is at fault, a test is made at once and a report sent to the customer. If the test as submitted is not satisfactory to him, the privilege of testing the meter in the presence of a third party is offered to him; the settlement thus aided or obtained being secured on the basis of referendum. A note is made of complaints of service and inspectors are sent to make an immediate investigation. If the fault rests with the lamps these are immediately changed; and if the fault is due to the wiring a suggestion is made to the customer of what would give him better results. The policy of the company is to give prompt attention to complaints and also a fair discussion of them.

The electric sign business in Yonkers has gained some headway and is materially advanced by the very liberal offer of the company; namely, that the sign is made, wired for, and owned by the company. A minimum charge is made of $3.00 per month for all small panel signs, and 75 cents per letter per month for lettered signs. There are about 40 signs in use of various kinds, 30 of which are owned by the company and leased as before stated.

An example of timely advertising literature now being distributed by the company is shown herewith. Another folder is entitled "Timely Suggestions," in which attention is called to the fact that the annual spring cleaning offers a good opportunity to introduce new electric light wires or to extend old ones. The manifold advantages of the electric light and electric fan are dwelt on in this little folder as well as the use of electricity for motors and cooking utensils. The electric sign as a business-getter is also one of the topics, and the company informs its patrons that it has experts in every line of electrical work who, upon request, are at immediate call. This folder is printed on yellow tinted paper in red and black ink, and across the top of each page is an illustration of four waiters delivering electric lamps on a platter, while under the illustration are the words, "At Your Service." "Where the Breezes Blow" is the title of another timely folder printed on green tinted paper and appropriately illustrated, which is devoted to fan motors. The company reminds its patrons that the fan season will soon begin and that it is time to have last year's fan put in good condition or to buy new fans. All of the advertising literature is attractive in form and shows both thought and taste in the arrangement and wording. The officers of the company are as follows: T. E. Murray, president; J. Williams, secretary; N. F. Brady, treasurer; W. T. Morrison, acting manager, J. P. Radcliffe, Jr., general manager, and W. J. Chisholm, superintendent.



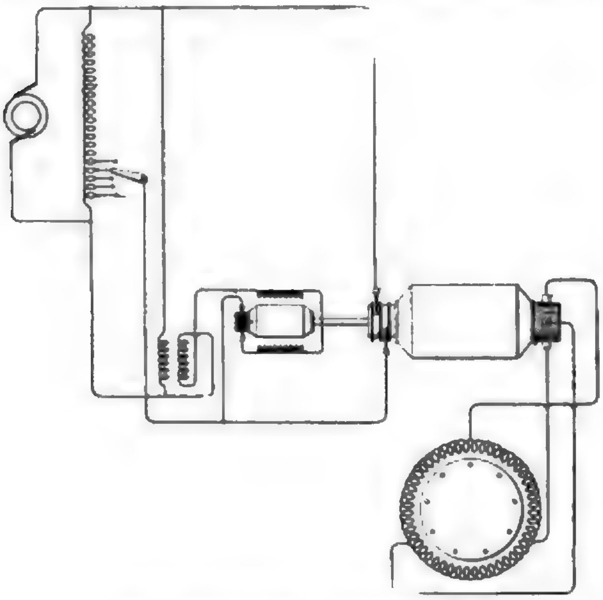
THE fan topic is always timely — more so at some times than at others. It is during the long hot nights of July and August that a softly, lightly running electric fan in a sleeping room is a boon to sweltering humanity.

It is the special province of a fan to keep the air in motion—not to blow directly on a person. The perfected electric fan is thoroughly adapted to use in private residences. It may be carried to any part of the house and attached to any convenient lamp socket.

For the office and store it is indispensable.

Variable Speed Induction Motor.

The accompanying diagram indicates a system for variable-speed operation of alternating-current motors as disclosed in a patent issued March 6 to Mr. B. G. Lamme. The inventor uses a polyphase induction motor and varies the speed by changing the frequency of the current supplied to this machine. The motor receives current from a special frequency changer, which consists of a rotary converter, the field magnets of which are not provided with magnetizing coils, alternating current at a constant frequency being introduced at the collector rings. The rotary is driven at any desired speed by means of an alternating-current series motor. When the rotary is stationary the frequency of the current supplied to the induction motor is equal to that of the main system, while when the rotary runs at synchronous speed the frequency is zero. By means of the circuits shown in the accompanying diagram the voltage impressed upon the induction motor varies with the frequency, and hence the core magnetism of the motor is constant.



LAMME VARIABLE-SPEED INDUCTION MOTOR.

* * *

Maximum Efficiency of a Storage Battery.

By Benj. F. Bailey.

The following test was conducted in the laboratory of electrical engineering at the University of Michigan by E. M. Gladden and B. A. Baker under the supervision of the writer. The object of the test was to get the highest possible efficiency from a storage battery. It is well known that the efficiency increases as the periods of charge and discharge are made shorter, and in order to make these cycles very short we used a 60-cycle alternating current furnished from the city mains at 110 volts.

As shown in the figure, we passed this current through a rheostat and the primary of a 10-to-1 transformer. From the secondary of the transformer we sent the current through a fuse box to an electrodynamometer by means of which we determined the current and kept it constant at 20 amp. by varying the resistance in the primary circuit. From the electrodynamometer the current passed to the storage battery consisting of two 160-amp.-hour cells, with a normal discharge rate of 20 amp. These were connected in opposition so that they might not discharge through the transformer. We used a double-pole, double-throw switch connected as shown, to facilitate comparisons of the voltage of our test cells and a cell which we used as a standard and left upon open circuit except when taking readings. The differences in voltage were so small that we connected the test cell in opposition to our standard and measured the difference in voltage with a millivoltmeter. This instrument read from 0 to 300 and gave a deflection of about two-thirds the scale.

At the beginning of the test the voltage of the standard cell was 2.074. No. 1 was .0055 volt greater and No. 2 was the same as the standard. All these cells discharged gradually, but the test cells, with the alternating current passing through them, less rapidly than the standard which remained on open circuit. The difference between No. 1 and the standard was practically constant for about 50 hours, during which time No. 1 was probably discharging slightly into No. 2 through the transformer, for at that time No. 2 had gained until it was .0036 volt ahead of the standard. From that time on the e.m.f. of the two test cells fell off at nearly the same rate until, at the end of the test, 128.5 hours after starting, No. 1 was .0068 volt and No. 2 .0050 volt ahead of the standard, whose voltage had dropped to 2.072 volts. The voltage of the standard had been as low as 2.058 volts, but the temperature, which varied between 55° and 65° F., was probably high at the end of the test.

The quantity of electricity passed in the two directions certainly averaged the same. Consequently this test shows that the ampere-hour efficiency of a storage cell when worked with very short cycles of charge and discharge is almost exactly 100 per cent. In fact, the loss of charge is not so great as in a cell standing upon open circuit.

We next investigated the watt efficiency of the cell under the same circumstances. We measured the alternating voltage and watt loss at the terminals of the two test cells, and, using a 20-to-1 multiplier to make the deflections readable, we got no appreciable voltage. The loss at 60 cycles per second was 1.35 watts, giving the high efficiency of 98.1 per cent by the formula:

$$Efficiency = \frac{\frac{I}{1.11}E - \frac{W}{2}}{\frac{I}{1.11}E}.$$

In which I = total current.
E = e.m.f. of one cell.
1.11 = form factor = ratio of effective current to average current.
W = total watts lost and $\frac{W}{2}$ = loss per cell.

I was 20 amp. and E averaged 2.07 volts.

In getting the watt efficiency we assumed, by using 1.11 as the form factor, that the voltage curve was a sine curve, which is approximately correct, and the difference in efficiency is negligible. The specific gravities of the cells showed greater density for the first 30 hours. Probably the decrease in temperature, also indicated by the drop in voltage of the cells, more than made up for the discharge, and this caused the specific gravity to rise. The average densities were as follows: Cell No. 1, 1.1777; No. 2, 1.1732; standard, 1.1702. The average of all was 1.1737.

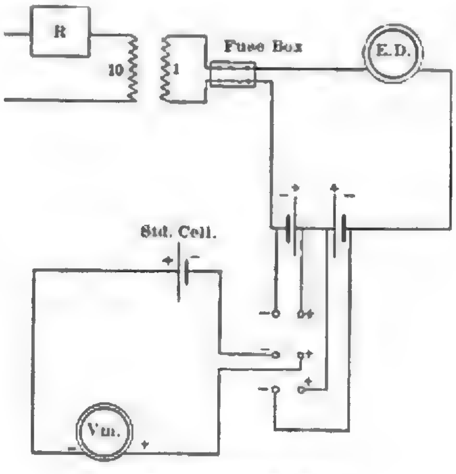


DIAGRAM OF CONNECTIONS.

On page 113 of Lyndon's "Storage Battery Engineering" the author says: "In passing alternating current of various frequencies through two electrodes immersed in dilute sulphuric acid. . . . at low frequencies, the deposit was brown peroxide, and at high frequencies, white sulphate only was produced, which fell from the plates as fast as formed. In the former case the time of one impulse was long enough to form sulphate and change it into peroxide; in the latter the impulse lasted only long enough to form the sulphate, which was thrown off on the succeeding impulse in the opposite direction."

No deposit of any kind was noticeable in our experiment and the cells showed no injury.

In addition to the long test we ran a short one to show the effect of various frequencies. With the current constant at 20 amp., it was as follows: 10 cycles, 97.4 per cent.; 25 cycles, 97.3 per cent.; 35 cycles, 97.6 per cent.; 60 cycles, 97.8 per cent.; 120 cycles, 97.8 per cent. As was expected, the efficiency increases slightly as the frequency becomes greater. In a storage cell we have at least two losses, an I^2R loss and a polarization loss. Apparently with very short cycles of charge and discharge, the polarization does not have time to manifest itself and we have the I^2R loss only.

Interior Illumination.

At the April meeting of the Illuminating Engineering Society, which was held on April 12, a general discussion was had on the subject of interior illumination, introductory papers being presented by Mr. R. M. Searle, of Mount Vernon, N. Y., and by Mr. Douglass Burnett, of Baltimore, Md. The secretary reported that the membership to date was 390, and it was announced that the next meeting would be held May 11, at which street lighting by incandescent lamps would be the topic of discussion.

The paper by Mr. Searle dealt specifically with the proper use of gas lamps, and pointed out the necessity which exists for teaching the general public to employ the most efficient and effective burners for each class of service. One of the greatest sources of loss is found in the absorption of the light rays by the globes. A portion of the loss may be attributed to the frosting on the globes, but in most installations the major part of the existing loss is caused by the deposit of dirt on the globes, which deposit is usually much greater with frosted than with clear globes. Poor and uneconomical service can often be traced to improper supervision of the lamps, and, in this connection, too much stress cannot be laid on the importance of using good tips. In selecting the locations for the lamps due regard should be had to the possible service which each lamp can render. A slight change in the position of a lamp may cause the light from it to serve more than one purpose, and in installing the lamps utility should not be sacrificed. It is to the advantage of the gas company to encourage the use of portable reading lamps. The author expressed the opinion that each person should work for the common good of illuminating engineering.

The paper by Mr. Burnett pointed out the great importance of securing definite information or rules by which lamps, and particularly electric lamps, should be arranged for obtaining the proper illuminating effect. The illuminating engineer should be well versed as to the characteristics of the various illuminants. The author presented a long list of questions relating to specific lighting problems, in order to invite discussion concerning them. He expressed the opinion that arc lamps are hardly to be considered acceptable for illuminating furniture stores or for general office lighting, and that incandescent lamps are not best suited to department store lighting. It is desirable that some definite agreement be reached with reference to the unit of illumination; that is, whether the unit should be candles or watts per square foot of floor area or cubic foot of room volume, or whether the foot-candle unit should be used. Already some very good results have been obtained by planning the illumination on the basis of from one to two watts per square foot.

Mr. V. R. Lansingh discussed in detail several of the lighting problems mentioned by Mr. Burnett. He stated that the object in illuminating a store window is both to attract attention and to display the goods. All lamps should be hid so that the light does not directly reach the eye of the observer. If border lamps are used they should be well shaded. In regard to the different styles of reflectors, it may be stated that the trough type is not as effective as the cone type, due to the limited area and position of the reflecting surfaces. Store fronts should be illuminated by lamps in the windows and not by arcs outside over the street. For large jewelry stores arc lamps have been found to give excellent service. It is important to eliminate all glare when office lighting is being arranged, and for this purpose the office lamps should be of small candle-power and well distributed. In theatres the illumination should be so designed that no lamps are placed below the balcony or in the line of vision between the spectators and the stage. It is incorrect to assume that only arc lamps are suitable for department stores, because the illumination can be carried out with excellent effect by means of incandescent lamps.

Dr. A. H. Elliott stated that with both gas and electric lighting excessive fatigue of the eye is produced when the illumination is irregular or the light is of improper color. The physiological features of illumination present numerous problems which should receive careful and thorough study. He endorsed the several statements made in Mr. Searle's paper with reference to gas lighting. The extremely small openings in globes at the present time may be attributed to the continued use of antiquated fixtures.

Mr. W. S. Kellogg, speaking from the point of view of the architect, remarked that more trouble arises from the excessive brilliance of the illuminants than from the lack of illumination. It is of prime importance to consider the distribution of the lamps.

Mr. T. J. Lytle, Jr., in continuing the discussion of the disadvantage arising from using concentrated illumination, pointed out that the objection which has been urged against the Welsbach gas mantle on account of the excessive whiteness of the light has been overcome in a recently developed mantle which affords a yellow white light. This latter form of lamp is even more efficient than the glaring white mantle. The most effective illumination is that obtained from tinted-globed lamps used in a room with white ceiling and cream-colored side walls. The inverted gas burner has been found to be quite efficient, and it is especially advantageous for decorative effects. The real problem which confronts the illuminating engineer relates to the proper selection of glassware for the lamps and the color scheme for the rooms.

Mr. J. D. Israel congratulated the Society on the good work it is doing in bringing together the different companies in the lighting business, and expressed the hope that the contractors, architects and manufacturers would all get together for the good of illuminating engineering. The Philadelphia Electric Company maintains a special department whose members devote their whole time to illuminating engineering for the purpose of establishing cordial relations between the company and its customers. Circular letters are sent regularly to the customers and to architects and contractors.

Mr. John Campbell stated that the major portion of the existing bad illumination is due to the misleading statements made by the different sellers of apparatus, and to the prevalent use of rule of thumb methods in deciding upon the number and location of the illuminants.

Mr. W. D'A. Ryan remarked that it is extremely difficult to get people to agree to use less light uniformly distributed. They insist on obtaining an excess of brilliancy. Mr. E. L. Elliott thought that the fixture manufacture should be instructed to build the fixtures to conform to scientifically designed lamps and shades, and that it is absurd to assume that the natural laws of light will be changed to conform to the desires of the manufacturer, who seems to wish to dictate just what shape of fixture shall be used.

New Telephone Patents.

WIRELESS TELEPHONY.

The wireless telephone has been used experimentally for some time, but it has always been seriously hampered because of the low energy of telephone currents. The practice for such working has been to earth both terminals of the transmitting circuit and likewise both terminals of its receiving circuit. The waves sent out from the two transmitting terminals, cutting the receiving terminals cause a flow of telephone currents in the receiving circuit. It will be readily understood how infinitesimal must be the received energy. To overcome this difficulty C. F. Collins proposes to augment his transmitted current by the use of the speaking arc. He superimposes his transmitter fluctuations upon the arc in such a way as to increase greatly the effective power fluctuations. Mr. Collins has patented this combination of arc and wireless telephone.

SYSTEM OF PARTY RINGING.

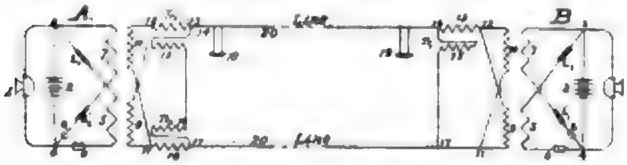
For farmer lines it has been found necessary from the commercial standpoint to connect a considerable number of stations to each line, and in signaling these stations code ringing has generally been resorted to. Many attempts to obviate this code ringing have but fixed the idea in the minds of telephone men of its necessity. Semi-selective ringing affords a considerable improvement in that the number of code rings required is lessened and because but one-half the bells are affected upon each ring. In this system one-half the bells are legged off each side of the line to ground.

A modification of this arrangement has been patented by L. W. Carroll, of Anamosa, Iowa, in which the bells are bridged, but the exchange drop is legged off one limb of the line to ground. In addition to this the generator at the stations is provided with a switch such that the generator may be either bridged or grounded. When the stations wish to signal each other the generator is operated bridged; for the exchange it is operated grounded. This system has the advantage over the semi-selective that the exchange is never called except when a connection to another line is desired. It has on the other hand the disadvantage of a more complicated code. The patent for the new system of ringing is assigned to the Kellogg Switchboard & Supply Company.

IMPROVED TRANSMITTING CIRCUITS.

There have always been recognized three methods of improving transmission: First, improving the power of the transmitting circuits; second, improving the sensitiveness of the receiving circuit, and third, improving the transmitting efficiency of the line. The last of these has received great attention of late and tremendous strides forward have been made. Further advance of the second was long ago abandoned because of the fact that the disturbances become amplified with the speech. The first has heretofore been effected first by gradually improved transmitters culminating in the "solid back" granular type; and second, by improved induction coils.

D. M. Therrell, of Charleston, S. C., has now improved the arrangement of the circuit itself, through purely electrical means. It is Mr. Therrell's idea that if the primary circuit may be arranged so that it resonates with the most prominent frequencies of the voice currents, a very much more powerful effect may be impressed upon the line. The general scheme is set forth diagrammatically in the accompanying figure, where it will be noted that the induction coil is divided into parts each in an independent circuit, the transmitter being in another branch. There seems to be an error here which should be noted. It is claimed that the transmitter will affect the potentials about the condensers 6 and 8. If, as is fair to suppose, the battery, 2, is of constant potential within the limits of working, the effect of the transmitter will be insignificant unless a resistance or coil be included in the battery circuit, 3, 4.



THERRELL TRANSMITTING CIRCUITS.

Granting this resistance, it is readily understood that the difference of potential of the points 3 and 4 will be varied with the resistance changes of the transmitter. These variations will cause surgings in the coil primary circuits. The introduction of the condensers admits of tuning the various primary circuits each to a prominent voice frequency and thus largely overcoming the primary loss. An additional improvement lies in the compensating transformer, Tr_1 and Tr_2. This transformer is arranged to compensate as far as possible for the losses of transformation.

LETTERS TO THE EDITORS.

A. I. E. E. Election.

To the Editors of Electrical World:

Sirs:—The approaching election of officers of the American Institute of Electrical Engineers presents an opportunity for the expression of views which I have long held and which are held by many others (the majority, I hope) in the Institute, relative to the office of President. I desire particularly to express these views with reference to the coming election.

I believe that no man should be elected to the office of President of the Institute unless he has done a considerable amount of good and effective work in advancing the best interests of the Institute. These interests can best be advanced by writing papers; taking part in discussions; serving on Committees and those other and similar time-consuming, tedious, and, to the average man, distasteful kinds of work which are absolutely essential for the best success and advancement of the Institute and its aims.

I believe that the office of President should be held out as an extra inducement to men of high standing in electrical matters to do work for the Institute; as a reward for such work when done well and conscientiously and in a manner showing the candidate's fitness for office.

I have no sympathy whatever with the idea of making a man President simply and only because he is of high standing in electrical work. I know of no man who will confer an honor upon the Institute by becoming its President. On the contrary, the Institute honors the man whom it elects to that office. Such honor is due those men of high standing who have served the Institute's best interests.

For the ability and personality of both the present candidates for the office of President of the Institute, I have the highest regard. Besides ability and standing, one of these men has the additional qualification mentioned above; the other has not. If the former be elected, it will be due to his possession of the qualifications in question, and to the fact that he is well and widely known to the membership. If the latter is elected, it will be mainly due, I believe, to the fact that his friends have at their command the commercial organization of the immense manufacturing interest with which he is connected. If success should crown their strenuous efforts, it will constitute a most regrettable precedent.

New York. Ralph D. Mershon.

To the Editors of Electrical World:

Sirs:—Enclosed you will find a copy of a letter which Mr. Ralph D. Mershon advises me he has asked you to publish. I also enclose copy of my reply which may interest you, and which you are at liberty to use as you may desire.

Schenectady, N. Y. E. W. Rice, Jr.

[The letter from Mr. Mershon enclosed is identical with that printed above, except that in the latter, in the fifth line from the end, the words "I believe" are added after the word "due." We print below the reply of Mr. Rice.—Eds.]

Dear Mr. Mershon:—I have received your favor of April 2, enclosing copy of a letter which you propose to send to one or more of the electrical journals for publication.

I fully appreciate and reciprocate your friendly spirit and complimentary references to myself.

While I respect the views you have expressed, I presume it is scarcely necessary for me to say that I do not think that it is for the best interests of the Institute that the choice of President should be invariably limited in the manner you suggest.

It is true that owing to the great demands upon my time I have been unable to contribute much to the Institute papers or discussions. This has not been due to any lack of interest.

If elected President I would not only regard it as a great honor, but as a special call to work, to which I would respond to the best of my ability by giving the necessary time and effort to the duties of the position.

I confess I do not understand the closing paragraphs of your proposed letter, in which you say, "If the latter is elected, it will be mainly due to the fact that his friends have at their command the commercial organization of the immense manufacturing interest with which he is connected. If success should crown their strenuous efforts it will constitute a most regrettable precedent."

I would heartily disapprove of the use of any commercial organization for election purposes. Of course, many of my friends are naturally associated directly or indirectly with our organization. Their votes have helped to elect past officers of the Institute. You surely do not mean to suggest that such men can be improperly influenced. In my opinion they would resent as quickly as yourself a suggestion to act in any manner not in absolute accord with their own personal views as to the best interests of the Institute.

I hope that the coming election will be in every respect conducted upon a plane in keeping with the best traditions and high character of the Institute. Yours very truly,

E. W. Rice, Jr.

[We desire to express our agreement with Mr. Rice in his comment on the suggested limitation of choice of President of the Institute. The custom of generations has been to select as the head of national and other professional and scientific bodies, men who have been leaders in the respective fields—whose work has been most fully representative of the higher aims of such bodies. To subordinate these considerations to those proposed would be apt to have two unfortunate consequences, particularly in the case of an engineering body. In the first place, the public at large and the many within a profession who do not keep in close touch with the society representing it, might have placed before them as representative of a profession one who, though an assiduous worker within the society, would be far from meeting this qualification. And second, a member of such a society who is in no sense a leader in his profession, but ambitious for its highest honor, might, under the proposed conditions, easily qualify himself for nomination by perfunctory contributions to the *Transactions* and discussions and by enforced activity in routine society work. Finally, in the specific case of the American Institute of Electrical Engineers under its present organization, the opportunities for acquiring most of the suggested qualifications would be very largely confined to members resident in New York City or vicinity.—Eds.]

The Magnetism in Induction Motors.

To the Editors of Electrical World:

Sirs:—The writer wishes to call attention to a fact connected with the space distribution of the flux in an induction motor which is not mentioned in the article on this subject by Messrs. H. F. and H. W. Connell in your issue for February 24. Messrs. Connell found that in the coils wound around the individual teeth of an induction motor there are induced sinusoidal e.m.f's equal in their effective values and shifted against each other as many electrical time degrees as the coils are placed electrical space degrees apart, which proves that the magnetic flux over the pole arc, as measured at the teeth, has a sinusoidal space distribution and travels synchronously around the air-gap, but it does not show that the ordinary assumption that the flux is proportional to the magnetomotive force divided by the reluctance is incorrect when applied to an induction motor.

In treating of the flux in induction motors it is necessary to consider both the primary and the secondary magnetomotive forces, the combined effect of which is to produce the apparent sinusoidal space distribution of flux when the rotor revolves at synchronous speed. It is to be noted, however, that the flux density must be constant from one current point to the next, properly considering both the primary and the secondary currents. Thus at that instant when a certain primary tooth is exactly opposite a secondary tooth, the primary tooth is submitted to a resultant magnetomotive force which is constant all over the tooth, and the flux density will be practically constant over the tooth area. It will be seen, therefore, that considering the tooth area, in distinction to the pole area, the space distribution of the flux is not sinusoidal. The actual instantaneous space distribution of the flux will depend upon the relative mechanical positions of the primary and secondary teeth. That is to say, the magnetic field varies slightly in form from instant to instant and revolves with a non-uniform speed, so that, in spite of the non-sinusoidal field, sinusoidal e.m.f's are generated.

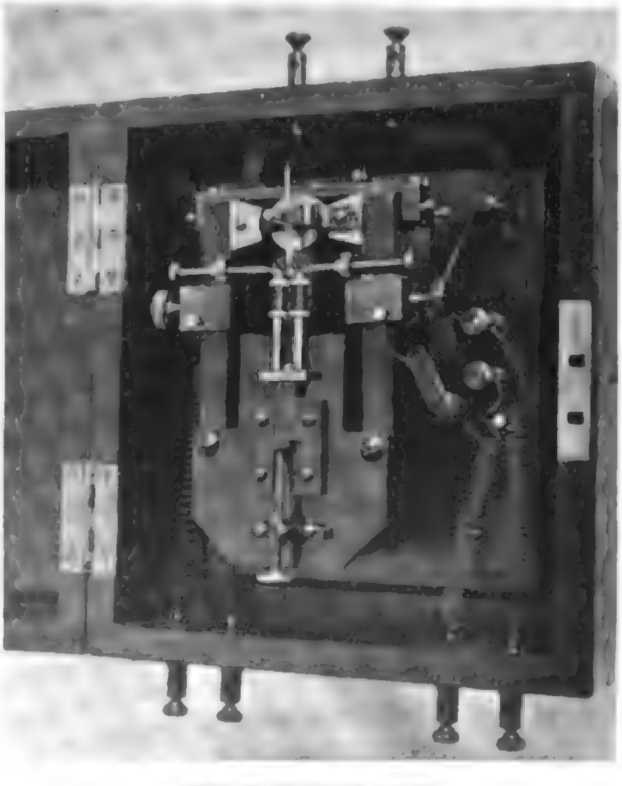
Although the final result is practically the same as though a sinusoidal magnetomotive force revolved synchronously around a non-uniform air-gap, the effect must be attributed in part to the mechanical shifting of the primary and secondary magnetomotive forces.

Hinsdale, Ill. R. E. Hellmund.

Polarized Relay.

To the Editors of Electrical World:

Sirs:—While in London in December, 1900, I was engaged making experiments with a view to developing a system of submarine signaling which required a polarized relay of much greater sensitiveness than any of the ordinary type, and failing to find anything of the kind either on sale or in the catalogues, I designed and made the one shown in the accompanying photograph, which did the work easily, though obviously leaving much to be desired on the score of mechanical refinement.



View of Polarized Relay.

It will be seen that the movable coil is mounted in jewels over a stationary core in the ordinary D'Arsonval manner, and the T-shaped aluminum needle has a light soft iron arc, capped with platinum at the contact end, which plays between the adjustable contacts on either side. The control is magnetic and adjustable over a wide range by means of the screw attached to the permanent controlling magnet; and since the angular motion of the contact cap need not be more than .02 mm. for the work intended, a high degree of sensitiveness may be attained with suitable proportions and coil resistance, by careful manipulation of the control. The coils shown on the permanent magnet arms are intended for use only when receiving unidirectional impulses and are then inversely connected to weaken the control at the critical moment.

It is evident that many changes can be rung on this instrument, either by substituting a permanent magnet for the soft iron arc, with an eye to the polarities in reference to the main field, or giving a wide sweep to the major magnet to lessen its influence on the local field, etc., etc. But in practice with about the proportions shown the local field dominates the stray field at any useful point of adjustment.

These facts are evoked by patent No. 814,501, issued by the United States Patent Office on March 6.

Rutherford, N. J. Leo Daft.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Magnetic Induction and Hysteresis Loss in Armatures.—Thornton.—A paper read before the New Castle Section of the British Inst. Elec. Eng., giving an account of experiments on the distribution of magnetic induction and on the hysteresis loss in armatures with toothed cores, hollow and solid. Two methods were used: First, the distribution of magnetic induction was directly measured by search coils wound in small holes drilled through the core parallel to the shaft. The second method was Hele-Shaw's method of observing stream lines in viscous liquids, which yields a vivid and graphic analogy to the unseen magnetic phenomena. The conclusions are summarized as follows: The magnetization of the teeth in slotted armatures is not alternating but rotating, and at the same time fluctuating; that of the core is rotating, but by reason of the distribution of density in the core not being uniform, it is unevenly distributed, being greatest at the outer parts below the teeth. The ratio of the mean dissipation coefficient to that corresponding to the mean density is found by the author's experiments to be about 0.8. The coefficient for the teeth alone is about 0.00105 joule per cubic centimetre per cycle; that for the core 0.00108. The low value for the teeth is caused by the drop in density between the poles and by the fact that it is rotating. An interesting conclusion is that the Steinmetz rule for calculating iron losses yields results which are too high in the case of the armature teeth. This is due to the fact that the flux through the teeth is not alternating, as is generally supposed, but rotating and fluctuating at the same time. This announcement is worth noting, for it happens occasionally that the flux density in the teeth of a particular machine is kept comparatively low so as to reduce the imagined losses in the teeth and the expected high rise in temperature. But if the losses are actually less than implied by the Steinmetz formula, the flux densities may be increased correspondingly.—Lond. *Elec.*, March 30.

Testing Induction Motors.—Howe.—An account of tests of an induction motor by Bach-Wüg. The method employed is due to Bragstad, and is really an adaptation of the well-known method of finding the losses in one motor by driving it by another, which has been accurately calibrated. The motor used was a direct-current separately excited one, directly coupled to the induction motor under test. Four sets of readings were taken: (1) The power taken by the direct-current motor running light; (2) the power taken by the direct-current motor when coupled to the induction motor, both primary and secondary being open-circuited; (3) the power taken by the direct-current motor when the primary was connected to the polyphase supply, the secondary being open; and (4) the alternating-current power supplied to the primary in the latter case. Readings were made in all cases for various speeds, both above and below synchronism. The results obtained in this way on a 20-hp, six-pole, 50-cycle, three-phase motor are shown in Fig. 1, in which the curves are numbered to correspond with the four sets of readings mentioned above. Perhaps the most striking peculiarity of the figure is the sudden break in curves 3 and 4 when passing through the synchronous speed. Explanation of this break is given. The stator iron loss, *b*, is the mean of the two readings of the alternating-current power supplied to the stator at synchronism. The friction loss, *a*, is given directly as the difference between curves 1 and 2. The mean difference between curves 2 and 3 at synchronism gives the generally neglected loss in the teeth of the stator and rotor due to their rapidly pulsating flux. As the loss is caused by the rotation of the rotor, the power necessary to cover it must be supplied by the rotor, and will be included in the load on the direct-current motor in experiments 3 and 4 without affecting the reading of the stator iron loss on the alternating-current wattmeter. In the case of an ordinary induction motor running light, this loss in the teeth will have exactly the same effect as an increase in the friction and windage. The various losses in the example given work out as follows: Friction loss, 100 watts; stator iron loss, 250 watts; loss in teeth, 230 watts. The sum of these three amounts to 580 watts, whereas when running light in the ordinary way the losses amounted to 575 watts. This close agreement was found in all cases. The sudden break in curves 3 and 4 at synchronism amounts to 100 watts, corresponding to a hysteresis loss in the stationary rotor of 50 watts; at synchronous speed this loss is non-existent. In this example, therefore, two-fifths of the no-load losses were due to the rapidly-pulsating flux in the teeth. The results obtained by the author also show the inaccuracy of Benischke's assumption that the slip at no load can be taken as a measure of the no-load losses.—Lond. *Elec.*, March 30.

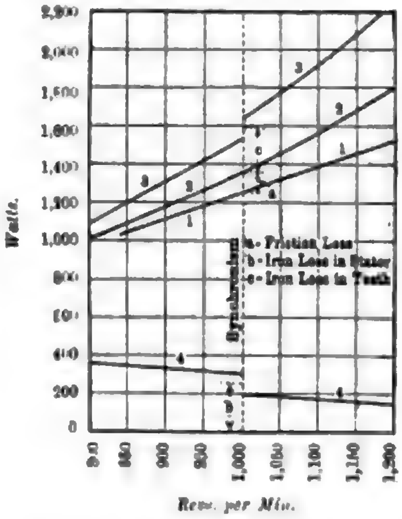


FIG. 1.—CURVES OF FRICTION AND IRON LOSSES.

Lamps and Lighting.

Mercury Arc.—Child.—An account of an experimental investigation of the conductivity of vapor from the mercury arc. The experiments of the author show that the space in the tube connected with a mercury arc becomes highly conductive. A luminous space gradually spreads out from the arc and the front of this region has the greatest luminosity and the highest conductivity. This conductivity is not due to ions coming from the arc, nor to rays sent out by it. It is not due to any leakage over the surface of the glass. It is probably not due to the high temperature of the gas. A probable explanation is that when ions first recombine, they are in a condition of unstable equilibrium much like the atoms of radio-active matter, and often break up again, this being a form of ionization which has not heretofore been studied. There is an e.m.f. between electrodes inserted in different parts of the tube. This is possibly due to the more rapid diffusion of the negative ions.—*Phys. Rev.*, April.

The Kuzel Lamp.—A note stating that Kuzel seeks leave to amend one of his patents for incandescent lamps, alleging as the reason a misunderstanding on the part of his Vienna patent agent. He desires to insert the following words after the description of the means for reducing the refractible metals to a colloidal state: "These colloidal metals can be used either in a more or less liquid or gelatinous form, containing more or less of the imbibition liquid or in a solid form obtained as usual, for instance, by cautiously evaporating colloidal solutions, or drying such precipitated sols, gels or colloidal suspensions." —Lond. *Elec.*, March 30.—A description of the method of Bredig, which is said to be used by Kuzel for the production of the colloids, may be found in an article by Burton in *Phil. Mag.*, April.

Conductivity of Nernst Filament.—See abstract of the paper by Horton on conductivity of metallic oxides under "Electrophysics."

Power.

Electrical Equipment of Colliery.—Sparks.—An illustrated paper on the electrical equipment of the Aberdake collieries of the Powell Duffryn Company. They produce one and one-quarter million tons of coal per year. Six of the nine pits in this valley formerly had isolated direct-current plants generating at 200 or 400 volts for lighting and power purposes. One generating plant has now been erected which will serve the whole district, eight square miles in area. Some of the mines are four miles from the power station. The three-phase system at 50 cycles and 3,000 volts is used with overhead transmission lines. The existing direct-current motors are utilized, 19 motors having a total rating of 210 hp, being grouped at one pit and driven from the three-phase system by a motor-generator supplied by 3,000 volts. The power station is equipped to deal with an average load of 1,500 kw, this demand being met either by a 1,500-kw or two 750-kw sets during the day and one 750-kw set during the night and on Sundays. The alternators, one of 2,000 and two of 1,000 kilovolt-amperes, are three-phase star-connected. The transmission lines are designed to supply 6,000 hp in motors and consist of hard-drawn copper conductors supported on creosoted wooden poles. Substations are provided at the different mines. The motors may be divided into two classes: Variable-speed, for haulage and hoisting, and constant-speed, for driving fans, pumps, screens, conveyors, and machinery in workshops and a brickyard. Forty motors of the first type were at work in January, 1906, varying in rating from 300 hp to 25 hp, and 37 of the second type, from 180 hp to 5 hp, totalling 1,450 hp. Last January the total power at these pits was 12,170 hp, of which 4,710 was electric, the remainder of 7,460 being obtained from steam engines. Details are given on gearing and operation of the motors.—Lond. *Elec.*, March 23 and 30.

Electric Winding.—Hooghwinkel.—A paper read before the Newcastle Section of the (Brit.) Inst. Elec. Eng. and replying to some of the criticisms in a recent paper of Mountain which showed certain disadvantages of electric winding compared with steam hoisting. The present author criticizes this comparison as unfair, and considers main winding as not only a suitable application of electric driving, but as the principal and the most urgently needed application of electricity to colliery work.—Lond. *Elec.*, March 23.

Cranes.—An illustrated article on the application of direct-current motors for cranes and some accessories.—*L'Ind. Elec.*, February 10.

Traction.

Electric Traction on Main Lines in Europe.—Dawson.—A long illustrated article in which the author analyzes the steam railroad suburban traffic conditions about London and Berlin, and points out the necessity for the electrification of these lines. He also describes and compares the different systems of heavy electric traction and types of cars for suburban service in Europe. He reaches the conclusion that in addition to the disadvantages of the third rail and the greater cost of the direct-current, as compared with single-phase system, the latter presents so many advantages that it would appear to be the only system which with our present knowledge will fill nearly all the requirements of railway men, and is, therefore, the most suitable for handling the suburban traffic of our main line railways. Electrification of main lines, as far as long distance and goods traffic is concerned, may be made under special circumstances, but does not appear to be likely to be adopted in the near future, as far as Great Britain is concerned.—*St. R'y Jour.*, April 7.

Single-Phase Traction.—An illustrated article on the experimental single-phase traction installations on the Swedish state railways which have been repeatedly referred to in the Digest. A description is being given of the various types of apparatus used, and of the line construction which is being tried.—The same issue contains a note on single-phase equipment for the Central Illinois Construction Company.—*St. R'y Jour.*, March 31.—Ward Leonard replies in a letter to the criticisms by Lamme of his motor-generator system and says it is his present belief that "at the same speed, ventilation, hp, and other determining conditions the losses would be 100 per cent greater in the commutating single-phase motor system than in the direct-current series motor system, and that its weight would be about 50 per cent greater." He challenges Lamme to publish complete data and curves of the Westinghouse Company's New Haven locomotive, in which case he will publish simultaneously equivalent data on the Ward Leonard-Oerlikon locomotive.—*St. R'y Jour.*, April 7.

Transporter Bridge.—Webster.—A paper on the Widnes and Runcorn transporter bridge over the river Mersey. The bridge is similar in construction to an ordinary cable-stiffened suspension bridge; but instead of the costly high-level approaches, the traffic is carried across by means of a car suspended from a trolley running on the underside of the stiffening girders, and driven electrically.—Lond. *Elec.*, March 30.

Overhead Construction.—An illustrated description of the overhead catenary construction for the New York, New Haven & Hartford Railroad.—*St. R'y Jour.*, April 7.

Folding Step.—An illustrated description of a new folding step for tramway cars.—Lond. *Elec.*, March 30.

Electric-Gasoline Automobiles.—Hospitalier.—The internal combustion motor on automobiles has the disadvantage of lack of flexibility. The rational way of overcoming this draw-back consists in aiding electrically the internal combustion motor by combining it with a dynamo connected to a storage battery. This combined set represents a group which runs at practically constant speed at all loads since the dynamo with the storage battery furnishes the needed overload or consumes that part of the energy which is not needed. The author discusses application of this general principle on automobiles, tramways and electric boats. The same issue contains a description of a locomotive of Pieper for railways operated by the above system.—*L'Ind. Elec.*, February 10.

Electrophysics and Magnetism.

Conductivity of Metallic Oxides.—Horton.—An investigation of the variation of electric conductivity of solid metallic oxides with change of temperature, with a research into the question whether the conduction is carried on electrolytically or metallically. The oxides experimented on were lime, baryta, magnesia, bismuth trioxide, plumbic oxide, cupric oxide, sodium peroxide and quartz. Nernst has given reasons for supposing the conductivity of metallic oxides to be electrolytic, the chief of these being (*a*) that definite traces of electrolysis were found in some cases (the chemical composition at the cathode after the current had been allowed to flow through the oxide for a long time being found to be different from that at the anode); (*b*) the conductivity of a mixture of oxides was found to be much greater than that of each oxide separately. Nernst states that the products of electrolysis are continually recombining, and thus the supply of electrolytic ions is kept up. The conclusion of the present author from his experiments is just the opposite of this view and is that the conductivity of the oxides investigated is mainly metallic. In some cases a feeble polarization current or other signs of electrolysis were observed. In these cases both metallic and electrolytic conduction are assumed to be associated in the same substance. Some oxides, like CuO, show no trace of electrolysis, and the author thinks that if the conduction of electricity through these was carried on by means of electrolytic ions some evidence of the liberation of the products of electrolysis would have been obtained in the experiment in which a current was passed through oxide of copper while it was heated in a vacuum. The distinction between electrolytic and metallic conductivity is often based on the sign of the temperature coefficient of the conductivity of the conductor in question. If the conductivity decreases with the rise of temperature the conduction is taken to be metallic; if it increases with rise of temperature the conduction is considered to be electrolytic. But the author thinks that this rule is one with so many exceptions that it is useless for deciding the question. In cases of electrolytic conductivity the increase of conductivity with rise of temperature is due to the increased mobility of the ions at a higher temperature. The author thinks that the enormous increase of the conductivity of solid metallic oxides at higher temperatures cannot be explained in the same way, and that it is rather due to a large increase of the number of the negatively charged corpuscles which carry the current in the case of metallic conduction.—*Phil. Mag.*, April.

Phosphorescence.—DIEBERNE.—A paper in which the author advances a theory of phosphorescence based upon thermo-luminescence and the coloration of phosphorescent bodies by the radiation which excites them. Many phosphorescent bodies are colored during phosphorescence. This coloration is attributable to the formation of a new body, which persists after phosphorescence has ceased. When, however, the phosphorescent body is heated up to a certain temperature, the new body is decomposed, and gives up the energy consumed in its formation in the shape of thermo-luminescence. When no coloration is produced and there is yet a thermo-luminescence, it may be assumed that the new body is colorless, or has the same color as the original body. When there is no thermo-luminescence the probability is that the new substance is decomposed as fast as it is formed. This theory embraces all the facts of luminescence under a single aspect. It is well known that most phosphorescent substances are mixtures in which the real phosphorescent body is present in very minute proportions. It is this body that is sensitive to the exciting radiation. It may be transformed into several different bodies according to the exciting radiation used.—Lond. *Elec.*, March 30; from *Comptes Rendus*, March 5.

Heavy Canal Rays.—GEHRCKE.—To account for the large masses of canal ray particles, the author supposes that they consist originally of metallic particles liberated by the disintegration of the cathode, and charged positively by the loss of electrons under the influence of the ultra-violet light. They are expelled from the cathode with a negative charge, but this is soon lost and converted into a positive charge, whereupon the particles are driven back towards the cathode. The varying size of the expelled particles accounts for the magnetic "spectrum" observed by Wien. The circumstance that the particles are derived from the metal, and from the gas, explains why the material of the canal rays is able to exceed the total gaseous contents of the vacuum tube, and also why the mass of the canal-ray particle may be as much as 650 times that of the hydrogen atom. These particles are large enough to be made visible by the ultra-microscopic method devised by Siedentopf and Szigmondy. That they occur in front of the electrode was already known to Goldstein, and their slow motion there is accounted for by their having to proceed for some distance against the electric force. When proceeding with it, they must show the Doppler effect discovered by Stark. The process by which the cathode disintegrates is still obscure. It is not solely due to the electric field, since disintegration may be produced by simple heating.—Lond. *Elec.*, March 30; from *Phys. Zeit.*, March 15.

Ions of Vapor.—WILSON.—An abstract of a (Brit.) Phys. Soc. paper on the velocities of the ions of alkali salt vapors at high temperatures. All the results so far obtained are consistent with the view that any salt of caesium, rubidium, potassium, sodium, or lithium gives in a Bunsen flame negative ions having a velocity of 1,000 cm. per second for one volt per cm. and positive ions having a velocity of about 80 cm. per second. This result can be explained by supposing that each salt molecule emits a negative corpuscle which forms the negative ion, and that the rest of the molecule forms the positive ion.—Lond. *Elec.*, March 30.

Ionization of Gases.—TUFTS.—An account of an experimental investigation of the phenomena of ionization in flame gases and vapors.—*Phys. Review*, April.

Electrochemistry and Batteries.

Pig Iron Production in the Electric Furnace.—An illustrated account of the experiments carried out by Heroult at the "Soo," with the co-operation of the Canadian Government, of the reduction of pig iron from ores. One of the main points is that it is possible to use ores of high sulphur content for the production of pig iron containing only a few thousandths of one per cent of sulphur. Charcoal and peat coke can be substituted for coke as the reducing agent. An output of 12 tons of pig iron per day was obtained with 1,000 e.h.p. The same issue contains a letter by Sjöstedt on the production of ferro-nickel from nickeliferous pyrrhotite at the "Soo."—*Electrochem. and Met. Ind.*, April.

Electrolysis of Fused Salts.—ASHCROFT.—The first article of a serial on factory-scale experiments with fused electrolytes. In the present installment the author deals with electrolysis of zinc chloride and lead chloride. After giving the general principles he deals with the construction of vats for fused electrolytes and with his method of stirring the electrolyte by electromagnetic means.—*Electrochem. and Met. Ind.*, April.

Production of Chlorates and Perchlorates.—COULERU.—A concise discussion of the fundamental principles of the electrolytic production of sodium chlorate from sodium chloride and of the perchlorate from the chlorate. Sodium chlorate may then be employed for the manufacture of potassium perchlorate and ammonium perchlorate which are useful in pyrotechnics and in the explosive industries.—*Electrochem. and Met. Ind.*, April; from *Chemische Zeit.*, 1906, v. 30, No. 21.

Hypochlorite for Sterilization.—KERSHAW.—An illustrated review of the use of electrolytic hypochlorite as a sewage sterilizing agent in the United Kingdom. The different types of electrolytic hypochlorite cells are described and illustrated.—*Electrochem. and Met. Ind.*, April.

Colloidal Solutions.—BURTON.—An experimental investigation of the properties of colloidal solutions prepared electrically by the method of Bredig. The chief results are as follows: The size of the diameters of the particles of gold, silver and platinum in the colloidal suspension lies between the limits 0.00002 and 0.00006 centimeter. The electro-negative non-oxidizable metals, gold, silver and platinum give solutions in water and ethyl malonate in which the particles are negatively charged. The electropositive, oxidizable metals give solutions in water, methyl alcohol, and ethyl alcohol in which the particles are always positively charged.—*Phil. Mag.*, April.

Electric Production of Ozone.—EWELL.—An account of an experimental investigation showing the superiority of the silent discharge obtained with an alternating current and the interposition of a thin dielectric of high dielectric strength between the electrodes over that obtained with point electrodes.—*Phys. Rev.*, April.

Units, Measurements and Instruments.

British Physical Laboratory.—A note on a recent annual report of the (Brit.) National Physical Laboratory. During the last year the ampere balance has been completed and Ayrton and Mather have carried out a series of determinations of the e.m.f. of a cadmium cell, in terms of the international ohm, and of the amount of silver deposited in a silver voltameter. The results are highly satisfactory. Fifty determinations of the e.m.f. of the cell have been made, and the greatest difference between any two is only 3 parts in 100,000. In the thermometric division the melting point of platinum has been carefully determined and has been found to be 1,710 ± 5° C. The government will grant a sum of $50,000 for building during the coming year and will increase the actual grant by $2,500. It is hoped that the new electrical buildings may be opened on June 25, on the occasion of the visit of the foreign guests of the Institution of Electrical Engineers. The scheme of work for 1906 includes a research into the resistance of materials of construction to impact, the continuation of the wind pressure and steam researches, the completion of the work with the ampere balance and some experiments of great interest on the effect of the continued application of high pressure to insulators. In the metallurgical division a research into the properties of aluminum bronze promises interesting results.—Lond. *Elec.*, March 30.

Measuring Insulation in Three-Wire Systems.—Muellendorf. In a three-wire system the neutral wire of which is not earthed, the total insulation resistance, R, of the network against earth in ohms may be found as follows: If E is the voltage between the outers and if by means of a voltmeter with an internal resistance of r ohms the tension, e_1, between the positive outer wire and earth and the tension, e_2, between the negative outer wire are determined, then

$$R = r\left(\frac{E}{e_2 + e_1} - 1\right)$$

This calculation may be avoided by the use of a voltmeter having its zero point in the center, the needle being deviated to either side according to the sign of the e.m.f. The scale of volts has uniform divisions, and below this scale a second movable scale is provided, having half the length of the upper scale and giving directly the ohms as calculated from the volts according to the above formula. The dial is shown in Fig. 2. The volt scale, I, goes on either side from 0 to 500. The ohm scale, II, goes from 0 to ∞. In using the instrument, it is first connected between the positive outer wire and the earth, giving a reading, e_1. The movable scale, II, is then revolved until the ∞ partition on II coincides with the e_1 partition on I. The instrument is then connected between the negative outer wire and the earth, whereby the needle is deviated to the right, giving a reading, e_2, on scale I. By taking the corresponding reading on scale II, the total insulation resistance is directly obtained in ohms, if scale II has been calculated from the above formula. —*Elek Zeit.*, March 29.

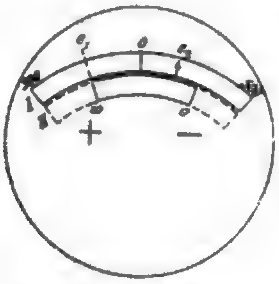


FIG. 2 DIAGRAM OF DIAL.

Telegraphy, Telephony and Signals.

Loaded Telephone Lines.—Nowotny.—A paper giving some results obtained on the Austrian telephone lines loaded according to the system of Pupin. The installation of the lines began in 1905 and there exists now a loaded line of 803 kilometers length between Vienna and Triest. It consists of bronze wire three millimeters thick, induction coils being inserted at distances of four kilometers. It was found that half as many induction coils were sufficient to give the same improvement of transmission speech as the number actually installed. The Government has therefore removed half of the induction coils and will use them on other lines. Experience has shown that it is not necessary to keep the distance between two succeeding coils constant with absolute exactness and that it is sufficient to use the same average distance in a general way. It was found that the loaded line was influenced by currents in adjacent telegraph lines and by currents in transmission lines to a greater degree than ordinary unloaded lines. Moist weather and fogs have no bad effect on the loaded line. When half of the coils which had been installed in 1904 and 1905 were recently removed it was found that the self induction which had been originally 0.08 henry had decreased in most cases to 0.05 or 0.06 henry, but in some cases even to 0.03 henry. This was the result of magnetic remanence caused by occasional strong magnetization of some coils, perhaps due to atmospheric discharges, etc. By using a sufficiently strong alternating current the remanent magnetism of the iron cores of the induction coils could be removed which resulted in a considerable increase of the self induction. The suggestion is made whether it is not possible to design the induction coils in such a way that the influence of the permeability of the iron core is of less importance. It is suggested to use a double inductance coil for the conductors as is done on American lines.—*Elek. u. Masch.*, April 1.

Automatic Telephone Systems.—Kruckow.—An article in which the author expresses the opinion that a larger application of automatic telephone methods would be desirable in systems of medium size. In view of the high first cost and of the license to be paid, no saving is to be expected, although a change in this direction may be hoped for, when automatic telephony will be used to a larger extent.—*Elek. Zeit.*, March 29.

Miscellaneous.

Blast Furnace.—Richards.—The first article of a new serial of his metallurgical calculations in which he will deal specially with the iron and steel industries. The first installment of this serial gives the balance sheet of the blast furnace. The materials put into the blast furnace are fuel, iron ore, fluxes and blast. The materials discharged are pig-iron, slag, gases and dust. The author discusses in detail the resolution of each of the four materials charged into the four avenues of escape, numerical examples being given.—*Electrochem. and Met. Ind.*, April.

Process of Combustion.—McElroy.—A discussion of the Eldred process, the underlying idea of which is to mix air with certain regulated amounts of carbon dioxide "for the purpose of obtaining certain relative proportions or partial pressures of oxygen and carbon dioxide, and ultimately obtaining therewith what may be called an 'auto-combustible' mixture having certain mutual relations of the partial pressures of carbon dioxide, carbon monoxide and free oxygen." Products of combustion are chosen as a source of carbon dioxide on account of being cheap and convenient.—*Electrochem. and Met. Ind.*, April.

Ignition.—Soulier.—An illustrated description of various electromagnetic ignition systems exhibited at the eighth automobile exposition in Paris.—*L'Ind. Elec.*, February 10.

Cable Ship.—A fully illustrated description of the cable gear and equipment which was recently made by an English firm for the new cable ship which the Japanese government is now building in Japan.—Lond. *Elec.*, March 23.

BOOK REVIEW.

Die Drahtlose Telegraphie. By Dr. Eugen Nesper. Berlin: Julius Springer. 157 pages, 29 illus. Price, 3 marks.

This small book is mainly a commercial prospectus of the different wireless telegraph systems in Europe and America. It gives the organization of each company; a list of its officers; the amount of its capitalization; some idea of the commercial work done, and a list of the stations owned or equipped by the company.

Perhaps the best part of the book is the bibliography given at the end. This list contains some 1,100 titles of books and papers on wireless telegraphy and electric waves. The list, however, although a large one, is not nearly complete. Thus, for instance, it does not include the important papers of Pierce in the *Physical Review* or of Ives in the *Electrical World and Engineer*. It is, nevertheless, probably the best biliography of the subject yet published.

There are some excellent pictures of apparatus scattered throughout the book. On page 95 is an interesting picture of Major Squier's receiving apparatus attached to a tree. The scope of the book is indicated by the following headings: Technique; historical development; organization; commercial activity; technical characteristics of the different systems; insurance; legislation and questions of neutrality; wireless telegraphy in war; the future of wireless telegraphy; list of stations of the different companies; bibliography of literature and patents.

Technical Publicity Association Meeting.

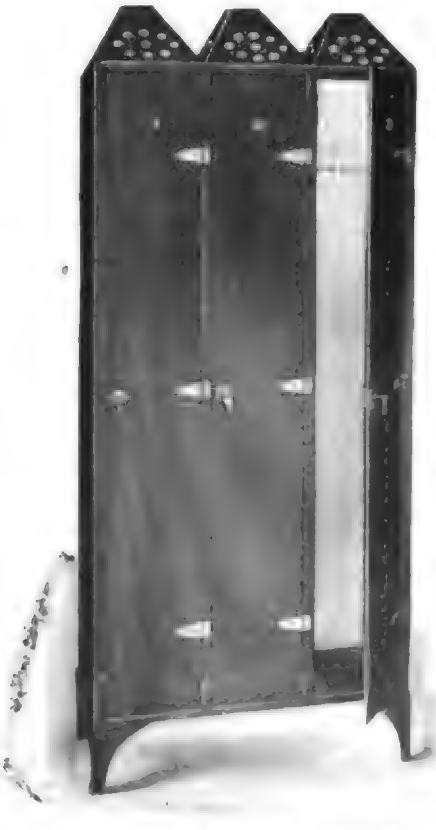
At the second annual meeting and banquet of the Technical Publicity Association, held Thursday, April 5, at the Aldine Association, New York, the following officers were elected: President, F. H. Gale, General Electric Company; first vice-president, H. M. Cleaver, Niles-Bement-Pond Company; second vice-president, C. B. Morse, Ingersoll-Rand Company; secretary, Rodman Gilder, Crocker-Wheeler Company; treasurer, H. M. Davis, Sprague Electric Company. Members of Executive Committee—Robert L. Winkley, Pope Manufacturing Company, and G. M. Basford, American Locomotive Works. Members Election Committee—C. W. Beaver, Yale & Towne Manufacturing Company; Charles N. Manfred, Johns-Manville Company, and H. M. Kress, A. S. Cameron Steam Pump Works.

P. F. Kobbé, former president of the Association, and now an advertising specialist, was the guest of the evening, and gave an address on the general subject of advertising. An informal discussion followed in which members and guests took part. Among those companies represented at the banquet besides those mentioned above were American Wood Working Machinery Company, *American Machinist, Railroad Gazette*, John A. Roebling's Sons, De La Vergne Machine Company, A. A. Griffing Iron Company.

The membership of the Association shows a steady increase, and its finances are in good condition. The following resolution was unanimously passed: Resolved, that the Association shall take active steps to secure definite information regarding the circulation of mediums in which the members of the Association are interested.

Lockers for Central Station Employees.

The accompanying illustration shows a clothes locker for employees in central stations and in other places brought out by the Metropolitan Engineering Company, 1250 Atlantic Avenue, Brooklyn. The lockers are made entirely of steel plates so as to be both substantial and fireproof, and in the dome of each locker is fitted an electric lamp which lights when the door is opened, enabling one to see whatever is in the locker. The outside of the locker is finished in any desired style, but a gun-metal surface is recommended for the best wear. The inside is finished in white enamel and the gauze basket at the bottom is finished in bronze, as are also the hangers; the doors are fitted with Yale locks. Inasmuch as lockers are usually situated in out-of-the-way places which are usually dark and unattractive and unavailable for other purposes, the incandescent lamp lighting up the contents of the locker when opened is deemed to be a great advantage.



ELECTRICALLY-LIGHTED LOCKER.

Some New Small Electric Tools.

The General Electric Company has recently developed a number of small motor adaptations, including an electrically-driven bench drill suitable for small work, a portable electric breast drill for the same range of requirements and an electric buffing and grinding outfit for household use. The bench drill has been particularly designed for the use of jewelers, repairmen and manufacturers who have a large amount of drilling on small work or otherwise where the drilling service is not severe. It is furnished with a vertical motor mounted on the top of a column sliding in a socket cast integrally with the base, in which it can be adjusted for various heights. The motor body or head is also adjustable radially for drilling position.

The whole outfit rests on a broad base about 6x10 in. which gives the desired stability. The minimum height is 16 in. when the motor arm is in the lowest position, and the maximum height is 22 in. when the motor arm is fully raised, thus giving a range of 6 in. through which the motor body may be raised or lowered. The work is fed to the drill by raising a circular table which is operated by a lever with a range of 1¼ in. vertically.

The motor is series wound for 115 or 230 volts and for direct-current circuits only. A single gear reduction is provided between the armature shaft and drill spindle. The hand wheel mounted on the armature shaft at the top is convenient for turning the spindle and adds a fly-wheel effect to the spindle as well, thereby insuring a smooth, steady rotation of the drill. The amount of power required in the operation of the drill naturally varies with the amount of work performed. The largest drill the chuck will hold is 21/64 in. diameter, and from this all sizes down to No. 40. The bearings are provided with self-oiling cups, which require attention only every three or four months. The outfit includes a chuck of standard design. The weight of the bench drill complete is about 40 lb., which insures firmness and rigidity.

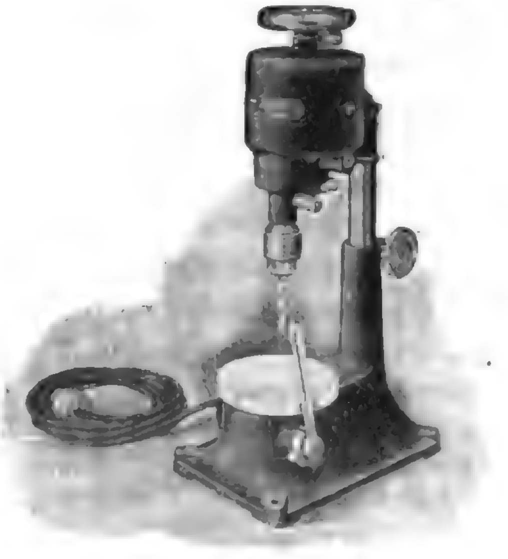


FIG. 1.—BENCH DRILL.

The motor used in the portable electric breast drill shown in Fig. 2 is similar in size and construction to that used with the bench drill just described. The tool is provided with a switch in the body of the motor so conveniently arranged as to bring the drill under absolute control of the operator. This switch is well protected from damage, of suitable design and sturdy construction. The weight of the breast drill is 16 lb. complete, and it measures 13 in. long by 5 in. diameter. The outfit includes a chuck. The oiling of the bearings is effected through protected oil holes which replace the self-oiling features of the bench drill motor. The use of a self-oiling bearing in which oil is stored is not practical with these drills as the breast drill is used in all conceivable positions, and oil could not be prevented from escaping out of the reservoirs. On this account the bearings of the breast drill must be oiled frequently. An extension cord permits a range of operation within a radius of 10 ft. from the source of current. The domestic grinding and buffing outfit, shown in Figs. 3 and 4, has been especially designed for grinding knives, scissors and other similar edged tools and for polishing small silverware, jewelry and other like articles. A grinding wheel of suitable character to insure a smooth cutting edge without the use of a second sharpening is interchangeable with the buffing wheel. These outfits are adapted for the intermittent service required in the ordinary household, but are not suitable for the heavier continuous work which is required by jewelers, dentists, etc. Other and larger outfits are made by the General Electric Company for this more exacting service.

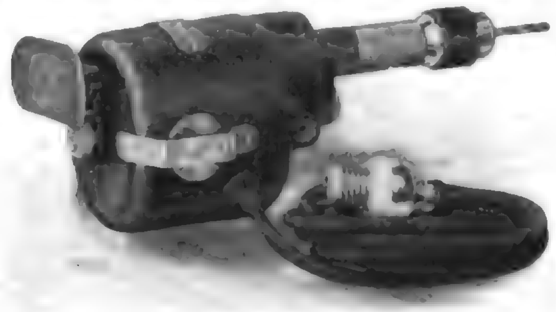


FIG. 2.—PORTABLE BREAST DRILL.

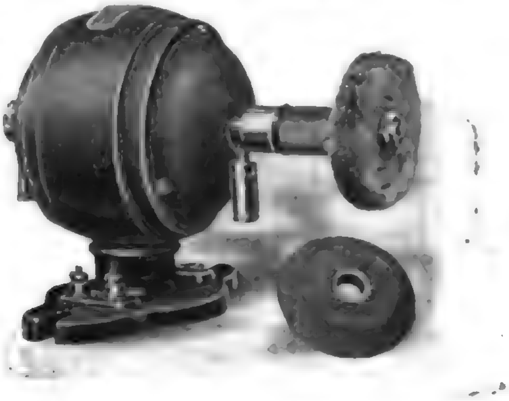


FIG. 3.—GRINDING AND BUFFING OUTFIT.

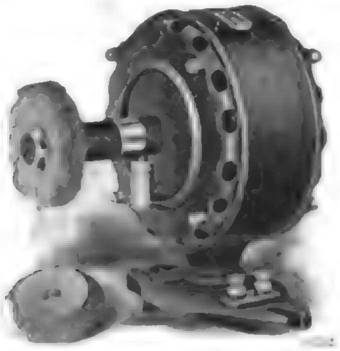
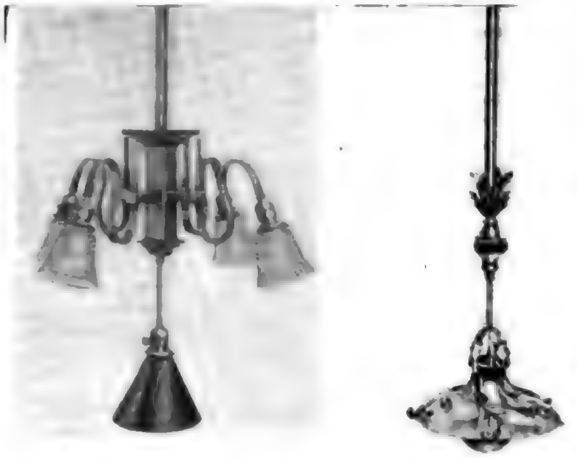


FIG. 4.—GRINDING AND BUFFING OUTFIT

The household outfit consists of motor with shaft extended 2 in. from end of bearing to inside of wheel, the necessary washers and nuts for holding the wheel in place, one rag wheel of 3½ in. diameter, one 3-in. emery wheel ½ in. thick with ⅝-in. bevel face, together with attaching plug with 10 ft. of cord. These outfits are furnished for 110 volts direct current and 110 volts alternating current and may be specially wound for 220 volts. The alternating-current motor weighs about 25 pounds. The direct-current motor is much lighter, weighing but 15 lb. Both motors are very simple, requiring no more attention in service than a fan motor. In connecting to source of current supply the cord is attached to the binding posts of the motor and the plug inserted in the nearest socket at which the proper current is available.

Adjustable Fixtures.

The Adjustable Fixture & Manufacturing Company, of Greenville, Ohio, has recently begun the manufacture of a very useful adjustable fixture under the patents of H. C. Ayres, formerly superintendent of the Greenville Electric Light & Power Company. Fig. 1 shows a handsome fixture with one adjustable reading lamp partially lowered. Fig. 3 is a drawing showing the construction inside the canopy of such a fixture while Fig. 2 is a one-light pendant with the adjustable feature. The reading lamp in Fig. 1 is mounted on a brass rod which slides up and



FIGS. 1 AND 2.—ADJUSTABLE FIXTURES.

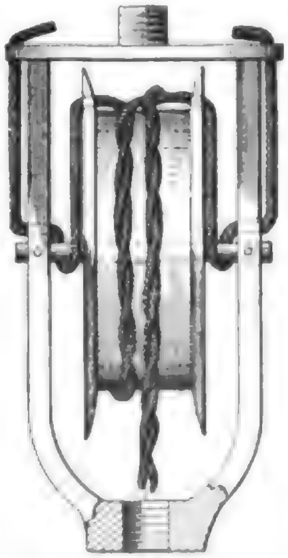


FIG. 3.—COILING DRUM.

down inside the chandelier. It can, therefore, be pushed up as if it were a regular bottom socket on the chandelier, or pulled down so as to be close above the reading lamp. In most cases it would be desirable to equip the adjustable socket with a more ornamental reflector than the green opal cone shown, but Fig. 1 illustrates the idea. The fixture is especially useful in the average living room of a small residence where reading or sewing is to be done and at the same time the general lighting of the room must be provided for. The adjustable fixture shown is much superior to the ordinary extension plug and cord used for lowering a light from a chandelier. The flexible cord from the adjustable socket winds around a drum in the canopy of the fixture. There is sufficient spring tension from a spiral spring inside this drum so that the cord always winds up when the adjustable rod is pushed up. There are no moving contacts as the cord after winding around the drum and around the shaft on which the drum is mounted is soldered directly to the outlet wires. The one-light pendant works upon the same principle. The president of the Adjustable Fixture & Manufacturing Company is Mr. D. L. Gaskill, president of the Greenville Electric Light & Power Company.

New Shops of the Allis-Chalmers Company.

The new shops of the Allis-Chalmers Company, now building at West Allis, Milwaukee, when completed will add 180,000 sq. ft. to the plant's present floor area of 62,000 sq. ft. and make the entire plant capable of affording employment to 11,000 men. These works when finished, together with the capacities of the other plants of the company in Milwaukee, Chicago, Cincinnati and Scranton, will be capable of affording employment to no less than 18,000 persons.

The extensions at West Allis consist of three machine shop units parallel to three existing units, the dimensions of two of these being 575 ft. by 145 ft., the third being 575 ft. by 168 ft.; an erecting shop 1,136 ft. by 113 ft. forming an extension to the present erecting shop and adjoining the six machine shop units; an extension of the existing foundry which has a total length of 994 ft. and a width of 222 ft., and an extension of the pattern shop and storage building, which has the same length and width of 119 ft. The work in constructing these extensions involved an expenditure of over $3,000,000. The extensions to the erecting shop and pattern shop have been practically completed and substantial progress has been made on the remaining buildings.

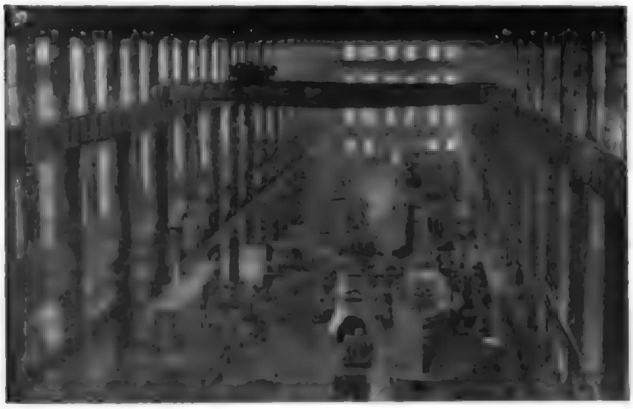


FIG. 1.—VIEW OF ERECTING SHOP.

The machine shop units are constructed to form two principal bays in cross-section, with a framing so spaced longitudinally as to form 36 bays, each 16 ft. wide. One of the principal bays is 65 ft. wide and 52 ft. high, and is served by a 50-ton crane with 44-ft. lift and a span of 67 ft. The other principal bay is 71 ft. wide and 42 ft. high with a gallery floor about 26 ft. above the main floor. This bay has a line of intermediate columns making the north division 40 ft. with a runway for a 10-ton crane having 38-ft. span and 17-ft. lift. A mezzanine floor suspended from the gallery floor girders is devoted to coat rooms and various service rooms. Three elevators of the plunger type serve the mezzanine floor and gallery.

The foundry is provided with a crane runway for a 60-ton crane with a 78-ft. span and 27-ft. lift. One of the bays has a runway for a 30-ton crane with 66-ft. span and 24-ft. lift, and the other for a 20-ft. crane of 30-ft. span and 34-ft. lift. Besides these traveling cranes the central bay and east bay are provided with traveling bridge cranes on both sides.

The existing power house contains three steam-driven, 250-volt, direct-current units, one of 550 kw, another of 300 kw and another of 100 kw; also a 150-kw, direct-current generator direct-connected to a two-cylinder tandem Nürnberg gas engine. To this equipment will be added a steam-driven 1,000-kw direct-current generator.

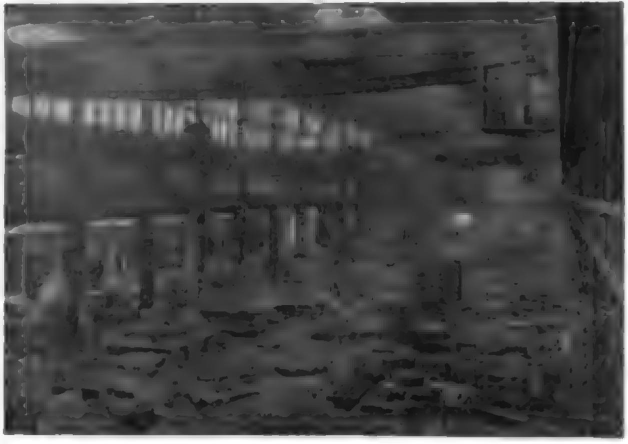


FIG. 2.—VIEW OF FOUNDRY.

The heavy machine tools of various kinds installed in units Nos. 1, 2 and 3 will be duplicated for units 4, 5 and 6 and supplemented by tools suitable for specific service, as for example the building of steam turbines and turbo-generators, gas engines, etc. One order recently placed covered forty-two machine tools of extra heavy pattern, involving an expenditure of $550,000. These tools were all designed especially for use with high-speed steels and driven by Allis-Chalmers motors. The combined weight of these tools within the motors used for driving them aggregates 2,141 tons. Fourteen of the new machines are vertical boring and turning mills from 8 to 16 ft. and extra heavy in design. There are five standard shaft lathes and two crank shaft lathes with a swing of from 60 to 125 in., and 30 ft. between centers; eight planers of various sizes, all of which are the spiral geared type; a 260-ton armature press, also several drilling and boring machines, slotters, etc. Over 1,200 hp in Allis-Chalmers motors will be required to drive the new equipment described. In addition to the machine tools, 34 electric traveling cranes have been ordered for sizes and capacities ranging from 2½-ton wall jib cranes to 60-ton, 78-ft. span cranes with 10-ft. auxiliary hoist for the foundry extension.

The system used for storing patterns and which renders each readily available for use when required is greatly simplified by the use of electric telphers, running through the various sections and by push cars and elevators. The telphers are supported on overhead I-beams and have a capacity of three tons each.

Direct current at 250 volts is distributed throughout the building for operation of motors used for machine tool drive. These motors are largely operated on the Ward Leonard multiple-voltage, five-wire system (Bullock system of control for variable-speed motors), making 27 different speeds possible for each machine.

The yards between the various units are as completely equipped with cranes as the interior of the buildings, the storage space thus made available, proving very serviceable. Seven cranes are provided for use between the various machine shops and the foundry and pattern shop.

Of the accompanying illustrations, Fig. 1 gives a view of the erecting works looking north, and Fig. 2 a view of the foundry.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The weather conditions favored retail trade, and improvement in collections is noted, but some country districts are still calling for funds. Crop reports are very good except from a few localities where there has been wet weather. Among the industries favorable features are the activity in building, the partial settlements and advances granted, in the central and western bituminous coal fields, and better inquiry for and stronger tone of pig iron, the consumption and production of which break all records. The total output of iron, 2,165,632 tons, was 261,600 tons greater than February, and showed an increase of 96,739 tons over January, the previous record month. March railway earnings are still by far the best ever recorded in March. The demand for steel rails continues heavy, while inquiries for 1907 delivery are developing. Structural material is active, and further new business is pending. Coal is in better demand at the East, and prices are a little stiffer, but in the West it is reported that prices have receded. Copper is steady, but business is lighter. Steady and large demands for electrolytic copper were reported by local sellers and buyers. Refiners are hard pressed for deliveries, especially for account of wire makers, all of whom are far behind the demands for trolley wire, for which there is a rush of orders for the sorts that weigh 2,129, 2,687 and 3,382 lb. to the mile. Telephone and telegraph lines and makers of cables and insulated wire for electrical engineering are all pushing for wire to the extent that is compelling the rushing of work on extensions to existing wire drawing works. There is no change in quotations for copper. Lake is 18⅝ to 18¾c. and electrolytic 18½ to 17⅝c. for June and July delivery. Casting copper is held at 18 to 18¼c. for thirty days' delivery. Business failures for the week ending April 12, as reported by *Bradstreet's*, numbered 161, against 151 the week previous, and 196 the corresponding week last year.

DEMAND FOR WESTINGHOUSE-PARSONS TURBINES.—The Westinghouse Machine Company, of East Pittsburg, during the months of February and March, received orders for 35 steam turbines aggregating approximately 50,000 brake hp capacity. The most important equipments were those ordered by the Transit Development Company, Brooklyn, 7,500 kw; Toledo Gas & Electric Company, 3,000 kw; Los Angeles Pacific Railway Company, 2,750 kw; Detroit United Railways, 1,200 kw; Columbia (S. C.) Electric Street Railway Company, 3,000 kw; St. Paul Gas Light Company, 1,500 kw; Grand Trunk Railway Company, for St. Clair Tunnel, 3,000 kw; Detroit, Monroe & T. S. L. Railway, 1,200 kw; Northern Heating & Electric Company, St. Paul, 1,000 kw, and Griffin Wheel Company, Chicago, 1,000 kw. The largest is of 7,500 kw capacity, or 11,000 brake hp, and will be installed by the Transit Development Company. It is of the well-known multiple expansion parallel flow type and will drive a direct-connected alternating-current generator at 750 r.p.m., developing 10,000 electrical hp at full load. By means of a secondary governor valve, with which all Westinghouse-Parsons turbines are provided, 12,000 kw may be developed when running condensing, or full load when operating without condenser. This corresponds to a maximum capacity of at least 16,000 hp at the shaft. A number of machines of similar capacity are being built by the Westinghouse Machine Company for large power houses in New York, Brooklyn and other cities.

ALLIS-CHALMERS APPARATUS.—The Bellefontaine Bridge & Iron Company, of Bellefontaine, Ohio, has purchased Allis-Chalmers electrical machinery as follows: A 75-kw type "H" generator, eight direct-current motors aggregating 35 hp, together with 8 starters for same. The American Steel & Wire Company, of Anderson, Ind., has purchased a 200-kw type "I" generator built at the Cincinnati works of the Allis-Chalmers Company. The Ellsworth Coal Company, of Ellsworth, Pa., is a recent purchaser of a new lot of Allis-Chalmers electrical machinery. The new equipment will consist of a 500-kw direct-current rotary converter, four 14-hp motors and four 7½-hp motors. Charles H. Besley & Co., of Beloit, Wis., has purchased electrical machinery as follows, to be furnished by the Allis-Chalmers Company: A 60-kw generator, a 30-hp induction motor, a 20-hp induction motor and a 2.4-kw exciter. The Russell Engine Company, of Allegheny, Pa., will install a 75-kw Allis-Chalmers type "I" generator recently purchased. The Anderson & Middleton Lumber Company, of Aberdeen, Wash., are purchasers of a 25-kw Allis-Chalmers type "I" generator and a 9-in. by 9-in. Lycoming engine. All the above apparatus will be built at the Cincinnati works.

SALES OF ECONOMIZERS.—Among recent sales of economizers made by the B. F. Sturtevant Co., Boston, Mass., may be noted the following: New Orleans Railway & Light Company, New Orleans, La.; Raritan Copper Works, Perth Amboy, N. J.; Lawton Mills Corporation, Plainfield, Conn.; Haverhill Electric Company, Haverhill, Mass.; Malden & Melrose Gas Light Company, Malden, Mass. An example of the Sturtevant economizers operating under the unusually high pressure of 225 to 250 lb. per sq. in. is found in the power house of the New Orleans Railways Company. The sections were tested to 500 lb. per sq. in. in the Sturtevant shops and to 400 lb. after erection. Each of the six economizers of the first installation is 10 pipes wide and 36 pipes long, making a total of 2,100 pipes with over 26,000 sq. ft. of heating surface. The boilers served by these economizers are rated at 6,480 hp; thus there are about four square feet of economizer surface per boiler horse-power. The engineers for the company recommended the Sturtevant so favorably that a second order for three more economizers, each 10 pipes wide and 12 pipes long, has recently been received. These are to be used in the Claiborne station.

ELECTRIC CABLE FACTORY.—The new factory of the Electric Cable Company, which is now in course of construction at Bridgeport, Conn., will be completed the latter part of April. A reception will be given on the date of its completion to the members of the Bridgeport Board of Trade, to the employees of the company and to the engineers and workmen who were at work on the building. The plant will be devoted to the manufacture of Voltax, the new insulating compound, of magnet wire, rail bonds and field and armature coils. These coils are to be insulated with the Voltax compound impregnated under a vacuum to insure thorough absorption and to make the product moisture and water-proof. The Electric Cable Company reports an increase of 50 per cent in the sales of its field and armature coils during February and March over the two preceding months.

STURTEVANT GENERATING SETS.—The very rapid increase in output of Sturtevant generating sets, manufactured throughout by the B. F. Sturtevant Co., of Boston, Mass., is shown by recent orders received from P. Barbey & Son, Reading, Pa.; Chrome Steel Works, Chrome, N. J.; American Sapphire Company, Moore, Mont.; Northern Central Railway Company, Canton, Md.; Ogdensburg Coal & Towing Company, Ogdensburg, N. Y.; S. Slater & Sons, Inc., Webster, Mass.; F. B. Allen, Swanee, Ont.; Cresson Springs Brewery Company, Cresson, Pa. Sturtevant marine generating sets are to be installed upon the steamer *W. S. Porter*, built by Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; Canadian Government yacht *Speedy*, the Dominion Government Toronto dredge and the Toronto Ferry Company's new boat, *Bluebell*.

PELTON WATER WHEELS.—The Pelton Water Wheel Company has received from a large corporation in British Columbia an order for a Pelton unit with which is incorporated 15,000 ft. of sheet-steel riveted pipe. From the Orient has come an order for a complete equipment to operate under two separate heads, conditions being such that two independent streams afford heads of 630 ft. and 420 ft., respectively, with varying water quantities. This involves two wheels of different diameters mounted on the same shaft, which is direct-connected to an electric generator by means of Pelton flexible leather link couplings. A single governor controls both wheels by means of stream deflecting hoods on the nozzles. Also from the Orient comes an order for an iron-mounted Pelton unit for driving a 300-kw generator under an effective head of 580 ft., the wheel to have 500 horse-power maximum capacity. The Alaska Electric Light & Power Company has ordered a three-wheel double-nozzle unit for operating under a head of 225 ft.

INTERPOLE RAILWAY MOTORS.—The Electro-Dynamic Company, of Bayonne, N. J., has decided to enter the electric traction field with a railway motor embodying the features of its interpole motor, which has met with so much success in stationary power work. Among the specific claims made for this motor in connection with electric railway work is its absolute sparklessness, great flexibility in speed regulation, high torque for a given amount of material and consequently smaller size for a given work than motors of other types, and much less cost of installation owing to its capability of utilizing higher voltages than the ordinary direct-current motor. It is stated that tests have shown that higher average speeds can be obtained with interpole railway motors than with other types, or that the same schedule speeds may be met with smaller currents and lower brake pressures with the same amount of energy consumption. In the specific case for which calculations have been made for a double equipment of 40-hp interpole motors on a 17-ton car, a saving of 25 per cent in energy was found to be possible in a one-mile run retaining the same schedule made with ordinary motors. The Electro-Dynamic Company will soon make public its designs of high-speed interpole railway motors, especially for trunk line service.

HEAVY FOREIGN TRADE.—The country's foreign trade in March exceeded all previous records for that month. The statement issued by the Bureau of Statistics of the Department of Commerce and Labor shows that the exports increased $8,543,913 over March, 1905, while imports increased $3,193,878. These increases bring the exports of the month up to $145,522,342 and imports up to $113,625,066. The preponderance of exports over imports, which amounted to $31,897,276, show substantial increase over the record for 1905, but has been exceeded three or four times in the past ten years. The record difference was in March, 1898, when the exports exceeded the imports by $51,058,313. The record for the nine months give the unprecedented total of exports of $1,343,913,725, or not less than $430,329,139 in excess of the imports.

THE ATLANTIC DE FOREST WIRELESS COMPANY has announced the closing of a contract with the New York & Cuba Mail Steamship Company (Ward Line) for the installation of the De Forest system on its fleet of steamers. The first installation will be placed on board the new Ward Liner *Merida*, which will go into commission April 21, leaving New York on that day on her maiden trip to Havana. The steamship company is building a handsome operating room of steel on the upper deck, just aft of the smoking room for the accommodation of the wireless.

REYNOLDS-CORLISS ENGINES.—The Hornbeak Milling Company, of Hornbeak, Tenn., will install a 10-in. by 24-in. Reynolds-Reliance Corliss engine, purchased from the Allis-Chalmers Company, Milwaukee. Henrich's Sons, of Buffalo, N. Y., have also recently purchased an 18-in. by 42-in. Reynolds Reliance Corliss engine.

POWER IN IDAHO.—The Inland Power & Electric Company, of Spokane, Wash., has acquired 20,000 horse-power at Albany Falls, Idaho, 20,000 horse-power at Hell Gate in the Columbia River, and an additional power at Metalline Falls on the Pend d'Oreille River. The company is incorporated for $1,000,000.

POWER HOUSE FOR SEATTLE.—Mr. F. B. Kilbreth, of New York City, has been awarded a contract for the construction of a reinforced concrete power house at Seattle, Wash., at an estimated cost of $500,000. Stone & Webster, of Boston, are the engineers.

Financial Intelligence.

THE WEEK IN WALL STREET.—Activity on the stock market was restricted, but prices were strong. No special features of importance developed, the present attitude of the market being one of waiting for easier money and for a definite outcome in the anthracite coal situation. The bond market was stagnant, the high price for money restricting the demand for such securities. United States Steel stocks were rather firm on the better bituminous coal outlook and on the news of renewed improvement in the iron and steel trade. Business in electric securities was rather limited, but prices were firm, some advances being recorded. Allis-Chalmers common closed at 22, which is a net gain of ⅜ point, but preferred lost the same amount, closing at 57½. General Electric closed at the highest quotation of the week—172—this being a net loss of 1 point. Westinghouse gained 1¾, closing at 161¾. The traction stocks are all higher, Brooklyn Rapid Transit closing at 87⅞—a gain of 1⅛—and Metropolitan Street Railway at 155, an advance of ⅝ point. On the curb the last quotation of Interborough-Metropolitan common was 54 and for preferred 90⅛, these quotations being net gains of ⅜ point in each case. Western Union is a shade lower, the closing price being 92⅛, and American Telephone & Telegraph closed at 138⅛, which is a net decline of 1⅛. The curb market was quiet throughout the week, with early heaviness, followed by general recoveries. The features were late strength in Mackay Companies, the traction issues, and two or three low-priced copper stocks. Indications were that the latter movements resulted from manipulation, which desired to stimulate interest in the curb again. For some weeks past the outside public has done next to nothing in curb stocks. Chicago Subway, Interborough-Metropolitan, Gold Hill Copper and Union Copper were active and strong late in the week. Following are the closing quotations on the Stock Exchange April 17:

NEW YORK

	Apr 10	Apr. 17		Apr. 10	Apr. 17
Allis-Chalmers Co	20⅝	22¼	General Electric	168⅛	171⅜
Allis-Chalmers Co. pfd	57⅞	57½	Hudson River Tel	...	...
American Dist. Tel	...	*39	Interborough Rap. Tran.	37⅝	...
American Locomotive	67⅛	69⅛	Mackay Cos	61⅝	65
American Locomotive pfd	114¼	115	Mackay Cos pfd	72⅛	73⅛
American Tel. & Cable	91	92	Marconi Tel.	...	...
American Tel & Tel	139	137	Metropolitan St. Ry	115⅛	116⅝
Brooklyn Rapid Transit	84⅛	87⅞	N. Y. & N. J. Tel	...	...
Electric Boat	27	...	Western Union Tel	91⅝	93⅛
Electric Boat pfd	65	...	Westinghouse com.	156	163
Electric Vehicle	10	...	Westinghouse pfd	...	...
Electric Vehicle pfd	16	19⅛			

BOSTON

	Apr. 10	Apr. 17		Apr 10	Apr. 17
American Tel & Tel	139	138⅛	Mass. Elec. Ry. pfd	68	67
Cumberland Telephone	...	...	Mexican Telephone	4⅝	...
Edison Elec. Illum.	...	...	New England Telephone	141	140⅛
General Electric	...	...	Western Tel. & Tel	...	...
Mass. Elec. Ry	19	20	Western Tel. & Tel pfd	...	84⅛

PHILADELPHIA

	Apr. 10	Apr. 17		Apr. 10	Apr. 17
American Railways	52⅞	53⅛	Phila. Electric	7⅛	8⅛
Elec. Co. of America	11⅜	11⅛	Phila. Rapid Trans	27⅛	28⅛
Elec. Storage Battery	78	78	Phila. Traction	90	90⅛
Elec. Storage Battery pfd	...	...			

CHICAGO

	Apr. 10	Apr. 17		Apr. 10	Apr. 17
Chicago City Ry	150	182	National Carbon	90	92
Chicago Edison	...	154⅛	National Carbon pfd	120	118
Chicago Subway	53⅛	60⅛	Union Traction	...	...
Chicago Tel. Co.	...	130	Union Traction pfd	...	...
Metropolitan Elev. com	26	26			

* Asked

PHILADELPHIA ELECTRIC.—The annual meeting of the stockholders of the Philadelphia Electric Company was held last week. By the largest vote ever recorded, 655,000 shares being represented, the stockholders elected the following directors: Thomas Dolan, Jeremiah J. Sullivan, William F. Harrity, Chas. E. Ingersoll, John V. Shoemaker, J. R. McAllister, William P. Conover, Jr., A. V. R. Coe and Joseph B. McCall. President McCall read the annual report, which showed that the income for the year has been sufficient to provide for the payment on the Edison Electric Light stock trust certificate 5s, the Philadelphia Electric gold trust 5s, the Philadelphia Electric gold trust 4s and the dividends on the stock of Philadelphia Electric amounting to $499,935, leaving a balance of $511,081 for transfer to surplus account, thus increasing the balance of credit to said account as of December 31, 1905, to $1,411,737. President McCall stated that the total number of 16-cp lamps connected December 31, 1905, was 1,072,143, an increase of 103,873, or 10⅝ per cent of the connected power of last year. He called attention to the fact that the total connected load had doubled within the last five years. President McCall also called attention to the reduction in the rate for private and commercial lighting, which went into effect January 1, 1906. He said that this would temporarily affect the income of the company, but that the great increase in the business of electric lighting had justified the company's policy. Mention was made of the purchase of the building at Tenth and Chestnut Streets. Contracts have been awarded for the erection of a seven-story office building on the site, which will be completed by February 1, 1907.

MARYLAND ELECTRIC.—The annual meeting of United Railway stockholders recently did not bring forth any announcement of immediate financial reorganization, excepting that the Maryland Electric Company, which is controlled by friendly interests, shall finance plans for improvements and betterments. The promise is also made of an early resumption of dividends on the income bonds. Gross earnings for the year showed an increase of $575,224.89; earnings in excess of operating expenses, etc., $2,258,406.

DIVIDENDS.—Directors of the New England Telephone & Telegraph Company have declared the regular quarterly dividend of 1½ per cent, payable May 15. The directors of the Grand Rapids Railway Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. The regular quarterly dividend of 1¼ per cent on the preferred stock of Butte Electric & Power Company has been declared, payable May 1. Directors of the Henry R. Worthington Corporation have declared the regular semi-annual dividend of 3½ per cent on the preferred stock, payable May 1. The Pacific Gas & Electric Company has declared its first dividend on the preferred capital stock, payable April 15, for the quarter ending March 31, and for $1.50 per share, or at the rate of 6 per cent. This preferred stock was taken share for share by the holders of California Gas & Electric stock. It now bears interest at double the rate of the old stock, said interest being guaranteed under the trust agreement filed at the time of the gas merger. Directors of the International Steam Pump Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. The directors of the Michigan State Telephone Company have declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. Chicago Edison Company's directors have declared the regular quarterly 2 per cent dividend, payable May 1. A regular quarterly dividend of 1¼ per cent has been declared on the preferred stock of the Columbus Railway Company. The directors of the National Steel & Wire Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable May 2. A semi-annual dividend of 4 per cent has been declared by the Lowell (Mass.) Electric Light Company directors, payable May 1. The directors of the Automatic Electric Company have declared the regular quarterly dividend of 2 per cent, payable May 1. The directors of the Milwaukee Electric Railway & Light Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock

THE WATER POWER ELECTRIC COMPANY, of Hickory, N. C., recently incorporated, is beginning with a capital stock of $250,000, which may be increased later to $700,000, the maximum authorization, and 6 per cent 30-year gold bonds to the amount of $250,000. The company has secured a water power three miles north of Hickory on the Catawba River, which will develop 6,000 hp. A power plant will be erected at that point for the generation and transmission of electricity to Hickory, where it will be supplied to the Thornton Electric Light & Power Company. The latter company will distribute the current for the operation of mills and factories and the proposed street railway system. It is proposed to build a concrete dam 30 ft. high, both rock and sand being available at the site. Plans and specifications are being prepared, and it is stated that bids for the construction will be received probably in June. The cost of the work is estimated at $250,000. Extensive improvements are also proposed at Hickory, which include a street car line out to the river, where a farm has been acquired and will be converted into a park. Col. M. E. Thornton, president of the Thornton Light & Power Company, will be the president of the new company. Robert E. Zell, of Birmingham, Ala., is consulting and superintending engineer.

NATIONAL LEAD.—The annual report of the National Lead Company shows net earnings of $2,082,632, the largest in the company's history and an increase of $486,939 over those of 1904. President Cole says that the company expects to pay dividends on the common stock, beginning July 1. The United Lead Company, the purchase of which was accomplished since January 1, is not mentioned in the President's report, but he says that the concern has demonstrated an earning capacity sufficient to take care of the fixed charges on the additional securities issued to pay for the new properties and "leave a handsome addition" to the net revenue of the National Lead Company. Payment has been made to the United Lead Company's stockholders by the issue of $5,713,600 of preferred and $5,750,000 of common stock of the National Lead Company, provided for last June, when the capitalization was increased from $30,000,000 to $50,000,000. The report shows a decrease of $985,000 in accounts and notes payable, which were liquidated out of the surplus of net earnings. Notwithstanding these payments, the surplus has increased $486,939, and is at present $3,554,596.

CONSOLIDATION IN VIRGINIA.—It is stated that behind the merger of all the electrical traction and lighting properties around Norfolk, Va., exclusive of those controlled by W. J. Payne, of Richmond, and Alexander Brown & Sons, of Baltimore, are moneyed interests in the United Gas & Improvement Company, of Philadelphia. The merger is to be under the name of the Norfolk & Portsmouth Traction Company and the capitalization is to include $6,000,000 in stock and $8,000,000 in bonds. There will be an issue of $3,500,000 of bonds and $5,000,000 of stock. R. Lancaster Williams, now president of the Norfolk Railway & Lighting Company, which owns the largest properties absorbed, is to be president, and E. C. Hathaway, now general manager of the Norfolk Railway & Lighting Company, general manager. The company will build a new interurban line from Portsmouth to Suffolk and Smithfield, Va., and control new lines to be extended to the Jamestown Exposition grounds on Hampton Roads.

DEVELOPMENT IN ATLANTA.—The common stock of the Georgia Electric Company has reached par recently, and was selling around $25 three years ago. Since that time, the company has been making a remarkable record of earnings. For the year ended with December 31, 1905, it earned $550,573 for the common stock equal to $9 per share upon the $6,000,000. The common stock in August, 1905, was placed upon a dividend basis of 4 per cent. For the 1905 year the net earnings increased over the previous year 25.33 per cent. The company is showing earnings for the common stock at the rate of about $12 per share. The Georgia Railways & Electric Company controls the street railways, gas and electric lighting facilities of Atlantic, Ga.

MICHIGAN UNITED RAILWAYS.—Articles of association have been filed by the Michigan United Railway Company, capital $5,000,000. This company means the combination of the Lansing Suburban from Lansing to St. Johns, and the Lansing City line, the Jackson and Battle Creek, including the Battle Creek city lines, and the Michigan Traction Company from Jackson to Kalamazoo and Cull Lake. It is the intention of the company to finish building the line from Lansing to Jackson. With George E. More, Myron W. Mills and James R. Elliott, are associated New York capitalists. The consolidation will have 185 miles of electric road.

CHICAGO TELEPHONE COMPANY reports a gain of 2137 telephones for March, and a total in use of 150,184. President Wheeler says: "During the past five years we made 10 3-100 per cent on our average investment of about $15,000,000. The percentage of net to capital was 11 62-100. Reductions in rates under our offer to the city amount to $797,104, or 5 7-10 per cent on $14,000,000 capital. The difference or about 6 per cent would be what we would show on the same business under the same conditions, but with the lower rates. We have made only one proposition to the city and are waiting to see what objections there are to it."

TELEPHONE EXPENDITURE.—The directors of the Michigan State Telephone Company have authorized additional expenditures for new construction sufficient to make the total expenditures throughout the entire State $1,800,000. Of this amount $1,000,000 approximately will be expended in Detroit. The construction work will be financed in part by the issuance of securities.

POWER FOR THE SOUTH.—The Southern Power Company, of South Carolina, has ordered eight 4,000-hp electric generators, twelve 2,500-hp oil-insulated, water-cooled transformers, and auxiliary apparatus from the Westinghouse Electric & Manufacturing Company. This is said to be the largest order for this class of apparatus that has ever come from the South.

MANILA EARNINGS.—The earnings of the Manila Electric Railway & Lighting Corporation for the month of March are reported as follows by J. G. White & Co.: Railway, gross, $42,500; net, $20,000. Light, gross, $28,500; net, $13,700. Total, gross, $71,000; net, $33,700. The property bids fair to exhibit rapid gains and is doing well.

WESTINGHOUSE MACHINE OFFICERS.—The directors of the Westinghouse Machine Company have increased the number of vice-presidents from two to four and have elected E. H. Shiffin and Arthur West to fill the new offices of third and fourth vice-president, respectively.

SAN FRANCISCO TROLLEYS.—The stockholders of the United Railways Investment Company of San Francisco at a special meeting in Jersey City last week, ratified the plan for the purchase of the Philadelphia Company. The decision was by a two-thirds vote.

INTERNATIONAL STEAM PUMP.—A special meeting of the stockholders of the International Steam Pump Company has been called for May 8 for the purpose of considering the acquisition of some additional properties.

GENERAL NEWS.

Construction Notes.

BIRMINGHAM, ALA. A certificate of the increase of the capital stock of the Birmingham Railway, Light & Power Company from $6,000,000 to $7,000,000 has been filed.

BESSEMER, ALA.—C. M. Braddy, of Atlanta, connected with the construction department of the Southern Bell Telephone & Telegraph Company, is making arrangements for the reconstruction of the entire system in Bessemer and tributary points including Brighton and Jonesboro.

NOME, ALASKA.—Preliminary work has been commenced on the construction of a large electric plant at Salmon Lake, on Pilgrim River. It is given out that the plant will be of sufficient size and capacity to supply the entire Seward peninsula with power and light. W. L. Leland of the Three Friends Mining Company is interested in the work.

FLAGSTAFF, ARIZ.—The Flagstaff Mutual Telephone Company proposes to put in an automatic system next year.

PRESCOTT, ARIZ.—F. W. Nelson is soliciting subscriptions to build a long-distance telephone from Holbrook to Springerville and other points.

KINGMAN, ARIZ.—The Las Animas Power & Water Company, of Durango, Col., will soon begin work on its big power plant near this place. Arrangements have been made to conserve a much larger body of water from Cascade and Lime Creeks. The company will increase its equipment and will generate between 30,000 and 40,000 hp. The plans of the company include the driving of a seven-mile tunnel.

PHŒNIX, ARIZ.—The Arizona Telephone & Telegraph Company is considering plans which involves rural ownership of telephone lines and will connect 90 per cent. of the residents of this valley by telephone. The company is offering to furnish without cost to the subscriber a transmitter and receiver, the signal service and the telephone line to be paid for by the subscribers. In addition to this they pay fifty cents a month for the service of the city exchange.

EUREKA SPRINGS, ARK. G. U. Matthews writes that he and C. M. Barnes, are to construct an electric light plant, to cost $35,000, and want a turbine wheel of 500-hp capacity.

LOS ANGELES, CAL. The Edison Electric Company has begun the erection of a power house to cost $60,000.

LOS ANGELES, CAL.—Contracts for the construction of the Main Street lighting system have been let to the Llewellyn Iron Works for $17,739.

SAN FRANCISCO, CAL.—The Ocean Shore Railroad Company has filed amended articles of incorporation increasing its capital stock from $300,000,000 to $5,000,000.

SAN FRANCISCO, CAL.—It is understood that the management of the Palace Hotel has decided to order a steam-driven electric lighting plant for the use of the Palace and Grand hotels.

OAKLAND, CAL.—Contracts are being let by the Oakland Home Telephone Company and the construction of the plant will begin May 1. It is expected that the plant will be installed by January 1, 1907, with 5,000 telephones.

REDONDO, CAL.—C. C. Moore & Co., of Los Angeles, have secured the contract for constructing a steam power electric plant at Redondo, for the Pacific Light & Power Company, to cost about $1,000,000. About 25,000 hp will be generated.

VALLEJO, CAL.—At a recent meeting of the City Trustees, J. W. Hartzell, a railroad financier and builder, made an application for a 50-year franchise to construct and operate an electric street railway to connect North and South Vallejo, through the principal streets of Vallejo,

VALLEJO, CAL.—It is stated that the $3,000,000 bonds of the new San Francisco, Vallejo & Vaca Valley Electric Railroad Company have been sold, and that arrangements are about complete for the commencement of construction work on the branch road between Vallejo and Benicia.

MARYSVILLE, CAL. At a recent meeting of the Board of Supervisors, Frank W. Anderson, of Wheatland, made application for a fifty-year franchise to operate a telephone system throughout the County of Yuba. Anderson asks the Board that the franchise be offered for sale and to fix a day for receiving bids as required by law.

SAN FRANCISCO, CAL.—Rudolph Spreckels has announced that the Municipal Railroad, of Francisco, will soon file articles of incorporation, with a capital stock of $14,000,000. There will be five directors, including Claus Spreckels, Rudolph Spreckels and James D. Phelan. It is the intention of the new company soon to ask for a franchise on Bush Street.

LOS ANGELES, CAL.—From its headquarters in Los Angeles comes the announcement that the work of installing a Home telephone system in San Francisco will begin shortly. On April 21 the franchise applied for by the Empire Construction Company will be sold by the municipality. As there are no other telephone companies trying to enter the field the Home plant is practically assured. It is estimated that two years time will be required to erect the large plant and system which will be automatic. The cost of construction will exceed $6,000,000.

LOS ANGELES, CAL.—All the holdings of the Riverside Power Company have been sold by the Southern California Savings Bank of this city to the cities of Santa Ana, Anaheim and the Pacific Light & Power Company. With the sale of the company's assets is conveyed the title to riparian rights to 6½ miles of the Santa Ana River banks. The headworks are at the Salt Lake bridge over the Santa Ana, and of its waters the company owns an average of 2,500 miners' inches. The price paid for the plant was $150,000. The power is now used for lighting Riverside.

CROCKETT, CAL.—In the expectation of quadrupling the output of the Crockett sugar refinery in the near future, the management has commenced installing electric motors, which will eventually replace steam in the operation of the big plant. Seven additional boilers are to be installed in the lower floor, and these will supply steam to the big compound Corliss engine in the main building, and will also operate the generator. This generator will supply all the power needed in the different departments of the refinery, as well as the lights in the buildings and the Crockett Hotel.

YREKA, CAL.—The extension of the Yreka Railroad from Yreka, its present terminus, to the towns of Fort Jones, Greenview and Etna in the Scott Valley is to be built by Scott & Van Arsdale, of San Francisco. Alex. J. Rosborough, the local representative for the new road, is the secretary of the Siskiyou Electric Power Company, and negotiations have already been entered into between the builders of the proposed extension and the electric company regarding the application of electricity to the running of this road. If the engineers report favorably the road will undoubtedly be electrified.

YREKA, CAL.—The Siskiyou Electric Power Company has entered into an agreement with W. W. Wright, superintendent of the Dewey Mining Company, near Gazelle, Siskiyou County, wherein Mr. Wright signifies his intention to organize a sub-electric company for the extension of a power line into the southern portion of Siskiyou County. It is estimated that the cost of extending these lines will be in the neighborhood of $75,000. The power to be used will be purchased from the Siskiyou Electric Power Company and delivered at Montague. The proposed line will run to Gazelle, Edgewood, Weed, Upham, Sisson, Shasta Springs, Shasta Retreat and Dunsmuir, and to the town of McCloud. A revenue of $2,000 a month has already been guaranteed the sub company. Under the terms of the contract, the purchase of electricity is for ten years, with option to buy this sub company or renew the lease.

FRESNO, CAL.—An order for 10,000 poles has been placed by the San Joaquin Power Company. A branch line will be built to Dinuba, Reedley, Sultana and Orosi, running west after making the circuit to a junction with the Visalia line. Four miles west of Selma, on the Hanford line, a substation will be erected from which a line will be run east into Selma and west into the Caruthers country, where it will be used for pumping. It is also proposed to extend the west branch to Summit Lake, where there is a demand for electric power for pumping purposes. From the plant that is now being built above Porterville, a line will be run to Porterville, thence west to tie with the Fresno system at Corcoran. Also from a point due south of Tulare a line will be built north to tie with the Fresno system at Dinuba. Another line contemplated will be built north to Madera.

DANIELSON, CONN.—Amendments to the borough charter will be prepared enabling and empowering the borough to own and operate a public water system and also an electric light and power plant.

WINDSOR, CONN.—The electric light company has ordered a new 175 kw., three-phase, alternating-current generator to be added to the equipment of the plant. It is expected to be ready by May 1.

NORWICH, CONN.—The Torrington Building Company, of Torrington has been awarded the contract for the erection of the new power house for the Norwich-Westerly Railway Company, which will be located just south of Hallville. The building will be ready for occupancy June 15. There will be considerable machinery installed, including eight Franklin 1,600-hp motors, three 400-kw generators, three 500-hp Hamilton Company's engines, and other necessary equipment.

WILMINGTON, DEL.—The Wilmington Light, Power & Telephone Company has issued $500,000 bonds for construction purposes.

SMYRNA, DEL.—A Benoy boiler has been installed in the municipal electric light and water plant. A new 65-kw Warren dynamo will be put in some time this month. Harry B. Crienes is secretary.

WILMINGTON, DEL.—The Wilmington City Railway Company has placed contracts for new equipment calling for an expenditure of $400,000. The improvements to be made extend to all departments of the system. A battery of four 400-hp boilers has been ordered from the Heine Boiler Company, of Phoenixville, Pa., and two additional generators, one of 800 and the other of 600 kw capacity, from the General Electric Company. These generators will be direct-connected to two engines to be built by Robert Wetherill & Company, of Chester, Pa.

JACKSONVILLE, FLA.—The County Commissioners have granted George W. Clark, owner of Panama Park, the right of way for an electric railway here. The new line will extend from the intersection of Main Street and the city limits, run along Main Street to Lawton Avenue at Panama Park, thence east on Lawton Avenue to Buffalo Avenue, to Virginia Street, thence to Cummer's road, and south to Talleyrand Avenue to the city limits.

DUBLIN, GA.—A syndicate has applied for a street railway franchise on the streets of Dublin.

ATLANTA, GA.—The City Council has decided upon an appropriation for the installation of a number of new incandescent and arc lamps in various parts of the city.

COLUMBUS, GA.—The Columbus Power Company has purchased property on Second Avenue to be used as a site for the proposed steam plant which will generate about 3,000 hp.

ATLANTA, GA.—J. D. Jacquish is at the head of a movement to build an electric railway from Atlanta to Gainesville, Ga. It is possible that the North Georgia Electric Company will supply the power.

ACWORTH, GA.—H. M. Putnam, city clerk, writes that it is proposed to construct water works and an electric light plant, at a cost of $12,000 or $15,000. J. B. McCrary, of Senoia, is engineer.

ROCKMART, GA.—Contracts for constructing an electric light plant, for which bids were opened April 9, have been awarded as follows: Boilers, to Walsh & Weidner Company, Chattanooga, Tenn.; engine to Harrisburg Foundry & Machine Company, Atlanta; electric apparatus, arc light system, switchboard and alternator to Ft. Wayne Electric Company, Ft. Wayne, Ind.; transformers and lamps to Newcomer-Maney Company, Atlanta, and heaters and pumps to Platt Iron Works, Dayton, Ohio. Joseph M. Roman & Co., Century Building, Atlanta, Ga., are engineers for the company.

COTTONWOOD, IDAHO.—The business men of this city have decided to install an electric lighting plant at a cost of about $3,500, which amount has been subscribed.

BOISE, IDAHO.—D. J. Winslow has secured an option on the Snake River Ox Bow power site from the owners, Charles Mullen, Dr. W. D. Springer, F. W. Hunt, John H. Meyers, R. M. Fairchild and the David Heron estate. The price to be paid is $25,000. The power site is one of the largest in this section of the State. It is located on the Snake River 50 miles below Huntington. By putting in a 25-foot dam and driving a tunnel through the lava rock a distance of 1,400 feet, a fall of 50 feet is secured for the entire volume of the river. Competent engineers estimate that 25,000 hp may be generated at low water.

FREEPORT, ILL.—The Pecatonica River Power Company has increased its capital stock from $5,000 to $100,000, and the general offices have been changed from 99 Stephenson Street to the plant in Silver Creek Township.

LINCOLN, ILL.—Lincoln Water & Light Company has recently purchased from the General Electric Company series alternating 7.5 ampere arcs to take the place of "Wood" open 9.6 ampere lamps. E. MacDonald is superintendent.

CENTRALIA, ILL.—Centralia & Central City Street Railway Company and Centralia & Central City Street Railway Company have been consolidated under the name of the Centralia & Central City Traction Company, with a capital of $4,110,000.

FREEPORT, ILL.—The Freeport Railway, Light & Power Company has presented a petition to the village Board of West Freeport for a franchise to construct and operate a street railway, electric lighting, heating and power plant in that village.

DUQUOIN, ILL.—St. Louis and Kansas City capitalists, represented by Albert B. Moebusa, of St. Louis, and C. W. Prince, Jr., of Kansas City, are about to apply for a franchise and right of way for a traction line to be constructed from this city to Terre Haute, Ind.

WAUKEGAN, ILL.—Agents of the Chicago Telephone Company are surveying a route between Chicago and Milwaukee for putting the main wires in conduits in order to better protect them. The route is largely along Sheridan Road near here. Permission will be asked from city an county authorities for the change from poles.

GALESBURG, ILL.—It is reported that the Central Union Telephone Company will make a number of changes and additions to its lines during the spring and summer. One of the additions is to be another copper metallic circuit between Galesburg and Bushnell, which, when completed, will make four toll lines between the two cities. A copper metallic circuit has just been completed between Bushnell and Roseville and a new circuit will soon be completed between Bushnell and Carthage by way of Plymouth.

CANNELTON, IND.—Work has begun on the city's new electric light plant. The authorities are now in the market for the installation of the plant.

WESTVILLE, IND.—A franchise has been granted to E. S. Smith, E. T. Scott and others to construct and operate a telephone exchange at this place.

DUNKIRK, IND.—The Dunkirk Lighting Company is contemplating making some improvements in its plant in the near future. T. R. Kent is secretary.

EARL PARK, IND.—The franchise recently granted to W. C. Ditton for a water and electric light plant has been referred to a vote of the people for ratification.

WABASH, IND.—The Home Telephone Company of this city will erect a new business block for its own use and install a $10,000 central energy multiple switchboard.

DECATUR, IND.—The city contemplates installing a series alternating-current street lighting system in the municipal electric light plant. W. J. Mylott is superintendent.

MARION, IND.—City of Marion electric light department has asked for bids for one 150-kw, 60-cycle dynamo to be installed in the city electric light plant. Otto Weeaner is superintendent.

HAMMOND, IND.—The Town Council has granted a franchise to the New York & New Orleans Electric Company by which it obtains the use of several streets in the town over which it proposes to operate an electric railway.

ANDERSON, IND.—The Remy Electric Company of this city has increased its capital stock from $50,000 to $75,000 for the purpose of improving and enlarging the plant. The company will also install some new machinery, it is said.

SHERIDAN, IND.—The Town Council contemplates installing in the city electric light plant a gas engine and producer plant to displace the present steam plant, and replacing a 75-kw with a 100-kw alternator. W. M. Robbins is superintendent.

KENDALLVILLE, IND.—The Chicago & Toledo Traction Company is erecting a large power house in this city which will develop 5,000 kw when completed. Sterling water tube boilers and turbo-generators will be installed. F. E. Johnson is superintendent.

TIPTON, IND.—Tipton Electric Light Company is contemplating stepping its pressure up from 2,200 volts to 6,000 volts and extending a line at that voltage to Windfall, eight miles from Tipton, for the purpose of furnishing the town with light and power. The work will probably be done this spring. J. H. Stewart is manager.

EVANSVILLE, IND.—By a vote of 5 to 4 the City Council refused to grant a thirty-five-year franchise to the Citizens' Telephone Company. The Council recently granted a thirty-five-year franchise to the Cumberland Telephone Company, and did not think it wise to vote a dual telephone system on the city. The Citizens' Company will make another effort to get a franchise through the Council.

CHIGLEY, I. T.—M. Wolf, of Old Wasbita, is trying to interest the citizens in the construction of a telephone line from here to Davis.

WASHINGTON, IA.—The plant of the Iowa Gas & Electric Company has been purchased by the Washington Illuminating Company.

GUTTENBERG, IA.—The Home Electric Company has succeeded the Guttenberg Electric Light, Heat & Power Company, Guttenberg, Ia., and will begin the rebuilding of the entire plant at once. B. G. Houck is secretary.

IDA GROVE, IA.—A number of Ida County farmers from Hayes, Blaine, Silver Creek, Grant, Corwin and Logan townships held a meeting in Anderson's hall in Ida Grove recently to plan the organizaton of a farmers' mutual telephone company in this vicinity.

PRATT, KAN.—The Pratt Ice & Light Company has secured a franchise for an electric light plant.

CALDWELL, KAN.—A proposition has been made to issue $15,000 in bonds to install a municipal electric light plant in this city.

MADISON, KAN.—D. C. Callen has made a good many new improvements in the electric plant here since he took charge of the same.

TOPEKA, KAN.—The city municipal street lighting system plant contemplates changing from open to enclosed arcs. H. K. Goodrich is superintendent.

OTTAWA, KAN.—J. H. Bell, city clerk, writes that the citizens voted April 3 to purchase the water work and electric light plant and will make improvements to same. Engineer, Owen Ford, Security Building St. Louis, Mo.

LARNED, KAN.—G. W. Smith, proprietor of the Larned electric light plant, is installing a 15-ton ice plant in connection with the light plant and is putting in a new 150-hp boiler and 14x36 rolling mill type Murray engine.

LOUISVILLE, KY.—The Louisville & Eastern electric line has been granted right of way over the State pike from Shelbyville, Ky., to the fair grounds.

MADISONVILLE, KY.—James L. Brown, City Clerk, writes that bids will be received about May 1 for the construction of a municipal lighting plant; probable cost, $25,000.

LOUISVILLE, KY.—The Board of Aldermen on April 3 adopted a resolution authorizing the Board of Public Works to prepare a contract with the Louisville Lighting Company for one year at $74 per lamp per year, the company to furnish electricity at 10 cents per kw-hour.

LAFAYETTE, LA.—An election will probably soon be held to vote on issuing $35,000 bonds for extending the electric light service and for water mains.

RUSTON, LA.—The City Council has granted a franchise for the operation of a street railway in Ruston. The proposed line will run to Chatauqua and Lincoln Parish Fair Grounds, outside the city.

EUNICE, LA.—Ira W. Silvester, of Alexandria, La., a civil engineer, has been looking over the town and making an estimate of the probable cost of an electric lighting and water works plant, which the Town Council proposes to install in the near future.

EL DORADO, KAN.--The El Dorado Light, Heat, Ice & Power Company, with a capital of $50,000, has been granted a franchise to build a gas and electric light plant in this city and has been given the contract for lighting the streets.

NEW ORLEANS, LA.—At the annual meeting of the New Orleans Railway & Light Company, President Foster stated that work contemplated and under construction includes the completion of the power house and the addition to the Claiborne station, and other extensions.

PORTLAND, ME.—The Portland Lighting & Power Company is to establish a new substation in which 800 hp will be developed by steam. The contracts for equipment are let.

SOUTH PORTLAND, ME.—It is understood that the U. S. Government contemplates quite an extension of its electrical equipment at Fort Williams and that an additional building will be required for the dynamo, etc.

FRYEBURG, ME.—Fryeburg Electric Light Company has suspended operations for the present on account of failure to get the supply of power according to contract. The company is now considering the development of ample water power in the near future. C. E. Harris is secretary.

BANGOR, ME.—Pembroke and Perry are to be lighted by electricity in the near future, it is said. The water power privilege of [illegible] H. Sprague & Son, of Pembroke, for the possession of which Boston parties have been negotiating for several months, has finally been transferred to the latter, who have acquired by the deal the old Pembroke Iron works also. Work on the proposed power station and the erection of 12 or more miles of poles will be commenced at an early date.

AUGUSTA, ME.—The Kennebec Light & Heat Company will soon commence some improvements in the equipment of its power station at the east end of the Kennebec dam which will increase to a considerable degree its already excellent facilities for furnishing light and power to Augusta and other places in the vicinity of the city, which means the introduction of new and modern machinery to take the place of some which has become obsolete. One of the important changes will be the installing of a 675-hp turbine, direct-connected to a 500-kw generator, to replace the engines now in use.

BALTIMORE, MD.—The Board of Estimates has decided to increase the price to be asked for a franchise on German Street for the United Railways Company from $7,500 to $15,000.

NORWOOD, MASS.—The citizens have vote to construct a municipal electric light plant, to cost about $25,000.

WORCESTER, MASS.—A proposition is being discussed for the city to purchase the plant of the Worcester Electric Light Company.

NORWOOD, MASS.—The citizens of Norwood have voted to appropriate $25,000 for the erection of the new municipal distributing electric plant.

SHEFFIELD, MASS.—It is reported that the Berkshire Power Company, of Canaan, is contemplating furnishing electric lights in this village.

FALL RIVER, MASS.—Plans have been completed for a new power house for the Fall River Electric Light Company on Hathaway Street; also for an annex to the Hartwell Street plant.

EAST BRAINTREE, MASS.—Braintree electric light department is considering installing a new unit for the station consisting of a 250-kw, 2,200-volt, 60-cycle, two-phase engine and generator. W. P. Mercer is superintendent.

STOUGHTON, MASS.—The citizens have voted to appropriate the sum of $4,700 for electric lights to be left to the direction of the selectmen. It was understood that some of the new lamps are to be placed at North Stoughton.

MILFORD, MASS.—The Milford Selectmen have contracted with the Milford Electric Light & Power Company to furnish 58 electric arc lamps for one year, the number now in use, for $5,000 a year. This makes the price per light per year $86.57. The price previously was $91.58.

MAYNARD, MASS.—The residents of South Acton have petitioned the American Woolen Company to furnish electricity for lighting the town, and as the proposition is agreeable to the company it is likely that before long wires will be extended to South Acton and the town lighted by power furnished at the Maynard Mills.

WESTBORO, MASS.—At a recent special town meeting, Special Justice John W. Slattery, Richard F. Parker and Melvin H. Walker were appointed to investigate the question of municipal lighting. This committee has visited a number of towns in the country where municipal lighting is being tried, and was to report at the adjourned March meeting, but did not have its report ready.

WESTBORO, MASS.—The contract of the Westboro Gas & Electric Company for lighting the town expires May 1, but the company is desirous of having the contract continue for another year and has so petitioned the Selectmen. The company proposes to accept the $3,360 appropriated at the annual meeting for the exact number of lamps in use at present, additional lights to be charged for at the prevailing rates.

PITTSFIELD, MASS.—P. H. Dolan, manager of the Pittsfield Street Railway, has closed a contract with the D. M. Dillon Boiler Works, of Fitchburg, for five new 200-hp boilers for the proposed new power house on Seymour Street. The contract calls for the brick and masonry work and setting them in place in the new house at a cost of about $10,000. The contract for the erection of the power house will be awarded in a few days.

AMESBURY, MASS.—At a recent meeting of the Amesbury Electric Light Committee, it was decided to make extensive improvements both in buildings and in machinery, and $30,000 will be expended in modernizing the whole plant. An addition will be put on the present power house so as to bring the electrical machinery all on one floor. Not only will the house be modernized, but the machinery as well. Superintendent H. A. Sawyer, B. F. Sargent and Mr. Mather will take up this work of enlargement and improvement.

VICKSBURG, MICH.—The Warner arc lamps are being installed in the municipal electric light plant. B. R. Platt is village clerk.

LAPEER, MICH.—F. J. Schlegel writes that it is proposed to construct an electric light plant in Lapeer at a cost of $15,000.

HOLLY, MICH.—The Holly Electric Light & Power Company is dissolved and out of business, and the plant is for sale. There is some possibility of the city purchasing the plant. Chas. H. S. Poole is manager.

IRON MOUNTAIN, MICH.—The city clerk writes that the matter of constructing an electric light plant will probably be brought before Council within the next two months.

GRAND RAPIDS, MICH.—The Boyne City Electric Company will build a new power dam over Boyne River during the present year to furnish light and power for Boyne City. M. W. Swift is superintendent.

DETROIT, MICH.—Promoters using the name of Attorney Frank D. Andrus have made application to the Common Council for a 30-year franchise for a complete street railway system, embracing some 200 miles of track. The company is known as the People's Railway Company.

MANCELONA, MICH.—The Mancelona Electric Light & Power Company will buy power from the Antrim Light & Power Company at Mancelona and change its system to alternating-current during the summer. The power company will soon commence operations to develop its water power plant on Cedar River, seven miles west of Mancelona and expects to have power in the city by November, 1906. Fred Wildi is manager.

RUSH CITY, MINN.—Rush City Electric Light Company contemplates changing from flat rate to meters. C. M. Johnson is manager.

ELBOW LAKE, MINN.—Elbow Lake Electric Light Station is installing a 66x18 high-pressure boiler. Geo. Arenson is superintendent.

BELLE PLAINE, MINN.—It is reported that bids will be received until May 1 by J. E. Townsend, borough clerk, for a 15 to 20-year franchise for a light plant.

EVELETH, MINN.—The Spruce and Adam mine of Eveleth will install a 100-kw 250-volt machine to drive the new locomotive that goes in the four hundred foot level of the Spruce No. 1.

EVELETH, MINN.—The Eveleth Electric Company will light the city water works at St. Marys Lake, a distance of three miles, and will pick up business on the way. S. S. Hough is manager.

EVELETH, MINN.—The Oliver Iron Mining Company is installing a 400-kw 250-volt generator, direct-connected at its No. 4 Fayal shaft. Most of this power will be used for lighting underground workings and driving its 18 electric locomotives.

BEMIDJI, MINN.—A. A. Warfield, of Bemidji, secretary Beltram Electric Light & Power Company, writes that it is proposed to install an 800-kw hydro-electric light plant some time this fall. About $50,000 will be expended.

LAKE CITY, MINN.—Lake City Electric Light & Water Works has changed from direct current to alternating current in the past year, and has installed a 250-hp Reeves engine, 150-kw Fort Wayne alternator, also a 30-kw Westinghouse alternator. The company will install a new boiler this summer and seven alternating current arc lamps. E. V. Lombard is superintendent.

BROOKHAVEN, MISS.—At a meeting of the Mayor and Board of Aldermen a petition was granted by H. Cassidy, J. W. McGrath, George C. Haskins, W. H. Sevey and E. E. Becker, asking that they be granted a franchise to construct and operate a street railway in Brookhaven. Action in the matter was deferred until the May meeting.

KANSAS CITY, MO.—The South Side Electric Light & Power Company offers for sale a franchise in this city not being used at present. H. C. Pfeiffer is president.

ST. LOUIS, MO.—The North American Company, which controls the United Railways Company, the Laclede Gas Company and the Union Electric Light & Power Company, is negotiating for the purchase of the St. Louis & Suburban Company.

SEDALIA, MO.—The Railway & Electric Company has taken possession of the street railway lines, power house and electric light plant, of this city, which were formerly operated under lease by the Sedalia Transit Company. The Railway & Electric Company will make improvements at once.

PENDER, NEB.—M. W. Murray, Village Clerk, writes that the citizens voted on April 3 to issue $10,000 bonds for an electric light plant.

OMAHA, NEB.—Herman Weise has been awarded the contract for the new building for the new telephone exchange at South Omaha, which will cost $26,000.

HUMBOLDT, NEB.—Humboldt electric light plant will install a 100-kw machine soon and will then start a day power circuit. It also expects to install a 200-hp engine this year. Address M. A. Williamson.

NEBRASKA CITY, NEB.—The Water & Light Company writes that it does not contemplate any changes this season as the city may purchase the plant, both water and light. B. P. Egan is manager.

ELY, NEV.—C. D. Vail, of Butte, Mont., is making preliminary surveys and estimates for the Ely Townsite Company, with a view to constructing water works and an electric light plant at Ely.

PATERSON, N. J.—The State Legislature has passed a bill enabling Paterson and Passaic to own and operate municipal electric lighting plants.

NEW BRUNSWICK, N. J.—The bill passed by the State Senate may enable this city to construct a municipal electric light plant.

BORDENTOWN, N. J.—The Bordentown Electric Light & Motor Company has secured the contract for lighting the city for five years at $90 per year for arc lamps and $18 per year for incandescent lamps.

ORANGE, N. J.—The Common Council has rejected the bid of the Public Service Corporation, recently received, for lighting the city, the bid being considered excessive. It is reported that if lower figures are not received, a municipal electric light plant will probably be constructed.

NEWARK, N. J.—The Board of Trade on April 11 passed a resolution in favor of the establishment of a municipal electric light plant, and recommended that the Mayor and Common Council employ experts to investigate and report not later than December 1 on the probable cost of the installation of such a plant.

NEWARK, N. J.—Bids will be received until April 26 by the Committee on Buildings of the Board of Chosen Freeholders, of which Hugh Gallagher is chairman for light fixtures in the Essex County Isolation Hospital. Herman Kreitler is the architect and John F. Capen, associate, 45 Clinton Street, Newark.

ROCKAWAY, N. J.—A petition is in circulation asking the Mayor and Council to call a special election to vote on bonding the borough to buy the electric plant of the Rockaway Electric Light & Improvement Company. The petition will be presented at the regular meeting of the Council on April 26. S. B. Libby is superintendent.

CORTLAND, N. Y.—The Cortland County Traction Company is planning to extend its line to Preble.

SANDY HILL, N. Y.—The Union Bag & Paper Company is contemplating an addition to its Baker's Falls power house so as to install a fourth generator.

PIKE, N. Y.—T. H. Couler, Village Clerk, writes that the village will not construct a municipal electric light plant, but will award the lighting contract to the Genesee Valley Power Company.

ROCHESTER, N. Y.—Eastern Monroe Electric Light & Gas Company is installing a 150-kw, three-phase, 4,400-volt Westinghouse revolving field generator. Geo. L. Colgate is consulting engineer.

ROCKVILLE CENTRE, N. Y.—The board of trustees of the municipal electric light plant proposes to separate street lighting from the commercial lighting during the coming summer. Geo. W. Rowe is village clerk.

CORTLAND, N. Y.—The Cortland Home Telephone Company has voted to spend $20,000 in improvements on its system.

EAST HAMPTON, N. Y.—East Hampton Electric Light Company is changing its plant from one to two phase system and is laying about 10,000 feet of underground cable in addition to about six miles now in use. Geo. R. Eldredge is manager.

FULTON, N. Y.—L. W. Emerick, vice-president of the Fulton Light, Heat & Power Company, writes that plans are now being prepared for improvements, to include water wheels, governor, generator, switchboard, boilers and a smoke stack.

WATERTOWN, N. Y.—Work is progressing satisfactorily on J. B. Taylor's electric power enterprise at Black River. It is expected the plant when completed will develop a minimum of 2,200 horse-power. It nothing unforeseen occurs, the construction work at Black River will be completed by July and wires or cables for power transmission will be placed to connect that village with Watertown by September.

WESTCHESTER, N. Y.—The Directors of the Westchester Lighting Company have elected Dr. B. W. Stillwell, of Yonkers, as vice-president of the company, and Mr. Stillwell has become the executive officer of the corporation. Francis A. Stratton, who retired from the active duties as president, was chosen chairman of the Executive Committee. Mr. Stillwell will be in charge of the general offices. He has been the treasurer of the company in the past. H. A. Carter will now act as secretary and treasurer.

SPENCERPORT, N. Y.—At a recent meeting of the stockholders of the Hilton Telephone Company, held in the village building at Hilton, it was voted not to sell the plant to the Bell Telephone Company, but to increase the amount of the capital stock from $8,000 to $15,000. At a meeting of the directors held immediately after the stockholders' meeting, the president and manager, John E. Cooper, was given the power to enlarge the plant and extend the lines as he thought advisable. An additional switchboard and other improvements will be added to the central office, and active operations will soon be begun on the construction of new lines and the extension of others.

GREENSBORO, N. C.—The Carolina Electrical Company, backed by Philadelphia capital, has secured a franchise from High Point to Thomasville.

CHARLOTTE, N. C.—The Charlotte Consolidated Construction Company of this city has been examining the latest patterns of gas engines with the view, it is said, of installing two large gas engines for driving electric generators.

MANCHESTER, OHIO.—The city is constructing an electric lighting plant. John K. Dunbar is clerk.

PAINESVILLE, OHIO.—The City Council is considering the establishment of a municipal lighting plant.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company is installing two 250-hp Aultman and Taylor water tube boilers.

PORTSMOUTH, OHIO.—The Portsmouth Street Railroad & Light Company has increased its capital from $125,000 to $500,000.

OXFORD, OHIO.—The Board of Public Affairs contemplates adding to the municipal electric light plant three new boilers this summer. S. H. Allen is clerk.

ALLIANCE OHIO.—The Sandy Valley Telephone & Electric Company has been incorporated with a capital of $50,000. The incorporators are R. S. Kayler and others.

SPRINGFIELD, OHIO.—It is stated that the Springfield, Troy & Piqua Traction Company is planning to build an extension from Troy to Greenville, Ohio, a distance of 30 miles.

BLUFFTON, OHIO.—William Plattner, superintendent, writes that extensions and improvements are to be made on the municipal electric light and water works plant this summer.

ELYRIA, OHIO.—The Elyria Milling & Power Company writes that it is proposed to enlarge its plant by the installation of a larger water wheel and dynamos for electrical power.

AKRON, OHIO.—The Akron Bell Telephone Company is preparing to make important improvements to its system. A new switchboard and 67,500 feet of new cable will be installed.

COLUMBUS, OHIO.—The Ohio Legislature has passed favorably on an appropriation of $25,000 for the purpose of installing an electric lighting system in the State capitol at Columbus.

SIDNEY, OHIO.—The Sidney Electric Light Company is using Westinghouse three-cylinder gas engines in place of steam engines with good success and economy. F. D. Elwell is superintendent.

HAMILTON, OHIO.—The Hamilton Home Telephone Company has made application to the City Council of Middletown for a franchise to establish an exchange and lay conduits in that place.

LISBON, OHIO.—The New Lisbon Gas Company has just added a new 30-kw generator and gas engine to take care of day current, and also putting in a number of motors and fans. N. Way is manager.

MANSFIELD, OHIO.—The Mansfield Railway, Light & Power Company is applying for a franchise from the city to build a loop around Central Park in the business section; also to lay a second track on Main Street.

URBANA, OHIO.—The city will soon place a contract for city lighting. A measure has been introduced in the council providing that the city shall not pay more than $7,500 for lighting the streets and public buildings of the city.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company is preparing to extend its line about 7 miles west of Bowling Green to a point on the Maumee River where a summer resort will be located.

FOSTORIA, OHIO.—The people of this city will be given an opportunity to vote on the question of issuing bonds not to exceed $50,000 for the purpose of installing an electric lighting plant in connection with the water works.

CLEVELAND, OHIO.—J. T. Ross, chief engineer of the Everett-Moore construction forces, has completed a survey from Sandusky to Clyde for the Lake Shore Electric Railway and is now making a survey from Sandusky to Fremont.

LORAIN, OHIO.—The Citizens Gas & Electric Company is planning to make extensive improvements to its Lorain plant this year. The company will purchase a new engine and a generator and will install a number of new lamps.

TOLEDO, OHIO.—The Toledo Railways & Light Company has been awarded the contract for illuminating the Government buildings here. The Toledo Gas, Electric & Heating Company, recently incorporated, also submitted a proposition.

LIMA, OHIO.—The Columbus & Lake Michigan Railroad has been purchased by the Widener-Elkins Syndicate for a consideration of $675,000. The portion now operated by steam will be electrified at once, and may be extended to Bryan, Ohio.

MT. STERLING, OHIO.—The municipal electric light and water plant will install new boilers and new lamps for street lighting and other improvements during the summer to the amount of about $7,000. H. Clay Johnson is clerk of the board.

SUMMERFIELD, OHIO.—The Noble County Telephone Company and the Stranathan & Milley Telephone Company have sold their interests to the Home Telephone Company of Cambridge. Important improvements will be made to the systems.

CINCINNATI, OHIO.—The directors of the Cincinnati Gas & Electric Company have authorized President N. G. Keenan to secure 6,000 additional hp of boilers for the electric lighting power plant. A large amount of wire in the central portion of the city is to be placed underground. The improvements will cost about $[illegible]

CLEVELAND, OHIO.—Attorney John N. Stockwell, representing the Cleveland Light & Power Company, has made an informal application to Mayor Johnson for an electric light franchise. The attorney promised that if the franchise is granted a provision would be included in the ordinance whereby the city can take over the plant at its discretion.

CLEVELAND, OHIO.—The Cleveland Light & Power Company has made application to the City Council for a franchise enabling it to supply light and power in all parts of the city. The company promises cheaper lights for the city and private citizens and a plan for ultimate municipal ownership of the plant. Some years ago the company secured a franchise to furnish current in a certain portion of the downtown district, and it claims to be furnishing 90 per cent of the electric light now used in this district. Mayor Johnson wants the company to agree to build a large power station on the lake or river front where power could be produced economically, before he will agree to support the company's project.

MARIETTA, OHIO.—The Parkersburg & Ohio Valley Traction Company has secured all the right of way from Sistersville to Waverly, W. Va., and is said to be securing right of way from Waverly to Parkersburg. Ultimately it is the intention to connect Parkersburg with Wheeling, W. Va.

CLEVELAND, OHIO.—It is stated that the financial matters for the proposed Cleveland, Ashland & Mansfield Railway have been adjusted, and that within the next two weeks the Roberts & Abbott Company, of this city, engineer for the property, will place the contracts for construction and material.

SPRINGFIELD, OHIO.—Officials of the Schoepf syndicate, which recently purchased the Appleyard lines, state that plans are being made for extensive improvements to the main power station at Medway near this city. It is stated that additional machinery will be installed and another sub-station erected.

TOLEDO, OHIO.—The Everett-Moore Syndicate, which owns the Maumee Valley Railway & Light Company and its extension known as the Toledo, Waterville & Southern Railway, is said to be investigating the advisability of extending the latter line from its present terminus at Waterville on to Whitehouse, Colton and Napoleon.

EAST LIVERPOOL, OHIO.—Thomas Bracken, of New York, is negotiating for the purchase of valuable coal lands near West Point. He proposes to establish a large power station to supply electricity to East Liverpool, Youngstown, Miles, Warren, Cleveland and other points within 100 miles. He is a mechanical engineer and represents New York capitalists.

OKLAHOMA CITY, OKLA.—N. S. Sherman, of this city, was recently awarded the contract for the construction of electric plant and water works at Wynnewood, I. T.

SHAWNEE, OKLA.—Shawnee Lighting Company has purchased and is installing a 500-kw steam turbine and two railway generators of 575-kw capacity. U. S. Hart is chief clerk.

READING, PA.—The Pennsylvania Telephone Company is preparing to do a great deal of work in this district this spring and summer.

MUNCY, PA.—Muncy Electric Light, Heat & Power Company contemplates installing a 150-hp Olds gas producer and engine. F. R. Bussler is chief engineer and electrician.

ETNA, PA.—The borough has just installed a 100-light Wood arc generator in the municipal electric light plant and completed its light circuits with Wood arc lamps. A. R. Dunbar is borough clerk.

PITTSBURG, PA.—The charter of the Fording-Morse Syndicate of Pittsburg for the construction of a subway in the down-town section of Pittsburg, has been approved by Governor Pennypacker.

PORT CARBON, PA.—Port Carbon Electric Light, Heat & Power Company has been leased to and is operated by the Edison Electric Illuminating Company of Pottsville. Isaiah Cartwright is secretary.

WILKESBARRE, PA.—An ordinance has been introduced in the Council giving the Midway Connecting Company the privilege of entering the city and constructing a railroad from its terminus at the corner of Merchants Alley and North Pennsylvania Avenue to Nanticoke.

HUMMELSTOWN, PA.—The Hummelstown electric plant has been purchased by the proprietors of the Hummelstown water plant and will be improved and continuous service will be given as soon as larger dynamo and new water wheels are installed. E. H. Leffler is manager.

ERIE, PA.—Additions to the present extensive equipment costing more than $50,000 are in progress at the plant of the Edison Electric Light & Power Company, corner of Twelfth and French Streets. A 1,500-hp engine of the vertical type will be put in place. A traveling crane with a lifting power of 20 tons will also be added to the equipment of the plant.

HAWLEY, PA.—V. A. Decker, E. C. White and Lewis P. Cooke have purchased the plant of the Hawley Electric Light Company and have organized the Paupack Electric Company. They will rebuild the plant, putting in new and additional water wheels, boilers and generators. F. C. White is president; Lewis P. Cooke, vice-president, and V. A. Decker, secretary and treasurer.

ALLENTOWN, PA.—At a recent meeting of the directors of the Consolidated Telephone Companies of Pennsylvania, a lease of three telephone companies for 990 years was effected. The companies in this consolidation are the Easton & Bethlehem, the Warren and the United States Long Distance Telephone Companies operating at Bethlehem, Easton, Phillipsburg and Alpha, N. J., and in the surrounding territory in Northampton and Bucks Counties of Pennsylvania, and Warren Counties, New Jersey. The leased companies have 250 miles of wire and fifty miles of cables, with more than 1,000 subscribers.

BAKER CITY, ORE.—The City Council has granted H. H. Andrews a franchise for a power system in Baker City.

BAKER CITY, ORE.—The Oregon Electric Power Company has applied for a 30-year franchise for supplying electricity for lighting purposes in this city.

SALEM, ORE.—The Citizens Light & Traction Company has decided to expend about $50,000 in enlarging the power station and reconstructing and extending its lines. R. Welsh is chief engineer.

PORTLAND, ORE.—The Pence Company has made application to the County Court for a 25-year franchise to build a double-track railway on the Portland-St. Helena wagon road from Portland to Lewiston.

PORTLAND, ORE.—An electric railway will be built from Seaside to Cannon Beach, in the vicinity of Arch Cape, a distance of about 15 miles. J. E. Simmons, of Portland, who promoted the Oregon & Pacific Coast Railway Company, is behind the project.

PORTLAND, ORE.—C. W. Miller, manager of the Mt. Hood Electric Company, writes that bids for construction will be received on May 2 at Portland. The initial installation will cost $300,000. Engineers, Bates & Clark, Seattle, Wash.

SALEM, ORE.—The Portland General Electric Company, which recently purchased the Citizens' Light & Traction Company of Salem, will increase the generating capacity of the Salem plant by 600 hp. Plans have been perfected for transmitting power at 60,000 volts from the hydro-electric plant at Oregon City for the Willamette Traction Company, to furnish light and power to the towns along the latter company's line.

SAUNDERSTOWN, R. I.—The Wickford Light & Water Company will establish an electric lighting system at this city.

PROVIDENCE, R. I.—The Legislature has granted permission to the Worcester & Providence Street Railway Company to increase its capital stock to a sum not exceeding $2,000,000.

WESTERLY, R. I.—The Board of Directors of the Westerly Automatic Telephone Company has voted to issue $20,000 capital stock. Of this amount $10,000 is reserved for the present subscribers, if taken and paid for between April 11 and May 10.

PROVIDENCE, R. I.—The New England Shaver Telephone Company has petitioned the Legislature for an amendment to its act of incorporation, to change its name to the Home Telephone Company, of Rhode Island, to increase is capital stock to $2,500,000, and to issue from time to time its first mortgage bonds not exceeding $1,500,000.

BAMBERG, S. C.—The Electric Supply Company, of Savannah, Ga., has the contract for the construction of an electric light plant.

COLUMBIA, S. C.—Surveyors have completed over 30 miles of the line of the proposed route of the electric line from Columbia to Augusta, Ga., via Aiken, there being a line already in operation between Aiken and the Georgia city.

ABERDEEN, S. D.—F. W. Raymond, City Auditor, writes that the citizens voted on April 6 to issue $85,000 bonds for constructing a municipal electric light and power plant.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company will probably ask the city for a contract to place 75-cp incandescent electric lamps in the place of the gas lamps for which the contract has been hanging fire for the last three months.

NASHVILLE, TENN.—The Board of Public Works has awarded several contracts for equipment of the light department. Among the contracts awarded were to the Braid Electric Company and John A. Roebling Sons Company for furnishing collectively copper and rubber covered wire. The Southern Electric Company was given the contract for furnishing 5,000 glass insulators.

ALVIN, TEX.—The Council has granted Henry Wamble a franchise to construct an electric light and power plant.

BROWNSVILLE, TEX.—F. J. Combe and S. C. Tucker, of Brownsville, are interested in the construction of an electric light plant here.

EAGLE LAKE, TEX.—The Eagle Lake Manufacturing Company will be in the market for a 75 or 80-kw generator this season. E. J. Scott is manager.

HARRIMAN, TEX.—The city is about to install a new 150-kw generator and 60 new street lamps in the city electric light system. J. B. Bodwell is city clerk.

CORPUS CHRISTI, TEX.—Randolph Robertson says that the Corpus Christi Street Railroad Company will construct a line from Aransas Pass Depot, a distance of 4½ miles.

DALHART, TEX.—Dalhart Ice & Electric Company is now installing a 40-kw, 110-volt direct-current dynamo for day use on a fan and power circuit. W. H. Wolff is manager.

AUSTIN, TEX.—The charter of the Northwestern Toll Line Company of Dallas has been filed. The company has a capital of $25,000. The incorporators are A. A. Miller, A. A. Marrs and W. Weaver.

WAXAHACHIE, TEX.—The Waxahachie Gas & Electric Company contemplates installing a 160-hp steam engine in its plant this summer. This will take the place of a 100-hp Armington & Sims engine. Thomas Cook is superintendent.

TEMPLE, TEX.—J. C. Houser has taken steps towards building an interurban electric railway between this city and Marlin, a distance of about 25 miles. Helland & Werenskoild, of Dallas, Tex., have charge of the survey of the route for the proposed route.

GALVESTON, TEX.—J. H. Hill, general manager of the Galveston, Houston & Henderson Railroad, has been directed by the board of directors of that road to investigate the substitution of electricity for steam as motive power on the line. The road runs between Galveston and Houston, a distance of 51 miles.

EL PASO, TEX.—T. B. Enochs, of Kansas City, Mo., is at the head of a syndicate which proposes to build an electric railway from the coal fields in the Caballero Mountains to Clint, passing through El Paso. The proposed road will be about 60 miles long. Judge M. W. Stanton, of this city, is the local representative of the syndicate.

HOUSTON, TEX.—Harvey T. D. Wilson, of Houston, is promoting an electric railway to connect the city with its principal suburbs. A number of St. Louis (Mo.) capitalists have been interested in the project and an application will soon be made to the City Council for a franchise. The proposed system will comprise about 15 miles of track.

HOUSTON, TEX.—G. E. Tripp, of Boston, Mass., representing the Stone-Webster syndicate, who has been making an inspection of the street railway systems owned by that corporation, states that it has been determined to expend about $500,000 in improving and extending the Houston electric lines. The capacity of the power house is to be increased in addition to other improvements.

FORT WORTH, TEX.—J. A. Murray, manager of the Texas lines of the Texas Long Distance Telephone Company, and J. C. Casler, manager of the independent exchange here, together with parties at Weatherford, have organized a home company at Weatherford and will incorporate with a capital stock of $50,000. They will spend $25,000 improving the Weatherford exchange, and will have long-distance connection with the independent exchange here.

AMERICAN FORK, UTAH.—C. J. Earl, of American Fork, has filed an application in the State Engineer's office for permission to divert water from the American Fork Canyon for power purposes.

MORRISVILLE, VT.—The citizens of Morrisville have voted to construct a municipal electric plant. A dam will be built across the Lamoille River at Cady's Falls, at a cost of $44,000. There is a possibility that the Mt. Mansfield Electric Railroad, which runs between Waterbury and Stowe, may be extended to Morrisville.

SUFFOLK, VA.—A company is seeking a franchise for an electric railway over the streets of the town.

NORFOLK, VA.—The Norfolk Railway & Light Company is building a new electric railway from Ocean View to Sewall's Point.

INDEPENDENCE, VA.—The Independence Electric Light & Milling Company have decided to construct an electric light plant and roller mill.

ALEXANDRIA, VA.—Alexandria municipal electric light plant needs new equipment, but the city has not the funds to purchase it. The city will sell the plant if it can get a fair bid. J. B. Waller is city clerk.

STAUNTON, VA.—The Blue Ridge Light & Power Company is enlarging and improving its plant. In addition to the large new alternating-current generator recently installed, two new boilers have arrived, and the machinery is being placed, and will soon be in operation, when the plant will be able to furnish all the power necessary for the street cars and for lighting purposes for a long time to come.

BREMERTON, WASH.—The question of establishing a municipal lighting plant is under consideration.

PASCO, WASH.—Dr. N. Fred Essig, of Spokane, has petitioned for a franchise for water works and an electric light plant in Pasco.

TACOMA, WASH.—The Home Automatic Telephone Company will build a three-story building. The structure will cost $75,000.

SEATTLE, WASH.—Another unit (5,500 hp) will be added to the municipal lighting plant as soon as the $600,000 bond issue is sold. This announcement is made by members of the Council and by Superintendent Youngs, of the light and water department.

MARBLEMOUNT, WASH.—W. A. C. Rowse, of Mt. Vernon, Wash., president of the Cascade Valley Railway Company, writes that it is proposed to construct an electric railway from Marblemount to Horse Shoe Basin, a distance of about 25 miles. The cost is estimated at $1,000,000.

WALLA WALLA, WASH.—The Columbia & Walla Walla Traction Company is making a survey of its proposed electric railway from Walla Walla to Clarkston, under the direction of C. E. Sears. The company has elected the following officers: Miles C. Moore, president, of Walla Walla; John H. Morrow, of Waitsburg, first vice-president and general manager; M. R. Hanger, of Dayton, second vice-president; Frank W. Paine, of Walla Walla, treasurer; C. C. Gose, of Walla Walla, secretary.

MORGANTOWN, W. VA.—The South Morgantown Street Railway Company has been given a franchise by the City Council.

PLYMOUTH, WIS.—The Plymouth City Water Works intend installing a new boiler during the coming summer. P. J. Douglas is superintendent.

GREEN BAY, WIS.—The Brown County Telephone Company will increase its capital stock from $10,000 to $20,000, and make considerable extensions to its lines.

GREENWOOD, B. C.—The West Kootenay Power & Light Company has purchased a site in Anaconda from B. C. Smith on which will be erected a plant to supply this town with light and power.

SUPERIOR, WIS.—S. M. White, city engineer, writes that the citizens voted April 3 to purchase the plant of the Superior Water, Light & Power Company or build municipal water works and electric light plant.

MILWAUKEE, WIS.—A franchise has been granted to the West Shore Telephone & Telegraph Company, and they will begin at once the construction of a $1,000,000 system in this city, which will also connect with independent lines throughout the State.

NELSON, B. C.—Efforts are being made to finance an electric railway to open up Duncan Valley. Address John L. Retallack, Kaslo, B. C.

LADNER, B. C.—The British Columbia Electric Railway Company is considering the extension of the electric lighting system to Ladner this year. R. H. Sperling, of Vancouver, is manager.

GREENWOOD, B. C.—The Greenwood Electric Company has a proposition before the Council to light the town and expects to erect a large power plant at Boundary Falls, B. C., for supplying towns in southern British Columbia with light and power.

NEW WESTMINSTER, B. C.—H. M. Burwell, representing the Burrard Flume Company has received permission to appropriate 25,000 inches of water from Lillooet River. The company proposes locating a power plant at a point where Kanaka Creek runs into Fraser River a short distance above Port Haney. The plan is to have the water brought from Lillooet Lake in a flume.

WEYBURN, CAN.—The City Council has approved the plans for a municipal electric lighting plant to cost $50,000. Address J. A. Wood, Mayor.

CALGARY, CAN.—The Council has voted $30,000 for the purpose of doubling the capacity of the civic electric light plant. Address J. Emerson, Mayor.

SASKATOON, CAN.—The Saskatchewan Telephone & Electrical Supply Company will increase its telephone system here by 300 lines and will generally improve the service.

PINCHER CREEK, CAN.—The Pass Electric Railroad Company has applied to the Alberta Legislature for permission to build an electric railway from here to Crow's Nest Lake, a distance of about 36 miles.

SASKATOON, CAN.—A. Turner city secretary and treasurer, writes that bids will be received on April 24 for the construction of an electric light plant and for sewerage and drainage systems. Engineer, Willis Chipman, of Toronto, Ont.

PINCHER CREEK, CAN.—The Crow's Nest & Prairie Electric Railroad has applied to the Alberta Legislature for powers to build an electric railway from Pincher Creek to the western end of Crow's Nest Lake, a distance of about 42 miles.

WINNIPEG, MAN.—The Council has decided to add two units to the civic electric light plant at a cost of $16,100. Address F. E. Cambridge, city electrician, or Alderman Gibson.

BRANDON, MAN.—The Kensington-Brandon Land & Development Company has made application to the city for a charter to build an electric railway in this city. Address Mayor Fleming.

NEW LISKEARD, ONT.—The Council has decided to install a civic lighting plant. Address the mayor.

STRATHROY, ONT.—The Council has decided to spend $5,000 on improvements to the municipal electric light plant.

LONDON, ONT.—The London Electric Street Railroad Company has decided to erect an addition to its power plant at a cost of $75,000.

MORRISBURGH, ONT.—William Bermingham, Ottawa, Ont., has the contract for developing the 1,100-hp electrical plant here. Cost, $73,000.

BOBCAYGEON, ONT.—The town will install an electric lighting plant which will be operated under municipal ownership. Address the mayor.

PARRY SOUND, ONT.—Work will be commenced at once on the new municipal electric lighting plant here. Simpson & Lewis, engineers, of Ottawa, Ont., have charge of the work.

THESSALON, ONT.—Corporation light and water system which is now running on a flat rate will install meters and adopt the meter rate this summer. E. F. Thompson is chief engineer.

GODERICH, ONT.—H. von Schon, of Detroit, Mich., is engineer for the proposed power plant to be constructed on Maitland River for the Maitland River Power Company, the cost of which is estimated at $250,000.

FORT WILLIAM, ONT.—The town will build a new telephone exchange which will be equipped with a 17-section switchboard with a capacity of 5,000 lines. The building will be completed by August 1. Address Superintendent Jones.

WELLAND, ONT.—Welland Electric Light Company is contemplating installing a distributing station for power, which is generated at De Cew Falls, Ont, 9½ miles distant. When this is done the company will discard the present local plant. F. W. Houston is superintendent.

TORONTO, ONT.—The Toronto & Hamilton Electric Railway Company has applied at Ottawa for permission to change its name to the Toronto, Niagara & Western Railway Company, to extend its line as far as Windsor, to increase its capital stock, and to lease its right of way to power companies.

PETERBOROUGH, ONT.—Otonabee Power Company, Ltd., plant comprises five-mile transmission from dam to sub-station, 1,500-kw, three-phase, 60-cycle generator, 6,000 volts transformed at sub-station to 2,300 lighting secondary 110 to 220-volt. It is all Canadian General Electrical apparatus.

HAMILTON, ONT.—The Hamilton, Galt & Guelph Railroad Company is applying for powers to build a line from Hamilton to Elmira, passing through Galt, Preston, Berlin and Waterloo, a distance of 56 miles; also for powers to build a line from Hamilton to Elora and Fergus, a distance of 40 miles.

BURLEIGH FALLS, ONT.—J. Alex. Culverwell, managing director of the Central Ontario Power Company states that work will be commenced on the power plant on May 1. The main line will pass through Peterborough, Millbrook, Bowmanville and Oshawa, the latter two places having applied for 1,800 hp each. A branch line will be run from a point north of Millbrook to Omemee and Lindsay. The falls have a capacity of 7,000 hp which the company will develop.

THETFORD, QUE.—The people have passed a by-law granting the necessary privileges to the Shawinigan Water & Power Company to enable it to distribute light and power in the municipality.

LONGUEUIL, QUE.—The Council of this town has granted the Longueuil Tramways Company an exclusive franchise for thirty years. It is the intention of the company to commence building as soon as ground is ready for the rails. The company will operate through the town and extend through the county of Chambly.

SANTA CRUZ DE BRAVO, MEX.—An electric light and power plant is to be installed at Santa Cruz de Bravo by the Federal Government.

MERIDA, MEX.—The American Gas Company has purchased the electric light and power plant at Merida. The price paid was $1,000,000.

MANZANILLO, MEX.—The representative of an American syndicate is said to have been investigating the situation in this vicinity with a view to building an electric railway.

EL DUERO, MEX.—The Guanajuato Electric Light & Power Company is preparing to extend its electric transmission lines to the towns of Ocotlan, Jemay and Ribera Castellanes. This is an American company which operates a large hydro-electric plant at El Duero. It is already furnishing lights and power to Guanajuato, Leon, Irapuato and La Barca.

CHILPANCINGO, MEX.—R. H. Springer, of Chicago, is said to be at the head of a party of engineers who are making a survey for a proposed electric railway from Chilpancingo to some point on the Balsas River. It is stated that a syndicate of Chicago capitalists is back of the project and that all preliminary arrangements have been made for the construction of the road.

MAZATLAN, MEX.—The machinery for the large hydro-electric plant which is to be installed on the Piaxtla River by the owners of the Guadalupe de los Reyes mines has arrived at the site of the proposed plant. The hydro-electric plant will have a capacity of 5,000 hp and will cost about $800,000. Robert McDoble, an electrical engineer of San Francisco, Cal., has charge of the construction work.

ZAMORA, MEX.—The Government of the State of Michoacan has granted a concession to an American company to install a large hydro-electric plant for the purpose of supplying the towns of Zamora, Puruandiren and La Piedad Cabadas with electric lights and power. The work of constructing the dam is now in progress and the necessary machinery for the plant has been ordered in the United States.

Company Elections.

GREENFIELD, IND.—The Carrolton Telephone Company has elected Charles Dalrymple, C. P. Davis, Julian Strahl, Charles Vetters and Edward Allen, directors.

ANDERSON, IND.—At the annual meeting of the directors of the Indiana Union Traction Company, held in Philadelphia, the following officers were elected: A. W. Brady, president; George H. McCulloch, chairman board of directors; C. Levering Jones, first vice-president; W. Kelsey Schoepf, second vice-president; D. G. Edwards, third vice-president; Messrs. Brady, Jones, Schoepf, Morgan and Kingston, executive committee.

VINCENNES, IND.—The annual meeting of the Vincennes Light & Power Company, of Vincennes, Ind., resulted in the election of this board: Edward M. Deane, Dwight Smith, Benjamin P. Merrick and Harry B. Wales, of Grand Rapids; Henry W. Frund, J. W. Emison, J. L. Bayard, Jr., R. E. Purcell, W. H. Vollmer and Charles Bierhaus, of Vincennes. Reports showed the past year with the company to have been a most prosperous one, with the outlook for this year's business bringing a gratifying improvement over that of the past.

GOLDFIELD, IA.—At a recent meeting of the board of directors of the Goldfield Telephone Company, W. V. Palmer was elected manager for the ensuing year, to take the place of L. A. McIntyre, who recently resigned. The company contemplates increasing the capital stock from $10,000 to $20,000. As soon as the weather will permit the company will commence the construction of new rural lines from this city in all directions where the field is not already covered.

FREDERICK, MD.—At the annual meeting of the stockholders of the Frederick County Telephone & Telegraph Company, the following directors were elected: Dr. P. D. Fahrney, Dr. F. B. Smith, D. T. Ordeman, C. D. Walker, G. M. Besant, Chas. C. Carty and James H. Harris.

BOSTON, MASS.—At the annual meeting of the Philadelphia Electric Company the retiring board of directors was re-elected.

MANKATO, MINN.—The directors of the Citizens' Telephone Company, at its recent regular meeting, organized by re-electing all of the present officers, as follows: Dr. J. H. James, president; H. A. Patterson, vice-president; W. D. Willard, secretary and treasurer; W. A. Funk, attorney. The company is considering the extension of its lines into the farming districts.

SPEISER, NEB.—The Speiser Rural Telephone Company held its annual meeting and elected the following officers: C. Lionberger, president; R. F. Conrad, secretary.

OMAHA, NEB.—A meeting of stockholders of the Omaha Electric Light & Power Company was held at Bangor, Me., March 29. The following directors were elected: S. Z. Mitchell, C. N. Mason, E. R. Coffin, H. W. Yates, E. W. Hart, Guy C. Barton, Casper E. Yost, G. W. Holdrege and F. A. Nash. The former officers will probably be re-elected, with the exception of G. E. Claffin, who will be succeeded as vice-president by H. W. Yates.

WEST UNITY, OHIO.—The West Unity Electric Light Company has elected its officers: A. M. Miller, president; J. A. Hollington, vice-president; L. P. Charpiot, secretary-treasurer. The company is planning to build an electric light plant in this village.

CINCINNATI, OHIO.—The Cincinnati Light, Heat & Power Company, the recently incorporated company which is to apply for a franchise to supply electricity to users in this city, has been formally organized. The officers are as follows: H. H. Bechtel, president; C. W. Cole, secretary-treasurer; these, with Cyrus E. Mead, E. R. Stearns and G. W. Mallon, are directors.

SALEM, ORE.—A recent meeting of the directors of the Citizens' Light & Traction Company, held for reorganizing the property, the following named officers were elected: President, H. W. Goode; vice-president, F. G. Sykes; secretary and treasurer, Sam G. Reed; manager, Rollin K. Page, all of Portland. Mr. Page has moved to Salem and will take charge of the railway, light, power and gas systems of Salem and the electric plants at Woodburn, Mount Angel and Silverton.

JACKSON, TENN.—At a stockholders' meeting of the Jackson Suburban & Street Railway the following were elected directors for the ensuing year: J. L. Wisdom, Sr., J. H. Hirsch, S. E. Wilson, Hunter Wilson, Thomas Polk, G. S. Wilkerson and T. J. Murray. S. E. Wilson was elected president of the board; J. H. Hirsch, vice-president; Hunter Wilson, manager and attorney; John Wisdom, Jr., superintendent; G. C. Wilkerson, secretary, and Thomas Polk, treasurer.

New Industrial Companies.

THE ELECTRIC CONSTRUCTION SUPPLY COMPANY, of Springfield, Ohio, has been incorporated with a $10,000 capital stock, by William Rodgers and others.

THE GARRETT TROLLEY WHEEL COMPANY, Garrett, Ind., has been incorporated to establish a plant and manufacture trolley wheels. John B. Mager, John Trapp and Adam Trapp are the incorporators.

THE WARREN J. GREEN ELECTRICAL SUPPLY COMPANY has been formed at Watertown, N. Y., to furnish electrical supplies and equipment, and to do electrical work of every description.

THE MANHATTAN ELECTRICAL RANGE COMPANY, of New York, has filed application for articles of incorporation with a capital of $30,000, and the following directors: Maurice Bayne, O. H. Seaman, New York.

THE SAFETY ELECTRIC VALVE COMPANY, of Brooklyn, N. Y., has been incorporated with a capital of $20,000. The directors are Edward Schrenkeisen, M. J. Kane, New York; E. H. Vogel, Brooklyn.

THE MARKLE ELECTRIC COMPANY, of Terre Haute, Ind., has been incorporated. The company will manufacture electrical devices and supplies. The incorporators are R. M. Markle, E. L. Cooper and G. R. Fields.

THE AMERICAN HORTUNG BATTERY COMPANY, of Jersey City, N. J., has been granted incorporation papers. The capital is $500,000. The incorporators are Gustave K. Hortung, George H. Fagan and A. M. Lynch.

New Incorporations.

JUNCTION CITY, ARK.—The Junction City Light & Water Company has been incorporated with a capitalization of $10,000. R. G. Brown is president, and W. V. Brown and D. K. Brown, directors.

SAN DIEGO, CAL.—Articles of incorporation of the Los Angeles & San Diego Beach Railway Company, capitalized at $6,000,000, with $165,000 actually subscribed, have been filed. The directors are E. S. Babcock, A. E. Babcock, A. B. Talbot, A. E. Lillicrap and James Stroup.

DENVER, COL.—S. S. Large, Fred W. Bailey and H. D. Allen have filed articles of incorporation in the office of the Secretary of State for the Denver Municipal Traction Company. The capitalization is $100,000, and the company's charter is for 20 years. Messrs. Large, Bailey and Allen form the board of directors for the first year.

HARRINGTON, DEL.—The Peall-Klier Company has been incorporated to install a system of electricity at Harrington also to construct a factory for the manufacture of ice.

MILLSTADT, ILL.—Millstadt Telephone Company, with a capital of $1,200, has been incorporated by F. W. Kreshper and others.

TAMAROA, ILL.—Tamaroa Telephone Company, with a capital of $2,500, has been incorporated by C. O. Winthrop, C. R. Rice, J. T. Marlow.

CHICAGO, ILL.—The Osmium Light Company has been incorporated with a capital of $25,000. The incorporators are Robert H. Izer and others.

OAKLAND, ILL.—Embarrass Telephone & Telegraph Company, with a capital of $45,000, has been incorporated by H. H. Knipe, E. N. Blair and J. D. Noel.

GALESBURG, ILL.—The Home Light & Power Company has been incorporated with a capital of $150,000. The incorporators are E. P. Robson, Harry Gardt and J. S. Callender.

VILLA GROVE, ILL.—The Villa Grove Electric Company has been incorporated with a capital of $6,000. The company will operate an electric light and water plant. The incorporators are: V. H. Elmore, E. C. Elmore and C. W. Hageman.

GOODLAND, KAN.—The Goodland Light, Heat & Power Company has been chartered with $50,000 capital. The company proposes to build an electric light plant at this place. Denver capitalists are backing the enterprise.

PARSONS, KAN.—J. A. Plotner, of Kansas City, and others, have taken out a charter under the New Jersey laws for the incorporation of the Prairie Telephone Company, with a capital of $200,000, and headquarters at this city.

CHANUTE, KAN.—The Southeastern Kansas Railway, Light & Power Company has been organized and capitalized at $4,000,000. The incorporators are L. Rosenthal, J. J. Jones, Frank Dixon and R. C. Rawlings, of Chanute, and J. W. Stephens, of New Orleans. The offices and power plant will be located in Chanute. The plans provide for the construction of 160 miles of track. As soon as this line is completed, extensions will be built from Galena to Webb City and Carthage and from Chanute to Coffeyville.

AUGUSTA, ME.—The Lake View Traction Company has been organized for the purpose of doing a general business in transportation, amusement, real estate, electrical, telegraph, telephone, etc., with a $50,000 capital stock, of which nothing is paid in as yet. I. L. Fairbanks, of Augusta, is president and treasurer of the new company.

JACKSON, MICH.—Articles of association have been filed by the Grass Lake & Sharon Telephone Company. The capital is $1,000, and the directors are W. G. Alber, John Lemm and Ashley L. Holden. The office is at Grass Lake.

HAGERSTOWN, MD.—A company has been formed of Cumberland Valley capitalists to build an electric railway from Greencastle to Mercersburg, about 15 miles. The following are the officers: T. M. Nelson, president; George B. Beaver, first vice-president; A. N. Pomeroy, second vice-president; H. B. McNulty, secretary; Joseph Sierer, treasurer. The company is capitalized at $500,000.

NELSON, MINN.—The Nelson Telephone Company has been incorporated with a capital of $10,000.

BELTRAM, MINN.—The Beltram Electric Light & Power Company has been incorporated, with a capital of $50,000, by W. G. Schroeder, W. C. Warfield and others.

MINNEAPOLIS, MINN.—The Mississippi River Power Company, recently incorporated with $50,000 capital, is planning to generate 12,000 hp by dams at Clearwater and Monticello, for transmission of electric energy for sale in the twin cities.

AKELEY, MINN.—The Akeley Telephone Company has been incorporated with a capital of $15,000. The incorporators are H. H. Thomas, Amos Thomas, H. H. Johnson, Robert Dulin, H. I. Davis, L. M. Thomas, Jorgen Laugen, C. R. Flink, Bert Rodman, Edward Darrow.

ATKINSON, NEB.—The Citizens' Telephone Company has filed articles of incorporation with the Secretary of State. The company will operate an independent telephone exchange in this city.

WAYNE, NEB.—The Wilbur Telephone Company has been incorporated. The capital stock is $2,800, and the incorporators are W. H. Bueton, F. M. Griffith, A. Grier, Ferdinand Thim and John Harder.

DOUGLAS, NEB.—The Solon Telephone Company has filed articles of incorporation with the Secretary of State. The principal place of business of the new concern is Douglas, Otoe County, and the capital stock is $25,000. The incorporators are George B. Hendricks, A. M. Malone and twenty-one others.

JAMESTOWN, N. D.—The Jamestown Traction Company has been incorporated with a capital of $150,000. The incorporators are Morris Beck and others.

MASSAPEQUA, N. Y.—The Massapequa Gas, Electric Light & Power Company has been incorporated with a capital of $50,000. The incorporators are J. S. Lily and others.

HANNIBAL, N. Y.—The Hannibal Telephone Company has been incorporated with a capital of $5,000, and the following directors: John McFarland, C. A. Cox and M. H. Miner, Hannibal.

NEVERSINK, N. Y.—The Neversink River Telephone Company has been incorporated with a capital of $7,000. The incorporators are Lee V. Gardner and Ernest W. Kinne, Centerville Station, N. Y.; Leo G. Laidlaw, Hurleyville, N. Y., and others.

BROOKLYN, N. Y.—The Independent League Railway Company is to be incorporated to build a double-track electric railway from Brooklyn Bridge to Coney Island, with a branch to Williamsburg. The preliminary capital is to be $150,000. Among those interested in the movement are: Charles T. Hartzheimer, Bela Tokaji, Michael F. Flaherty, Alfred J. Boulton and William H. Boyes, all of Brooklyn.

PENN YAN, N. Y.—The certificate of incorporation of the Hause Hill Telephone Company has been filed with Henry T. Reed, County Clerk. The directors for the first year are as follows: William [illegible], Frank [illegible]son, [illegible], Martin J. Howell, [illegible] Henry[illegible], Adrian Babcock and George [illegible], all of Dundee. The capital stock of the corporation is $[illegible]. The main office of the company is in Dundee.

HIGH POINT, N. C.—The North Carolina Electric Company, of High Point, has been incorporated with a capital of $1,000,000 to generate electricity for power, light and heat; also to construct and operate a railway. Weirlle C. Hard, of Philadelphia, Pa., is one of the incorporators.

HAMERSVILLE, OHIO.—The Home Telephone Company has been incorporated with a capital of $10,000. The incorporators are Harvey McCall and others.

CLEVELAND, OHIO.—The Northern Light Company has filed articles of incorporation with a capital of $10,000. The incorporators are Fred Desberg and others.

COLUMBUS GROVE, OHIO.—The Columbus Grove Farmers' Mutual Telephone Company has been formed with S. M. Keirns, president; Samuel Williams, secretary, and E. A. Fancher, treasurer.

YOUNGSTOWN, OHIO.—The Wheatland Street Railway Company and the West Middlesex Street Railway Company have been incorporated by Randall Montgomery, M. C. McCaskey, W. T. Burns and S. C. Rodgers, of Youngstown, and Charles Beckman, of Sharon.

NEWKIRK, OKLA.—A charter has been granted the Newkirk Commercial Mutual Telephone Company, with a capital stock of $12,000. The incorporators are C. A. Johnson, H. M. Ziegler and associates.

SHAWNEE, OKLA.—The Shawnee Gas & Electric Company has been incorporated, with $75,000 capital stock. The incorporators are: F. P. Stearns, of Shawnee; T. W. Odell, of Oshkosh, Wis.; Sinclair Mainland, of Green Bay, Wis.

MOUNTAIN PARK, OKLA.—The Mountain Park Telephone Company, of Mountain Park, has been incorporated with a capital stock of $5,000. The incorporators are W. W. Watson, C. E. Jecks, D. A. Giles, T. C. Gessner and J. C. Watson.

PROVOLT, ORE.—Applegate Valley Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are F. Badger, E. N. Provolt and Charles Meserve.

PENDLETON, ORE.—A telephone company has been organized at Milton for the purpose of building a line from the town into the country. The capital is $5,000. The organizers are C. E. Simonds, William Forsythe and J. B. Saylor.

ALBION, PA.—The Albion Light & Power Company has been incorporated with a capital of $5,000.

BETHEL, PA. Bethel Street Railway Company, with a capital of $75,000, has been incorporated with S. L. Tone, of Pittsburg, president.

LIGONIER, PA.—Ligonier Street Railway Company has been incorporated with a capital of $60,000. J. Williams, of Allegheny, is president.

EBENSBURG, PA.—The Ebensburg & Black Lick Light, Heat, Fuel & Power Company has filed articles of incorporation with a capital of $5,000.

HARRISBURG, PA.—St. Clair & Sodom Street Railway Company has been incorporated, with a capital of $28,000. President, S. L. Tone, of Pittsburg.

NORTH EAST, PA.—The North East Heat & Light Company has been incorporated with a capital of $24,000. The incorporators are E. J. Evans and others.

MOSCOW, PA.—Pocono Mountain Telephone Company has been incorporated with a capital of $10,000, by R. J. Tanfield, of Valeville, Lackawanna County.

HARRISBURG, PA.—Uniontown & Masontown Street Railway Company has been incorporated with a capital of $72,000. P. F. McCool, of Butler, is president.

DUNBAR, PA.—The Dunbar Water Supply Company and the Dunbar Electrical Company have been incorporated with a capital of $5,000 each and with the same directors as follows: Wm. W. Fitzmiller, Ja. McMullen, John N. Shimer and others, all of Philadelphia.

PITTSTON, PA.—The Pittston Light, Heat & Power Company has been incorporated with a capital of $150,000 to furnish light, heat and power in Pennsylvania. Directors: J. Rutledge, Pittston, and Frank P. Slattery and John Flanagan, both of Wilkesbarre. This company recently secured a contract to light the city of Pittston for five years.

PROVIDENCE, R. I.—The Legislature has granted to William Segar, Jones Pendleton, R. W. Perkins, H. W. Gallup and E. W. Jackson a charter incorporating them as the Westerly & Connecticut Railway Company, with a capital stock not exceeding $[illegible] with a place of business in the town of Westerly, R. I.

ABILENE, TEX.—The Abilene Light & Water Company, of Abilene, has been incorporated with a capital of $200,000 by W. G. Swenson, Abdon Holt and George S. Browne.

MALLARD, TEX.—The Mallard Telephone Company, of Mallard, has been incorporated with a capital stock of $8,600. Incorporators are J. D. and G. L. Parr and J. H. Golightly.

HUBBARD CITY, TEX.—The Union Central Light & Ice Company has been incorporated with a capital of $35,000. The incorporators and officers are W. August Bass, president and manager; J. E. Waller, first vice-president; J. M. Carroll, second vice-president; Hon. W. E. Spell, attorney, and Allen & Scott, of Waco, are the architects and supervising engineers.

SOUTH RYEGATE, VT.—The Boltonville Falls Electric Company has been organized with the following charter members: M. F. Sargent, R. [illegible], J. J. Tewksbury, Geo. H. Robie, Jas. Craigie, H. W. Goodale and Chas. [illegible].

BLACKSBURG, VA.—The Blacksburg Power & Supply Company has been incorporated, with a capital of $50,000, by D. H. Keister, J. L. Eakin and others, all of Blacksburg.

BIG STONE GAP, VA.—The Cumberland Traction Company has been chartered with a capital of $10,000 which may be increased to $25,000 later. J. S. Wright is secretary and treasurer.

TENINO, WASH.—The Tenino Light & Water Company has been incorporated with a capital of $10,000.

OLYMPIA, WASH.—The Washington Electric Railway & Power Company has filed articles of incorporation with the Secretary of State, showing a capital stock of $1,000,000. The incorporators are James R. Wood, of Portland, E. C. Peets, O. J. Smith, C. Guler, C. W. Moore and A. E. Frost.

BARABOO, WIS.—Farmers' Mutual Telephone Company has filed articles of incorporation, with a capital of $6,000. The incorporators are Robert Attride and others.

KAUKAUNA, WIS.—The Kaukauna Gas Electric Light & Power Company has been incorporated with a capital of $100,000 to make improvements to the electric light plant. A. R. Coates is interested.

STRATHCONA, CAN.—The Strathcona Radial Tramway Company is applying to the Alberta Legislature for incorporation. Address F. C. Jamieson, secretary and treasurer.

WINNIPEG, MAN.—The James Ballantyne Company has been incorporated here with a capital of $50,000 to establish and operate steam, gas, electric lighting and heating plants. The directors are J. Ballantyne, A. W. P. Buchanan, Montreal; G. A. Young, Hamilton, Ont.

ST. JOHN, N. B.—The Maritime Light & Power Company has been incorporated here with a capital of $100,000 to operate light and heat systems and manufacture apparatus for lighting and heating purposes. The directors are J. R. L. Starr, J. H. Starr, J. H. Spence, A. Rogers, all of Toronto, Ont.

INGERSOLL, ONT. The Ingersoll Independent Telephone Company has been organized.

HAMILTON, ONT.—The Hamilton, Galt & Guelph Railway is seeking incorporation for the purpose of constructing an electric railway from Hamilton to Elmira.

OTTAWA, ONT.—The Frontenac Gas Light & Power Company will ask Parliament for power to manufacture gas and electricity in the Quebec District. It has a capital of $1,000,000.

MOOSEJAW, SASK., ONT.—The Moosejaw & Suburban Rapid Transit Company is applying for incorporation with powers to build telephone lines along the route of its electric railway lines.

LOW BANK, ONT.—The Low Bank Telephone Company has been incorporated with a capital of $40,000 to build and operate telephone lines in this town. The directors are A. Barrick, J. E. Furry, A. Mann, Haldimand County, Ont.

WELLAND, ONT.—The Falls Power Company has been incorporated with a capital of $10,000 to manufacture electricity, gas, etc., for lighting and heating purposes. The directors are G. C. Brown, D. Ross, J. E. Cohoe, Welland, Ont.

DELHI, ONT.—The Delhi Light & Power Company has been incorporated here to manufacture gas and electricity for light and heat. The capital is placed at $40,000 and the directors are P. Quance, S. Stront, E. Morgan, all of Delhi.

TORONTO, ONT.—The Central Oil & Gas Company has been incorporated here with a capital of $40,000 to manufacture gas, oil and electricity for lighting purposes. The directors are J. S. Lovell, W. Bain, E. W. McNeill, all of Toronto.

COBALT, ONT.—The Long Lake Power Company has been incorporated here with a capital of $100,000 to carry on a general business as an electric power company. The directors are S. White, Windsor, Ont.; T. P. Watson, New Liskeard, Ont.; and H. C. Barber, Cobalt, Ont.

Legal.

STEAM TURBINE LITIGATION.—The Westinghouse Machine Company has begun a third suit against the Allis-Chalmers Company in which infringement of another Westinghouse-Parsons steam turbine patent is alleged. The bill was filed in the Circuit Court for the District of New Jersey. The patent sued on is No. 783,840, owned by the Westinghouse Machine Company. This patent covers the construction of the rotating element of the turbine as used by the Westinghouse Machine Company and the Allis-Chalmers Company. The suit was filed on April 11.

SUIT AS TO NUISANCE.—The Court of Appeals of New York has ruled against the defendant in the suit of Miller versus the New York Edison Company. Plaintiff sued to restrain a nuisance and for damages caused by the maintenance of an electric light and power plant by defendant on adjoining premises. The evidence showed that after the plant had been erected plaintiff had made a lease of its premises for a term of years, and at the expiration of such term the lease had been renewed, and that at the expiration of the second term they were again leased to the same tenant for lower rent. The court found that no injury was done plaintiff's premises by the electric plant at the time of the trial, and there was no probability that any injury would result in the future; that, though the rent to be paid under the last lease was less than that in the other leases, there was nothing to show that the difference was caused by defendant's acts; and that the only injury which had been caused by the plant was to the occupation of plaintiff's premises, and was not of a permanent character. It was held on appeal that plaintiff could not recover for any depreciation in the rental value pending the lease, as the tenant was alone entitled to recover for any such injury. This decision reversed that of the lower court.

SHOCK FROM TELEPHONE WIRE.—The Kansas City Court of Appeals has reversed a decision for plaintiff, for injury received, in Politowitz versus Citizens' Telephone Company. It was alleged that defendant carelessly and negligently constructed, maintained and operated its wires, in that they were not properly insulated and protected, that the attachments and fastenings were defective, that the wires sagged down, that they were made of poor and rotten material, and that they broke and fell across the street. The court directed the jury to find for plaintiff, if defendant carelessly and negligently permitted its wires to fall and lay down on the streets. It was held that the instruction was erroneous, in that it authorized a recovery if the wires fell upon the ground from any negligent cause, instead of confining the jury to a consideration of the negligence charged in the petition. Where a company maintaining electric wires in streets is negligent in the construction and maintenance of its wires, and in permitting them to sag down and fall on the street, it is liable for injuries caused to a person coming in contact with the wires, regardless of whether it has notice that the wires are down. Where the particulars constituting negligence are pleaded, plaintiff is limited to prove the particular negligent acts alleged, notwithstanding a general charge of negligence.

INJURY FROM LIVE WIRE.—The Supreme Court of Montana, in the appeal of Bourke versus Butte Electric & Power Co. has sustained the verdict of $20,000 for the plaintiff. It was held that defendants' electric light wire, by which the plaintiff was injured, was strung on and along a public street and over a tramway trestle leading to a mine, built at right angles with the wire, the plaintiff was injured by coming in contact with the wire while working on the trestle as an employe of the owner of the mine, and that, in the absence of anything to justify the conclusion that either the owner of the wire or the owner of the trestle was a trespasser as to the other, an instruction imposing on defendants the duty of inspecting their lines of wire was not objectionable, on the ground that plaintiff was a trespasser as to whom defendants owed no duty of inspection. It was also held that the owner or operator of an electric plant is bound to exercise reasonable care in selecting appliances and insulating wires, wherever people have a right to go and are liable to come in contact with them, and in maintaining a system of inspection by which any change in the physical condition of such apparatus which would tend to increase the danger to persons lawfully in the pursuit of their business or pleasure may be reasonably discovered. The plaintiff had been earning $3.50 per day and was 45 years old; and it was stated that he will never be able to work again for a living.

INJURY TO LINEMAN.—The Circuit Court of the Western District of Pennsylvania has held that only reasonable care is required from a company as to its appliances, machinery, etc., the case being that of a lineman injured on duty. The plaintiff, who was in the employ of the defendant telephone company (Central District Printing & Telegraph Co.) as cable splicer, was sent by a superior in the daytime to locate and repair an injury to the cable sheathing which had been reported. He climbed a pole which stood at a place where the street curved and between two lines of electric light wire, the outer one of which had been fastened on a bracket to the telephone pole to hold it from swinging against such pole and wires. This wire had become detached from the insulator and had dropped against the pole, and was in contact with a guy wire, and plaintiff, taking hold of such guy wire, received a shock which caused him to fall, and he was injured. The displacement of the light wire could not be observed from the ground, and the placing of the pole between the light wires and the manner in which the light wire was fastened to the same were shown to have been usual and customary. Held, that defendant was not chargeable with negligence, either because of such mode of construction or for failing to discover the dangerous condition of the wire, which could not have been done by the usual methods of inspection. Held, further, that plaintiff was guilty of negligence contributing to his injury in failing to see and avoid the danger after he had climbed to the place of contact of the two wires. A master is bound to the exercise of only reasonable care with respect to machinery, appliances or places to work, and the measure of such care is that ordinarily exercised by others in the same business.

Obituary.

MR. L. BANNISTER.—We note with deep regret the death at the Hotel Imperial in this city, on Saturday, April 14, of Mr. Lemuel Bannister, for many years vice-president of the Westinghouse Electric & Manufacturing Company. Mr. Bannister was born in a small town in northern New York in 1841. He was educated in the public schools. His first business ventures were in the lumber trade and for many years he was connected with R. DeWees Wood in that business in Philadelphia. In 1888 he went to Pittsburg and became connected with the Westinghouse Fuel, Gas and Manufacturing Co., as general manager. Then he went into the electrical business, becoming connected with the Westinghouse Electrical & Manufacturing Company. After a time he gave special attention to the European business, to take charge of which he left America ten years ago. He built the electric railways in Berlin and other European cities. He was a member of the Lawyers and Engineers

Clubs of New York and the Duquesne Club of Pittsburg. Eight months ago Mr. Bannister was taken ill in Europe with a cancerous affection of the throat. He got worse and came to New York two weeks ago. His wife, Frances Kenyon Bannister, survives him.

Personal.

MR. THOMAS HALL.

MR. THOMAS HALL.—The veteran electrical inventor and manufacturer, Mr. Thomas Hall, celebrates in Cincinnati this week his eightieth birthday. He was born at Norwich, England, April 20, 1826, and at the age of two was brought to America by his father, who settled in Boston. After attending public school there he went to work for Mr. Daniel Davis in 1839, succeeding him in 1850 under the firm name of Palmer & Hall. Shortly after that he bought out his partner and styled the firm Thomas Hall, manufacturing electrician. From 1860 to 1898 he was located at 19 Bromfield Street, when he gave up business. At the time when Mr. Hall was apprenticed to Daniel Davis, the latter was the only electrical instrument maker in the United States. They made the first telegraph instruments for Morse in 1844, and afterwards built sounders, keys, registers, etc. Mr. Hall was one of the first men in this country to teach telegraphy. At this period of his life he invented the double adjustable relay, lightning arresters, railway signals, magnetos and an automatic safety gate, several of these appliances being still produced. In 1850 he built and operated a model electric motor car taking current from the rail, and exhibited this at the Massachusetts Charitable Mechanics' Association in Faneuil Hall, Boston. In 1860 he exhibited a car called Volta. In 1867 he invented the Hall life raft and other electrical apparatus, which was followed by the electric stop on ruling machines and the electric valve used in creameries to keep milk at an even temperature for separation. Another device was the electric recorder for noting at the pumping station the height of water or of gas at the reservoir. The result of all this work was to bring him a large number of gold, silver and bronze medals in this country, as well as a medal from the Paris Exposition of 1867 for his railway signal. Such work, however, being largely experimental, was also costly and Mr. Hall was never able to derive any large pecuniary reward from his inventions, although they brought him the acquaintance of all the leaders in the electrical and scientific field throughout the country. The portrait reproduced herewith was taken some years ago, but is a fair representation of Mr. Hall at the present time, hale and hearty and full of interesting reminiscences of pioneer electrical days in America. His son, Mr. W. A. Hall, with whom he is living in Cincinnati, is well known in the electrical field and has a great deal of his father's inventive skill.

MR. R. P. BOLTON, consulting mechanical engineer, will remove his offices May 1 to the Night & Day Bank, Fifth Avenue, New York.

MR. GEORGE A. ILER has succeeded Mr. J. Minick as electrical engineer for the Davis Coal & Coke Company, of Thomas, W. Va.

MR. V. RAY RONK, auditor of the Detroit, Monroe & Toledo Short Line, has resigned to become manager of the electric lighting and heating plant at Bowling Green, Ohio.

MR. GEORGE WESTINGHOUSE, JR., has sailed this week for Europe, where various important matters await his attention. It is expected he will return some time in July.

MR. FRANCIS W. JONES, chief electrical engineer of the Postal Telegraph Cable Company, has returned to New York after a trip of about a month in the south and west, chiefly on engineering work.

MR. T. A. EDISON has returned with his family to Orange, N. J., after his usual winter vacation on his Florida plantation. He is in much improved health and has resumed active work at the laboratory.

MR. N. D. MACDONALD, of the Electrical Testing Laboratories, New York City, has been spending his time this month at the Locke and Thomas insulator factories, inspecting and testing high-tension insulators for several transmission plants in the west.

LOUIS J. AUERBACHER has resigned his position as engineer for Shoenberg & Co., and has organized The Beck Flaming Lamp Co., of which he is president. Mr. Auerbacher sailed for Europe April 21st to study the flaming arc lamp industry on the other side.

COL. R. C. CLOWRY, president and general manager of the Western Union Telegraph Company, sails this week for Europe, accompanied by his wife and by Mr. H. D. Estabrook, the solicitor of the company. He will be absent about six weeks touring England and the Continent.

MR. LAWRENCE W. CADY, formerly designing engineer in the electric heating department of the General Electric Company, has severed his connection with that corporation and has accepted the position of designing engineer for the Simplex Electric Heating Company of Cambridge, Mass.

MR. HARRY T. REITER, manager of the Fremont Street Railway Company, of Fremont, Ohio, has resigned to become manager of the Fort Worth & Arlington Heights Interurban Railway Company, of Fort Worth, Tex., operating the electric light and water works plants and the street railway system.

MR. JOHN A. BRITTON, president of the Pacific Gas & Electric Company, of San Francisco, Cal., sailed on the Pacific Mail Liner Siberia, April 7, for a three-months' pleasure trip in China and Japan. Mr. Britton has had charge of the recent consolidation of the properties of the California Gas & Electric Corporation and the San Francisco Gas & Electric Company, and is now taking a well-earned rest.

GENERAL EUGENE GRIFFIN, first vice-president of the General Electric Company, sailed from New York on April 10, on the steamer "Graf Waldesee." General Griffin plans an extended trip in England and on the Continent, largely for rest and recreation. As he is a director in the Cie Francaise Thomson-Houston and vice-chairman of the British Thomson-Houston Company, these interests will naturally claim a portion of his time.

MR. J. RAWLE.—Mr. James Rawle, secretary and treasurer of the J. G. Brill Company, has been elected president of that company, succeeding the late G. Martin Brill. Mr. Rawle is a civil engineer by profession, and was for some time in the service of the Pennsylvania Railroad Company. He entered the old firm of J. G. Brill & Son in 1872, and ever since that time has been conspicuous in car building and in steam and electric railway development.

MR. C. L. EDGAR, president of the Boston Electric Company, who has been under a good deal of strain lately through the long and fatal illness of his father, has gone South for two or three weeks to recuperate. On his return he will sail for Europe to take up his duties as a member of the municipal ownership commission of the National Civic Federation. Several municipal plants on the other side are now under investigation by the commission and Mr. Edgar's expert aid is desired.

LORD RAYLEIGH.—A dispatch from London says: "That a scientist who is also a peer can at the same time be a good business man is proved in the case of Lord Rayleigh. Lord Rayleigh is one of the greatest scientists of the day. He was Senior Wrangler and Professor of Experimental Physics at Cambridge; is a Professor of Natural Philosophy and has innumerable decorations and scholarships. In addition he is a good business man. He owns a large estate, Terling Place, near Witham, Essex, and this he has converted into a huge dairy farm from which he supplies the three stores he runs in London under the name of "Lord Rayleigh's Dairies." His profits from this source are very large. Lord Rayleigh is a brother-in-law of the Hon. A. J. Balfour and is staying with him at Carlton Gardens in the house which Ambassador Choate once occupied. Lord Rayleigh married Miss Evelyn Balfour, a sister of the former premier."

WESTINGHOUSE MACHINE PERSONNEL.—On account of the rapid expansion of the business of the Westinghouse Machine Company, the board of directors has decided to enlarge the executive organization by increasing the number of vice-presidents from two to four, and has elected Mr. E. H. Sniffin and Mr. Arthur West to fill the new offices of third and fourth vice-president respectively. Mr. Sniffin will be in charge of the sales department as heretofore, his field of work not being altered in assuming the new title. Mr. West, who has been chief engineer of the company, still retains that title and position. Mr. William A. Bole, in consequence of his election to the vice-presidency of the Westinghouse Foundry Company, has resigned as manager of works of The Westinghouse Machine Company in order that he may better serve the interests of the Foundry Company, of which he assumes the entire management. The Westinghouse Machine Company, however, retains Mr. Bole as consulting engineer, availing itself of his services and counsel on important work, which his ripe experience has made peculiarly valuable. Mr. Henry L. Barton, formerly general superintendent of the East Pittsburg Works of the Westinghouse Machine Company, has been appointed manager of works.

News of the Trade.

ANDERSON LINE MATERIAL.—Albert & J. M. Anderson Mfg Co., Boston, has appointed Mr. T. C. White, 416 Market Street, St. Louis, sales agent for Anderson line material at that point.

BULLOCK & GOODWIN, electrical contractors, of 4 Mason Street, Biddeford, Me., would like to receive catalogues, discount sheets and bulletins from Eastern electrical supply houses.

THE PARAGON INSULATING COMPANY, of Cleveland, Ohio, is preparing to remove its plant to Findlay, Ohio, where a new plant is being erected. The company manufactures all kinds of insulating products from the by-products of the National Refining Company with which concern it will be associated in Findlay.

SIERRA Y. FERNANDEZ is the name of a new firm formed by M. J. Sierra and A. Fernandez at Ortega 11, City of Mexico, for the purpose of carrying on a business in electrical apparatus, machinery and installations in general. Their letter gives good references to public officials and others. They invite correspondence.

THE NATIONAL CARBON COMPANY, Cleveland, O., has for some time operated gas engines of different makes up to 200 hp in its various factories. It is now installing in its works at Clarksburg, W. Va., a 600 b.h.p. Koerting gas engine supplied by the De La Vergne Machine Company, of New York. The engine will be used for general power purposes and will operate on natural gas.

THE PELTON WATER WHEEL COMPANY, San Francisco, Cal., has recently increased its pipe works in the East and is now prepared to turn out sheet-steel riveted pipe of any length, diameter or thickness, having exceptional facilities for the manufacture of this class of pipe, as well as the highest grade lap-welded pipe in all diameters and thicknesses for high-duty hydraulic work in connection with power developments.

COAL AND IRON BANK.—At a meeting of the stockholders of the Coal & Iron National Bank of the City of New York, held April 3, 1906, it was voted to increase the capital stock to $500,000 by the issuance of 20,000 additional shares. This, together with accumulated earnings, will make a total capital and surplus of $1,000,000. The action was taken to accommodate the increased and growing business of the bank.

THE MARINE ENGINE & MACHINE COMPANY has been awarded the elevator contract for the new "Brunswick site building," at 26th Street, Broadway and Fifth Avenue, convering eleven electric elevators. The building is to be twelve stories high and used as a high-class office building instead of a hotel as originally intended. The builder is Mr. Charles T. Wills, 156 Fifth Avenue, and the architect is Mr. Francis H. Kimball, 71 Broadway, New York.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY for Manhattan Borough has moved its erecting department from offices in the Trinity Building to the Fuller Building, corner of 23rd Street and Broadway. This change was made necessary because the department was in want of more space than it was possible to obtain at 111 Broadway, and also because the uptown location is more suitable and convenient for the construction work, most of the power plants being located within easy reaching distance.

HODGE-WALSH COMPANY, of Kansas City, Mo., has adopted the new firm style of Hodge Electric & Manufacturing Company, with headquarters at 701 Delaware Street, that city. Its efforts hereafter will be to push the sale of telephone apparatus and electrical supplies. The engineering department will be continued however. On account of the rapid increase in the jobbing department during the last two or three years, the firm has found it necessary to increase largely its stock and force, in order to take proper care of that end of its business.

THE AMERICAN FENOFID BRAZING COMPANY, of Philadelphia, Pa., announces that on account of its having secured control of the Donnelly portable oil torch, the fenofid process of brazing castings is made available everywhere. The company is prepared to enter into negotiations with companies looking toward the acquirement of shop rights for this process in localities where territorial rights have not been granted. The practicability of this method of repairing broken castings is demonstrated by its successful use by the Philadelphia Rapid Transit Company, the Public Service Corporation of New Jersey, J. G. Brill Company and others.

GAS ENGINES.—A lively and widespread interest has been aroused among engineers of all classes by the gas engine's rapid advance to the front rank of efficient and reliable prime movers. Especially has this interest been attracted by the recent remarkable development of the large gas engine. Taking the Koerting engine alone, that being probably better known and more widely used than any other, we find that there are 157 Koerting 2-cycle gas engines aggregating 131,685 B.H.P. in operation or in course of construction at the present time. This engine is handled in America by the De La Vergne Machine Company, East 138th Street, New York City.

NEW INDUSTRIAL VARNISHES.—The electrical world will be interested to learn that the Standard Paint Company, whose headquarters are at 100 William Street, New York, and which has been for over twenty years manufacturers of the P & B electrical compounds, has just placed upon the market a new line of insulating varnishes. They are as follows: P & B baking varnishes, black and clear, oil-proof; P & B finishing varnish, black, oil-proof; P & B air-drying varnish, black; P & B core-plate varnish, baking, oil-proof; P & B core-plate varnish, air drying. Although these are called P & B, they are entirely different from the P & B compounds, and lack the odor peculiar to the latter. Full information can be obtained from the Standard Paint Company, sole manufacturer.

STURTEVANT BLOWERS AND ENGINES.—The prestige which a concern attains in a special line of manufacture is often likely to seriously overshadow its development in other lines. An interesting example is that of the B. F. Sturtevant Co., of Boston, Mass. It is undoubtedly known from one end of the country to the other as the pioneer in the manufacture of fan blowers and a "Sturtevant" blower can be found in almost every manufactory of reasonable size. But alongside of the development of the blower by this company has been a similarly progressive development of the high-speed engine in a great variety of designs and sizes ranging from 3 to 300 hp. Designed originally for direct attachment to fans, the use of these engines, because of their special qualifications, has broadened into a larger field—particularly the direct-connected driving of Sturtevant generators. This has brought the annual output up to fully 1,000 engines per year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 10, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

817,152. APPARATUS FOR NICKEL-PLATING; Jonas W. Aylsworth, East Orange, N. J. App. filed Sept. 17, 1904. In an apparatus for the plating of a continuous strip, the combination of a support, means for sustaining and moving a continuous strip relatively submerged, means for raising and lowering the support, and an occluding chamber carried by the support and normally partially submerged in the solution, substantially as set forth.

817,160. HEAT-COIL; Frank B. Cook, Chicago, Ill. App. filed Nov. 14, 1903. In a heat-coil, the combination of a hollow, heat-conducting element, heat-producing means, a conducting-pin inserted into the said element, fusible material securing the conducting-pin to the said element, and means whereby, when the fusible material is softened, the said pin is turned in the said element.

817,162. PROCESS OF TREATING ALKALINE STORAGE BATTERIES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Sept. 29, 1904. The process of treating, prior to shipment, an alkaline storage battery, the negative mass of which contains when charged, finely-divided iron and metallic mercury, which consists in completely discharging the negative mass so as to fully oxidize the same and prevent atmospheric oxidation, substantially as and for the purposes set forth.

817,210. MAGNETIC FRICTION CLUTCH; Harry W. Williams, Akron, O. App. filed May 26, 1905. The friction surface is formed by an expansible ring which has a centrally projecting lever by which it is expanded. The lever engages an independently revoluble disc which can be gripped and held by magnets to operate the clutch under certain circumstances.

817,212. ELECTRIC FURNACE; Charles O. Wingren, Pasadena, Cal. App. filed Aug. 21, 1905. The combination of a metallic air-tight casing composed of a body portion and a removable cover secured thereto, said cover being provided with an upwardly-extending dome; electrodes insulated from and secured to said body; resistance material in said casing between said electrodes a crucible in said resistance material between said electrodes; heat-insulating material within said casing and surrounding said electrodes and crucible except at and near the dome; a viewing-pipe extending from the crucible, upward through the heat-insulating material and terminating the dome; and air-exhaust mechanism connected to said dome whereby the air may be exhausted from the crucible.

817,222. ELECTRIC SWITCH; Harold E. Case, Bridgeport, Conn. App. filed March 24, 1904. A knife blade switch in which the contacts are formed mainly of steel and brass for the purpose of economy. A leaf or blade of copper is, however, included to give proper conductivity.

817,232. REGULATION OF ELECTRIC CIRCUITS; Edgar A. Edwards, Cincinnati, O. App. filed March 7, 1902. The combination with a normally open constant-current circuit and a regulating-magnet in shunt thereto, of a differentially-wound dynamo for supplying current thereto, and means for automatically closing said circuit by current from the dynamo, substantially as described.

817,256. ELECTRIC SIGNALING FOR TROLLEY RAILROADS; Edward W. Lee, South Atlanta, Ga. App. filed Jan. 31, 1905. Details of trolley contact device for a signal circuit employing a wooden base or support with copper covered wooden strips thereon for engagement with the trolley wheel.

817,264. ELECTRIC CONTROLLING DEVICE FOR CARS; James H. K. McCollum, Toronto, Canada. App. filed March 1, 1905. A complete control system for cars having a magnetic brake and control circuits by which the various combinations are automatically effected.

817,281. AUTOMATIC INTERCOMMUNICATING TRAIN REPORTING SYSTEM; Elmer E. Steiner, Knightstown, Ind. App. filed July 14, 1905. The usual trolley pole carries an additional wheel or contact to engage a special signal wire.

817,290. ELECTRIC RAILWAY SWITCHING MECHANISM; Harry L. Young, Pueblo, Col. App. filed Oct. 5, 1905. Complete railroad switching system employing magnets at the switches which directly actuate the switch points and are energized by a special trolley connection which is provided at a proper point along the track.

817,293. AUTOMATIC RAILROAD SIGNAL; James S. Anderson, Ames, Neb. App. filed Dec. 26, 1905. The locomotive has a number of inclined frames fastened to it which constitute contact plates and engage with contact rollers supported adjacent to the track in order to complete the necessary signal circuits.

817,305. ELECTRIC METER; Thomas Duncan, Lafayette, Ind., App. filed June 6, 1904. The usual permanent magnet of a wattmeter is formed with a magnetic shunt, the reluctance of which can be varied to compensate for the decreasing strength of the magnet.

817,322. DISPLAY APPARATUS; Calvin Jackson, Reading, Pa. App. filed May 31, 1905. A whirligig having planetary parts. The rotation gives a novel effect from the colored incandescent lamps carried.

817,329. TERMINAL OR COUPLING FOR ELECTRIC CABLES; William and John Y. Middleton, Newcastle-upon-Tyne, England. App. filed June 5, 1905. A pair of notched discs have annular recesses in their opposed faces and are clamped together so that the cables lead out through the notched portions.

817,346. ELECTRIC HAND LAMP; Herman F. Stakelbeck, Philadelphia, Pa. App. filed Aug. 9, 1905. A two-part plug is received into the base of the lamp and serves to clamp the circuit wires in proper relation thereto.

817,348. TRACK INSTRUMENT FOR AUTOMATIC RAILWAY BLOCK SIGNALING; Alfred J. Stecker, Detroit, Mich. App. filed Mar. 27, 1905. Mechanical details of a circuit making tappet adjacent the track rails. A hinged blade is deflected to close one signal circuit when the train passes in one direction and an additional blade closes the second signal circuit when the train passes in the opposite direction.

817,366. ELECTRIC SWITCH FOR ELECTRIC RAILROAD CARS; Otto Frank and Peter J. McCaffrey, Brooklyn, N. Y. App. filed Apr. 1, 1905. A pair of magnetic valves control the respective inlets at the two ends of a pneumatic cylinder which moves the switch arm, and a pair of springs are disposed to normally hold the arm in central relation.

817,368. OVERHEAD TROLLEY SUPPORT AND SWITCH; Byron E. Green, Ilion, N. Y. App. filed Sept. 28, 1904. A metallic box or casting having means for the attachment of the usual trolley wires at a turn-out, and having grooves to guide the wheel on to the proper wire.

817,300. PRIVACY DEVICE AND BUSY-SIGNAL FOR TELEPHONE APPARATUS AND SYSTEMS. Egbert A. Reynolds, New York, N. Y. App. filed Aug. 19, 1904. In a telephone system, the combination with a generator and a conductor arranged to conduct therewith, of a plurality of telephone instruments, each provided with a switch for connecting same in talking-circuit with the conductor and having a common return to said generator, of a privacy device for each instrument including an electromagnet arranged in a normally open branch in series with said talking-switch, said branch, when closed, also constituting a return-path from the said switch to the generator, and means for momentarily closing and then opening the branch of any one instrument prior to the closing of the talking-switch thereof, whereby circuit will only be completed through the privacy branch of one instrument and the talking-switch of another instrument.

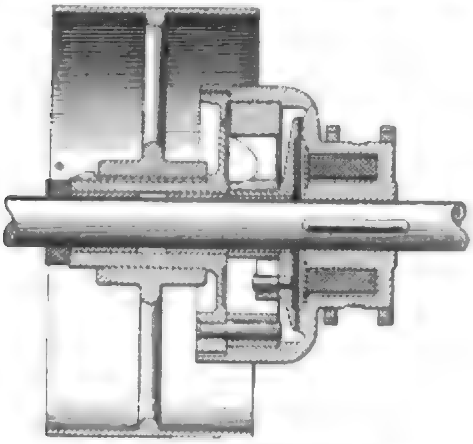
817,306. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; Albert P. Seymour, Syracuse, N. Y. App. filed Jan. 30, 1905. A two-part porcelain socket having grooves to receive the circuit wires and having pointed pins which penetrate the insulation and establish the connection.

817,399. PROCESS OF MAGNETIC SEPARATION; Frederick T. Snyder, Oak Park, Ill. App. filed Dec. 20, 1902. A magnetic separator in which the table has two movements, one when the magnetic field is active, and another when it is not active, so that both the magnetic and the non-magnetic ore particles have a net movement in separate direction.

817,419. PROCESS FOR THE ELECTROLYTIC MANUFACTURE OF METAL TUBES; Otto Dieffenbach, Darmstadt, Germany. App. filed Jan. 9, 1906. The process of producing galvanic deposits, which consists in mixing comminuted kieselguhr with a suitable electrolyte, passing an electric current through the mixture and simultaneously producing a relative movement between the electrolyte and the cathode to dislodge the hydrogen bubbles and to smooth the metallic deposit by the action of the kieselguhr.

817,449. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; Albert P. Seymour, Syracuse, N. Y. App. filed March 15, 1905. Details of a porcelain socket having a threaded shell and a central stud secured in place by screw connections.

817,457. HEAD BAND OR SUPPORT FOR TELEPONE-RECEIVERS; Kelley M. Turner, New York, N. Y. App. filed Jan. 18, 1906. A supporting band or holder for telephone-receivers comprising a pair of curved spring-sections pivoted together at their upper ends, and a sing or fork adapted to receive and hold a telephone-receiver and arranged to fold into the plane of said spring-sections.



817,210.—Magnetic Friction Clutch.

817,463. RAILROAD SIGNAL SYSTEM; Rollin A. Baldwin and George D. Foote, New Haven, Conn. App. filed Aug. 10, 1903. A recording signal transmitter adapted to register the entrance of cars into a single track block section from either end, and to give a semaphore indication of the fact from the opposite end. The device also records the number of cars which enter the section so that a clear signal is not given until they have all left the same.

817,483. ELECTRIC FUSE IGNITING APPARATUS; James W. Howard, Connellsville, Pa. App. filed May 23, 1905. Details of an appliance containing a spark coil in a box and a push button to complete the circuit thereof when it is desired to ignite the blast.

817,484. INSULATING SCREW SHELL; Harvey Hubbell, Bridgeport, Conn. App. filed June 28, 1905. An adapter for Thomson-Houston and Edison incandescent lamps.

817,485. CHAIN GUIDE FOR PULL SOCKETS; Harvey Hubbell, Bridgeport, Conn. App. filed July 14, 1905. The socket has a laterally projecting tube which serves to guide a beaded chain which makes a partial turn around the switch element so as to rotate the same when the chain is pulled.

817,497. SIGNAL SYSTEM; Joseph H. Lynch, Red Bank, N. J. App. filed Oct. 25, 1905. The locomotive has a depending finger or tappet which is engaged by a projection on the track so as to establish certain alarm circuits within the locomotive cab.

817,498. STORAGE BATTERY; James R. Macmillan, Menomonie, Wis. App. filed Apr. 1, 1905. In a storage-battery grid unit, the combination of an inclosing frame, a plurality of horizontal ribs extending across said frame, a plurality of transverse ribs extending across said frame and intersecting said horizontal ribs to form compartments for lodgement of active material, projections on said transverse ribs extending into said compartments, said ribs and projections being quadrilateral, the top and lower edges thereof being disposed in a common vertical plane, and a web on said ribs and projections, disposed in said vertical plane, substantially as described and for the purpose set forth.

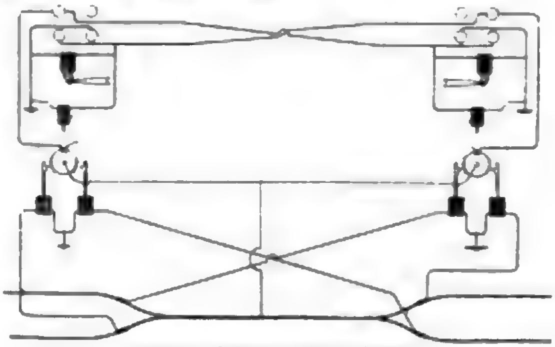
817,588. WIRE CLAMP; John A. Reising, Aurora, Ill. App. filed Apr. 13, 1905. A hollow sleeve has threaded oppositely coned ends which are longitudinally slotted or split so as to be deflected inward and clamp the circuit wires when nuts are screwed thereon.

817,593. ELECTRIC WATER HEATER; Frederic F. Shipp, St. Louis, Mo. App. filed Aug. 10, 1903. A water heater having a resistance coil embedded in an insulating cylinder and contained in a water jacket through which the fluid passes.

817,594. ELECTRICAL WATER HEATER; Frederic F. Shipp, St. Louis, Mo. App. filed Sept. 16, 1904. A number of sections of porcelain are organized together by wrapping the resistance wire thereabouts so as to form a complete resistance element.

817,597. APPARATUS FOR COMMUTING ELECTRIC CURRENTS PASSING THROUGH LAMPS, ETC.; Campbell Smart, Swansea, England. App. filed Sept. 19, 1905. The switch arm is mounted on a rod which is capable of longitudinal and rotary movements. Magnets are provided to give the longitudinal movements and a series of cam surfaces are effective to impart the necessary rotation.

817,606. ELECTRIC BRAKE; George R. Yancey, Louisville, Ky. App. filed Aug. 7, 1905. A chain or rod is connected to extend throughout the entire train and may be tightened to apply the brakes on all the cars by a motor driven drum on the forward car of the train.



817,463.—Railroad Signal System.

817,642. INCANDESCENT LAMP CLUSTER; Harvey Hubbell, Bridgeport, Conn. App. filed Sept. 1, 1905. The usual threads of the sockets are formed directly in the porcelain and a pair of plates are organized therein so as to make the necessary electric circuits.

817,664. CONTACT DEVICE; Andrew Plecher, Los Angeles, Cal. App. filed Dec. 27, 1904. A detector for wireless telegraphy employing a plate floating against a contact in a highly rarified atmosphere. The position of the plate is adjusted by a magnet.

817,687. MAGNETIC ACTUATOR; Daniel Bacon, Brooklyn, N. Y. App. filed Aug. 24, 1904. A magnetic clutch in which the driving and the driven member have a multitude of electromagnets which when energized transmit the torque by means of their magnetic field.

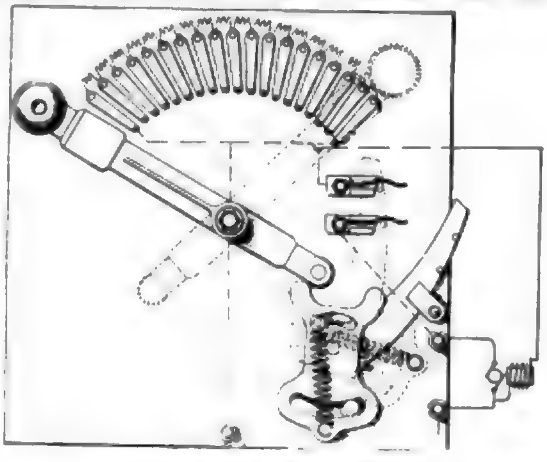
817,719. ELECTRICAL CIRCUIT CONTROLLER; Harry W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. A complete motor starter or rheostat having the usual swinging arm, but having various locks and features for preventing improper movements of the arm.

817,720. AUTOMATIC ELECTRIC CIRCUIT CONTROLLER; Harry W. Leonard, Bronxville, N. Y. App. filed Jan. 26, 1903. A combined no-voltage and excess current circuit breaker having a detent which moves by failure of current in either the shunt or the series magnets.

817,730. ELECTRICAL FRICTION CLUTCH; Harry A. Williams, Akron, O. App. filed Oct. 22, 1904. A multiple disc clutch in which the necessary pressure is supplied through a magnet.

817,732. ELECTRIC INCANDESCENT LAMP; Werner von Bolton, Charlottenburg, Germany. App. filed May 31, 1902. An incandescent body for electric glow-lamps, consisting of substantially pure metallic tantalum.

817,733. HOMOGENEOUS BODY OF HIGHLY REFRACTORY METALS; Werner Bolton, Charlottenburg, Germany. App. filed Jan. 5, 1904. A metal derived from tatalum compounds and possessing the quality of being homogeneous and ductile.



817,719.—Electrical Circuit Controller.

817,734. INCANDESCING BODY FOR LIGHTING PURPOSES; Werner von Bolton, Charlottenburg, Germany. App. filed May 31, 1902. A homogeneous metallic glower for incandescent lights containing ductile metal of the vanadium group, the light-emitting properties of the glower being due to the presence of this metal.

817,736. APPARATUS FOR DETECTING AND LOCALIZING MINERAL DEPOSITS, Leo Daft, Ealing, and Alfred Williams, Wimbledon, England. App. filed Oct. 14, 1902. A complete apparatus by which a fall of potential is secured through the ground in the region of a mineral deposit and an investigating circuit is provided to study the nature of the fall of potential, and thereby locate the mineral deposit.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the Electrical World 16,000 *copies are printed. Total circulation for* 1906 *to date,* 323,500, *an average of* 19,029 *per week.*

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OUTPUT OF ELECTRICAL APPARATUS.

We print in this issue the preliminary report of the Bureau of the Census on the production of electrical apparatus and machinery for the calendar year 1904. It gives a total value of $157,949,514 as compared with $104,746,319 in 1900, a gain of 50 per cent in the short period. Our own estimate made at the beginning of 1905 was $175,000,000 for the total inclusive output, a figure that is thus shown to be very close to the fact, although discrepant as to some of the constituent items. There are several concerns in this country outside the electrical field that make their own apparatus, which of course is not included, and a great many of the public service corporations, telegraphic, telephonic, electric lighting and electric railways make considerable apparatus and in the aggregate do an enormous amount of what is grouped as "custom work and repairing." None of this is included in the $157,000,000. Bare copper and iron wire, poles, etc., are not in this showing, but an attempt was made to include cross arms, cord adjusters, rail bonds and miscellaneous items that are in reality distinctively electrical. Porcelain electrical supplies and pottery and fire clay conduits are not reported, but appear in the pottery manufacture group.

One notable feature is the small gain in dynamos and motors. A leading reason is that the transition has been from the small units of old to the large three-phase generators, so that with a great increase in capacity the price has fallen enormously per horse-power; and the same statement applies to the average motor since 1900. The gain in incandescent lamps for the period was the largest of all, but here the reverse fact probably applies in an appreciation of price as well as the increase in quantity, as it is known that 1905 was almost stationary as to incandescent lamp production. The detailed figures are now awaited as to the entire production with great interest.

THE SAN FRANCISCO DISASTER.

The news of the terrible earthquake and fire at San Francisco has fallen with stunning effect upon the nation; but the recovery has been swift and the outflow of charity has been magnificent. The fact was always recognized that the city was liable to shock, but as a matter of fact, with its prevalent wooden construction it was, as shown, much more vulnerable to fire. The damage has been very serious, but like the loss of life, tremendously exaggerated in the natural alarm and confusion attendant upon the deprivation of more than 250,000 people of their offices, stores and homes. The work of restoration and renovation has already begun and will be pushed apace until a more stable, beautiful and more prosperous city occupies approximately the site of the old one. California and San Francisco will be no less desirable places of residence and business than they have been since the days of '49; and the exhibition of courage and confidence there is most stimulating as to the future. Meantime, it is obvious that the demand for new constructive material will be tremendous, and a large part of it must be for electrical supplies and apparatus of all kinds—wire, motors, lamps, telephones and all the indispensable adjuncts of modern civilization that depend upon current. Incidentally we cannot withhold hearty praise from the brave telegraph operators who stuck to their posts through indescribable horrors and dangers, and thus kept the stricken city in touch with the rest of the world

The Iowa Convention.

The convention last week of the Iowa Electrical Association was up to the high standard set by that association in its meetings of the past several years. In practical value to central station men operating in small and medium-sized towns, the proceedings of this wide-awake body are of unique value, and should serve as a model to similar associations. We are glad to note that a discussion on the grounding of secondary low-tension circuits formed an important part of the proceedings. We have repeatedly urged the importance of grounding the secondary as a safety precaution, and it is not unlikely that this will be made compulsory everywhere within a few years. Nevertheless, there are yet many of the smaller stations which have failed to avail themselves of this very cheap form of liability insurance, and to these we particularly commend the above-mentioned discussion. All those taking part were strongly in favor of grounding and in most of cases their opinions were supported by practical experience—a costly one in at least one instance. The discussion on the results of experience in the practical operation of steam turbines is of particular interest from the fact that it dealt with details which heretofore have not been brought forward. The turbine efficiency test communicated is also of special interest from the fact that the test was conducted entirely by the operating company, and the results are, we believe, the first published in this country coming from an entirely disinterested source.

The paper of Prof. Shepardson on technical men in central station work brought out forcibly the fact that central station companies are far behind manufacturing companies in appreciating the value of technical graduates. It is certainly a reflection on the central station industry that so small a percentage of technical graduates in recent years have gone into central station operation. When we note the practice of successful central station operating syndicates in seeking technical graduates, the conclusion is inevitable that the companies which have ignored this means for the advancement of their interests are not awake to their opportunities. The situation may be stated briefly as follows: In taking on the staff of a central station raw material, which is preferable—the young man taken from the ordinary walks of life, or the technical graduate with a mind well trained by years of systematic study, with well-grounded knowledge of every technical principle applying in central station work, and eager to a fault to be up to date in everything pertaining to his work? Experience in manufacturing lines has demonstrated the great flexibility of the technical graduate, but a small percentage of whom remain in purely technical positions, the great majority finally being absorbed into the administrative and commercial departments, where their technical knowledge serves as an admirable check in almost every matter coming up for action.

The subject of depreciation of central station properties has apparently always been such a painful one for the central station man to discuss, that it is seldom brought up in electric light conventions except in connection with the marvelous accounting methods of some municipal plants. The electric lighting industry is now settling down to a stable basis and depreciation due to the changes in the art is not so enormous as in the early days. There are those who maintain that the increase in the value of a public service company's business in the ordinary city will take care of depreciation. This has been true in the past in America to a large extent, or many more companies would have been wrecked as a result of reconstructions, but it will be less and less true as years pass by. Depreciation must be taken into account in one way or another, either by money invested from year to year in the business or by a sinking fund set aside each year out of the net earnings. In many cases the profits have been put back into the business by the purchase of new machinery, enlargements and extensions in such a way as virtually to amount to taking care of depreciation. A very limited number of companies in Iowa, as shown by Prof. Bissell's paper, provide for a sinking fund. With the short-term franchises now becoming common and the insistence of capitalists upon better security, depreciation must be given vastly more attention than the subject has received in the past.

Color Photometry.

The paper by Herr Satori, abstracted in our Digest this week, will amply repay thorough reading. It sets forth with commendable clearness the situation with respect to color photometry, which is at once the most difficult and the most interesting branch of the subject—the most difficult because it leads us at once into physiological complications of a very troublesome character—the most interesting because it involves problems of vital importance to future improvements in illumination. Color photometry dates back even to Fraunhofer, like so many other fundamental researches in optics, but neither he nor any of his successors evolved any simple and satisfactory method of dealing with the problem. If the luminosity of the solar or any other spectrum could be measured in terms of fixed quantities the task would be an easier one. As it is, however, the physiological variable of the eye render color photometry a work much like trying to lay off a base line with a rubber band as the standard of length. Of course, Purlinje's phenomenon, with the uncertainty it introduces, has been painfully well known to all investigators in this domain, but in view of the "Duplicity Theory" of vision, which is the result of recent researches, it takes on a new and startling significance. Briefly stated this theory ascribes to the "rods" and "cones," which, packed closely on end, make up the velvet-like structure of the retina, quasi-independent functions. The former are not color sensitive and play the most important part in vision in very weak light. The latter are strongly color sensitive and the sensation derived from them is predominant in ordinary seeing.

The most striking fact that all eyes are color blind in very weak light, and that peripheral vision in the region of few cones is notoriously lacking in color sensitiveness, thus finds a simple reason for being. It is as if in photography one were to overlay a strongly stained and rather slow emulsion with a film highly sensitive, but unstained and rather poor in silver. In weak light the resulting negative would owe nearly its whole density to the latter layer and would show no orthochromatic values, while on a full exposure it would be strongly orthochromatic with density mainly due to the lower emulsion. In the eye the sensitive layers are, of course, in the same plane, but varying in distribution over the retina. Now in photometry one deals simultaneously with rod-vision and with cone-vision in varying and generally unknown relation. In normal vision under illumination of useful intensity for ordinary purposes the cones have the better of it and color vision is the important consideration. In weaker and weaker light the cones lose their grip so to speak and only the rods are left in action at last. Hence in color photometry the results under weak light when rod-vision predominates do not correctly represent the situation under the conditions of actual illumination. This is bad for all extinction methods as well as for all balancing methods when weak light is used. In either case colored components of the light are likely to fail of getting full justice.

The long and short of it is that photometry and in particular color photometry is in anything but a satisfactory state. To begin with, there is no generally accepted standard of light, and the nearest approximation to it, the Hefner, introduces the difficulties of color photometry to an exasperating degree. Even were there a first-class standard the ordinary processes of photometry involve these purely subjective difficulties in a way that is very often disastrous to precision. It is not the photometer settings that are troublesome, but their interpretation to meet practical conditions. It is not difficult in photometry to obain consistent results, which may, however, be in spite of consistency very wide of the real facts. Perhaps as Herr Satori suggests, photographic methods may make up in reliability what they lack in directness, but we hardly think they have yet been sufficiently developed to be generally used to advantage. The whole subject is just now worth especial investigation on account of the introduction of illuminants giving strongly selective radiation, and for this very reason capable of very high efficiency. So long as one dealt with illuminants of approximately uniform color quantity, comparisons, irrespective of color, were measurably fair. To-day, however, with Welsbachs and enclosed arcs, mercury tubes and flaming arcs all in the field in competition, the situation is greatly complicated. Photometric processes once entirely satisfactory must now be examined very critically and the whole subject needs a thorough overhauling. Even the question of standards of light is further than ever from a solution. The more one deals with the processes of commercial photometry, the more one is dissatisfied with their precision. If one were to take a couple of incandescent lamps and send them around to various institutions to be standardized, we fancy the results would be anything but reassuring. Probably no commercial measurement is subject to greater uncertainty from a greater number of causes.

THE ELECTRICAL CONDUCTIVITY OF METALLIC OXIDES.

There is reason for believing that electricity is conducted in three different ways. All of these ways involve the transport of matter. The first way is the bodily movement of a charged body, such as a thunder cloud, or an electrified pith ball. This is a movement of gross matter, usually capable of being observed by the eye. The second way is the bodily movement of electrified atoms, or groups of atoms. This is the electrolytic way. If we take copper electrodes immersed in an aqueous solution of copper sulphate, we suppose that there are plenty of dissociated molecules, i. e., atomic constituents, swimming about loose in the solution. The supposed free constituents are copper atoms and sulphion groups. For some reason, when a neutral copper sulphate molecule splits up in water into constituent copper atom and sulphion group, the copper travels about with a positive charge and the sulphion groups with a negative charge. These swim about like electrified pith balls. A potential difference applied to the electrodes establishes an electric gradient, or field of force in the solution, and the electrified pith ball constituents immediately begin to travel in opposite directions towards the positive and negative electrode, respectively. When they arrive at the goal, they give up their electric charge and are thereby rendered incapable of swimming about in solution. They pile up on the electrode in material form as a solid, liquid or gas. The conductivity of the solution depends upon how many dissociated molecules there are in it, and also on the speed at which they can travel under a given electric intensity of field—that is, how little jostling there is. As the temperature of the solution is raised, there will be less jostling, more freedom to move, more velocity and greater conductivity, even if no more dissociation of neutral molecules should occur. In electrolytic conduction the conductivity increases with the temperature.

The third way is supposed to be the bodily movement of particles of matter much smaller than atoms, viz.: corpuscles. These corpuscles are the bricks of which atoms are built, and all bricks are exactly alike, although the atomic structures composed of them differ as much as do brick houses. All individual corpuscles are inherently negatively electrified somehow. Yet normal atoms comprising hundreds or thousands of corpuscles are neutral, and if a corpuscle is abstracted from a neutral atom, the latter remains positively charged. In corpuscular conduction the atoms do not move, but the corpuscles move through them and carry the electric charges up grade, or from the negative toward the positive pole. The movement of the charge is supposed, therefore, to be subatomic. It is further supposed that normal atoms are constantly shaking off corpuscles and taking them on again, in the jostling which occurs when atoms and molecules rub elbows in a solid body; so that a metal has at any instant a plentiful stock of free corpuscles capable of moving at a definite mean speed under an electric field and, therefore, of carrying an electric current. The subatomic, or corpuscular, conductivity of metals tends to increase inversely as the absolute temperature; or to diminish as the temperature increases.

It is commonly supposed that conductivity in a substance is atomic or subatomic—that is, electrolytic or metallic, according as it increases or diminishes with temperature; but this is not a safe conclusion. A paper in the *Philosophical Magazine* for April, 1906, on "The Electrical Conductivity of Metallic Oxides," by Dr. F. Horton, describes experiments on the changes of conductivity of metallic oxides with temperature, going to show that their conductivity is metallic and not electrolytic, although their conductivity increases with enormous rapidity as the temperature is increased. In the case of cupric oxide there appeared to be no polarization of the electrodes and no electrolytic conductivity, although the conductivity increased thirty million times between the limits of 12° C. and 1,038 ° C. On the other hand, investigators have shown that such oxides emit and, therefore, probably contain, more and more free corpuscles as their temperatures is increased, and the observed rate of increase of conductivity agrees with the stated rate of increase in emission of corpuscles. Some of the oxides tested, such as lime, gave evidences of some slight electrolytic conductivity at high temperatures; but the main character of the conductivity appeared to be metallic or corpuscular. If these theories are correct a process for the treatment of copper or iron, whereby the atomic dissociation could be enhanced without destroying the structural properties, would be of enormous value.

The Earthquake and Fire at San Francisco.

Shortly after 5 a.m. on Wednesday, April 18, San Francisco was visited by an earthquake shock of unusual duration and of extreme severity, which made itself felt destructively also in other parts of California. The shocks were repeated during the day, and at intervals during the ensuing week. Great damage and loss of life occurred as a result in various places, but in San Francisco the disaster was rendered horrible and complete by the instantaneous breaking out of innumerable fires in the wrecked buildings. The conflagration swept away the entire business district of the city except parts of the water front, destroying Chinatown, invading Nob Hill and other residential districts, and not stopping until over 250,000 people found themselves homeless and destitute.

At this moment order is slowly working out of chaos in the ruined city, and San Franciscans are bending their energies to the renovation of their homes and offices, aided by the charity of their fellow countrymen already amounting to over $15,000,000. It will be many long months, however, before the ordinary course of events can be resumed, and social and business life can settle down to the normal condition.

The immediate effect of the earthquake and fire was to interrupt all the electric utilities carried on by the public service corporations in the vicinity. Gas pipes, electric light and power wires, railway circuits, telegraph and telephone systems were instantly interrupted and remained out of commission for several days. Up to the time of our going to press little definite information has been secured with regard to specific damage.

The Western Union and Postal Telegraph Companies both lost their headquarters at San Francisco and were driven across the San Francisco Bay to Oakland, although it was not long before they re-established themselves in the stricken city or secured footholds also at such points as Goat Island in the bay, where the cables could be tapped. Throughout the following week thousands of messages have piled up in the hands of both companies, there being no means of delivering them to the addresses in San Francisco or Oakland, as there are no messengers to deliver the telegrams, and in almost every case it would have been impossible to find the persons for whom they were intended. During the first few days very few personal messages could be got through from San Francisco or Oakland, and the wires were occupied chiefly by Government dispatches or by the bulletins describing the disaster furnished by the Associated Press, whose whole force, from Mr. Melville E. Stone down, has been working night and day keeping the newspapers supplied with the latest news from the scene of devastation. All the officials of the great telegraph systems have been under tremendous strain since the occurrence, and are now able to announce rapid resumption of the service. The Postal Telegraph Company swiftly installed a dynamo plant and telegraphic apparatus at Oakland, and has been making that city its headquarters for the vicinity, while Mr. J. C. Barclay, assistant general manager of the Western Union Company, states that by Tuesday of the following week the company had opened up offices in San Francisco itself, and had several wires running into the city. The relief train sent by the Western Union to San Francisco had 150 men aboard, including operators, linemen and superintendents; and, as few houses were available for occupancy, provision had been made for housing the staff on tourist cars.

The telephone system on the Pacific Coast was one of the most highly developed in the world and the use of the telephone in San Francisco was unusually extensive. President Fish, of the American Telephone & Telegraph Company, under date of April 23, writes us: "It will be some time before we can expect any definite information as to the condition of the telephone plant in San Francisco. At the present moment I believe that at least two of our exchange buildings escaped the fire and that while they are somewhat shattered by the earthquake they can be restored to service within a reasonable time. I am also informed that the Western Electric Company's building is not destroyed. The new switchboard in the central office is in any event not entirely destroyed. At last advices there had been no opportunity to go into details as to any of the buildings that were subjected to the fire." The new switchboard referred to by President Fish is the largest in the world, and it was understood would have been ready for very early use. The telephone officials on the coast are doing their best to assure a swift resumption of service, realizing its immense value at this juncture.

As is well known, San Francisco has a very extensive street railway system, and a large service for electric light and power. Both were, of course, immediately interrupted, and so far as known have remained out of business up to the present time, while it has been impossible to secure any very definite data as to the amount of damage done. The street car tracks were dislocated in every direction by the earthquake, and many of them have since been encumbered by the ruins of the shock and fire. This is equally true of the electric light and power circuits. As regards the power plants of the United Railway & Investment Company, it appears that the electric power houses are safe, although the company appears to have lost its cable power house, operating the Market Street line, upon which it was proposed shortly to substitute electricity. This cable power house, which was shortly to be abandoned, was insured for $325,000. So far as can be learned, the plants of the Pacific Gas & Electric Company, and the California Gas & Electric Corporation, are practically intact. San Francisco is the center of some of the longest hydro-electric power transmission systems in the world—230 miles—but also generates on the spot large quantities of current in the usual way.

The General Electric Company appears to have suffered very materially from the fire following the earthquake. The only definite information received, however, by the officers came in a telegram from Dr. Addison, manager of the Pacific Coast territory, stating that so far as he knew all the members of the San Francisco organization were personally safe, but everything else had gone. Similar stories could be told with regard to many of the large concerns in the electrical field, but the advices are still meagre. John A. Roebling's Sons Co., which has always carried a very large stock out on the coast, is understood to have lost it all, to the tune of several hundred thousand dollars, while the Allis-Chalmers Company also reports the loss of its offices and of $20,000 at least in material. The insurance in all cases, whether of public service corporations or of commercial organizations, appears to be ample, while up to the present time no single case of loss of life has become known of anyone connected with the electrical industries.

For a time submarine cable communication with San Francisco was interrupted and advices eagerly sought for by residents on the Sandwich Islands, Australia, etc., were secured by sending messages the other way around the world. The Commercial Cable Company is now able to report, however, that its underground lines in San Francisco are uninjured and that business has been resumed.

It is impossible at this moment of writing to state what will be the nature of the plans of the local public service companies in the near future, and this uncertainty may continue for some time, although all the companies are, as indicated above, making vigorous efforts to get in complete running order again. One of the largest of the new projects at San Francisco was that of the San Francisco Coke & Gas Company, which had worked out plans for a large electric light plant to be located near the present gas works at North Beach, the idea being that it would thus be possible to obtain gas cheaply for gas engines driving the generators. This plant was to have been equipped also with underground conduits and was intended to supply some of the most profitable districts of the city. The plant, which would cost $1,500,000, was intended to be sufficient to carry on the business until the transmission system of the Stanislaus Electric Power Company, now in course of construction in the mountains, could reach the Golden Gate. Several sites were under consideration for the new electric light plant and for the new gas works, but what will now be done under the radically changed circumstances is not known.

A hearty word of praise is due to the telegraph operators who, under conditions of danger and exhaustion, remained at their posts, and even returned to their keys at the peril of death. The first news of the earthquake came from a Postal Telegraph operator, who reported the disaster while the walls and ceilings were falling around him, and then with the humorous remark: "Me for the simple life!" managed to make a hairbreadth escape.

The latest dispatches now available from the scene are those of April 24. They state that 80 men from the Benicia Signal Corps, referring doubtless to the United States Signal Corps, had arrived and were at work on the Government telegraph and telephone lines. The Home Telephone Company announced its intention to begin work at once on a new independent system to cost $4,000,000 in the next three years. With the resumption of telegraphic communication, the Stock Exchange has opened again. "Within twenty-four hours probably four street car lines will be in operation in the city, and the streets of two extensive districts will be lighted by electricity. The United Railways assert that their lines are safe for operation, and the cars will be run perhaps to-day. The lights will be turned on as soon as the wires leading into the houses which might prove a source of danger have been cut. This work is progressing rapidly." Mr. G. H. Davis, chief engineer of the United Railways in San Francisco, reported the loss on the property at $2,000,000. The securities of the company have meantime shown a decline of $16,250,000. Moreover, a large part of the loss is insured. All the electric cars—455—were saved, except 7, and only 75 out of the 423 cable cars were lost. The street railway company through its engineers, Ford, Bacon & Davis, of New York City, is already making plans to meet the new conditions of route that will arise with the rebuilding of the city.

Production of Electrical Apparatus in 1904.

The Director of the Census announced this week the result of the tabulation of the statistics of Electrical Machinery and Apparatus for the calendar year 1904, forming a part of the Census of Manufactures of 1905, taken in conformity with the Act of Congress of March 6, 1902. The figures indicate that there has been a substantial increase in this industry in the United States, as compared with the statistics of 1900, which covered the fiscal year ending May 31st. Comparative figures for 1905 and 1900 are shown in the following summary:

	1905.	1900.	Per cent. of increase.
Number of establishments...	783	580	35.0
Capital	$191,469,874	$83,130,943	130.3
Salaried officials, clerks, etc.:			
Number	11,590	4,987	132.4
Salaries	$11,675,576	$4,563,112	155.9
Wage-earners:			
Average number	59,336	40,890	45.1
Wages	$31,226,721	$20,190,344	54.7
Miscellaneous expenses	$17,934,878	$6,788,314	164.2
Total cost of materials used	$66,728,176	$48,916,440	36.4
Total value of products..(1)	$140,614,481	$91,348,889	53.9

(1) Exclusive of $17,335,033 reported as by-products of other industries, the aggregate value of electrical machinery and apparatus production for 1905 being $157,949,514.

The principal products are summarized as follows:

Dynamos	$11,084,234	$10,472,576	5.8
Motors	22,370,626	19,505,504	14.7
Carbons	2,710,935	1,731,248	56.6
Incandescent lamps	8,319,159	4,036,112	106.1
Telephone & teleg. apparatus	16,974,892	12,154,678	39.7
Insulated wires and cables..	34,519,699	21,292,001	62.1
All other products.........	59,171,047	33,490,464	76.7
Custom work and repairing	2,798,922	2,063,736	35.6
	$157,949,514	$104,746,319	50.8

The figures are "factory" values, and do not include therefore the profit make in marketing or the actual amount paid by the public. They do not include such details as insulators, poles, etc., which are part of the pottery and lumber statistics, although these appliances are made and employed solely for electrical purposes. Moreover they do not embrace the large amount of manufacturing and repair work done by the thousands of public service corporations throughout the country. In addition to the 783 electrical manufacturing plants, there are a number of industrial concerns that make electrical apparatus for themselves but not for sale. It is believed that these additions would bring up the total to the estimate given by the ELECTRICAL WORLD for 1904 of about $175,000,000 electrical product.

Death of Prof. Pierre Curie.

A cable dispatch from Paris, dated April 19, states that Prof. Pierre Curie, who, with his wife, discovered radium, was run over and killed by a vehicle in Place Dauphine, in the Latin Quarter. Pierre Curie was born in Paris on May 15, 1859, and received his university education at the Sorbonne. In the year 1879, at the age of 20, he undertook a series of chemical researches on his own account. It was while engaged upon this work that he met Mlle. Marie Sklodowska, who had come from Poland to Paris to study mathematics, physics and chemistry. In 1895 Mlle. Sklodowska became the wife of Curie, who was then professor in the Ecole de Physique et Chimie, of Paris. Mme. Curie was appointed a professor of physics at the High School of Sevres, from which she received the degree of Doctor of Science for her work with radium. Her researches in science have been interlinked with those of her husband, and their names have been inseparably associated in their later work. The work of the Curies was carried on in a small laboratory in the Rue L'Homond, the expenses of the undertaking being obtained from their limited private resources. During a series of experiments on the conductivity of air under the influence of the rays of uranium and thorium, known as Becquerel rays, they made a searching investigation of the properties exhibited by compounds of the two metals, and were led thereby to the discovery of radium.

The first results of their work were communicated to the Academy of Sciences in 1898. In the year 1901 the Academy of Sciences awarded to them a prize of $2,000. The Nobel prize of $40,000 for scientific discovery was also presented to them, which they set aside for carrying on their researches. In 1903 they received the Davy medal, awarded by the Royal Society of Great Britain, for the greatest chemical discovery of the year. Prof. Curie refused the decoration of the Legion of Honor. When offered, he was reported to have said: "I am of the opinion that the hope of receiving decorations is not necessary as an inducement to acts of devotion or courage." Prof. Curie leaves one child, a daughter nine years old.

An Appreciation of Lemuel Bannister.

With reference to our recent obituary notice of the late Mr. Lemuel Bannister, we have received the subjoined appreciation from Mr. L. B. Stillwell, the consulting engineer, who was like some others who have since risen to eminence a protégé of Mr. Bannister and associated with him in the early upbuilding of the Westinghouse electrical manufacturing interests in Pittsburg:

"Few men making no pretence of technical knowledge have contributed more to the remarkable increase in the use of electricity during the last fifteen years than the late Lemuel Bannister. Chosen to be first vice-president of the Westinghouse Electric and Manufacturing Company at a time when that company was laboring under great financial difficulties, the confidence inspired by his integrity of character, his profound knowledge of sound business principles and his exceptional ability in meeting and solving commercial problems were most effective factors in placing his company upon a sound financial basis.

"Entering the electric field at the age of fifty his mature experience and conservative temperament were of great value in the commercial development of the industry and were influentially felt far beyond the limits of the company with which he was connected. This valuable influence has been recognized freely not only by those who have had the good fortune to be closely associated with him but by his ablest business competitors in other companies. Particularly did his character and ideas impress themselves upon the technical staff and commercial representatives of his company, and the writer has never talked with a man who was a member of either of these organizations during the years of Mr. Bannister's active administration who does not acknowledge with appreciation and high personal regard the benefit derived from this early association.

"As regards the effect of his work in establishing the confidence of purchasers of electrical machinery in the ability of the designer and the builder and in the sincerity of the seller, probably no man in America or Europe has surpassed him. To the remarkable development and extension of the uses of electricity in every-day life, which in the industrial field is the most striking factor in the world's progress during the last twenty years, many have contributed. On the side of production, the inventor, the designer, the builder, the engineer, the lawyer, the seller, the organizer and the business executive, each is entitled to his share of credit. On the side of use the buyer and his engineer and builder and lawyer also have had their work to do, and in the important work of establishing and maintaining between producers and users relations profitable to both, recognizing the rights of both, and therefore, essentially satisfactory to both, no man has contributed more than Lemuel Bannister."

The Iowa Electrical Association Convention.

The Iowa Electrical Association held its sixth annual convention at Des Moines, Iowa, April 18 and 19, 1906, at the Kirkwood Hotel. At the first session held Wednesday morning, President Burt, of Waterloo, introduced Mr. Milo Ward, secretary of the Commercial Association of Des Moines, who gave the address of welcome.

President Burt, in a brief address, called attention to the increasing importance of the work of the Iowa Electrical Association to Iowa central stations. In these days of large syndicates which are constantly "gobbling up" new properties, it is pertinent to ask: Are you prepared to be "gobbled"? Do you have your business in such shape that you know exactly where you stand financially? Are you keeping records which make it possible to determine how much your properties are really worth, and how they compare with other properties in the same State? Are you prepared to meet the present much-talked-of movement to regulate rates of all kinds by facts and figures showing whether the present rates are reasonable? In all these things the association is a help.

Secretary George S. Carson's report dealt mainly with an investigation he had carried on during the past year to determine the financial condition of Iowa central station companies. Out of 130 operating companies he had received reports from 82, of which 5 had to be rejected because of the combination of central station with other business. From the 77 companies remaining the following figures were obtained:

Capital stock	$3,679,525
Bond issue	2,495,100
Total bond interest	130,290
Total paid out in dividends	108,837

8 were earning dividends of 10 per cent.
15 were earning dividends of 8 per cent.
10 were earning dividends of 7 per cent.
10 were earning dividends of 6 per cent.
5 were earning dividends of 5 per cent.
2 were earning dividends of 4 per cent.
2 were earning dividends of 3 per cent.
2 were earning dividends of 2 per cent.
25 were earning no dividends.

The average dividend was 2.95 per cent. The population served was 401,398, so that the total issue of securities was less than $15 per capita, which is very much less than in the State of New York, with which he had made some financial comparisons. He urged the members to make more effort to learn what other plants are doing in the way of economy and development of business.

The report of the executive committee announced the appointment of Mr. George S Carson, of Iowa City, as secretary during the year to fill the resignation of P. E. Bellamy, of Knoxville. It was voted by the executive committee to hereafter give the secretary a salary of $250 per year.

The publication committee which issued the printed proceedings, reported an income from advertising of $600 and an expense for publishing the proceedings of $241, leaving $359 to be turned into the association treasury. The association passed a special vote of thanks to the publication committee for its remarkable showing.

A nominating committee was elected consisting of W. J Greene, of Cedar Rapids; L. D. Mathes, of Dubuque; George S. Carson, of Iowa City; Austin Burt, of Waterloo, and D. F. McGee, of Red Oak. This nominating committee reported at the afternoon session the following day in favor of the following officers, who were elected: President, Mr. A. W. Zahm, Mason City; vice-President, Mr. George S. Carson, Iowa City; secretary, Prof. L. B. Spinney, Ames, Iowa; treasurer, Mr. W. A. Mall, Belle Plaine; executive committee, the officers, and Messrs. '. D. Mathes, of Dubuque; O. E. Brownell, of Lake City, and W. N. Kiser, of Des Moines.

Invitations were received from the electric light and railway interests of Clinton and of Des Moines for the next convention. After some discussion it seemed to be the consensus of opinion that while Des Moines' hospitality was appreciated, and while it was the most convenient point in the State, it would be well to follow the precedent established the past few years of meeting every other year in Des Moines and every other year in some of the other towns where there were interesting developments in electric lighting and railway work. The invitation of Clinton was seconded by representatives from Davenport. It was shown that much electric work of interest in Clinton and Davenport would be ready for inspection by the next convention. It was voted to hold the next convention at Clinton.

Mr. George S. Carson, at the close of the convention, presented the association with a Crosby steam engine indicator. It is the intention to make this the beginning of a collection of testing instruments to be kept in the custody of the Iowa State College at Ames. The engineering department of that institution has already become a kind of testing headquarters for the central stations of the State.

PRESIDENT A. W. ZAHM.

During the convention the Des Moines City Railway kept a special car in operation every half hour between the hotel and the power plants of the Des Moines Edison Light Company and the Des Moines City Railway Company. Free transportation was issued by the Des Moines City Railway Company and the Interurban Railway Company to all delegates both to the Iowa Electrical Association and to the Iowa Street & Interurban Railway Association, which met at the same hotel April 19 and 20.

Mr. A. W. Zahm, the new president of the Iowa Electrical Association, has taken a prominent part in the affairs of the association for the past four years and is among its most progressive members. Mr. Zahm is 35 years of age and was born and brought up at St. Paul, Minn. He attended the University of Minnesota, but is not a graduate. He began electrical work with the Northwest Thomson-Houston Company, St. Paul, this company being then under the management of H. M. Byllesby. After three years with this company he became manager of the Manhattan Light, Heat & Power Company of St. Paul, where he remained five years. After this he spent one year rebuilding the electric light plant at St. Cloud, Minn. Upon finishing this work he took the management of the Brice Gas & Electric Company, of Mason City, Iowa, which position he now holds.

Abstracts of the papers presented at the convention and of their discussion will be printed next week.

The N. E. L. A. Exhibit at Atlantic City.

Note has already been made of the fact that the National Electric Light Association has taken Young's Pier for the exhibits at the Atlantic City convention, June 5, 6, 7 and 8. Mr. Arthur Williams, chairman of the convention committee, notifies us that the executive committee has decided to recommend to the exhibitors the adoption of a uniform style of booth construction and decoration. A comprehensive plan has been submitted by Mr. M. A. Singer, who has done a great deal of highly commended work for other associations.

It was understood at the executive meeting that this letter of recommendation should be issued, urging that, as far as practicable Mr. Singer be given the work. He has made prices of $56, $60, $67.50 and $70.50 for complete booths, according to their location. Where exhibitors have more than one section 10 by 10 ft., concession will be made offsetting the saving of labor and material. This will be a matter of negotiation in each instance.

Mr. Singer, or his representative, is to see each exhibitor—the object of this notice being simply to advise the membership of the action of the executive committee and of the desire to have a uniform plan of decoration in keeping with the best exhibition work here and abroad. Mr. Singer's figures include the erection of the booth on a platform five inches in height, with railings, fluted columns, cornices, lettering, electric lighting (there will be ten lamps to each 100 sq. ft.), and all wiring, including the supplying mains from the Atlantic Electric Light & Power Company's services. Neither the Association nor any member of the committee has any interest in Mr. Singer's contracts.

New York Central and New Haven Locomotives.

By Frank J. Sprague.

Commenting, in your issue of October 21, 1905, upon the proposed New Haven locomotives at the New York Central's terminal, I stated that as they were designed to operate at a maximum of about 250 volts alternating per motor at full normal speed, when in the direct-current zone they would of necessity be coupled in series in units of two because of the higher potential, with the result that when operating at switching speeds up to about twelve miles an hour they would require at least twice as much current for like train weights as the Central's locomotives, because the latter's motors were designed for 600 volts.

I hardly need to refer in detail to the comments these statements aroused, but an attempt was made to belittle them by distributing this excess demand over a long run, and ignoring local yard movements, despite the fact that this excess falls entirely upon a single sub-station.

Again, at the last meeting of the Railroad Club I called attention to a comparison of the Central and New Haven locomotives, and especially to the great weight of the latter in proportion to its capacity under like conditions, stating that the former has about 70 tons weight on the drivers, its motors measured on the hour rating and without special ventilation aggregate 2,200 hp capacity, and it is guaranteed to handle trains of from 400 to 550 tons, according to the schedule; while the New Haven alternating-current locomotive is variously reported to have from 72 to 95 tons on the drivers, to have an hour rating without ventilation of only 1,000 hp, and is intended to handle trains of 200 to 250 tons. Ventilation is, of course, equally possible to both, and hence comparisons should be made under like conditions.

I have waited with reasonable patience for the official curves of performance of the New Haven machines, and those given in the detailed description in your issue of April 14 not only confirm my criticism, but are pregnant with interest. According to that description, the normal full load potential of the alternating-current machines is 235 volts per motor, and in the matter of control it appears that the independent operation of the motors in parallel has been abandoned, probably because of the potential and current requirements, and the acknowledged "necessary and unavoidable" excess of weight in proportion to capacity—the tractive effort attained, even considering the pulsating torque when operating alternating, requiring only a low co-efficient of friction. The motors instead of being independent are, at all times, coupled in units of two armatures with their compensating coils in series, the exciting fields of both machines being external to this combination, and provision is made for coupling the latter in series and parallel relations, also for shunting them with a resistance when in series on direct current.

When operating on alternating current the fields in each group are always in parallel, "to work the iron rather gently" as is so naively stated, and which tells a whole story in itself. The parallel arrangement of the fields is also used when operating direct current under heavy load to keep down the heating.

According to the latest reports, the weights of the two locomotives are about 100 tons for the Central, of which 70 tons are on the drivers, and 85 tons for the New Haven, all on the drivers. Of the Central's weight 30 tons is on the guiding trucks and has nothing to do with the weight of the electrical apparatus. True comparison of weights which can be strictly assigned to the motor equipments in the two types is difficult, but for equal capacity without ventilation it is very much less in the case of the Central.

With 15 per cent traction coefficient, which is all that can be counted on for continuous work, the Central's locomotive should be able to exert a tractive effort of 21,000 lb., and the New Haven locomotive 25,500 lb., if it were not for some unbalancing of wheel pressures, and much more with sand on a dry track. In both machines, however, on account of being uncoupled, when the armatures are in series the drawbar pull with any given coefficient of friction will be reduced because of the reduction of the pressure on the leading wheels, with consequent tendency to slip them.

By assuming the use of sand, interesting comparisons of performance with special reference to the operating conditions necessarily governing terminal yard movements are indicated in the following typical examples:

(*a*) With 1,000 amperes from line, direct current operation, slow speed, with armatures in series and all resistance cut out:

Machine.	Fields.	Tractive effort.	Speed
Central	Series	29,200 lbs.	6 miles
New Haven	Series	11,800 lbs.	22 miles
New Haven	Ser. Par.	9,200 lbs.	27 miles

With the same direct-current line current, then, which is well within the capacity of the Central's locomotive, it exerts at its slowest economic speed a tractive effort from two and a half to more than three times that of the New Haven. If thrown into series parallel combination, the Central's locomotives would, with 1,000 amp. from line, develop a tractive effort of 12,600 lb. at 21 miles, but with very much less heat rate than the New Haven.

(*b*) With 20,000 lb. tractive effort, which is practically about the limit of the New Haven machine, direct-current operation, armatures in series and all resistance cut out:

Machine.	Fields.	Current from line.	Current in fields.	Speed.	Time to Rise 75° C.
Central	Series	725	725	7 miles	90 minutes
New Haven	Series	1,540	1,540	14 miles	8 minutes
New Haven	Ser. Par.	1,740	870	19 miles	14 minutes

A tractive effort of 20,000 lb. on alternating-current operation with the New Haven machine is, save momentarily, out of the question, because it would require nearly 2,100 amp. in the armatures, and even at 2,000 amp. the temperature rises 75° C. in the extraordinarily short time of four minutes, and it cannot be kept down.

(*c*) With 18,000 lb. tractive effort, since 20,000 lb., which is only two-thirds that possible to the Central's locomotive at slow speed, is impracticable for New Haven alternating operation. Then with armatures in series we have the following comparisons:

Machine.	Supply.	Fields.	Current from line.	Current in fields.	Speed.	Time to Rise 75° C.
Central	d. c.	Series	665	665	8 miles	105 minutes
New Haven	d. c.	Series	1,420	1,420	19 miles	11 minutes
New Haven	d. c.	Ser Par.	1,620 (in arm.	810	21 miles	18 minutes
New Haven	a. c.	Parallel	1,900	950	Variable	8 minutes

Of course, these high tractive efforts are for starting, and the locomotives would acquire higher speeds while the motors are in series on direct-current operation. It is, therefore, quite evident that the New Haven locomotive, despite an excess of fully 20 per cent on the drivers, does not approach the Central's in tractive possibilities, and will in yard movements in the direct-current zone require at least double the line current for equal tractive effort. In any case, when operating at slow speeds the controlling resistances must, on the New Haven locomotive, be left in circuit.

Comparison of the heating of the machines when required to be run at slow speed on like duty without ventilation shows an enormous disparity between the two locomotives, and it is safe to say that with equal ventilation a single Central locomotive can on direct-current operation be made to perform an all-round service almost equal to that of the New Haven locomotives on alternating operation. Verily, these latter machines, to quote one of my critics, "cannot turn a square corner, climb a tree, or please" me overmuch, under the circumstances. Moreover, it seems clear that, leaving aside comparison between motors each built solely for direct or alternating-current operation, which cannot but be to the ultimate disadvantage of the latter, the attempt to make the same machine acquit itself with equal satisfaction on either circuit cannot but meet with disappointment.

The Franklin Bicentenary in Philadelphia.

The exercises planned in connection with the Franklin bicentenary in Philadelphia were duly carried out April 17-20, with great èclat. Note was made of the preliminary proceedings last week in these columns. The whole of Wednesday, April 18, was devoted to the consideration of papers on scientific subjects before the American Philosophical Society, three of these papers dealing with electrical subjects on "Positive and Negative Electrons," by Prof. H. A. Lorentz, of Amsterdam; "Franklin's Researches in Electricity," by Prof. E. L. Nichols, of Ithaca, and the "Modern Theories of Electricity and Their Relation to the Franklinian Theory," by Prof E. Rutherford, of Montreal. In the course of his paper Prof. Nichols said:

"He took up the subject as an amusement. Residing in a remote colonial community and imperfectly acquainted with previous work in electricity, he was compelled to rediscover for himself many of the things which had already been observed in Europe. Franklin's earliest achievement in electricity was his discovery of the power of a pointed conductor to discharge an electrified body when brought near the same, and to prevent the accumulation of charge upon a conductor to which it was attached Of this property he later made application in the lightning rod. During the summer of 1747 he performed a series of experiments with the Leyden jar.

"He devised the cascade arrangement by which a number of jars can be charged or discharged in series and made condensers of glass plates with coatings of lead—such as are still known as Franklin plates He also magnetized and demagnetized steel needles and even reversed their polarity by means of the discharge current from his condensers. He constructed two forms of electric motor driven by means of the energy thus stored. With the exception of the lightning rod, these two machines represent Franklin's nearest approach to practical electrical invention.

"No scientific achievement of Franklin's made so profound an impression upon the public of his day as his demonstration that lightning is an electrical phenomenon, and even now nothing is more generally associated with his memory."

"Had the many-sided Franklin been one-sided," said Prof. Nichols, "and that side turned to science, what might he not have accomplished? But then he would not have been our Franklin!"

Prof. Rutherford, in his paper, said: "The theory of electricity developed by Franklin, generally known as the 'one fluid' theory, must be regarded as the greatest of his additions to electrical knowledge, for it has exerted a profound influence on the development of electrical ideas, and, even after the lapse of a century and a half of ceaseless activity in electrical research, still holds its place, though in a modified form, as the generally accepted explanation of positive and negative electricity.

"After a century and a half of great scientific activity, which has added enormously to our knowledge of electricity, the ideas of electricity, which are in vogue to-day bear a remarkable resemblance to those advocated by Franklin in the infancy of the subject. This resemblance must have been obvious to you all in the light of the recent developments which have been touched upon in this paper. We believe that there is one kind of electricity, namely, negative electricity, which is carried in small definite units by the electrons. These electrons are a mobile constituent of all matter and are able to move freely through metals."

On Thursday, April 19, honorary degrees were conferred by the University of Pennsylvania upon a number of well-known men, the list including Mr. W. Marconi, Mr. A. Carnegie, Dr. E. L. Nichols, Prof. A. A. Michelson, Prof. E. Rutherford, Prof. H. A. Lorentz. A degree was also conferred upon King Edward, of England, through Sir Mortimer Durand, the British ambassador. In the afternoon the tomb of Franklin, which generally suffers from neglect, was visited, there being a parade, the firing of guns by the armored cruiser *Pennsylvania* and the placing of wreaths on the grave. The day concluded with a reception of the Philosophical Society at the Bellevue-Stratford Hotel in the ballroom, the centerpiece of the decorations being a kite worked out in electric lamps in red, white and blue.

On Friday an imposing ceremonial took place at the Academy of Music, when Mr. Elihu Root, Secretary of State, on the part of the National Government, presented to the Republic of France, through its ambassador, Mr. Jules Jusserand, the gold medal in memory of Franklin authorized by Congress. The medal is a beautiful piece of work, executed by Saint Gaudens. Mr. Joseph H. Choate at the same function also announced the receipt of the Benjamin Wilson portrait of Franklin just restored to this country by Earl Grey, Governor-General of Canada, and stated that the picture is to be kept in the White House at Washington, probably in the historic East Room.

During the day final papers were read at the meeting of the American Philosophical Society, one of them by Prof. W. M. Davis, of Cambridge, Mass., on Franklin's studies of storm origin, and the other a most interesting description of Franklin as a meteorologist by Dr. Cleveland Abbe, of the United States Weather Bureau.

The official exercises of the week were brought to a close by a magnificent banquet at the Bellevue-Stratford, attended by a brilliant company of 300 scientists, public men, etc., from all parts of the world. Dr. Weir Mitchell read an original poem, one passage of which was as follows:

A memory only? Nay, for us who find
Familiar here the impress of his mind,
Warmed by his thought when glow the evening fires,
Hearing his genius in the whispering wires,
More than a memory he seems to tread
Our streets to-day, the quickest of the dead!

The speakers of the evening included Senator Lodge, Ambassador Jusserand, Sir George Darwin, Mr. Andrew Carnegie and Governor Pennypacker, the general theme of the oratory being the inestimable public services of Franklin as a statesman and philosopher.

CURRENT NEWS AND NOTES.

THE ELECTRICAL CLUB.—The Electrical Club, New York, had its opening on April 21 at the new club rooms over Kalil's Restaurant, 14 and 16 Park Place, and about 75 members and guests inspected the handsome quarters for the first time. The reception accorded every one was most cordial and the entertainment was excellent. The new club promises to afford an agreeable place for the gathering of electrical men at midday, and the cuisine, lounging and smoking rooms, etc., are as good as those found anywhere down town.

WIRE IN AUSTRALIA.—The Australian demand for wire continues very active. Prices of telephone wire are hardening with the great demand. One requirement will be 1,000 miles of wire by the Australian Government for a new system between Sydney and Melbourne. Extensions to Brisbane, Victoria and New South Wales will also be made.

SEARCHLIGHTS FOR SHORE.—A new departure proposed for the life saving service on the Long Island coast is the introduction of powerful searchlights. Three stations have been already provided with these searchlights, which will enable the crews to work on the darkest nights. It is expected that within a short time all the stations will be equipped with the lights. One difficulty is to render electricity available on the long stretch of beach that forms the southward rampart of the Great South Bay. It is at most points several miles from the mainland.

QUADRUPED POLE CLIMBERS.—Monkeys and woodpeckers, with occasional snakes, have been known to do serious damage to telegraph circuits, and new troubles of the same kind are reported. Telegraph companies in South Africa have trouble with wild giraffes. Recently there was an interruption of the service on the Victoria Falls line. Investigation showed that a herd of giraffes became entangled by their necks in the wires at Intundhia, 125 miles from Bulawayo, and pulled about a mile down, breaking three of the iron poles. In other instances of breakdown elephants were responsible through a misunderstanding of the phrase "trunk lines."

CABLE TO CHINA.—Messages of congratulation were exchanged on April 16 between President Roosevelt and the Dowager Empress and the Emperor of China on the completion of the last link of the Commercial-Postal cable into Shanghai, from Manila, thus connecting the United States with the Celestial Kingdom. The completion of the cable between Manila and Shanghai finishes the transpacific line, which was begun several years ago. The first stretch of cable was laid between San Francisco and Honolulu. The line was later extended to Manila by way of Guam and Midway, and finally to Shanghai. Nearly 10,000 miles of cable have been laid in an average depth of 2,640 fathoms. The greatest depth found on the line of the cable was 3,490 fathoms, approximately four miles.

CANADIAN WATERWAYS COMMISSION.—Advices from Toronto state that the report of the Canadian section of the International Waterways Commission has been made public. It declares the maintenance of Niagara is a national affair and should be dealt with as such. The United States Secretary of War has enforced rules and regulations upon American companies which the commission will probably use as a foundation for regulations to be ultimately recommended to the two governments. The whole question of riparian rights in relation to navigable streams or international waters will most likely have to be adjudged by some treaty arrangement between the two countries. The commission passed a resolution asking that no further rights or privileges be granted regarding the water flowing out of Lake Superior.

AN INDUSTRIAL TOWN.—The New York *Herald* of Sunday, April 22, devotes a column to a description of Kinkora, an industrial town being built on the Delaware about twelve miles below Trenton by the Roebling Company. It is stated that about $4,000,000 will be expended for providing almost ideal homes for the men employed in the Roebling Works. The streets will have a width of 100 ft., a parkway running through the center bordered with shade trees. A hotel conducted on the plan of a private club and department store are among the features. Other buildings contemplated are an assembly building, a school house and perhaps a church. The hotel will have a model bar. Six hundred houses will soon be constructed, which will be rented for $9 a month. Other houses will rent at $8 a month and $14 a month. The Roebling Works at Kinkora will employ about 3,000 men.

CHINESE TROLLEY PROJECTS.—United States Consul Smith, of Victoria, B. C., reports the first strictly Chinese project to build an electric railroad line. He states that Mr. Lim Dat, a successful Chinese merchant of that city, has organized among his countrymen located in British Columbia a $2,000,000 company to construct an electric trolley railway in China from Canton to San Wu, a distance of 60 miles. No white men need apply for stock, as their presence in the company would forfeit the charter from the Chinese Government. The route of the proposed line is a populous one, Canton having a population of 2,000,000 and San Wu 500,000. The prospectus of the new company sets forth that there are no serious topographical difficulties to be encountered in building the line; that water power will be obtained from the Quai Tong Shun Mountains, 30 miles from San Wu; that now there are 22 junks plying on the river between these points, carrying heavy cargoes and many passengers; that it takes these junks 14 hours to make the trip, which the electric cars will make in 3 hours. It is also stated that the summer cars to be operated—the climate being warm—will each be equipped with 50-hp motors. The plan is to build the line entirely with Chinese labor, even using Chinese electricians as far as possible. It is stated that the company also intends to seek from the city of Canton a concession of the light and power privileges. The streets there are so narrow that some difficulty would be experienced in attempting to secure the franchise for a city street railway system, although this may be sought later. Mr. Lim Dat is at the head of the leading Chinese mercantile firm in Victoria, known as "Gim Fook Yuen." They own a large brick block, conduct a department store, a rice mill and have several other stores in British Columbia, as well as a branch house in China. Mr. Dat, in 1895, invented and secured a patent on an improved device for electric rice mill machinery, the first patent issued to a Chinaman in British North America.

A NEW CUNARDER.—The electric installation to be fitted on the Cunard steamer *Mauritania,* will be the largest and most complete ever fitted on board such a ship. The generating plant consists of four sets of Parsons turbo-generators and each machine will be capable of producing 4000 amperes at 110 volts. This machinery will be placed in the aft end of the engine-room in two separate compartments divided by a water-tight bulkhead, and arranged in such a way that the ship would remain lighted in the event of either engine-room being flooded with water. There will be two switchboards, one in each compartment, for distributing electricity throughout the ship. A large portion of the auxiliary machinery will be driven by electric motors, including sixteen forced draught fans of fifty horse-power each for the stokeholds, and about sixty horse-power for the refrigerating machinery. Two electric passenger elevators are to be fitted for conveying passengers between the six decks, and also six smaller elevators for the conveyance of stores, mails, etc., and two large luggage hoists. Electric motors are to be fitted for raising and lowering the lifeboats, heaving in the sounding line, and for driving various machines in the bakery, galley, and pantry. In connection with the ventilation of the ship there will be about sixty large electrically-driven fans, including thermotanks, for heating and ventilating the whole of the passenger accommodation. The electric lighting of the ship will require about 5000 lamps of sixteen candle-power, which is more than double the number fitted on the steamer *Cedric.* In the staterooms de luxe there will be three lamps for lighting each room, electric fan, electric curling tong heaters for the ladies, and an electric radiator for heating the room independent of the general system. In addition to the usual electric bell system, there will be a telephone exchange fitted in connection with the first-class rooms and the principal officers of the ship, and special telephones from the bridge to the wheel-house aft, the forecastle head, and the engine-room. On the bridge deck there will be four powerful searchlights, and there will be two mastheads and two side lights, fitted with electric duplicate apparatus which automatically replaces a broken lamp filament, at the same time signalling to the officer on watch that such has taken place. In addition to this, the steam whistle will be electrically controlled, and all the water-tight doors throughout will be closed automatically by electric connection from the bridge.

TELEPHONES FOR AUSTRALIA.—The fiscal authorities of Australia note that a drawback duty will be allowed on telephone parts used for manufacturing telephones.

OHIO RAILROAD DILEMMA.—The steam railroads of Ohio have been operating for some time past under a law limiting fares to two cents per mile. They state that it means operation at a loss, and various plans of relief are under discussion, and one of these is a general resort to electric traction or the use of gasoline-electric cars.

COST OF SUBWAYS.—The Rapid Transit Commission of New York received last week from the Commissioner of Accounts a letter asking for a detailed statement of the bonds which would be required for new subways this year and for the amount of bonds that would be required for all of the routes laid out. A reply was sent stating that the lines laid out for Manhattan will cost $175,000,000, those for the Bronx $46,000,000, and those for Brooklyn $97,500,000, a total of $318,500,000.

NIAGARA POWER.—At Albany on April 20, Governor Higgins approved the bills introduced by Senator L'Hommedieu, repealing the special charters of the Lockport Water Supply Company, the Lewiston Water Works, the Lewiston Water Supply Company, and the Buffalo & Niagara Power & Drainage Company. All are said to be inactive corporations. On the same day in Washington, Senator Platt of New York presented a memorial from the board of trade of Niagara Falls, remonstrating against the Burton bill to prevent the taking of water from Niagara River for power purposes.

CATCHING THE PUBLIC EYE.—The Boston Edison interests, now in control of the Natick Gas & Electric Company, have made clever use of the old 100-ft. chimney at the distributing station. The company solicited bids for tearing the structure down a little while ago but the cost of the work was considered too high and it was determined to use it. The chimney has been painted white and on three sides "Edison Light" appears in large black letters. On the front seventy-five 16-cp incandescents have been arranged for an electrical sign, "Use Edison Light," which illuminates the entire neighborhood. It makes an attractive sign.

A TELEPHONE REPEATER.—A special telegram from San Francisco of April 16 says: "David C St. Charles, an engineer of this city, has invented a repeater, which will make it possible, he claims, to telephone from here to New York. What the so-called "repeater" has done for telegraphy, St. Charles's invention is intended to do for the telephone. The combining of the echo in nature with the sounding board of a violin furnished the clue to the discovery, according to a statement of the inventor. The superintendent of the local telephone company says that the invention is a success." Mr. C. J. Glidden, the well-known telephone financier, has virtually offered, in our pages to put up a million dollars for such an invention, if practicable.

WIRELESS IN CHINA.—U. S. Consul-General Ragsdale writes from Tientsin that the Chinese Government has arranged to establish several stations throughout China for experiment with Marconi's system of wireless telegraphy and instruct Chinese operators in working the same. The apparatus has been installed on four Chinese men-of-war at Shanghai and at the three north China cities of Tientsin, Peking, and Paotingfu, the radius of action being about 230 kilometers and the cost about 25,000 taels. An Italian officer has been appointed, not only as instructor, but also as engineer to superintend the installation. Under his supervision a number of students have already been detailed to act as operators and learn the art of management. It is also said that the viceroys throughout the Empire have been directed to consider the advisability of establishing other stations to work in conjunction with those above mentioned.

AN ADVERTISING EXPOSITION will be held at Madison Square Garden, New York, from May 3 to 9, inclusive. The show will be under the management of George F. Parker and J. L. Bieder, of 116 Nassau Street, New York, who gave a similar show at the Coliseum, Chicago, last fall, when it attracted nearly 200,000 people. The exhibitors will include publishers and advertising agencies who will set forth to all visitors the importance of newspaper and magazine advertising; printers and lithographers who will show the value of their various products and methods of manufacture; calendar manufacturers will exhibit specimens of calendar advertising; novelty manufacturers and dealers will put on view novelties of various kinds; sign manufacturers will show the value of indoor and outdoor signs.

CUBAN CABLE.—The following bill is in progress in the U. S. Congress, having passed the Senate already: "The secretary of war is hereby authorized to construct, and thereafter maintain and operate for governmental and commercial purposes, a submarine cable from Key West, Florida, to the United States naval station at Guantanamo, Cuba, and from there to the Canal Zone, on the Isthmus of Panama; and for the purpose of carrying the foregoing provisions of this act into execution the sum of $927,000 or so much thereof as is necessary, to be immediately available, is hereby appropriated: Provided, that in connection with the installation and operation of such cable system the Secretary of War is authorized and empowered to utilize, if consistent with the public interest, the personnel and resources of the military establishment, as far as they can be advantageously used without detriment to the public interest, and to employ such experts and other persons as may be deemed necessary to assist in carrying into execution the provisions of this act."

MONORAIL AGAIN.—Mr. F. B. Behr, whose electric monorail system has been so long before the public on the other side of the Atlantic without any practical results, appeared last week before the New York Aldermanic Committee on Railroads, and advocated the use of his system in Brooklyn, with a three-cent fare. Mr Behr wants the initial or test line constructed from Atlantic and Flatbush Avenues, in Brooklyn, via Fourth Avenue to Fort Hamilton and Coney Island. The cars would run on a single rail laid on top of an "A"-shaped structure along the sides of which would run the feed rails. The system could be built either as an elevated line or as a Subway. His general plan, of which the Coney Island line would be but the first step, would be for a line from Tottenville, S. I., running through the island under the Narrows by tube to Fort Hamilton, through Brooklyn to Borough Hall, and thence under the East River to Manhattan and north to the Bronx or Kingsbridge. The entire line would be thirty-five miles long, and, with the branch to Coney Island, would cover forty-six miles. Mr. Behr states that the cost of building an equipment for use would be $86,000,000.

TELEPHONY IN NEW YORK.—A hearing as to telephone rates in New York was had last week by the Aldermanic Committee on Laws and Legislation. Mr. A. R Conkling spoke in favor of the adoption of a five-cent interborough telephone rate. Mr Reynolds, president of the Great Eastern Telephone Company, spoke in favor of the establishment of an independent telephone system. While not urging the establishment of a municipally owned system, Mr. Reynolds asserted that the city could run such a system on a two cent per call basis and make money. The committee said they would take the matter up and report to the board later on. Mr. Martin Littleton, as counsel for the Atlantic Telephone Company, has sent a letter to the Board of Estimate, asking for the appointment of a sub-committee of the board, or of engineers acting in its behalf, to investigate the workings of the automatic telephone system which the Atlantic Company proposes to use if it gets its franchise. The company wishes to have the committee visit other cities to see the workings of the automatic telephone exchanges. By the recent ruling of corporation counsel, the Great Eastern Company has no franchise under which to operate in the present tripartite fight.

A New North Italian Hydro-Electric Power Plant.

ANOTHER interesting hydro-electric power plant has just been completed in North Italy at San Giovanni Bianco for the transmission of power to the Lecco and Erba district in Lombardi, the seat of large manufacturing interests. Water is taken through a canal 4½ miles long from the Brembo River at San Pellegrino. At this place there is a dam on the "Poiree" system having a length of 156 feet. The canal has four underground sections, one of which is nearly a mile in length. The generating station (Fig. 1) is in the Brembo Valley about a mile from Zogno. The reservoir in which the canal ends is shown above the station, with which it is connected by steel conduits.

In the generating room of the station are installed four 2,000 hp turbines (Fig. 5) of the Francis type and constructed by Riva, Monneret & Co. of Milan. These are rigidly coupled to three-phase alternators made by Gadda, Brioschi, Finzi & Co., Milan. The alternators are of the revolving field type with fixed armature having removable windings composed of form wound copper plates. In case of damage an armature winding can be rapidly replaced even by workmen not accustomed to this kind of work. The revolving field frame is laminated so as to form a ring of great mechanical strength. Upon the projecting poles there are dampers consisting of copper plates spirally wound and held in position by bronze bars which form a bridge from pole to pole. Each set is rated at 1,800 kw, and will develop 400 amperes at 2,700 volts and power factor of .75. The speed is 315 r.p.m., corresponding to a frequency of 42 cycles. The journals are fitted with water cooling devices to reduce the temperature of the lubricating oil.

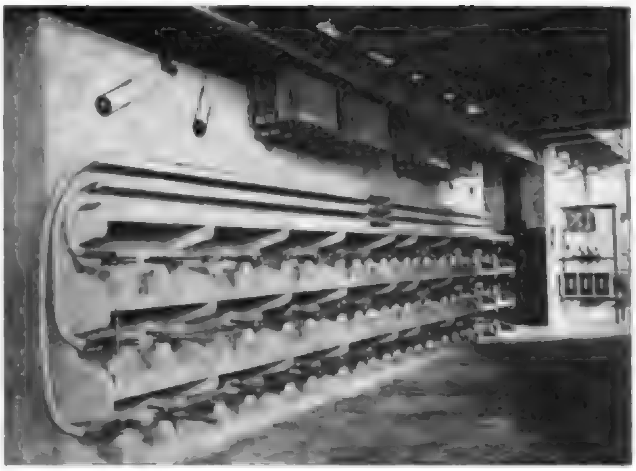


FIG. 3.—CEMENT BUS-BAR COMPARTMENTS.

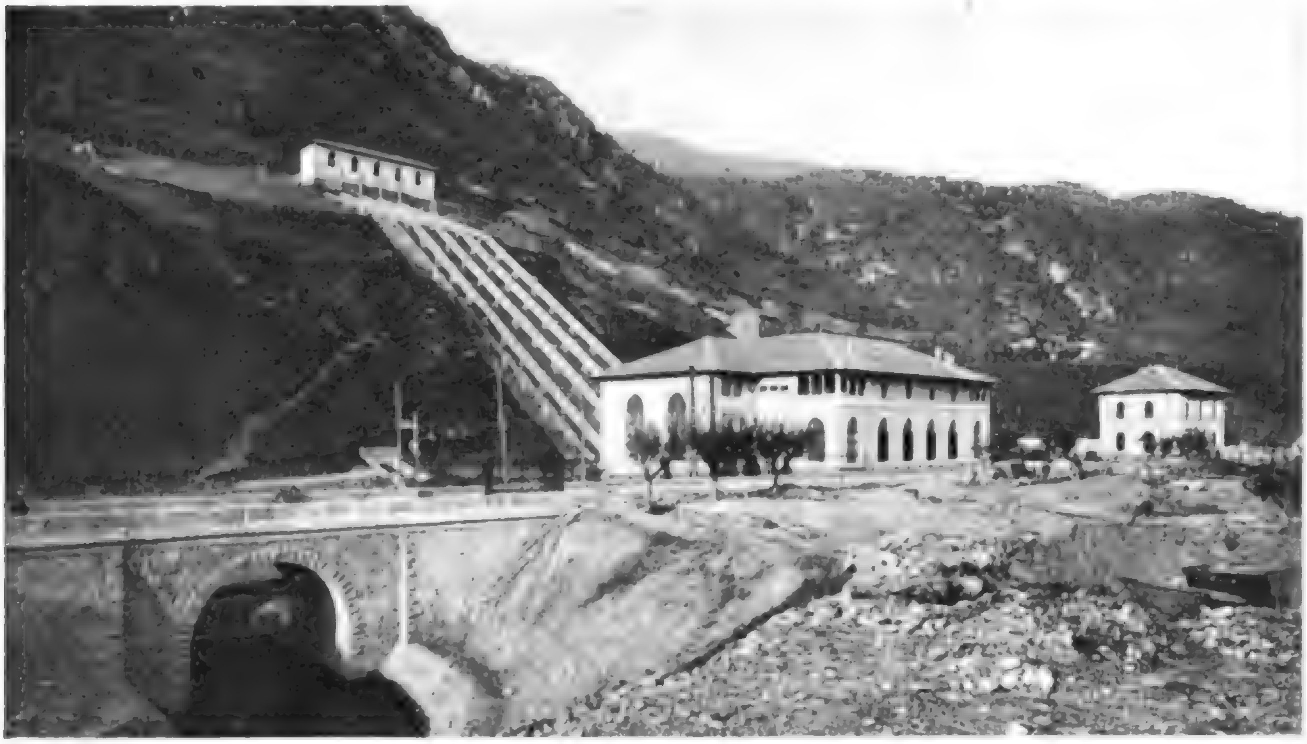


FIG. 1.—GENERAL VIEW OF ZOGNO HYDRO-ELECTRIC POWER STATION.

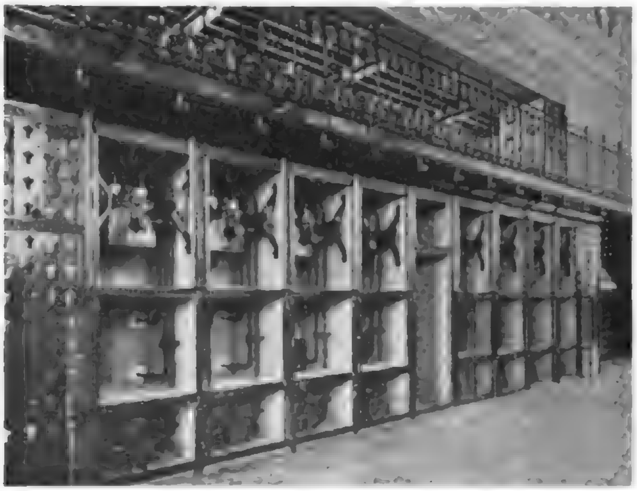


FIG. 2.—CEMENT SWITCH COMPARTMENTS.

The exciting current is furnished by two small turbine sets of 150 hp each, the two machines of a set being flexibly coupled. Each is capable of delivering 950 amperes at 110 volts at a speed of 75 r.p.m., and one set is more than sufficient to energize three alternators at full inductive load. The voltage generated (2,700 volts) is raised by means of four sets of transformers to 25,000 volts for transmission. Each set of transformers is rated at 800 kw and consists of three single-phase transformers of the air-cooled type. Each has its own air fan operated by a small motor.

In the station a series of cells (Figs. 2 and 3) of armored cement contains the apparatus, the bus-bars and the 2,750-volt conductors. A second group of cells contains the instruments and the 25,000-volt connection (Fig. 4). Above, supported by a steel ceiling, is the controlling room (Fig. 6), containing a cast-iron board divided into seven compartments. The central compartment contains the line ammeters and the general voltmeter. Four other compartments correspond to the four generators, the two last being for the respective transformers. Six small pillars of cast iron carry the devices for operating the 25,000-volt switches. At one end of the controlling platform is the switchboard for the exciters, and at the other is the totalizing watt hour meter. No high-tension wires connect to the board, all the measuring and safety apparatus receiving current through suitable transformers.

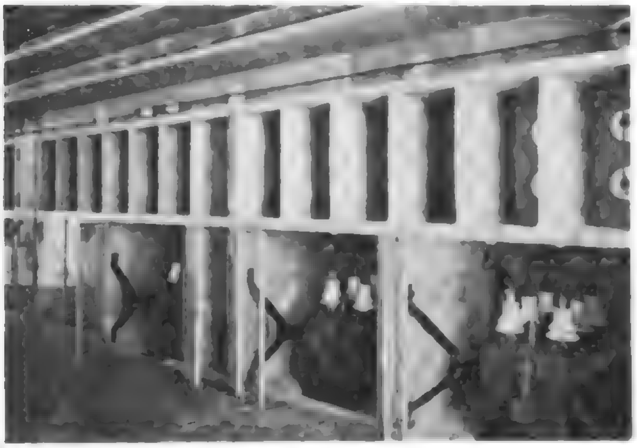


FIG. 4.—HIGH-TENSION SWITCHES.

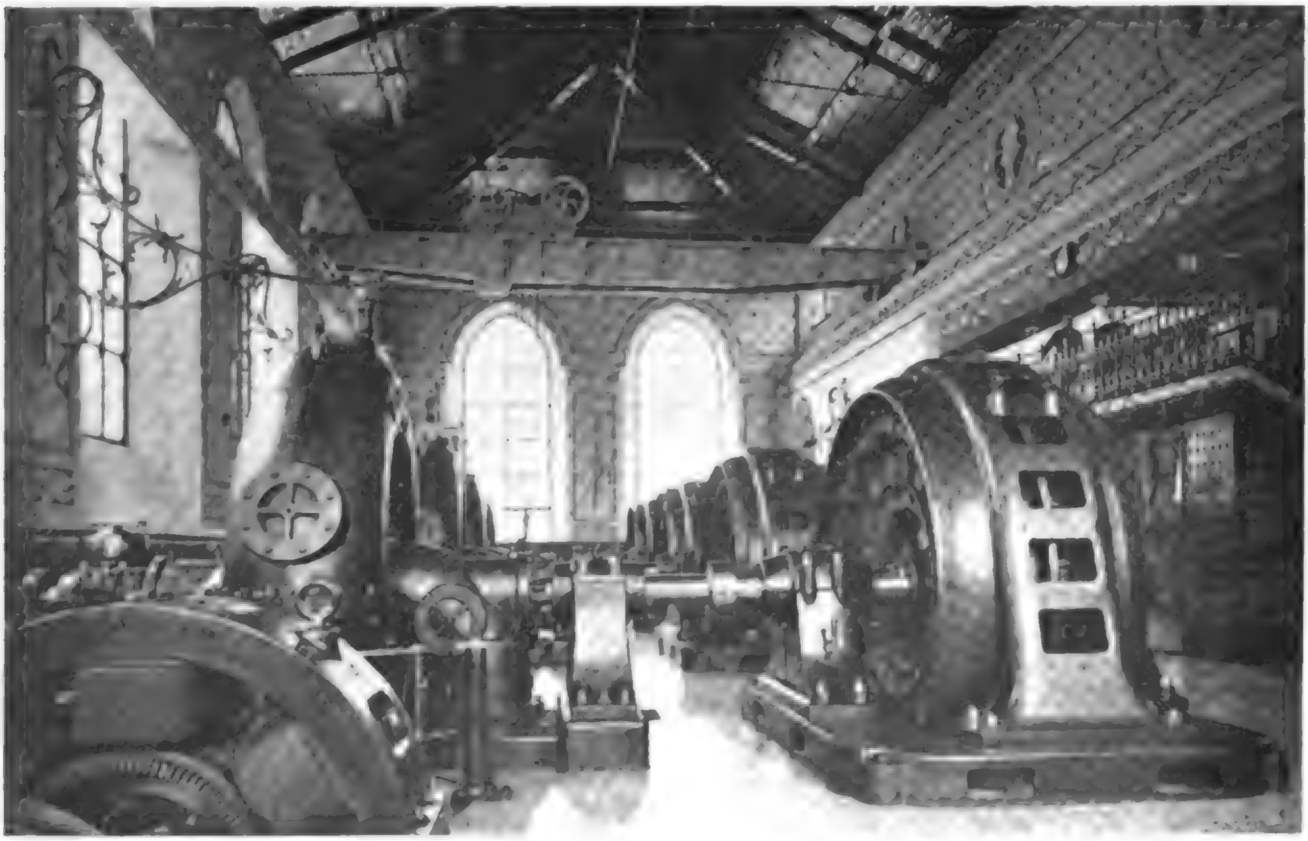


FIG. 5.—VIEW OF INTERIOR OF CENTRAL STATION AT ZOGNO.

Following up the conductors or "leads" from the machines to the transformers, there are first, from the alternators three single-conductor lead-encased cables to the corresponding cells. Two cables pass to current transformers (for the maximum relays), and one to a transformer for the ammeter. The leads then continue upwards to the air-blast raising transformers, the secondaries of which are connected to automatic three-pole oil switches, and thence to the high-tension bus-bars.

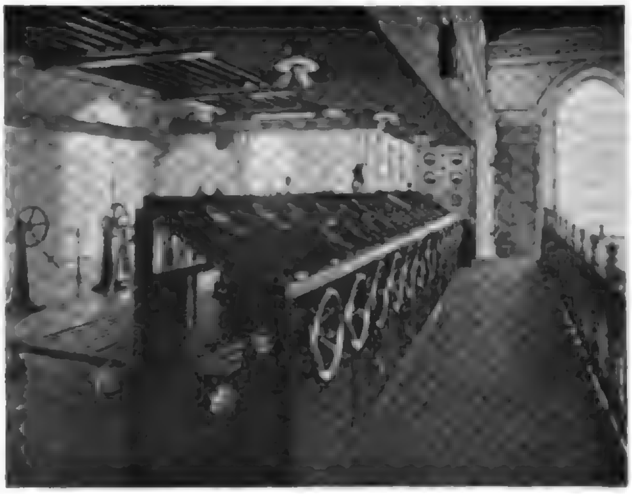


FIG. 6.—VIEW OF SWITCHBOARD GALLERY.

The same course is followed by the leads running from the bus-bars to the four groups of three-phase 1,800-kw transformers. Time relays are applied to all the automatic switches at the central station, which only operate when a small safety fuse arranged in parallel with the relay has blown.

As stated before, the generator e.m.f. of 2,750 volts is increased to 25,000 volts for transmission by groups of single-phase transformers. In these transformers the external magnetic circuit protects the winding mounted upon the central core and formed of alternate coils arranged vertically. They are of the air-cooled type with forced ventilation, obtained by means of suitable ventilators coupled to electric motors. The air, guided in suitable conduits placed beneath, enters into the body of the transformer passing over the whole surface of the coils, and then escapes at the top. Messrs. Gadda, Brioschi Finzi & Co. have adopted this type for high-tension work and for the large units, as the construction combines great mechanical strength and the best utilization of the ventilation.

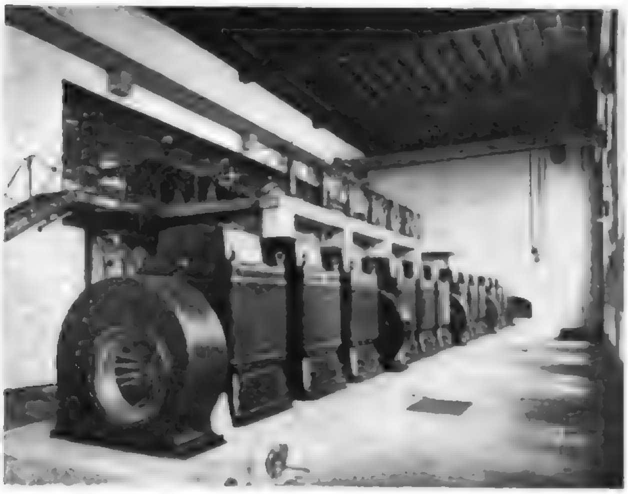


FIG. 7.—GROUP OF AIR-BLAST TRANSFORMERS.

The twelve transformers are mounted in line upon a base of cement, behind the high-tension cells. In this way the connections are reduced to a minimum and are well protected. The high-tension mains leading from the four units are connected across switches and separators to a system of bus-bars to which the two outgoing lines are connected. By the system of conduits and cells adopted a transformer room has been obtained without an exposed wire. The lightning arrester room, which is on the upper floor, is built up with cement cells or chambers. The Gola, Siemens and Wurts arresters used are separated pole by pole by means of cement walls.

The transmission line is in duplicate and each is divided into two sections at a switch cabin, in which it is possible to connect up the two lines, or, in case of necessity, to throw out of service any one of the four sections. The operation can be effected without interrupting the service by means of switches located in cells of reinforced concrete, of the same type as that adopted in the central station. The switch cabin is connected to the generating station and to the substation by means of a telephone line.

Massie Wireless Telegraph System.

OUR issue for July 29, 1905, contained a complete description of the operating characteristics of the Massie system of wireless telegraphy, and many of the constructive features of the apparatus employed were mentioned at that time. It is believed, however, that the equipment as used at the present time possesses a sufficient number of interesting improvements in details to justify a more extended discussion.

The operating circuits of the Massie system are arranged in three distinct, although somewhat interconnected, groups. These groups may, for convenience, be designated as the transmitting, the detecting and the receiving, respectively, each of which is designed so as best to perform its particular function. Thus the transmitting circuits are arranged so as to allow of the production of the most effective electrical ether waves with the least expenditure of power; the detecting circuits are adjusted to announce at the receiving station that the sending station wishes to transmit a message, while the receiving circuits are arranged for the most effective results in interpreting the message.

A special controlling switch allows either one of the three groups to be used as the operator may desire. When the apparatus at a certain station is in active use, the switch is so constructed that the aerial will be connected to the receiving circuit or disconnected for transmitting, as the case may require. At all other times, however, the aerial is connected with the detecting apparatus, which contains a bell alarm in a relay circuit, so that the operator is relieved from the tedious task of "listening in," and yet no messages intended for the station will be overlooked. The switches employed vary somewhat in design according to the character of the stations at which they are used.

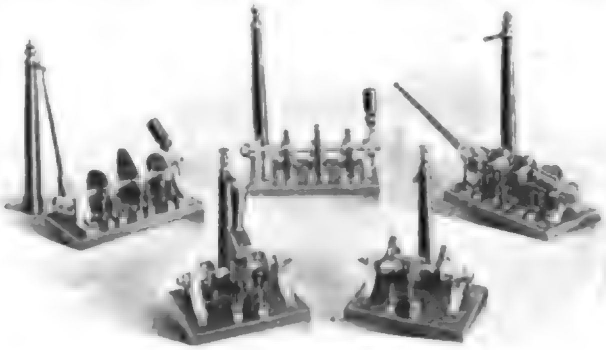


FIG. 1.—MAIN CIRCUIT-CONTROLLING SWITCHES.

Views of circuit-controlling switches for high-power land and ship stations and for low-power portable sets are shown in Fig. 1, while a controlling switch in active service with a portable set is indicated in Fig. 2. To use the powerful transmitting apparatus the switch must be placed in such a position that the delicate receiving equipment is entirely separated from the aerial and effectively insulated therefrom, the battery circuits must be broken and the detectors short-circuited and grounded; when the switch is changed so as to put the receiving apparatus in an operative condition the transmitting circuit is broken. Thus the switch device effectively protects all the apparatus by making it impossible to send while the receiving circuits are closed and vice versa. The aerial connected to the receiving apparatus is separated from the transmitting apparatus by means of an insulated microscopic air-gap termed an "anchor gap," in the transmitter circuits; otherwise the antennæ would be grounded through the inductance of the transmitting apparatus. Although this small gap is sufficient to insulate the vertical when receiving, it is practically a short-circuit for the high-tension oscillations produced when transmitting.

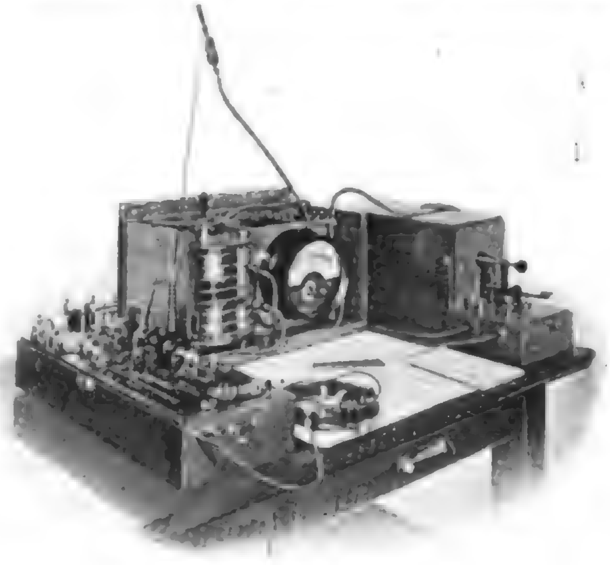


FIG. 2.—COMPLETE PORTABLE SET.

The transmitter equipment includes the usual spark-gap, inductance coil, condenser, high-potential transformer, interrupter, when direct current is used, and source of energy. Each of these parts possesses features of construction deserving special mention. The spark-gap is surrounded by a micanite tube, fitted with a window, which serves to deaden the excessive noise from the disruptures and yet allows the gap to be inspected at any time. It is placed within the inductance coil, as shown in Figs. 2 and 3. The inductance of the coil may be varied by shifting the position of the connecting terminal along the turns, so that, in connection with the proper capacity in the condenser, the transmitting circuits may be adjusted to give forth any desired length of electrical wave. The turns on each coil are carefully calibrated and the inductance for each position of the sliding terminal is indicated on the framework, while the mechanical mounting of the coil is such as to allow any desired inductance to be found at once by merely revolving the coil.

As a table giving the capacity of the condensers is also furnished, the operators can easily determine the wave lengths by the following formula:

$$\lambda = 2\pi V \sqrt{LC},$$

where λ = wave length,
V = velocity of light,
L = inductance,
C = capacity.

Difficulty has frequently been experienced in causing a spark-gap to operate continuously and to repeat its performance indefinitely, a gradual change usually taking place in the behavior of the gap. This change has been attributed to the heating and to the ionizing of the air surrounding the gap, and a remedy for the difficulty has been found in cooling the terminals of the gap and removing the air from the immediate neighborhood. In his latest equipments Mr. Massie builds the air-gap terminals of tubing through which air is forced under pressure. The terminals themselves are cooled by the expansive action of the compressed air, while the ionized particles are removed before they have accumulated in sufficient quantities to affect the operation of the gap by exhausting the expanded air through small openings in the ends of the rods. The expanding compressed air is also allowed to flow through the hollow turns of the inductance coil in order that the coil may be kept at a temperature lower than that which would otherwise be produced in the windings by the high-frequency currents. Needle valves control the admission of the compressed air to the inductance coil and the spark-gap rods; an electromechanically-operated valve in the main supply pipe is connected to the main controlling switch, so that the valve is opened when the transmitting circuits are in use and is closed at all other times.

A condenser for an 8-kw station set is shown in Fig. 3. The condenser is built up of plates of glass on which are secured sheets of tin-foil. The connections are so made that the glass itself becomes the dielectric, and the air is not depended upon either for insulation or for inductive capacity. Each glass plate with its two sheets, therefore, possesses a definite capacity, and the capacity in circuit depends upon the number of plates in use. The immediately near sheets of adjacent plates are connected together by means of a spring contact inserted between them. These contacts are mounted on rods, and the alternate rods are joined in groups to bus-bars, so that the active capacity of the condenser depends upon the number of rods which are "in" or "out." Since the air space separating adjacent plates is not subjected to any difference of potential, there is no possibility of a disruptive discharge between these plates. A leakage path through air is found, however, over the exposed sides and edges of each glass plate. For the purpose of improving the insulation and preventing the formation of corona, all of that portion of the glass not covered by the tin-foil and a limited section of the coil is given a coating of asphaltum varnish. This material is intended solely as an insulator and it contributes in no way to the inductive capacity of the condenser. It is used in preference to other varnishes as brush discharge is reduced to a minimum, thus producing a more defined period of oscillation and therefore sharp and true wave lengths.

The transmitting key is in each case similar to a telegraph sender key, and the apparatus is of such a nature that any one familiar with the Morse alphabet can send messages without additional instructions. With a small portable or boat set the key is connected directly in circuit with the primary of the high-potential transformer, as shown in Fig. 4. When the energy is obtained from a battery or a direct-current generator a mechanical interrupter is also inserted in the primary circuit, but when alternating current is used the interrupter is omitted. In a high-power land station where the heavy currents would tend to destroy the key, unless an extremely large and unwieldy one were used, the key is used merely to close a battery circuit to an electromagnetically-operated oil switch in the primary circuit of the high-potential transformer. (See Fig. 5.)

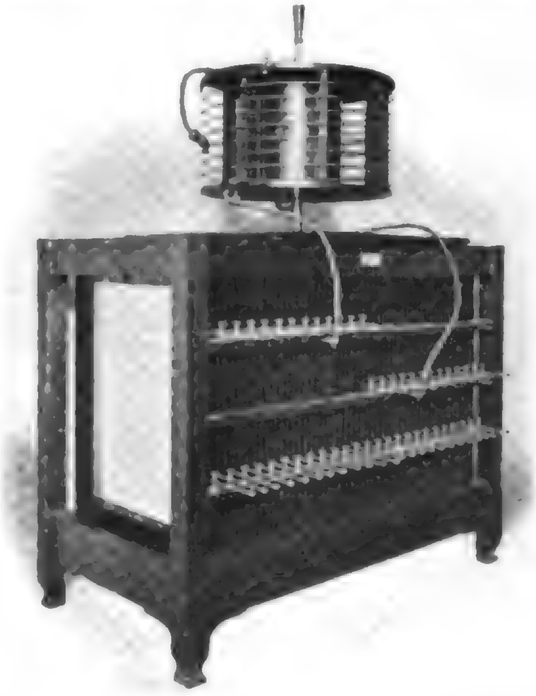


FIG. 3.—CONDENSER WITH INDUCTANCE COIL AND SPARK-GAP.

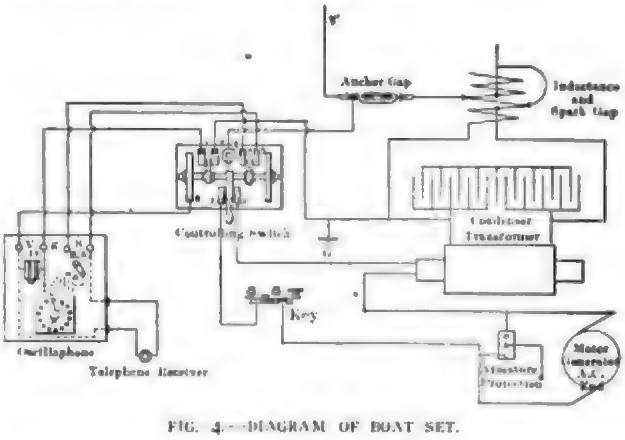


FIG. 4.—DIAGRAM OF BOAT SET.

The Massie detector is of the filings coherer type. Its most prominent feature is its sensitiveness, which may be attributed largely to the mechanical arrangement of the parts. The main axis of the device is placed in the vertical direction, so that the force of gravity assists in the action of the coherer. The coherer consists of a magnetized needle with its lower end supporting magnetic filings immediately above a mixture of non-magnetic filings—the former being of iron and the latter of silver. The filings are placed in a silver-lined cup which forms one terminal of the coherer, the magnetized needle being used as the other terminal. The needle causes the iron filings to be arranged in line just above the silver filings, with a minute film of air between them, thus forming an electrical path of high resistance. The effect of an electrical oscillation is to cohere the filings and to decrease the resistance and thus to allow a current to flow from a battery circuit through the coherer and a relay which in turn operates a bell alarm and a tapping device, which latter decoheres the filings and restores the resistance to its normal high value. The main features of this coherer were discussed in the article referred to above. On a flexible brass strip is securely mounted the silver-lined cup, and to this is fastened a substantial glass tube which serves for holding the needle in place. The tapper strikes against the brass strip, but does not come in contact with the glass tube so that the breaking of a tube by the tapper is unknown. The filings are completely enclosed and the performance of the coherer is not affected by atmospheric changes, while the effect of external mechanical disturbances is negligible. When cohered the resistance is less than 50 ohms, often being less than one ohm, thus an inexpensive relay can be used, which is an important factor in the cost of manufacture. The coherer with its bell alarm remains in circuit at all times when messages are not being transmitted or received, and to it is given the task of announcing when a distant operator wishes to communicate with the home station. Sensitiveness, simplicity, reliability and immunity from derangement are prime requisites for such a device, and this coherer seems to fulfill these requirements successfully.

After the coherer has announced that a message is to be sent from some distant station, the operator at the home station moves the main circuit-controlling switch so as to connect the aerial to the receiving apparatus. The predominating feature of the receiver is its ability to withstand rough treatment. It is of the microphonic type, and, mechanically considered, is extremely simple. The "oscillaphone," as the inventor terms the device, consists of a steel needle held in contact with two sharp edges of carbon by means of a small permanent magnet. The terminals of the oscillaphone are formed by the two carbon compound (carbon and paraffin) strips. The resistance of the two contacts between the carbon edges and the needle is normally about 40,000 ohms. When the contacts are included in the aerial circuit, the resistance decreases to less than 1,000 ohms, while electrical oscillations are being received, and it then automatically increases to its initial value when the oscillations cease. The oscillaphone is connected simultaneously in series in the aerial circuit and in a local battery circuit containing an ordinary telephone receiver wound to 1,400 ohms resistance, in order that the signals may easily be interpreted. The loudness of the signals received is adjusted by means of variable resistance inserted in series in the local battery circuit or in shunt to the oscillaphone; the effectiveness of the adjustment is ascertained by the use of a miniature electric wave producer which consists of a pocket-size primary cell connected to a magnetic make-and-break contact device, so that the operator need not depend upon signals from other stations for testing the effectiveness and sensitiveness of the oscillaphone.

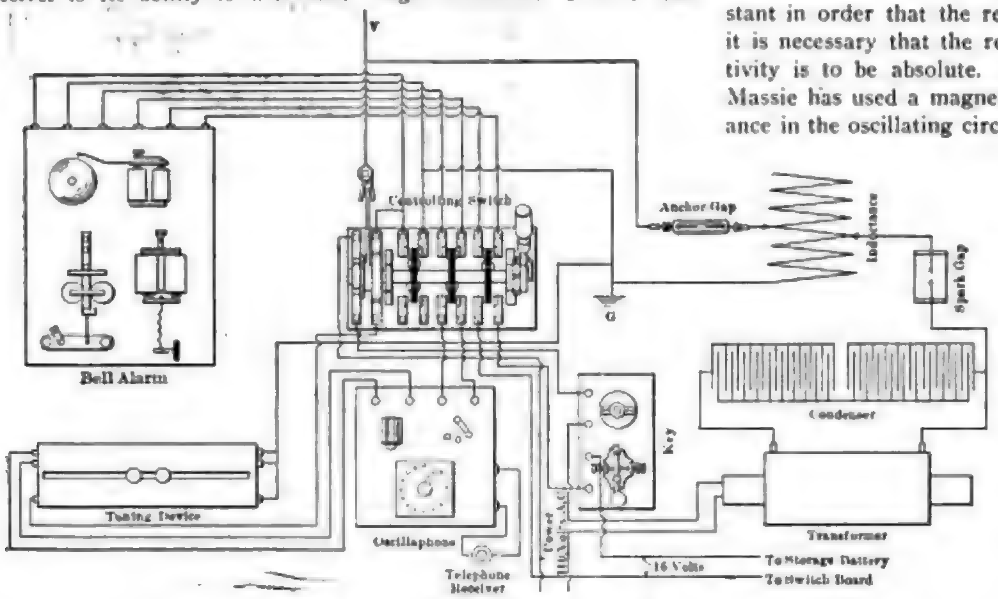


FIG. 5.—DIAGRAM OF LAND STATION.

For the purpose of eliminating from the oscillaphone such messages as may not be intended for the particular station in question, an inductance coil is used in series with a condenser, the inductance and the capacity being so adjusted as to render the combined circuits resonant at the single frequency selected for this station. It is stated that messages which differ in frequency as much as 20 per cent from that for which the receiving apparatus is adjusted will not affect the oscillaphone. The resonant frequency depends largely upon the inductance and the capacity, and it varies only slightly with the resistance in circuit; the sharpness of the tuning, however, depends to a great extent upon the resistance. It is desirable, therefore, that the resistance be constant in order that the resonant frequency may not change, and it is necessary that the resistance be small in value if the selectivity is to be absolute. In some of his latest equipments Mr. Massie has used a magnetic type of receiver in which the resistance in the oscillating circuit is constant and of a negligible value. In this device the telephone receiver circuit is inductively related to the oscillatory circuit. Through the common magnetic paths of the two circuits is moved slowly an iron wire which has been subjected to the influence of a permanent magnet. When a high-frequency current flows in the oscillatory circuit the iron wire suddenly loses its magnetism, and the great rate of change of magnetic lines interlinked with the telephone receiver circuit generates therein an e.m.f. which causes the production of a sound in the receiver. The "iron wire" which is built up of overlapping and concentrically arranged spirals of wire, is moved along the face of the permanent magnets and through the coils by means of a driving mechanism similar to that used in a phonograph. The tuning obtained is claimed to be remarkably sharp and complete.

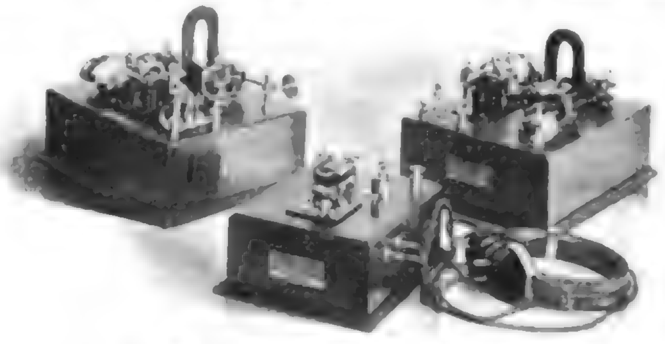


FIG. 6.—BELL SETS AND OSCILLAPHONES.

That the Massie apparatus has passed beyond the experimental stage will be appreciated when it is known that the United States Navy has obtained two 15-kw, two 10-kw, three 5-kw and three 3-kw sets; one of the 15-kw sets is being installed at the Washington Navy Yard, the other will be installed at the Brooklyn Navy Yard and the eight sets, ranging in power from 3 to 10 kw, are for the Pacific Coast. Previous to this contract the Massie Company installed for the United States Navy a 3-kw set at Cape Henlopen, Del.; a 5-kw set at Beaufort, N. C., and a 5-kw set at Charleston, S. C. The United States Signal Corps has obtained two portable sets, while three sets are being used by the Coast and Geodetic Survey. The boats of the Fall River, Providence, New London and New Haven Lines are equipped with Massie wireless apparatus. In addition to the above, commercial land stations are located at Block Island, R. I.; Point Judith, R. I.; Wilson Point, Conn., and Cape May, N. J.

Atmospheric Electricity and Trees.

By Prof. A. G. McAdie, U. S. Weather Bureau.

I. EFFECT OF SUNSHINE ON TRANSMISSION OF WIRELESS MESSAGES.

In 1897, during the experiments made by Marconi, Slaby and others in wireless telegraphy, it was noticed that more favorable results were obtained in the transmission of electromagnetic waves over sea surfaces than over land. Moreover, if trees stood in front of or near the transmitting devices the messages were received with difficulty. In Marconi's long-distance experiments in 1902, it was evident that transmission at night was more effective than during the day. It was possible, for example, to send 1,500 miles at night when with practically the same adjustment the limit in the daylight was about 700 miles. This difference Marconi attributed to the discharging influence of sunlight upon the vertical wires. It will be remembered by those familiar with the experiments of Hertz, that he noticed the influence of light upon the terminals of the discharge knobs. Unless the discharging surfaces were kept highly polished, the breaking down of the air-gap was gradual. Minute roughnesses, dust, etc., caused a rapid loss; and ultra-violet light falling on the vibrator prevented its proper working. Indeed Hertz mentions that the knobs of his vibrator had to be cleaned every fifteen minutes. The experiments of Elster, Geitel, Wilson, and others have been based largely upon this principle of the discharge of highly electrified bodies, by sunlight. In the experiments aboard the *Carlo Alberta*, the disturbing influence of sunlight was again plainly demonstrated, and Lieutenant Solari showed that while sunlight lasted, a greater expenditure of energy was necessary.

Perhaps the most noteworthy paper lately written in connection with wireless work is that of Major George O. Squier, U. S. Signal Corps, upon "The Absorption of Electromagnetic Waves by Living Vegetable Organisms," published in December, 1904. In this paper, there is discussed the action of trees as conductors of electricity and the possibility of using trees as receivers of wireless messages. In a number of experiments, Major Squier has utilized trees as receiving stations.

An illustration of some of the experiments is given in Fig. 1, in which *N* and *P* are nails driven into a tree; *M* a microphone or receiver. In these experiments a small ebonite tube filled with carbon dust and having two steel needles nearly touching was used. *T* is a telephone and *B* a battery. The transmitting coil gave a 4-in. spark; the wave length employed was about 300 ft. (91.4 meters); and the frequency in free space about 3.27×10^6 per second.

It was shown that a marked difference in efficiency was noticeable with various trees, and that a tree with a small amount of leaf surface, and generally dry and unhealthy gave poor results—and that a dead tree behaved practically as an insulator. In live trees the electromotive force of the tree will vary with change in the weather. In Squier's experiments a curve of volt-time variations of a large eucalyptus tree was obtained in the rough by using a standard milli-voltmeter. The resistance of the tree was about 6,150 ohms. The interesting feature of the record appears to be that the maximum changes occurred at times when the general influence of the sun during the day is withdrawn for the night (6:30 p. m. to 9 p. m.) and when this again appears in the morning (6:30 a. m. to 9 a. m.). The significant statement is made that resistances were more easily measured at night than in the day, as the balancing of the bridge was then more readily obtained.

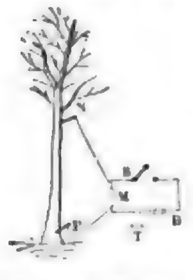


FIG. 1.—TREE AS WIRELESS RECEIVER.

Such changes might well be studied with the aid of self-recording multiple quadrant electrometers, and the fact established whether or not during the night hours there is a minimum of electrical activity in the atmosphere while during sunlight a rapid ionization goes on, resulting in a marked disturbance of the electrons and a consequent dissipation of electrical energy. Making use of this principle it might be possible to devise a sunshine recorder more sensitive than those now in use.

II. BEHAVIOR OF TREES DURING THUNDER STORMS.

Particularly interesting and of great practical value is a knowledge of the behavior of trees under great electrical strain, as for example during thunder storms previous to the beginning of rain. The question has a practical significance if it be remembered that probably the majority of the lives lost annually not only in the United States, but throughout the world, by lightning, are those of persons standing under trees for shelter. The loss of stock and sheep is also largely through this same cause, although in certain parts of the United States the barbed wire fence is equally dangerous. Furthermore no inconsiderable number of forest fires are started by trees which have been struck by lightning.

Satisfactory explanations of the reason why some trees are apparently so much more liable to lightning stroke than other trees have not yet been given. The oak is especially liable to injury, and the beech only infrequently struck. The character of the root system is believed to be an important factor, more so probably than the nature of the wood or even the moisture content, though this last needs careful study. An important matter, as is shown in experiments noted below, is the condition of the tree. Living vegetable organisms behave differently from decaying, or dead vegetable fiber. A dead tree may be expected to act as a flag pole and it has been noted in the case of certain flag poles struck by lightning that the splintering effect was most pronounced at the top. In the living tree it would appear that the shattering or splintering effect is most pronounced in the trunk about midway between the ground and the foliage. There may be some connection between this and the fact that people are so infrequently struck when standing under trees.

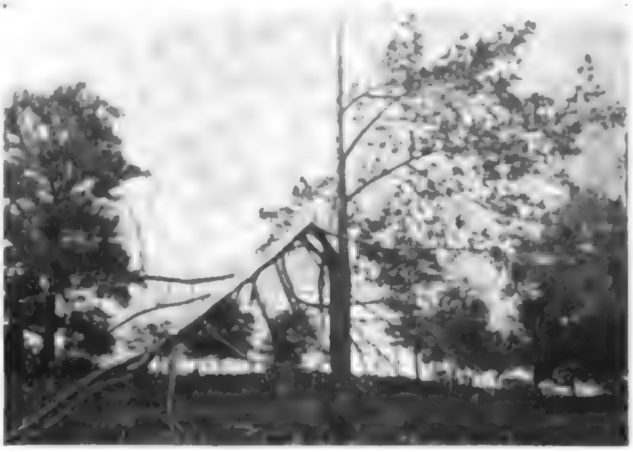


FIG. 2.—EFFECT OF LIGHTNING ON A POPLAR TREE.

Prof. Oliver J. Lodge once pointed out that with a wire joining the outer coats of two equally insulated Leyden jars, side flashes were strong at either end of the wire and not obtainable at the middle, the middle being in fact an anode. In the case of a tree there is a large collecting capacity in the foliage, connected with an infinite conductor, the ground; by a vertical resistance, the trunk of the tree, which is in fact a column of vegetable cells filled with conducting fluids. With electrical oscillations of high frequency the conductivity becomes a matter of the amount of surface area rather than of the volume, and it is likely, therefore, in the case of lightning that the oscillations are very rapid and the conducting layer is either the outer bark or the cambium. Dead vegetable matter, thoroughly dried, acts probably as an insulator. An account of the relative liability of different kinds of trees to lightning stroke is given in "Lightning and Electricity of the Air" by McAdie and Henry, *Bulletin No. 26*, U. S. Weather Bureau, pages 64 to 69. It has also been shown by Jonesco that fresh wood of trees rich in fatty materials is a poor conductor, while fresh wood rich in starchy material is a good conductor.

Some illustrations of the effect of lightning upon trees are given herewith. Two photographs, indicating the effect of lightning on a poplar and a chestnut, Figs. 2 and 3, made by Mr. E. B. Calvert, show characteristic splintering. The following extract from the *Bulletin* referred to above describes the effect of lightning upon an oak and a walnut:

"In general, the effect of lightning stroke on trees is to plow one or more furrows down the side, as shown in Fig. 4. The tree in this illustration is a black walnut a little over two feet in diameter, situated on the edge of a forest and about 100 paces from a barn, which together with a dwelling house, the latter surrounded by locust trees, stands on the knob of a slight eminence. The tree was struck in January, 1899. A much more destructive effect is shown in Fig. 5. The tree in this case is an oak 16 in. in diameter and about 50 ft. high. It was struck in the summer of 1898, and the photograph from which the illustration was made was taken in March, 1899. The trunk of the tree lies on the right side of the tree as it fell; it is not very clearly outlined in the photograph on account of the dead leaves that still cling to the branches. The remarkable feature in this case is the fact that there is not a single vestige of the effect of the lightning stroke on the prostrate trunk above the point of fracture or splintering. It would seem as if the entire force of the discharge was felt only at the point of fracture. The ground at the root of the tree was not disturbed, and save for a slight crack, the stump is intact at the surface of the ground. Another, and somewhat similar case of complete fracture of the trunk of a tree by lightning, was observed in the same neighborhood. In the latter case there was less splintering, probably owing to the toughness of the wood, red cedar and the stump showed no injury below the point of fracture. Unfortunately, the top of this tree had been cut up for fuel and carried away before we could examine it."

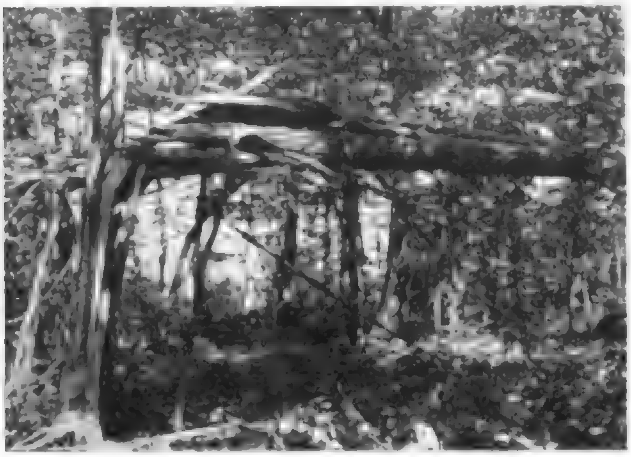


FIG. 3.—EFFECT OF LIGHTNING ON A CHESTNUT TREE.

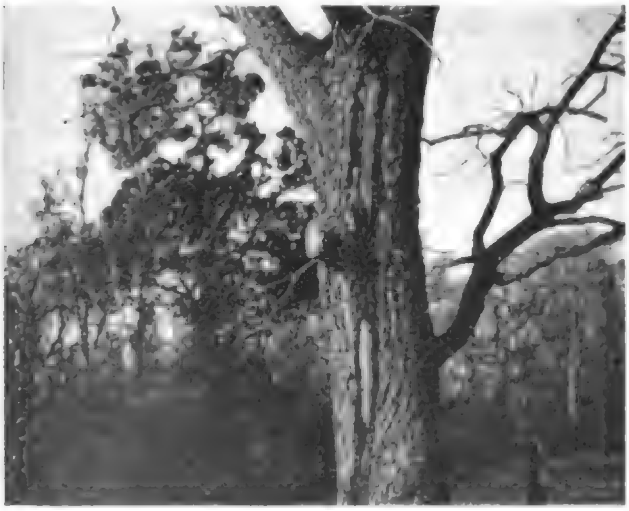


FIG. 4.—EFFECT OF LIGHTNING ON A WALNUT TREE.

In a tree there are, proceeding inward from the outer edge, first the bark, then the cambium, the wood and the pith in the order named. The cambium is the portion which probably acts as a conducting layer. Cross sections of trees which have been struck by lightning should be obtained and studied.

While there are doubtless marked rises in potential at the top and bottom of a tree, due to electrical surging, it is necessary to consider as equally important the "ground" which the root of the tree makes. Experiments might be made with a view of determining whether a metallic conductor from branch to earth would protect the tree. Excellent telephonic "grounds" have been obtained by utilizing the root systems of trees. Squier states that in a wooded country, "a much better ground could be obtained by attaching the earth side of the instrument to an iron nail driven into the trunk of a tree or shrub than by the ordinary and more laborious method of burying a conducting plate, or by driving an iron spike into the earth itself . . . "

It is found that the conductivity of a healthy living tree is often so good that a ground may be had by simply touching a wire to an upper branch or twig. Experiments indicate that there are limitations to the use of trees as grounds. The root of a tree is a modified trunk. The cambium being practically continuous, an old root resembles a trunk in that it has concentric layers; the innermost of woody fibre is dead, and the outer layers or feeding roots alive and capable of absorbing moisture. Root systems differ for different trees, and it is more than likely that they play a determining part in the fracture of trees by lightning.

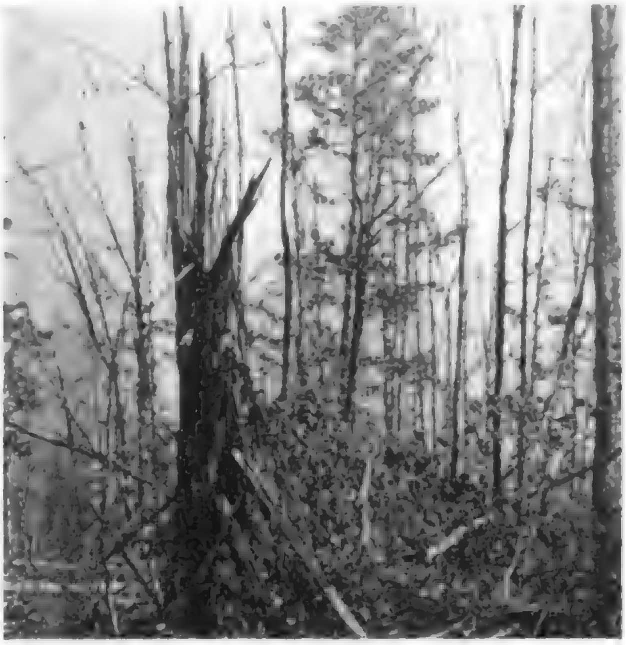
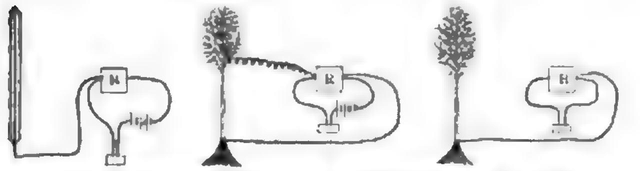


FIG. 5.—EFFECT OF LIGHTNING ON AN OAK TREE.

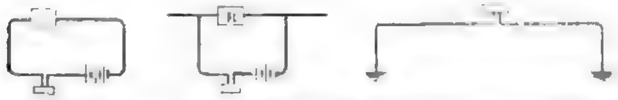
The line of strain from cloud to earth, consists of the charged surface of the cloud, one plate of the condenser, the intervening air column or dielectric, and the branch-trunk-root-earth system, or other plate of the condenser. When the electric strain exceeds the dielectric strength, the break-down, or fracture, occurs; the main line of fracture shown by the streak of incandescent air which we call a lightning flash and the minor ramifications are the branch discharges. Photographs show some of the more prominent of these minor breaks; but there must be a large number which pass without notice.

In some experiments made by the writer at the top of the Washington Monument and elsewhere, it was shown that the needle of a quadrant electrometer could be successfully used to indicate the degree of strain in the air during the passage of a thunder cloud. Moreover the equalization of potential caused by every discharge could be detected, and it was discovered that numerous discharges which otherwise passed unnoticed could be thus detected. These experiments should be repeated and some measurements made of the relative frequency and intensity of the discharges of all natural condensers. It might also be practicable to study the differences of potential between the tops of trees and the roots; and to determine whether the trunk portion of a tree maintains the potential of the ground during a thunderstorm, or whether there are momentary marked differences of potential at points on the trunk system, and corresponding nodal points increasing liability to side flashes. The effect of lightning upon trees might also be studied by microscopic analysis of wood specimens.



FIGS. 6, 7 AND 8.—DIAGRAMS OF EXPERIMENTS 1, 2, 3 AND 4.

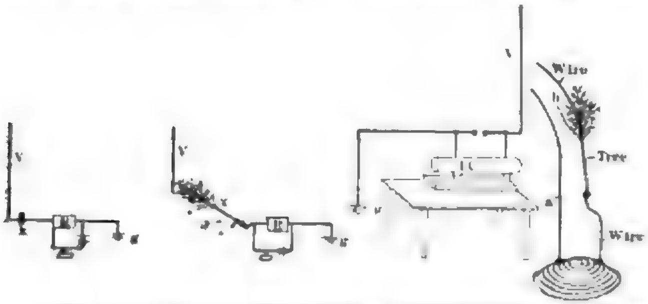
Some interesting observations upon trees struck by lightning are given by K. E. F. Schmidt in *Elektrotechnische Zeitschrift* for September 7, 1905. The track of the discharge seemed to be along certain grooves, following the grain of the wood. By injecting staining fluid in the roots of some maples and oaks it appeared that this was carried slowly up the trunk in certain narrow paths. It was therefore argued that the electric discharge probably passes from the top branches to the roots along these paths. For wireless work one connection should be made at that portion of the trunk where one of these lines of communication can be tapped, and the other connection with the branches corresponding.



FIGS. 9, 10 AND 11.—DIAGRAMS OF EXPERIMENTS 4, 5 AND 6.

III. A POSSIBLE COLLECTOR FOR ATMOSPHERIC ELECTRICITY.

In 1887 Rowland and Morrill devised a mechanical collector to take the place of the Thomson water-dropper in common use. The principal objections to the water dropper are the change in head, the varying character of the jet and the freezing of the water during winter months. The mechanical collector referred to above, which was described in the report of Prof Mendenhall, consisted of a revolving arm driven by heavy clockwork, which arm alternately covered and uncovered the cap of an insulated conductor called the inductor. The arm was connected with earth. The inductor was alternately connected with the ground and to an electrometer. No definite results were obtained with this collector owing to causes beyond the control of the designers. There is no reason to think that a mechanical collector constructed on these lines would not be efficient. An improvement might be effected by the substitution of two rubber discs, carrying metallic sectors, the discs revolving in opposite directions. In place of water dropper, nitrate of lead, match or flame collector, a collector using mercury, might be employed, the drops falling between the faces of the discs and being caught in a proper receptacle and returned to the dropper mechanically. A constant pressure could easily be maintained. It might also be desirable for comparative studies to provide a chloride of radium receptacle on the collector.



FIGS. 12, 13 AND 14.—DIAGRAMS OF EXPERIMENTS 7 AND 8.

IV. WIRELESS EXPERIMENTS WITH TREES

Mr. W. W. Thomas, in charge of the Weather Bureau office at Mount Tamalpais, made the following experiments, bearing chiefly upon the conductivity of freshly cut trees. The apparatus used consisted of two aerials, each 20 ft. in length and composed of seven strands of No. 14 copper wire. The receiving set consisted of a portable outfit, comprising a wave detector and necessary adjuncts. The sending set consisted of the usual coil and aerial and a special device for making and breaking.

Experiments 1, 2, 3 and 4.

The object of the experiment indicated in Fig. 6 was to test the effectiveness of the apparatus. A portable receiver, *R*, was connected with the vertical, there being no ground connection. The signals could be plainly heard in the telephone.

The object of the experiment of Fig. 7 was to test Squier's statement that electromagnetic waves are received by a living tree. Receiver, *R*, was connected with a living bush having luxuriant foliage, 15 ft. high and 200 ft. from sending station. The signals were heard easily, thus confirming Squier's view.

The object of the experiment indicated in Fig. 8 was to eliminate the foliage and the trunk of the tree and test electromagnetic effects through the ground. The signals were heard, but less distinctly.

Experiments Nos. 4, 5 and 6.

The object of the experiment shown in Fig. 9 was the elimination of trunk and roots, and to test whether signals could be heard with the receiver insulated. Neither ground wire nor vertical was used. The signals were heard.

Fig. 10 shows the circuits used to test the capacity of two insulated wires, each 25 ft. in length, connected with the receiver only. The signals were heard distinctly from a distance of 600 ft.

Fig. 11 shows the circuits when two wires were connected with a telephone receiver and the loose ends earthed 30 ft. apart. No battery was used. The vertical was removed from the induction coil, but one terminal of the coil remained connected with the earth. The signals were heard distinctly. It is seen, therefore, that electromagnetic effects can be detected regardless of trees and roots, unless it be that the surrounding trees and root systems act as antennæ.

Experiment No. 7.

The receiving apparatus was set up as shown in Fig. 12, 600 ft. from the transmitting station, and the strength of the signals (which were clear and very distinct) were carefully noted.

The vertical was parted at *X*, and a thrifty, live bush, full of sap, and about 10 ft. in length, which had just been cut off at the roots, was introduced into the break, as shown in Fig. 13, at *B*; the bush thus became a part of the aerial; not the faintest signal could be heard. The arrangements were alternated a number of times with the result that signals were always heard with 12 and never heard with 13. The bush failed to conduct the oscillations. The effect is the same as introducing impedance.

Experiment No 8.

The sending apparatus was set up near a large coil of cable (lead-covered). The spark-gap was set at about one-eighth inch. Two wires, *a* and *b* (Fig. 14), were attached to the sheathing of the cable and the loose ends placed conveniently near the vertical; *b* was parted and a live bush was introduced into the break. Upon touching the vertical with *a*, while the coil was in operation sparks ceased to cross the gap, but touching the vertical with *b* made no apparent reduction in the amount of spark crossing the gap.

Experiment No 9

The vertical was erected at a railroad track 300 ft. from the wireless station. A capacity was used as a ground for the receiver. An insulated wire, *O* (Fig. 15), was connected with one of the rails of the track, and the loose end was placed conveniently near the receiver. An insulated wire, *M*, was connected 10 ft. above ground to a young tree 30 ft. in height, and the loose end of the wire placed near the receiver. Loud and clear signals were heard through the receiver without either *O* or *M* being connected with the receiver. Upon holding *O* against the vertical at *X* the signals disappeared at once. On removing *O* and connecting *M* with the vertical at *X* the signals reappeared as clearly and distinctly as at first; *O* and *M* were alternately connected at *X* several times with the same results in each case, as first shown. The contact, *M*, was then moved down the tree and again alternated with *O* in connections with *V* at *X*, but with the same results. The wire, *O*, would readily conduct the electrical oscillations from the vertical to the ground at the rail, thus cutting out the receiver entirely, but the tree would not so conduct the oscillations from the vertical to the ground. Changing the position of *M* on the tree made no apparent difference in the results obtained.

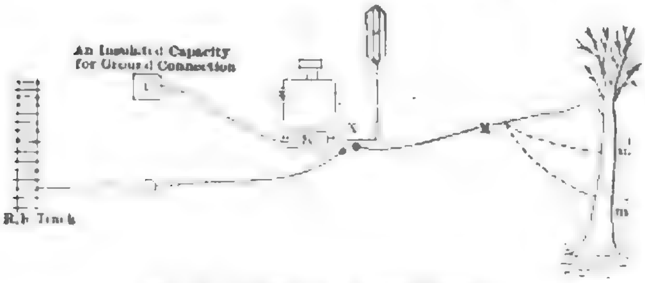
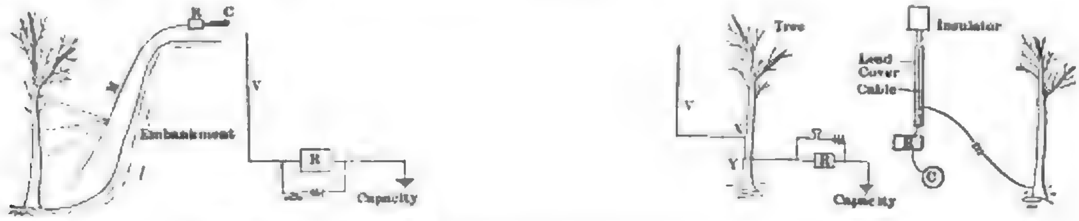


FIG. 15.—DIAGRAM OF EXPERIMENT 9.



Figs. 16, 17, 18 and 19.—Diagrams of Experiments 10, 11 and 12.

Experiment No. 10.

While making experiment No. 10 it was found that a long insulated wire hanging over an embankment acted as a vertical; hence the arrangement in this experiment. The upper end of the wire, *M*, was connected to the receiver, and signals were heard distinctly. Connecting *M* to a small tree 30 ft. below made no apparent difference in the strength of the signals; *M* was connected further and further down the tree, but the results remain unchanged.

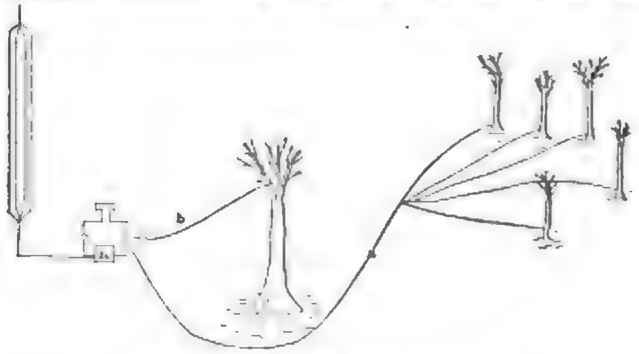


FIG. 20.—DIAGRAM OF EXPERIMENT 13.

Experiment No. 11.

The receiving apparatus was arranged as shown in Fig. 17. The signals were loud and clear. The vertical was then released from the receiver and connected to a small tree at a point, *X*, three or four feet from the ground (Fig. 18), while the receiver was connected by a short wire to the same tree at a point, *Y*, about one foot from the ground. Not the faintest signal could be heard. The contact, *X*, was made closer and closer to *Y*, but still no signals were heard. When *X* and *Y* were finally brought in contact the signals reappeared with the same strength as when the vertical was connected as shown in Fig. 17. This is similar to the second part of Experiment 8, and proves that the tree trunk acts as an impedance. The same result would follow by the introduction of a choke coil. Squier notes that even 100 ohms will materially modify the signals.

Experiment No. 12.

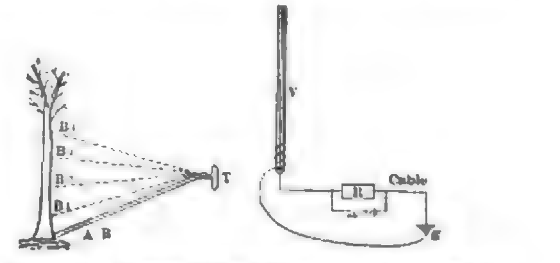
A section of nine conductor, lead-covered cable, 15 ft. long, was suspended in free air from an insulator, as in Fig. 19. The sheathing was ground by a wire, *m*, leading to the root of a tree. On connecting the cable wires to the vertical pole of the receiver, the signals were heard distinctly. The distance was about 600 ft.

Experiment No. 13.

The vertical used was 50 ft. long, and cage shaped. A primary ground wire of insulated copper wire with several branches was connected to green scrub oaks at the earth line, as indicated in Fig. 20. A secondary ground consisting of a single copper wire was connected to the top of a green scrub oak. Signals from the sending station, 400 yards distant, were plainly heard without any ground connection and receiving box insulated from earth. The signals were slightly increased on introducing a primary ground. When both the vertical and the primary ground were connected to the vertical post, the signals were greatly reduced, but were not entirely eliminated. The secondary ground wire had no effect whatever upon the strength of the signals.

Experiment No. 14.

The two wires of a head telephone, *A* and *B* (Fig. 21), were connected near each other at the base of a tree. No signal was heard. When *B* was moved higher, as shown at *B*1, *B*2, *B*3, the signals increased in strength until *B*4 was reached. When the terminals were left at *A* and *B*4 and the vertical was disconnected from the induction coil, signals were heard as before. When the vertical was replaced, and the ground wire of the coil was disconnected no signals were heard. The distance was about 50 ft.



FIGS. 21 AND 22.—DIAGRAMS OF EXPERIMENTS 14 AND 15.

Experiment No. 15.

For this experiment there was used a section of lead-covered cable (Fig. 22), 15 ft. in length, having its sheathing earthed, and its inner wire connected to *R*, and no electrical connection between the sheathing and the inner wire. A roll of wire netting having a fine mesh was wrapped around *R*, completely covering it, top, bottom and sides. The telephone wires were kept entirely within the wire covering. Signals were heard, and they were scarcely less distinct than those heard when the netting was removed. The only openings in the wire covering were those just sufficient to admit the aerial and the ground wire. However, these openings, though small, were sufficient to admit enough radiations to distinctly affect the receiver.

The following apparatus was used in these experiments: Two aerials, each 20 ft. in length and composed of 7 strands of No. 14 copper wire. One of these aerials together with a portable receiving set constituted the receiving outfit, while the other aerial together with a small induction coil actuated by the current from four dry cells constituted the sending outfit. The maximum spark length used was one-fourth inch.

An automatic device for operating the sending apparatus during the absence of the writer in making the experiments was devised and put in operation. This consisted of a tipping water bucket arrangement actuating a mercury commutator. During part of the time occupied by the bucket in tipping from one position to another, a circuit was completed. A gallon of water was sufficient to operate the device for several hours.

The Boston Edison Company's Natick Station.

In the extension of its distributing system to the westward the Edison Electric Illuminating Company of Boston has found it necessary to establish sub-stations at important centers of population, in several cases replacing old steam plants by modern transforming and distributing equipment. The lines of this company now reach as far west as Holliston, a town about 25 miles from Boston. The main generating plant of the system at L Street, South Boston, supplies power to a large number of cities and towns outside the limits of Boston proper, and the Natick and South Framingham district is served through a 900-kw distributing station located in the town of Natick on the Saxonville branch of the Boston & Albany Railroad. Several features of this station are of interest in view of its replacement of the old belt-driven steam plant which formerly supplied the Natick territory with electricity.

The Natick station or "Station No. 23," as it is known on the Edison system, at present supplies current for lighting and power to the towns of Natick, South Framingham, Ashland, Cochituate, Holliston and to the sections known as Saxonville, Framingham Centre and also the street lighting of the town of Wellesley. All the power and light sold in this territory is supplied by 60-cycle alternating current. The current is generated at the L Street station in South Boston, transmitted to the Zeigler Street sub-station in Roxbury and thence to the Dedham sub-station, whence it is brought into Natick at a potential of 6,350 volts in three three-phase circuits. About half a mile of the Natick lines is placed underground, between the station and the town center.

In order to remodel the old power house it was necessary to tear out all the equipment which had formerly carried the load in the territory served, and to install an entirely new outfit in the renovated area. The old power plant consisted of a boiler room and an engine room with a low basement beneath the latter, the station being a brick structure with a tar and gravel roof. These two rooms were retained in laying out the new plant, the old brick stack being painted white and labeled "Edison Light" in striking letters for the benefit of passersby. An illuminated sign is also in use on the stack as noted elsewhere in this issue.

The sub-station is characterized by ample room and excellent natural light supply. The old boiler room is now occupied by an H. B. Smith No. 2 Mercer boiler for steam heating the building, special toilet and washing facilities for the employes and a linemen's storeroom, which is partitioned off with a screen from the rest of the room. The water for washing is electrically heated by a 40-gal. tank supplied by the Simplex Electric Heating Company, of Boston, the coil operating at 110 volts alternating. The basement is unoccupied, except by induction regulators connected in the outgoing lines.

The engine room of the old plant is now the transformer and switchboard room. It is 54 ft. long by 48 ft. wide, with a concrete floor and a roof supported by wooden trusses. It contains a row of high-tension switch cells, 900 kw in transformers, a distributing switchboard, storage battery charging set and four 50-light tub transformers with appropriate panels for arc lighting service. General views of the transformers and switchboard equipment, the former also showing the wiring to the transformers, are given herewith. Probably the most interesting feature of the sub-station is the great flexibility of its electric wiring, although another interesting point is found in the fact that there is not a revolving piece of machinery in the plant, with the exception of the battery charging motor-generator set and the transformer blowers.

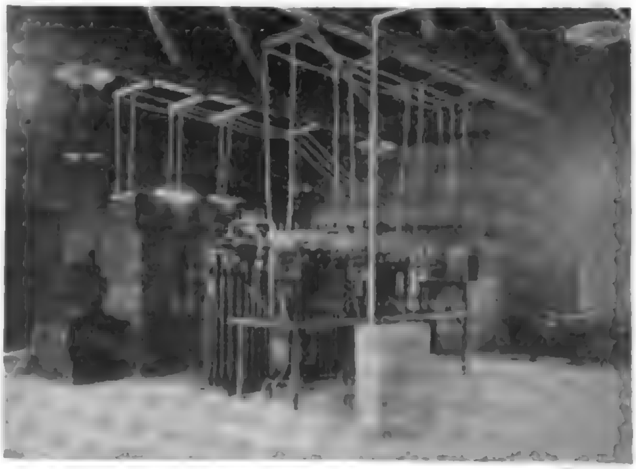


FIG. 1.—TRANSFORMER BANKS AND HIGH-TENSION CELLS.

The 6,350-volt current from Dedham enters the station in three circuits brought up through the floor behind the switch cells, in insulated lead-covered cables. After passing through end bells and current transformers the current is led to the switch cells. There are six of these cells occupying a space 20 ft. long and 3 ft. 8 in. wide, with a clear space of 3 ft. 1 in. between the cells and the wall. There are six double-throw, triple-pole automatic oil switches here, and two sets of three-phase bus-bars. Any incoming set of lines can be thrown upon either set of buses. From the 6,350-volt buses are supplied the transformer banks, as shown in the diagram. There are two sets of stationary transformers and a group of tubs. The stationary transformers consist of three 200-kw air-blast units and three oil-cooled, 100-kw transformers, delta-connected in the primaries and star-connected with a neutral wire in the secondaries. The secondary voltage is 2,300.

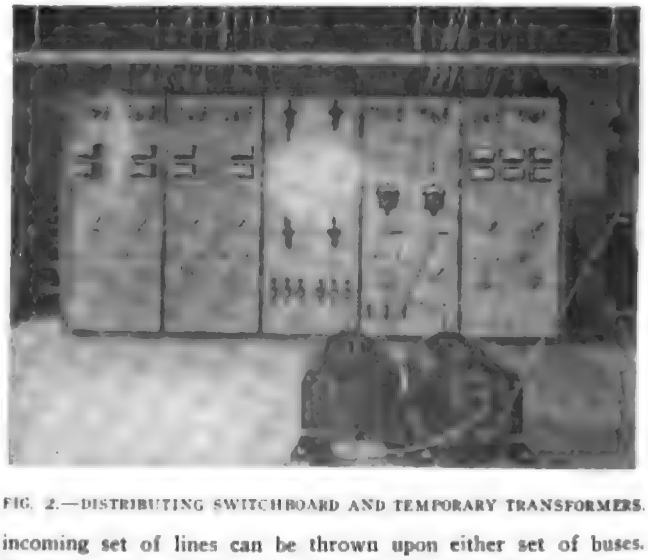


FIG. 2.—DISTRIBUTING SWITCHBOARD AND TEMPORARY TRANSFORMERS.

The high-tension air-blast transformers are cooled by two 35-in. Buffalo Forge Company's blowers, each driven by a 2-hp, 220-volt, three-phase induction motor. Disconnecting oil switches hand-operated are provided in the high-tension lines at the transformers and knife switches in the secondary leads. Recording and indicating wattmeters are installed with suitable transformers in the high-tension side of the station between the oil switches and the transformer primaries. All 6,350-volt lines are run overhead through the station in plain sight, and the wiring is painted white to render it conspicuous.

The battery-charging set consists of a 10-hp Wagner single-phase induction motor wound for 104 volts and direct-connected to a 57-amp., 115-volt Wagner generator running at 1,800 r.p.m. A charging panel is installed in connection with this set, which is used for electric automobile charging, which is rapidly becoming an important feature of the service.

The distributing switchboard consists of five blue Vermont marble panels upon which are mounted the various automatic oil switches and instruments controlling and measuring the outgoing leads. This board carries 2,300-volt service in two sets of four-wire, three-phase bus-bars. Either set of transformer secondaries can be thrown upon either set of buses, and any outgoing circuit can likewise be transferred from one bus group to the other. The auxiliary circuit for the release of oil switch trip coils is operated at 110 volts. Each outgoing circuit is equipped with an Elden circuit-breaker, potential and current transformers, induction regulator and recording wattmeter. The oil switch relays are connected so that if a heavy overload occurs upon any phase the other phases from that bus-bar set will be open-circuited. The distributing circuits are mainly single-phase lines, none smaller than No. 2 wire being used. The 2,300-volt buses are built up of 300,000-c.m. cable, and the distributing board is installed 7 ft. from the nearest parallel wall.

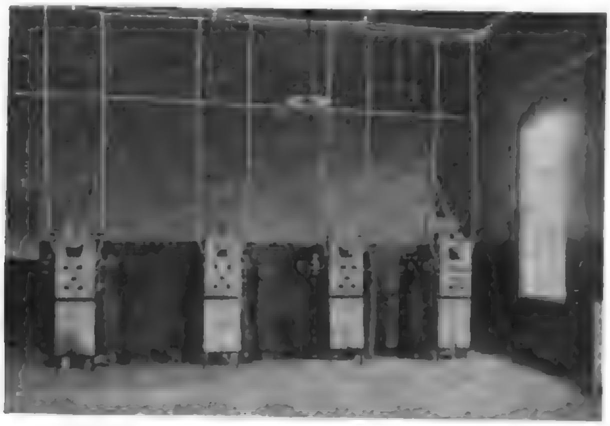


FIG. 3.—CONSTANT-CURRENT TRANSFORMERS.

The tub transformers are supplied by a single set of three-phase bus No. 0 leads running overhead from the 6,350-volt oil switch compartment to the group of tubs. Totalizing wattmeters, indicating and recording, are connected between the oil switch compartments and the transformers, and one lead of each outgoing alternating-current arc circuit is equipped with a Palmer short-circuiting trip which prevents the building up of high potentials as the transformer coils come together, by opening the primary circuit at the moment the break occurs in the secondary.

The 6,350-volt buses are of No. 0000 section. The Wellesley street lighting circuit is entirely of the incandescent type at present, so this line is taken off the 2,300-volt distributing board; the two transformers shown on the floor in the cut being merely temporary. The circuit-breakers in the plant are all of the Condit type and all the rest of the electrical equipment was supplied by the General Electric Company. The lighting of the distributing switchboard is very effectively accomplished by a series of five 16-cp incandescent lamps set in a long horizontal reflector, shown in the illustration. The incandescent lamps are mounted on the switchboard itself. The transformer room is lighted by nine four-light clusters of 16-cp units, and the distributing switchboard is 16 ft. long and 7 ft. high. The middle panel is devoted to the transformer secondaries and the outgoing lines are controlled by the others.

The Diversion of Water from Niagara.

By Alton D. Adams.

Water diverted from the Great Lakes or Niagara River reduces by just so much the volume that goes over the Falls, but the relative effects on the two cataracts depend on the point at which the diversion takes place. The Chicago Drainage Canal which diverts Lake Michigan water to the Mississippi River, the Welland Canal which carries water from Lake Erie to Ontario, and the Erie Canal which allows water from the lake of that name to flow over the Niagara escarpment, all lower the river level along its entire length above the Falls. Such general reduction in the level of the upper river diminishes the volume of water at both the American and the Horseshoe Falls, but the effect on the former is much the more notable, because the bed of the channel on the New York side of Goat Island is as much as ten feet higher than that on the Canadian side. As a result of this difference of elevations in the two channels, and of the fact that the one above the American Falls is only one-eighth as wide as that on the Canadian side of Goat Island, it is estimated that as much as 90 per cent of the entire discharge of the river goes over the Horseshoe Falls. From all these facts the inference has been drawn that the diversion of certain quantities of water from the Great Lakes and the Niagara River, put by one authority at 80,000 cu. ft. per second, would lay bare the precipice over which the American cataract plunges. This opinion must be taken with some limitations. If 80,000 cu. ft. of water per second are diverted from Niagara River along the New York bank, within a mile above the head of Goat Island, there can be little doubt that the American Falls will be totally destroyed. A similar result, at times of low water, would probably follow the diversion of water at this rate from any part of Niagara River or the Great Lakes, above the head of Goat Island. But a large part of the present and prospective diversion of water from Niagara River takes place along the Canadian bank, at points 1,000 to 4,000 ft. above the crest of the Horseshoe Falls. Add to this the fact that the river descends fully 50 ft. on the Canadian side, and more than 40 ft. on the New York side of Goat Island, along a distance of 3,000 ft. above the crests of the Falls, and it is evident that the operation of the power plants in Queen Victoria Park must be largely at the expense of the greater of the two cataracts. Detailed examination of the intake works of the power plants makes this point clear.

Three large electric power plants now have intakes along the water front of Queen Victoria Park, and there is also the intake for the comparatively small plant of an electric railway. First or highest of these intakes is the one just above the Dufferin Islands, and opposite the upper end of Goat Island, fully 4,000 ft. from the crest of the Horseshoe Falls. This intake is 618 ft. long, and the water between its piers has a depth of 13 ft., when the low level of the river is 553 ft. above the sea. At times of high water the surface of the river at this intake is 560 to 561 ft. above sea level and the depth is about 20 ft. Some few feet downstream from the lower end of this intake, which runs out diagonally from the shore, comes the upper line of the series of cascades over which the water descends more than 50 ft. to the crest of Horseshoe Falls. Across and above the river from the intake, the natural water level is about that named above, and water drawn from the forebay fed by the intake will affect the level of the entire river above the head of Goat Island. While the greater part of the water diverted from the river at this point must come from the Canadian channel, it will no doubt diminish to some extent the flow over the American Falls. Three steel pipes will lead from this intake and forebay to the Gorge below the Falls, and of these pipes two have a diameter of 18 ft. each, and the third a diameter of 20 ft. No limit seems to be placed on the volume of water to be carried by these pipes, save that due to their diameters, friction and slope, which latter is 28 ft. in a length of 6,180 ft. At present it is understood that the plans call for the carriage by these pipes of about 14,000 cu. ft. of water per second, but it is computed that only about 20 ft. of the head will be required to maintain this rate of discharge, so that the remaining 8 ft. of drop in these pipes may be utilized to obtain a larger flow. Besides the drop of 28 ft. along these 18 and 20-ft. pipes, there is an additional head of at least 19 ft. that may be used to increase their rate of discharge, as the centers of these pipes at the gate house that marks the lower end of the forebay is 19 ft. beneath the low water level there. Next in point of position, along the water front of Queen Victoria Park is an intake and forebay that begins at a point in the river about 2,200 ft. above the crest of Horseshoe Falls, and runs diagonally into the bank. Along the upper line of this intake, the low level of the river is about 533 ft. above sea level, and this is also the elevation of the great gathering dam, with a bull-nose at its upper end, that runs up and out from the shore of Queen Victoria Park, until it reaches a point 600 ft. from the old line of the bank. From the bull-nose of this gathering dam to the lower end of the intake above the Dufferin Islands, as before described, is about 1,100 ft., and in this distance the river drops some 20 ft., or from elevation 553 to 533, at low water, over two lines of cascades. The first or highest of these two cascades crosses the Canadian channel from Queen Victoria Park to a point on the shore of Goat Island about 300 ft. below its head, and a little above the Three Sister and Little Brother islands. About 400 ft. downstream from this first or upper cascade, the Canadian channel is crossed by another, that lays some distance above the intake under consideration, and reaches Goat Island below the Three Sisters. As the division of Niagara water between the American and the Canadian channel is definitely made at the head of Goat Island, it seems that after the Canadian portion has reached a point some 1,700 ft below the upper end of that island, and has fallen 20 ft. over two lines of cascades, its diversion into the pit and tunnels of a power plant can have little or no effect on the volume of the American Falls. By means of this second intake it is proposed ultimately to divert some 22,000 cu. ft. of water per second from the river, but the power house now under construction has a capacity for only one-half of this amount. Substantially all of the water taken by this plant will diminish the Horseshoe rather than the American Falls. The third and lowest of the intakes of the great power plants in Queen Victoria Park is located on the shore, about 1,000 ft. in a direct line from the crest of the Horseshoe, and some 3,000 ft downstream from the first cascade. Along the line of this intake the low water level is 514 ft., or 39 ft. below the surface of the river before it reaches the first row of breakers, after passing the head of Goat Island. It having fallen 39 ft. since the division at the head of Goat Island was made, the diversion of water at this intake can have material effect on the volume of the American Falls. Horseshoe Falls will thus furnish the entire volume of water for the power plant connected with this intake, which will divert about 9,000 cu. ft. per second. One other power plant, devoted to the operation of an electric railway, has an intake on the shore of Queen Victoria Park, some 450 ft. from the crest of the Horseshoe, but the volume diverted at this intake appears to be materially less than 1,000 cu. ft. per second.

From this review of the hydraulic developments for the power plants along the water front of the park, it is evident that only one of them is capable of lowering the surface level of Niagara River above Goat Island, and thus diverting water from the American Falls. This one plant is to have power machinery that requires 14,000 cu. ft. of water per second, according to the plans now announced, but its three pipes may be used to divert a much larger quantity from the river, at a point above the first line of cascades. As this diversion takes place near the Canadian bank, its effect will be greater on the Horseshoe than on the American Falls, but it will no doubt take some water from the latter. For the three large and one small plant along the water front of Queen Victoria Park, the total contemplated diversions of water, as above named, amount to some 46,000 cu. ft. per second. According to the figures of the United States War Department, the discharge of Niagara River, at the low Lake Erie level of 570.25 ft. above the sea, which is not, however, the lowest level of that lake, is 165,340 cu. ft. per second. If the Canadian channel gets 90 per cent of this discharge, the proportions assigned to it by the most favorable estimates, it carries 148,800 cu. ft. of water per second, when Lake Erie has the above level. Deducting from this last named volume the 46,000 cu. ft. per second found for all the power plants on the water front of Queen Victoria Park leaves 102,000 cu. ft. per second to go over the Horseshoe Falls. This figure should be a little more than 102,000, because a small part of the 46,000 cu. ft. will come from the New York side of the river, due to the diversion near the Dufferin Islands and above the first cascades. An imposing volume thus appears to remain for the Horseshoe Falls, as far as the Canadian plants are concerned, but when the discharge of 165,340 cu. ft. per second was noted there was no diversion at Chicago, and only a small one on the New York side of Niagara Falls.

Under present conditions, with the lake level of 570.25 ft. above the sea, 165,340 cu. ft. of water per second would never reach the head of Goat Island, and so the Canadian channel would get something less than 148,800 cu. ft., from which to supply the 46,000 cu. ft. per second for the power plants in Queen Victoria Park. The result would be a discharge of less than 102,000 cu. ft. per second over the Horseshoe Falls.

In any event, those who are more interested in the preservation of the American Falls may find comfort in the fact that only a small fraction of the water diverted in Queen Victoria Park could have found its way to the lesser cataract.

The Development of the Westinghouse Company's Single-Phase Railway System.

That the single-phase railway system is now definitely established as an important factor in the railway field, and that it is certain to play an increasingly greater part in electric traction, appears no longer to admit of dispute. The rapidity of the recent development of this system is made evident in the description recently printed in these columns of the New Haven locomotives with their great gearless single-phase motors; and we believe it will be a matter of interest at this juncture to retrace from the first beginnings the various stages of the Westinghouse Company's system up to the present development, as illustrated by the New Haven motors. On a recent visit to the Westinghouse Works data were gathered for such an account, which is presented below.

Early in the year 1893 the problem connected with the use of single-phase current for traction was investigated, and on April 29, of that year, design specifications were prepared by Mr. B. G. Lamme for a single-phase railway motor. This machine was designed for 16⅔ cycles and for an output of 30 hp at 200 volts. It was provided with a laminated field core having 12 poles, without slots or compensating winding. The armature was of the commutator type without auxiliary resistance in the leads. This motor was completed and thoroughly tested, its operation being fairly satisfactory.

On September 9, 1897, specifications were prepared by Mr. Lamme for a 40-hp, 60-cycle, 200-volt, single-phase series motor. Two of these machines were completed. They were of the inductively-compensated type, and were used with narrow brushes. These motors were in commercial service for eight or nine months, after which they were replaced by constant-speed motors, not so much owing to the better performance of the latter machines as to the fact that the service did not require variable-speed motors.

In the year 1900 the single-phase railway problem was again attacked, this time with a view to reaching a final solution. For the purpose of making exhaustive tests on a scale comparable to actual railway conditions, design specifications were completed on May 20, 1902, for a 100-hp motor which was operated with very gratifying results at a frequency of 16⅔ cycles per second. The armature of this machine was provided with auxiliary leads placed away from the armature core in the space between the core and the commutator. The auxiliary leads were given a resistance such that the decrease in the loss due to the short-circuit current was much more than the increase in loss caused by the introduction of the resistance in the path of the main line current, so that the total loss was less with the leads than without them. On account of this action, combined with the spark-preventing features of the leads, the term "preventive" has been applied to the auxiliary leads. The armature winding was later altered so that the preventive leads were placed in the bottom of the main core slots. The field core was constructed with projecting poles in which holes were cut transversely to the direction of armature rotation in order to aid in reducing the cross magnetization and in decreasing the armature reactance. This construction was described in detail in two United States patents issued May 3, 1904, to Mr. Lamme on application filed December 26, 1901. (See Electrical World and Engineer, May 14, 1904. A British patent describing the same motor was reviewed in our issue for February 13, 1904.)

It was on the strength of the tests made with the motor just mentioned that the Westinghouse Company accepted the contract to supply single-phase equipment for the Washington, Baltimore & Annapolis Railway. The design specifications for the motor for this system, which were prepared on Aug. 26, 1902, called for an 8-pole, 100-hp machine to be operated at 700 r.p.m. by 16⅔-cycle current at 200 volts. The projecting field poles were slotted and in the slots was placed a so-called "compensating" winding. The preventive leads were arranged in the main slots immediately under the armature winding. This railway system was outlined by Mr. Lamme in a paper before the American Institute of Electrical Engineers, which was published in our issue for October 4, 1902. Although twelve of these motors were completed and tested in the shop with satisfactory results, they were never placed in commercial service, due solely to the financial failure of the companies interested in the W., B. & A. Railway.

In order to determine experimentally the factors which limit the capacity of the single phase motor, it was decided in 1902 to construct a 300-hp machine for testing purposes, and design specifications were completed on July 16 of that year. This motor was provided with eight poles, and operated at 600 r.p.m. under an impressed e.m.f of 400 volts. The projecting field poles were slotted; when 16⅔-cycle current was used with the machine, no winding was placed in the slots, but for 25-cycle current it was found desirable to use a compensating field winding in order to improve the power factor Two armatures were built for the motor. In one of these the preventive leads connected between the armature winding and the commutators were placed outside of the armature core, while in the other the leads were placed in the same slots with the armature coils.

Owing to the desirability of using the same frequency for the single-phase railways as that in common use for motor purposes, and to the excellent results obtained with the compensated motors at this frequency, it was decided to build the standard single-phase motors for 25 cycles. On December 18, 1903, specifications were completed for a 150-hp, six-pole, 250-volt motor to operate at 700 r.p.m., with 25-cycle current. The preventive leads used with this machine were placed in the main armature slots. The field was provided with a compensating-winding connected permanently in series with the armature. This motor, which was the forerunner of the present standard single-phase machines, was sent to Sweden, where it is now in use. The standard motors have been built according to specifications prepared as follows: 100-hp, four-pole, 225-v., on December 18, 1903; 75-hp, four-pole, 250-v., on January 5, 1904; 50-hp, four-pole, 250-v., January 7, 1904. In these motors was introduced the present construction in which the compensating winding is placed first in slots in the projecting field poles, in order that the field coils, which are afterwards placed around the projecting poles, can be removed at any time without disturbing the compensating coils.

In regard to the methods used for controlling the motors, it is interesting to note that with the first 100-hp motor built for testing purposes there was employed a simple drum controller which varied the voltage obtained from the taps on a transformer winding. On the Washington, Baltimore & Annapolis Railway it was the intention to use an induction regulator for varying the voltage. On the present standard equipments, the induction regulator has been abandoned, and the step-by-step method of control is used. Several factors have contributed to this change. An induction regulator possesses fewer advantages at 25 cycles than it does at 16⅔ cycles; the step-by-step control is much preferable for equipments which must at times use direct current, and it lends itself most readily to electropneumatic unit-switch operation. Moreover, some form of multiple-unit control is necessary with many types of equipment, and the electropneumatic unit-switch system affords at once, and without change, convenient means of control from any desired point to which low-voltage wires may be led.

The cause for the change from 16⅔ cycles to 25 cycles was given above. It may be noted in this connection that it is more difficult to design a motor for 25 than for 16⅔ cycles, and that any satisfactory 25-cycle motor can be operated with 16⅔-cycle current. The designers hold that for services where the choice of frequency is not limited by reason of existing installations, that is, for the locomotives under steam railway conditions, it is preferable to use the lower frequency so as to simplify the design problem and to improve the performance of the equipment. During the period required for the introduction of the single-phase system, it is more or less necessary to consider the interconnecting of the new system with the old, and a frequency of 25 cycles is practically demanded for certain installations. There are, however, reasons for believing that the time will arrive when single-phase railways will be electrically separated from other power equipments, in which event a lower frequency can be selected.

Speed Control of Hydraulic Turbines.

At a meeting of the Philadelphia branch of the American Institute of Electrical Engineers, Mr. Lamar Lyndon presented a paper describing an electromagnetic method of regulating the speed of water wheels. The method is based primarily on changing rapidly the main gate opening of the wheel without altering either the pressure in the penstock or the velocity of the flow of water through the gate opening at the instant of change.

The control mechanism is so arranged that the velocity of the water in the penstock changes so slowly that there is never any appreciable fluctuation in the penstock pressure, or in the velocity of the entering water. There is applied to the penstock a compensating valve by means of which the pressure in the penstock is maintained. The compensating valve is of the butterfly type working in a by-pass pipe, which is tapped into the penstock.

All water which passes through the valve goes around the wheel and does no work. In plants where no waste can be allowed the valve is normally fully closed. If the turbine gate be quickly closed, the compensating valve will open quickly, thus acting as a positively operated relief valve. The valve then slowly closes tight, thus limiting the waste water to the ordinary relief valve losses.

In plants where the amount of water available is in excess of that passed through the turbine, the compensating valve is kept just half way open and a continual flow through it results. If the load on the turbine be increased, and the turbine gate be suddenly opened, the compensating valve will close, at the same speed, and thereby turn an increased amount of water into the turbine. If the load should decrease, the valve would open at once and allow more water to pass through it. In each case, when the regulation is completed for the new load, the compensating valve returns slowly to its normal half open position, thereby slowly changing the velocity of the water column to correspond to the supply required.

The active control mechanism consists of three electromagnetic clutches; one is used for opening the main turbine gate, the second tends to close the gate, while the third varies the opening of the compensating valve. When the gate openings are correct for the load on the machine, none of the clutches is energized. If the load increases or decreases, either the first or the second clutch comes into play, while the third operates to tend to close or open the compensating valve.

A diagram of the control circuits is shown in the accompanying illustration. Both the first and second clutches and a dynamo for supplying current to all of the clutches are driven from the turbine. The dynamo is a simple shunt-wound machine. It is provided with laminated field cores, so that the magnetism may respond quickly to changes in the magnetizing force, and is operated at low magnetic density, in order that the voltage may vary enormously with a change in the speed. The speed at which the dynamo must be driven in order to generate a certain e.m.f. varies largely with the resistance in the field circuit, and this fact is utilized in adjusting the normal speed of the generator, and in giving to the turbine any desired load-speed characteristic.

The dynamo supplies current continuously to an electromagnet which serves to hold open the switches in the circuits to the three electromagnetic clutches when it possesses the proper strength, but allows the switch to the gate opening clutch to be closed by a spring if its strength is too small, and causes the switch to the closing clutch to be closed if its strength is too great.

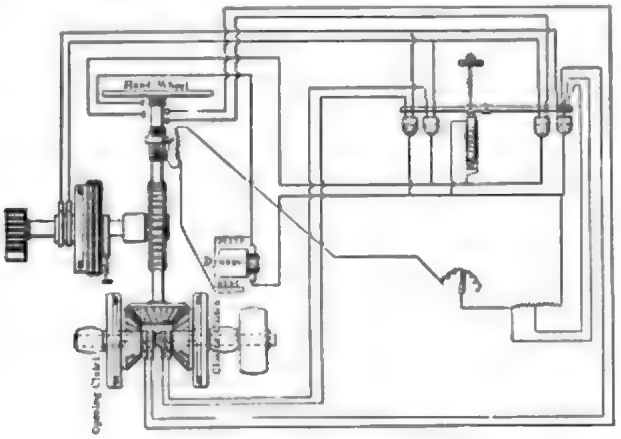


DIAGRAM OF CONTROL CIRCUITS.

The compensating valve is moved positively in a direction corresponding to the movement of the turbine gate by means of an electromagnetic clutch which is driven directly by the gate mechanism when either of the gate controlling electromagnets are energized, and is slowly returned to its normal position by means of a spring when the speed becomes normal and these clutches are idle.

New Telephone Patents.

COMBINED ALARM AND TELEPHONE SYSTEM.

While electrical power interests have been working constantly to level up the plant load by all sorts of means, telephone men have apparently given little thought to bringing up the economic efficiency of their wire plant. Few stop to consider that in the actual working day of the large majority of telephone lines, the actual total length of conversation per day is measured by minutes, instead of hours. As the lines represent an investment which must continually pay interest and depreciation, every effort should be made to increase the line efficiency, provided always there is brought about no interference with the telephone, for which the line is primarily designed.

A step in the right direction is described in a patent for a combined telephone watchman's clock and fire alarm system, issued to J. J. Berry, of Indianapolis. In this system the exchange may, at the end of the business day, cut off the telephone devices and cut in the watchman's recorder. This recorder receives the calls from the various premises, the record sheet progressing continuously. If the watchman fails to report within a given interval after the expired time for any signal, an alarm signal is sent to the exchange. If the operator fails to locate the watchman by telephone a messenger may be sent. Mr. Berry's patent has been assigned to the Indianapolis Watchman Clock Company.

SWITCHBOARD CIRCUIT SYSTEMS.

In Fig. 1 is shown a transfer trunk signal system circuit of great simplicity. The relay being differently connected, responds to any difference of condition of the circuits of its two windings. The contacts of this relay further control lamp signals at either end of the transfer. Thus upon connection, the light at the calling end acts as an indicating signal, and that at the receiving end acts as a call signal. Upon disconnection, on the other hand, the signal at the calling end acts as an indicator while that at the other end acts to disconnect. The disadvantage at once evident is the confusion of call and indicating signals liable to arise in cases of two connections following each other closely. The circuit is the invention of C. A. Simpson, of Chicago, who has assigned his patent to the Kellogg Switchboard and Supply Company.

Another transfer circuit, invented by H. D. Stroud, of Chicago, has been patented recently, the patent being assigned to the Stromberg-Carlson Company. This also works through the use of differential magnets, these being wound on magnetic signals and located at either end of the transfer. In this case the coils are differentially connected into the two sides of the talking circuit. The signals are controlled by a plug-seat and relay combined in one apparatus.

H. G. Webster and W. M. Davis, both of Chicago, have obtained patents on two-wire switchboard circuits. The system of the former hinges upon a peculiar method of controlling the supervisory lamp. The circuit of these is formed partly by the talking wires, an impedance coil in series serving to effect non-interference. A single back contact relay controls the lamp circuit. The Stromberg-Carlson Company has been assigned the patent.

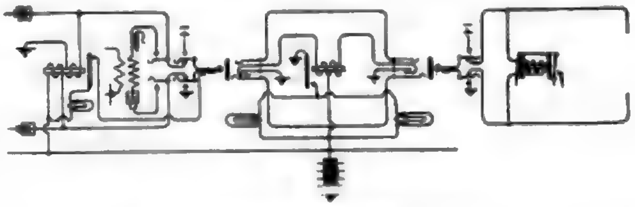


FIG. 1.—SIMPSON TRANSFER CIRCUIT.

Mr. Davis's system of operating supervisory lamps is similar, but no impedance coil is included. The Stromberg-Carlson Company has been assigned this patent also.

NEW TRANSMITTERS.

E. E. Yaxley has patented a transmitter, the button of which is shown in Fig 2. The novelty lies in mica diaphragms which are perforated and are clamped in planes parallel to the faces of the electrodes upon which their edges bear. By this means the carbon granules are kept in contact with the electrode faces only. The electrodes are, of course, supported by the usual circular mica diaphragms in addition to the shielding diaphragms. The Honash Telephone Manufacturing Company has been assigned the patent for this transmitter.

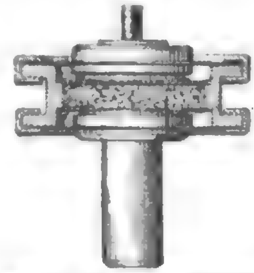


FIG 2.—YAXLEY TRANSMITTER.

LETTERS TO THE EDITORS.

A. I. E. E. Election.

To the Editors of Electrical World:

Sirs:—I have read, in your issue of April 21, Mr. Ralph D. Mershon's letter concerning the A. I. E. E. presidency, and also the letter from Mr. Rice, in reply.

I deem it a duty, as one of the members of the A. I. E. E. who not only has *had*, but has *taken*, opportunities to keep in touch with Institute men and Institute affairs—having attended over eighty per cent of all of the Institute gatherings, since 1884, the year of its birth, to express my cordial approval and indorsement of Mr. Mershon's views and position.

Mr. Rice's reply also compels me to add a few words of comment on his views and position and on the propriety and fitness of his candidacy for the Institute presidency.

Let it be clearly and emphatically understood, at the outset, that I hold Mr. Rice in the highest esteem, personally, and that my remarks relate merely to the propriety and fitness of his *candidacy*.

It is not surprising that Mr. Rice should promise to take active interest in the A. I. E. E., if elected. It may safely be asserted that if this were the only necessary and the sufficient qualification, there are several *hundred* members who also possess it. It could also be assumed with perfect confidence that any member who is a candidate would be apt to feel that way, especially about this time of the year. There may not be a total lack of interest on the part of Mr. Rice, but his interest does not appear to be sufficiently great to have induced him to sacrifice time or convenience to any remarkable extent.

Without entering further into the discussion of Mr. Rice's intentions, past and present, with respect to the Institute, and with due deference to the high personal merit of Mr. Rice, I wish to submit that the real question is not, after all, what is *due to Mr. Rice*, but really what is *due to the Institute*.

Mr. Rice, whether by his own wish or that of his friends, has become a candidate for an honor—a "degree"—perhaps the highest "degree" that can be conferred upon any member of the profession of electrical engineering, in this country. *If it is not the highest degree, it ought to be.* Now, as we all know, there are two kinds of degrees—*honorary* degrees and *earned* degrees. We all know that *honorary* degrees are granted in recognition of work, attainments, and prominence, *outside* of the Institution which confers the honorary degree. We also know that an *earned* degree is conferred, by a self-respecting, high-class Institution, only after a certain amount of work done *in that Institution*, independently and irrespective of whatever may have been done *out of it*. Any institution conferring an earned degree on the strength of a mere promise on the part of a candidate to take interest in the Institution and in its work, would, I need not say, cheapen itself and its degrees to the lowest value. If Mr. Rice's friends wish to have him honored, on account of the prominence of his *position*, or even of the technical work which he has done, *outside* of the Institute, then it should be done in the *regular* way. The Institute has provision for such cases, in its honorary membership. Let us make Mr. Rice an honorary member, and put him in the same class with Lord Kelvin and Sir William Preece, our two present honorary members. This ought to be a high enough honor for anybody. But, in my opinion, we owe it to the dignity and standing of the Institute that the highest degree which it can confer should be conferred for work done *inside* as well as *outside* of it. There are plenty of good men who satisfy both of these important, and, in my opinion, indispensable requirements; and Dr. Sheldon is pre-eminently one of these men. It is lowering to the dignity of the Institute and unjust to the many worthy men who have worked hard in and for the Institute, and who have, besides, all the qualifications of Mr. Rice for the office of president, that the principle which the candidacy of Mr. Rice represents, should be countenanced by the Institute. I feel this way, not at all because it is Mr. Rice, but because I deprecate the establishment of the precedent that "position" and "influence" *outside* of the Institute are of greater avail and value than meritorious work and prominence *inside* of the Institute. I feel that if influence wins the battle against merit, the presidency will have lost greatly in its value as an honor, and the Institute will have lost still more in its prestige.

I sincerely hope that the Institute membership will show, by electing Dr. Sheldon, that the honor of the A. I. E. E. presidency and the requirements for it are much higher than the estimate made of them by the friends of Mr. Rice.

As to your own editorial comment on the letters of Mr. Mershon and of Mr. Rice, it is a reflection on the intelligence of the A. I. E. E. members and associates, by the clear inference which it conveys, that they cannot distinguish between a "perfunctory" and a meritorious contribution to the *Transactions*, or that they do not know the difference between real, genuine service and merit, and the *spurious* merit based upon what you term "enforced activity in routine society work."

The reference to the question of residence, in your concluding paragraph, is a most unfortunate one, for Mr. Rice, in this case, because every member and associate knows that Dr. Steinmetz, who lives in the same place as Mr. Rice, has not found his residence to be a handicap sufficient to prevent him from becoming at least as great *inside* of the Institute as he is *outside* of it. The contrast between the "Institute records," in these two cases, cannot be anything but painful to Mr. Rice and his friends.

New York. C. O. Mailloux.

[Our comments last week on the letter of Mr. Mershon apply equally and with even more force to the above communication. The criterion proposed, if established, would exclude from the presidency such members of the Institute as Brush, Edison, Weston and others who have been the largest factors in creating the branch of engineering upon which the Institute is founded, and would practically confine the honor to a small coterie living in New York and vicinity. As to the relative professional qualifications of Prof. Sheldon and Mr. Rice, this we believe is a matter that should be left to the individual judgment of the membership at large.—Eds.]

Motor-Generator Fly-Wheels.

To the Editors of Electrical World:

Sirs:—I was much interested in the article in your issue of March 3 entitled "Ward Leonard System in a German Colliery." I find that the system described is rapidly going into extensive use abroad for heavy duties for hoisting, rolling mills, etc., etc., but it is generally spoken of as the "Ilgner System."

The only feature which might be attributed to Mr. Ilgner is the employment of a heavy fly-wheel on the motor-generator. In this connection I wish to point out that the advantages of such a fly-wheel were fully appreciated by me in 1891, and were demonstrated in an elaborate test at the works in Philadelphia of Wm. Sellers & Co. in the fall of 1891, a full description of which forms part of the record in my recent multiple-voltage patent suit. I urged the employment of such a fly-wheel frequently upon my licensees and others, and finally became so impressed with the advantages of a fly-wheel on a motor-generator that on March 27, 1896, I filed in the Patent Office an application (No. 585,038) showing a number of modifications of the idea, the principal application, however, being to heavy hoisting duty, using the Ward Leonard system. To quote from the application:

"The object of my invention is to provide a method and apparatus for storing energy outside of the source of supply and the translating devices, which stored energy will be drawn upon when a large amount of energy is suddenly required by the translating devices, so that the amount of energy drawn from the source is very much reduced. . . . My invention consists mainly in providing in the immediate vicinity of the translating devices a fly-wheel or its equivalent, which is continually in operation and whose weight and velocity represent a large amount of energy. . . . In the drawings, for simplicity, I have illustrated the motor-generator, *A B*, as two distinct armatures, with a fly-wheel between them. My invention, however, is not intended to be limited to the particular type of electrical apparatus described, nor to the use made of the fluctuating energy required in the translating devices, and my invention is applicable to both continuous and alternating systems, and to cases in which the final fluctuating current is used for translating devices other than motors, but applies broadly to instances in which electric energy fluctuating in character is demanded."

It will be noted that this application contains every published feature of the so-called "Ilgner System." In the Patent Office, however, I was met with the argument that I was only using a fly-wheel for its well-known purposes, and although I amended three times, all claims were finally rejected as devoid of patentable novelty, and as my patent lawyers thought it had no commercial importance I was persuaded to allow the case to die, which it did on March 8, 1901.

Bronxville, N. Y. H. Ward Leonard.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Changes of Energy in Dynamos.—Pichelmeyer.—A paper in which the author discusses in an interesting manner the changes in the energy of dynamos on the basis of Maxwell's theory and of the electron theory. As a striking analogy, he compares the induction phenomena in a direct-current motor running at no load with the rotation of a spinning top.—*Elek. und Masch.*, February 25.

Unipolar Single-Phase Motors.—Huppers.—A translation with illustrations of the German article on unipolar machines as single-phase motors, which was recently noticed in the Digest.—Lond. *Elec. Rev.*, March 23.

Compound Dynamos in Parallel.—An article illustrated by diagrams on the regulation of compound-wound dynamos operating in parallel.—*Power*, April.

Lamps and Lighting.

Tungsten Lamp.—"It is reported from Vienna that the German patents for the Wolfram lamp have been sold to financiers at Augsburg for the sum of $200,000, of which one-half is payable in cash, and the other half in shares of a new company which is to be formed with a paid-up share capital of $212,500 for the development of the invention in Germany. The manufacture of the lamp has been entrusted to the Augsburg-Lechhausen Glühlampen Fabrik, of George Lüdecke & Co." The lamp is the invention of Franz Hanaman and Alex. Tust, of Vienna.—Lond. *Elec. Rev.*, March 30 and April 6.

Photometry.—Satori.—A paper read before the Elec. Soc'y of Vienna. There is no difficulty in making photometric tests if lights of the same spectroscopic composition are compared. In comparisons of lights of different colors very great differences are often obtained if different persons make the comparisons. The author discusses at length the physiological reasons of this phenomena. It is essentially impossible to state whether two lights of different colors have the same brightness. The author discusses all physiological possibilities which have been tried so far for the comparison of lights of different colors, and concludes that it is impossible to compare the degree of the physiological effect of differently colored sources of light, for the reason that these physiological effects are of different nature.—*Elek. und Masch.*, March 18.

Photometry of Incandescent Lamps.—Lux.—In a method described in the regulations of the German Association of Electrical Engineers, incandescent lamps are tested by means of inclined mirrors, without revolving the lamp itself. However, the employment of this method is recommended only for lamps with a single-loop filament. The author shows that with filaments of several loops or with filaments of complicated structure (as in the tantalum lamp) this method leads to appreciable errors. In such cases it is necessary to revolve the lamp.—*Zeit. f. Beleucht.*, March 30

Power.

Power House Economics.—Hancock.—A discussion of the importance of details of operation in power houses. The author first discusses the buying of fuel, and says that the only true way for the consumer to buy coal is on the heat-value basis. It should be agreed that the consumer will pay a stated price for the coal, provided it contains a stated value in heat units per pound of dry coal when unloaded at the power house, the values to be determined by analysis. For anything less than the stated heat value per pound a pro rata reduction in price is to be made to the purchaser, or the purchaser may reject it altogether. For any additional heat value, over and above the stated value a pro rata addition is to be made per ton. Proper attention should be paid to repairs in the boiler room and to the use of the proper kind of oil. If attention is paid to such apparently small details, considerable economies will result in the operation of power houses.—*Cassier's Mag.*, April.

Pyrometer Records.—An editorial advocating the use of the electric pyrometer as a power plant auxiliary. Probably the portable pyrometer is the simplest apparatus for general power-plant service. If desired, recording pyrometers can be installed in the flues, economizer and superheated steam mains, and connected to a common record tablet at any part of the plant where it is desired to take readings. The analyses of such records ought to throw a great deal of light upon the efficiency of combustion, the fitness of mechanical stokers for the work in hand, the value of various methods of hand firing, the steaming power of different fuels, the quality of chimney draft, etc.—*St. R'y Jour.*, April 14.

Water Power in France.—Bresson.—A statistical article on hydro-electric installations deriving energy from navigable rivers. In contradistinction to hydro-electric developments of waterfalls, the height of the fall of navigable rivers is small, but the quantity of water is large. The curve showing the water available during the different months of the year has a maximum in February and a minimum in July. On the other hand the corresponding curve for water power stations at waterfalls in the mountains has a maximum in July and a minimum in January. A list of French water power stations of the former type is given together with a map.—*L'Ind. Elec.*, March 25.

Italy.—A paper giving a statistical summary on the large water power installations of upper Italy.—Lond. *Elec. Eng.*, March 30.

Electric Driving of Machines.—Ker.—A paper read before the (Brit.) Inst. of Engineers and Ship Builders giving "notes on some common errors in the use of electric motors for machine driving." Direct-current motors are discussed and the adaptability of the series, shunt or compound motor is dealt with according to the requirements of speed and torque. The effect of fly-wheels in then taken up. The article is to be continued.—Lond. *Elec. Eng.*, March 30.

Electric Winding in Mines.—An account of the long discussion which followed the recent papers of Mountain and Hooghwinkel. Various speakers criticised Mountain's figures as being particularly unfavorable to electric winding. Figures of cost are given. —Lond. *Elec.*, April 6.

990-Volt Direct-Current Railway.—An illustrated description of the railway along the river Rhine between Cologne and Bonn, the total length being 28.3 kilometers. There are two trains per hour in either direction, the speed being 80 kilometers per hour. Each train contains not more than four cars, with a capacity for 250 passengers. It was required that within the city limits of Cologne and Bonn the 550-volt, direct-current of the municipal tramway lines be used. Three possibilities were considered: First a system proposed by the Allgem. Elec. Ges using single-phase current at 6,000 volts between the cities and

550-volt direct-current within the cities; second, a system proposed by the same company, using direct current at 800 volts between the cities and 550 volts within the cities, and third, a system proposed by the Siemens-Schuckert Company using 990 volts direct current between the cities and 550 volts within the cities, the 990-volt current to be generated in a power plant near the center of the line. This last system was adopted for the following reasons: The single-phase system would have required a transformer in the car and the use of motors which could be operated both by the direct current in the cities and by the alternating current outside of the cities. It is stated that these requirements would have resulted in appreciably greater weight of the alternating-current cars compared with the direct-current. The single-phase system was, therefore, found to be less economical than the direct-current system. Savings in the feeders and the overhead construction on account of the intended high voltage of the single-phase system were more than annihilated by the much more expensive equipment of the cars. Moreover with the direct-current system it is easy to use storage batteries. Finally the total length of the line, which is 22 kilometers, is too short to enable the single-phase system to show the advantages which it has on longer lines. The third rail was considered unsafe under the local conditions, and for this reason the overhead trolley wire system was adopted. Each motor car contains two 130-hp motors, designed for a speed of 700 revolutions per minute. Each motor car is able to draw one trailer. Several motor cars in one train are controlled by the multiple-unit system. The direct-current motor used on the cars has four main poles and four interpoles. The design is shown in Fig. 1 and 2. The latter are of solid construction and in order to avoid eddy currents they are provided with slits towards the center. The armature current passes through the windings on the interpoles as well as through those of the main poles; when the direction of running is reversed the connections of the interpole windings are reversed together with the armature. The armature core has four ventilation slits. The gearing has the ratio of 1 to 3.1. The diameter of the running wheels is 950 mm. and the gauge is 1435 mm. The motors of one car are able to run a train consisting of a motor car and a trailer with a weight of about 54 tons at a speed of 70 km. per hour.—*Elek. Zeit.*, March 29.

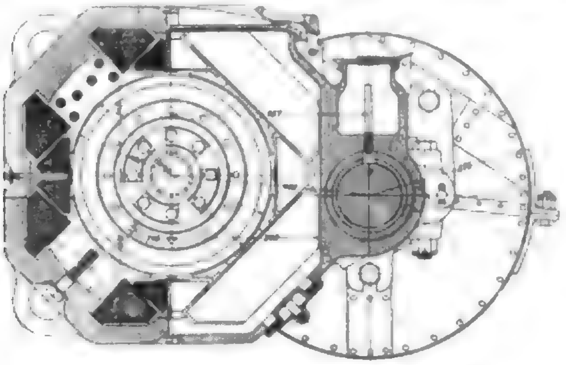


FIG. 1.—CROSS-SECTIONAL VIEW OF MOTOR.

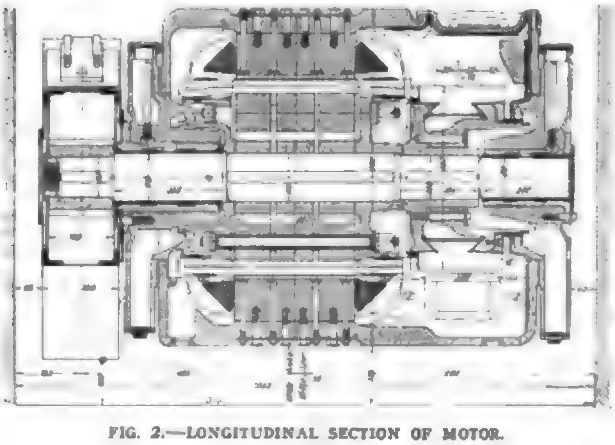


FIG. 2.—LONGITUDINAL SECTION OF MOTOR.

Single-Phase Traction.—Some notes on the experiments made by the Oerlikon Company on the road from Seebach to Wettingen with 15,000-volt single-phase current. Originally it was intended to use two different systems, first a motor-generator locomotive on which the alternating current was changed to direct current by means of an induction motor coupled to a direct-current generator, the latter supplying direct current to the motors. The second locomotive is a straight single-phase locomotive with two commutator single-phase motors. It is now stated that the trials of the motor-generator locomotive have been abandoned. In the single-phase locomotive, current passes from the trolley to transformers, placed in the center of the locomotive; there the voltage is changed from 15,000 to 600, the capacity being 200 kilovolt-amperes. The secondary winding is divided into 20 steps which are used for regulating the speed of the motors, a special regulating switch being provided for this purpose. A second method of regulation is obtained by means of an induction regulator, the movable member of which is connected with the external 600-volt terminals of the transformer. It can be so adjusted that in the fixed member of the transformer a voltage between +150 and −150 may be induced, which is then combined with the motor tension of 400 volts. Both systems of regulation will be tested. Each motor (Fig. 3), running at 650 revolutions per minute has a capacity of 200 hp, and has eight laminated main poles and eight auxiliary poles. The main poles, 5, have compensating windings, 9, which may be either short-circuited on themselves or connected in series with the armature. The auxiliary poles, 7, have windings which are in series with each other and which are connected to the secondary winding, 13, of a main-current transformer. A resistance may be connected in parallel to the commutation pole winding to adjust the phase-difference. The ratio of gearing is 1 to 3.1.—*Elek. und. Masch.*, April 8.

Single-Phase Direct-Current Locomotive.—A very long illustrated account with drawings of the mechanical and electrical details of the first electric single-phase direct-current locomotive for the New York, New Haven & Hartford Railroad Company. Diagrams are given showing the performance of the locomotive and motors when operated by alternating current and direct current.—*St. R'y Jour.*, April 14.

Meters on Tramways.—An account of the use of meters on the Frankfurt tramways. They first made experiments with kilowatt-hour meters and with recording meters whose record sheets were connected to the driving wheels. Much better results were obtained, however, with a recording meter whose sheet was driven by a clock mechanism. In 1905 all the tramways of Frankfurt were supplied with such meters and, although formerly the consumption of energy had increased from year to year, the introduction of the time meters resulted in an appreciable saving amounting to almost 13 per cent, the mean consumption now being 469 watt-hours per car-km. It is explained why such recording meters enable one to test the individual ability of the motorman. The advantages of the record-

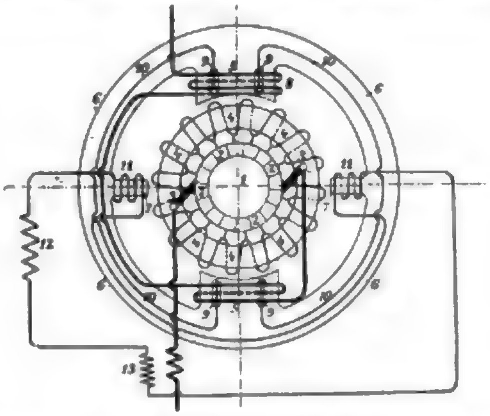
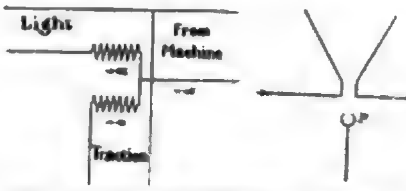


FIG. 3.—DIAGRAM OF MOTOR CIRCUITS.

ing meter over the energy meter are pointed out.—*L'Ind. Elec.*, March 25.

Installations, Systems and Appliances.

High Tension Installations.—Siedek.—A paper read before the Vienna Electrical Society, giving some details from modern high-tension plants. The Sill works furnish two-phase current for lamps and motors in Innsbruck as well as for traction on the Stubial Valley road. Since the current for lamps and for the traction motors is taken from the same machine and even from the same phase, it is necessary to use a special device for preventing voltage fluctuations in the lightning network. This is done by means of a "suction transformer" (Fig. 4), the primary winding of which is in series with the traction circuit while the secondary winding is in series with the lighting circuit. If a car starts, the traction current rises suddenly and this rise of current produces an increase of voltage in the lighting network which counterbalances the voltage drop which would occur without this device. The transformer has 380 turns from which some turns must be taken off, or to which some must be added, according to the different load in winter or summer. In the transmission system from the Morbegno plant, which utilizes the waterfalls of the Adda River, the high tension switches are of the simple form shown in Fig. 5. As soon as the connecting piece, *P*, is taken down the arc which is formed rises upwards along the two horns until it is broken in the well known manner.—*Elek. und Masch.*, April 8.



FIGS 4 AND 5.—HIGH TENSION INSTALLATIONS.

Manchester.—The first part of a fully illustrated description of recent extensions at the Manchester electricity works which comprises three generating stations. Among the most interesting additions which have been made to the plant are the 500-kw LaCour "cascade" motor-converters (which machine consists, as has repeatedly been mentioned, of an induction motor coupled to a direct-current generator, the rotor of the motor being electrically connected with the armature of the direct-current machine). Three of these machines have already been installed, and nine more have been ordered. This is thought to represent the largest industrial application of the new machine. The construction, design, and operation are described in detail.—Lond *Elec.*, March 30.

Cost of Electricity for Private Plants.—Hartnell.—A paper read before the Leeds section of the (British) Inst Elec. Eng., giving figures on the cost of electricity per kw-hour from private electric plants. Twelve numerical examples are discussed referring to flour mills, woollen mills, cloth factories, iron works, etc. In the examples given an increase on interest and depreciation from 10 per cent to 15 per cent adds as much to the cost per kw-hour as an increase of 50 per cent in the price of fuel. This cannot be taken as a general conclusion, but it points to the advisability of keeping down capital charges. The cost per kw-hour in the different examples varies between 0.5 and 3.2 cents.—Lond. *Elec.*, April 6.

Consumers' Records.—An illustrated article giving notes on the keeping of consumers' records in electric central stations. Forms of blanks are given.—Lond. *Elec. Rev.*, March 23.

Wires, Wiring and Conduits.

Wires.—Carter.—An article giving useful formulas on wires. The following formula is first developed: $c^2r \div d^3 = 2614ht$, where c is the current in amperes, r is the resistance of the wire 1 inch long by 1 square inch in cross section in ohms, d is the diameter in inches, h is the number of British thermal units emitted from one square inch surface of wire per second per degree rise in temperature of the wire above its surroundings, t is the rise of temperature above the surroundings, h may be considered as fairly constant and equal to 0.000006. For instance, if the actual temperature of the wire is 250° F., then the rise above ordinary atmospheric temperature is $t = 190$, and the above formula gives $c^2r = 3d$. Several results are at once apparent from this. For instance, in wires of the same material r being constant, c^2 is proportional to d^3, or the current which gives a certain temperature rise is proportional to $d^{1.5}$. This is a well-known fact, and is one of the most frequently used relations in working out resistances. Again, in two wires of different materials, if the current be the same in each, then for the same rise in temperature d^3 must be proportional to r or d is proportional to $r^{1/3}$. If on the other hand the diameters are the same, the current, for a given temperature rise, is proportional to $r^{-1/2}$, since c^2r is constant. If the equation is written $c = d^{1.5}\sqrt{3/r}$ then the factor $\sqrt{3/r}$ can be determined for each source of wire and is a figure of merit for the material as regards its current-carrying capacity. This figure is 1830 for copper, 1330 for aluminum, 710 for iron, 420 for platinoid and manganin, 300 for eureka, 300 for resista, 290 for krupp, wolffin and beacon. A useful table, giving various figures for the materials just mentioned, is added.—Lond. *Elec. Rev.*, March 30.

Wooden Poles.—Soewit.—In order to prolong the life of wooden poles the author describes a method of protecting them by means of a cover of concrete at the point where the pole is inserted in the earth.—*Elek. und Masch.*, March 11.

Electrophysics and Magnetism.

Unilateral Electric Conductivity Over Damp Surfaces.—Trouton.—An abstract of a (Brit.) Phys. Soc'y paper. The author has noticed a rather perplexing difference in electrical resistance depending on the direction in which the measuring current is passed. The resistance under examination was that of a layer of moisture which adheres to glass when exposed to moist atmospheric conditions. The arrangement in which this resistance measurement was effected was one used for determining the temperature of deposition of dew. For this purpose two parallel wires of platinum were fused on to a glass surface at a small distance apart. The surface could be artificially cooled. A cell and a galvanometer were inserted in series with the two platinum wires. As soon as moisture condensed on the glass the circuit was completed and a current passed, thus permitting the accurate determination of the dew point. When a delicate galvanometer is used, a small current can be detected long before the true dew point is reached. It is at this stage that the anamalous behavior in the resistance is found. On passing a current across the glass surface when exposed to ordinary atmospheric conditions it was found to diminish to a certain minimum value, the amount of which depended on the hygrometric state. On reversal, the current assumed its original value and then diminished to a minimum as before, and so on for further reversals. In order more conveniently to study the matter with larger currents, tin-foil grids were prepared by pasting strips of tinfoil on to glass plates. Every second strip was connected to one pole of the battery while the intermediate strips were connected to the other. 'In this way was obtained a length of surface lying between parallel strips of tinfoil placed at a short distance apart. Grids of various widths were prepared. One set, consisting of eight glass plates with strips 0.2 cm. apart, gave a total length between electrodes of 250,000 cm. When an e.m.f. of 110 volts was applied, a current of about 0.0009 ampere was found to pass, but this gradually diminished to about 0.00015 amp. On reversal, the current was found to be about 0.0003 amp., which rapidly rose to about 0.0009 amp., and then diminished to about 0.00015 amp., and so on for further reversals. The resistance was measured by a Wheatstone bridge when the grid was in good conducting phase and when in a badly conducting phase, and found to be about 140,000 ohms and 800,000 ohms respectively. That the effects observed were not due to anything similar to ordinary polarization was shown by the fact that no back e.m.f. was obtained on short-circuiting through a galvanometer in the usual way, and also by the fact that the ratio of the currents in the two phases was independent of the difference of potential applied. Pressures up to 3,000 volts were applied. This would require a back e.m.f. of 1,500 volts to give a falling-off in current to half value. The theory put forward to account for the phenomenon depended on the transportation of moisture over the surface by the current. In this way the effective thickness of the layer might be much diminished by a banking up of the moisture along the edge of one of the metallic electrodes.—Lond. *Elec.*, April 6.

Effect of Heat on Radium Emanation.—MAKOWER.—An account of experiments on the influence of temperature on the activity of radium emanation when in radioactive equilibrium with radium A, B and C, and when sealed up in a quartz tube so that there can have been no possibility of the escape of any volatile product. The results show clearly that the activity as measured by the beta and gamma rays can be changed by high temperatures, the observed effects being consistent with the explanation offered by Curie and Danne, the rate of decay of radium C is increased by high temperatures. The experiments do not, however, prove that it is this particular product which is affected, as the results could be equally well explained if one or more of the other radioactive bodies present underwent some alternation. The effect increases with the temperature up to 1,200° C. and with the time of heating, but not after the first hour. (The chief interest of these results rests in the fact that it had always been considered a characteristic feature of radioactivity that it cannot be influenced by any of the physical forces and agents at our disposal).—Lond. *Elec*, March 30; from *Proc. Royal Soc.*, 516, March 6.

Magneto-Optics.—ZEEMAN.—A paper read before the Royal Inst. on recent progress in magneto-optics and the Zeeman effect.—Lond. *Eng'ing*, April 6.

Units, Measurements and Instruments.

Measurement of Resistance.—JAEGER.—A paper in which the author (who is a member of the Reichsanstalt) discusses the four chief methods of measuring resistances with the needle galvanometer, and points out the cases in which they can be used to the greatest advantage. In Thomson's method the resistance to be measured, A, should be nearly equal to the standard B The ratio of the bridge resistance, a to A, should be very small. The galvanometer resistance, g, should be $A/2$. The sensitiveness is then $E/2\sqrt{2}$. In Wheatstone's bridge arrangement, the most favorable conditions are given by $a = A$, $B/A =$ infinite, $g = 2A$. The sensitiveness is then the same as in Thomson's method. The differential method is the most sensitive, when the conditions are favorable. These conditions are $b = A$, $ab/A^2 = 1$, $a/A = O$, $B/A =$ infinite, and $g = A$. The sensitiveness is then $\frac{1}{2}E$. The compensation method is the least sensitive under the most favorable conditions, which prescribe $b = a = A$, $a/A = B/A = 1$, and $g = A$. The sensitiveness is $\frac{1}{4}E$, E being the e.m.f. used. The differential method can be employed only with large resistances. If the resistance A and b can be changed simultaneously by the same amount, a sensitiveness $= E$ may be attained. With a movable coil galvanometer of half the sensitiveness of a needle galvanometer, the same delicacy of measurement of resistances can be attained.—Lond. *Elec.*, April 6; from *Zeit. f. Instrumentenk*, March.

Determination of Resonance Curves with the Cymometer.—DYKE.—An abstract of a British Phys. Society paper. The experiments described were made with a view to the adaptation of the direct-reading cymometer to the delineation of resonance curves and the determination of the logarithmic decrements of wave trains and the resistance of oscillating sparks. A special form of ammeter was inserted in the cymometer circuit, enabling the current to be observed for any position of the instrument. The ammeter used was of the hot-wire type with a bismuth-iron junction in contact with the hot wire, the e.m.f. of the junction and hence the current through the fine wire being read off from the deflections of a single pivot galvanometer of low resistance. The results of the work of Bjerknes and Drude on the oscillation transformer are referred to and the application of their final equations to the determination of logarithmic decrements from the resonance curves are discussed.—Lond. *Elec*, April 6.

Direct Reading Ohmmeter.—An illustrated description of a compensated direct reading ohmmeter of French make which may be used in any location, for instance in the neighborhood of dynamos or pieces of iron or of cables carrying strong currents. It enables the direct measurement of the insulation of a line charged or not charged. The dial has a double scale, one measuring from 1 to 10 megohms (in which case the instrument is used in connection with a battery in the same case), the other measuring up to 5, 10 or 25 megohms, according to the voltage employed, the current being obtained in this case from an external source. The principle of the instrument is based on the well-known method of the voltmeter-ohmmeter. A source of e.m.f. E is in series with a resistance of comparison and a galvanometer. The greater part of the total resistance, R, is represented in the resistance of comparison. By closing the circuit, one gets a reading $a = kE \div R$. By inserting in the circuit the resistance, X, to be measured, one gets a second reading $a_1 = kE \div (R + X)$, hence $a_1 = aR \div (R + X)$. Since R is known and a has a fixed value, the reading, a_1 depends only on the resistance, X, to be measured, and the reading is independent of the e.m.f. E, and of the constant, k, of the galvanometer. Several applications are described. The article is illustrated.—*L'Industrie Elec.*, February 10.

Ballistic Galvanometer.—SMITH.—A note on a mathematical Phys. Society paper on the damping of a ballistic galvanometer. A simple formula is given together with a method for determining the damping factor.—*Phys. Rev.*, April.

Determining the Self-Induction Coefficient by Weighing.—FLOWERS.—A letter giving some corrections of the formulas given by Peukert whose method by weighing was described some time ago in the Digest. Numerical results are given of an experimental investigation using the method of Peukert with the corrected formulas.—*Elek. Zeit.*, March 8.

Telegraphy, Telephony and Signals.

Wireless Telegraphy in War.—An illustrated article on wireless telegraphy in German Southwest Africa. In the beginning of the present Herero rising, heliographs were made use of extensively for the transmission of information between the various troop detachments and the camps, but this service was found useful only in the case of clear weather and over relatively small distances. Wireless telegraphy is free from this restriction and has later been proven very satisfactory. Three transportable stations have been used in German Southwest Africa, each being arranged for waves of two lengths, 350 and 1,050 meters, respectively, the same aerial being used in each case. The complete equipment comprises three two-wheeled vehicles, carrying the generating plant, apparatus and stores, respectively. Each car weighs about 600 kg, and can easily be hauled by one horse or mule. The equipment is described and illustrated.—Lond. *Elec Rev.*, March 23.

Miscellaneous.

Phantom Grounds.—KINTNER.—A record of a test in which the armature of an alternator was believed to be grounded because the alternating current voltmeter connected with one terminal to ground indicated voltage when the machine was running. As a matter of fact there was no ground whatever. The phenomenon is explained with the aid of diagrams.—*Elec. Jour.*, March.

BOOK REVIEWS.

HYPOCHLORITE UND ELEKTRISCHE BLEICHE. By Dr. Emil Abel. Halle: Wilhelm Knapp. 110 pages, 10 Ills. Price, 4.50 marks.

The recent progress of electrochemistry from a technological standpoint is excellently illustrated in this little text-book on the theory of a particular branch of industrial operations involving the actions of hypochlorites and bleaching agents developed electrochemically. The treatment of the subject is distinctly chemical, and the book is written by an electrochemist for the use of advanced electrochemical students. The subject is a complex one and has only admitted very recently of quantitative discussion. The book will be welcomed by electrochemists and electrochemical students as a text-book on the subject dealt with, and as a distinct advance in the literature of a process hitherto but little understood.

BOOKKEEPING BY MACHINERY. By E. W. Thompson. New York: Published by the author. 176 pages, illustrated. Price, $2.00.

A great many people think of a bookkeeper as at best only an animated machine, and it is a fact that machinery will do pretty nearly every feat, and just as rapidly, that the "lightning calculator" of the music halls will do. The principles of Babbage carried out far enough should give us some day the results, if not the reasoning, of the star mathematicians, for anything that proceeds from determined data and distinct postulates to a definite conclusion is but mechanical. It will, of course, still be left for talented trust magnates and absorptive insurance presidents to let their imaginations play over the statistics, and show what can be done with the inherent values.

Meantime, bookkeeping by machinery is becoming almost as much of a truism as business by method, and each needs its own literature. Here we have a clever and competent work, written in a distinterested way, to show how the genius of the inventor has virtually abolished the human side of bookkeeping and rendered everything possible to the machine side. Needless to say, electricity plays quite a large part, and the office that has its electrical and other apparatus here described is deprived of any excuse for not paying its bills promptly because the treasurer is sick or in the West Indies.

And yet, noting carefully all the skillful mechanism here brought to account on the credit page of human advance, the feeling arises that, after all, the demand on the men who administer systems like these becomes greater rather than less. It is still much easier to write a letter by hand than "type" it. The tallow candle, if brought out to-day would be declared the most wonderful illuminant the world has ever seen, and the brain has not yet abdicated to the "wheels" of a Frankenstein creation. In brief, all these ingenious devices are auxiliaries, to be adopted from that standpoint as indispensable, but not dispensing anybody from attending personally to business just as sedulously and as strictly as Astor when he lived over his store.

Sumter "Unitype" Telephone Switchboard.

The Sumter Telephone Manufacturing Company, Sumter, S. C., has placed on the market a switchboard known as the "Unitype," which embodies several new features. One of these is the type of drop, a side elevation of which is shown in Fig. 1.

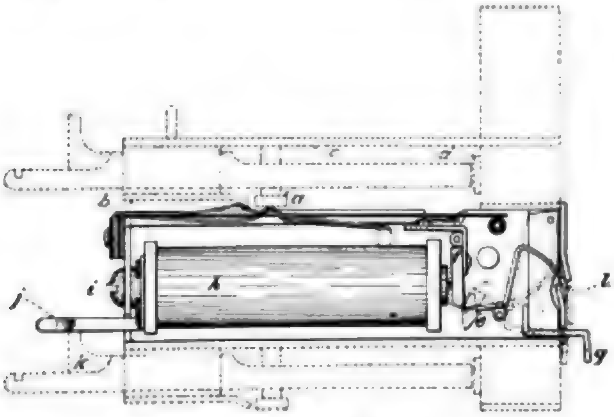


FIG. 1.—DIAGRAM OF DROP.

The armature *F* of a drop hangs in front of the coil *H* and is balanced on a brass rod which runs entirely across the frame; this mounting obviates the necessity for pivot screws, a fruitful source of trouble. The shutter, *E*, which is very light, is held in its normal or unexposed position by a knife edge on the armature engaging a small projection on the bottom of the shutter. When the armature is attracted by the coil, the shutter is released from the knife edge and falls forward and projects through the slot, *L*, in front of drop case, thus giving the signal to the operator. The signal is thus displayed by the force of gravity alone and does not depend upon any electrical means except for the short space of time the drop winding or coil is energized by the current from the calling telephone. The dotted lines in Fig. 1 show the drop after a call has been received and Fig. 2 gives a front view of three drops. The method of inserting the drops in the board is new, there being no wires connecting to them in any manner. Fig. 3 gives a rear view of a couple of drops, showing the locking contact springs connecting the drop to the jack. Fig. 4 shows the manner in which a drop is removed or inserted in the switchboard; it is simply pulled out or pushed in and it is only the work of an instant to change the drop from one position to another.

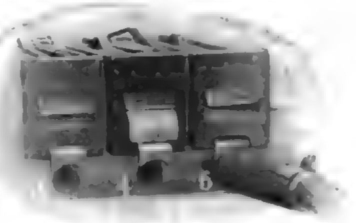


FIG. 2.—FRONT VIEW OF THREE DROPS.

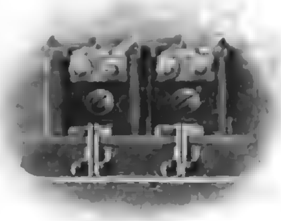


FIG. 3.—REAR VIEW OF DROPS.

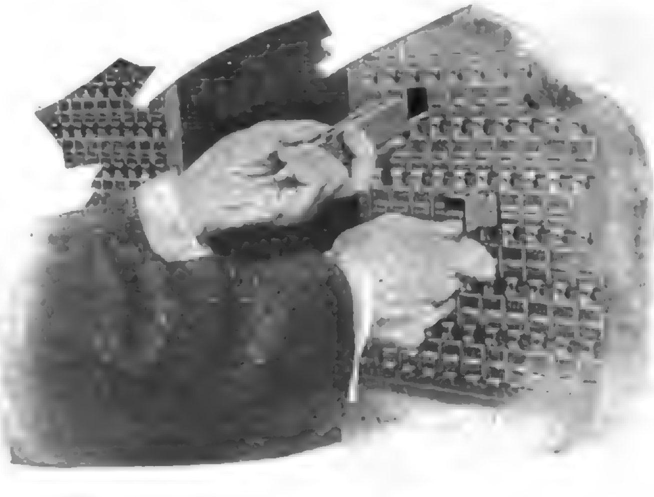


FIG. 4.—METHOD OF REMOVING AND INSERTING A DROP.

Adjustable Switch Box.

R. E. Yonge, Jr., of Jacksonville, Fla., has designed an adjustable switch box as shown by Fig. 1 herewith, for which many advantages are claimed. As superintendent of the construction department of the Florida Electric Company Mr. Yonge had often felt the need of some such appliance, since when installing switch boxes in the wall prior to the application of the finishing coat, it was often found that variations in the thickness of this coat rendered it impossible to place the switch plate snug against the switch unless the plaster was cut away, which was not always desirable. The switch box is made in two parts as shown by Figs. 2 and 3, one part sliding within the other. The permanent portion is fastened to the wall in the usual manner by screws passing through lugs provided for them. The adjustable portion is fastened to the permanent portion by means of the machine screw shown. The two lugs are adapted to slide in the recesses provided for them in the permanent portion, and the switch is fastened to the telescopic portion by means of screws fastened to these lugs. Before the switch is inserted, however, the telescopic member is adjusted by means of the machine screw so that the switch plate will come snug up against the switch.

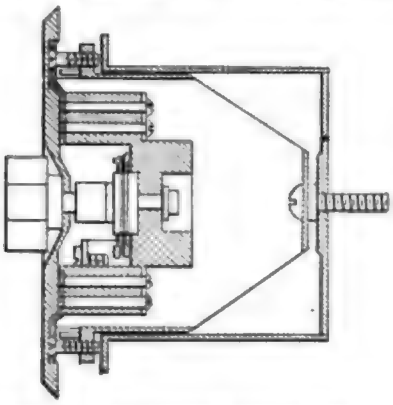
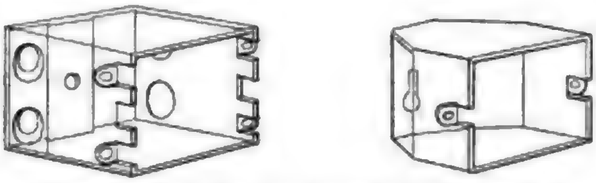


FIG. 1.—ADJUSTABLE SWITCH BOX.



FIGS. 2 AND 3.—PARTS OF ADJUSTABLE SWITCH BOX.

Electric Power in the Manufacture of Railroad Frogs.

The shops of the Weir Frog Company, located in Norwood, Ohio, a suburb of Cincinnati, furnish an excellent example of the application of electric power to manufacturing purposes. Every machine tool in the great shop, which is a single-story brick structure 720 ft. by 125 ft., is operated by an electric motor; and with the exception of a few small machines taking power from two lines of motor-driven shafting every tool is driven by its own motor.

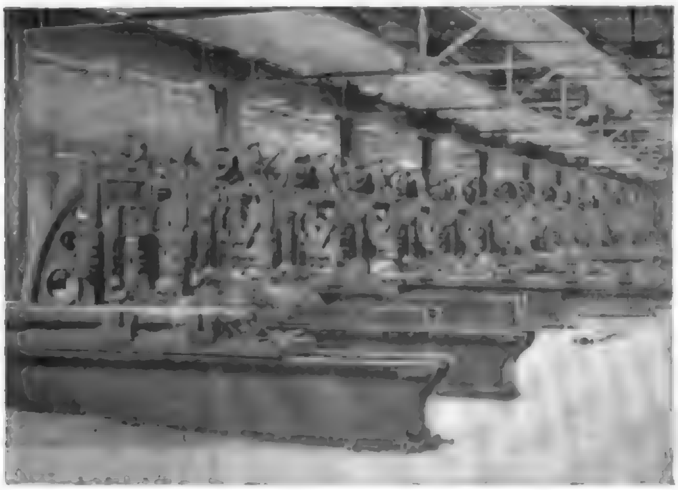


FIG. 1.—LINE OF MOTOR-DRIVEN PLANERS.

The erecting and main machine floor is 125 ft. by 340 ft. and is served over its entire length by two electric cranes, one of which is used largely in loading and unloading freight cars. The second crane supplies the erecting floor and machines with material from the stock department, which is located just beyond the floor. The power plant consists of a 500-hp compound engine directly coupled to a 300-kw, 220-volt, Allis-Chalmers direct-current generator.

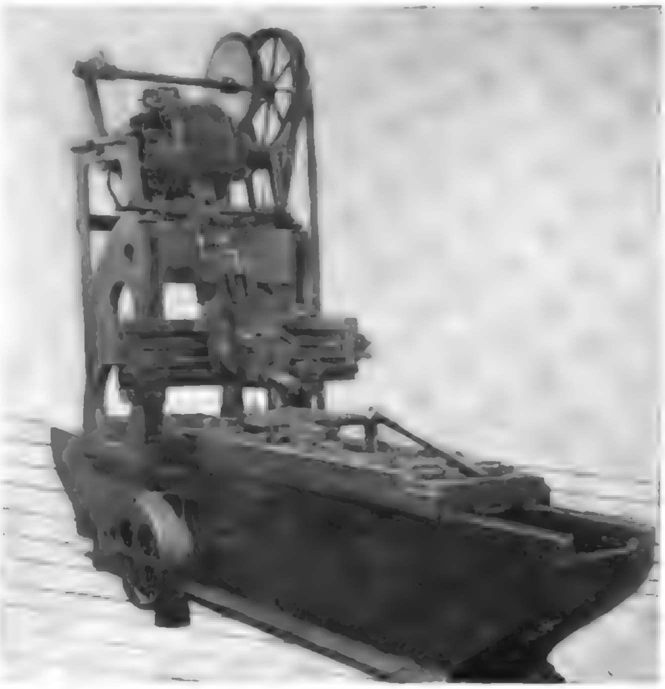


FIG. 2.—MOTOR-DRIVEN PLANER.

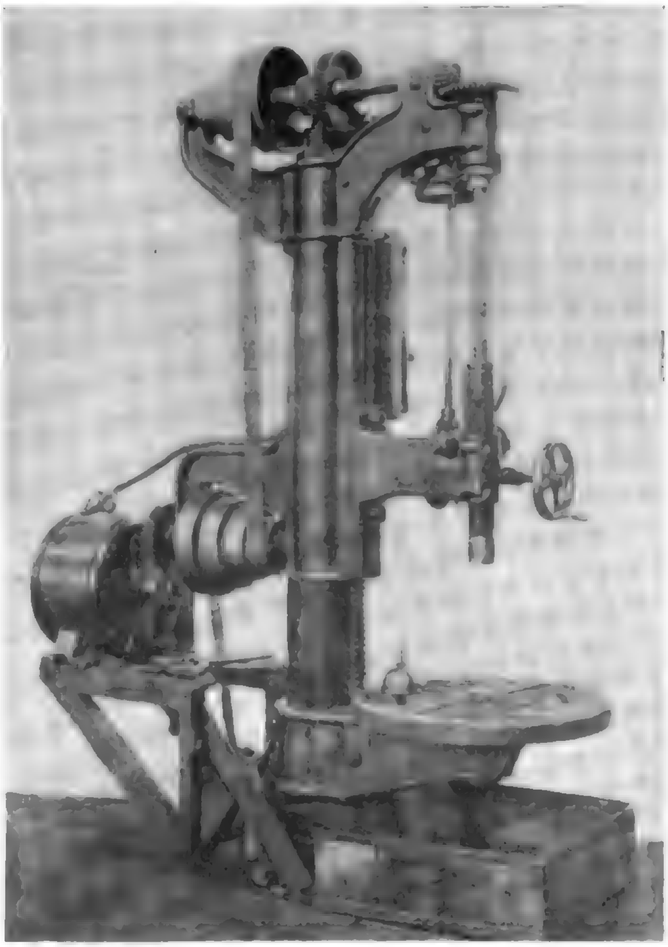


FIG. 3.—MOTOR-DRIVEN VERTICAL DRILL.

The accompanying illustrations show some of the motor-driven tools. Fig. 1 shows a line of motor-driven planers and Fig. 2 a motor-driven planer of another type. Fig. 3 illustrates the mounting of a motor for a vertical drill, and Fig. 4 shows the method of motor mounting to a multi-spindle drill.

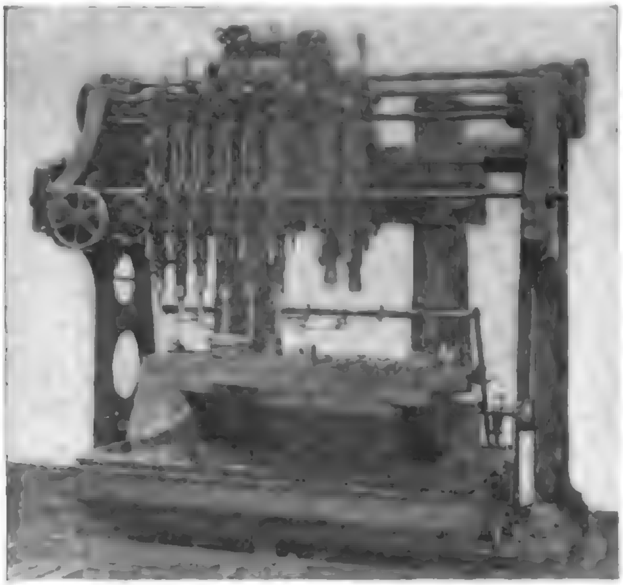
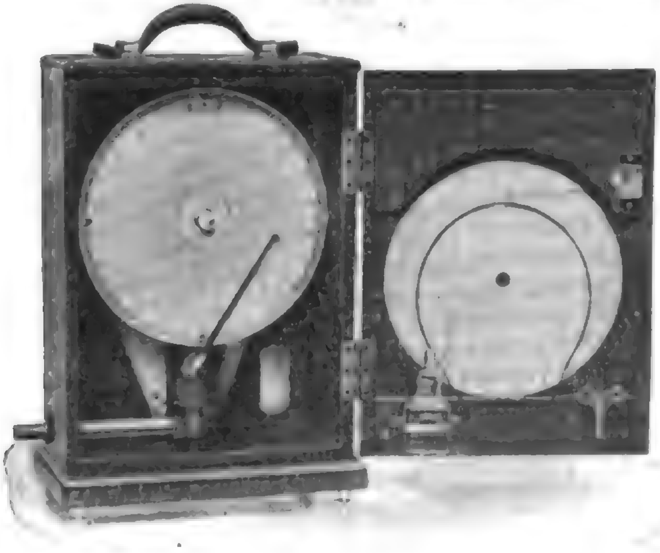


FIG. 4.—MOTOR-DRIVEN VERTICAL MULTI-SPINDLE DRILL.

Portable Recording Steam Gauges.

In response to a demand for a light, compact, portable recording pressure gauge, the Bristol Company, Waterbury, Conn., has placed upon the market a modification of the well-known recording gauge, which is free from delicate mechanism so that an ordinary workman can manipulate it successfully with reasonable care. In the portable type of gauge, a view of which is given in the accompanying illustration, the metal arc has been omitted. The pressure tube and clock for driving the chart are mounted on a light aluminum back which is in turn mounted in a wooden carrying case designed with special reference to ease in handling and in making connections.

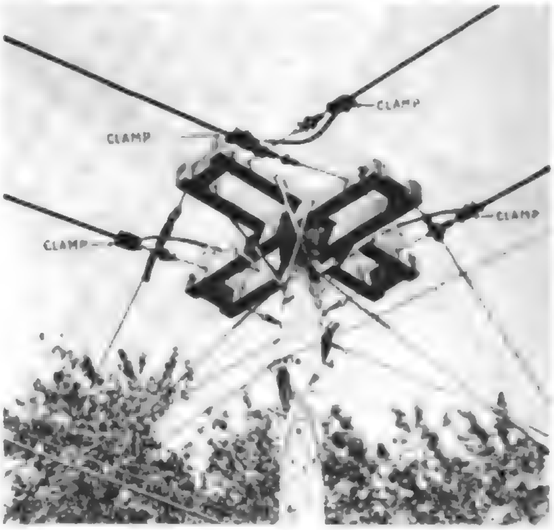


PORTABLE RECORDING GAUGE.

Two forms have been developed. One of these is used when the pressure may exceed five pounds per square inch, while the other is employed for very low pressures. The latter form is capable of recording pressures as low as that due to a one-twentieth of an inch head of water. Each form is furnished with leveling screws to facilitate adjustment, and provision is made for carrying charts and ink with the instrument.

Cable Clamps in Service.

The accompanying view of a pole in Topeka, Kansas, clearly illustrates the method used by the Topeka Railway Company in turning a corner with two 500,000 cm. cables, by the use of four Kearney cable clamps. This company has used almost 1,000 cable clamps of this type during the past two years, and has found that the cables can be placed in position in much less time than is required with the old method of splicing the cable or serving strands around it. Moreover, the final result is in each case an extremely neat and strong piece of line work when the cable clamps are used. These clamps are manufactured by W. N. Matthews & Bro., 227 N. Second Street, St. Louis.



CABLE CLAMPS IN SERVICE.

High-Efficiency Incandescent Lamps.

The Tipless Lamp Company, of 256 West 23d Street, New York, has developed and placed on the market a line of 2½-watt metallic filament incandescent lamps in 12, 16, 20 and 25-cp. sizes for various voltages up to 130. The company has also brought out an 8-cp, 2½-watt metallic filament lamp for train lighting service which is used extensively on the New York Central and other large trunk lines having electrically-lighted coaches. The president and manager of the company, Mr. H. J. Jaeger, has experimented with metallic filaments since 1894, and for the past seven years has marketed miniature lamps containing metallic filaments. The present high-efficiency lamp marks the culmination of his experiments along this line. The carbon filament as at present made is employed as a cathode on which the metal is deposited, the process being secret; the filament is then subjected to a high heat. The lamps are claimed to have a life equal to that of the 3.1-watt incandescent

METALLIC FILAMENT LAMP FOR TRAIN LIGHTING SERVICE.

lamps on the market; the lamp for train lighting service, which is shown in the accompanying engraving, is stated to have a life of from 400 to 500 hours.

Solid Insulation for Underground Conductors.

An improved form of the wooden conduit system which is being largely used by electrical engineers in Germany for the installation of underground conductors is being introduced by the Electric Cable Company, of New York City. In this system extensive use is made of Voltax, the new insulating material, which was noted in our issue for February 17, 1906, when a report was given of tests made by the Electrical Testing Laboratories of New York City, showing its high dielectric strength and specific resistance, which are prime requisites in the insulation of high and low-tension conductors.

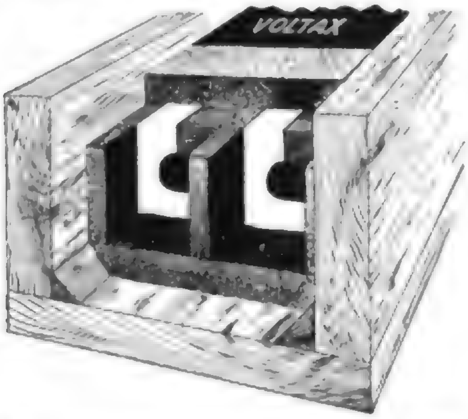


FIG. 1.—PERSPECTIVE VIEW OF THE CONDUIT SYSTEM.

In making the installation according to the above system a wooden trough is laid in a trench about 18 in. deep. Porcelain carriers are placed in this trough at intervals of four or five feet, acting as bridgework for supporting the conductors. As shown in Fig. 1 the bridgework rests on, and is surrounded by, impregnated felt or similar material, the space between the carriers, after the conductors have been placed in position on them, being filled with Voltax, which rapidly hardens, thus creating a solid insulating material throughout the entire conduit.

Connections to the conductors are easily made by opening the trench at any desired point and melting the Voltax by means of a blow torch. After the connection has been made the trough is again filled with the insulating material, and the continuity of the insulation of the system is thus re-established, perfect connections being secured by this means.

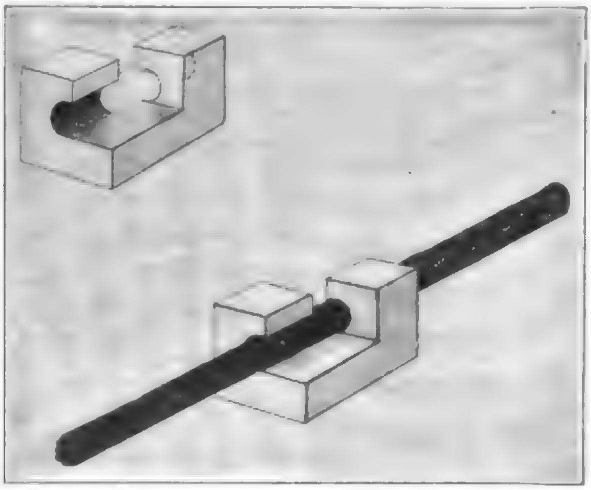


FIG. 2.—TYPE OF PORCELAIN BRIDGE WORK FOR CARRYING THE CONDUCTORS.

The tests referred to indicated, among other things, that Voltax is impervious to atmospheric conditions, water, acid and alkali, thus making this new insulating material particularly desirable for use in connection with underground conductors.

It is stated that installations made according to the system outlined above involve an outlay one-third less than those made according to the duct system. The objection still existing in some quarters against the solid system of insulation, based on the ground that it is not possible to increase its capacity as readily as that of a system in which idle ducts can be laid, is readily overcome by the fact that a solid system embodying two or three conductors is less expensive to install than a duct system with its cost for annual maintenance and extra ducts, the interest on the idle wires being considerable less than the maintenance and duct charges.

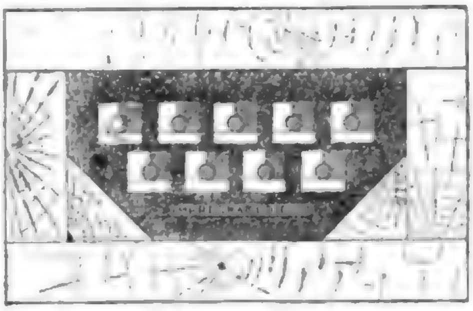


FIG. 3.—CROSS-SECTION OF CONDUIT.

Dry Battery Fan.

The electric fan shown in Fig. 1 has been designed for use in places where electricity cannot be obtained directly from lighting circuits. The equipment consists of a 10-in. brass fan provided with well-protected blades and driven by a direct-current motor, the energy for which is obtained from a battery of dry cells arranged in a portable form (Fig. 2). It is stated that one set of cells will operate the fan for from 250 to 350 hours, which, under ordinary conditions, will be more than sufficient for one summer season. This portable fan outfit is manufactured by the Jones Electric Company, 62 Vesey Street, New York.

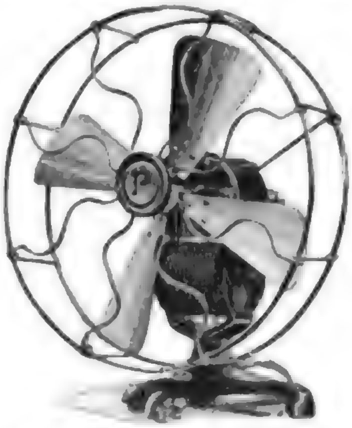


FIG. 1.—LOW-VOLTAGE, DIRECT-CURRENT FAN.

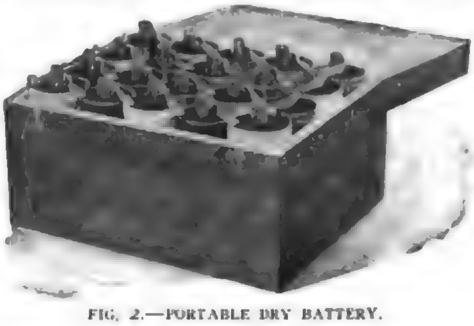


FIG. 2.—PORTABLE DRY BATTERY.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The appalling disaster in San Francisco was the thought uppermost in the minds of the people last week, and to some extent had a disturbing effect upon business in many lines. The first news seemed so incredible that it paralyzed everyone, but when the true situation became known, forces were set to work with the utmost vigor to aid the inhabitants of the stricken city, and out of San Francisco's great misfortune will arise an activity in business that will be felt for a long time to come. It was recognized that the disturbance, though unprecedentedly hurtful, has been confined to a comparatively small area of country, and the rest of the nation, contemplating, as it does, prospects of bountiful crops and another year of great prosperity, finds itself alike willing and able to give freely of its abundance to help the stricken city and State. Aside from this, practically every trade and news feature of the week was satisfactory. Crops, trade and industry, excepting only the coal situation, improve with the weather and the natural spring tendency to expansion. Retail trade shows considerable stimulus as the result of warmer weather, and this in turn has resulted in much reordering to fill in stocks. Iron and steel conditions are even more favorable; railway earnings are heavy; collections tend to improve, and money is certainly easier, though still in active demand. Freer sales of pig iron; more inquiries; firmer prices; further sales of steel rails; growing congestion at the rail mills; the booking of business for 1907 delivery by a leading Southern interest at $29 a ton, the placing of contracts for upward of 200,000 tons of steel bars by agricultural implement makers—the business having been closed on a concession and more moderate trade in structural material, due probably to the housesmiths' strike—are the week's most important developments in the iron and steel industry. Copper continues firm, and there is said to be very little April or May copper available. Coal is comparatively quiet, the miners' trouble having little influence, supplies being ample, and coke on the whole is probably less active, though prices are firm. Business failures during the week ending April 19, as reported by *Bradstreet's*, numbered 167, against 161 the week previous and 183 the corresponding week last year.

ALLIS-CHALMERS MOTOR EQUIPMENTS.—The Allis-Chalmers Co. has recently received a number of orders for its Bullock generators and motors, to be built at the Cincinnati works. The Atlas Portland Cement Company, of Northampton, Pa., recently purchased two 50-hp motors for the operation of cement machinery. The Hammermill Paper Company, of Erie, will install a 150-kw generator and a 175-hp motor, recently ordered. The Ellsworth Coal Company, of Ellsworth, Pa., recently purchased a three-phase, 25 cycle, 600-volt, 500-kw rotary converter for general mine service. The American Steel & Wire Company, of Chicago, will install at Anderson, Ind., a 200-kw generator recently purchased. The Anderson & Middleton Lumber Company, of Aberdeen, Wash., has recently ordered a 125-kw generator, 120 volts, 350 r.p.m., for direct connection to a 9x9-in. automatic engine. The Tuttle Press Company, of Appleton, Wis., will install a 10x24-in. horizontal Reynolds Corliss engine, Reliance type and a 45 kw. D. C. belted generator. Thomas C. Basshor & Co., of Baltimore, Md., recently purchased three 16-30-in. Reynolds Reliance Corliss engines for direct connection to 150-kw generators to be installed at Atlantic City, N. J., for the Nixon Amusement & Realty Company. These engines will run non-condensing at 150 r.p.m., 100 lbs. steam pressure.

GAS ENGINES FOR RAILWAY SERVICE.—The Westinghouse Machine Company, of East Pittsburg, Pa., has recently contracted with the Olean Street Railway Company to install in their power house at Ceres, N. Y., two gas engines for supplying current to the Olean Street Railway, serving Olean, Ceres, Boliva, etc. In the near future, current will also be supplied to an interurban railway system between Olean and Salamanca, N. Y., a distance of 15 miles. The engines are to be of the Westinghouse horizontal heavy duty double acting type, with single cranks, and cylinder 22-in. in diamater by 30-in. stroke. Each unit will have a normal capacity of 500 brake hp, running at 150 revolutions per minute. They will operate on natural gas having a calorific value of approximately 1,000 B.t.u. This fuel is very plentiful in the region. The engines are to drive 300 kw, 25-cycle alternating current generators, operating in parallel and supplying current at 380 volts to a high-tension three-phase transmission distribution system through step-up transformers. At present the Olean Street Railway Company has a steam power plant in service burning gas under the boilers, and a large saving is contemplated in using gas power.

SALES OF BALL ENGINES.—The Ball Engine Company, of Erie, Pa., reports the following recent sales of Ball engines: Fruit Growers' Refrigeration & Power Company, Anna, Ill., one 200-hp engine; Central Ice Company, Mounds, Ill., two 150-hp simple engines; National Tube Company, Pittsburg, Pa., one 700-hp cross-compound Corliss engine; Burnham Brothers, Milwaukee, Wis., one 60-hp simple engine; Oliver Iron Mining Company, Hibbing, Mich., four 100-hp single cylinder engines; James W. Ellsworth & Company, Cleveland, O., two 400-hp simple engines; Erie County Electric Company, Erie, Pa., one 70-hp center crank engine; Norristown Electric Light & Power Co., Norristown, Pa., one 400-hp single cylinder engine; Worcester Polytechnic Institute, Worcester, Mass., one 350-hp vertical cross-compound engine; Young & Summers, Lima, O., one 350-hp horizontal cross-compound engine.

LARGE ELECTROLYTIC GENERATOR.—The American Can Company, of Paulsboro, N. J., will install a 20x42x42-in. horizontal cross compound engine, direct connected to a 500-kw engine type electrolytic generator and a switchboard, recently purchased from the Allis-Chalmers Co., Milwaukee. The engine will run condensing at 135 lbs. steam pressure and 100 r.p.m. It will be equipped with a special speed changing device for varying the speed so that the generator voltage may be governed over a range of 100 to 200 volts. The generator will be a 14-pole machine, 500 kw, 200 volts. The shunt field coils will be so proportioned as to allow for increases in voltage between 100 and 200 volts, by approximately equal increments by varying the speed of the engine and by rheostat, the output in amperes being constant at 2,500 throughout the range.

REYNOLDS CORLISS ENGINE ORDERS.—The Falk Co., of Milwaukee, whose steel foundries are among the largest in the State, has recently purchased new equipment for the plant from the Allis-Chalmers Co., Milwaukee, consisting of a 20x42x42-inch. Reynolds heavy duty, cross compound, Corliss engine, a 550-kw, D. C. engine type generator, an 18x36-in. steam, 30x18-in air, 42-in. stroke Reynolds heavy-duty, cross-compound air compressor; two Tomlinson barometric tube condensers, 32 x 24 in. respectively, together with centrifugal pumps, boilers, switchboards, etc. The J. B. & J. M. Cornell Co., of New York City, recently purchased an 18x36-in. Allis-Chalmers Reynolds girder Corliss engine for re-shipment. The Pittsburg Reduction Company, of Bauxite, Ark., is also a recent purchaser of a 20x36-in. Reynolds Reliance Corliss engine.

OUTPUT OF COPPER.—Copper production in the United States for the first quarter of 1906, it is estimated, amounted to 250,000,000 pounds in round figures, or at the rate of 1,000,000,000 pounds per annum. Copper production in the United States for the year 1905 was estimated at 950,000,000 pounds, an increase of 16 per cent. over 1904. It is estimated that Mexico will produce this year 150,000,000 pounds of copper, and British Columbia about 50,000,000 pounds. Hence the production of copper from the American continent in 1906 will amount to 1,200,000,000 pounds. The production for 1905 was between 1,050,000,000 and 1,100,000,000 pounds.

A 4,000-HP OIL ENGINE INSTALLATION.—The Baldwin Locomotive Works, who recently ordered 26 125hp "Hornsby-Akroyd" oil engines have just placed an order for six more of these engines of the same size, or a total of 32 engines, some of which will be coupled together and run direct connected to electric generator, making 250 hp units. Aggregating 4,000 hp, this will be the largest oil engine installation ever made. These engines will be run on crude oil, and are all supplied by the De La Vergne Machine Co. of New York.

Financial Intelligence.

THE WEEK IN WALL STREET.—After wavering uncertainly on Wednesday, when news of the San Francisco earthquake and fire first came in, the markets fell on Thursday into extreme weakness, with numerous declines of 5 to 10 points in active securities. Even at London, it was reported that financial markets were upset by the San Francisco news. Later the market became firmer on renewed support and short covering. Heavy liquidation occurred in pool stocks as well as in transcontinental rails. Easier money, due to large imports of gold, abated the stringency, Secretary Shaw's action in facilitating gold imports enabling New York to arrange for a large flow of money to the Pacific Coast. Electric securities declined with the rest of the market, and while there were some recoveries none of them regained the losses sufficiently to come out even, with the exception of Westinghouse, which made a net gain of 2¼ points. The closing price was 164, which was also the highest for the week. General Electric fell to 167, but regained some of the loss and closed at 169⅛, a net loss of 2⅞ points. Allis-Chalmers common closed at 22, and preferred at 56½, the latter being a decline of 1 point. Among the tractions the lowest quotation for Metropolitan Street Railway (154½), was also the closing price, and represents a loss of ⅝-point for the week's business. There was active trading in Brooklyn Rapid Transit, but on a falling market. The lowest price was 82½ and the highest 89, the quotation at the close being 84⅜—a net loss of 3½ points. In the telegraph list, Western Union remained steady at 92⅝ throughout the week, and the same condition was recorded as to American Telephone & Telegraph, the unvarying price being 138. American Locomotive closed at 68¼ for common and 114½ for preferred, these quotations being a net gain of ⅛-point for the former and a net less of ½ for the latter. Curb stocks felt the effect of the San Francisco disaster, and business was almost at a standstill as far as public buying was concerned. Interborough-Metropolitan lost 1½, in closing at 52½ and preferred 2⅛, the closing quotation being 88. Mackay Companies closed at 65, which is a net advance of ⅛-point. Following are closing Stock Exchange quotations of April 24:

NEW YORK

	Apr. 17	Apr. 24		Apr. 17	Apr. 24
Allis-Chalmers Co.	22¼	20¾	General Electric	171½	169½
Allis-Chalmers Co. pfd.	57½	56½	Hudson River Tel.	...	...
American Dist. Tel.	*30	*30	Interborough Rap. Tran.	...	236
American Locomotive	69⅝	68¼	Mackay Cos.	65	65¾
American Locomotive pfd.	115	113½	Mackay Cos. pfd.	73½	72⅝
American Tel. & Cable	93	92	Marconi Tel.	...	...
American Tel. & Tel.	137	137½	Metropolitan St. Ry.	116⅜	112½
Brooklyn Rapid Transit	87⅞	83¼	N. Y. & N. J. Tel.	...	..
Electric Boat	...	18	Western Union Tel.	92⅝	92⅝
Electric Boat pfd.	...	65	Westinghouse com.	163	158
Electric Vehicle	...	15½	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18¼	17½			

BOSTON

	Apr. 17	Apr. 24		Apr. 17	Apr. 24
American Tel. & Tel.	138⅜	137½	Mass. Elec. Ry. pfd.	67	66
Cumberland Telephone	..	...	Mexican Telephone	...	...
Edison Elec. Illum.	...	...	New England Telephone	140⅜	138½
General Electric	...	...	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	18½	Western Tel. & Tel. pfd.	84½	...

PHILADELPHIA

	Apr. 17	Apr. 24		Apr. 17	Apr. 24
American Railways	53½	52	Phila. Electric	8¼	8⅜
Elec. Co. of America	11⅜	11¼	Phila. Rapid Trans.	28¼	27⅞
Elec. Storage Battery	78	75	Phila. Traction	99¼	99
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Apr. 17	Apr. 24		Apr. 17	Apr. 24
Chicago City Ry.	182	180	National Carbon	92	90
Chicago Edison	154⅛	..	National Carbon pfd.	119	120
Chicago Subway	60¼	55½	Union Traction	...	...
Chicago Tel. Co.	110	107½	Union Traction pfd.	...	...
Metropolitan Elev. com.	28	28			

* Asked

DIVIDENDS.—American Light & Traction Co. has declared the regular quarterly dividends of 1½ on the preferred stock and 1 on the common, payable May 1. The preferred dividend of 1¾ per cent. on National Carbon is payable May 15. The regular quarterly dividend of 1¾ per cent. has been declared on the preferred stock of the American Graphophone Co., payable May 15. Directors of the North American Co. have declared the regular quarterly dividend of 1¼ per cent., payable June 1 to stockholders of record on May 15. The Helena Light & Railway Company's directors have declared a dividend of 1¼ per cent. on the preferred stock for the quarter ending March 31, 1906, payable April 30. The directors of the Amalgamated Copper Company have declared a regular quarterly dividend of 1½ per cent and an extra dividend of ½ of 1 per cent without any extra dividend. At that time the regular rate was increased from 1¼ per cent. quarterly to 1½ per cent. quarterly, placing the stock on a 6 per cent. basis. The Montreal Light, Heat & Power Co. has declared a quarterly dividend, payable May 15 at the rate of 4 per cent per annum. The Twin City Rapid Transit Company has declared the regular quarterly dividend of 1¼ per cent on common stock, payable May 15.

CINCINNATI GAS & ELECTRIC.—A lease of the business and plant of the Cincinnati Gas & Electric Company for ninety-nine years to A. S. White and associates of New York has been ratified by the board of directors of the company. A holding company will be formed under the laws of Ohio to take over the local company, and the new corporation will have a capital of $10,000,000. Of this amount $6,000,000 will be issued and the balance will be retained by the syndicate. The new stock will be sold to provide funds to build a pipe line from this city to the natural gas fields of West Virginia. The leasing company is also to guarantee $3,000,000 in cash to the old company, and an expenditure of $2,000,000 on improvements in the next ten years. In addition 5 per cent dividends are to be guaranteed on the present outstanding capital of the Cincinnati Gas & Electric Company, which is $36,000,000, of which $31,000,000 is outstanding.

ELECTRIC LIGHTING REPORTS.—Stone & Webster, of Boston, report the earnings of the following companies for the month of February, 1906, also for the twelve months ending Feb. 28, 1906:

	1906.	1905.		
Edison Electric Illuminating Co., of Brockton:				
February gross	$14,285	$11,853	Inc.	$2,432
February net	4,301	2,995	Inc.	1,306
February sur. over chgs.	3,572	2,326	Inc.	1,246
Twelve months' gross	150,289	125,976	Inc.	24,313
Twelve months' net	44,177	49,743	Dec.	5,566
Twelve months' surplus over charges	35,605	39,544	Dec.	3,939
Jacksonville Electric Co.:				
February gross	$22,371	$23,916	Dec.	$1,545
February net	7,647	10,300	Dec.	2,653
Feb. sur. over chgs.	4,322	7,283	Dec.	2,961
Twelve months' gross	303,447	297,417	Inc.	6,030
Twelve months' net	121,871	120,193	Inc.	1,678
Twelve months' surplus over charges	83,398	83,680	Dec.	282
Lowell Electric Light Corporation:				
February gross	$24,099	$20,791	Inc.	$3,308
February net	10,912	10,491	Inc.	421
Feb. sur. over chgs.	10,222	9,560	Inc.	662
Twelve months' gross	261,714	240,962	Inc.	20,752
Twelve months' net	100,094	104,182	Dec.	4,088
Twelve months' surplus over charges	91,253	89,697	Inc.	1,556
Savannah Electric Co.:				
February gross	$45,821	$39,491	Inc.	$6,330
February net	16,574	15,814	Inc.	760
Feb. sur. over chgs.	5,670	5,260	Inc.	410
Twelve months' gross	600,844	546,634	Inc.	54,210
Twelve months' net	240,991	228,906	Inc.	12,085
Twelve months' surplus over charges	112,595	102,427	Inc.	10,168
Houghton County Electric Light Co.:				
February gross	$19,889	$18,323	Inc.	$1,566
February net	10,038	10,744	Dec.	706
Feb. sur. over chgs.	7,851	8,557	Dec.	706
Twelve months' gross	218,984	189,434	Inc.	29,550
Twelve months' net	113,859	92,254	Inc.	21,605
Twelve months' surplus over charges	87,609	66,004	Inc.	21,605
Minneapolis General Electric Co.:				
February gross	$71,250	$56,106	Inc.	$15,144
February net	39,454	27,712	Inc.	11,742
Feb. sur. over chgs.	30,404	17,260	Inc.	13,144
Twelve months' gross	750,610	648,454	Inc.	102,156
Twelve months' net	358,809	325,280	Inc.	33,529
Twelve months' surplus over charges	248,986	212,064	Inc.	36,922
Tampa Electric Co.:				
February gross	$35,873	$30,590	Inc.	$5,283
February net	16,551	12,186	Inc.	4,365
Feb. sur. over chgs.	16,551	10,285	Inc.	6,266
Twelve months' gross	423,746	374,774	Inc.	48,972
Twelve months' net	184,186	152,738	Inc.	31,448
Twelve months' surplus over charges	166,258	129,428	Inc.	36,830
Terre Haute Traction & Light Co.				
February gross	$54,902	$40,746	Inc.	$14,156
February net	18,706	10,047	Inc.	8,658
Feb. sur. over chgs.	6,074	950	Inc.	5,124
Twelve months' gross	657,500	574,927	Inc.	82,573
Twelve months' net	228,521	205,300	Inc.	23,222
Twelve months' surplus over charges	101,114	92,297	Inc.	8,819

NEW ORLEANS LIGHTING.—The New Orleans Railway & Light Company in its annual report just issued by President E. C. Foster, gives the gross earnings as $5,093,709; operating expenses, $2,671,460; the fixed charges and taxes, $1,784,226, and the surplus $638,023. The separate earnings, etc., of the lighting system are not given, but it is stated that during the last three years $255,042 has been spent on additions to electric light properties, $147,475 on arc lamps, meters, transformers, etc., and $108,244 on new plant for city lighting. A considerable amount of new electric lighting work is to be done at an early date. The gross earnings of January, 1906, were $498,578, and of February, $506,507, leaving a surplus for the two months of $210,841, or more than the preferred dividend for the whole first quarter.

CONSOLIDATION OF STATE OF WASHINGTON RAILWAY COMPANIES.—The plan of a merger of the Coeur d'Alene & Spokane Railway Company, the Spokane Traction Company and the Spokane & Inland Railway Company to form the Inland Empire Railway of Spokane, provides for the issue of $10,000,000 each of common and preferred stock. The preferred stock will be 5 per cent non-cumulative for the first five years, and after that cumulative with a provision that in case of more than a 5 per cent dividend being paid upon the common stock an increased dividend not to exceed 7 per cent shall be paid. The preferred stock, the par value of which is $100, is to be redeemable at the pleasure of the corporation at any time at $135 per share, but is to have no vote. It is planned to issue at the present time about $6,000,000 of the common stock, the amount remaining after taking over the capital stock of the merging companies to be used for the establishment of a hydro-electric plant of the Spokane River near Spokane, and the building of an electric railway to connect the same with Spokane. The Coeur d'Alene & Spokane Railway has been in operation for about two years and runs between the cities after which it is named—a distance of about 33 miles. The Spokane Traction Company has 22 miles of track in Spokane, a considerable part of which has been in operation for less than a year. The Spokane & Inland Railway will run from the former place to Colfax and Palouse and have a total mileage of 115 miles, the lines being now under construction.

GROWTH IN EARNINGS.—The Milwaukee Electric Railway and Light Company reports for March:

	1906.	1905.	
Gross earnings	$274,026	$252,833	Inc. $21,193
Exp., taxes, dep	183,874	171,738	Inc. 12,136
Net earnings	$90,152	$81,005	Inc. $9,057
Total net	93,602	83,393	Inc. 11,209
Charges	45,173	33,648	Inc. 11,525
Surplus	$48,429	$48,745	Dec. $316
Gross, three months	804,560	742,028	Inc. 56,062
Exp., taxes, dep	534,677	508,615	Inc. 26,062
Net, 3 months	$269,883	$233,413	Inc. $36,470

The Toledo Railways and Light Company reports for March:

	1906.	1905.	1904.
Gross earnings	$158,285	$146,565	$138,665
Expenses and taxes	84,702	75,672	77,858
Net earnings	$73,583	$70,893	$60,807
Charges	42,200	52,863	41,971
Surplus	$31,383	$28,030	$18,836
Gross, three months	460,147	430,915	400,220
Expenses and taxes	243,016	220,994	223,764
Net earnings	$217,131	$209,921	$176,456
Charges	126,794	128,383	124,873
Cur., 3 mos	$90,337	$81,538	$51,583

AMERICAN LIGHT & TRACTION.—The American Light & Traction Company's surplus earnings, after dividend requirements and after deducting $180,099 for reconstruction reserve account, for the quarter ending March 31, 1906, were $129,840, against $105,495 for the corresponding quarter last year. The company's net earnings for the twelve months ending March 31, 1906, increased 47 per cent. Not including the earnings of the Quebec-Jacques Cartier Electric Co., the Lacombe Electric Co., the Muskegon Traction & Light Co., and the Detroit City Gas Co., all of which properties have been acquired by it during the present year, the American Light & Traction Co.'s net earnings for the first quarter in 1906 increased 32 per cent. over those of the first quarter of 1905. At the organization meeting of the company's directors, numerous changes in officers were made, all to take effect May 1. Sheldon J. Glass, now secretary and treasurer, was elected vice-president and general manager of the company's subsidiary company in Milwaukee. Lanson P. Lathrop, now the vice-president and general manager of the Detroit City Gas Co., was elected vice-president and treasurer of the Light & Traction Co. H. L. Doherty, now general manager of the company, was elected a vice-president and consulting engineer. James M. McCarty, now connected with the company's Quebec property, was also elected a vice-president. James Lawrence was elected secretary and Marion McMillin assistant secretary of the company.

PENNSYLVANIA ELECTRIC VEHICLES.—The stockholders of the Pennsylvania Electric Vehicle Company will meet in Camden this week to vote upon the proposal to liquidate the company's affairs. The directors have unanimously approved this step, and it is understood that a majority of both the preferred and common stockholders are in favor of dissolving the company. A conservative estimate is that the preferred stockholders will get about $3.75 a share from a sale of the company's effects. As the preferred stock is entitled to the full par value ($10 a share) in liquidation, before anything goes to the common shares, it is obvious that the latter stock will get nothing when the assets are sold. This has directed the attention to recent heavy purchases of the common stock at ⅛, the significance of which is not understood, unless it is the intention of these purchasers to ask the courts to stop the proposed dissolution. Some of the directors say the common stock has nothing to gain by the company continuing in operation, in view of the small amount of its business, and the possible further depletion of the assets in maintaining its organization for a business not sufficiently profitable to warrant it. They think, therefore, that the best thing for all concerned is to dispose of the assets and close up the business.

LOS ANGELES REFUNDING.—The Los Angeles Edison Electric Company is issuing $1,500,000 of refunding 5 per cent mortgage gold bonds, which will bring the bonded debt up to $8,265,000 out of $10,000,000 issued. The capital stock is $4,000,000 cumulative 5 per cent preferred and the common is $6,000,000, of which is issued $3,840,200 of the preferred and the same amount of common. The gross earnings for the year ending February 28, 1906, were $1,341,684, with operating expenses $549,573 and accrued bond interest of $295,524, leaving a surplus of $496,587. The company has valuable water power rights on the Kern River, 110 miles distant, and will secure 20,000 hp there. Last February the company's connected load was 480,653 incandescent lamps, 1,938 commercial arcs, 552 city arcs, 14,451 hp in motors, and 26,307 connected electric meters. The population served is 275,000. Perry, Coffin & Burr, N. W. Harris & Co. and E. H. Rollins & Sons handle the above offering of bonds.

SUBMARINE SIGNAL STOCK.—It is stated in Boston that the issue of $250,000 new stock by the Submarine Signal Co. at $20 per share is equivalent to a right worth from $4.50 to $5 per share, as the stock has been selling on the curb at about $24.50 per share. The new issue has been underwritten at $25, or par, less a commission of $5 per share, with an agreement between the company and the underwriters that it should be first offered to the stockholders on the same terms. The underwriters are paid no commission except on such stock as they are allotted. The directors who have offered the stockholders an opportunity to take the entire new issue on the same terms as the underwriters are ready to take it, feel they have come as near to paying a dividend by giving a right worth $4 or $5 per share as is wise or safe at this time.

BRUSH ELECTRICAL ENGINEERING.—The dividend announcement of the Brush Electrical Engineering Company, of England, just published, indicates a considerable improvement in the company's position during the past twelve months. A year ago only the preference dividend was paid, but now the ordinary are to get 2½ per cent. for the year, and this is not effected by dividing the profits up to the hilt, as nearly $34,500 is allowed for depreciation and $37,500 is placed to general reserve, each of which appropriations is, in round figures, about $2,500 more than the sums allotted to these items at this time last year. The dividend is certainly encouraging, as it is the first return for the ordinary shareholders since 1900, when they received 5 per cent.

TO DEAL IN PLANTS.—The Continental Public Utilities Company filed with the Secretary of State of Maine recently its certificate of incorporation. The purposes, which are numerous and varied, are mainly to construct, buy and operate gas and electric lighting plants and street and interurban railroads. The company has an authorized capitalization of $12,500,000, of which $10,000,000 is common stock. Milard W. Baldwin, of Portland, is president and clerk.

THE NORFOLK (VA.) MERGER.—The consolidation of all the electrical traction, light and gas properties in Norfolk, Portsmouth, Berkeley and Suffolk, with the exception of the Bay Shore Terminal and Norfolk & Atlantic Terminal properties, into the $14,000,000 holding corporation known as the Norfolk & Portsmouth Traction Company, has been finally completed, and the merger becomes effective from June 1.

GENERAL NEWS.

Construction Notes.

BESSEMER, ALA.—The North Johns Telephone Company, recently organized, has let the contract for the erection of a complete system and work has commenced.

TOMBSTONE, ARIZ.—D. A. Adams, of Dragoon, has been granted permission to erect a telephone line within limits of the town of Benson. He contemplates extending the line to Johnson.

HARRISON, ARK.—J. B. Quigley and J. C. Settle, of St. Louis, Mo., have secured a franchise for an electric light and gas plant and water works.

WYNNE, ARK.—A 120-hp engine and electric alternator will soon be installed in the city lighting and water works plant. E. H. Demsey is superintendent.

TEXARKANA, ARK.—Plans and specifications have been prepared by H. A. Overbeck, Juanita Building, Dallas, Tex., for the erection of a fireproof building for the Southwestern Telegraph & Telephone Company at Texarkana.

LITTLE ROCK, ARK.—The Southwestern Telegraph & Telephone Company will soon commence to put its wires underground in that part of the city in which the company obtained a franchise to lay underground conduits. It is expected that the work will be completed by July.

DE QUEEN, ARK.—The De Queen Light, Ice & Cold Storage Company of De Queen, Ark., has purchased an additional horizontal Reynolds Corliss engine, 10x30 inches, from the Allis-Chalmers Company, of Milwaukee. The new unit will run non-condensing with 100 lbs. steam pressure, and direct connected to a 13x26 ammonia compressor.

EUREKA SPRINGS, ARK. Matthews & Barnes, who recently obtained an electric franchise for ninety-nine years from the city, purchased the famous Woodruff power site on Kings River, nine miles east of town, and will install large turbine water wheels there, transmitting the power by wire to their proposed plants here. A concrete dam will be put in at a point where the river forms a loop of 8,000 feet, separated only by a bluff 100 feet high and 150 feet across and through which a tunnel will be drifted. Sufficient power can be generated to supply every industry, public and private, in the city.

PASADENA, CAL.—It is reported that the mayor is in favor of issuing bonds to establish a municipal lighting plant

ESCONDIDO, CAL.—H. T. Duff has secured a franchise for the construction of an electric light plant at a probable cost of $25,000.

SANTA CRUZ, CAL.—The City Light Company will soon install 40 more arc lamps, making a total of 140 lamps owned and operated by the city. R. S. Tait is superintendent.

MARYSVILLE, CAL.—The Northern Electric Company has awarded the contract for the construction of the proposed electric railway from this city to connect with the road already built between Chico and Oroville.

LOS ANGELES, CAL.—The Home Telephone Company is reported to have purchased the Cuaymaca telephone lines, leading from Lakeside to the Stonewall lines in the mountains, and it is reported the company will extend its lines across the desert to Imperial.

REDDING, CAL.—The Shasta Power Company will build its substation on the northeast corner of Pine and Sacramento Streets in Redding The work of construction on the power-house and pole line will be resumed as soon as the weather conditions will permit The company's power station is on Snow Creek and the water for power will be taken from Hat Creek.

FRESNO, CAL.—The San Joaquin Power Company's new power plant is almost ready for operation and is now being thoroughly tested. The present plant with four units furnishes but 2,500 hp. The new plant with two hydro-electric units furnishes 3,500 hp in addition. The work of tunneling for the ditches running to Crane Valley, where still more power is to be developed, has been greatly hindered by the recent storms. There is to be in all 4,000 feet of tunnel. Of this amount 800 feet is completed.

SAN FRANCISCO, CAL.—Construction has been begun by the Union Pacific in Wyoming on the new independent telephone system to be established by E. H. Harriman along the lines of the Union Pacific and Southern Pacific from Chicago to San Francisco. James McReynolds, who has just completed the construction of 2,000 miles for the Postal Telegraph Company in Wyoming, will have charge of the work, with headquarters in Cheyenne This line will be built for the purpose of facilitating the handling of trains. A separate pole line which will be used exclusively for the telephone and block system will be built the entire length of the system. The first division to be constructed will be from Green River to Cheyenne and will be completed this year.

PLACERVILLE, CAL.—H. J. Maxwell, of San Francisco, has recently located two large water rights on streams 35 miles east of Placerville. On one location he claims 6,000 inches of water measured under a 4-inch pressure on the south fork of the American River, in township 11 north, range 16 east. By the second location Maxwell claims 3,000 inches of water measured under a 4-inch pressure of the Silver Fork of the South Fork of the American River. The two water rights are so situated that the waters from both may be brought together and furnish a great fall back to the American River. The water is claimed for the purpose of mining, manufacturing and general electrical power. By his appropriation he will be enabled to use a large quantity of water that will be stored in Echo and Silver Lakes, by other interests, which will flow down the American River, and be used by Maxwell, and turned back in the river without interfering with the use of the water by prior locators.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Lighting Company has recently installed a new engine and generator in its lighting plant.

NORWALK, CONN.—The Connecticut Railway & Lighting Company has decided to install new arc lamps in the city of Norwalk. The kind of lamp has not yet been decided. A. D. Wainwright is superintendent, to whom communications should be addressed

YALESVILLE, CONN.—The Electric Light Committee has made arrangements with the electrical commissioners of Wallingford to furnish the town with fifty 32-cp incandescent lamps to be in operation by August 1.

EAST HADDAM, CONN.—East Haddam Electric Light Company contemplates raising the present dam from 14 feet to 72 feet the coming summer, which means an entirely new plant. E. W. Crocker is superintendent.

BRIDGEPORT, CONN.—The United Illuminating Company contemplates building an addition to the electric light station on Congress Street It will be a brick building two stories high, and will cost about $8,000. Warren R. Briggs is the architect.

WALLINGFORD, CONN.—At a recent borough meeting the citizens voted to enlarge the municipal electric lighting system by utilizing the water privileges on the Quinnipiac River, which were purchased last June; installing a water wheel, generators and other appliances necessary and constructing a transmission line to the present lighting station. The cost is not to exceed $5,500.

WILMINGTON, DEL.—The Wilmington City Railway Company has placed contracts for new equipments, which will cost about $400,000. Work will be started as soon as possible.

WILMINGTON, DEL.—It is reported that work will soon begin on the addition to the Delaware & Atlantic Telegraph & Telephone Company's building at Sixth and Shipley Streets.

WILMINGTON, DEL.—Ground has been broken for the proposed electric plant of the Wilmington Light, Power & Telephone Company, on the site purchased on the north side of the Brandywine. The engine and boiler rooms will be 90 by 62 feet. The new buildings will run up to the end of the present wharf and it will be necessary to build a coffer dam about fifteen feet out from the wharf. It is expected that the plant will be finished some time next fall. The A. S. Reed & Bro. Company has the contract to put up the buildings.

WASHINGTON, D. C.—Bids will be received until May 8 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards, at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa ; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 518—Incandescent lamps, electrical supplies, bar steel, strip brass, etc. Schedule 510—Motor, electric motor equipment for launch, sheet copper, bar steel, cast steel block, copper iron pipe, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

LAKE CITY, FLA.—The Lake City Water & Light Company writes that it will soon move its plant and install new machinery and make improvements in general. Frank A. Farwell is superintendent.

TALLAPOOSA, GA.—The city is now constructing a new electric lighting plant which will cost $13,000. A. J. Radcliff has charge of the work.

COLUMBUS, GA.—The Columbus Power Company is contemplating the construction of a new power plant, and has purchased the site for the same.

CORDELE, GA.—The Citizens' Electric Light & Power Company has purchased a 350-hp Corliss engine, a 150-hp boiler and a 115-kw generator with switchboards, which are to be added to the present plant of the company in this city.

GRANGEVILLE, IDAHO.—The City Council has granted the Nez Perce Telephone Company a twenty-five year franchise to extend its line here from Cottonwood, and also to start an exchange. The line is expected to be built and in working order within three months.

GILBERTS, ILL.—The Elgin & Belvidere Railway Company will build a power plant in this place.

CHICAGO, ILL.—The North Shore Electric Company will increase its capital stock from $750,000 to $2,000,000.

HAMPSHIRE, ILL.—The lighting commission has decided to install meters in the village lighting system and abolish the flat rate system.

QUINCY, ILL.—The Quincy Gas, Electric & Heating Company is considering the extension and improvement of its plant. W. A. Bixby is manager.

CORNELL, ILL.—M. J. Rhodes, proprietor of the Cornell electric light plant, contemplates installing machinery for a day load during the coming season.

CAIRO, ILL.—It is stated that the Central Union Telephone Company contemplates making extensive improvements on its local equipment which will cost $8,000.

LAWRENCEVILLE, ILL.—Charles G. Arnold, superintendent of the Lawrenceville Light & Water Company, writes that the entire system is being overhauled and rebuilt.

MATTOON, ILL.—The city electric light plant, under the management of H. W. Clark, has just completed the change of equipment in its plant. H. A. Schrock is superintendent.

ALTON, ILL.—The Village Council of North Alton has granted a franchise to the Alton, Jacksonville & Peoria Traction Company, giving the company the use of the main street of the village.

AURORA, ILL.—It is stated that the contract for the installation of the new electric lighting plant for the city has been awarded to the Ball Engine Company and the Western Electric Company.

FREEPORT, ILL.—The Freeport Railway, Light & Power Company is considering the extensions of its street railway lines and building a water power plant six miles from the city. Charles Baumgarten is superintendent of the light and power department.

WAUKEGAN, ILL.—The Chicago Telephone Company is considering the question of putting the toll lines between Chicago and Milwaukee in underground conduits to insure more reliable service. Permission to change from poles to conduits will be asked of the cities and counties along the route.

BELLEVILLE, ILL.—The Belleville Gas & Electric Company is now installing a 750-hp Reynolds direct-connected Corliss engine in its plant, the unit being furnished by the Allis-Chalmers Company. This with other improvements will entail an expenditure of $40,000. Harry P. Kucher is manager.

VEVAY, IND.—The matter of adding another dynamo and engine to the municipal electric light and water works plant is now under consideration. Charles Allen is engineer.

WABASH, IND.—The Home Telephone Company of this city, is arranging to erect a new business block for its own use, and to install a 10,000 central-energy multiple-switchboard.

WESTVILLE, IND.—The Town Council of Westville has granted a thirty-year telephone franchise to E. S. Smith, E. T. Scott, O. W. Weed and Jacob Harold, of this place, and James H. McGill, of Valparaiso, Ind.

WOLCOTT, IND.—The Wolcott Electric Light Company writes that the company will put in a water works system in this town, and is considering the question of extending its lines to Remington, a distance of 6 miles. W. S. Lewis is manager.

MARION, IND.—O. L. Barger, who has an option on a franchise for the installation of an automatic telephone system in Marion, has stated that he has placed $125,000 of the stock of the new company that is to be organized and that he expects to be able to place the other $25,000.

LINTON, IND.—The City Council has sold the Linton electric light plant to the local gas company for $32,000; the company to give the grounds and building to the city. The company agrees to furnish street lamps at $50 a year. It is understood the plant will be practically rebuilt.

EVANSVILLE, IND.—Henry W. Marshall, Charles Murdock and Samuel T. Murdock, of Lafayette, have secured a controlling interest in the Evansville Electric Company. In the reorganization Charles Murdock succeeds James O. Parker as president, and Henry Marshall becomes secretary-treasurer, vice Judge Alexander Gilchrist. Herbert Moran is retained as vice-president and general manager. The new directory includes the four new persons named, with the addition of Thomas Krutz, of New York, and William G. Krutz, of Chicago.

ARDMORE, I. T.—The Chickasaw Telephone Company is preparing plans for a new central energy exchange, fully equipped with new switchboard and telephones.

SAPULPA, I. T.—The Central Light & Fuel Company of this place has been sold to the Deming Investment Company, of Oswego, Kan. Mr. Deming owns the natural gas plants of Parsons, Baldwin and Weir City, Kan., and at Chelsea and Coweta, I. T.

CHICKASHA, I. T.—The Chickasha Light, Heat & Power Company contemplates making important changes and improvements in its plant. The company will install a 4,000-light unit and rebuild the entire overhead system. A. B. Coryell is manager.

DURANT, I. T.—The Pioneer Telephone & Telegraph Company is installing a complete metallic circuit in this city, capable of handling 1,500 subscribers. The cable is being strung over all sections of the city and the system will be in operation in about forty days.

CHEROKEE, IA.—The local telephone company is extending its lines to Afton and Spring

NEVADA, IA.—The Nevada Electric Company expects to install one 25-hp alternating-current motor and one 5-hp alternating-current motor for pumping purposes. M. A. Harrison is superintendent.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company is considering the erection of an addition to its building, to cost $3,900.

ABILINE, KAN.—The Riverside Light & Power Company is now installing a 200-kw Stanley alternator and will soon start day service for power.

SALINA, KAN.—It is reported that the Salina Telephone Company will soon begin putting its wires underground. The company will spend about $50,000 in improvements this year.

TOPEKA, KAN.—The Independent Telephone Company has increased its capital stock from $150,000 to $1,000,000. The company will spend about $400,000 in improving its system in this city. The company will place all its wires under ground and also erect a new office building. B. F. Pankey is president and general manager.

BELLEVILLE, KAN.—Bids will be received until May 15 at the office of J. B. Peach, city clerk, for furnishing material and supplies necessary for equipping and installing a complete electric lighting system for this city, and for making certain improvements in the water works, to consist of the following: Brick power house; steel stack; one 66-ft. x 16-in. tubular boiler; two high-speed engines for direct connection to alternators; steam piping, valves and covering; steam specialties; two 75-kw alternating-current generators and exciters with switchboard; pole line material, arc apparatus, transformers, station wiring, etc. W. K. Palmer is consulting engineer, 718 Dwight Building, Kansas City, Mo.

OLYMPIA SPRINGS, KY.—Smith, Watkins & Company are contemplating installing an electric light plant in this city.

LOUISVILLE, KY.—It is stated that the East Tennessee Telephone Company will soon improve its system by substituting individual lines for party lines. The company also contemplates extending its lines into Clark County.

LOUISVILLE, KY.—The Board of Aldermen on April 17 adopted the ordinance requiring companies using electricity in the central portion of the city to place their wires underground, beginning five months from passage of ordinance.

MINDEN, LA.—The Minden Electric Light and Power Company, Ltd., recently installed a new Corliss engine to replace the old one of other make. Louis Arnard is chief engineer.

SOUTH PARIS, ME.—The citizens of this village will soon hold a meeting to decide whether the village will have a plant of its own for lighting the streets and public buildings. This is the outgrowth of the contest with the Oxford Light Company, of Norway, which resulted in the act passed by the last Legislature allowing the town corporation to do its own heating and lighting.

MILFORD, ME.—The concrete dam which is being constructed between Oldtown and Milford by the Milford Construction Company, is nearing completion. Excavations are now being made at the Milford end of the dam for a power-house 224 feet in length and 80 feet wide. Twelve 800-hp wheels will be installed. The Allis-Chalmers Company will furnish the water wheels and the generators will come from the Stanley Electric Company. The Union Iron Works of Bangor has the contract for the structural steel and the castings. Electrical power will be generated at this plant for distribution to manufacturing establishments along the river for the distance of twenty miles.

BANGOR, ME.—The Maine & New Brunswick Electrical Power Company, Ltd., has commenced an electrical power plant at the great falls on the Aroostook River just across the line from Fort Fairfield, Me. The plan also includes the construction of a concrete dam 32 feet high and the development of estimated 3,000 hp. It is intended to generate electrically the power in four units of 750 hp each, and 1,500 hp will be developed as soon as the plant is in operation. The electricity will be transmitted to all parts of Aroostook County for lighting and power purposes, and also to places in New Brunswick, the company being chartered both in Maine and New Brunswick. The company already has a contract to transmit to Houlton, a distance of 60 miles, 250 horse-power for 15 years. The company has been incorporated with a capital stock of $250,000

BALTIMORE, MD.—It is reported here that the charter of the Baltimore & Ocean City Railroad Company, which was granted at the recent session of the Legislature, will be used for a monorail line between this place and Ocean City, Md. The American Monorail Company, in which a number of Pennsylvania capitalists are interested, owns the charter and proposes to build the road.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company will construct a new electric light plant at Westport, Md.

BETTERTON, MD.—The Betterton Improvement Association will receive bids for installing a lighting plant for the town. The proposition must include part ownership.

MARLBORO, MASS.—The trustees of the municipal light plant are contemplating the extension of the lighting system to the town of Stow.

MILFORD, MASS.—At a recent meeting of the board the Selectmen voted to contract with the Milford Electric Light & Power Company for 58 arc lights for one year at $5,000 and with the Globe Gaslight Company for 75 boulevard gasoline lamps to burn all night, twenty-five nights a month, at $1,800.

MIDDLETON, MASS.—The electric light committee is making investigations in regard to the actual expenses of installing electricity in the town, in order to make a more definite report at the next meeting. At the last meeting the committee was unable to recommend a sum of money the town would be required to appropriate to carry out the proposed plan.

PITTSFIELD, MASS.—The Pittsfield Electric Company, which recently bought a large tract of land on the north shore of Silver Lake, plans to expend about $50,000 for new buildings and machinery. A power-house, 80 by 100 feet, is to be erected, also a boiler-house, 50 by 100 feet. A spur track will extend from the Boston and Albany railroad to the latter building, where coal pockets will be built. The electrical equipment will include a 50-kw alternating-current Stanley generator. Two Deisel oil engines of 500-hp are also to be installed.

HOUGHTON, MICH.—The Keeweenaw Copper Company has decided to develop the water power of Mosquito Lake.

ONTONAGON, MICH.—The Lane & Bodley Company, of Cincinnati, Ohio, has secured the contract for the new electric lighting plant in this village.

WHITEHALL, MICH.—The village is contemplating installing a series alternating arc system in the municipal electric light plant. W. E. Pierce is superintendent.

DURAND, MICH.—Fred L. Eldridge, village clerk, writes that the village expects to install a new boiler of 150 hp in the municipal electric lighting and water works plant.

OWOSSO, MICH.—Permission has been granted to the Owosso & Corunna Street Railway Company to extend its franchise, and work on the road will be extended to Durand at once.

OXFORD, MICH.—A. H. Betwee, superintendent of the city water and lighting plant, writes that a 60-kw Westinghouse alternator, an engine and new switchboard, are now being installed.

BERRIEN SPRINGS, MICH.—The Berrien Springs Power & Electric Company has been formed to construct a dam on the St. Joseph River at Berrien Springs. The dam will be 21 feet long and will cost with the electric light plant complete about $1,000,000.

SHEPARD, MICH.—C. C. Fields, of this place, has secured options on the land along the Chippewa River, and will construct a power plant to supply power in the counties of Isabella, Gratiot, Midland and Clare. The capital necessary for the construction of the dam, power houses, etc., is ready.

DETROIT, MICH.—The Michigan State Telephone Company is putting 100 miles of wire under ground, building two new exchanges, one in the extreme west portion and one in the extreme east portion of the city. It will also build a six-story building adjoining the present head office, to cost $160,000.

COLDWATER, MICH.—It is reported that the Battle Creek & Coldwater Electric Railway Company has purchased all its right of way and that rails will be laid this summer. The road will be operated by the third rail system, and will run from Battle Creek through Athens and Union City to Coldwater, a distance of 37 miles.

SWARTZ CREEK, MICH.—It is reported that the newly organized telephone company, which is formed of business men and farmers of this place, has commenced setting poles for the system. The new company will erect the building and the Bell Telephone Company will equip the exchange. It is expected to have the line in operation soon.

NORTON, MICH.—Preliminary steps toward forming a company to build a rural telephone line in Norton township were taken at a meeting held recently. Officers were elected as follows: William H. Patton, president; L. R. Coston, secretary; Edward Seng, treasurer. Plans for the proposed line have already been prepared and have been submitted to the Citizens Telephone Company of this city for consideration.

GRAND RAPIDS, MICH.—Negotiations are now under way for the promotion of an electric railway from Grand Rapids to Battle Creek via Hastings and Alaska, a distance of about 50 miles. Mr. Jackson, of Madison, Wis., will probably have charge of the electrical construction of the road. J. J. McVean, consulting engineer, of this city, will have charge of the preliminary survey. A. C. Sekeel and John E. More are also interested.

MUSKEGON, MICH.—Press reports states that the Grand Rapids-Muskegon Water Power Electric Company has awarded the contract for the construction of a second dam and water electric plant at Croton with a capacity of 12,000 hp. The work is to be completed before freezing weather next fall. To convey the current from this dam to the switch station near Casnovia village a new pole line 30 miles long will be built. The poles will carry three wires, the same as the present line.

GRAND RAPIDS, MICH.—John McNabb has received the contract for the addition to the main exchange of the Michigan State Telephone Company, and work will begin at once. The addition will be a two-story building similar to the present exchange adjoining it on the east. On the second floor will be installed the long-distance exchange and the present equipment will be doubled, over 200 connections being accommodated on the new board. The approximate cost of the improvements is $12,000.

GRAND RAPIDS, MICH.—The new water power electric company on the Big Manistee River, which is under the direction of M. B. Wheeler and R. A. Opdyke of this city, is assuming proportions that excel any of the similar plans in the State. It is understood that a good share of the $2,000,000 capital stock has been subscribed by Chicago capitalists and that part of the material for the construction of the big dam is already on the grounds. The dam will be located on the Manistee River in Wexford County, and two miles west of Sherman. It is estimated that 50,000 hp can be developed.

SEDAN, MINN.—The Sedan Telephone Company will soon start work on its lines.

TENSTRIKE, MINN.—The citizens have voted to issue bonds for the construction of a lighting system.

McINTOSH, MINN.—Anton Jensen, proprietor of the McIntosh electric light plant, will soon install a 70-hp gas engine.

STAPLES, MINN.—It is reported that the town will receive propositions for an electric light plant. J. D. Marlin is recorder.

HASTINGS, MINN.—The citizens have voted to issue $50,000 bonds for the construction of water works and an electric light plant. H. M. Durris is city clerk.

STAPLES, MINN.—The Staples Electric Company has purchased the plant of the Northern Electric Company and will rebuild it this season. E. Rohan is lessee and manager.

SHAKOPEE, MINN.—A. K. Adams, superintendent of the Shakopee electric light plant, writes that the city is considering adding 15 or 20 new series arc lamps to the street lighting system.

DULUTH, MINN.—It is reported that the Duluth Telephone Company will expend $100,000 in extending and improving the service in the two cities and the Range towns and installing better facilities for the long-distance business.

LA VERNE, MINN.—The street lighting system of the La Verne electric light and water works will be changed this season. A 60-kw Thomson-Houston alternator will be installed in place of the series arc machine now in use. The style of lamp has not yet been determined. L. J. Philbrick is chief engineer.

OSAKIS, MINN.—The farmers and business men of Nelson, Douglas County, have organized a company to build a telephone exchange at Nelson and build farmers' lines into the surrounding country. Connection will probably be made with the Leslie Rural Telephone Company. The company will be capitalized at $10,000. The company will incorporate under the name of the Bolson Telephone Company. The following officers have been elected: John Nelson, president; Charles Schelin, vice-president; H. J. Ernster, secretary; N. O. Johnson, treasurer.

UNIVERSITY, MISS.—The University electric light plant, of which E. Campbell is superintendent, is considering the installation of some new machinery the coming season.

IUKA, MISS.—The city electric lighting plant has recently installed larger mains and arc lamps and also expects to change its system from direct current to alternating current soon. J. E. Marshall is general manager.

BAY ST. LOUIS, MISS.—The Bay St. Louis Ice, Light and Bottling Works will install a 60 or 75-kw, 60-cycle, single-phase, belted generator in the near future, also a 125-hp high-speed engine. A. L. Stokoe is proprietor.

ABERDEEN, MISS.—The city of Aberdeen purchased the lighting plant of the local company about one year ago, and has recently built and equipped a new plant in connection with the new water works system. The electrical outfit is 60-cycle, three-phase with 50 series alternating-current arc lights on streets. John A. Walker is superintendent.

NEW MADRID, MO.—The electric light plant owned by H. B. Day was recently destroyed by fire, causing a loss of $5,500.

BLOOMFIELD, MO.—Bloomfield Electric Light, Heat & Power Company will install a 100-hp engine and a steam heating and water works system this spring.

MILAN, MO.—The Milan Electric Light Company is on the market for enclosed street arc lamps and transformers. E. S. Bennett is superintendent of the plant.

ST. CHARLES, MO.—The city of St. Charles contemplates combining the electric light plant with its water plant, which will necessitate larger boilers, etc. Charles H. Kansteiner is city clerk.

BELTON, MO.—A company has been formed and chartered with a capital stock of $200,000 to construct an electric or gasoline motor road from Kansas City to Belton, a distance of 20 miles. G. W. Scott and H. W. Mastin, of Belton, are among those interested in the project.

ST. LOUIS, MO.—The St. Louis & Suburban Railway Company has bought the franchise authorizing the Connecting Railway Company to build an electric railway in St. Louis County from the Florissant Division of the Suburban Railway on the north to the St. Louis & Meramec Railway on the south.

ST. LOUIS, MO.—The United Railways Company has filed a petition with the county court asking permission to erect poles for electric wires along the Fee Fee road, between the St. Charles and Creve Cœur Lake electric railways, which are a part of the United Railway system. It is reported that a new electric power station will be built on the Fee Fee road to furnish power for the two car lines.

ANACONDA, MONT.—It is reported that the Bell Telephone Company is preparing for the rebuilding of its lines in this city and the establishment of a new exchange.

LIVINGSTON, MONT.—The Livingston Water Power Company has just installed a new 750-kw General Electric, 3-phase, 2,300-volt, 60-cycle alternator, direct connected to a 1,325-hp Leffel water wheel. The company is going to rebuild its entire system and put in day service. J. L. Bright is manager.

WAKEFIELD, NEB.—The citizens have voted to issue bonds for the construction of an electric light plant.

NEBRASKA CITY, NEB.—The Nebraska City Telephone Company will spend about $25,000 in improving the local toll connections.

TECUMSEH, NEB.—The city will soon take action on rebuilding the city electric light plant or granting a franchise, as the present plant will not supply the demand. The plant is to be changed from direct to alternating current. Frank B. Thurber is electrician.

ASHLAND, NEB.—The Ashland Light, Mill & Power Company has rebuilt its lines through the town and is now putting in meters, and it contemplates extensive improvements in its dam during the summer. The company has a steam plant which is run in connection with its water power. The water power will develop 125 hp under ordinary conditions and the steam 100 hp. F. E. Miete is superintendent.

VIRGINIA, NEV.—Sam Longabaugh has incorporated a company to supply Reno, Sparks, Virginia and Carson with electricity. The generating plant will be built south of Slide Mountain.

WESTVILLE, N. J.—Plans have been made for the new power house to be built in this city for the new electric railway of the West Jersey & Seashore Railroad. Stern & Silverman are the architects and engineers.

LONG BRANCH, N. J.—The telegraph, telephone and electric light companies have agreed to remove all of their poles and bury all of their wires in front of the Ocean Park block on Ocean Avenue. The 100-foot plaza in front of the park has already been graded and the westerly curb line laid.

SOCORRO, N. M.—E. M. Burgess, of Denver, general superintendent of the Colorado Telephone Company, and J. E. Elder, local manager at Albuquerque, are contemplating the extension of its line from Socorro to San Marcial in the near future.

BERNALILLO, N. M.—E. M. Burgess, general manager of the Colorado Telephone Company, was in town recently on a tour of inspection. The company contemplates putting in an exchange at Corrales and to connect it with the Bernalillo switchboard.

ALBUQUERQUE, N. M.—The Colorado Telephone Company has let the contract for construction of its fireproof, three-story building to H. V. Tegner. The building will cost $20,000. J. L. Bell Company has contract for the plumbing and Nash Electric Company the electric wiring and fitting.

ALBION, N. Y.—The Bell Telephone will spend $28,000 in putting its wires under ground in this city.

GREEN ISLAND, N. Y.—The Hudson River Telephone Company will ask for permission to place its wires under ground in this village.

WATERTOWN, N. Y.—The City Council has awarded the contract to the Watertown Electric Light Company for lighting the public streets for a term of five years.

PHELPS, N. Y.—The local telephone company, with its lines and business, has been sold by Great Brothers to the Inter Ocean Company, which will rebuild the lines.

COHOES, N. Y.—The Council has granted the Hudson River Electric Power Company permission to extend its system into Cohoes and sell electricity. Bryce E. Morrow, of Glen Falls, is manager.

BINGHAMTON, N. Y.—Plans are being made by the New York State Telephone Company to begin the construction of the Henry and Wall Street subway, and it is expected to have the work completed by June.

NEW YORK, N. Y.—The New York, Westchester & Boston Railway Company is preparing plans for a power plant to be erected in Westchester County at a cost of $500,000. Wilson & Butler are architects.

ALBANY, N. Y.—An ordinance has been passed by Council, providing for the placing of all telegraph, telephone and electric wires underground, and in conduits, with the exception of the wires used by the electric car lines.

NEW YORK, N. Y.—Bids will be received until May 3 by Francis J. Lantry, commissioner of correction, for furnishing material and installing a new underground system of feeders for supplying electric lights to the various buildings and chapels, etc., also furnishing and erecting outside lights to entrances to buildings on Hart's Island, New York.

UTICA, N. Y.—The John F. Hughes Constructing Company, has secured the contract for the construction and equipment of four sub-stations to be built along the West Shore Railroad between Utica and Syracuse for use of the Mohawk Valley Company in the electrification of the West Shore Railroad from Utica to Syracuse, the substations to cost about $25,000 each. The Archbold-Brady Company has secured the contract for stringing the high-tension wires between Clark Mills and Manlius Center, for about $100,000.

GLENS FALLS, N. Y.—Piles have been delivered at the plant of the Hudson River Electric Power Company for use in constructing a foundation for the proposed high-tension building on which work will soon be started. This building will accommodate wires extending from the Spier Falls plant on the upper Hudson, and the apparatus that will be required in connection with them. The power company recently shipped back to the General Electric Works, Schenectady, a 500-kw machine that has been used in generating power since last June. A 1,000-kw machine is ready for permanent installation.

BUFFALO, N. Y.—The Aldermen have unanimously adopted the report of the joint council committee in favor of contracting with the Buffalo General Electric Company for supplying electric street lamps for the city for five years. The Buffalo General Electric Company has agreed to furnish electric arc lamps to the city for five years from March 1, 1907, for $50 a lamp per year instead of $75, the present price. The city is also to have the benefit of the $60 rate for the remaining nine months of the present contract, commencing June 1, 1906. The saving in the new five years contract figured from $75 will amount to $269,135, or $53,827 per year. The saving for the five years and nine months will be $309,500. The company also agreed to reduce the maximum price of electric lights to private consumers from 12 cents per kw-hour to 9 cents per kw-hour.

MARIETTA, OHIO.—The county commissioners have decided to install an electric light plant for the court house.

OBERLIN, OHIO.—The Oberlin Gas & Electric Company has placed contracts for new equipment which will about double the capacity of its lighting plant.

MASSILLON, OHIO.—The Massillon Light, Heat & Power Company is stringing several lines from Massillon to Canal Fulton and will supply that town with light.

MARIETTA, OHIO.—The Board of Public Works has authorized the purchase of an additional generator for the municipal electric lighting plant. C. Hancock is manager.

SPRINGFIELD, OHIO.—The Springfield Emery Wheel Company is erecting a large addition to its plant and will install a 150-hp boiler, a 100-hp engine and a 75-kw generator.

LAKEWOOD, OHIO.—The village council committee has reported favorably on a proposition to issue $25,000 worth of bonds for the purpose of enlarging the village municipal lighting plant.

HUDSON, OHIO.—Citizens of Hudson will hold an election in the near future to vote on the proposition of bonding the village for $10,000 for the purpose of building a municipal lighting station.

CLEVELAND, OHIO.—The Cleveland Light & Power Company has applied for a general franchise in Cleveland. Heretofore the company has done business in a certain part of the downtown section of the city.

CINCINNATI, OHIO.—The Globe-Wernicke Company is having plans prepared for a large power plant in its manufacturing plant near Norwood, Ohio, with a view of driving all of the machinery by electric motors.

TOLEDO, OHIO.—The Toledo Shipbuilding Company will shortly place contracts for the steam and electrical equipment for a large power station. All machinery in the new plant and the dry dock pumps will be electrically operated.

CLEVELAND, OHIO.—It is reported that the Cleveland Electric Illuminating Company will erect a large addition to the power house on Canal Street, which will cost $50,000. The general contract has been awarded to John Gill & Sons.

CANTON, OHIO.—The Canton Light, Heat & Power Company, which recently secured a new 10-year contract to light the city, will install 95 additional arc lamps in various parts of the city, in accordance with the terms of the new contract.

CINCINNATI, OHIO.—The Proctor & Gamble Company, of Cincinnati, is preparing to erect an enormous plant on Long Island Sound. Elzner & Anderson, of Cincinnati, are preparing plans for the plant. A large power station will be included.

LORAIN, OHIO.—The Cleveland & Southwestern Traction Company will start work immediately on the construction of a four-mile belt line in Lorain, for which a franchise was granted last week. The company is also endeavoring to secure a franchise for a line through South Lorain.

STEUBENVILLE, OHIO.—The Steubenville & Pleasant Heights Railway Company has agreed to build an extension through the district known as the Hill Tops on Wilkins Street and Wellesley Avenue. The company will also receive a new grant for 25 years on the older portion of the line.

SANDUSKY, OHIO.—The Sandusky Telephone Company, which is now controlled by the Barber and Brailey syndicate, of Toledo, recently voted to increase its capital stock from $75,000 to $200,000. The company now has about 1,000 telephones and it is the intention to install apparatus that will enable it to double its capacity.

TOLEDO, OHIO.—Contracts have been made for a power plant to be installed in the new Ohio building at Toledo, Ohio. The Toledo Boiler Company will furnish three 150-hp boilers, the Watertown Engine Company of Watertown, N. Y., will furnish three engines, while three generators will be furnished by the General Electric Company.

WARRENSVILLE, OHIO.—Bids will be received until May 1 by the Board of Public Service, Cleveland, for an engine, generator and appurtenances for a lighting and power plant at the transfer station of the Cleveland Farm Colony at Warrensville. A. R. Callon, of Cleveland, is secretary.

TOLEDO, OHIO.—The Toledo, Port Clinton & Lakeside Railway Company, with general offices in this city, is negotiating for the purchase of small lighting plants at Marblehead, Port Clinton, Oak Harbor and Lakeside. The company passes through these towns and desires to secure the lighting business to help out the load of its large power station recently erected at Port Clinton.

NORWOOD, OHIO.—The city will install immediately two new wells and will contract for an air compressor, double duty type, for the municipal electric lighting and water works system. It will also install additional feeders and one more electrical and steam unit as soon as funds are available. The city expects to spend about $20,000 for improvements to the plant this year. Albert Richards is chief electrician.

CINCINNATI, OHIO.—The Commissioners of Water Works of Cincinnati are advertising for bids on two motor-driven centrifugal pumps of 1,000 gallons capacity, and two direct-connected electric generating units of 75-kw capacity. Bids will be received until April 27. Specifications are on file with the chief engineer of the Board of Trustees of the Commissioners of Water Works. Elmer G. Prior is clerk.

SPRINGFIELD, OHIO.—Negotiations are on for the consolidation of the People's Light, Heat & Power Company and the Home Light, Heat & Power Company, operating competing systems in this place. The plan is to use the Home Company's plant for heating and lighting the business section of the city while the People's plant will take care of the street lamps and furnish power and lamps for the residence districts and hot water in the outlying section.

OKLAHOMA CITY, OKLA.—The Oklahoma City Railway Company will construct a new line within the next ten months at a probable cost of $200,000.

PERRY, OKLA.—The citizens will hold an election on May 8 to vote on the question of issuing bonds for $30,000 to repair the municipal electric lighting plant. F. F. Busch is city clerk.

OKLAHOMA CITY, OKLA.—The directors of the Gas & Electric Company have decided to spend $125,000 in improvements at the plant, in the way of buildings and new equipment. F. H. Tidman is manager.

ANADARKO, OKLA.—W. T. Croslen, of Shreveport, La., vice-president of the Washitu Valley Interurban Electric Railroad, is reported to be interested in the development of water power on the Pennington, Blue and Washitu Rivers in Chickasaw Indian Nation, and will establish water power stations along the line of its proposed road from Shreveport, La., to Anadarko, Okla. It is estimated that about 50,000 hp will be developed.

ELK CITY, OKLA.—The town of Elk City will receive bids until May 11 for material and the construction of a water works system. There will be required two triplex vertical power pumps of one-half million gallons capacity each, two direct-current electric motors, pipe hydrants, valves, one 60,000-gallon steel water tank and tower. Also one or more 8-in. tubular walls and a small brick building. Bids will be received in each item and on the works as a whole. Address M. A. Earl & Company, Consulting Engineer, Muskogee, I. T., or Chicago, Ill.

ONTARIO, ORE.—The Ontario Light and Water Company has recently been organized to build a water works system and to absorb the present Ontario Electric Light Company.

BAKER CITY, ORE.—The Baker Light & Power Company has added 16 miles of 22,500-volt transmission line to its system and two 350-hp Cahall water tube boilers to its steam plant in Baker City. The company operates a hydro-electric plant of 800-kw capacity and steam plant of 400-kw capacity, 50 miles of transmission lines at 22,500-volt and has four substations. F. N. Averill is superintendent.

PORTLAND, ORE.—The Interior Development Company has let contracts for building what will be one of the largest power development plants in the State on the Deschutes River, near Shear Bridge, about 30 miles south from The Dalles. The company contemplates the development of 50,000 hp for the generation of electricity, and will spend about $200,000. A. Welch, of this city, is president of the Interior Development Company, which was incorporated recently, and E. P. McCornack, of Salem, is secretary. Mr. Welch has just returned from the site of the proposed power plant, and says that the contract for all work has been awarded to Van Dyne & Brown, of the Tygh Valley Company, and a force of men has already begun building bunkhouses and tool sheds, preparatory to starting the construction of the dam across the Deschutes.

PORTLAND, ORE.—The St. Helens Public Service Company is being promoted by Dr. Henry W. Coe, of Portland, Ore., and associates, to construct a standard gauge electric railway from Portland to Vancouver, Wash., in the form of a loop, known locally as the St. Helens Loop. The road when completed will be about 200 miles long. Cowlitz and Clark Counties have granted 50-year franchises for the use of about 200 miles of county roads. Castle Rock, Kalso, Kalama and Vancouver have granted franchises within their limits. All franchises are for 50 years with no restrictions as to when the work must begin. Franchises also cover for all public services, water, gas, telephone and telegraph, electricity, poles and conduits. About 200 miles of surveys have been completed. Thirty miles of private right-of-way have been secured. George W. Lilly, of Portland, Ore., is chief engineer. Kelsey & Young, of Salt Lake City, Utah, have been appointed consulting engineers and will come at once to Portland and take up the work in connection with the road.

GRANTS PASS, ORE.—Two carloads of machinery have arrived here for the Golden Drift Mining Company, consisting of equipment to be added to the big power and hydraulic mining plant of this company in the Dry Diggings, near Grants Pass. Ten more turbines and two additional pumps will be placed. The pump now employed has a capacity of 13,000,000 gallons daily, or 9,000 gallons per minute, delivered through two three-inch monitors under a pressure of 140 pounds to the square inch. This is said to be the largest high-pressure pump ever manufactured. The two pumps that will be added are of the same type as that now employed, but will have a slightly less capacity. The combined capacity of the three pumps will be close to 40,000,000 gallons daily. A portion of this will be lifted into ditches and used for irrigating purposes. Besides the installation of the turbines and pumps, the tailrace will be widened and deepened, and for this purpose a large dredge is being built by the company. Another line of 22-inch steel pipe will be built from the power dam to the diggings to convey the water from the pumps. The pumps are of the five-step centrifugal type, and weigh 35 tons each. 1,200 hp is required to operate each one. The dam develops a total of 6,000 hp.

DURYEA, PA.—It is reported that the business men in this city are making preparations to install an electric lighting plant for commercial purposes.

PHILADELPHIA, PA.—Plans have been made for alterations and repairs to the power and engine house of the University of Pennsylvania. Cope & Stewardson are architects.

SHARPSBURG, PA.—Bids will be received until May 4, by A. H. F. Black, borough clerk, for one 200-kw alternating-current generator, one 300-hp engine and connections.

MANHEIM, PA.—The electric lighting plants of the Lancaster Valley Electric Company at Manheim and Mt. Joy have been purchased by C. T. Leland and Dr. Henry U. H. Stoever, of Philadelphia, Pa. The plants were sold by the Commonwealth Trust Company, of Harrisburg, trustee for the bondholders of the Conestoga Valley Electric Light Company. The indebtedness on the properties amounted to $53,400. The price paid for the two plants was $20,800.

CHESTER, PA.—The Philadelphia Suburban Heat, Light & Power Company, which was recently incorporated and which purchased the Lansdowne Electric Light Company, is about to extend its lines all over the county. It is reported that this corporation has purchased the Faraday Heat, Light & Power Company, of Morton, which has been in existence for many years, supplying light for the boroughs of Morton, Rutledge and Swarthmore. The company was recently granted a franchise by Darby Borough Council to furnish light and power in that borough. It is also said that a large plant will be built in Darby and that the plant in Lansdowne will be discontinued when the new plant is finished.

OLNEYVILLE, R. I.—Work will soon be started on the new telephone building in this city. A large force of men are now laying the underground wires from the main line at Westminster and Howard Streets to the site for the new building.

ABERDEEN, S. D.—Bids will be received until April 30 for the construction of a municipal electric light plant. F. W. Raymond is city auditor.

JACKSON, TENN.—The Louisville syndicate of the Columbia Finance & Trust Company has purchased the Jackson street railroad and electric light plant at a cost of $115,000.

MARTIN, TENN.—At a recent meeting of the Weakley County Telephone Company, of this city, it was decided to increase the capital stock $6,500 and improve the plant, putting in cables and up-to-date fixtures.

MEMPHIS, TENN.—It is stated that the Memphis Consolidated Gas & Electric Company will expend about $150,000 in improvements in the electric generating department of its plant. An Allis-Chalmers turbo-generating set of 1,500 kw capacity will be installed. Work will begin soon on the foundations for additional boiler rooms and coal sheds adjacent to the present plant, and it is expected that the new system will be in operation by next August.

TEMPLE, TEX.—The Southwestern Telephone Company contemplates the expenditure of nearly $20,000 in modernizing and otherwise improving its plant in this city.

NEW BRAUNFELS, TEX.—The Landa Electric Light & Power Company is making extensive improvements to its power plant by the addition of three large dynamos and a switchboard of seven panels.

AMARILLO, TEX.—The Amarillo Water, Light & Power Company will soon add a 150-kw, 2,200-volt generator and a 225-hp engine to its plant. The machinery has not yet been purchased. H. B. Jones is superintendent.

ABILENE, TEX.—The Abilene Light & Water Company has purchased the plants of the Lytle Water Company and the Abilene Light & Power Company. The company will make some extensions and improvements. W. G. Swenson is president.

HUNTINGTON, UTAH.—The Electric Light & Milling Company will receive bids until June 1 for constructing an electric light plant. Wm. Howard is president and general manager.

SANFORD, VA.—It is reported that the town is considering the question of buying the local electric lighting plant.

WILLIAMSBURG, VA.—The citizens voted April 17 to issue $30,000 bonds for water works and an electric light plant. E. M. Lee is clerk of council.

NORFOLK, VA.—The Penn Bridge Company, of Beaver Falls, Pa., has secured the contract for installing a complete water and electrical system in the new marine barracks, at the Navy Yard, for about $11,500.

MORRISVILLE, VT.—The citizens of this village have voted to have the commissioners proceed with the work of establishing a municipal power station. This includes the construction of a large dam across the Lamoille River at Cady's Falls and an expenditure of $75,000 or more. The lake thus created will cover 106 acres, from which a large amount of power can be developed as soon as the power plant is completed. The dam is to be of concrete, 35 feet thick at the base and six feet at the crest, with gates and spillway and a steel penstock 1,106 feet long. A bid of $44,500 for the construction work has already been submitted, but the other necessary work will make the expense $75,000. The commission that will have charge of the work is composed of C. A. Morse, C. A. Gile, C. H. A. Stafford, G. M. Powers and C. H. Clocum.

PORT ANGELES, WASH.—The city is undertaking to change its electric system from steam to water power in connection with a municipal gravity water system. John Hallahan is manager.

RITZVILLE, WASH.—The Ritzville Electric Company is now installing a new McEwen tandem compound engine and a 100-kw Stanley generator. Also a 5-ton ice plant made by the United Iron Works, Oakland, Cal., to be in operation May 1st. H. Warner is manager.

SPOKANE, WASH.—The Spokane & Pend d'Oreille Rapid Transit Company has definitely located most of its line between this city and Lake Pend d'Oreille, a distance of 44 miles. It has acquired 1,600 acres of land on the southwestern shore of the lake and proposes building a town at that point.

SPOKANE, WASH.—The electric power plants of Newport and Bonners Ferry are to be united under the name of the Northern Electric Light Company, and the business for the two concerns will hereafter be conducted under one management. Articles of incorporation for the Northern Company have been filed by A. M. Winston and M. A. Folsom as incorporators. The capital stock is given at $35,000.

SPOKANE, WASH.—The plan of the merger of the Cœur d'Alene & Spokane Railway Company, Spokane Traction Company and the Spokane & Inland Railway Company as the Inland Empire Railway Company, of Spokane, has been approved by the constituent companies, provides for the authorization of a capital stock of $20,000,000. It is planned to issue at the present time about $6,000,000, for the purpose of taking over the capital stock of the Cœur d'Alene & Spokane Railway Company, Spokane Traction Company and Spokane & Inland Railway Company, and the balance will be used for the establishment of a hydro-electric power plant on the Spokane River near Spokane, and the building of an electric railway to connect the same with Spokane. The Spokane & Inland Railway Company will have a total mileage of 115 miles. The company now has the road well under construction.

MILTON, WIS.—A stock company is being organized to build a lighting plant for Milton and Milton Junction.

HUDSON, WIS.—Sealed proposals will be received at the office of the city clerk until May 7th, to do the pumping and to operate the street lighting system in and for the city of Hudson. A. Keras is city clerk.

PESHTIGO, WIS.—John Burke, superintendent of the Peshtigo Lumber Company writes that the company will add two new American water turbines to the present equipment and will make improvements in general amounting to about $16,000. The work is to be done in June.

MILWAUKEE, WIS.—The West Shore Telephone & Telegraph Company, for which the City Council has just voted a franchise, expects to begin at once the construction of a $3,000,000 system in Milwaukee, which also will connect with independent lines throughout the State and elsewhere. The company expects to build a central exchange and four other exchanges in outlying parts of the city.

LARAMIE, WYO.—The Laramie Electric, Gas, Light & Fuel Company, which recently sold its plant here to W. E. Sterne, of Denver, and others, has called a meeting to dissolve partnership and retire from business. On account of the vexatious troubles experienced during the past year with the lighting franchise of the city the municipal ownership of the plant is being discussed, the city reserving the right to buy the plant from the new company. This, it is believed, will solve the problems confronting the city and afford light at a less cost than at the present time.

SALTILLO, MEX.—Alfred Lilliendahl has secured a franchise for an electric light plant.

AMHERSTBURG, ONT.—F. W. Falls, secretary and treasurer of the Amherstburg Electric Light, Heat & Power Company, writes that the company will install a meter system during the next few months.

BRAMPTON, ONT.—The Brampton Electric Light & Power Company has installed three new turbine water wheels, built by Barber & Sons, of Medford, Ont., 24, 42 and 60-inch respectively, and will also add a new 250-kw, 60-cycle, three-phase generator, with a speed of 500 r.p.m. to its plant.

OWEN SOUND, ONT.—The city is considering the question of adding a 500-hp steam or producer gas equipment to the city electric light and power plant. The electric power will be three-phase, 60-cycle, 2,200-volt primary, secondary, 104, for lighting. Joseph McLanden is superintendent.

Company Elections.

BALTIMORE, MD.—At the annual meeting of the stockholders of the Consolidated Gas, Electric Light & Power Company, the board was re-elected as follows: Messrs. S. Davies Warfield, John B. Dennis, Alexander Brown, Alten S. Miller, Anthony N. Brady, William A. Marburg, Samuel R. Bertron, T. J. Hayward, Thomas F. Ryan, Charles Adler, Charles T. Crane and F. S. Landstreet.

LINCOLN, NEB.—At a recent meeting, the Nuckolls County Telephone Company elected directors for the ensuing year as follows: J. C. Chamberlain, B. F. Cormar, J. C. Day, J. R. Parsons, J. A. Wehrman, W. A. Wehrman, W. A. Voigt and S. A. Lapp.

UTICA, N. Y.—At a meeting of the Utica Gas & Electric Company, the following officers were elected: President, Anthony N. Brady; vice-president, William E. Lewis; treasurer, George H. Stack; secretary, M. J. [illegible]; executive committee, John F. Maynard, William E. Lewis, Charles S. Symonds, Charles B. Rogers, Samuel A. Beardsley, Anthony N. Brady (members ex-officio). General manager of the electrical department, C. A. [illegible]; general manager of the gas department, William J. [illegible].

SPRINGFIELD, OHIO.—At a recent meeting of the Peoples' Light, Heat & Power Company, the following officers were elected: John L. [illegible], president; J. M. [illegible], vice-president; J. K. [illegible], secretary, and W. W. Keifer, treasurer.

New Industrial Companies.

THE BOSSMASSLER-BONINE ELECTRIC COMPANY, Philadelphia, Pa., has been incorporated with a capital stock of $60,000.

THE DIAMOND GAS & ELECTRIC FIXTURE COMPANY, a new firm just starting in business, will make a specialty of repairing and refinishing electric and gas fixtures at Meriden, Conn.

THE MULTIPHONE COMPANY, New York, N. Y., has filed articles of incorporation with a capital stock of $1,000. The directors are Isaac Thorman, F. G. Wenzel and E. J. Campbell, of New York.

THE VADEM INTERNATIONAL ELECTRO-CHEMICAL COMPANY has been incorporated at New York, N. Y., with a capital stock of $500,000, to develop water power. The directors are E. A. Ashcroft, Murray Hill Hotel; R. L. Redfield, R. P. Lyden, of New York.

THE MARLBORO EQUIPMENT COMPANY, of Marlboro, Mass., with a capital of $3,000, has been incorporated for the purpose of importing and exporting electrical goods. Julius P. Watson is president; Herbert Smith, treasurer, and Eugene W. Godfrey comprise the board of directors.

THE McCREA MOTOR TRUCK COMPANY, of Cleveland, has been formed with $50,000 capital stock by George G. Whitcomb, George H. Kelley, C. C. Easty, L. J. Malin and M. G. MacLeen. The company will manufacture heavy electric trucks and drays. Offices have been opened in the Williamson Building, Cleveland.

THE WATSON ELECTRICAL SUPPLY COMPANY, Ltd., was recently chartered in Shreveport, La. The following officers are named: Ivie M. Watson, president; W. C. Evans, vice-president; W. W. Jones, secretary and treasurer. The company is capitalized at $5,000. W. C. Evans and W. W. Jones, vice-president and secretary-treasurer, are identified with the Shreveport Gas, Electric Light & Power Co.

THE HURLEY MACHINE COMPANY, Chicago, Ill., has incorporated with a capital stock of $150,000 to manufacture the Little Giant floor scraper, the Little Giant electric sandpapering machine and the Little Giant electric floor polisher and surfacer. The plant of the company will be located at 153 to 159 South Jefferson Street, Chicago, and offices have been opened in New York at 1,010 Flatiron Building. The incorporators of the company are Edward N. Hurley, John Maynard Harlan and S. E. Sheehan.

STANDARD ELECTRICAL SUPPLY COMPANY has been formed at Norfolk, Va., under the laws of the State for the purpose of carrying on the electrical supply business in all its branches. The officers of the company are practical electricians, and the companies they are associated with are large consumers of electrical apparatus. The company will carry an up-to-date stock. It has become a member of the National Jobbers' Association, and as jobbers would greatly appreciate receipt of catalogues, price lists, circulars and other trade literature. The company has an establishment also at Charlotte, N. C. The officers are: President, W. N. McAnge, of the Nansemond Telephone Company; vice-president and general manager, Jonathan Woodhouse, P. Anne & Virginia Beach Telephone Company; secretary and treasurer, C. Fred Bonney, Southern States Telephone Company, who are directors with E. C. Hathaway, vice-president and general manager, and H. R. Palmer, general superintendent Norfolk Railway & Light Company, and R. L. Dibrell.

New Incorporations.

LOS ANGELES, CAL.—The Twentieth Century Light Company has been incorporated with a capital stock of $75,000. The incorporators are C. S. Hollis and others.

FORT BIDWELL, CAL.—The Madoc Power Company has been incorporated by Colorado and California men to develop water power on Bidwell and Lake City Creeks for electric light and power purposes.

LOS ANGELES, CAL.—The South Nevada Power & Light Company has been incorporated with a capital stock of $150,000 by U. S. G. Todd, G. D. Gipp, J. D. McNab, T. B. Wickinson and B. F. Rocking, all of Los Angeles.

ARGENTINE, COL.—The Argentine Electric Light & Power Company has been incorporated with a capital of $100,000, by W. B. Le Wall, J. H. Meyers and others.

ADAMS, ILL.—The West Union Telephone Company has been incorporated with a capital stock of $9,000. The incorporators are C. J. Dege and others.

LENZBERG, ILL.—The Risdon Telephone Company has been incorporated with a capital of $500. The incorporators are Henry Kirchoefer and others.

CHICAGO, ILL.—The Chicago Flasher Electric Company has been incorporated with a capital of $10,000. The incorporators are Thos. R. Wood and others.

SPRINGFIELD, ILL.—People's Mutual Telephone Company, with a capital of $[illegible], has been incorporated by J. W. Johnson, William Arnsmeyer and Fred Albersett.

LITCHFIELD, ILL.—The Secretary of State granted incorporation papers to the St. Louis, Litchfield and Eastern Electric Railroad Company. The directors are J. H. Belt, president, and others. The company is to build an electric interurban line from Alton to Litchfield.

ANDREWS, IND.—The Andrews Electric Railway & Power Company has filed articles of incorporation, with a capital stock of $30,000. H. B. Thornton is president, T. D. Devere is vice-president and W. E. Nichols is secretary.

VINCENNES, IND.—The Vincennes Traction & Light Company has been incorporated with a capital of $200,000 for the purpose of building new lines and supplying electricity and steam for cities in Knox, Gibson, Daviess and Sullivan Counties. Benjamin G. Hudnut, of Terre Haute, is one of the incorporators.

INDIANAPOLIS, IND.—The Goshen, South Bend & Chicago Railroad Company has filed articles of incorporation with the Secretary of State. The capital stock is $150,000. The directors are F. C. Raff, D. D. Bates and John W. Tell, of South Bend; Anthony Deahl, of Goshen, and George S. Lay, of Lafayette.

SOUTH PORTLAND, ME.—The Cape Shore Railway has been incorporated with a capital of $32,000 by Jabez True, Charles Dalton and Edward C. Campbell, of Portland, to construct a street railway in South Portland and Cape Elizabeth.

ST. LOUIS, MO.—The Kobusch Automobile Company, established about sixteen months ago by George J. Kobusch, president of the St. Louis Car Company, has filed articles of incorporation, with a capital stock of $1,000,000. The other stockholders are Harry F. Vogel, vice-president of the St. Louis Car Company, George A. H. Mills, general manager, and W. S. Miller, manager of the automobile plant.

WADDINGTON, N. Y.—The New York & Ontario Power Company has been incorporated with a capital stock of $2,000,000 to manufacture electricity for light, heat and power purposes and to supply Plattsburg, Ogdensburg, Watertown, Rome, Utica, Syracuse, Oswego and villages in the counties of Franklin, St. Lawrence, Jefferson and Oneida. The directors are David J. Crichton, Jr., John W. Easton and William F. Burt, Ogdensburg.

CINCINNATI, OHIO.—Incorporation papers for the Indianapolis, Columbus & Eastern Traction Company have been asked for. It is reported that this is a project of the Schoepf syndicate and that it will take over all the lines between Indianapolis and Zanesville. It is stated that the Schoepf interests will build a line from Richmond to Dayton parallel to the Dayton & Western Traction Company's line, as the syndicate has been unable to acquire this property. A new road will be built parallel to the National Park. The combination of these roads would make a system over 250 miles and the largest system in the country operating under one management.

BOLTONVILLE, VT.—The Boltonville Electric Company has filed articles of incorporation with a capital stock of $25,000. The company has an option on some of the best water power in the State. It is expected that it will build a large dam and power station to furnish light and power to all the villages in the Wells River valley. The incorporators are M. F. Sargent, Robert Farquarson, James Craigie, C. H. Taplin and H. W. Goodine, all of South Ryegate.

Legal.

CORPORATION CERTIFICATE.—The New York State Commission of Gas and Electricity has received an important opinion from the Attorney General holding that upon application of a corporation for a certificate of authority to transact business the commission need not permit the legality of the consent granted by the municipality to the corporation to be attacked.

NEW YORK CENTRAL POWER Justice Clinch of the New York Supreme Court has denied the application of the Mount Morris Bank to restrain the New York Central and the New York and Harlem River Railroads from constructing pipes, conduits and wires for the change of motive power from steam to electricity on the viaduct in front of the premises of the bank at 125th Street and Park Avenue. The judge said that it would not be a proper exercise of the equitable power of the court to restrain such an improvement.

PLACING WIRES UNDERGROUND.—The Arlington Telephone Company has brought suit against the Indianapolis & Cincinnati Traction Company to determine which company shall bear the expense of placing wires underground. The telephone company alleges that the traction company placed its high voltage wire beneath and close to the company's wire instead of putting them above or underground; that in case of storm the telephone wires are likely to be blown down and across the high voltage wire of the trolley line and thereby endanger the lives of patrons. The suit is to recover the cost of putting the telephone lines underground at the crossing.

NEW YORK TELEPHONE FRANCHISES.—According to an opinion given by Corporation Counsel Delaney, the Great Eastern Telephone Company will be unable to establish a telephone system in New York City unless it can obtain a new franchise from the Board of Estimate and Apportionment. It was to have done business on the strength of a franchise claimed to have been granted in 1883 to the Electric Lines Company, which it controls. Mr. Delaney's opinion says that the Electric Lines Company never had a franchise, but that it did have a license, which has since been forfeited by disuse. The Great Eastern Company will press the matter, and mandamus the city officials to grant the necessary permit for opening the streets.

Obituary.

MR. G. W. STOCKLY.—We regret deeply to note the death of one of the industrial electric lighting pioneers in this country, Mr. George W. Stockly, who passed away at Atlantic City, on April 20. He was born in Cleveland, Ohio, December 20, 1843. He was a son of John Galt Stockly, a descendant of John Stockly, who came from England and settled in Virginia in 1609 at the first occupation by John Smith. Mr. Stockly studied law for some time after leaving the public schools, and later went into the transportation business. He was a teller of the Commercial Bank of Cleveland for seven years. In 1873 he became manager of the Telegraph Supply and Manufacturing Company, of which he later became president. Mr. Stockly was, it is said, the first man to introduce the telephone into Ohio. He obtained control of the rights for that part of the country, and was the first to establish and operate a telephone exchange there. But he was best known from his prominent and active connection with Mr. Charles F. Brush in the creation of the Brush Electric Company of Cleveland, which manufactured the famous Brush arc lighting system and founded over a hundred local arc lighting companies in this country besides assisting to found allied companies in England and other parts of the world. From 1878 to 1884 a great piece of pioneer work was thus done, laying the bases of the modern electric light industry; and when consolidation was effected with the Thomson-Houston Company, by purchase of the Brush business, Mr. Stockly was able to retire from the field with a large fortune. He engaged in other enterprises, notably one for developing the pneumatic field gun; but his interest in life virtually was crushed out of him when his son, Lieut. Paul Stockly, a young engineer of great ability and promise, disappeared in the Philippines while out on the firing line with one of the guns. A daughter of Mr. Stockly married Owen Johnson, a rising litterateur and novelist and son of R. U. Johnson, editor of the *Century* Magazine. Mr. Stockly was a member of several clubs in Cleveland and of the Lotos and Lawyers' Clubs of New York.

Personal.

MR. L. F. BOWER.

MR. L. F. BOWER, formerly manager of the Electrical Works of the Allis-Chalmers Company in Cincinnati, who was recently promoted to the position of comptroller of the company, has already assumed the duties of his office, with headquarters at the general offices, Milwaukee. He was born and spent the early years of his life in Berwick, Pa. He attended Wesleyan University, Middletown, Conn., from which he graduated in 1879. For five years following graduation, he held a position in the treasurer's office of the Jackson & Woodin Mfg. Co., Berwick, Pa., where he became intimately associated with the persons now in control of the American Car & Foundry Company. Mr. Bower then spent three years in Carlisle, Pa., as principal of the preparatory department of Dickinson College. For one year thereafter he was managing partner of Bower & Mallory, chain manufacturers in Carlisle, Pa. Having sold out his interests to the Standard Chain Company, he was, for two years, superintendent of the car department of Allison Mfg. Company, in Philadelphia, which concern he left on the death of Mr. Allison. For six years Mr. Bower was manager and treasurer of the Carlisle Mfg. Company in charge of all departments. They manufactured freight cars, frogs and switches, and vertical steam engines. From 1896 to 1901 Mr. Bower was secretary and treasurer of the Dickson Mfg. Company, of Scranton, Pa., manufacturers of locomotives and all kinds of heavy machinery. When the machinery department of this concern was absorbed by the Allis-Chalmers Company in 1901, Mr. Bower was retained as manager of the Scranton plant until 1904. On April 1, that year, he went to Cincinnati as secretary and treasurer of the Allis-Chalmers Company's electrical department, and in 1905 he was appointed manager. While at Scranton, Mr. Bower studied law and was admitted to the bar of Lackawanna County.

MR. JOSEPH H. THOMPSON, JR., has removed his offices from 11 Broadway, New York City, to 17 Battery Place.

MR. R. BORLASE MATTHEWS, formerly with the General Electric Company at Schenectady, has been appointed electrical engineer of the Edison Light & Power Company, Amsterdam, N. Y.

MR. TRUMAN HIBBARD, chief designer of the Electrical Machinery Company of Minneapolis, has been giving a course of lectures at the University of Minnesota on factory methods in electrical design.

MR. CHARLES A. BROWN, of Chicago, has moved his offices in the Monadnock Building to 1550 and will continue the practice of patent law in association with Lynn A. Williams, Charles J. Schmidt and Harvey L. Hanson.

MR. F. L. MARTIN, who has had charge of the advertising of the Stromberg-Carlson Telephone Manufacturing Company for the past few years, has resigned his position to assume one with White's Class Advertising Agency of Chicago.

MR. A. C. WALTHER, electrical and mechanical engineer, who has had a great deal of experience in the design of large power stations and suburban street railway systems, has accepted a position with Ford, Bacon & Davis, of New York City.

MR. EDGAR S. NETHERCUT, chief engineer of the Buda Foundry & Manufacturing Company, of Chicago, was elected assessor of Evanston, Ill., at the last election. Mr. Nethercut is one of the first two prohibitionists to be elected to office in Evanston.

MR. HARRY H. HORNSBY, conduit sales manager of the Sprague Electric Company, has recently returned to New York from a very successful trip through the West and South. He reports business as very active and the outlook promising in those sections.

MR. T. M. MESTON, secretary of the Emerson Electric Manufacturing Company, of St. Louis, has been spending the new in New York on important business, and in visiting local headquarters. He reports the western outlook as generally bright and promising.

MR. A. E. AEBY, who has been connected with the office of the Pennsylvania Steel Company and the Maryland Steel Company for the past 18 years, has resigned as sales agent, to accept the position of general manager of the Carbon Steel Company. Mr. John C. Jay, Jr., his assistant, has been appointed New York sales agent to take effect May 1, 1906.

MR. FRANKLIN M. NICHOLL has been appointed Eastern manager of the Streeter Journal Bearing Company. Mr. Nicholl, who will make his headquarters in the new Reed & Barton building in New York City, was recently connected with the F. B. Tait Manufacturing Company, of Decatur, Ill., and was previously with the Rochester Railway Company of Rochester, N. Y.

MR. H. M. WARREN, electrical engineer of the Delaware, Lackawanna & Western Railroad, will deliver an address on May 8, before the New York Alumni Association of the Worcester Polytechnic Institute, on the electrical work on the railroad and on the use of electricity in the company's extensive coal mines. The lecture will be at the Hotel Albert, preceded by a dinner.

MR. J. L. ADAMS, manager of the Hartford, Manchester & Rockville Traction Company, of South Manchester, Conn., has been appointed general manager of the Indiana, Columbus & Eastern Railway Company with headquarters at Columbus. This is the company formed by the Schoepf syndicate to take over all the lines between Dayton and Zanesville, heretofore known as the Tucker-Anthony lines and the Appleyard lines.

FRANK A. PARKER, for thirty-one years connected with the Quincy Gas & Electric Company, has tendered his resignation with the request that the same be accepted as early as possible so that he may assume the local management of the new Quincy Home Telephone Company, which plant is speedily nearing completion. A more competent man for the new telephone company than Mr. Parker would be hard to find for the new enterprise.

MR. A. B. CORYELL, formerly manager of the Huntsville Railway, Light & Power Company, of Huntsville, Ala., has been appointed general manager of the Chickasha Heat & Power Company, Chickasha, I. T. Mr. Coryell is an expert electrical and mechanical engineer, having made it a study all his life, and has had the management of several first-class properties, installing many electric plants and railway systems.

MR. N. J. NEALL, who has for the last few years represented the Westinghouse Electric & Manufacturing Company in the design, development and application of lightning protective apparatus, has recently resigned to open an office for himself in Boston, Mass. Special attention will be given to protective apparatus in all phases of its development and application; also to high-tension installations, rehabilitation of existing electrical plants and to general engineering problems, particularly those of an alternating-current character.

MR. E. G. ACHESON has been invited to deliver an address before the Department of Engineering, Sibley College, Cornell University, on May 3. His subject will be "Discovery and Invention." This address will be in a revised form, virtually the same as that given in March before the Massachusetts Institute of Technology. It deals with invention without discovery; discovery without invention; and discovery with invention. References are made to Mr. Acheson's own admirable work in the electrochemical field, with deductions from the lessons that it teaches. The American Electrochemical Society will be in session in Ithaca at that time.

MR. G. L. H. ARNOLD, formerly principal assistant to Mr. F. A. Waldron, consulting engineer, has been appointed engineer of construction of the National Cash Register Company of Dayton, O., and will be in direct charge of the design and construction of the extensive additions and alterations of plant now under way. Mr. Arnold is a graduate of Yale, and was for several years associated with the late Mr. Miers Coryell in the exploitation of the Belleville water-tube boiler. Subsequently he became chief draftsman and later mechanical engineer of the Atlas Portland Cement Company. He has had an extensive experience in the design and construction of industrial plants and in reinforced concrete construction and is a member of the American Society of Mechanical Engineers and an associate member of the American Society of Naval Engineers.

Trade Publications.

LAMP SOCKETS AND SHADES.—Flyer No. 2176 of the General Electric Company, Schenectady, N. Y., is devoted to universal lamp sockets and shades and portable desk lamps. By the use of these universal fittings the incandescent lamp is made to give a powerful but well-diffused illumination in the desired direction, while the lamp itself is concealed.

DE LA VERGNE.—We have just received from the De La Vergne Machine Company of New York, an artistic little four-page mailing card, which we understand is for free distribution. On the first three pages are illustrations of some of the many different types of refrigerating machines, both vertical and horizontal, which this company builds. The fourth page gives a short description of the company's chief products in addition to refrigerating machines, namely, the "Hornsby-Akroyd" oil engine and the Koerting gas engine.

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News of the Trade.

CHARLES WIRT & CO., of Philadelphia, have moved to a new address at Stenton Avenue, above Wayne Junction, corner of Rockland.

CLARK INSULATION COMPANY.—The Clark Insulation Company, H. B. Burley, treasurer, has changed its name to Boston Insulated Wire & Cable Company, which is now in force.

THE WARNER & SWASEY COMPANY, of Cleveland, prominent manufacturers of machine tools, is making a large addition to its plant and is placing contracts for the machinery for a large power station.

THE SPRAGUE ELECTRIC COMPANY reports a constantly growing demand for its flexible conduits and armored cables, manufactured under the Greenfield patents. Last month was a banner month in total sales.

DE FOREST LABORATORY.—The American De Forest Wireless Telegraph Company is moving its laboratory on or about May 1 to the building corner of Hudson and Sussex Streets, Jersey City, N. J., where it will increase its available space four times.

THE STAR ELECTRIC COMPANY, of Warren, Ohio, which is associated with the Standard Electric Company, of Niles, manufacturer of electric lamps and fans, has opened a factory in the old skating rink at Warren, where it will manufacture storage batteries.

THE REMY ELECTRIC COMPANY, of Anderson, Ind., contemplates moving its works to Richmond, Ind., and will erect a factory building at a cost of $20,000. The company manufactures electric sparkers for automobiles, gasoline launches and all kinds of gas and vapor engines.

THE BLAKESLEE AUTOMOBILE COMPANY, of Cleveland, Ohio, has increased its capital stock from $25,000 to $100,000. The company manufactures electric automobiles, and it is erecting a large factory on Wilson Avenue, Cleveland. J. R. Blakeslee is at the head of the company.

THE CLING-SURFACE COMPANY, of Buffalo, N. Y., manufacturer of Cling-Surface "for belts and ropes," has just moved into a fine new plant which it has erected in Buffalo at 1032-1048 Niagara Street. This new plant is of the most modern fire-proof construction, brick, concrete, hollow tile and wire glass, for wall, floor and ceiling. The increased domestic and foreign business of the firm has necessitated the change and the present new plant trebles its capacity.

THE G. M. DAVIS REGULATOR COMPANY has established a branch office at 117 Market Street, St. Louis, Mo., where it will carry a complete stock of specialties which it manufactures for the benefit of its increasing trade in the Southwest. This company makes the Davis pressure regulator, steam trap, back pressure valve, damper regulator and other power plant specialties. Its factory and main office are at 144 Milwaukee Avenue, Chicago.

JOHN A. ROEBLING'S SONS COMPANY announces the total destruction of its store and warehouse in San Francisco. In order that the coast trade may be promptly supplied, stocks in the companies' warehouses in Los Angeles, Portland and Seattle will be largely increased. Until arrangements can be made for a resumption of business in San Francisco, it is requested that those who have been dealing with the company there divert their orders to one of the other three coast branches.

NEW WAGNER FACTORY.—The Wagner Electric Manufacturing Company, of St. Louis, has completely outgrown its present quarters and has bought a tract of land 15 acres in extent, just outside the city. It has engaged Dodge & Day, of Philadelphia, to make the layout, design buildings and select the necessary equipment. The preliminary layouts have been submitted and the buildings decided upon. Work will be started at once and about one-third of the ground will be covered by buildings before the end of the present year.

THE C. E. HEWITT COMPANY, 17 Park Row, New York City, begs to announce that by an agreement just completed, its entire business interests will be merged in a new corporation to be known as the Stevens-Hewitt Engineering Company, which will continue the business as heretofore and will take over all existing contracts and liabilities of the C. E. Hewitt Company. The rapid growth of the business conducted by the C. E. Hewitt Company has made it necessary, it is said, to enlarge its technical staff and to enlarge its facilities for financing the increasing number of important municipal and other contracts for installation of lighting and power plants that it is engaged in. All of the members of the C. E. Hewitt Company will come into the Stevens-Hewitt Engineering

Company, and the new members, Mr. Edwin A. Stevens, of Hoboken, N. J., and Mr. Irving Cox, of New York, are well known.

THE CENTRAL ELECTRIC COMPANY, Chicago, is bringing to the attention of construction men the Western Union standard steel cross arm pin, for which it is general Western selling agent. This pin has been adopted as a standard by the Western Union and Postal Telegraph Companies, and is made according to their specifications. A highly carbonized steel is used insuring great stiffness and strength, which is very important, especially during storm periods when great damage is often done through the breaking off or pulling out of wooden pins. Another point in favor of this pin is that it only requires a ½-inch hole bored in the cross arm, as against a 1½-inch hole for the wooden pins. It will be readily seen that this strengthens the cross arms. It is suggested that construction men write to the Central Electric Company, 264-270 Fifth Ave., Chicago, for prices and information concerning these pins.

McGRAW BUILDING.—A contract has been placed with Frank B. Gilbreth, New York, for the erection of a building on Thirty-Ninth Street, between Seventh and Eighth Avenues, for the McGraw Publishing Company, publisher of *The Engineering Record*, *Street Railway Journal*, ELECTRICAL WORLD and other periodicals. The plot is 126.4 feet front and 98.9 feet deep. It is planned to make this structure ten stories high, with the basement and lower floors devoted to printing machinery, the top floor to an engraving establishment and the remaining floors to offices. It is proposed to construct this building entirely of reinforced concrete. It will be the most important concrete structure in New York City, and will have much influence in determining the future of such work, but until the specialists who are preparing the plans and the Building Department of the city which must approve them, have definitely reached a conclusion, no definite plans can be made. The building is designed by Prof. William H. Burr and Messrs. Radcliffe & Kelley. Mr. W. S. Timmis, consulting engineer, will be in charge of the mechanical equipment of the printing offices.

NEW INSULATED WIRE PLANT.—The new plant of the Electric Cable Company was formally opened at Bridgeport, Conn., on the afternoon of Monday, April 16. Refreshments were served by the officers of the company to members of the Bridgeport Board of Trade and to neighboring manufacturers, representatives of the press, and employees of the company. The new building is a one-story brick structure occupying a space 230 by 62 feet on the corner of Crescent and Cenral Avenues. Room is provided for 300 employees and for 30 machines. The plant is equipped with a steel traveling crane which carries the finished product to a platform erected on the north side of the building. Thence the products will be loaded on the cars which will be run from the main line of the New York, New Haven and Hartford Railroad over a private sliding. It is the intention of the Electric Cable Company to erect further buildings on the large plot of ground at the west of the present plant. The Electric Cable Company was incorporated in January of this year with a paid-up capital of $500,000, which in the near future will be increased to $1,000,000. Its products include Voltax, the new insulating compound which is taking the place of rubber, magnet wire, field and armature coils and soldered mesh rail bonds. Large orders have already been received from the Interborough Company of New York, the Brooklyn Rapid Transit Company and other large concerns.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 17, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

817,746. ELECTROSTATIC APPARATUS; Lucien I. Blake, Lawrence, Kan. App. filed Jan. 23, 1905. A rectifier or converter for alternating currents fom an induction coil or a transformer, comprising a closed casing from which the air may be exhausted to any degree, and having a pair of electrodes therein. One of the electrodes is covered with silica or insulating substance, and the other electrode is pointed and may be adjusted toward and from the covered electrode.

817,749. ELECTRICAL APPARATUS FOR DETERMINING THE LOCATION OF METALLIC ORES; Fred H. Brown, Los Angeles, Cal. App. filed Mar. 31, 1902. An apparatus for locating buried ore and minerals, working on the resistance or Wheatstone Bridge principle. A number of metallic stakes are driven into the ground at varying points and the resistance of the ground between the various stakes is measured.

817,761. TELEPHONIC REPEATER; Merritt Gally, Brooklyn, N. Y. App. filed Apr. 14, 1904. In a telephone-repeater for repeating telephonic pulsations from one telephone-line to another telephone-line; a single receiving-diaphragm; and two independent receiving-magnets, both magnets on one side of said diaphragm and to operate said single diaphragm, one of the magnets for connection with one telephone-line, and the other magnet for connection with the other telephone-line.

817,767. ELECTRIC FURNACE; John F. Hammond, Brewster, N. Y. App. filed Apr. 13, 1905. In a furnace, the combination with a muffle whose interior is wound with a heat-generating wire, of a casing for said muffle and whose exterior is wound with a resistance-wire, both of said wires being connected, and means for traveling from one to another of the convolutions of the resistance-coil for varying the resistance.

817,781. MULTIPLE SWITCHBOARD FOR TELEPHONE - EXCHANGES; Milo G. Kellogg, Chicago, Ill. App. filed Nov. 30, 1891. In a telephone-exchange system, a metallic-circuit and a ground-circuit line connected together in a complete circuit for conversation from the ground of the subscriber's ground-circuit line through such line and thence through the metallic-circuit line to ground at the central office, two circuit connections of high retardation, one for each line, through both of which respectively said complete circuit is grounded at the central office and the line-annunciators forming part of said circuit connection, substantially as set forth.

817,807. ELECTRIC MOTOR; Charles H. Roth, Chicago, Ill. App. filed Dec. 27, 1904. A system for avoiding distortion of the magnetic field by armature reactions under different loads and field strengths. The field has a plurality of poles which are energized in combinations or separately so as to give the same field location under the same or different field strengths.

817,827. SYSTEM OF CHARGING STORAGE BATTERIES; Asbury G. Wilson, Wilkinsburg, Pa. App. filed Mar. 14, 1905. The system relates to charging storage batteries from an alternating-current circuit. The patentee employs chemical rectifiers in the circuit of the transformers and charges storage batteries by the uni-directional current produced.

817,843. ELECTRICAL MEASURING INSTRUMENT; John C. Gano, Chicago, Ill. App. filed July 24, 1905. Mechanical construction of an ammeter or volt meter having permanent fields and an armature pivoted between the pole pieces thereof. Each of the pole pieces has a face eccentric to the armature so as to produce a varying turning moment thereon for different current strengths.

817,846. TROLLEY HEAD AND CURRENT COLLECTOR; John E. Greenwood, Utica, N. Y. App. filed Oct. 31, 1904. In place of the usual harp, the patentee provides a centrally swiveled arm upon the pole, which carries two trolley wheels, one at each end. The journals of the trolley wheels are specially made so as to permit easy removal of the wheels.

817,857. ELECTRICAL MEASURING INSTRUMENT; John M. Lea, Chicago, Ill. App. filed July 31, 1905. Relates to a measuring instrument of the same general type as patent No. 817,843 above mentioned. In this case, however, the armature core is fixed and the coil is pivoted to be movable between the armature and the field magnet pole faces.

817,858. AUTOMATICALLY TRIPPING TROLLEY POLE; Thomas H. Mars, Chicago, Ill. App. filed July 18, 1905. The trolley pole has an extensible link connection with a spring which normally holds the wheel against the wire, but the spring is tripped out of operative relation by any sudden upward movement of the trolley pole. The extensible link serves to re-position the parts in normal relation when the pole is drawn downward.

817,860. SIGNAL FOR SWITCHES; Bernard G. Matz and Michael Worniewski, Chicago, Ill. App. filed July 17, 1905. The switch point has mechanical connections with a rocker arm which moves a switch lever over segments to illuminate different signal lamps.

817,863. WINDING MACHINE; Edwin H. Smythe, Chicago, Ill. App. filed June 24, 1905. Details of a winding machine of that general class in which an annular gear is threaded through the circular core to be wound, and the annular gear is made to carry the spool of wire around the core until the latter is wound.

817,867. SUPERVISORY SIGNAL FOR TELEPHONE - SWITCH BOARDS; Frank R. McBerty, Evanston, Ill. App. filed Jan. 24, 1902. The combination with a source of current, of a local circuit having two parallel branches with a signal device in each branch, means for opening and closing each branch, a resistance in the undivided portion of the circuit and an electromagnetic switch controlling a shunt or short circuit of the resistance, the source of current, signal devices and resistance being proportioned to prevent the actuation of either signal device when both of said parallel branches are closed, one of said signal devices being adapted to be actuated by the increased current when the resistance is shunted by the switch, substantially as described.

817,869. ELECTRICAL MEASURING INSTRUMENT; Joshua Patrick, Chicago, Ill. App. filed Aug. 3, 1905. Details of construction of a measuring apparatus of the general type of patent No. 817,843 above mentioned. Relates particularly to the trunnions and pivot supports of the movable element.

817,892. ELECTRIC CLOCK; Guy H. Andrews, Eastland, Cal. App. filed Aug. 22, 1905. Construction of a clock adapted to close an electric circuit at periodic intervals, for example, every minute. The patentee specifies as important features, a pair of tiltably mounted inclined tracks, and a balance wheel having a staff or spindle for altering the position of the tracks.

817,920. METERING OF TELEPHONE SERVICES; Isidor Kitsee, Philadelphia, Pa. App. filed Oct. 29, 1904. In a telephone system wherein the outlying subscriber centers through a circuit in an exchange, means at said exchange to register the value of the conversation at the outlying station, said means embracing at the exchange automatic means to make and break a circuit in accordance with the value to be registered, means to connect this make-and-break means to the circuit of the subscriber and a grounded source of current for said make-and-break means, and which embraces at the subscriber's station a registering device.

817,921. ELECTRIC TRANSMISSION OF INTELLIGENCE; Isidor Kitsee, Philadelphia, Pa. App. filed June 24, 1904. A composite sectional line conductor comprising a plurality of sections, each section consisting of conductively independent conductors twisted together, one of said conductors being common to neighboring conductors.

817,926. TRANSFORMER; Carl A. Lohr, Wilkinsburg, Pa. App. filed Apr. 27, 1905. A method of winding transformers so as to avoid intimate proximity of parts or windings having wide potential differences. The circuits are divided into alternately disposed sections with links connecting the inner and outer terminals of the sections of the low voltage circuit, said links being disposed alternately inside and outside of the sections of the high-voltage circuit.

817.832 ELECTROPLATING-TANK; Clarence G. Backus and George L. Wallace, New York, N. Y. App. filed July 27, 1905. In a device of the kind described, a tank, arms attached at one end to a side of the same and a rotatable drum supported by the outer ends of said arms, and means for raising said drum out of said tank and lowering it on one side of the tank substantially as described.

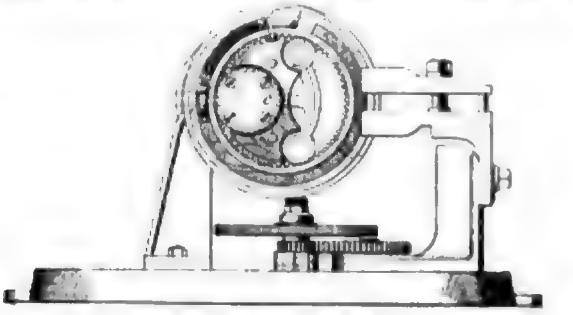
817,945. ELECTRIC CONTROLLING DEVICE; Frederick L. Willard, Brooklyn, N. Y. App. filed Oct. 2, 1905. The object of the invention is to provide a controlling device for use in connection with electric power apparatus for illuminating signs. A plurality of circuit closing switches are actuated by electromagnets with compound windings specially connected together and with relation to the lamp circuits.

817,076. ULTRA VIOLET LAMP; Thomas B. Kinraide, Jamaica Plain, Mass. App. filed June 12, 1905. An electrode for an ultra-violet lamp consisting of a plurality of metal plates clamped together in mutual contact at the discharge end thereof and spread apart from each other at the opposite end of said electrode.

817,959. ALARM-FUSE FOR TELEPHONE EXCHANGES; Edward B. Craft, Chicago, Ill. App. filed Feb. 5, 1904. A protective device comprising an insulating mounting-strip and terminal plates therefor, a spring secured to one of said terminals, a fuse-wire electrically connected with the other terminal and united with said spring to maintain the same under tension, and a target carried by said spring, said spring when under tension holding said target in an inconspicuous position, but being adapted upon the parting of the fuse to move said target into a position of display.

817,998. MEANS AND METHOD OF TRANSMITTING POWER; William Stanley, Great Barrington, Mass. App. filed Mar. 10, 1905. In a system of distribution, the combination of means for generating low-frequency currents of high potential mains leading therefrom, step-down transformers connected in multiple to said mains, and motors of the commutator type connected to the secondaries of said transformers.

818,027. INDUCTION MOTOR. Dugald C. Jackson, Chicago, Ill. App. filed Mar. 8, 1900. The method of operating an induction motor, provided with an armature having a progressive winding, a commutator, and auxiliary conductors for short-circuiting conductors of the armature-winding, which consists in establishing a field by a single-phase alternating current, subjecting the progressive armature-winding to the influence of the said single-phase alternating field, inducing currents in the said armature winding and passing the same in progression through the coils of the armature-winding, the commutator and brushes, whereby the motor is started, changing the number of poles of the field to which the armature is subjected, and conveying current between the coils of the armature that are subject to unlike poles of the field through said auxiliary conductors for normally operating said motor.



817,883.- Winding Machine.

818,035. ELECTRIC SWITCH; Henry E. Leppert, New Britain, Conn. App. filed Apr. 24, 1905. A rotary snap switch including a ball clutch which is released to permit an abrupt movement of the switch element.

818,068. REGISTERING APPARATUS FOR TELEPHONE EXCHANGES; Clarence E. Wright, Cleveland, O. App. filed Jan. 19, 1905. In apparatus of the class described, the combination with a controlling-circuit-closing device, of a source of current, an electrically-actuated counter, another electrically-actuated counter, and means for supplying interrupted current thereto and adapted to be connected with the latter, substantially as set forth.

818,133. COMBINED SYSTEM OF ELECTRIC SIGNALING AND SWITCH SETTING FOR RAILROADS; Bruno O. Wagner, El Paso, Tex. App. filed Oct. 28, 1904. Specific construction of a complete signaling system having electro-magnetically operated switch points and various operating and signal circuits, including means for heating the rails in winter.

818,145. TELEGRAPH SYSTEM; Myron J. Carpenter, La Grange, Ill. App filed June 2, 1905. In a system of telegraph, the combination of a telegraph-key, a telephone-transmitter, a support common to both adapted and arranged to communicate mechanically vibrations due to the manipulation of the telegraph-key to the telephone-transmitter, a source of electric current, and a circuit including said source of current, the key, and the transmitter in series, whereby said transmitter is responsive to the sound-vibrations and to the current variations produced by the manipulation of said key.

818,169. ELECTRICAL CIRCUIT AND DEVICE; Robert J. Hewett, Westfield, N. J. App. filed June 2, 1905. An over-lap block signal system operated by the successive short circuiting of the rails by the train axles. The invention is designed to effect an economy in the power consumption of the signal circuits.

818,170. ELECTRICAL DEVICE AND CIRCUIT; Robert J. Hewett, Westfield, N. J. App. filed June 2, 1905. Relates to modifications of the above.

818,174. PROCESS OF RECLAIMING WASTE GOLD AND OTHER VALUABLE METALS FROM WATER AND OTHER LIQUIDS; Charles E. Holland, New York, N. Y. App. filed June 5, 1905. The process of reclaiming gold or other precious or valuable metals from water or other liquids, consisting in conducting the stream or body of liquid to an electrolytic apparatus, subjecting it to electrolysis, in the presence of a body capable of forming a coagulum, and collecting the coagulum produced thereby.

818,186. INSULATING CLEAT; Henry D. Murdock, Wilkinsburg, Pa. App. filed July 17, 1905. A two-part cleat, one member of which has a deep groove, and the other member of which has a protuberance engaging said groove, but leaving a space for the reception of the wire or cable to be clamped.

818,[illegible]. RAILWAY SIGNAL CONTROLLING CIRCUIT; Herbert B. Taylor, Newark, N. J. App. filed Oct. 1, 1900. Relates to improvements in "open rail circuits," the object of the improvement being to provide a signal controlling circuit with all the functions of any of the standard rail circuits now in use with the additional features peculiar to this circuit, which simplify the operation of the signals and render them more sensitive to control.

818,[illegible]. ELECTRIC SWITCH; Lewis R. Brown, South Orange, N. J., and Fred H. Wentworth, New York, N. Y. App. filed May 5, 1905. Details of a switch including a mercury cup and a movable bar moved by an electro-magnet arranged to enter said mercury cup and complete a circuit when desired.

818,[illegible]. SPACE SIGNALING SYSTEM; Cornelius D. Ehret, Ardmore, Pa. App. filed [illegible] 27, 1905. Relates to apparatus for generating electroradiant energy and impressing it upon the natural media in such manner that a plurality of separate trains or waves of electromagnetic energy are simultaneously transmitted, such wave trains being dephased or displaced as to time with respect to each other.

818,253. INCANDESCENT LAMP SOCKET; Walter J. Jones, Hackensack, N. J. App. filed Dec. 3, 1900. An automatic cut-out for series incandescent lamps including a pair of spring blades which are separated by a thickness of tissue paper which breaks down in case the potential rises due to a burn-out of the lamp.

818,200. HIGH-TENSION CIRCUIT BREAKER; Robert H. Read, Schenectady, N. Y. App. filed June 25, 1903. A rotary magazine is provided for feeding enclosed fuses into position so that the circuit is broken through the fuse at each actuation instead of at the switch levers.

818,291. ELECTRIC CUT-OUT; Robert H. Read, Schenectady, N. Y. App. filed Sept. 26, 1904. Construction of enclosed fuse in which the pressure generated by the expansion of the air when the fuse burns impels a piston lengthwise so as to separate the contacts of the circuit.

818,290. SNAP SWITCH; Frank W. Sanford, Schenectady, N. Y. App. filed Sept. 30, 1904. Details of a snap switch having an insulating base with a rotary switch blade and stationary contacts, and a push button arranged in line of the axis of the switch blade and operating to put under tension a spring connected to the switch blade so as to release and move the same through a given angle.

818,309. INTERLOCKING SWITCH; Charles W. Stone, Schenectady, N. Y. App. filed Oct. 4, 1904. In combination with an alternating current generator, two or more sets of main bus-bars, one or more sets of synchronizing bus-bars, main switches and synchronizing switches, and means for interlocking said switches so that when a given synchronizing switch is closed, none but the right main switch can be closed.

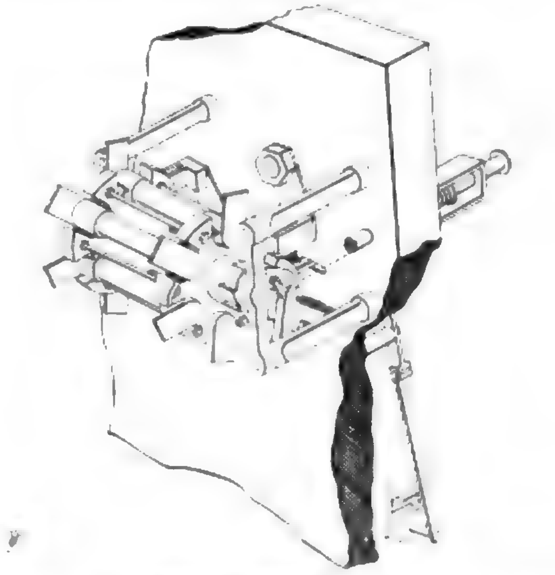
818,349. CONTROL SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed Oct. 10, 1904. A system to prevent the careful insulation which is now required for the pilot wire of a train which actuates the circuit-breaking magnets. Provides that the circuit-breaking wire shall be operable to throw the circuit-breakers only when the motor circuits are energized but not when the motor circuits are de-energized.

818,361. ARC WELDING APPARATUS; Arthur C. Eastwood, Cleveland, O. App. filed May 2, 1905. Details of a supporting handle for the electrode which is used in burning over blow holes in castings. Has a perforated supporting handle to dissipate the heat, and an insulating sleeve which is grasped in the hand.

818,363. ART OF SIGNALING THROUGH SPACE; Cornelius D. Ehret, Ardmore, Pa. App. filed Aug. 25, 1905. Relates to methods of receiving wireless messages, and boosting or reinforcing the alternating current produced to more effectually control or actuate a receiver or other translating device.

818,376. ARC EXTINGUISHING CUT-OUT; Edward M. Hewlett, Schenectady, N. Y. App. filed Aug. 8, 1903. The usual copper brush switch blade pressed against anvils or blocks has an auxiliary spring carbon brake between iron pole pieces in an arc expelling chute. The important feature is that the main and the shunt contacts have the same impedance.

818,377. REVERSE CURRENT RELAY; Edward M. Hewlett, Schenectady, N. Y. App. filed Oct. 22, 1904. Comprises a stationary field magnet member, an armature journalled between poles thereof, a cam carried by the armature shaft, a reciprocating member adapted to be moved by said cam, and a switch contact carried by said reciprocating member.



818,290 High Tension Circuit Breaker.

818,[illegible]. SWITCH-RECEPTACLE; George H. Metheany, Lima, O. App. filed May 25, 1905. A device of the character described, comprising an inverted, cup-shaped casing, said casing provided with an internal screw-threaded surface formed near its lower edge, an annular extension formed upon the inner face of said casing, said screw-threaded surface terminating short of said annular extension, a removable base member positioned within said casing, and contiguous to said annular extension, said base member provided with an upper concaved surface and with a central aperture, said member provided with a conical, depending portion, said depending portion provided with a concaved recess, a standard formed integral upon said base member, ribs extending in opposite directions from said standard and formed integral with said base member, a block formed upon the upper end of said standard, spring-terminals carried by said block, and an annular locking member positioned within said casing for securing said base member in a fixed position, said locking member provided with an outer screw-threaded surface and with inwardly-projecting extensions.

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The Metric System.

The secretary of the American Institute of Electrical Engineers issued, during the first week in April, a circular letter to the membership, asking for the return by mail of a coupon vote either for or against resolutions of the Institute's Standardization Committee. The gist of those resolutions is contained in the last clause, namely, that the Institute Standardization Committee "favors such legislation by Congress as shall secure the adoption of the metric system by each department of the National Government as speedily as may be consistent with the public welfare." We are informed that 1,635 votes have been returned from the membership in answer to the circular letter. Of these, 1,474, or 90.15 per cent, were for the metric system resolutions, and 161, or 9.85 per cent, were against. It thus appears that there is an overwhelmingly large sentiment among electrical engineers in favor of some legislative action which shall pave the way for the ultimate general adoption of the metric system on the North American continent. We certainly think that Congress should recognize this strongly expressed sentiment, and that to ignore it would be a positive injustice not only to international comity, civilization interests and common sense, but also to the engineering and electrical manufacturing interests of its citizens.

There is a bill in the House of Representatives named the Littauer bill, entrusted to the House Committee on Coinage, Weights and Measures. That bill provides that after June, 1908, all departments of the United States Government shall employ the metric system in conducting their business. It is well known that a number of the Government departments already use the metric system in their business, and that others would only be happy to be permitted to do so. Consequently, the bill merely provides for uniformity in Government action, and would stop the existing duality and unnecessary expense of carrying on two systems of bookkeeping side by side. The only opposition of any consequence comes from a certain section of manufacturers, the great body of manufacturers being divided upon this question. The conservative element fears that if we have a Government that reckons in metric units the Government will insist upon every part of a machine or a commodity being to exact millimetre size. It believes that Uncle Sam, if he measures with a metre-stick inside of a yard-stick, will become a veritable Shylock, and insist on his exact kilo of flesh. But Uncle Sam if he were as unreasonable as that might be just as oppressive now without any metric system club. He could insist on buying only such clocks, for instance, as had mainsprings exactly three-eighths of one inch wide, with a tolerance of no more than one-thousandths of an inch, broader or narrower. When Uncle Sam buys an article, however, he displays the same reasonable desire to get the finished product in satisfactory working order as do ordinary mortals.

There is not the least ground for supposing that under the metric system of measurement things made by the foot-rule would be discriminated against, or standard gauges, tools or sizes depreciated. Witness the fact that many American manufacturers now sell tools and commodities abroad to metric-using countries, without any difficulty, although these tools were made by the use of the inch or foot-rule. No man living in a house built by the foot-rule is made discontented with his abode because he adopts the metric system and measures things with a metre-stick. The English-speaking peoples always have been slow to adopt a good thing. Venice had the present Arabic system of notation for many decades before England changed from Roman numerals in keeping accounts. All continental Europe save Greece, Russia and remnants, adopted the present Gregorian Calendar in 1582, while England stuck to the old Julian Calendar until 1752, when she joined the procession by skipping eleven days. The English-speaking peoples are still driving the lumbering old family coach of barbaric weights and measures, to the laughter of Continental Europe, and to the joy of our commercial rivals. Out of self-respect, let us reform.

STANDARD UNDERGROUND CABLE PRACTICE.

Two papers on standard practice in underground cables for light and power distribution were read at the last meeting of the American Institute of Electrical Engineers. They indicate jointly how much room for improvement exists in the development of insulated wires and cables in regard to economy of first cost combined with a large factor of safety at high pressures. The first paper, a very practical one, by Mr. John Langan, on "Standardizing Rubber-Covered Wires and Cables," takes the general position that there is nothing like rubber, and that when you have Para rubber, there is nothing like thirty per cent of it. The creed might be formulated thereon, that there is but one insulator, which is rubber, and that its proportion is thirty per cent. Therefore, we should draw all specifications for cables in such a manner as to make sure that in their dielectric composition there exists 30 per cent of pure Para and let the remaining 70 per cent look after itself.

It is quite true that many of our best cables have about 30 per cent of Para rubber in them, but the subject is far too broad to be delimited in this way. Pressures of long-distance distribution are steadily rising. It is now standard practice to operate overhead lines at 60 kilovolts, to test special forms of apparatus at 200 kilovolts, and to operate underground lines at 11 kilovolts. Certain portions of underground cable in the United States are operating at 20 kilovolts. The industry is restricted to some extent to-day by reason of the expense of insulating cables for high pressures. Rubber is by no means the only good insulator to employ. It withstands a stress of from 20 to 40 kilovolts per millimetre; but it is one of the very few elastic or non-rigid insulators. It is also obtained by electric cables, in competition with automobiles, at a constantly increasing cost, and in a constantly decreasing degree of purity, from the tribes that inhabit tropical forests.

It is doubtful if there could be a more valuable industrial discovery at this time than an insulating substance of large dielectric strength, durability, pliability and low cost. The search for such a material among compositions is wide open. In the case of a search for conductors like copper there appears to be a law of Nature limiting the requirements to pure metals, so that the field is quickly exhausted; but as to insulators enclosed in a metal sheathing, like paper, varnished cambric and the like, there appears to be no such limitation, and either a compound or a mixture of substances might at any time be found capable of meeting the demand. Practice seems tending to demand a factor of safety of at least three, in the purchase of high-tension cables, as far as working pressures of 12 kilovolts at least. Much experimental investigation and practical experience will have to be accumulated, however, before the underground cable can be fully standardized.

A RECENT LIGHTING RIVAL.

Central station men have perhaps noted the recent attempts to produce a Welsbach burner capable of working upside down so as to give unobstructed light below it. With the ordinary Welsbach they are already only too familiar, and the effect of the new arrangement will be watched with keen interest. So far as we have seen the upside-down burners they have been only very moderately successful. The trouble seems to be that unless the gas is under more pressure than is generally permitted there is a tendency to smoke that greatly diminishes the usefulness of the light, while the heat damages the finish of the fixtures. These are practical objections that may or may not be overcome, but beyond them lie others even more difficult to avoid. The color of the mantle burner is not changed by inversion, and so long as it remains of the prevalent hue it will be unpopular in many fields. It is doubtful indeed whether the color can be materially changed without affecting the efficiency injuriously, since that efficiency is largely due to the very selective radiation that causes the greenish light. More than this, it is difficult to see how inverting the mantle really is of much service to the distribution of light, since the taper of the mantle is slight and the downward illumination rather weak in either form unless a reflector be used, in which case the results would be substantially alike.

The fact is that a great deal too much has been made of the natural distribution from flames and glow lamps. The latter are generally and advantageously placed with axes inclined considerably from a vertical, and if any particular distribution of light is wanted it is much more effectively obtained by a reflector than by changing the form or axial position of the lamp itself. The same fact holds good for gas lamps of all kinds, and granting that downward illumination is wanted for some particular purpose, the ordinary Welsbachs can and do obtain it efficiently by reflectors; and that is substantially all that the inverted Welsbachs are capable of. On the whole we cannot see that this new form of an old lamp is any more of a menace to the central station man than was and is the old one. The only real menace is the extreme cheapness of light from the mantle burners, but until the color thereof is remedied its quality will stand against their use. With arcs, Nernst lamps, Hewitt's and metallic or graphitized filament lamps, the central station man will be in a pretty good position to make a winning fight against the Welsbach in all its forms when he gets ready to do so. The electric arc can make a good fight against the "gas arc," particularly if the flaming arc gets down to a broad commercial basis, and the others mentioned can carry the conflict into smaller units. So long as the central stations discourage the small consumer he will very naturally take to Welsbachs, but when they get really ready to carry the war into Africa the munitions are ready at hand. The flaming arc is actually the cheapest known illuminant for work on a large scale, beating out even the gas arc under its most favorable conditions, and the new crop of incandescents can push the Welsbach hard even in price. When central stations get out after the cheap lighting business it will be theirs if they keep up with the times.

Combination Pole Lines.

There is rightly a constantly increasing tendency for electric light, railway and telephone companies covering the same territory to consolidate pole lines in the outlying districts wherever possible, thereby saving the expense of separate sets of pole lines as well as improving the general appearance of the streets. The necessity of keeping electric light and telephone wires well apart on combination pole lines, of course makes advisable the use of longer poles than would usually be needed if the two lines were separate. Where two companies occupy the same poles the question always comes up as to the proper location of the various wires. Sometimes this is worked out on common sense engineering lines and sometimes it is a result of an arbitrary decision by the management of one of the companies owning the lines, this decision being virtually backed up with the convincing argument "Do things our way or not at all." Sound engineering practice usually places the heavy wires on the top cross arms and the small telephone or signal wires on the lower cross arms. There are two good and sufficient reasons for this. The small telephone and signal wires are more likely to break than the lighting and power wires. Furthermore, there are usually more of them on a pole than there are lighting and power wires. The chances are, therefore, much greater that telephone wires if placed on the top cross arms will fall among the light and power wires than that the light and power wires will fall upon the telephone wires. With telephone wires on the lower cross arms they simply fall on the ground. The other good reason for placing the light and power wires on the top cross arms is that the telephone lines are worked on by linemen much more than light and power wires, and they are less dangerous for a lineman to pass through. With the light and power wires on the lower cross arms, telephone linemen must pass through them every time work is done on the telephone lines. They are not only in constant danger from passing through these lines so frequently, but there is always a chance that in stringing new lines they will get a cross between the wire that is being strung and the electric light wire. Taken all together, it would seem that no worse arrangement could be proposed than that of placing telephone wires on the top cross arms when it can be avoided; yet this is being done in some places under the method of arriving at decisions before mentioned.

Voltage Regulation.

It should hardly be necessary to call attention at this late day to the importance of good voltage regulation to central station service. Next after reliability of service, good voltage regulation is most essential in giving customers satisfaction. Without it low-efficiency lamps must be used. With it high-efficiency lamps are feasible which will reduce the cost of supplying light more than anything except radical changes in generating apparatus. In spite of these facts, which have been dwelt upon for years, there are scores of central station systems on which the voltage regulation is very bad. As a rule, there is no excuse for such bad conditions. If a central station company will figure up what poor voltage regulation costs it in the shape of lamps burning below good efficiency on one hand and excessive lamp renewals due to over-voltage on the other, it will usually find that the loss will fully justify the cost of the necessary changes to secure good regulation.

These changes may consist in the purchase of automatic voltage regulators to be placed on the generators; the purchase of additional feeder copper; the securing of better switchboard attendance, or the combination of these remedies. There is now less excuse than there used to be for poor voltage regulation at station bus-bars because of the presence on the market of automatic voltage regulators which will maintain a steady voltage under exceedingly trying conditions of mixed fluctuating power and lighting load. It is certainly short-sighted for a company having poor voltage regulation and not furnishing free lamp renewals, to argue that since lamp renewals cost the company nothing, good voltage regulation is of secondary importance. If the voltage is above normal part of the time, the customer objects to the poor service when it is not above normal, without considering that the high voltage causes excessive lamp renewals. On the other hand, if the voltage is below normal, the customer is not being given the results he should get for his money, to say nothing of his objections to a dim light.

Concerning Electric Heating.

In these days when central stations are actively looking for new business, it strikes us that a little more attention to the uses of electricity for heating would pay well. Plants here and there have been devoting some attention to the subject for a few years past, especially in connection with flat-irons, but it has not been pursued with much vigor save in a few instances. There has been much hesitation in favoring a use for energy in which full lighting rates are evidently out of place, even when rates in themselves profitable can be obtained. There are at present available all sorts of heating appliances at reasonable prices and of good quality which would give the central stations good revenue if their use were encouraged, and the load is one which in itself has usually proved to be desirable in that it tends to level up the hollows in the load curve. Moreover, it is a use that when once made economically possible will persist, while some other popular uses will not. For example, the very extensive use of electric signs now evident is one that may feel severely the first incursion of hard times, as representing a fashion rather than a daily necessity of commerce. Once get electric appliances into the household, shop or factory, however, and they will stay so long as they give good and reasonably economical service. On the other hand, appliances the practical value of which is not immediately evident, are easily displaced.

The policy of the gas companies has been very far-sighted in this respect. Instead of making rates to penalize the small consumer, they have favored him, perhaps even unduly. They have made it possible by persistent and liberal exploitation, for the small consumer to be introduced on an economic basis to all manner of gas-heating appliances, and they are getting ready to raid the motor business with small gas engines in a way that may before long be felt. The moral effect of this policy is at once felt through the community. A householder who finds that a gas range is cheaper than a coal range, and that a gas log is not to be despised as an occasional auxiliary heater, will generally not think it worth his while to run an additional bill for electric lights; and he is an easily made friend of the gas engine. And that is the policy that we expect of our central station friends—to develop every field, old and new, that promises ultimate profits, and to occupy it so fully that the other fellow cannot get a foothold. The electric heating appliance business at the prices of energy ordinarily met, cannot at present be a very large item, but in certain plants it can be made thoroughly profitable as a source of additional load. Once show a man that electric cooking apparatus and the like is wonderfully handy and reasonably cheap, and he will keep it in use and add to the station's revenue year after year. In summer and in the warmer parts of our country, this line of work can be followed up with good results, especially when the station uses hydraulic power. Some of the Southern California plants have built up quite a large business in this way, selling energy at 3 to 4 cents per kw-hour and competing very successfully with gas at, say, $1.50 per thousand cubic feet.

Attempts at ordinary air heating by electricity have not been satisfactory at a similar price, nor is it to be expected. On the other hand, gas for this purpose fails in similar fashion, save as an occasional auxiliary. Gas heat as ordinarily used is extremely bad from the hygienic standpoint. It vitiates the air very seriously indeed, and the moisture produced by the combustion makes itself a nuisance unless there is very thorough ventilation. Of course, there are places where coal is high enough in price to give electric heating a chance. It has even now been found that electric radiators can be made useful in bathrooms, bedrooms and the like, at a cost that is not prohibitive. With energy down to 2 or 3 cents per kw-hour, and especially when its use for this sort of work can be kept off the peak of the load, there is chance for a growing business. Of course, it is clear that there are many plants which could not profitably meet such a price. On the other hand, there are many which can and do make such quotations even for load carried over the peak. The miscellaneous thermal uses of electricity can be carried at better prices, air heating representing the least general and most unfavorable case. We know of plenty of hydraulic plants where a thousand kw-hours per day of off-the-peak load would not be looked at with contempt even at 3 cents per unit. It should be noted, too, that this kind of load, being mainly off the peak, does not bear heavily on the capacity of transformers or of the distribution system. At the price mentioned, electric kitchen equipment is not outclassed in economy by either coal or gas. Experience has shown that 3-cent energy is about on a par with dollar gas in cooking apparatus, and it is reasonably certain that dollar gas is cheaper than anthracite at the cost now common away from the anthracite districts. Even with energy at 4 to 5 cents per unit, the electric cooking and miscellaneous heating is on a par with the use of coal at $6 to $7.50 per ton. Here is a field for exploitation worth serious effort. Granting for the present that heating on a large scale by electricity is too costly, there still remains a chance for putting in the auxiliary and miscellaneous heating appliances on a sound economic basis. The gas companies make no pretense of competing with coal for general house heating, but they derive large revenue from just the class of work here referred to, a revenue which is thoroughly available if the central station will really get after it in earnest.

Isolated Plants as Non-Peak Load.

One possible relation of isolated plants to central station business which does not seem to have been given the attention deserved is that of supplying such plants with current during periods when, on account of the light load or the absence of steam heating they can only operate at very poor economy. As is well known, the operation of an isolated electric light or power plant is in many cases justified only by the fact that exhaust steam can be used for heating the building; during the summer the kw-hour cost becomes high unless it is very large or so situated that there is plenty of room in which to install economical types of apparatus. There are certain other plants, especially those driven by gas engines, whose operation 24 hours a day is an expensive proposition, although they can doubtless be operated on good economy during the evening peak load. Not a few isolated plants are operated by central station supply during periods when they cannot operate profitably themselves, and this is a matter which will bear looking into still further in places where central station men have taken it for granted that once an isolated plant is installed there is no further hope for doing business with the owner. As a matter of fact, he may become a very desirable customer, helping to increase the non-peak central station load. In such cases the customer carries the heavy readiness-to-serve investment which otherwise the central station would have to bear. While the kw-hour consumption may not be very great during the light load hours of an isolated installation, it is nevertheless a desirable class of business. When it comes to supplying an isolated plant with what is usually called a break-down service—that is, a service available for use at any hour in case of break-down—it is a very different proposition, as the central station must be prepared to take load at the peak at any time. Readiness-to-serve charges on isolated plants which are likely to be thrown on at any moment in this way, should justly be on a parity with the readiness-to-serve charges paid by any large customer.

Rates for "Non-Peak" Load.

We are inclined to think that insufficient attention has been given by central station managers to the question of motor and other load which would not come on the peak during the months of November, December and January. The capacity of the majority of central stations operating under normal conditions must be determined by the demand for energy about 6 p. m. during these three months of the year. It has been the constant aim of the more progressive companies to flatten out this winter peak by various schemes for securing long-hour users for both lamps and motors. Nevertheless, the majority of the long-hour users are on during the winter peak as well as during the hours when the general demand for energy is low. Whenever it has been suggested in discussions of this matter at conventions and elsewhere that small industries using motors might be secured as customers at low rates with the express stipulation that power should not be used during the winter peak load hours, some one has invariably raised the objection that the central station must be prepared to deliver energy whenever it is demanded, and that attempts to regulate the hours when the customer will use it are failures.

The objection has also been raised that such a contract is difficult to enforce because theoretically it takes a patrolman to determine whether special contract customers are using power during the winter peak hours, and second because even if they are using the power in violation of their contract during such hours they are likely to object strenuously to shutting down if they happen to be in need of power, during the prohibited time. While these arguments sound plausible and have much of truth in them the fact remains that the plan of taking certain customers at low rate contracts which expressly stimulate that power shall not be used during the winter peak load hours is being very successfully put in practice in a number of cities. The most notable example is Montreal, Canada, where numerous factories in consideration of low rates for electric energy shut down during the winter before the domestic lighting load comes on. We recently printed an account of the plan put into effect at Rockford, Ill., for automobile charging at a rate considerably below the regular lighting rate with the express stipulation in the contract that charging is not to be done during certain hours which correspond to the winter peak load period.

Several years ago we mentioned the low rate contracts made at Red Oak, Iowa, for the operation of refrigerating machine motors, which the central station company has the option of cutting off during its peak load hours if it desires. Most of the central station companies with contracts for city water pumping have taken these at a figure much lower than they could afford if it were not that they have control of the hours of pumping, so that they do not come on during the lighting peak. We have in mind another enterprising central station company in a town of 20,000 inhabitants operating a very economical electric and hot water plant, which maintains a load factor on week days of 55 per cent for 24 hours. The economy of production in this case is in no small degree due to the high load factor maintained through a large number of factories taking power under contracts which expressly stipulate that at the company's request power shall not be used during certain hours, these hours being closely calculated so that the factory power users shall not come on at the top of the winter peak, and at the same time shall not be seriously inconvenienced by being obliged to shut down during these hours. Many of these factories operate day and night shifts. It is a simple matter for them to arrange their shut-down period to cover the central station company's winter peak hours. Central station managers have been too much inclined to accept without question the assertion that manufacturing companies cannot be induced to change their working hours to accommodate the central station. The ordinary factory hours do not greatly overlap the winter peak load hours and in many cases it is an easy matter to change them. When there is offered the inducement of cheap power in consideration of shutting down during this short period every day for three months of the year a factory manager is more than likely to consider the proposition seriously, as the example of Montreal demonstrates. Even where a factory is running overtime—that is, when the regular force is working days and also a few hours each evening—it is an easy matter to make the supper hour from 5 to 6.15 rather than from 6 to 7.

In many cases it is not necessary to insist upon the non-peak clause in such a contract, as the central station ordinarily has (or should have) reserve capacity over and above its maximum winter peak load. There is no reason why this reserve should not be operated to carry customers on non-peak contracts who may be especially desirous of operating during peak hours; and if for any reason the central station is obliged to call on its reserve capacity for its regular lamp and motor load, the non-peak customers can be notified by telephone and the situation at once relieved without difficulty. Wherever, however, a large number of non-peak contracts are entered into a manager cannot impress too strongly on a customer's mind that his is a non-peak contract; and the ordinary use of power during peak load periods by non-peak customers should be discouraged even though he may have the reserve capacity to serve them most of the time. If these non-peak customers once get in the habit of using power during the peak, they are apt to consider it a hardship if they are occasionally asked to shut down; whereas, if they are ordinarily shut down during the peak anyway, it is accepted as a matter of course as a part of the low rate contract.

The unusually low rates which are made to non-peak users are, of course, based on the fact that many of the fixed and running charges in a central station are supposed to be taken care of by the ordinary rates for electric service which is likely to come on at the peak, and that the non-peak customer is entitled to use energy at a little above the operating cost of production without figuring much for interest and depreciation on the plant and distribution system. The practical effect of non-peak contracts is to give the central station double use of a part of its capacity. The equitable rate for this non-peak business would seem to be one which would charge the non-peak customer with some of the interest and depreciation on the plant, leaving the balance of these fixed costs to be borne by the peak user in the usual way. As a matter of fact, where non-peak users are factories employing motors a large number of hours per day, the fixed charges become such a small percentage of the total cost to the customer that the adjustment of this point is not one of very great importance in most cases. In the case of smaller intermittent non-peak users it cuts much more figure.

The greatest difficulty about making non-peak rates to small consumers lies in enforcing the contract. There is no check upon the small intermittent user, and the company cannot afford to watch what is going on as in the case of the large power user. To insure keeping such small users off the winter peak would necessitate a patrolman or a rather expensive electrically-operated switch with a reliable clock for opening and closing the circuit at each customer's premises. Should there be any difficulty about enforcing non-peak contracts by larger power users, such an appliance for cutting in and out would be feasible. This whole subject of non-peak contracts is worth more attention than it has been receiving, for upon it depends the securing or the losing of important long-hour business, which, however, can be obtained only at very low rates which will compete with isolated plants. It is perfectly evident that a central station company with economical generating apparatus should be able to sell energy at a small profit to factories having small plants of their own. The load factor on these isolated plants may be excellent and the cost of production low, but the central station company should be able to beat the isolated plant's figure and make a profit. The central station can afford to make a better figure for non-peak load than for load which comes on the peak, and therefore should stand a better chance of securing this class of business at a profit on a non-peak contract than on an ordinary contract.

A. I. E. E. Election.

The following communication from Dr. Louis Bell was received too late for classification under "Letters to the Editors":

I note with regret the acrimony that seems to have been aroused in the matter of the A. I. E. E. election. I do not desire to raise the question of fitness between two gentlemen for both of whom I have high regard, but the turn which the controversy has taken should certainly evoke a protest from the members who reside outside the immediate neighborhood of New York City. The American Institute of Electrical Engineers is supposed to be a national and not a local organization, and if preferment is to be based upon activity in the New York meetings it is high time either to change the Constitution accordingly or to make some drastic reforms in the workings of the central organization. The wishes of the members at large were indicated by the nomination papers and apparently showed in spite of a rather scandalous attempt at electioneering, that Mr. Rice was desired for president, and Dr. Sheldon for vice-president. Why the directors in making up their official ticket should have disregarded this I am at a loss to understand, for their action was needless, there being full provision for election of candidates not on this ticket, if the voting membership so desires. If this action is to be taken as a deliberate attempt to influence voters by giving them the choice of voting Dr. Sheldon into the presidency or ignoring him altogether then the sooner the directors drop this kind of ward politics the better it will be for the Institute. The whole proceeding strikes me as derogatory to the dignity of what ought to be a representative national body.

As to activity in the New York section as a prerequisite for office, the less said the better. Active workers have always been appreciated in the Institute, but it should be remembered that some of our most honored members have been too busy professionally, and too retiring personally, to be voluminous contributors to the proceedings. The Institute would have made itself a subject of international merriment had it turned down Mr. Edison as president on the ground that he has not been active in its debates. The Institute has indeed departed far from its early ideals if it allows itself to appear before the public as a local mutual admiration society swapping dignities among its ward workers. It is time to check the growing tendency toward denationalization. Personally I think it would be an excellent thing to so revise the Constitution and By-Laws that the official monthly meetings of the Institute should be held in rotation at the various large centers where the members are organized, reserving for New York in addition the titular headquarters and the annual meeting. The present relations between the Institute and its branches are farcical, and unless they are improved the inevitable result will be disintegration, which as an old member keenly mindful of the hard united work of the earlier days I should profoundly regret. Distances in our country are too great to permit the long continuance of narrowly centralized administration in a general society and steps should at once be taken to get upon a broader basis. It is the short-sighted attitude displayed in the present election which I regret more even than the existence of an irregular and unfortunate contest. I write this in the hope that the great unobtrusive majority of my fellow-members may be aroused to rebuke petty politics to waken the directors to a keener sense of democratic ideals, and to work for the nationalization of the Institute lest it shall enter evil days of strife and lose the prestige which it has honestly earned.

The following letter has also been received from Mr. Herbert A. Wagner:

A short time ago I was requested to subscribe to a circular sent to the members of the A. I. E. E. urging that votes be cast for Dr. Sheldon for president. The letters from Mr. Mershon and Mr. Rice, published in your issue of April 21, and from Mr. Mailloux, published in your issue of April 28, impel me to write a word of explanation. My action in subscribing to the said circular was based upon the feeling that the prominent engineers of the large manufacturing companies had been honored with the presidency of the Institute with a frequency, which if continued, might result in the ignoring of many other prominent and eminently qualified members of the Institute, who by their work, both in and outside of the Institute, are highly deserving of the honor.

I had no desire, however, to draw any comparison between the qualifications of the two present candidates, both of whom I hold in high regard, and who, I think, have equally the welfare of the Institute at heart. I do not agree with Mr. Mershon and Mr. Mailloux that work in and for the Institute should be regarded as the strongest qualification for the office of president. On the contrary, I am fully in accord with the point of view taken in your editorial comments.

It is to be deplored that any reference should have been made in the published letters to the alleged employment of commercial organization and methods to obtain votes for Mr. Rice, and I think Mr. Rice's reply thereto should commend him to every member of the Institute.

Rubber Covered Cables.

At the regular monthly meeting of the American Institute of Electrical Engineers, held April 27, two papers were read on the general subject of high-tension underground cables. A paper by Mr. John Langan dealt with the standardizing of rubber-covered wires and cables, while a paper by Mr. Wallace S. Clark consisted of comments on present practice in underground cable work.

A considerable portion of Mr. Langan's paper was devoted to a discussion of the defects which develop in cables when the insulation has not been properly prepared and applied. Nothing could be more misleading than the general belief that a potential test is, in itself, a criterion of permanent value. Many obviously cheap insulating compounds will withstand very high potential tests, and yet will, in a short time, break down in actual service. Compounds containing certain oils may possess good insulating qualities initially, but when the oils evaporate the compounds disintegrate and decay. The consensus of opinion is that rubber is the best of all insulating materials. Rubber in itself, however, is valueless as an insulating medium. The mysterious factor which gives to rubber its durability and immunity from oxidation when exposed to atmospheric and other conditions is the process of vulcanization, which consists in adding about three per cent of sulphur to the rubber and then subjecting this association to a certain temperature for a certain duration of time. It has been found that the life of rubber bears a direct relationship to the resinous matter it contains; the best grade of rubber seldom has more than one per cent, while in the cheaper grades there may be from five to twenty per cent. It is possible, therefore, to determine the grade of the rubber by ascertaining chemically the amount of resinous matter.

The author suggests that all conductors should have at least 98 per cent conductivity and should be thoroughly and evenly tinned. The insulating compound should contain not less than 30 per cent and not more than 32 per cent of fine Para rubber. No shoddy, reclaimed rubber, rubber substitutes, or the like, must, in any form, be in the compound, the extractive resinous matter of which, when chemically analyzed, must not exceed 5 per cent. All wires and cables properly insulated in accordance with the above provisions should, after a 48-hour immersion in water, at a temperature of 60° F. and before tape, braid, or lead is applied, show the following insulation resistance and voltage tests. A 600-volt cable should withstand a test e.m.f. of 1,000 volts for one minute, and should possess an insulation resistance of from 500 to 1,000 megohms per mile. A 3,500-volt cable should withstand 5,000 volts for one minute, and should show a resistance of from 600 to 3,000 megohms per mile, depending upon the size of the cable. A 5,000-volt cable should withstand 10,000 volts and have a resistance of from 1,000 to 2,500 megohms per mile, while a 11,000-volt cable should withstand 15,000 volts and show a resistance of from 1,500 to 4,000 megohms per mile. For railway signaling, fire alarm, telephone and telegraph purposes the insulation resistance per mile should vary from 2,000 megohms for a 4-0 conductor, to 3,000 megohms for a No. 18 wire, while the voltage which the insulation will withstand should vary from 2,000 for the former to 1,000 for the latter.

In addition to the above tests, the insulating material of every wire should withstand an elongation test of stretching three times its length several times; that is, a piece 2 in. long must stretch to 6 in. and promptly return to within 20 per cent of its original length. It must then stretch four times without break or rupture and return to 25 per cent of its original length. This elongation test is intended principally for Code wire, and would, even by omitting all conditions as to rubber, compel results that would be entirely reliable and satisfactory for all conditions of Code use.

Any piece of insulation, about ½ in. wide by 1/16 in. thick, stripped from the completed wire or cable, should withstand a tensile strain of 800 lb. to the square inch, and stretch to 3½ times its length without rupture.

The paper by Mr. Clark reviewed some of the practices in underground cable work for lamp and motor service which have now become almost standard in America. In discussing the lead covering on cables, attention was drawn to the fact that the continuous sheath on a cable, which is used as one side of a grounded circuit, is an invitation to stray currents and to electrolysis. It has sometimes been found that the ground of the sheath instead of being a cure for electrolysis is a cause of trouble. A proper cure would be obtained by omitting the sheath. Abandoning the lead entirely, however, is an economic possibility with only very large conductors. Where it is necessary to use a lead sheath, the best results will be obtained when the sheath is interrupted by some form of insulating joint on low-tension cables. In this case the insulation of the cable may be tested by means of an insulated wire inserted in the outer layer or strands forming the copper core.

For the purposes of initial tests when cable is installed, the joints in the sheath may be bridged by fine fuse wires, which are afterwards removed. Several methods are suggested for utilizing the pressure wire. The outer end of the pressure wire being insulated, periodic tests of this wire for insulation resistance will show any incipient fault in the main conductor. The wire may be used to read the pressure at the far end of the line. A secondary use of the pressure wire would be to calculate the temperature of the main conductor by measuring the variation in its resistance.

With high-tension lines some of the troubles due to the metallic sheath on low-tension cables are less marked. The metal sheath on high-tension cables must be earthed to prevent danger to life, and also to eliminate the risk of puncturing the insulation by cumulative static charge. It is unnecessary, however, to use insulating joints in the sheath of such cables, except in some special case where local conditions require them to prevent an excessive amount of stray current being carried.

DISCUSSION

Mr. H. W. Fisher thought that a voltage test upon a cable may be used for determining to a certain extent the quality of the rubber compound. A voltage test which would not injure a cable insulated with 30 per cent Para rubber might be sufficient to puncture a cable having a cheaper rubber compound. There are conditions under which rubber is not the best insulating material; it will not withstand under voltage stress the continued application of high temperatures, as well as other forms of insulation. There are some very prominent engineers in this country who, because of repeated burn-outs on rubber cables, are rather averse to them. Saturated paper-insulated cables certainly preponderate here, and they are giving excellent satisfaction.

Mr. H. G. Stott remarked that the condition of specifications for rubber-covered cables is an extremely chaotic one at the present. Each engineer has his own specifications, and the result is that the purchaser is almost entirely dependent upon the honesty of the manufacturer in building the cables. He showed the results of tests on samples of rubber-covered wires containing various percentages of Para, which indicated that a manufacturer who wishes to use reclaimed rubber can provide a cable which will show up better than a cable containing the specified amount of Para. From the tests it would appear that the variation of the insulation resistance with change in temperature is the best measure of the amount of Para used in the insulation compound. The stretching test, however, is absolutely unreliable.

Mr. Philip Torchio stated that the desirable features in the insulation of a cable are durability, a moderately high insulation resistance and high dielectric strength for high-tension cables. For a certain class of requirements cables built with less than 30 per cent of Para mixed with other ingredients will give a product of the same durability and the same general satisfaction as a 30 per cent rubber cable and yet save the purchaser a considerable percentage in cost. He thought that the proposed specifications should be made the foundation for the work of a special committee of the Institute to investigate and collect data on the subject. This committee should communicate with the English association of cable makers to obtain the benefit from their experience along the lines which led them to manufacture two types of rubber-insulated cables.

Dr. A. E. Kennelly said that the dielectric strength of the insulation does not depend solely upon the thickness of the wall, but upon the ratio of the external thickness to the internal thickness. It must always be kept in mind that the maximum dielectric stress will be exerted upon the inside layer, which should be constructed of the best and strongest dielectric materials, and the outside layers can be made up more and more of what might be called stuffing.

Mr. E. W. Stevenson, in comparing paper-insulated and rubber-insulated cables, stated that each has its special advantages and is suitable for certain duties. For extremely high-tension transmission and heavy power work, however, paper has almost entirely supplanted rubber. He agreed with Mr. Langan that the chemical analysis of rubber is not always practical, and that fairly good results can be obtained from mechanical tests. A convenient formula for determining the insulation resistance in megohms per mile for different sizes of wires is $R = 6{,}000\ (\log D - \log d)$, where D is the diameter of the insulation and d is the diameter of the copper. This formula expresses the reresistance at 60° F. after one minute electrification. Excessive pressure tests are unnecessary and dangerous. Although there is no objection to Mr. Langan's rule of using double the working pressure, 2½ times the working pressure is quite within safe limits, and this is generally understood throughout the country.

Mr. Townsend Wolcott stated that the Signal Corps has found that the best way to determine the amount of rubber in a compound is to have an inspector at the works to see the compound mixed. The determination of the amount of rubber by the acetone extract is a very uncertain matter, because rubber is not a definite chemical compound.

Prof. Durand Woodman said that when standard specifications are finally adopted they will include electrical tests, physical tests and some chemical tests. It is necessary to consider very carefully whether to adopt such a figure as 6 per cent of acetone extract, as such a quantity would allow for rubbers that are not Para.

Mr. William McClellan thought that any specification which calls for 30 per cent of pure Para rubber uniformly, without regard to the particular use for which the insulation is designed, is fundamentally bad from an economic standpoint. For a large portion of the work, 30 per cent Para is wholly unnecessary and much too expensive. It is noteworthy that the extractive matter could be considerably higher than 6 per cent, and yet a durable insulation obtained for many purposes.

Mr. C. F. Scott stated that in preparing specifications the operator should be considered as well as the manufacturer, and they should not be limited to the methods and materials used in manufacture. The cable is for use and the real essence of a cable test should be to determine its reliability.

At the conclusion of the discussion President Wheeler suggested that the standardization committee at its next meeting consider the matter and determine whether to appoint a special committee on cable insulation or to take it up themselves. The matter was referred to Dr. Kennelly, as secretary of the standardization committee.

Ithaca Meeting of American Electrochemical Society.

The ninth general meeting of the American Electrochemical Society commenced on May 1 at Ithaca, N. Y. At the beginning of the first meeting, which was held in the large lecture room of the Chemical Laboratory of Cornell University, President Schurman, of Cornell, presented a felicitous address of welcome. Prof. Bancroft, as president of the Society, replied.

A brief business meeting followed at which the results of the election of officers were announced, as follows: Mr. Carl Hering, president; Messrs. S. P. Sadtler, J. W. Richards and S. Reber, vice-presidents; Messrs. C. J. Reed, E. G. Acheson, C. F. Burgess, managers; Mr. P. G. Salom, treasurer, and Mr. S. S. Sadtler, secretary. A full report of the proceedings, with abstracts of the papers presented, will be given in our next issue.

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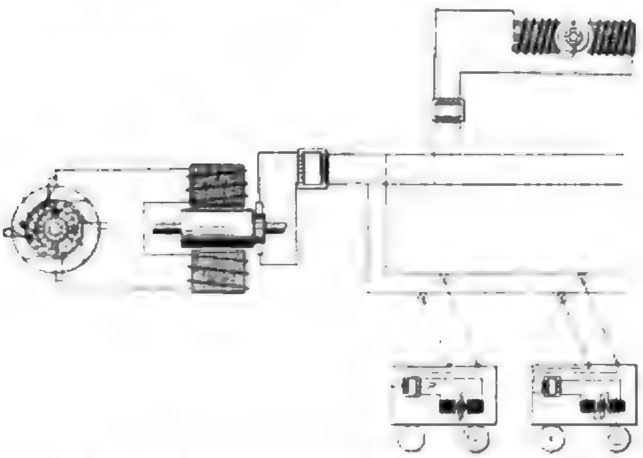
Low-Frequency Transmission System.

The accompanying diagram indicates a single-phase railway and power transmission system as proposed by Mr. Wm. Stanley in a patent issued April 17. The characteristic feature of the system resides in the production and use of single-phase current at a frequency of from three to fifteen cycles per second. It is evident that a series motor having laminated paths for the field flux will operate with five-cycle current practically the same as with direct current, so that a commutator motor for such a low frequency presents no difficulties in design or construction. The problem resolves itself into one of building a successful and economical low-frequency generator. The main generator illustrated differs from a direct-current machine merely in having a laminated field circuit and in being excited by low-frequency current; thus the frequency of the current delivered by it is independent of the speed of its armature, and it may be constructed for the most advantageous rotative speed. The exciter is a specially constructed low-frequency generator, and, though its weight might be large for its output, the effect of the increased weight would be relatively small in comparison to the output of the main generator.



STANLEY RAILWAY AND TRANSMISSION SYSTEM.

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An Important Niagara Project.

At various times during the past few years it has been proposed to develop power at Niagara Falls by means of a canal from La Salle in the upper river to the mountain top at Lewiston, where, by a system of locks or a hydraulic lift, boats could be lowered into the lower Niagara River, the flow of water in the canal being utilized for power purposes. This plan has been revived at various times and now it is announced that Eastern capitalists have secured the franchise of the Niagara County Irrigation & Water Supply Company, and will build a canal from La Salle substantially along the line of the Deep Waterways Canal for 3½ to 4 miles, to a point where it diverges towards the Devil's Hole. There by means of a 300-ft. drop power is to be developed and the water returned to the river. Considerable work has been done at La Salle, and the company expects to begin work in the near future developing from 200,000 to 300,000 hp. The canal will be 200 to 250 ft. wide and 18 to 20 ft. deep, large enough for the passage of lake vessels, so that by dredging the channel of the Niagara River it will be possible for them to reach Niagara from all the lake ports.

Of the power developed, 30,000 to 50,000 hp will be used by new industries which are expected to locate in the immediate vicinity of the canal. A considerable amount of power will be transmitted, it is asserted, to Pittsburg, Cleveland and intermediate points.

The estimated cost of the complete development is between twenty and thirty millions of dollars. It is stated that the charter of the Niagara County Irrigation & Water Supply Company has not been affected by the recent State legislation and has been sustained by the New York State courts. The charter gives the company the right to an unlimited amount of water, but the company is willing to have the amount which it will divert restricted to a reasonable extent so as to leave it on an equality with the companies authorized to make developments on the American side of the falls. The Burton bill, as introduced in Congress, limiting use, would affect the enterprise, although it is not thought that the bill will pass as it now stands. It is claimed that the diversions proposed at Niagara represent such a small proportion of the flow in the stream that the falls will not be substantially affected, and the power generated will add so materially to the industrial and commercial welfare of the entire Western part of the State that it is believed the conflicting interests will arrive at some equitable adjustment.

One feature of the enterprise is that, in putting through this development, over one-half of the Deep Waterways Canal will be built and maintained free of expense to the people. When the canal is completed all the lake ports will have free passage past the falls, on American soil; so that with the Deep Waterways and the thirteen railroads which center at Suspension Bridge, Niagara Falls will become, by means of the cheap power and unlimited transportation facilities, one of the great industrial centers of the world.

With this development a fall of 300 ft. will be available. This is over twice the average fall utilized by the companies at Niagara Falls, so that any water used at this site gives twice the power used at the average plants already developed at Niagara. In other words, if any additional water is to be diverted at Niagara the water can here be used in a way which will give the greatest possible development to the industries in New York State. Complete plans of the enterprise have been prepared by Messrs. Viele, Cooper and Blackwell, of New York.

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The Situation in San Francisco.

News this week is more cheering, though the immensity of the task of restoration becomes daily more apparent. Telegraphic and telephonic service is being rapidly resumed, and fortunately the underground wires and cables have been found generally in good condition—a long step toward renewal of operation. On May 1 arc lighting was resumed in the Potrero district of the city, and some of the street car lines are running, the Market Street cable route, trolleyized, being one of them. Electrical supplies, material and men are pouring into the district and the call comes for more. In addition to the concerns reported in these pages last week, the Westinghouse Electric & Manufacturing Company reports the loss of its offices and of its warehouse, with $160,000 of stock. Abner Doble Company inform us of the destruction of their old shops and the immediate construction of new. The power plants in San Francisco, owing to their suburban location, appear to have been fortunate in escaping any serious damage, so that the ability to supply energy in any quantity as soon as needed, is unimpaired. It is believed that the great facility of installing electric lamps, motors, heaters, etc., will lead to an enormous demand during the reconstruction of the city, and permanently thereafter.

CURRENT NEWS AND NOTES.

PHILADELPHIA SUBWAYS.—Mayor Weaver has approved the plans for the construction of the Philadelphia Rapid Transit Company's Market Street Subway east of the City Hall. The building of the underground electric road will be pushed so that it can be running within two years.

FUEL AND FURNACES.—At the regular monthly meeting of the New England Street Railway Club, held at the American House, Boston, on Thursday evening, April 26, a paper was read by Mr. John S. Schumaker, of the Farrell Foundry & Machine Company, Ansonia, Conn., on the subject of "Fuel and Boiler Furnaces."

ATLANTIC WIRELESS.—At the present time wireless communication across the Atlantic does not appear to be attended with great difficulty. The Cunard liner *Campania*, on her last passage from New York, eastward, established communication with Poldhu, in Cornwall, when 2,350 miles from the English coast. When 1,850 miles from Poldhu news messages were received both from Europe and from America.

ELECTRICAL ESSAYS IN SCHOOL.—Another central station has tried with success the idea of giving prizes for the three best essays on electricity in the household, written by public school children. The Mifflin County Gas & Electric Company, of Lewiston, Pa., offered three such prizes recently to students in the Lewiston High School. One of the essays sent us, the work of a girl of sixteen, is excellent, and shows that the rising generation has a keen idea of what electricity is going to do and can do for the housewife of to-day and of the future.

TELEPHONE RATES.—Chief Engineer Harry P. Nichols, of the New York Bureau of Franchises, in a report to the Board of Estimate expresses doubts as to the desirability of having more than one telephone company in the field and recommends that negotiations be opened with the New York Telephone Company for the establishment, if possible, of tolls and franchise payments on the same basis that is proposed for the Atlantic Telephone Company. The New York company has made progressive reductions for several years, and particularly since the introduction of the measured-rate system.

THE TELEPHONE ANTI-RELIGIOUS.—At a business meeting of the authorities of the Camden Old Order Dunkard Brethren Church, held at Camden, Ind., it was decided that all members of that church must have their telephones taken out at once. These people entertain the peculiar idea that the telephone does more harm than good, and that it is virtually irreligious. The telephone has been a subject of much argument among the members of the denomination, but this is the first compulsory law made by the brethren to taboo the service. The subject was hotly contested last summer in the national meeting, but was finally left to the individual conscience of the user. The Camden ruling affects only the members of this one church.

N. E. L. A. TRANSPORTATION.—The approaching convention of the National Electric Light Association promises to be most interesting and important. The papers arranged for by President Blood cover a wide range of topics, and the authors are men eminent in their respective branches of the profession. In addition to the convention proper, there will be an exhibition by the associate members, occupying the large hall at the entrance to Young's Pier, which has been noted elsewhere in this issue. On one of the days the committee expects to take the ladies attending the convention to Philadelphia, where luncheon will be served at the Bellevue-Stratford. Efforts are also being made to secure an exhibition drill of either the beach guards or the United States Life Saving Crew at the Atlantic City stations. The hotel circular will be issued in a few days. Any other information regarding the convention can be obtained at the secretary's office, 136 Liberty Street, New York City.

TELEGRAPHY IN ENGLAND.—A plan is under consideration in England, it is said, to reduce the cost of a six-word telegram, including the address, to 6 cents. Meantime there is agitation for a cheaper telephone service, although it is the telephone that so constantly undermines the telegraph income. Mr. J. Henniker Heaton, the well-known champion in the British Parliament of cheap postage, is now seeking to provide a telephone for every householder at a cost not greater than 24 cents a week. In Great Britain the post-office department comes into control of the telephones in 1911, but Mr. Heaton thinks that cheap telephones, with underground wires, should be provided before 1911, as it would mean an annual saving of "millions of dollars."

CANADIAN TELEPHONE CONTROL.—A bill was introduced last month in the Dominion Parliament, the chief feature of which is the control given of telephone rates, to the railway commission. The minister of justice announced that it was the intention of the Government to make this control as effective as that now exercised over railway freight and passenger rates by the same tribunal. The bill also provides for the interchange of traffic between telephone companies, and removes a barrier to the entrance of independent telephones to railway stations, abolishing in settling the compensation any exclusive contract between the railway and any other telephone company. The leader of the opposition has given assurance that he will do all he can to assist in perfecting the telephone measure. Its passage, therefore, is virtually assured.

NEW YORK ELECTRICAL SOCIETY.—The New York Electrical Society held its 258th meeting at the Edison Auditorium, 44 West Twenty-seventh Street, Wednesday, April 25. The address of the evening was on the subject of "News, Newspapers and the Telegraphic Art," by Melville E. Stone, general manager of the Associated Press. In view of the interest in the disastrous earthquake and fire at San Francisco, the officers of the Society supplemented this with special addresses bearing on the catastrophe. President Barstow gave a sketch of the remarkable power transmission development in California, for which San Francisco is the focal point, and Dr. F. A. C. Perrine, speaking on the same subject, showed on the screen some of the most interesting features of these installations, together with many of the buildings in San Francisco which have been destroyed. Mr. Stone gave a lucid exposition of the development of news gathering and of the extraordinary achievements which telegraphy now renders possible.

AUTOMOBILES AND TELEPHONY do not appear closely related, but it is the fact that telephone companies, like electric light and power companies, use the machines to advantage. Mr. Leland Hume, general manager of the Cumberland Telephone & Telegraph Company, Nashville, Tenn., states that the corporation now owns and operates fourteen machines of the runabout type that are used daily by the "trouble men" and installers. Six of these machines are used in and around Nashville, where the country for a radius of 100 miles is traversed by macadamized turnpikes, along which the company owns and operates long-distance and local telephone lines. When a line is found out of order and the trouble is 20 miles from Nashville, it can be reached in an hour and a half. Under the old mode of conveyance by horse and wagon two-thirds of a day was required to reach the trouble. As a result the use of the automobile has been of great advantage to telephone subscribers and users, because it minimizes the time that any line remains out of order. Mr. Hume himself uses an automobile almost entirely in inspecting the long-distance lines in Kentucky and Tennessee, and in visiting the 150 different exchanges in that territory. It is said that each machine costs twice as much as a horse and buggy, but does easily three times the work.

A BELL TELEPHONE CONVENTION.—The annual meeting of the contract agents of the Bell Telephone companies of the United States and Canada is announced to begin in Atlanta on May 15, continuing one week. There will be addresses by prominent officials, and other attractive features on the programme. Two or more representatives from each of the Bell Telephone systems will be present besides others interested. These meetings have usually been held in the North and East, but it was decided this year to bring the convention South partly on account of the growth of the business there.

WHAT SUBWAYS COST.—Before a commission appointed to hold public hearings as to the necessity of building on several routes designated by the Rapid Transit Commission, in New York City, George S. Rice, chief engineer of the permanent commission, gave the estimated cost of all the subways on the 19 routes approved by the commission as $450,000,000. He said that a subway in Third Avenue would cost $30,000,000 and would probably carry 600,000 passengers a day. A subway up Seventh and Eighth Avenues, he said, would cost $40,000,000. The cost of municipal operation he estimated at 60 per cent of gross receipts, while the present subway is being operated at 50 per cent.

JERSEY-NEW YORK TRAVEL.—The Public Service Corporation of New Jersey, which operates the trolleys of Essex and Hudson Counties, has made an agreement with the Pennsylvania Railroad and the McAdoo tunnel interests by which it undertakes to abandon its own plans for a special Jersey terminal and high-speed line. By this agreement the Pennsylvania road and the McAdoo tunnel interests will build a high-speed electric line that will take passengers of the Pennsylvania at Harrison, and of the Public Service Corporation at Park Place, Newark, and land them in Manhattan, at Church and Cortlandt Streets, in fifteen minutes. These two companies are to co-operate in building the main Jersey terminal at Harrison.

STREET RAILWAY CONVENTION.—A meeting of the Executive Committee of the American Street & Interurban Railway Manufacturers' Association was held in New York April 27 to elect permanent officers, make arrangements for the Columbus convention next October, and adopt a permanent constitution and by-laws. The following officers were elected: President, James H. McGraw, president McGraw Publishing Company, New York; vice-president, Charles C. Peirce, General Electric Company, Boston; treasurer, E. H. Baker, Galena Signal Oil Company; secretary, George Keegan, Interurban Rapid Transit Company, New York. A committee was appointed to take up the details of the Columbus convention at which a very fine exhibit fully equal to that last year at Philadelphia is expected.

TWO TELEPHONE SERVICES.—In a recent interview, Controller Metz, of New York City, said flatly that he was opposed to any new telephone system on Manhattan Island. "I have read the report of Mr. Nichols to the board on the Atlantic grant, and I have been especially interested in what he says about the advantages of doing business with a single company. The telephone business is an essential monopoly, and two companies in a city means an infernal nuisance, with no saving. I have had experience in Philadelphia and in St. Louis, where in each city there are independent companies. My private business has offices in both cities. You have to bother with two books, with two exchanges, and have to keep a force of clerks busy hunting up telephone numbers, only to find that the man you want subscribes to some other system than the one whose book you have."

CHICAGO TROLLEY PROBLEMS.—A special dispatch from Chicago of April 28 states that Mayor Dunne has submitted to the chairman of the Council Transportation Committee what he considers final plans for the settlement of the traction question. He practically abandons immediate municipal ownership for immediate street car service improvement, and calls for the opening of negotiations with the present traction companies at once. The Mayor's plan contemplates having the companies improve their service and continue under a license and not a franchise for a definite period, and an agreement between the companies and the city whereby the municipality is ultimately to buy the street railway properties. The aldermen, without exception, have been stirred by the new attitude of Mayor Dunne, and the opinion prevails that he is making easy his backdown from his municipal ownership ideas in the near future.

TROLLEY STREET CLEANING.—In Brooklyn the Street Cleaning Department has a smaller mortality among its horses, by reason of the use of the trolley as an adjunct. Last year Borough Superintendent William S. Clarke reported that he had lost only 61 horses; the year before he had lost 77; the year before that 119, and in 1902, 168. The present system of bringing the waste to thirteen centrally-located receiving stations and removing it thence in large trolley cars is the reason. Under the old system the average haul to the inland dumps, scattered at various points over the area of Brooklyn, was estimated at nearly two and one-half miles for the round trip. In some instances the haul was nearer four miles. Now each of the receiving stations is the center of a rough circle having a radius of a mile. The average trip of the horse and cart to the station and back is, therefore, one mile also, the maximum being only two. Other humanitarian reasons are also apparent.

NEW ENGLAND CONVENTION TRANSPORTATION.—Mr. Charles H. Hodkinson, of Boston, master of transportation for New England for the National Electric Light Association, was in New York last week conferring with Mr. George F. Porter, master of transportation, regarding the facilities for carrying visitors to the convention in Atlantic City from New England points. Mr. Hodkinson is endeavoring to get 150 fares from Boston and vicinity, in which case he will be able to secure an entire special train to run direct to Atlantic City without change, via New York, New Haven & Hartford Railroad, and by transfer boat to Jersey City, thence to destination. If he is successful in pledging the above number the train will consist of baggage, Pullman and broiler and observation cars. There is a mistaken idea that to avail themselves of this excellent service all passengers must be members of the association. This is not the case, and Mr. Hodkinson will consider it a favor if all intending visitors from New England will communicate with him before completing their arrangements. He has already issued special circulars.

ATLANTIC CITY PREPARATIONS.—To begin the preparations for the convention of the National Electric Light Association the first week in June, Mr. Arthur Williams, chairman of the convention committee, and Mr. T. C. Martin, chairman of the committee on progress, visited Atlantic City last Friday and Saturday to make preparations and lay out carefully a large amount of preliminary work. As is already known, Young's Pier has been engaged for the week, and the exhibit and meetings will all be held there, right over the ocean, and cooled by sea breezes. A spacious hall provides for the main exhibits and already very little space is left owing to the demand, so that an overflow into the pier wings is probable. The exhibit of central station advertising material by the committee on progress also promises to be very large and to embrace a number of new features. This will be given in an adjoining hall, en route to the convention meeting place, further down the pier, which is of considerable length and width. The uniform plan of exhibit decoration and booth is found to lend itself admirably to the space provided, and the lighting and color scheme will prove very effective. While the convention is going on there will be in full swing on the pier without any interference concerts by an excellent band, a vaudeville theatre, a skating rink and net deep sea fishing, so that the variety of instruction, entertainment and amusement will be something never enjoyed before or under such favorable conditions for comfort. Inquiry brought out the fact that the reservations at the thirty-seven hotels on the association list are already very large, running up into the hundreds.

Electricity at the New York Hippodrome.

THE great part played by electricity in modern spectacular performances and the extent to which electricity is used for utilitarian, decorative and advertising purposes in the modern playhouse are well illustrated in the electrical equipment at the New York Hippodrome. This building occupies the entire block from 43d to 44th Street on Sixth Avenue and is 240 ft. deep. It is built entirely of brick, marble and steel and has two electric towers abutting from either corner which rise to a height of 120 ft. above the sidewalk. The building is designed to be used exclusively for amusement purposes, principally those associated with circus, menagerie and aquatic performances. The seating capacity of the house is 5,200 persons.

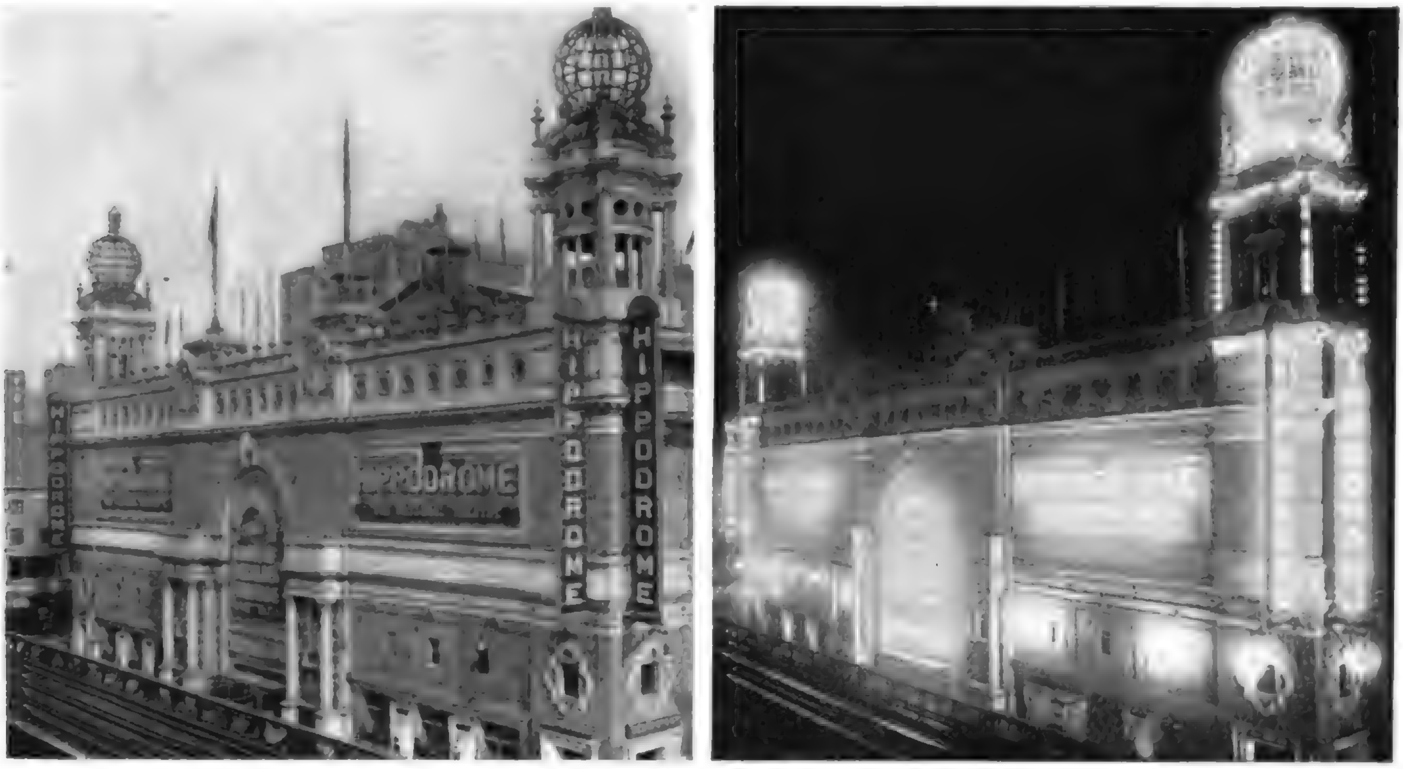


Fig. 1.—The Hippodrome by Day and by Night.

THE STAGE.

Not the least interesting is the stage and the novel arrangements for raising and lowering parts of it, filling and emptying a large tank and handling the scenery. From the footlights to the rear wall the stage is 110 ft. deep and is divided into two parts. The main stage, or that portion back of the proscenium arch is 60 ft. deep and 200 ft. wide. That portion of the stage between the curtain and the footlights, technically known as the apron, which in the average theatre is but a few feet deep, in the Hippodrome is 50 ft. deep and 100 ft. wide, elliptical in shape and large enough to accommodate two regulation circus rings each 42 ft. in diameter. Beneath the apron is a huge tank 14 ft. deep, which, when aquatic performances or naval pageants are to given, is filled with water. The movable apron may be submerged in this tank to various depths so that this portion of the stage, may be converted into a creek, lake or rushing mountain stream. The tank is built of concrete on rock bottom and its walls are reinforced with I-beams and channels.

The greater portion of the main stage consists of a movable platform carried on four girders and held up by four 12-in. plungers. These plungers are raised by hydraulic pressure, automatic equalizing valves compelling all four to travel at the same speed. The steel guiding columns are provided with dogs which lock the stage at any desired height. The dogs are operated simultaneously by two lines of countershafting extending the width of the stage. One line of shafting is placed in front and one line is placed in the rear of the stage lifting mechanism, and each is driven through a worm gear by a motor placed at the center of each countershaft. Hydraulic pressure is furnished by a triplex pump located beneath the stage. This is driven through double reduction gearing by a 40-hp, 220-volt motor and delivers water to a tank in which a pressure is maintained of 1,000 pounds by two accumulators. The latter consist of massive weights on top of steel plungers working in a cylinder. The accumulators are electrically connected with an Otis regulator and through it control the operation of the pump. The apron is also carried on 12-in. plungers, but has a maximum downward movement into the tank of 14 ft., while the main stage has a maximum upward movement of 8 ft. The normal position of the main stage and of the apron is level with the wings.

The three motor-driven centrifugal pumps which supply water to the tank beneath the apron are shown in Fig. 2. The pumps have a combined capacity of 8,000 gallons of water per minute. The small pumps are each direct-connected to a 16-hp motor and the large pump is direct-connected to a 40-hp motor. All the pumps discharge to a 12-in. main connected to the tank. The motors which are of C. & C. make are controlled by Ward Leonard starting boxes. In the basement are also provided four ventilating fans each of which is driven by a 25-hp motor. The electric motors in use in the building for various auxiliary purposes have a combined rating of over 350 hp.

DISTRIBUTION OF CIRCUITS.

The system of lighting which has been installed at the Hippodrome is of interest on account of the many novel features involved and the magnitude of the installation. Over 20,000 incandescent lamps are connected in circuit, exclusive of the large number of miniature lamps and projector lamps provided for stage use and the lamps used for electric signs on the exterior which alone number many thousand. There are also installed eighteen low-voltage transformers for supplying alternating-current to miniature lamps for decorative purposes on the stage and a large number of plug sockets on the stage and in all parts of the building for temporary lighting supply. The lamps are arranged on 934 circuits which are controlled for the most part from the stage and dimmer switchboard and in part from the general house board located in the office. The motors are supplied through eight circuits, and there are fourteen plug-socket circuits exclusive of the system for the stage.

The wiring for both the distribution and supply has been installed in a most thorough manner and in accordance with the latest practice of using conduit and metallic junction, outlet and panel boxes. Simplicity was secured by arranging for control from two independent switchboards for the different classes of service, and economy in the installation was secured by virtue of the more direct runs possible thereby. The general arrangement of the supply boards and distribution circuits is well shown in the special feeder diagram reproduced herewith. It will be noticed that there are three incoming supply boards, two on the 43d Street side, one of which is for alternating current, and one on the Sixth Avenue front. These boards merely contain the meters and main cut-out switches and fuses. From the Sixth Avenue board heavy feeders are carried to the general house switchboard as shown, and individual feeders are also carried directly to the lamps in the basement, which being required continuously are thus kept independent of the house board. The boards on the 43d Street side supply the stage and dimmer board through six large feeders, each consisting of a 4-in. conduit containing six 500,000 circular mil cables and a small feeder of two 300,000-circular mil cables supplies the motors in the basement for auxiliary service and the lighting circuits in the dressing rooms. The supply boards are interconnected by a heavy tie line in case of failure of either one.

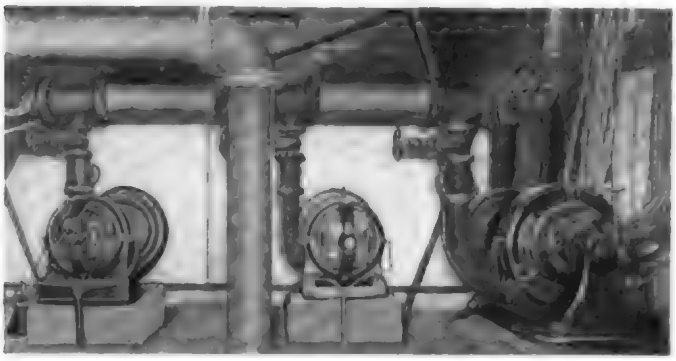


FIG. 2.—MOTOR-DRIVEN CENTRIFUGAL PUMPS FOR SUPPLYING TANK.

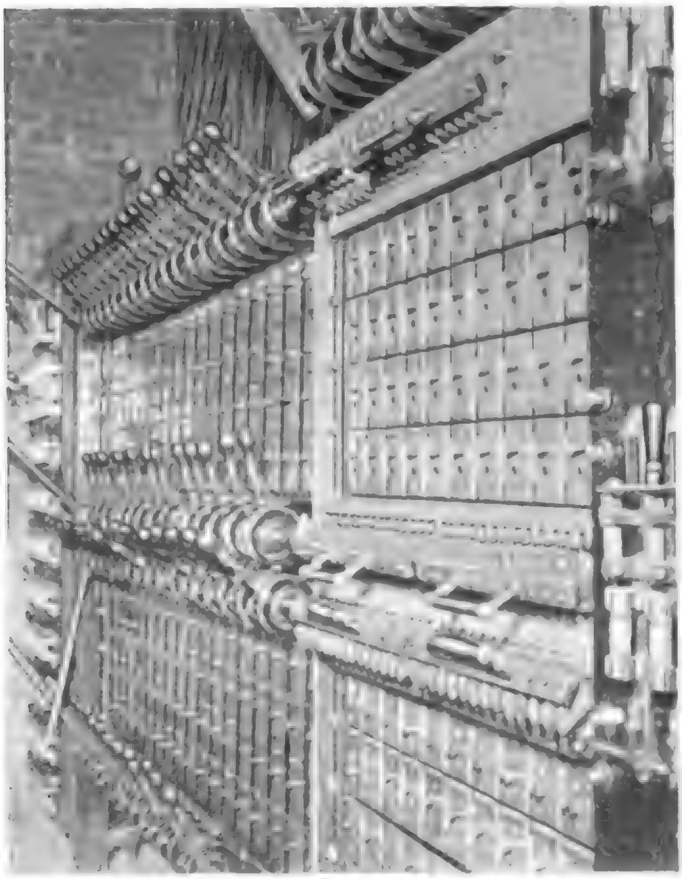


FIG. 3.—OPERATOR'S BOARD ON SWITCHBOARD GALLERY.

The locations of the general house and stage and dimmer switchboards are indicated in Fig. 6. The general house board controls the lighting circuits for the office, lobby, all corridors on the main floor, balcony and gallery; the electric signs and decorative lamps on the exterior of the building, the cafe and a portion of the lamps in the basement are also controlled from this board. All the lamps visible in the auditorium, with, of course, the exception of the ruby exit lamps, are controlled from the stage and dimmer switchboard, and from here are also controlled all the ceiling and side lights, the footlights, border lights and miniature lights on the stage. The borders are of large proportions, over 3,700 lamps being used in the borders alone. These are arranged on 296 circuits, delivery to the drops being made through multi-conductor cables of 75 No. 12 wires for the first seven borders, and of 100 No. 12 wires for the rear four borders. The miniature lamps for the

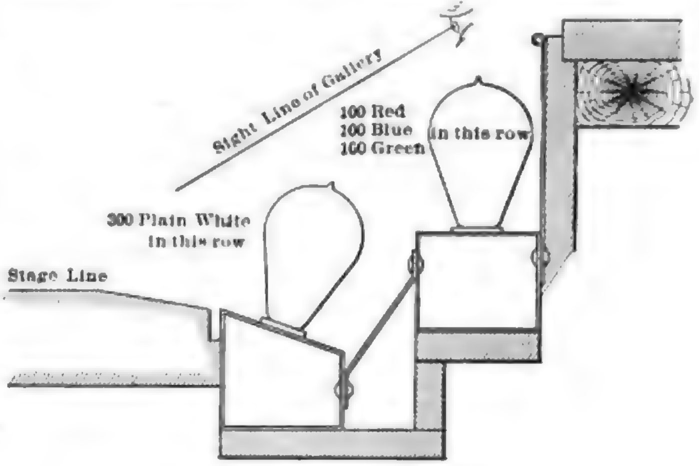


FIG. 4.—DETAIL OF FOOTLIGHTS.

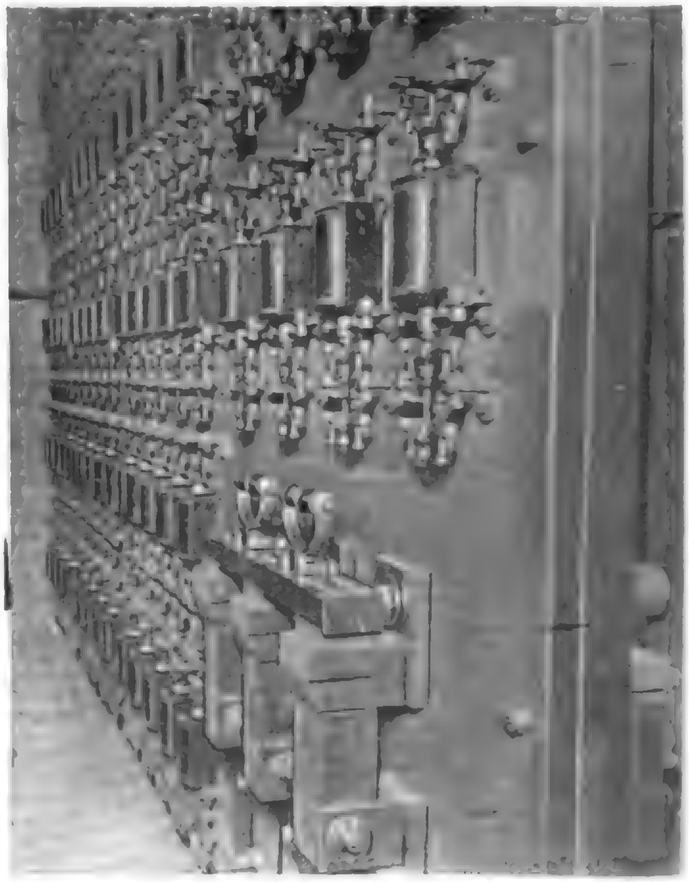


FIG. 5.—SOLENOID SWITCHES CONTROLLING STAGE LIGHTS.

decorative lighting are, as already stated, operated on low-tension alternating-current circuits, the transformers being located close to the outlets where the current supply is delivered.

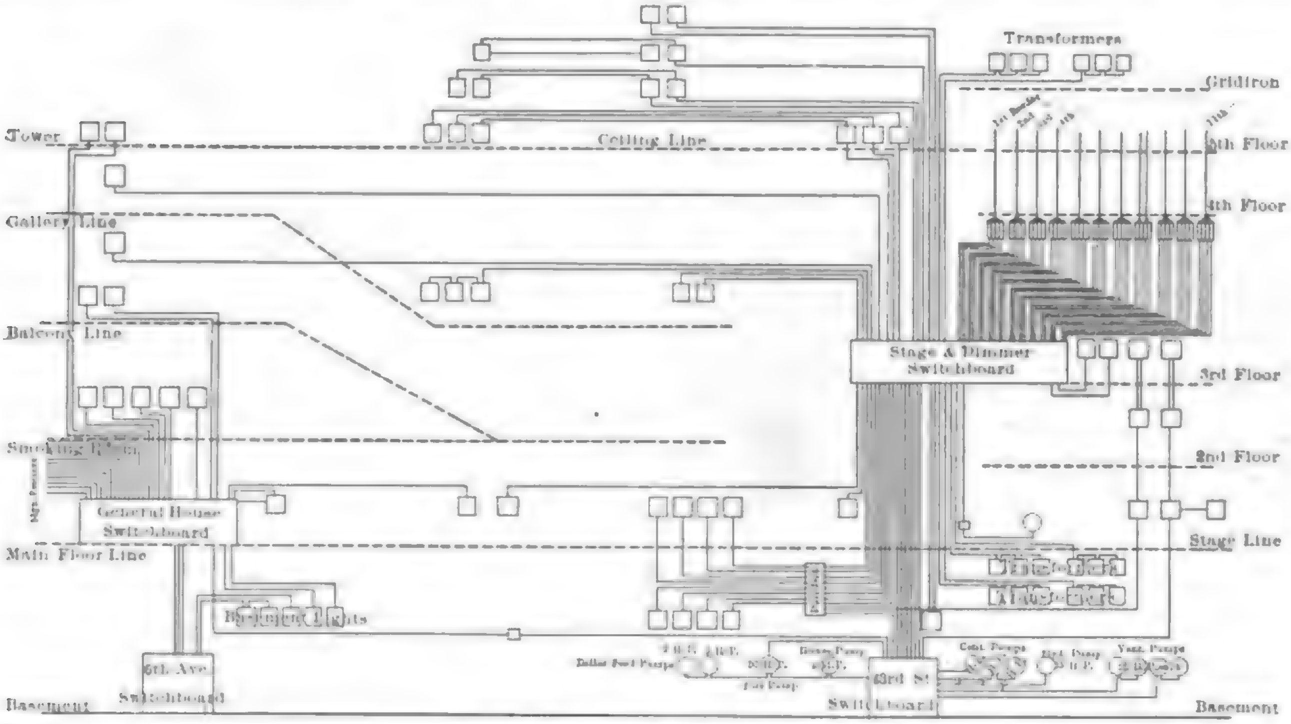


FIG. 6.—DIAGRAM OF FEEDER SYSTEM.

APPLICATIONS OF ELECTRIC POWER.

Electricity is used for handling heavy scenery and for operating the drops. An elaborate crane system has been installed which operates on four concentric semi-circular tracks running from a pocket on one side of the stage to a pocket on the other side of the stage. The tracks are formed of 12-in. I-beams upon the lower flange of which are the trolley hoists These are fitted with 2-hp motors for transverse operation and a 3-hp motor for hoisting. A cable wound around a drum fitted to each transverse motor is used to move the lifted scenery to one pocket or the other. The crane system is not used much at present, the scene shifters preferring to push the set pieces and use the hoists for lighter parts. All the motors are controlled from the floor of the stage by means of pull ropes. There is in addition in each wing of the stage a set of hoists for lifting set pieces of scenery, drop curtains, etc. Each hoist carries eight winding drums and each set of drums is driven by a 3-hp motor. The motor is connected to a shaft extending the length of the hoist frame, and the shaft of each hoist drum has a worm wheel driven on a vertical shaft. The upper end of the shaft carries a paper cone, and the motor-driven shaft carries two wooden cones for each winding drum, one on either side of the cone on the worm shaft so the winding drums may be turned in either direction. The lever for throwing the cones in contact latches as soon as contact is made between the cones, and the cable wound around the drum passes through a slot in the lever. Knots are tied on the cable at predetermined points and these in passing strike the lever, unlatching it, and the cones becoming thereby disengaged, the hoisting drum is stopped immediately. There are 60 separate drums provided in the two wings, each drum having a lifting capacity of about 800 pounds.

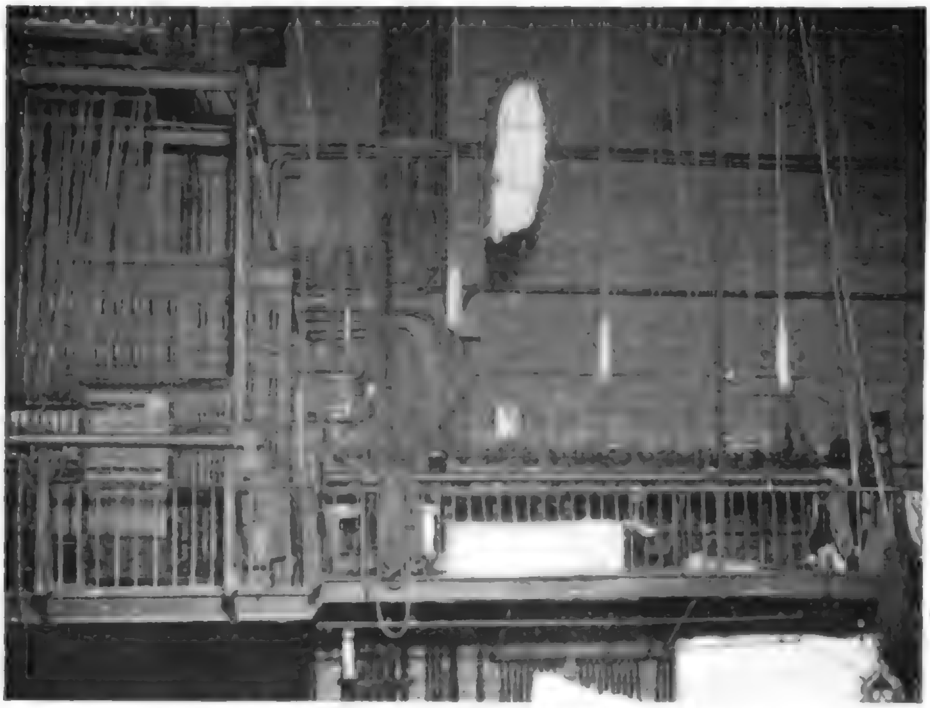


FIG. 7.—SWITCHBOARD GALLERY, SHOWING ALSO SCENERY HOISTS.

STAGE SWITCHBOARD.

The stage switchboard for controlling the lamps is one of the most interesting parts of the Hippodrome equipment. The board is located in the 43d Street wing on a gallery 25 ft. above the stage floor so that the operator is in full view of the stage at all times. The operator's board is made up of two panels containing 112 push-button switches which control as many solenoid switches on a board in the rear of the operator's board. These latter switches control the stage lighting circuits. To the left of the operator's board is a panel controlling the current for energizing the solenoids. At the top of the panel is a main switch and three triple-pole single-throw switches below which are arranged 24 switches for separate banks of solenoids which control different colored lamps. To the right of the operator's board is the alternating-current switchboard which is connected with the United Electric Light and Power Company's board in the basement. The board in the operator's gallery controls the circuits for the miniature stage lamps; but in the present show no alternating-current is used, the service being kept merely as a reserve for emergency use in case of failure of the direct-current service.

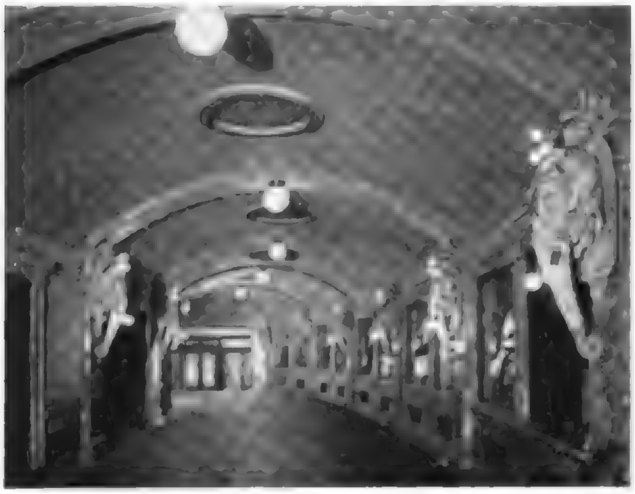


FIG. 8.—EXAMPLE OF CORRIDOR LIGHTING.

The push-button switches are arranged in duplicate rows, there being two rows for controlling the white lamps, two for red lamps, two for blue and two for green. This arrangement enables the operator to set the lamps for one scene while another scene is being enacted, the switches for the following scene being disconnected from the solenoids. To throw in the new set of lamps one switch on the board to the left is thrown open and another closed. This, however, is too slow a method for changing the stage lamps inasmuch as it necessitates the opening and closing of switches for each color of light. The smaller panel is therefore equipped with throw-over switches, as shown in Fig. 3 by means of which the change may be made almost instantaneously, all colors being thrown in simultaneously.

The larger operating panel is divided into two parts by a row of dimmer handles, there being a row of dimmer handles across the top and another row across the bottom of the panel also. While the character of the lighting of the present attraction is such that the dimmers are preferably operated by hand, the dimmers are arranged for motor operation. On a framework behind the board are mounted four variable-speed motors each driving a screw carrying a nut. The nut is connected by a link to a lever on the shaft of the dimmer handles causing it to rotate as the nut moves backward or forward. Beneath the screw are snap switches, which are thrown by the nut when the latter reaches the end of its travel in either direction, so that the dimmers are not injured through the negligence of the operator.

All the lamps controlled from the stage are connected through dimmers, and each bank of dimmers is connected to a set of different colored lamps. Each dimmer shaft carries a pulley which is connected by belt to seventy-six 200-light theatre dimmers located in a gallery above the switchboard gallery. Interlocking handles control these pulleys permitting any circuit to be thrown out as desired. The motors operating the dimmers are controlled by starting boxes, located at the bottom of the smaller panel, the switches being set on a separate panel over the board. On the solenoid board is also installed a master solenoid switch which may be operated from a number of emergency switches placed in various parts of the house. This switch controls the glare lamps which stud the proscenium arch and which are sufficient to light the whole theatre adequately in case of accident. The lamps are connected to both the direct-current and alternating-current main, a relay on the back of the alternating-current board in the basement connecting the circuit automatically to either service in case of the failure of one.

ILLUMINATION.

The auditorium is lighted chiefly by an immense sunburst in the dome forming the ceiling, the number of lamps forming the sunburst being in the neighborhood of 3000. In the inlay proper of the sunburst are 675 eight cp lamps. The ribs contain 400, and the rims over 600 lamps, all of 8 cp. In the outer rim forming the ceiling border are twelve hundred 16 cp lamps besides three hundred strip lamps made up of red, white and blue lamps in equal numbers. The clusters in the ceiling of the gallery and balcony each contain four 16-cp lamps and under the mezzanine floor are about five hundred 8-cp lamps studded in the ceiling. The elephant's head, the emblem of the proprietors, is the keynote in the ornamentation, and is found wherever the design of the building permits its installation. Each head is lighted by five incandescent lamps, three over the forehead of 8 cp and two of 32 cp tipping the tusks.

For the lighting of the stage both arc and incandescent lamps are used in large numbers. In the border lights over the stage are thirty-seven hundred 32-cp lamps, one half of which are white, the others being red, blue and green. In the footlights arranged as shown diagrammatically by Fig. 4, are six hundred 32-cp incandescent lamps, 300 white and 100 each of blue, red and green lamps. At the side of the proscenium are one hundred and forty-eight 32-cp lamps, and in mirror troughs are fifty 50-cp lamps. The mass lights which form a rim around the arch consist of one hundred and seventy-eight 50-cp mirror trough lamps. There are 125 portable trough strip lights each containing twelve 16-cp lamps used in all scenes in addition to 12 borders made up of twelve 32-cp lamps each at the bottom of the cyclorama which throw light upward in order to kill shadows made by the border and spot lights. Over 150 stage pockets are connected, some through resistance for arc lamps and others through dimmers for incandescent lamps. In the center of the gallery back of two 10-ft. color boxes provided with eight color screens are 25 spot lamps, 20 of which require 30 amperes each and the others used for spot light work consume 50 amperes each. There are two spot light bridges on either side of the balcony, each bridge containing twelve arc lamps. Ten of these are used behind color boxes and consume 30 amperes each and the two used for strictly spot light work require 50 am-

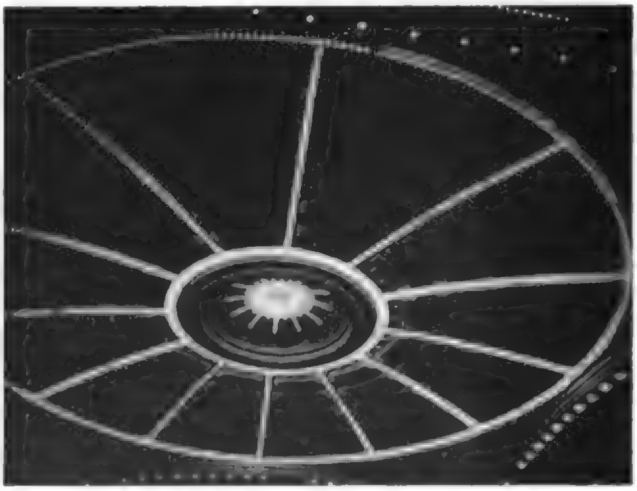


FIG. 9.—SUNBURST IN CEILING OF HIPPODROME.

peres each. In the dome of the ceiling are two holes back of which are two 75-ampere search lights for lighting the fountains from overhead. On either side of the apron are eight 6-in. spot lights back of color boxes, each lamp consuming 30 amperes; there are in addition four mirror back reflector lamps for the ballets which consume 50 amperes each. Back of the proscenium arch curtain line are two double bridges on either side of the stage. Each lower bridge has six 6-in. spot lights consuming 50 amperes each, and on the upper bridges are eight mirror-back reflector lamps consuming 50 amperes each. Over the center and back of the proscenium arch is a 30-ft swinging bridge on which are fourteen 50-ampere spot lights for lighting the cyclorama, and over the switchboard are six 50-ampere spot lights. On either side of the proscenium arch are the arc lamps for giving the lighting effects. In the second scene there are six effect machines used to produce cloud effects for a "Moon Song." Each of these machines requires 50 amperes and they are placed over the center arch of the scenery used in this act and fed from stage pockets. In the last scene there are in addition to the equipment mentioned below nine 50-ampere cyclorama arc lamps at the back of the scenery which throw light upward to heighten the effect of the tableau and also to kill shadows.

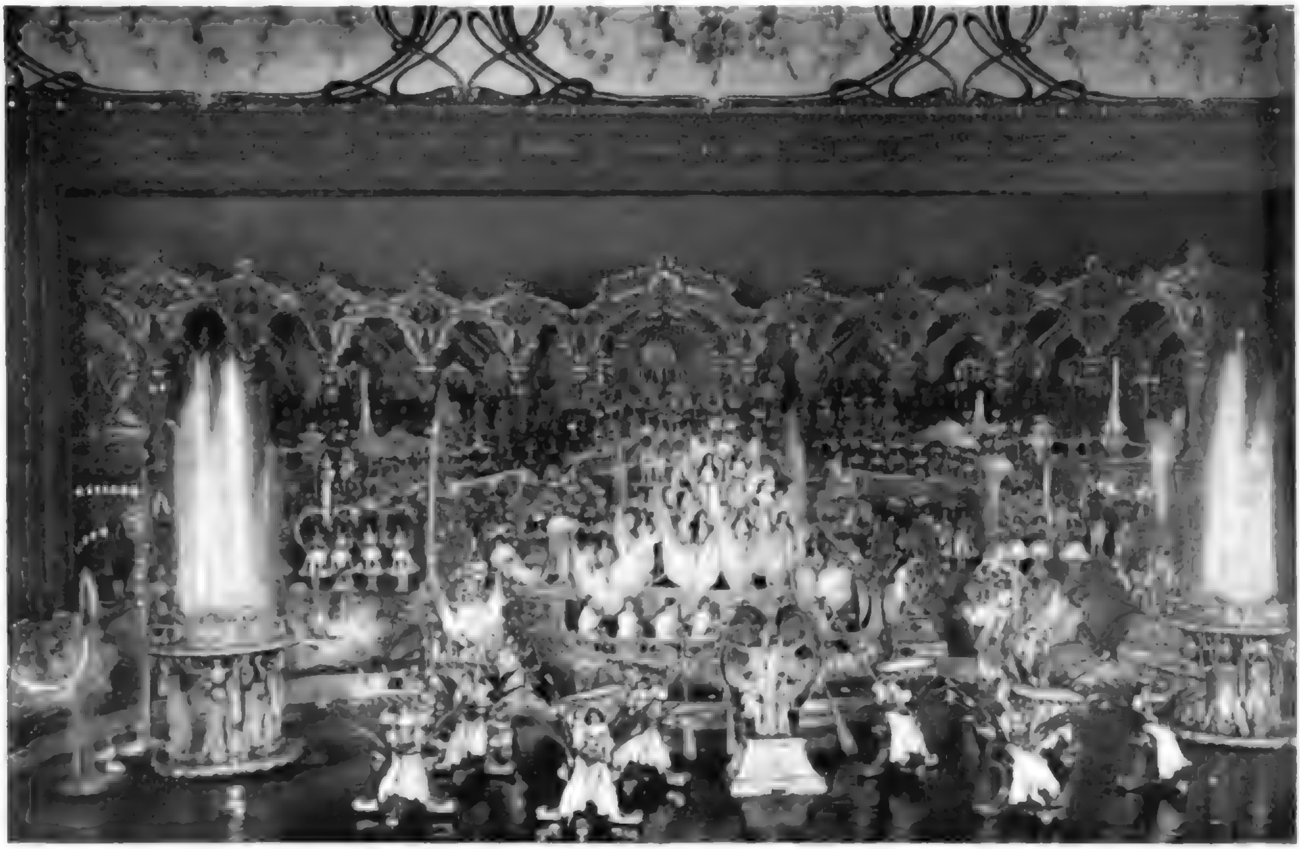


Fig. 10.—"Court of the Golden Fountains," the Illumination of Which Requires Over 10,000 Amperes.

The "Court of the Golden Fountains," which is the final scene of the performance now running, is a spectacular aquatic tableau which neither words nor photographic reproduction can adequately describe. It is a notable example of scenic art of dazzling brilliance made possible only by the use of the electric light. In the center is a boat 36 ft. long and about 17 ft. high studded with 700 standard and miniature lamps. These are fed from two sets of stage pockets through cables run in ¾-in. rubber hose. The circuits are divided and fused in the boat and every other lamp in the outline is connected to one circuit so that should one feed line become accidently short-circuited the effect will not be noticeable to the audience. Around the apron are four 10-ft. sea shells 7 ft. high each seating two girls. There are forty 16-cp lamps connected to a double set of feeds concealed under the outer rim of each of these shells which serve to heighten the color of the shell. Each girl holds in her hand a string of pearls consisting of 17 ball-shaped incandescent lamps graduated in size from 32-cp at the bottom to 4 cp at the top of the string. There are also eight large-egg-shaped mussels which, as the curtain rises, are gradually opened by a girl secreted within each. Each of these mussels is lighted by sixteen 32-cp ball-shaped lamps placed around the edges. In front of the boat are arranged eight seats representing bullrushes. Each of these is provided with twelve leaves and at the tip of each leaf is a 16-cp bunkhole lamp specially dipped to give the desired color tone to the cattail which each represents. Twenty 16-cp lamps are concealed beneath the shell or umbrella over the head of the girl to light her face.

The two electric fountains on either side have each within them under a water-tight glass-covered color box a 75-ampere search light, and in the ceiling overhead, as already mentioned, is a 75-ampere search light also.

The color changes are made within the fountain and from the search light overhead both blending and giving a very pretty effect on the jets of water issuing from the fountain. One hundred and fifty submarine lamps are used to light the girls who seemingly support the fountain, and there are forty-two floating lilies, some below and some above the water, each of which is fitted with an electric lamp. Four girls, each holding a wreath of twelve 32-cp ball-shaped lamps stand on two dolphins, whose eyes are studded with green lamps and whose eight fins have eight forty-eight 4-cp lamps. Twelve 16-cp lamps are concealed in the mouth of each dolphin to heighten the effect. All the floats are fed through No. 10 stage cable encased in ¾-in. hose and connected to stage pockets around the footlights. No less than 2,000 ft. of rubber hose is used for this purpose. Seventeen hundred 8-cp lamps are laced to the scenery in the background. These are divided into circuits of 24 lamps each, fed from stage pockets through dimmers.

Before the curtain rises on the last scene the floats are rolled into place and the electric connections made. The main stage, with over 500 performers, is then elevated eight feet and the apron is submerged a few feet into the tank of water. The water is then turned on to the fountains and as the curtain rises the entire lighting capacity of the stage board is thrown on through dimmers. Gradually the dimmers are cut out until full brilliancy is attained and for the space of about one minute over 10,000 amperes of current is consumed to light the gorgeous spectacle. The performance is given twice daily and the tableau at the afternoon performance comes on at about 5:15. Readers may imagine what such a sudden load means during the winter months to the station of the New York Edison Company which supplies the electric energy. The Edison Company requires no greater recommendation than that it has supplied this sudden demand nightly without a single failure.

MISCELLANEOUS.

Electricity is used in all the dressing rooms for curling irons and cosmetic heaters, there being 400 combined sets in use. The irons used for pressing the thousands of costumes used in the ballets are also electrically heated. In addition there are 28 ceiling fans and 18 stand fans in use during the warmer months. Electric carriage calls are installed on the 44th Street and 43d Street sides. Fig. 1 shows the exterior of the Hippodrome by day and by night. Arranged in rows across the face of the building are about six hundred 16-cp incandescent lamps. The towers and spheres are studded with over one thousand 8-cp incandescent lamps and in the four double-faced signs on the corners of the building are nearly fifteen hundred 8-cp lamps. In the other signs on the face of the building and over the doorway there are about two thousand 8-cp lamps employed, and 12 arc lamps are distributed across the front wall, making the building a blaze of light and attracting the attention of every passenger in the cars of the elevated railroad, and of pedestrians and others on the streets. The proprietors, Messrs. Thompson and Dundy, are firm believers in the use of electricity for advertising purposes and maintain a number of large electric signs in Manhattan and Brooklyn. At Broadway and 34th Street, one of New York's busiest corners, is a sign 40 ft. by 36 ft. with the words "Hippodrome, A Society Circus, Nine Blocks," with a hand pointing in the direction of the theatre. This sign is brilliantly illuminated by fourteen hundred 8-cp lamps, the name Hippodrome being in red, the rest in white light. It is also worthy of note as showing the enormous current consumption by arc lamps alone that the number of 9½-in. cored carbons used weekly in the arc lamps at the Hippodrome is a trifle less than 2,500.

Mr. Charles De Soria, of the New York Hippodrome, is responsible for the lighting effects, and it is to him that we are indebted for the information contained in this article.

The Distribution of Illumination in the Neighborhood of Two Lamps.

By J. R. Benton.

The distribution of illumination in the neighborhood of a single source of light follows a very simple law, being inversely proportional to the square of the distance from the source, but when illumination takes place from several sources its distribution becomes far more complicated, and cannot generally be computed in advance. In practice, illumination is very frequently effected by using several sources, as when lamps are placed at intervals near the ceiling of a room. It would be advantageous if the illumination to be obtained at any point by such an arrangement could be computed in advance, since the information gained by a mathematical study of the conditions would be helpful in deciding upon the best number, spacing, and power for the lamps to be used.

If the intensity of illumination upon any surface depended simply upon its distance from the various lamps, it would be very easy to calculate it by summing together the illuminations produced upon it by each of the lamps separately, but in reality the intensity is proportional also to the cosine of its angle of incidence upon the surface, which makes calculations impracticably laborious. Besides this, the thing of interest is not always the intensity of illumination upon a fixed surface, but sometimes it is more important to know the maximum intensity which can be obtained at a given point by turning a surface into different positions at that point. This would be the case where the illumination is to serve for reading, as in a church; each person naturally holds his book in such a position as to obtain the maximum illumination upon it.

The problem is then to find the maximum intensity of illumination which can be obtained at any point from a number of sources of light acting together. When the number of sources is very great, the number of independent variables involved is so large that any formula which might be worked out would be inconvenient to use; but in case only two sources come into consideration, the problems which arise may be handled rather simply with the help of the table given below. The case to which this table is applicable occurs when a room or hall is to be lighted from two chandeliers, each of which may usually be considered as a point source of light. The problems which arise in planning for such an arrangement are as follows: (1) When the positions of the two sources and their candle-powers have been fixed upon, to find the resulting intensity of illumination at any point; (2) when the positions, but not the powers, of the two sources have been fixed upon, to decide what is the proper candle-power for each in order to produce a given illumination at given points; (3) when the positions of the sources have not been fixed upon, to ascertain how they should be placed in order to get the best distribution of light in a room of any given shape and size.

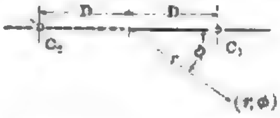


FIG. 1.—DIAGRAM ILLUSTRATING THE MEANING OF r, ϕ AND D.

To solve these problems, it is necessary to make use of a system of co-ordinates in order to define the position of points. It is obvious that the distribution of illumination is symmetrical with respect to the line passing through the two sources of light. It will be sufficient, then, to define the positions of points, if plane polar co-ordinates are used, taking as origin a point midway between the two sources, and as line of reference the straight line joining the two sources. This is illustrated in the diagram of Fig. 1. On this system let r be the radius vector and ϕ the vectorial angle. Let C_1 and C_2 be the candle-powers of the two sources and D the distance of each from the origin. Then the expression for the maximum intensity obtainable at any point as a function simply of r and ϕ is as follows:

$$I_{max} = \sqrt{\left(\frac{C_1}{D^2+r^2-2rD\cos\phi}\right)^2 + \left(\frac{C_2}{D^2+r^2-2rD\cos\phi}\right)^2 + \frac{2C_1C_2(r^2-D^2)}{[D^4+r^4+2r^2D^2(1-2\cos^2\phi)]^{3/2}}} \qquad (1)$$

If the two sources are of equal power, as would usually be the case in practice, this expression becomes:

$$I_{max} = C\sqrt{\frac{1}{(D^2+r^2-2rD\cos\phi)^2} + \frac{1}{(D^2+r^2-2rD\cos\phi)^2} + \frac{2(r^2-D^2)}{[D^4+r^4+2r^2D^2(1-2\cos^2\phi)]^{3/2}}} \qquad (2)$$

This expression is a formula which may be used to find the maximum intensity of illumination at any point (r, ϕ) when the power of the sources and their positions have already been fixed upon. In practice the converse problems are of much greater importance, namely, to find the proper candle-powers and positions of the sources in order to have them produce a certain intensity of illumination at a given point, or at all points within some prescribed space. These problems may be handled most conveniently with the help of the following table, mentioned above, which gives values of D^2 times the coefficient of C in equation (2) for all values of ϕ and r/D. That is to say, the numbers in the table are values of $I D^2 \div C$, where I stands for the maximum intensity of illumination at the point (r, ϕ), C is the candle-power of each of the sources, and D is one-half the distance between them. The use of this table in solving the above problems may best be explained by a few examples.

VALUES OF $(I D^2 \div C)$ FOR DIFFERENT VALUES OF ϕ.

$\frac{r}{D}$	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.5						1.33	1.05	0.863	0.752	0.716
1.0		32.9	8.29	3.74	2.16	1.43	1.05	0.848	0.740	0.707
1.2	25.2	13.2	5.49	2.85	1.74	1.20	0.904	0.740	0.656	0.630
1.5	4.16	3.64	2.44	1.65	1.16	0.866	0.689	0.585	0.530	0.512
1.8	1.69	1.53	1.28	1.00	0.773	0.627	0.524	0.459	0.424	0.412
2.0	1.11	1.05	0.911	0.752	0.616	0.513	0.440	0.393	0.366	0.358
2.2	0.792	0.760	0.675	0.585	0.497	0.426	0.373	0.338	0.318	0.312
2.5	0.526	0.513	0.472	0.422	0.372	0.330	0.297	0.274	0.260	0.256
3.0	0.312	0.300	0.291	0.271	0.249	0.228	0.212	0.200	0.192	0.190
4.0	0.151	0.150	0.146	0.140	0.134	0.127	0.122	0.118	0.115	0.114
10.0	0.0206	0.0206	0.0205	0.0204	0.0202	0.0201	0.0199	0.0198	0.0197	0.0197

To ascertain from this table the maximum intensity of illumination at a point (r, ϕ), due to two sources, each of power C, and placed at the points $(D, 0°)$ and $(-D, 0°)$, find the number in the table corresponding to the assigned values of ϕ and r/D; multiplying this number by C and dividing by D^2, gives the required intensity of illumination. As an example, suppose that there are two sources of light, each of 50 cp. and placed 3 meters apart; it is required to find the intensity of illumination at a point 2 meters directly below the point half way between the two sources. In this case $C = 50$, $D = 1.5$, $r = 2.0$, $\phi = 90°$, $r/D = 2/1.5 = 1.33$. Looking in the table in the column for 90°, it is noted that when $r/D = 1.33$, the number to be taken from the table lies between 0.630 and 0.512, and by interpolation it is found to be 0.58. Multiplying this by 50 (the value of C) and dividing by $(1.5)^2$, the value of D^2, the required intensity of illumination is given as 13 candles per meter square.

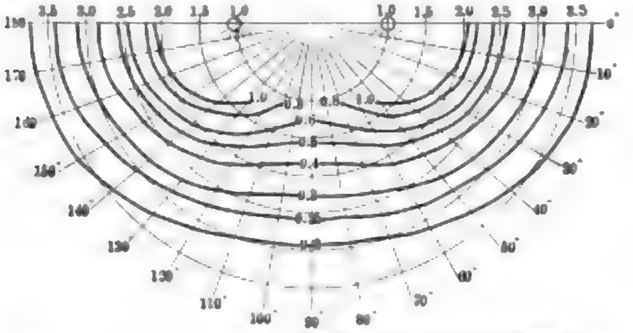


FIG. 2.—LINES OF EQUAL INTENSITY OF ILLUMINATION.

The following may be taken as an example of the converse problem; that is, to find the proper candle-power of the sources necessary to produce a given intensity of illumination at a given point: A hall 12 meters long by 6.8 meters wide is to be lighted from two chandeliers 3 meters above the floor, equally distant from the ends of the hall, and 4 meters from each other; what candle-power should be provided in order that the intensity of illumination in the corners may be sufficient for comfortable reading? Taking the intensity for comfortable reading as 4 candles per meter square, $I = 4.0$, and $D = 2.0$ meters. To find r for the corner, assume that a book will not be held nearer to the floor than 1.0 meter, so that the point (r, ϕ) will be in the corner and one meter above the floor. The $r = \sqrt{6^2 + 3.4^2 + 2^2} = 7.2$ meters; and $\phi = \cos^{-1} 6/7.2 = 33.5°$, $r/D = 7.2/2 = 3.6$. By the use of the table, these values of ϕ and r/D indicate by interpolation the number 0.19, which is to be set equal to $I D^2/C$. Whence $0.19\,C = 4.0 \times (2.0)^2$, or $C = 84$ cp, which should accordingly be supplied at each chandelier.

This gives the candle-power necessary to produce proper intensity of illumination in the corners, but does not prove that the intensity will be sufficient at all other points. In order to ascertain the intensity at other points, further investigation is necessary. For this purpose it is very convenient to make use of Fig. 2, which shows graphically the distribution of illumination, by means of lines of equal illumination. In this figure D is given unit length and a set of lines is drawn, each one of which connects all points at which the maximum intensity of illumination is the same. Each line is marked at the middle with numbers which give the intensity corresponding to it when C is taken as 1 and D as 1. The diagram is limited to a plane, while in reality there are surfaces of equal illumination reaching into three dimensions; the latter are the surfaces of revolution which would be traced by the lines of the diagram when rotated about the line through the two sources.

This diagram may be taken as representing the state of affairs in the problem under discussion if the scale be so chosen that D is equal to two meters. The numbers attached to the various lines will then represent the intensities of illumination in the problem if they are multiplied by 84, the value of C. The figure shows that the point where $r = 3.6\,D$ and $\phi = 33.5°$ falls just outside of the line marked 0.2, as it should. If, now, all the other points in the region to be lighted fall within this line, they will get more illumination than the corners of the hall; otherwise they will get less and be insufficiently illuminated. It is clear that the darkest part of any cross-section of the hall will be that next to the walls; and if all the points along the walls be mapped out on the figure, it can be seen whether there is sufficient illumination at all points. To do this r and ϕ can be computed for a few of the points and then a continuous line can be drawn connecting them. Thus at the point on the wall, at the center of the hall, and 1 meter above the floor, $r = \sqrt{2^2 + 3.4^2} = 3.9$ meters, and $\phi = 90°$. $r/D = 2.0$, nearly. Referring to the figure, it is noted that the point where $r = 2\,D$ and $\phi = 90°$ is well within the line marked 0.2; and it is seen that all points along the wall and therefore all points throughout the hall are sufficiently illuminated. Thus 84 cp at each of the chandeliers is sufficient for comfortable reading at all parts of the hall.

It is to be noticed that with the above arrangement the intensity of illumination near the center of the hall is far greater than necessary. By referring to the figure, we see that at the wall in the center of the hall (the second of the two points considered, where r equalled $2.0\,D$ and $\phi = 90°$) the intensity is nearly twice as great as in the corners. It is clear that the light might be better distributed if the two chandeliers were placed nearer to the ends of the hall; and this leads to the problem of determining how far apart the two sources should be placed for the best distribution of light.

As the two sources are separated more widely, the corners of the hall receive more light, but the points between the two sources receive less. The best distribution will be attained when they are so spaced that the intensity of illumination in the corners will just equal that on the wall opposite the point midway between the two sources. In the example chosen this requires that the intensity should be the same at the points (7.2, 33.5°) and (3.9, 90°). The problem consists, then, in finding the value of D for which this condition will be fulfilled. This may be ascertained by trial, assigning different values to D, and finding from the table the corresponding intensities at the two points in question. The work may be tabulated as follows:

Value of D assumed.	r/D for the point (7.2, 33.5°)	r/D for the point (3.9, 90°)	Intensity, from table, (C being the candle-power of one of the sources) for the point (7.2, 33.5°)	for the point (3.9, 90°)
2.0 meters.	3.6	2.0	0.048 C	0.090 C
3.0 "	2.4	1.3	0.051 C	0.066 C
3.5 "	2.1	1.1	0.052 C	0.054 C
3.6 "	2.0	1.1	0.054 C	0.054 C
4.0 "	1.8	1.0	0.058 C	0.044 C

It appears, therefore, that the most advantageous positions for the two sources are obtained when each is 3.6 meters from the center of the hall. For this position the required candle-power is determined from the relation: $0.054\,C = 4.0$ candles per meter square, so that $C = 74$ cp, instead of the 84 required when D was taken as 2.0 meters.

If a single chandelier at the center of the hall had been used, the candle-power necessary to produce 4.0 candles per meter square at the corners would be determined by the relation: $C/(7.2)^2 = 4.0$, whence $C = 207$ cp, or in practice, thirteen 16-cp lamps. When two chandeliers are used, placed in the best position, only five lamps are required in each, or ten in all, so that a saving of 23 per cent is effected.

The best spacing for two sources depends on the dimensions of the space to be lighted, and also upon the height of the sources above the floor (or other surface upon which the illumination is desired). It is possible to work out the best value of *D* for a number of different dimensions of hall, and tabulate the results for future reference. If such a table is computed it will be found that for all ordinary dimensions of halls and heights for the chandeliers, the best value for *D* comes out almost exactly 0.3 of the length of the hall in every case.

The Lighting of Desks.

By J. R. Cravath and V. R. Lansingh.

In the lighting of desks there are five principal requirements:

1. The light should be out of the line of ordinary vision of the person working at the desk or should be shaded so that the rays cannot strike the eye.

2. The position of the lamp with reference to the top of the desk should be such that the worker at the desk will not receive the regular reflection or glare from paper on the desk. This regular reflection is one of the commonest causes of trouble in continued working at an artificially lighted desk.

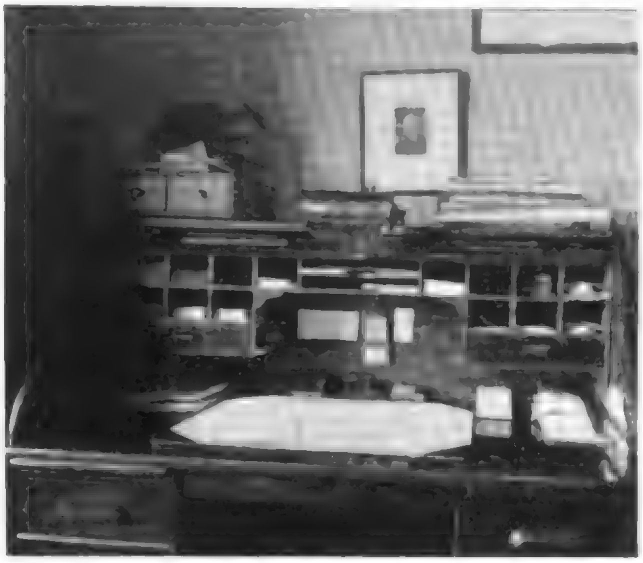


FIG. 1.—POOR ARRANGEMENT OF DESK LAMP.

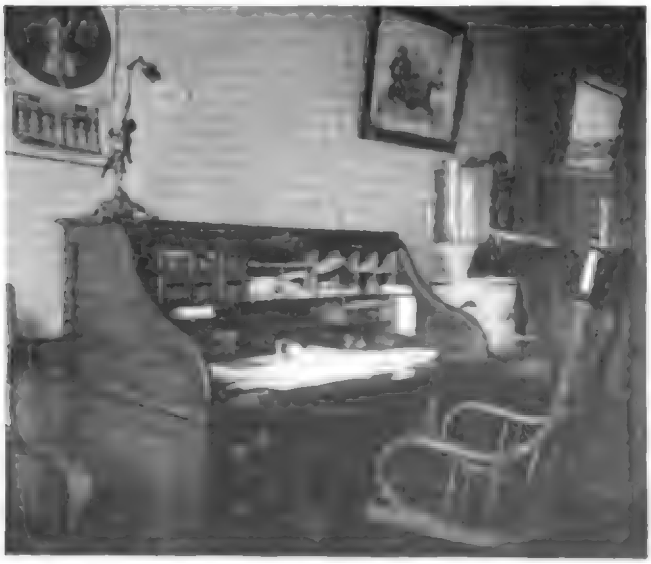


FIG. 3.—DESK PORTABLE IN RIGHT POSITION.

3. The light should be free from streaks or striations.

4. Too great intensity of light should be avoided. An intensity of from 3 to 5 candle-feet (normal) on the top of the desk is about right.

5. The light should be steady—in other words, should not be swinging; and if it is electric light the voltage regulation must be good.

Before considering the illustrations which follow, it may be well to call attention to a misapprehension which seems to have existed in some quarters as to the illustrations of examples of lighting in previous articles in these columns by the authors. Some readers seem to have received the impression that the photographs from which the illustrations were made were taken by the artificial light in the room in order to show the illumination. As a matter of fact, it would be impossible, as any photographer knows, to take such photographs by artificial light. The photographs were taken by daylight for the purpose of showing the location and arrangement of fixtures and glassware and not to show the illumination from the lamps themselves.

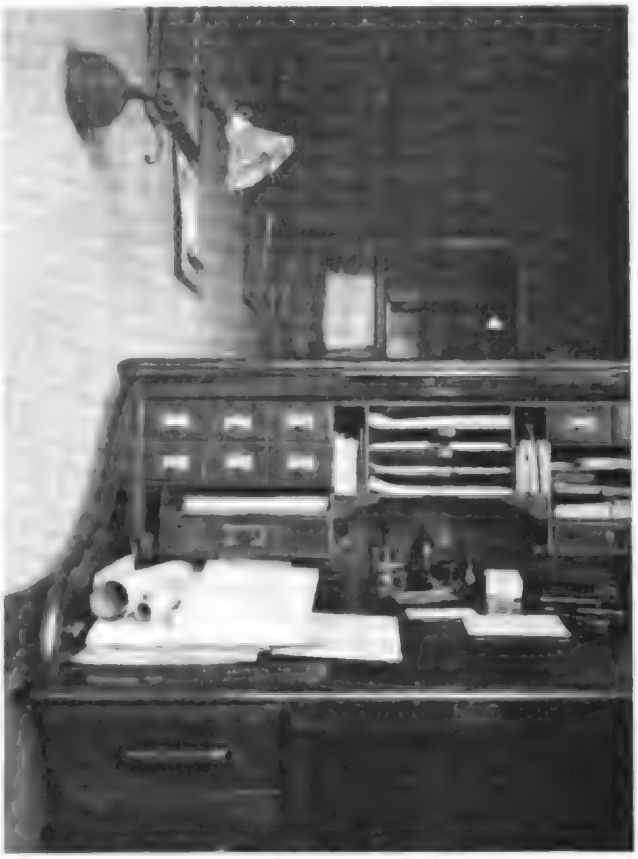


FIG. 2.—PROPER POSITION OF LAMP FOR DESK LIGHTING.

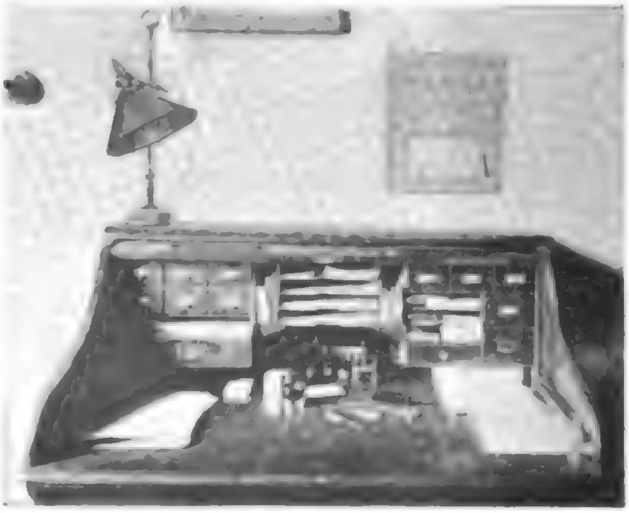


FIG. 4.—POSITION OF STANDARD PORTABLE DESK LAMP.

A very common and popular method of lighting desks is by the use of a cylindrical desk shade at the center of the desk, as in Fig. 1. While this arrangement is fairly satisfactory, it is capable of much improvement. The lamp is in such a position that when the user of the desk attempts to read or write with a paper directly in the middle of the desk in front of him, there is so much reflection or glare from the paper as to make it not only very trying to the eyes, but difficult and sometimes impossible to read. The work must usually be shifted either to one side or the other of the desk or the lamp must be shifted. The cylindrical desk shade shown in Fig. 1 does not throw a light nearly as strong as the parabolic aluminum reflector shown later in Figs. 7 and 8, as was pointed out in previous articles published in these columns.

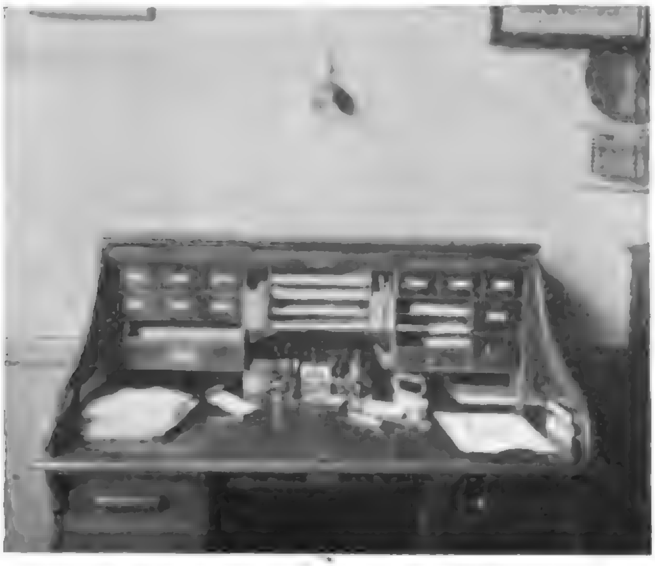


FIG. 5.—BAD POSITION FOR DESK LAMP.

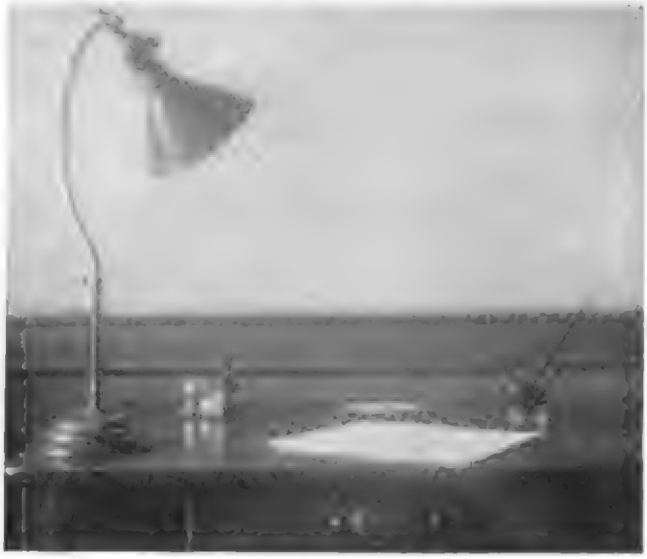
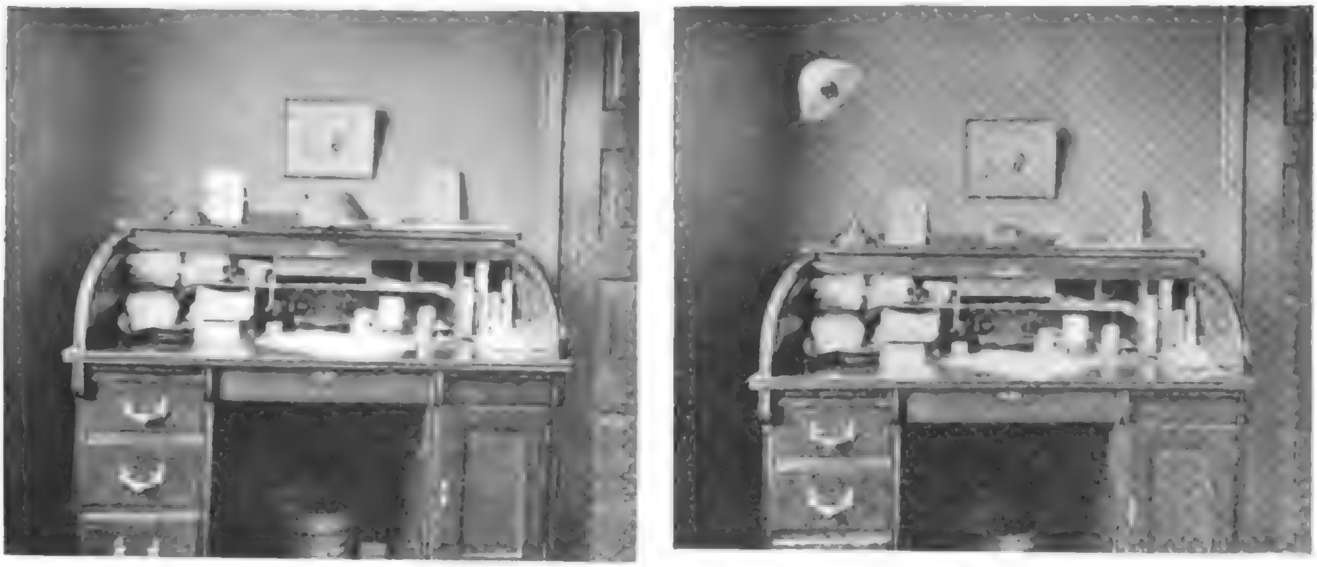


FIG. 6.—PROPER POSITION OF LAMP ON FLAT-TOP DESK.

Fig. 2 shows one of the most satisfactory, comfortable and efficient ways of desk lighting. Here the lamp is located on the bracket at the left-hand end of the desk. The bracket is equipped with a concentrating type of prismatic glass reflector. The user of a desk so lighted experiences practically no discomfort from the glare or regular reflection from the paper, while at the same time the desk is well lighted over its entire surface. The comfort of working at such a desk as compared with those lighted by many of the common methods is remarkable. The light is high enough above the user of the desk to be out of the line of ordinary vision, so that as far as desk use is concerned it is not absolutely necessary to equip the lamp with a frosted bulb for diffusing purposes. It is advisable so to equip it, however, on account of other occupants of the room, and because the light is so well diffused by the frosting that less glare is received from the work on the desk and it is consequently an easier light to work by. The lamp should be so placed that a plumb line dropped from the lamp to the top of the desk would strike about one foot from the front edge of the desk.



FIGS. 7 AND 8.—IMPROPER AND PROPER POSITIONS OF PORTABLE DESK LAMP.

The bracket in Fig. 2 would give good results with any one of several other types of concentrating reflectors, including the opal cone, "X-ray" desk shade, McFadden desk shade, McCreary desk shade and frosted aluminum cone reflector. The two first should be used with frosted bulb lamps.

The same relative location of the lamp shown in Fig. 2 can be obtained with portable desk lights, as, for example, in Fig. 3, which shows a fixture of special design. This fixture, however, does not bring the lamp as far out toward the front edge of the desk as it should to give the best results. It should overhang far enough to bring it directly above a point one foot from the front edge of the desk, as before explained.

Fig. 4 shows the same position of the lamp as in Fig. 2, but with an ordinary portable desk fixture equipped with a green opal desk shade. The light obtained on the desk with the green opal shade in Fig. 4 will not be as great as with the prismatic glass reflectors in Figs. 2 and 3. It will furthermore always be necessary to eliminate the streaks which accompany the light from the opal desk shade by using a frosted bulb lamp.

Fig. 5 shows a misdirected attempt to light a desk which is bad from every standpoint. A powerful prismatic reflector mounted on a bracket above the middle of the desk throws the light down at such an angle that the occupant gets an enormous amount of glare from the paper by working anywhere near the middle of the desk, and receives the full glare of the light from the reflector whenever he raises his eyes. Furthermore, much of the light does not fall on the desk, but on the person who is using it. This could be easily rectified by simply turning the desk around as shown in Fig. 2.

Fig. 6 shows the proper position for a lamp on a flat-top desk or table. The stand should be placed near the left-hand elbow and an opaque shade should be used, pointed at such an angle that the light will fall on the work without striking the eyes of the user. This position can manifestly be obtained with several other types of portable desk lamps. Fig. 6 was taken merely to show the proper position.

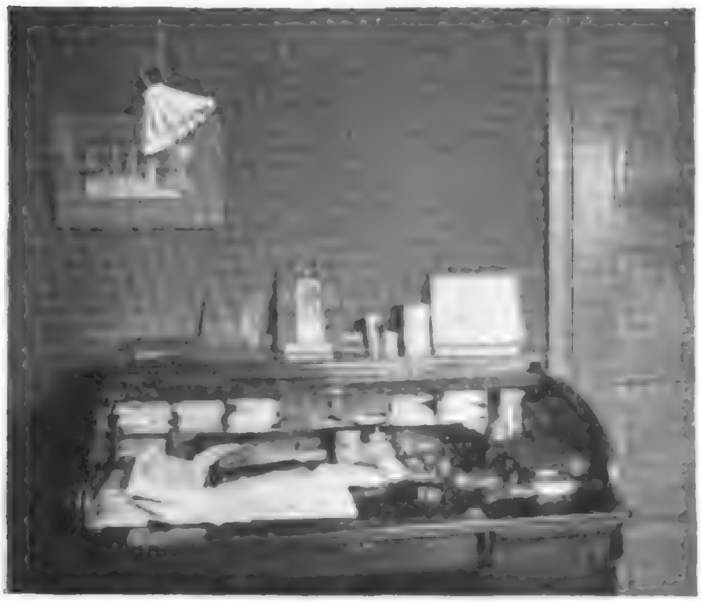


FIG. 9.—FAIR DESK ILLUMINATION.

Fig. 7 shows an excellent desk fixture misused. In Fig. 7 the desk is small, and in placing the lamp in the parabolic aluminum reflector in the position shown it is entirely too close to the paper. The intense light is concentrated on the paper at one point, the edges of the desk being in darkness; and there is much glare or reflection from the paper under the reflector so that the only portion of the desk which is well lighted can hardly be used without ruining the eyes. On a low top desk such as this the proper position for such a fixture is as shown in Fig. 8. Here the lamp is virtually placed in the same relative position to the user as in Figs. 2 and 3. The fixture is a very useful one because it can be adjusted in so many different positions. The parabolic aluminum frosted finish reflector with which it is equipped is more efficient than the cylindrical desk shade shown in Fig. 1. A frosted bulb should be used with it.

With opaque desk shades such as shown in Figs. 1, 4, 6, 7 and 8, other light should always be used in the room to supplement the desk light, as otherwise there will be too much strain on the eye in changing frequently from the brightly lighted top of the desk to the dark room. With opal or glass reflectors, as in Figs. 2 and 3, enough light escapes through the reflector for considerable general lighting of the room, so that other lighting of the room may not be necessary.

Fig. 9 shows a method by which as a makeshift a lamp on an ordinary drop cord can be made into a fairly satisfactory desk light. The lamp should hang over the left-hand end of the desk. By looping a short piece of cord around the thumbscrew on the shade holder and tying the other end around the lamp cord, as indicated, the lamp can be given the proper angle to light the entire surface of the desk.

Papers and Discussions Before the Iowa Electrical Association.

Below are given abstracts of the papers presented at the recent meeting of the Iowa Electrical Association and abstracts of the discussion on the same. The first paper on the programme was a report on progress by Mr. James R. Cravath, an abstract of which follows:

REPORT ON PROGRESS.

The most notable development in the central station field during the past year was stated to be the increasing amount of attention given to means for expanding and increasing central station business, great activity having been manifested in the organization of departments or methods for getting new business. Observation of what a few of the more progressive companies are doing, as compared with unprogressive companies, indicates great possibilities of future development on lines which have been well tried by the former; and the central station business as a whole promises within the next few years through a proper awakening among central station companies an increase equalled by few other lines of business of equal stability.

One of the most interesting developments during the past year has been the increasing number of small single-phase high-tension lines for supplying a number of villages in a district from a central station located in one of the larger towns. Activity in the building of such lines seem to have been greatest in Illinois, where conditions are favorable to them.

Another important development of the year is the increasing attention given by central station companies and others to the efficient use of light, or in other words, to illuminating engineering. There appears to be at the present time far greater opportunity to increase the efficiency of electric lighting in a manner which will enable it to better compete with other illuminants by attention to the proper placing of lights and their equipment with the proper globes and reflectors than by an increase in the efficiency of the lamps themselves. A company can afford to give considerable attention to seeing that its customers are provided with electric light so installed that it will be a credit to the business. Some of the larger central station companies are beginning to fully realize that as a matter of self-defense the efficient use of electric light is something to which the central station must give attention, if it is to compete successfully with other illuminants and retain the growth all are hoping for. The formation recently of the Illuminating Engineering Society with a large membership shows the interest being taken in this subject.

For companies having alternating current supply in down-town districts and where a decent voltage regulation is maintained, the Nernst lamp has during the past year still further proved its efficacy as a competitor of gas and gasolene lamps. On account of its better downward distribution of light, the Nernst lamp is able to make a much better showing in store lighting than the alternating current arc of similar capacity.

The Cooper-Hewitt mercury vapor arc lamp is making rapid progress for the lighting of factories and all kinds of workshops where its color is not objectionable. Of its high efficiency and the superior diffused quality of illumination it gives there can be no question. Practically the only objection to it is its color, which is somewhat a matter of personal taste and usually ceases to be an objection after it has been used a few days.

Another new illuminant which has been heralded the past few months is the flaming or luminous arc, alongside of which, as one writer expressed it, the ordinary arc lamp appears about as luminous as a tallow candle. The present cost of carbons and the daily trimming on the flaming arc partially, if not entirely, counterbalance the increase in efficiency, while the fumes given off unsuits the lamp to some interior lighting. The place that the flaming arc will occupy in the art is yet uncertain on account of these conditions.

Referring to the use of arc lamps with smaller carbons, it is stated that the Chicago Edison Company now has about 1,500 direct-current enclosed arc lamps using carbons of 5/16-in. diameter. On a 3.5-amp. arc lamp, the increase in efficiency by using 5/16 instead of ½-in. carbons is over 50 per cent. Alternating-current arc lamps with small carbons are also being put out in Chicago with considerable improvement in efficiency, although no tests of these are yet available. There is not only a gain in efficiency, but the light is much steadier and whiter than with large carbons which allow the arc to wander and which give an excess of violet rays.

While some central station managers have been skeptical as to the possibilities of electric heating, the fact remains that flat irons are being introduced in such large quantities in a number of places that there is now no question as to their importance to the central station business. While the cost of their operation is somewhat higher than that of other irons, they are so far superior that once properly introduced in a house the chances are ten to one they will never come out. Where indifferent success has been met in the introduction of electric flat irons as manufactured to-day it can be due only to failure to introduce them in the right way. Either the central station men themselves do not understand the merits of what they are offering and thus cannot talk electric irons intelligently, or in placing them out on trial they do not take pains to see that customers are properly equipped to use the iron conveniently. It is usually cheaper to place a lot of irons on trial among customers than to spend a lot of money or time soliciting to persuade them to buy something with which they are not familiar. After trial, a certain per cent will come back to the company, but these can be placed elsewhere so that there is no loss in the long run. The electric iron business bids fair to double the present revenue from residence customers. For that reason it is a most desirable class of business to push. It requires no additional investment in transformers and lines since it is non-peak load. Other heating devices are also worth pushing, but the electric iron is undoubtedly the most promising thing of the immediate future because it is a good revenue producer, is low in first cost and reasonable in cost of operation.

Another class of non-peak load which is worth some attention is the motor-driven ice machine business. Motor-driven refrigerating ice machines at ordinary rates can make a decided saving as against refrigeration by natural ice. The principal obstacle to be overcome in getting meat markets, hotels, restaurants and the like to put in ice machines is the high first cost of the ice machine as compared to an ice-box. The saving over ice is, however, enough to fully warrant the investment if the customer has the necessary capital to make the change.

Gratifying progress has been made in the design of single-phase motors so that companies operating single-phase distribution systems exclusively (of which there are many) can now offer to customers motor service of any kind that is available on direct current with the exception of variable speed machine tool and printing press motors. During the last year hoisting motors for elevator and crane service and the like have been developed for single-phase 60-cycle circuits.

There is an increasing realization of the fact that residence lighting, although giving a small income per customer, is a very desirable class of load for a company if it can only develop this business so that it is not too scattered. Smaller residences are, on the whole, a better class of customers than large ones. The aim should be to get a large number of these smaller residence customers connected. With a reasonable number of customers per block the distribution charges can be kept at a point where there is a profit in this business. Although the scheme of wiring residences on the installment plan has never been tried extensively, some such plan may be worth pushing in some towns for the sake of getting hold of this class of business.

Centrifugal pumps for use in pumping high heads have been in common use on the Pacific Coast for many years for irrigation and mine pumping direct connected to electric motors. This practice is now spreading eastward, and eastern manufacturers are also taking up the direct connected centrifugal pump. For some classes of city water pumping this puts in the hands of central station companies which are endavoring to secure such contracts a very efficient and easy to maintain form of apparatus for carrying on this work. It is, of course, not suited to deep well pumping.

In discussing this report, Mr. D. F. McGee, of Red Oak, asked for figures on the cost of maintaining electric flatirons and other heating devices.

Mr. A. W. Zahm said that the five tailoring establishments of Mason City which used electric tailoring irons spent altogether $5 per year in maintenance and renewals. These irons were in service so much of the time and were so large that their maintenance would naturally be high. In the case of one type of household iron, the manufacturers guaranteed them against burn-outs.

Mr. L. D. Mathes, of Dubuque, said that of 160 household irons on his circuits only one burn-out had been recorded. It was necessary to coach carefully customers turning current on and off irons, not to use the ordinary key socket. While the short-circuiting of a socket in breaking a 500-watt iron circuit might not cause any serious damage, it would scare the user and create a prejudice against the iron, especially if the user was a servant girl. He thought the maintenance on electric household irons with the manufacturers' guarantee could be counted on as practically nothing.

Mr. Cravath said that a central station company could safely leave household iron maintenance out of consideration with the present manufacturers' guarantees.

FACTS AND FACTORS.

Mr. D. F. McGee, of Red Oak, chairman of the Committee on Facts and Factors, reported having sent out report blanks with a view to obtaining data. The members had not responded in a way which would enable him to make a report. Mr. Zahm explained that many companies did not have the data called for by the reports and urged such companies to put in the necessary instruments to find out their switchboard costs.

Mr. McGee showed the form of report which must be made to the State commission in Massachusetts. As a commission of this kind was being advocated by some Iowa central station men as the best way of handling the rate regulation question, it would be well for members to look over the Massachusetts report form which was much more elaborate than the committee on Facts and Factors had asked. If a commission is to be created in Iowa in the future companies will have to prepare to make such reports.

Mr. Gus Lundgren, of Cherokee, urged the members to buy recording switchboard meters, water meters and scales to find out where they stood. Mr. George S. Carson cited a case under his notice where a great saving had been made by a little use of such instruments. It is notable that large syndicates, in buying a property, ask what the gross earnings are rather than the net earnings. Such syndicates with their engineering talent know what the operating expenses ought to be and know definitely how to go to work to reduce them to the proper figure. Mr. Lundgren cited a case where an engine which was thought to be all right was found upon test to take 63 lbs. of steam per indicated hp-hour. It was decided to continue the committee another year, in the hope that more data could be obtained upon the next trial.

WAYS AND MEANS OF INCREASING BUSINESS IN TOWNS UNDER FIVE THOUSAND.

Mr. O. E. Brownell, of Lake City, read a short, pithy paper on this subject. He explained at the outset that he was operating his station under a lease and hence was somewhat handicapped as compared with a company which could make extensions and improvements without consulting the owner. He placed much stress on uninterrupted service as a foundation for increasing business since new business cannot be secured if the service is not satisfactory. In this connection prompt, courteous attention should be given to local troubles on customers' fixtures or wiring. Customers must be impressed with the stability and reliability of your service. In connection with storage of coal in anticipation of the recent coal strike, he had watched the railroad companies, whose actions were good indicators of what might be expected. When he found they were laying in a three months' supply, he went one better and laid in four months' supply. When the strike began it was a good advertisement for the company's service and management to be able to assure both electric light customers and the city (for which he did water pumping) that he had four months' coal supply on hand.

He had found it well to get the interest of certain local merchants in electrical matters, that these merchants might seek to have for display in their stores as curiosities some of the most recent electrical appliances, thus drawing people to the store to see these and incidentally advertising electric central station service. There are usually some such merchants in every town. For example, by getting on friendly terms with a druggist his natural interest in scientific subjects will induce him to get posted on electrical developments and he will become a good talker for electric service. Mr. Brownell further suggested that a good thing to counteract some of the municipal ownership and anti-corporation sentiment of the present time is to advertise well by talk around the town some of the heavy expenses of the company for coal and other items, which items of course in a small town look very large. With the expenses of the business better understood, there will not be so much complaint about rates or objection to private ownership. He urged companies to aid customers in keeping their bills down by seeing that they are equipped to utilize electric light economically. For lighting living rooms he had been generally advocating ceiling lamps for general lighting of the room with brackets for reading lights. He was among the earliest to take hold of and push prismatic glass reflectors. These are some of the methods he had used to increase his business 30 per cent in the past 20 months in a town of 2,350 population.

Mr. Carson, in discussing this paper, thought Mr. Brownell made a good point in trying to avoid overloading a customer with electric light bills. In most small towns the majority of people were of necessity forced to economize. Anything which can be done to help the customer along and keep bills so that he does not consider them a burden will make friends for the company in the community.

Mr. McGee, speaking about advertising, did not favor publications sent out indiscriminately to customers which might educate them to something they ought not to have. He thought in a small town the manager should know best what a customer ought to have. If the customer is sent literature advertising devices which look well on paper, but are not suited to his conditions, he is made dissatisfied, which means trouble for the company.

ENGINE LUBRICATION.

A paper was on the programme on the effect of boiler compounds on engine lubrication, but as the author of the paper was not present the subject was dismissed with a short discussion.

Mr. W. J. Greene, of Cedar Rapids, had used soda ash in some badly scaled boilers some time ago with some resulting trouble in cylinder lubrication.

President Burt asked for figures on the ratio of cost of cylinder oil to coal bill. Mr. J. A. Innes, of Eagle Grove, reported cylinder oil as costing one per cent of the coal bill. He operates a heating plant. F. L. White, of Traer, reported one-half of one per cent. He operates a heating plant. Mr. McGee, of Red Oak, who operates also a heating plant, reported one and one-half per cent Mr Greene, of Cedar Rapids, who operates a heating plant, reported one per cent.

CONDENSING PLANTS IN SMALL STATIONS

Mr. W. A. Mall, of Belle Plains, described conditions and results in his plant where an engine of 115 hp was equipped five years ago with a condenser The expense for equipment, including necessary oil separator and alterations in the building, was $2,000 Cooling water was obtained from a constantly flowing artesian well A surface condenser was installed so that the water of condensation could be used in the boilers, as much trouble had been experienced with scale. From 23 to 28 in. vacuum was obtained. The boilers became heavily scaled at first and for some time the scale would not come off, but was finally started by the use of a boiler compound. The saving in fuel was $300 the first year Since then the business had been increased 25 per cent and the price of coal increased 15 per cent, with an increase of only 10 per cent in the fuel bill. An inquiry by the president following this paper revealed the fact that only four condensing stations were represented in the audience.

Mr. A. W. Zahm, Mason City, said that his company was arranging to use the hot water heater of the Yaryan heating system as a surface condenser so that the station could be run condensing during the summer time. The circulating pump of the hot water heating system will become the circulating pump of the condenser in the summer.

Mr. J. G. Boyd said that at Blair, Neb., a saving of fuel 22 per cent had been made the first year by the use of a condenser. Attention was called by Chairman Burt to the fact that the condenser, besides giving increased economy, increases the capacity of the engine, a fact sometimes lost sight of in figuring condenser advantages.

THE EFFECT OF A DAY LOAD ON STATION ECONOMY.

Mr. J. P. Jones, of Cedar Falls, read a paper on this subject, giving figures on the cost of operation of the Cedar Falls station several years ago, showing what the effect of operating it during daylight hours would have been at that time. In figuring the cost of operation during the day the coal used in banking the fires in the morning and in getting up steam in the evening where no day service is given must be credited. In this station he figured 175 lb. of coal for banking fires and 250 lb. for steaming up. This 425 lb. of coal would operate the station about a quarter of the time during the day. He figured the cost of day operation in this plant after making proper deductions and credits, would be $103.50 per month, divided as follows: Coal, $51; oil and waste, $2.50; engineer, $50. The income to be gained from daylight operation of this plant, he figured considerably less than this, but with the increase in business in the course of a few years, the day service could be made to pay for itself, and in the long run would, probably, be worth what it cost. The Cedar Falls station is not operated at the present time, having been changed to a sub-station supplied from Waterloo.

Mr. W. J. Greene, of Cedar Rapids, read a short paper on the same subject, which gave figures on Cedar Rapids conditions 15 years ago, at the time day service was begun. These figures showed a great increase in the net earnings as a result of the day service, Cedar Rapids being a city of over 20,000 population.

Mr. D. F. McGee, of Red Oak, said that 40 per cent of the receipts from electric business in his town of 5,000 inhabitants were from power business. The first year that day service was given, but little power was sold. He had to work a long time on most customers to get them to change to electric power. One common misapprehension among power users was that they thought they needed a much larger motor than was actually necessary. For example: A blacksmith in his town had a 25-hp engine and boiler which was fired up once a week to clean up what work the blacksmith had on hand. After a long time he was persuaded to put in an electric motor so that he could turn out work requiring power whenever it came in. It was found that a 5-hp motor was ample for his work. Overestimates of this kind were the rule rather than the exception.

Mr Carson thought that towns of 3,000 inhabitants and over ought to support 24-hour service. Mr. White advocated storage batteries for day service in small direct-current plants.

A DISTRIBUTION SYSTEM.

Mr. J. A. Innes, of Eagle Grove, read a paper on the distribution system at Eagle Grove. Seventy per cent of his company's income is from residences, and he has one meter for every ten inhabitants. The original distribution system was two-wire direct current, which had been retained in the down-town districts. The direct-current mains in the residence districts were changed to secondary mains fed from transformers. The street lighting is supplied on a constant-potential system from four transformers, located at centers of distribution. A common primary main supplies both residence and street lighting transformers on one side of the circuit, separate mains being used on the other side of the circuit so that the street lights can be switched off independently. One side of both house and street lighting secondary circuits is grounded, the same grounded main being used for both. The other side is provided with lightning arresters. A double-pole lightning arrester is used with one pole connected to the non-grounded side of the residence lighting secondary mains and the other pole connected to the non-grounded street lighting secondary main. The grounded secondary main supplies both residences and street lamps, being common to the two systems. He believed grounded secondary circuits reduce lightning disturbances.

CARE AND MAINTENANCE OF METERS.

Mr. A. W. Zahm, of Mason City, read a paper on the above subject. In urging the importance of meter testing at regular intervals to avoid loss through meters which failed to record all the energy passing through them, he cited the case of a municipal plant which had never had its meters overhauled and which upon being tested gave some "fearful and wonderful" results. But a small percentage of the energy being delivered to customers was paid for on account of slow meters. He thought it a good plan for small central station companies to employ the service of some of the regular meter-testing companies, which for a fixed sum will go over the company's entire equipment of customers' meters, testing them for accuracy and making repairs, adjustments and cleaning whenever necessary. Such companies are better equipped for this work than the small central station company. Where this is done he thought it well to give publicity to the fact that the company was having its meters tested by an outside, disinterested concern which makes meter testing its business. A record should be kept of all meters owned by a company from the time they are received from the factory. This record should include manufacturer's number, operating company's number, date of purchase, dates of installation in various locations, dates of tests and notes on work done upon the meter.

Messrs. Innes and Lundgren both spoke on the advantages of purchasing a master watt-hour meter which can be put in circuit with watt-hour meters and indicating instruments to calibrate them. Upon taking a vote it was found that a large percentage of the companies represented test new meters when received from the factory.

UP-TO-DATE LIGHTNING PROTECTION.

Mr W. P. Casper, of the Garton-Daniels Company, read a paper devoted principally to that company's type of arrester, and presented a chart showing its construction and method of operation. He pointed out the fact that since lightning discharges are oscillatory in character, and hence greatly influenced by the inductance of long lines, frequent opportunities to discharge to earth should be offered if the insulation of lines and apparatuses is not to be punctured. Unless arresters are installed at frequent enough intervals to take care of these discharges, it is only to be expected that arresters will fail to accomplish their purposes. He urged the importance of good grounds for lightning arresters.

Mr. George S. Carson told of an extremely severe lightning condition on the line supplying Iowa City from a water power plant three miles distant. Although lightning arresters had been installed in as great numbers as recommended by the manufacturers, apparatus continued to be lost until choke coils were used in the line. Barbed wires were also placed about 18 in. above the highest conductor. The choke coils consisted of 18-in. porcelain tubes wound with wire and having an iron rod inserted in the tube. To the ends of the iron rod insulating attachments to the line were made so that the choke coil was inserted in the line like a turnbuckle. He believed the choke coils had been largely responsible for their freedom from lightning troubles, as there had been no burn-outs since the coils were inserted, the number of arresters remaining same as before.

President Burt told of inserting choke coils 6 in. in diameter of No. 0 wire in a 10,000-volt transmission line. The coil was about 2½ ft. long. There had been no trouble on this line since the coils were inserted. Two 75-kw transformers had been lost previously.

GROUNDING SECONDARY CIRCUITS.

Two papers were read advocating strongly the grounding of secondary circuits of transformers. One paper by Mr. H. G. Gorr, superintendent of electric lighting of the Union Electric Company, of Dubuque, was read by the secretary in the absence of the author. The paper pointed out that crosses between high-tension and low-tension secondary circuits are unavoidable in practical operation. High-tension wires may fall over low-tension wires and transformers may become defective through lightning discharges so that there is a leak from primary to secondary. Furthermore, there are frequent discharges on non-grounded circuits during thunderstorms from the live conductor to grounded fixtures or gas pipes. All these conditions are dangerous to life and property. The grounding of secondary circuits was urged emphatically as a positive relief from these dangers. The recent attempt to have grounding made compulsory in the National Electrical Code was mentioned as further supporting the author's position.

Mr. Thomas Sloss, of Cedar Rapids, read a paper also advocating the grounding of secondaries. Every transformer is now grounded at Cedar Rapids. One argument had been made against grounding, namely the possible failure of watt-hour meters to properly register if placed on the grounded side of a circuit which was grounded at the transformers and also in the building. Out of 1,400 watt-hour meters at Cedar Rapids, there had been almost no trouble from this source. On the other hand, transformer troubles and burn-outs had apparently been almost eliminated by grounding. The grounding was accomplished by connecting one side of the circuit to a copper-tinned plate 6 ft. square buried in the ground in permanent moisture. Eight bushels of charcoal are put around the plate. The cost of such a ground is about $10.

President Burt remarked that it was disquieting for those operating with non-grounded circuits to consider this subject because of the constant possibilities for fatal accidents on the low-tension incandescent circuits where these circuits were not grounded. One never could tell at what moment such crosses between high and low-tension wires might occur. At the present time if it could be shown in court that a company had not taken due precautions to ground its secondary circuits, it could be held absolutely liable for damages to persons or property due to the presence of abnormal voltage on low-tension circuits.

Mr. Mathes told of a case now in the Iowa courts in which the plaintiff maintained as a basis for a damage suit that the company had failed to ground its secondary circuit and as a result a man in contact with a good ground had touched a lamp socket with fatal results. The company's contention was that the secondary circuit supplying that lamp socket was grounded and that the man who was killed had been suffering from heart disease for some time, having been treated medically for the same. It was believed that if thoroughly established by the evidence that the transformer secondary was grounded the company could not be held liable on account of negligence. The decision in this case would be looked for with interest.

Mr. Cravath described a method of grounding transformers adopted by the Commonwealth Electric Company in Chicago as being fairly as effective and cheaper than the ground plate mentioned in the National Electrical Code. This method consists in driving a galvanized-iron pipe about 10 ft. into the ground to permanent moisture and soldering the ground wire to the upper end of the pipe. The cost of grounding small transformers with a ground plate might deter some companies from doing it. This iron pipe ground offered a fairly efficient substitute at considerably less cost.

Some question was raised as to the efficiency of iron pipe grounds for lightning arresters on the theory that they would offer too much inductance in the path of a discharge.

Mr. McGee, of Red Oak, gave his method of grounding, which is to use a 1¼-in. galvanized-iron pipe, but instead of driving this pipe down as is the practice of many, he bores a hole down to water with a 2-in. carpenter's auger mounted on the end of a piece of pipe. By drilling an auger hole one can tell when water has been reached whereas if an iron pipe be driven down there is no telling the condition of the soil at the bottom.

Mr. Zahm cited the experience of a certain trolley road which would indicate that grounding to track rails is not sufficient and that ground plates should be used for all arresters.

Mr. Greene said that grounding of secondaries removes a great load of anxiety from the mind of the manager who has had a little experience with fatal or severe accidents by shocks from non-grounded secondaries. His company had two such accidents a few years ago and after that were in fear and trembling, especially after thunderstorms, lest there should be another one. They only rested easy after all transformers were grounded.

PRACTICAL EXPERIENCES WITH STEAM TURBINES.

Wednesday evening an informal session was held at which the subject, "Some Practical Experiences with Steam Turbines," was taken up. This discussion was opened by a paper from C. E. Stanton, chief engineer of the Union Electric Company's plant at Dubuque, Iowa. The greater part of Mr. Stanton's paper was given to describing precautions found advisable in maintaining the step-bearing at the bottom of the Curtis turbine shaft upon which the weight of all the revolving parts rests. This weight is carried in the step-bearing by a film of water which is forced through the bearing under high pressure. Step-bearing water at Dubuque is now passed through a Jewel water filter to insure its purity. Trouble having been experienced with the packing from pumps coming loose when old and plugging up the strainer in the step-bearing piping, it was found advisable to keep a record of the number of days packing was in service and to renew this packing after a certain number of days' service, before it would start to go to pieces and stop up the strainers.

The hydraulic accumulator is a weighted hydraulic piston designed to supply water to the step-bearing for a few moments in case the step-bearing pump should stop. This accumulator is tested every 24 hours to prevent it from rusting fast at one point and sticking. This testing is done by lowering and raising the accumulator piston 4 or 5 ft. every day. The construction of the accumulator is such that there is opportunity, in the language of the author, for "an elegant rust joint" to form around the piston if it is left long enough in one position. It is well to have a signal such as a whistle or gong, which will sound as soon as the accumulator begins to lower, thus giving notice that the water supply from the step-bearing pumps is failing and giving the attendant time to shut down the turbine or get another pump into operation.

The step-bearing should be carefully inspected before assembling to see that surfaces are perfectly smooth and free from burrs or dirt which would cause friction. In assembling it is important to see that the step-plate fits perfectly square and that nothing like metal chips or dirt is present to prevent it from seating itself squarely.

The turbine is governed by opening a greater or less number of valves. If it is operated on less than a certain load for a number of weeks, as may sometimes occur, some of the valves will not have occasion to open in that length of time, so that when an unusual demand comes on the turbine calling for the opening of these extra valves they will stick if they have not been moved by opening occasionally. The governing of the turbine is so excellent that at Dubuque lighting and railway loads are carried on the same bus-bars.

With superheated steam it was found that metal valve packing melted out, resulting in the presence of metal chips which were decidedly undesirable around a steam turbine system. Since this trouble with metal packing, asbestos packing has been used where there is superheated steam. The general conclusions of the paper were favorable to the steam turbine as against the reciprocating engines.

At the close of Mr. Stanton's paper Mr. Niels Christensen, chief engineer of the Citizens' Gas & Electric Company, of Waterloo, Iowa, was given the floor to answer any questions put to him regarding his experiences in operating the 500-kw Curtis steam turbine recently placed in his company's power house. His company did not install an accumulator to maintain step-bearing pressure. It has pumps in duplicate for this purpose. He did not consider accumulators very good insurance against step-bearing failures since two step-bearings had been burned out at Dubuque for reasons given in the previous paper. It requires about ten minutes to get the turbine up to speed. The turbine will run about 20 minutes after the steam has been shut off. This 500-kw turbine will give 400 kw running non-condensing. He thinks most turbine troubles are due to the use of superheated steam. Superheated steam was not used at Waterloo on account of the added complications, although probably about 10 per cent increase in economy could have been secured by its use. The economy is about the same as that of a compound condensing engine. The advantages are mainly those of better speed regulation, saving in space and pure boiler feed water.

Mr. Mathes, of Dubuque, said that another point in favor of the turbine was that its overload capacity makes possible a low investment per kilowatt of peak load to be carried. He cited some enormous overloads carried by the 5,000-kw turbines in the Commonwealth Electric Company's plant in Chicago.

At the request of President Burt, who is superintendent of the Citizens' Gas & Electric Company, of Waterloo, Mr. Christensen then read a report of the official test on turbine and engines in the Waterloo station. An abstract of this report will appear in these columns next week. The discussion then drifted into the action of centrifugal circulating condenser pumps and it appeared that some attempts to get balanced column syphon effects and make a long column of descending water to balance a column of ascending water had been partial failures with such pumps.

TECHNICAL MEN IN CENTRAL STATIONS

Prof. George D. Shepardson read a paper entitled "Technical Men as Dividend Earners." He said the subject had been suggested to him by two recent incidents. One was a proposition that young engineers engage with central station companies under a contract by which their salary would be proportional to the dividends paid. Some central station men had laughed at this proposition on the ground that many central stations paid no dividends whatever. The other incident which induced him to write on this subject was a letter received from the editor of a prominent electrical paper reviewing the conditions of the central station business and the need for technical men in it. He then read from this letter at length. It said that previous to 1902 there had been an increase in the incandescent lamp output of approximately 20 per cent per year. This rate of increase had been falling off steadily since that time, which indicated that the central station business was hardly in a satisfactory state. It is to the technical man that we must look to change this condition of affairs, not so much on account of his technical knowledge as on account of his trained mind, which gives him the advantage over the non-technical in grappling with new problems and analyzing results. A technical man, after he has passed through a probationary period in getting acquainted with the practical part of the business, should be of great value to central station companies.

After reading this letter, Prof. Shepardson analyzed the alumni list of a Western university's electrical engineering department (presumably University of Minnesota). He found that 27 per cent of the graduates since the beginning of the department were to be found in central station work. This figure, however, applies to the whole period rather than to recent years. In the past four years 34 per cent of the graduates have been taken by manufacturing companies, 24 per cent by telephone companies and 24 by lighting and railway companies. Of the latter, half were with one company, which was a large operating syndicate. This year he had received applications from manufacturers for 128 per cent of the year's graduating class. From operating companies he had received applications for only 25 per cent. From these figures he was forced to the conclusion that manufacturers were appreciating the value of technical men more than the operating companies. Outside of the large syndicates less than 2 per cent of the recent graduates were with the smaller operating companies, leaving out of account a few who owned stock in operating companies. The owners of large operating companies and syndicates realize that they must have technical men. These facts should be sufficiently suggestive to smaller central station companies as to the value of the technical man. He gave some reasons why central station operating work is not more attractive to technical graduates. To begin with, the salaries are low. There is likely to be a lack of appreciation of good work and there is some monotony about the work with an operating company where there is not as much contact with other bright men in the same line of work as in the larger manufacturing companies.

As to the place of the technical graduate when he enters central station work, he should be considered not as a trained engineer, but as one who needs development and practical experience. A technical man when going to a central station should not propose radical changes at first, but should rather work in gradually, demonstrating what he can do with poor apparatus already available, rather than recommending expensive changes. After he has demonstrated his ability it will be time to recommend more radical moves. He thought the small central stations should be more attractive to the young graduate than the large on account of the possibility of grasping the situation in its entirety more easily in the small station. Nevertheless, many prefer the larger stations because of the greater specialization and the chance for a long line of promotion into high salaried positions.

Prof. Shepardson then gave some practical illustrations of what technical men could do in the way of increasing economy of small central stations. One young engineer by fixing up a leaky boiler setting, cleaning flues, etc., made a 20 per cent saving in the coal bill. Another by cleaning the feed-water heater and boiler made a saving of 30 per cent in fuel. Another made a saving of 30 per cent by indicating the engine and resetting the valves. The engineer in charge knew how to use the indicator, but could not correct the trouble. Another man found a plant which was much overloaded and by fixing up leaky insulation made it possible to increase the load one-third. Another caused the reduction of the load on a station 50 per cent without reduction in the gross earnings by introducing meters. Another earned his salary several times over by getting after customers' meters, cleaning and adjusting them.

The growth of syndicate ownership makes central station work more attractive to young engineers because in such syndicates ability and enterprise are appreciated and put at their proper value. Prof. Shepardson recommended to small stations the plan of profit sharing with its employes. In conclusion he explained that he was not out hunting jobs for his boys among central station men since he already had applications for many more graduates than he could supply. He had written his paper simply to suggest that central station companies for their own good might make more use of technical men.

DEPRECIATION OF ELECTRICAL PROPERTIES.

Prof. G. W. Bissell, of Ames, Iowa, read a paper on the depreciation of electrical properties which will be published in abstract in a later issue. It takes up the practive of several Iowa central station companies in regard to depreciation and sinking funds and also goes into the general theory of these matters.

VARIOUS ASPECTS OF RATE REGULATION.

In view of the sentiment all over the country for rate regulation of all kinds, the programme committee arranged for a discussion of this question in all its aspects. The paper by Prof. Bissell on depreciation was intended as an introduction to the subject. The legal status of rate regulation was set forth in a very clear, concise paper by Hon. L. G. Hurd, of Dubuque, Iowa. Under Iowa laws he showed it to be well established that rates named in franchises are subject to revision by city councils if by virtue of changed conditions they are not reasonable. The whole question is whether they are reasonable, and it is upon this that the court passes when the right of a city council to establish a certain rate is made the basis of a suit. The court will refuse to sustain a rate which is proved to be below that at which a corporation can reasonably be expected to maintain good service. In case a rate-fixing body adopts a rate which is believed by the corporation to be too low, the corporation has recourse to the court which passes upon the reasonableness of the rate. If the rate is held unreasonable, the rate-fixing body can adopt another higher rate and so on until the court decides that a reasonable rate has been fixed.

Mr. George McLean, of Dubuque, Iowa, in a paper on equitable rates in relation to rate regulation, considered especially the question of the equity of the minimum bill, which is charged by many companies as a kind of readiness-to-serve charge. He then pointed out how the readiness-to-serve charge is common in many other lines of business and that it is generally accepted that such charges are entirely just. The argument that a readiness-to-serve charge requires a customer to pay for something which he does not receive will not hold any more in connection in the electric lighting business than in any other. He discussed two kinds of franchises under Iowa laws. Under one it is agreed that the city council shall have the power to regulate rates at certain specified intervals during the life of the franchise. Under another with the absence of specification this right can be asserted at any time. The first plan has the advantage of giving the company security against rate regulation between intervals, but rather invites the probability of attempts at rate regulation at the intervals specified in the franchise. He advocated, as being probably the most satisfactory plan, a form of franchise whereby the company would share its profits with the city, thus making the interests of the city and company identical, and making the amount of payment to the city dependent entirely upon the dividends earned. In case the surplus earned is paid back into the property instead of being paid in dividends, the benefits accrue to the city in better service and extension of lines into new territory. Rate regulation then becomes entirely automatic. By taking the public into partnership municipal ownership and rate regulation agitation would be entirely prevented.

Congressman M. J. Wade, of Iowa City, gave an address on the political status of rate regulation. He believed that demands for municipal ownership, rate regulation and the like have arisen from abuses or believed abuses by corporations. Corporations like individuals suffer through the misdeeds of a few, and because of great abuses for which some corporations have been responsible in the past. Of all things which have caused the most prejudice against corporations he thought the practice of stock watering had done the most. People do not like to be hoodwinked. They do not object to large dividends being paid by the corporation so much as to an attempt to cover up actual profits by the issuing of watered stock. Then again the practice of many corporations in bribing public officials was responsible for much prejudice against them. Here again it is a case where the many suffered for the few and where the many fair and honest companies were injured in reputation by the practice of a few bad ones.

We cannot shut our eyes to the fact that the people are demanding regulation of rates. He suggested that the way to prevent unjust legislation is for corporation officers to get down among the people, get acquainted with them and educate them to the difficulties of the public service business. The public will demand nothing more than it believes to be reasonable and fair.

ADVERTISING METHODS.

Mr. Frank B. Rae, Jr., who was on the programme for a paper on modern advertising methods, could not attend the convention, but his paper was read at the last session. Advertising, he said, is the talk of the hour among central station men. It is being discussed everywhere. Where will it all end? He thought it would end in this way, that the central station business would become just as other lines of business. Central station product will be sold by advertising and solicitation just as the products of other lines of business where these methods have become well established.

In discussing this paper Mr. F. W. Kelley, of Davenport, was called upon as one who had made considerable use of advertising and solicitors. He said that his company's solicitors had been working mainly on the gas business, but had also done good work in the electrical department. On account of the competition in his town they had used considerable advertising space in the daily papers. They had found it best not to invest their money in small spaces over long periods, but that better results could be secured by taking spaces of one-half or one page. Such advertisements were the ones which helped the solicitor the most. His company recently moved its offices into a large office room on the main floor on one of the principal streets. The offices had previously been in an out-of-the-way place. The new offices were made attractive. As an illustration of what a difference the location made, he said that a chafing dish which had been on exhibition two years in the old offices was sold the second day after they moved into the new rooms. His directors had wondered how they were going to get enough out of the change to pay for the greatly increased rent of the new offices. The profit from sales of small devices since they moved into the new offices would pay for the increased rent.

Mr. McGee, of Red Oak, believed in newspaper advertising rather than advertising by the distribution of novelties. People in his town were tired of the latter. He had secured the insertion in the local papers of recent articles telling how burglars avoid electrically-lighted houses because of the possibility of having the lights snapped on them. These few items had brought more direct returns than all the advertising they had done for some time. A lot of residences were being wired as a direct result of it, since it had struck the town at the psychological moment after a number of burglaries had been committed. He told of an amusing scheme that had been used in Lincoln, Neb., where the company advertised for a thousand dogs to be brought to the company's offices. All the small boys in town appeared at the offices the next morning with all the dogs they could find. Every dog was furnished with a blanket with an advertisement on it and they were again turned loose. It is needless to say that this created a sensation.

Mr. F. W. Kelley, of Davenport, had found it a great help in the sale of small appliances, especially sewing machines, motors and devices in which ladies are specially interested, to make it a point to sell the first machines to those who are most likely to talk about them. By carefully selecting the first list of possible customers for these things and placing the devices where they would be talked about the most, they would in time come to sell themselves.

Mr. J. R. Cravath, in further illustration of the point brought up by Mr. Kelley, recited the work done by Mr. O. K. Cole, manager of the Grinnell Electric & Heating Company. Mr. Cole had placed over 125 flatirons in that town of less than 5,000 population during the past 16 months. This was due largely to placing the first few irons where they would be best advertised by their users.

Mr. D. F. McGee said there was usually a leader in every neighborhood and that the thing to do was to concentrate all efforts upon securing that one as a customer and the others would follow. This was the secret of his success in getting residence business.

Mr. George S. Carson, of Iowa City, thought it not a good plan when putting out electric irons and cooking devices to give the customer the idea they could be operated cheaply. If put out with this idea, dissatisfaction would follow. It was not the cheapness, but the convenience of these devices that make them popular.

Prof. G. W. Bissell called attention to the advertising value of having a company's power station in good and neat condition. Slovenly looking power stations create a bad impression.

GASOLINE VAPOR LAMPS.

A short informal discussion was started on the introduction of gasoline vapor lamps for store lighting and the amount of competition they are able to offer to electric lighting companies.

Mr. E. B. Hillman, of Quincy, Ill., and Mr. O. E. Brownell, of Lake City, Iowa, called attention to the fact that although such gasoline lamps introduced a greater fire hazard than electric lighting, insurance companies are not charging higher rates. This is an evident injustice.

Mr. J. R. Cravath stated that the bulletins issued by the Underwriters, which give the list of approved gasoline vapor lamps, plainly state that these introduce an extra fire hazard which should be recognized by increasing premiums in every case where they were used. The trouble was that the insurance companies did not live up to their own engineers' recommendations in this matter. If they did, extra rates would be charged.

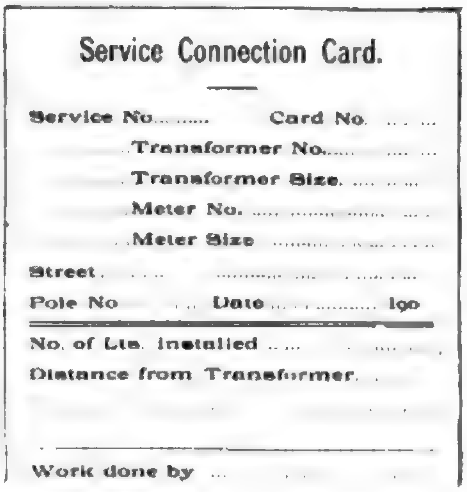
Mr. George S. Carson thought the best policy toward gasoline vapor lamps was to let them alone and not stir up a feeling against the electric light companies by opposition to the gasoline lamps. It would be a case of survival of the fittest, and while some customers would be lost to gasoline lamps they would come back to electric light service in time on account of its inherent safety and convenience. The more the electric light company opposed gasoline lamps the more likely some people would be to put them in. At the same time, it might be well to take means for keeping prospective users posted as to the numerous accidents from gasoline vapor lamps, as there were plenty such.

Collinwood, Ohio, Municipal Plant.

The municipal lighting plant of Collinwood, Ohio, is probably one of the most successful of the smaller municipal plants in that state. Without having any unusual advantages either in territory or equipment, it has had a successful career, largely through effective methods in the solicitation of business, the systematic handling of accounts and records and the application of live business methods in general.

The town lies on the outskirts of Cleveland, and it has a population of 5,500, made up largely of employees of factories in that district, so that the number of wealthy residents is comparatively small. The plant was started in 1900. The equipment consists of three 125-hp and one 150-hp tubular boilers; one 150-hp Russel engine and one 325-hp Hamilton Corliss engine belted to a jack shaft, to which are belted one 180-kw Warren 2,000-volt alternator, one 75-kw Wood 2,000-volt alternator, a Wood direct-current series arc machine and a Western Electric series arc machine, both generating 6.5 amp. at 6,000 volts.

The station adjoins the tracks of the Lake Shore & Michigan Southern Ry., with a spur for unloading fuel into covered bins. The care used in purchasing coal illustrates one of the businesslike methods of the management. Each year proposals are invited and sample lots of coal received are given practical boiler tests to ascertain the amount of water evaporated per pound of coal. A contract is awarded for the most efficient fuel, price, of course, being considered. This year Youghiogheny gas coal is used, run-of-mine, costing $1.89 delivered. The product of a certain mine is specified, and it is tested at frequent intervals to see that the quality is kept up. The consumption averages 9 lbs. per kw-hour, which is considered satisfactory in view of the equipment. An accurate record is made of the amounts delivered and the daily consumption, and balances are made each month.



Service Connection Card.

Service No........ Card No. ......

Transformer No...... ......

Transformer Size. ......

Meter No. ....

Meter Size ......

Street. ....

Pole No ...... Date 190

No. of Lts. Installed ......

Distance from Transformer.

Work done by ......

The town is illuminated by 100 arc lamps. They are the Adams-Bagnall 2,000-cp (nominal) series type, using 6.5 amperes at 75 volts, and are arranged in two circuits. The town is lighted on a moonlight schedule. The cost for operating, not including interest and depreciation, was stated to have been as follows for the past four years:

1902	1903	1904	1905
$47.94	$48.45	$49.47	$47.80

The council paid $54 each for lamps last year, taking care of the interest, thus allowing a small profit to the plant.

The commercial load is considerably heavier on an average than the street-lighting load, the division of expenses last year based on current output being 35.5 per cent to street lighting and 64.5 per cent for commercial. The total load on the station is considerably heavier in summer than in winter, this being due to the fact that the plant supplies Euclid Beach Park, a large pleasure resort on the lake front about a mile from the plant. This customer pays the plant about $800 per month for four months in the year, the greater portion of the consumption being between 7 p. m. and midnight. Current is sold at 4 cents per kw-hour measured on the primary side of a transformer at the park entrance. The peak load for the commercial circuit during these four months is about 260 kw. while the peak load for other months is from 100 to 120 kw.

There are about 475 customers among residences and business places. Residences are supplied at 10 cents per unit for the first 20 units per month and 8 cents thereafter. It is probable that this may be reduced to 8 cents and 5 cents, respectively. Business houses using over 100 units are supplied at 5 cents. There is a day circuit for supplying several factories having about 50 hp in motors, which are charged for at the rate of $4 per month per hp. The day circuit is handled by the smaller engine. During the winter months the large engine is sufficient to handle the evening load, while during the peak loads in the evenings of the four summer months the plant is somewhat overloaded with both engines going full; during these hours, of course, the factory load is off. All four boilers are required during the peak load in summer, while in winter three are used. It is not the practice to bank the fires in preparation for peak loads but rather all the boilers required at the peak load are used with light fires and dampers closed; then when they are needed the steam output is increased gradually. It is claimed that boiler repairs are apt to be smaller by this practice than by keeping one or more boilers banked and then firing up suddenly for a peak load.

The town covers quite a large territory and several lines have been run a distance of three miles to reach some residences of large consumers. Originally all house circuits had individual transformers, but this is being changed as rapidly as possible to the group plan, although this cannot be fully carried out owing to the scattered service. Included in the commercial circuits are about 50 alternating arcs in stores. A few Nernst lamps have been installed in residences, these being operated at 220 volts on a three-wire system. There are several electric signs and about 50 electric fans. The sale of electric flat irons and other utensils has been pushed with some success, but the management is handicapped somewhat in introducing such side lines owing to the fact that the plant is loaded up to its limit during the summer months when they are most likely to be used.

The company does all its own house wiring and sells lamps and other appliances. For this work it has an arrangement with a large electrical supply house in Cleveland which is under contract to supply as many men as are necessary at any time to do installation work; the materials, of course, being purchased from this concern. Workmen are charged for at the union scale and the plant manages to make a trifling profit on such jobs. The manager endeavors to arrange for the wiring of every new house of any size that goes up in the village whether he can secure a contract or not; during the past year about 175 houses and places of business were wired in this way and wiring facilities were increased in 100 other buildings. Not all the wiring in this town is done by the plant, as city contractors are very active. As a result of this practice the commercial load is increasing very rapidly.

Lamp renewals are not made free, a charge of 20 cents being made for 16-cp lamps. It is the practice to use the most efficient lamp that can be obtained and while customers are permitted to buy lamps outside, the management insists that they must show a certain efficiency. This practice not only decreases the load but it gives the customers better illumination, and in all arguments over this point, it is demonstrated to the customer that he saves current by using the more efficient lamp. There is no natural gas in the town and artificial gas sells at 70 cents per thousand. The management has literature demonstrating that electric lighting costs only about 10 per cent more than gas with Welsbach mantles, considering renewals on globes and mantles, and with the added advantage of being clean and hygienic. In wiring new houses the superintendent makes a personal inspection of the work and offers suggestions as to the best types and arrangements of fixtures and the best decorations to use in order to secure the most satisfactory illumination.

HOUR	INCANDESCENT DYNAMOS				ARC DYNAMOS				ENGINES				BOILERS					REMARKS
	No. 1		No. 2		No. 1		No. 2		No. 1		No. 2			No. 1	No. 2	No. 3	No. 4	Engineers on duty will report all trouble, and other matter of importance.
					84 Cir.		84 Cir.											
	Amperes.	Volts.	Amperes.	Volts.	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Steam	Water	Water.	Water.	Water	
6.40 P. M.																		
7.00																		
7.30																		
6.00 A. M.																		
Total																		
Average																		
K. W.																		
Meter Reading																		

The systems of records and accounts are much more complete and detailed than is usually found in a small municipal station of this kind. Card systems are used in keeping records of the accounts of customers and of the expenses and output of the station. When a customer makes application for service it is entered on an order card showing the name, residence, how order was received, date, time, description of service desired, remarks and signature of applicant. When the connection is made, a brass tag is sealed to the meter, which carries the customer's number, and this number is used in all accounting. A service connection card is filled out showing the service number, card number, transformer, transformer size, meter number, meter size, street, pole number, date, number lights installed, distance from transformer, remarks and signature of workman. The customer's number is used for the page in the meter book and a page of the same number is inserted in a loose leaf ledger. In making bills the customer's number is used with a prefix of the number of the month. Invoices are copied in a tissue leaf bill of sale book, and there is a similar bill of sale book for supplies furnished. Monthly collections are made, but all bills are rendered every two weeks.

Records of current produced are very complete. The daily station report shows a half hourly record of volts and amperes for each generator, time of starting and stopping of generators and engines, and water and steam conditions of boiler, with trouble remarks. Sheets are footed daily so that the totals, averages, kilowatt and boiler meter readings are shown for each day. These are recapitulated from week to week and month to month and a card system shows the exact conditions for any period of any year with comparisons with the previous year.

The general accounts include general expense, office expense, street lighting expense and commercial light expense. The various sub-divisions include: Bond account, premium and interest account, general and police fund account, commercial lighting account, street lighting account, construction fund account, profit and loss account, office expense account, accounts receivable account, wiring and supply account, electric rents fund account, and construction account. All items of expense and salaries are charged to the account to which they belong or divided between certain accounts on the basis of time spent in certain work or proportioned according to the current output. Thus the day fireman and engineer are charged to commercial lighting, the night men are charged 35 per cent to street lighting and 65 per cent to commercial. The entry for the chief engineer is divided, as his services are necessary regardless of the output. The lighting portion of the superintendent's salary is charged 75 per cent to commercial and 25 per cent to street lighting, as this is about the division of his time in the lighting business. He also has charge of the waterworks business which is conducted by the village, but for which there is no plant, the water being supplied by Cleveland and metered at the city limits, the village maintaining its own distributing system and collecting its own rents. The superintendent attends to all collections for both departments, so that his salary is divided between the two departments.

The operating force includes the superintendent, two engineers, two firemen, one coal handler, two linemen, who also attend to work for the water works department, one general man who attends to meter reading, soliciting, etc., and a bookkeeper.

No free lighting is furnished to anyone or any of the city departments. All lighting in public buildings and in the plant itself is metered and charged to the proper account. Superintendent C. G. Beckwith has considerable more leeway than is usually accorded to the operator of a municipal plant. He has been in charge since the plant was installed, and credit is due him for its efficient state. Following are some extracts made from Mr. Beckwith's last annual report:

Total cost of plant	$63,537.90
Total receipts, 1905	24,134.50
Total operating expenses	12,292.45
New construction in 1905	5,377.73
Profits after paying new construction	5,530.00
Total incandescent output	452,028 kw-hours
Total arc output	119,232 kw-hours
Total output of plant	571,260 kw-hours
Total coal used	2,018.9 tons
Average number arc lights operated	94 lamps
Operating cost per arc lamp	$47.80
Cost per kw-hour sold	4.9 cents
Cost per kw-hour generated	2.7 cents
Average price per kw-hour sold	6.3 cents
Average price per kw-hour generated	3.4 cents
Profit per kw-hour sold	1.4 cents
Profit per kw-hour generated	0.7 cent

Central Station Notes from Indianapolis.

The Indianapolis Light & Heat Company is just completing a large steam plant about two miles from the downtown district on Mill Street. Here two 1500-kw Curtis steam turbo-alternators have been installed and space is left for one of 5000 kw. Condensing water is obtained through a 4-ft. tunnel 1000 ft. long running from the power house to Fall Creek. Perhaps the term "horizontal well" would be more exact, as the tunnel is closed at the creek end and the water is all obtained by seepage between the brick and concrete blocks of which it is built. The lower half of the tunnel is built of concrete blocks dovetailed into each other and the upper half is of brick. The discharge tunnel is located directly above this intake tunnel. Both tunnels are a considerable distance under the ground much of the way from the power house to the creek.

The power house turbine room is designed without any basement, all the pumps and other operating machinery being on the floor level. The feed pumps are located in the turbine room, but can be controlled by a long valve stem from the floor of the boiler room, which is considerably above that of the turbine room. The boiler room is designed with rows of boilers at right angles to the turbine room in order to get a sufficient capacity of boilers opposite each turbine unit.

The turbo-generators are 4100-volt, three-phase, star connected. By connecting from the neutral to the outer leg of any circuit, 2300 volts for standard lighting distribution is obtained, while the benefits of 4100-volt transmission are secured. The company has a direct-current three-wire net work in the downtown district of Indianapolis to supply which from this new power station motor generator sub-stations will be installed. The company has begun to use three-phase transformers for supplying three-phase induction motors in connection with its power service.

The company has not made much effort recently to get new business, because until this new power plant was in operation it would have been unable to carry more load had it been secured. But one solicitor is employed. The intention is to go after new business more actively now that the new power station is being completed.

Natural gas competition is a thing of the past in Indianapolis, the Indiana gas fields having been practically exhausted and the Indianapolis natural gas service discontinued. Mr. T. A. Wynne, superintendent of the Indianapolis Light & Heat Company, states that the competition of natural gas was never felt much in high-class lighting.

Central Station Notes from Kokomo, Ind.

The Kokomo, Marion & Western Traction Company supplies central station electric lighting and street railway service in Kokomo and operates an interurban line between Kokomo and Marion, Ind. Although the interurban line is in prosperous condition, Mr. T. C. McReynolds, general manager of the company, believes that the central station end of the business offers much greater opportunities for growth than the railway, and thinks that this is true of such combined properties generally. He points to the fact that his company's light and power business increased 33 per cent last year, which was more than any ordinary railway property can show. He considers that he is as yet only skimming the surface in his community as far as light and power business is concerned; that the company's output should be increased year by year and the rates reduced, and that the central station manager should not be satisfied until he has well loaded light and power mains on every street in a town.

LIGHTING FROM INTERURBAN RAILWAY TRANSMISSION LINES.

The company is lighting the village of Swasey (population 2000) with current supplied over a 10,000-volt, three-phase, 60-cycle transmission line supplying the interurban railway. For lighting this village a sub-station transformer reducing from 10,000 volts to 208-104 volts secondary is employed. The distribution in Swasey is by a three-wire 208-104 volt system. The transformers are located in the interurban railway sub-station. The company also at present writing is preparing to light Greentown, which also has a population of about 2000. Mr. McReynolds believes that it would be to the advantage of many other interurban railway companies to take on this kind of business. The cost of supplying village lighting by this means is far below what it would be with a separate lighting plant in the village. In this connection it is of interest to note that the transmission is at 60 cycles instead of 25 cycles which is the usual frequency employed on interurban railway transmission lines. Sixty-cycle rotary converters are used for the railway supply in the sub-stations but at the main power station in Kokomo a motor generator is used to supply the street railway instead of a rotary converter. All power is generated at 2300 volts, 60 cycles.

POWER STATION AND POWER COSTS

The power station is a new plant with compound condensing engines. An Allis-Chalmers steam turbine of 1000-kw has recently been ordered. The company's power station records show in a striking way the influence of load factor and load on power station economy. The cost per kw-hour for February, 1905, before the interurban railway was started and when the light and power load was 33 per cent less than a year later, was about 1.4 cents per kw-hour. The cost per kw-hour in February, 1906, averaged .89 cent varying between 1 and .86 cent per day. The output for the latter month was about 6800 kw-hours per day. The load factor for the combined railway and light plant on week days is now about 60 per cent. That residence lighting has been given some of the attention it deserves in Kokomo is shown by the fact that the evening peak in February extends over about 3½ hours.

The voltage regulation on the light and power service is at present very bad owing to the fact that the same generators supply both railway and lighting and no automatic voltage regulators are used. The company does not furnish free lamp renewals.

ELECTRIC HEATING.

The company put out 50 flat irons in December, these being taken on by the company's regular solicitor. These were placed on trial and some came back, but those coming back were soon placed with other customers. The irons have been sold at their cost to the central station company.

Mrs. F. Violet Sanborn recently gave a week's lectures on cooking by electricity, as previously mentioned in these columns. The company's rates are rather favorable to electric heating devices. They are 12 cents per kw-hour for residences and 10 cents per kw-hour for commercial purposes. Energy in excess of 30 hours' use of a customer's connected load is billed at 15 cents per kw-hour. Up to 120 hours of use and over and above 120 kw-hours the rate is 4 cents. One man, a technical graduate, tests and reads all meters and acts as solicitor.

Progressive Central Station Work at Lewiston, Pa.

Mr. E. M. McCabe, general manager of the Mifflin County Gas & Electric Company, of Lewiston, Pa., sends the following note in response to a query in these columns as to any central station which has done as well as the central station at Janesville, Wis., the business methods of which recently furnished the subject of an article.

The population within the limits of the Lewiston central station district is about 10,000. The station connected from January 1 to April 1 twenty-two residences and sixteen business places, consisting of stores, restaurants, laundries, churches, skating rinks, etc. From April 1 until April 13 twelve new customers, all residences, were connected. Each residence connected has twenty or more lamps. No special inducement to get these customers was offered, there are no solicitors on the central station staff and no advertising has been done. The rate is 12 cents per kw-hour, less 10 per cent discount for cash.

Priming Caused by Poor Circulation in a Boiler.

Prof. D. S. Jacobus, of Stevens Institute, Hoboken, N. J., has recently made some experiments to demonstrate how priming in a boiler may be caused by the poor circulation of the water contained therein. A small vertical tubular boiler of ordinary construction, was used, with the water-heating surface enclosing a circular grate and with tubes leading directly upward from the combustion space above the fire to the upper tube-sheet at the top of the boiler. The steam was taken from the boiler at a point in the outer shell near the top of the boiler. When the boiler was run under normal conditions the steam generated was dry for ordinary rates of combustion, and superheated when the fires were forced.

In this class of boiler the temperature of the flue gases escaping from the tubes near the center of the tube-sheet is much higher than that of the gases from the outer tubes, and tests were arranged to determine whether there would be a gain in the economy through placing retarders in the center of the tubes so as to distribute more evenly the work done by the different tubes. In these tests the retarders were so adjusted that the temperatures of the escaping gases were made about the same for each of the tubes. After this was done there was an unexpected action through the boiler priming so severely that it was impossible to run it at other than a low capacity. The water level would be constant for a short time and the steam would be dry, when suddenly water would be thrown from the boiler along with the steam. On removing the retarders the priming disappeared, and on replacing them it was again present. From this it would appear that the retarders were the cause of the boiler priming.

Without the retarders the tubes near the center of the boiler were hotter than those near the side and caused an upward current of water at the center of the boiler and a downward current of water at the sides, the circulation of water being brisk and definite. With the retarders, however, all the tubes were at the same temperature and there was no tendency to produce a definite circulation, so that the water was for a time quiescent until after storing a certain amount of heat it would foam up and some of it would be thrown from the boiler.

A Texas Pole Line.

One of the best electric light pole lines in the south is to be found in Texarkana, Texas. The poles are white cedar, 36 feet in length, with seven and eight-inch tops. All are painted with brown paint, and the butts are coated with tar. All poles are stepped with standard steps placed 18 inches apart.

The line is also graded at the top so that the top arms from one end to the other are absolutely level. In order to grade the poles at the top it was necessary to set some of them in the ground as far as nine feet on account of the fact that the alley itself is not graded and runs up and down hill. It was thought best to do this, however, because the alley probably will be graded soon and it then will not be necessary to reset any of the poles. No pole is set less than 5¼ feet in the ground.

The line is guyed at both ends by means of 30-ft. guy stubs with "dead men" behind them buried in the ground to a depth of six feet. The "dead men" consist of pieces of bois d' arc about six feet long and 20 inches in diameter, and are coated heavily with tar. Galvanized ⅝-inch stranded guy wire runs from the guy stubs to the anchor rods that are bolted to the dead men.

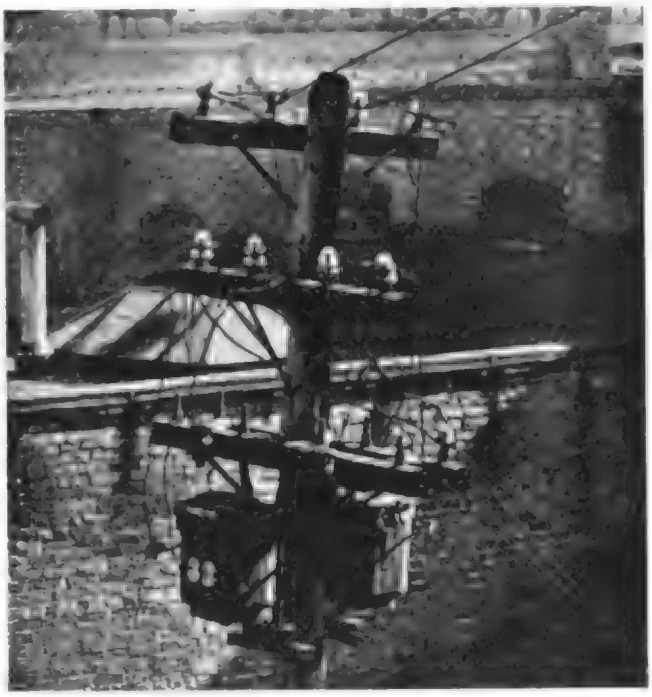


FIG. 1.—TRANSFORMERS ON POLE LINE.

All the poles are roofed. The distance from the top of the top arms to the peak of the pole is six inches, but any pole that shows indication of decay at the top is roofed with galvanized sheet iron. Every pole is double-armed with two sets of arms, the top arms for high voltage lines and the lower arms for secondary wires.

The arms are of yellow pine and are painted red. They are the so-called alley arms made according to specifications used by the Chicago Edison Company. They are eight feet seven inches in length. The pins are spaced 14 inches, and are of locust. Every pin was given a coat of white lead before being placed in the arm.

The primary and secondary wires are "dead-ended" on insulating spools held by a through bolt to a bolt that passes through the double arms, and to which ⅜ guy wire is attached in order to take all strain off the arm that the latter may be at right angles to the pole. Strain insulators are installed on the guys holding the primary wires and also one large strain insulator on the ⅝ guy leading from the guy stubs to the dead men.

For the lower arms one-inch pipe is used as an alley arm brace to which is attached directly a T-iron brace to hold the upper arms in position. The bolts holding these braces pass through both arms and the block between the arms. These braces will hold a heavy lineman working on top of the arms at the end of same. All poles are wrapped with galvanized sheet iron at points where guy wires pass around them in order to prevent cutting into the poles.

Primary wires are run on adjacent pins on the top arms and secondary wires on adjacent pins on the lower arms. The secondary wires from the transformer tap three No. 4 wires running at right angles to the main lead. Straight jumpers run from these wires to the three No. 0 wires on the alley lead.

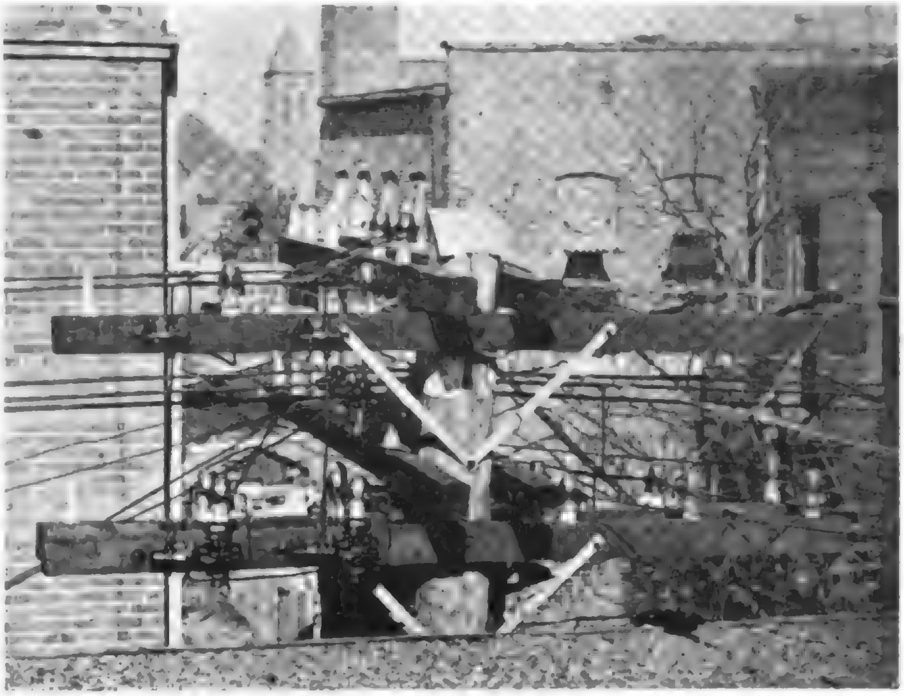


FIG. 3.—ELECTRIC LIGHT POLE LINE IN TEXARKANA.

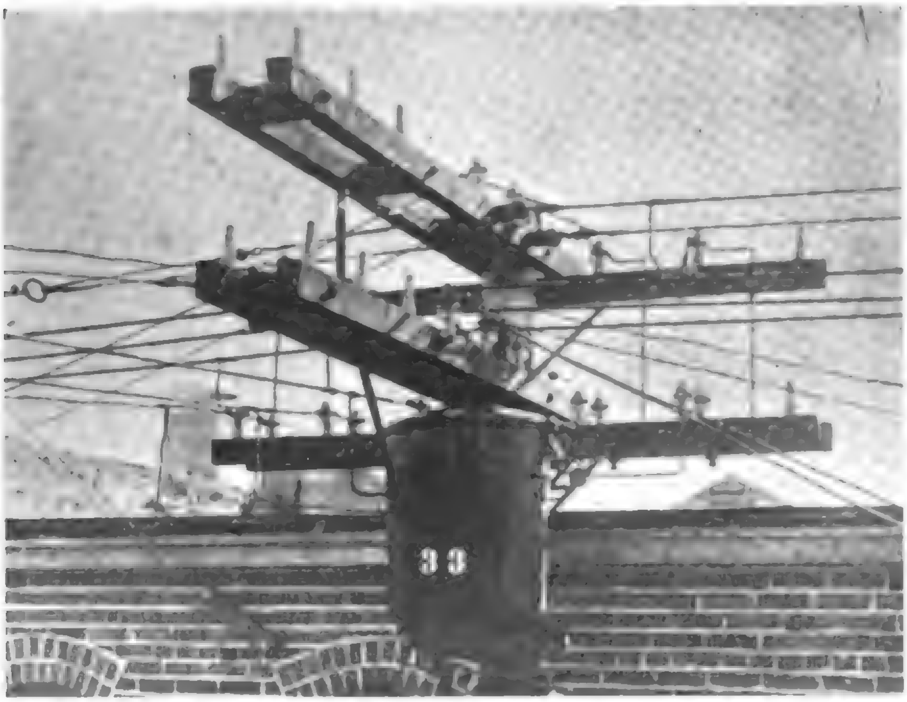
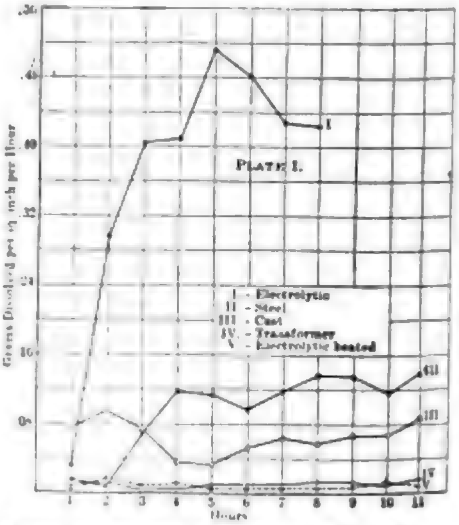


FIG. 2.—ELECTRIC LIGHT POLE LINE IN TEXARKANA.

Mr. A. T. Lloyd, who is now electric superintendent of the Shreveport Gas, Electric Light & Power Company, had charge of the work. Mr. Lloyd was formerly with the Chicago Edison Company.

Corrosion of Iron by Acids.

In a paper presented at the ninth general meeting of the American Electrochemical Society at Ithaca, N. Y., May 1 to 3, Messrs. C. F. Burgess and S. G. Engle say that the rate with which iron corrodes or combines chemically with its surrounding medium depends upon various factors, including temperature, nature of the chemical agent, speed with which the resulting compound is removed and the physical and chemical state of the iron itself. The authors give the results of a few observations made in connection with a more extensive study of electrolytic iron under a grant from the Carnegie Institution of Washington. These observations deal mainly with the rapidity of solution of several grades of iron in dilute acids.



CURVES SHOWING CORRODIBILITY OF VARIOUS IRONS.

The corroding mediums employed were normal solutions of sulphuric and hydrochloric acids; distilled water and chemically pure acids being used. The several grades of iron which were compared included electrolytic iron deposited from a mixed sulphate and chloride solution, the same iron which had been heated to about 1,000° C. and allowed to cool slowly, soft sheet iron known as transformer iron, a temper steel and an ordinary grade of cast iron. The relative rates of corrosion during the progress of the test are shown graphically in the curves shown herewith. The unheated electrolytic iron was attacked vigorously and evolved hydrogen rapidly.

The investigators conclude that the percentage of purity is not the controlling factor, since electrolytic iron having the same chemical composition exhibits wide variations in the rate of solution when heated. The crystalline or granular structure of iron seems to influence the rate of corrosion in a marked degree. The rapidity with which unheated electrolytic iron liberates hydrogen in a dilute acid solution suggests a useful application of this material in the production of pure hydrogen by replacing zinc; electrolytic iron liberating hydrogen about four times as rapidly as pure zinc and twice as rapidly as commercial zinc. One pound of electrolytic iron produces 16 per cent more hydrogen than does one pound of zinc, and if a sufficient demand for iron for this purpose should arise, it could be supplied at a cost materially less than that of zinc. While the measurement of electric potentials of iron against corroding agents seems to afford some indication as to the rapidity with which it will become attacked, the authors state that it does not seem possible to establish definite relations between electric potentials and corrodibility.

Practical Installation of Electrical Apparatus.

By Thomas W. Poppe.

When setting an electric generator in a dynamo room it is important that the foundation prepared for it be strong and firm. If the foundation be built of brick these should be well set and grouted so as to eliminate air spaces; and if concrete be used the ingredients should be well mixed and tamped. The method given below will be applicable to any size of generator liable to be handled by the ordinary central station, the largest machines usually being set by contractors making a specialty of such work.

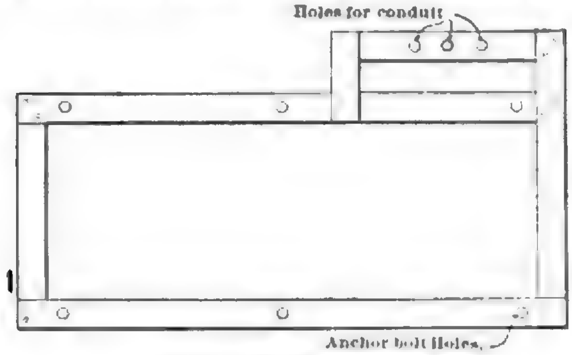


FIG. 1.—DYNAMO TEMPLET.

If the generator is direct-connected a wooden pattern of the base should be made showing the location of the holes for the anchor bolts. This is called a templet and can be of pine seven-eighths of an inch thick and four inches wide for ordinary machines and as wide as necessary to allow proper size holes for the anchor bolts of larger machines, as shown in Fig. 1.

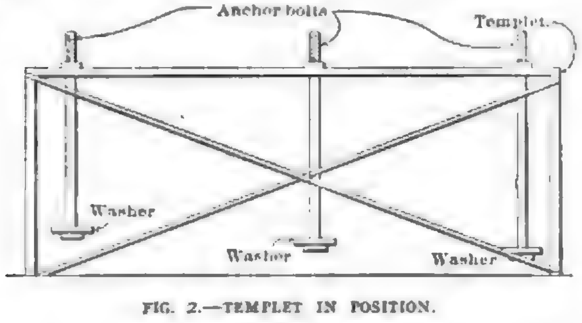
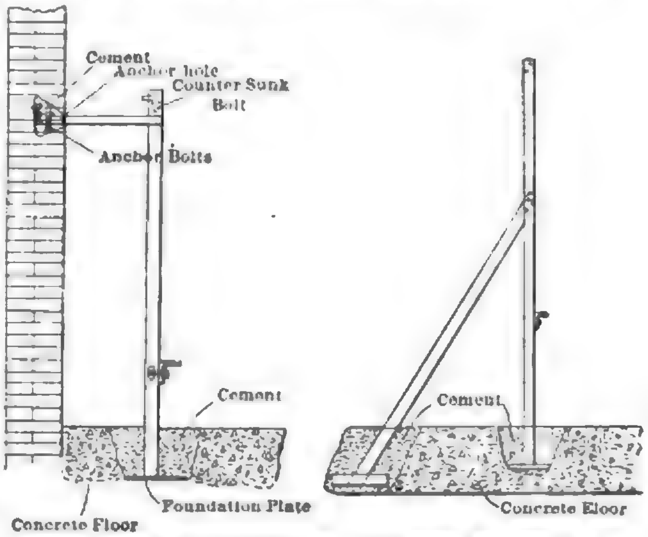


FIG. 2.—TEMPLET IN POSITION.

The templet should have holes bored for the insertion of the anchor bolts which are suspended head downward as shown in Fig. 2. The templet is then placed on uprights or a framework to hold it rigidly at the proper level. On the anchor bolts are placed large iron washers to prevent them from pulling upward and allowing the nuts to be tightened firmly. A second nut should be screwed above the first one to act as a lock nut. This prevents the vibrations of the engine from loosening the nut. A loose nut or bolt will speedily loosen another and unless promptly tightened the foundation will be weakened and may have to be rebuilt. It is also apt to loosen the steam connection, causing a loss of steam and a waste of power. With the templet in proper position a walled enclosure of brick or wood is built up about it level with the bottom and afterwards filled with concrete. This insures a strong and durable foundation.



FIGS. 4 AND 5.—METHODS OF ANCHORING SWITCHBOARDS.

If it be desired that the conduit lines connecting the generator with the switchboard be run under the floor a strip of wood may be added with the proper size and number of holes for the conduit lines to the switchboard bored in it.

When the concrete has hardened the templet can be removed and the bed of the engine set. The bolts will fit each hole in the bed if the templet has been carefully constructed. The foregoing method is applicable to belted dynamos, motor, balancer sets and rotary converters.

The switchboard should be firm and neat. A suitable frame can be made of angle iron, as shown in Fig. 3. The size of the panel containing the switches should be ascertained before the frame is built and the frame should be constructed to suit.

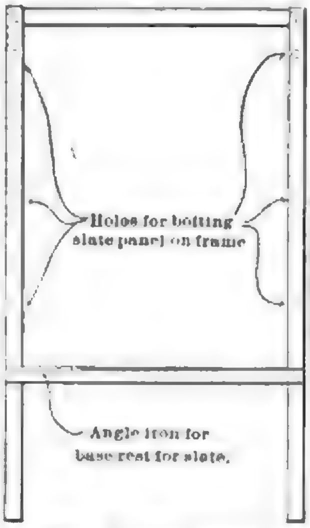

Holes for bolting slate panel on frame
Angle iron for base rest for slate.

FIG. 3.—SWITCHBOARD FRAME.

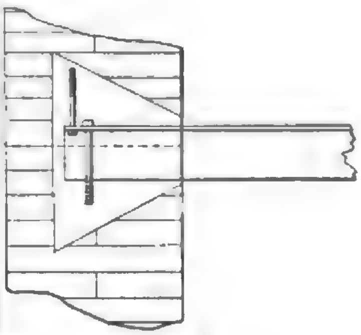


FIG. 6.

The uprights of the frame should be made about two feet longer than the slate. This will allow six inches to set in the cement floor and 18 in. between the floor and slate. The lower horizontal strip of angle iron should be set as shown in Figs. 4 and 5 so as to allow the slate panel to set thereon. This relieves the bolts holding the slate, whose only function will be to keep the slate from falling outward. Holes should be drilled through the upright angle iron to correspond with the holes in the slate panel. The angle iron will act as a washer for the rear of the slate board, but a leaden washer should be placed between the slate and the nut on the front of the board. This allows the nuts to be tightened firmly without danger of cracking the slate.

When the frame has been built, as shown in Fig. 3, holes should be cut in the concrete floor for the uprights of the frame. If in doing this the concrete should be pierced, that is, cut through to softer material, it is good practice to put a piece of flat iron, about 8 in. square or larger, according to the weight of the panel, under each upright. These serve as a foundation and prevent the board from settling afterwards. Some cement mortar should then be mixed and poured into the cavities surrounding the angle irons. Enough water to thoroughly wet the concrete should be sprinkled into the holes before the cement is put in. This causes the fresh cement to adhere to the older concrete. The frame should be set plumb and level and the angle iron on which the slate rests should also be made level.

Fig. 4 shows the frame anchored to the wall at the top. This is to render the construction as rigid as possible. The method of anchoring is shown in detail in Fig. 6. A wedge-shaped hole is cut in the wall and two holes are drilled in the angle-iron brace near the end. Two bolts are inserted in the holes thus drilled, one pointing one way and the other pointing in the opposite direction. When the brace is inserted in the hole in the wall the bolts are spread apart as shown and the hole filled with cement mortar. Another method is to drill a hole through the wall and use iron rod instead of angle iron for the brace. The rod is threaded on the end passing through the wall for the reception of a large washer and nut. If it is desired to conceal the latter a hole may be cut in the wall and the washer and nut buried by bricking up the outside again. Expansion bolts may also be used. If the board is not set near a wall it may be braced as shown in Fig. 5 or the uprights of the frame may be continued from the floor to the ceiling if this is not too high. On the end of the brace shown in Fig. 5 will be noticed a horizontal anchor. This anchor should not be omitted as the cement is liable to loosen around the angle-iron brace and render the structure weak.

Modern Practice in Water-Wheel Operation.

At the Chattanooga meeting of the American Society of Mechanical Engineers, held May 1 to May 4 inclusive, a number of papers were presented dealing specifically with water-wheel operation, the subjects of the papers being as follows: "Some Stepping Stones in the Development of a Modern Water-Wheel Governor," by M. A. Replogle; "Regulation of High-Pressure Water-wheels for Power Transmission Plants," by G. J. Henry, Jr.; "Turbine Design as Modified for Close Regulation," by G. A. Buvinger; "Speed Regulation of Water Power Plants," by J. Sturgess; and "Efficiency Tests of Turbine Water-wheels," by W. O. Webber.

In Mr. Replogle's paper attention was called to the fact that a perfect governor must be susceptible of a greater range of adjustment than any other known machine. Its "reasoning" power must be prescribed for every power plant in which it is placed. It must "anticipate" the rapidity of gate movement, as well as the point to which the gate should be moved for every change in load. Both of these must be performed before the speed has begun to return to normal. It must hold itself in suspense until gravity has fully charged the water added with power and this power is extracted by the turbine. If the speed returns to normal too fast or too slow, the governor must of its own volition shift the gates to a new point of opening. There are thus four distinct acts of judgment that may take place in one change of load, and a smaller or larger change of load will require a change in all of the ratios. In case a second or third change in load occurs before equilibrium for the first change has been established, it is apparent that the governor's action must be further complicated. A perfect governor will not assure perfect regulation in a turbine plant because any of the following defects will cause erratic action on the part of the governor; Unbalanced gates; cramping or interfering in gates; ponderous, unwieldy gates; lost motion in gates; torsion in gate rigging; irregular effects of gatage; lack in power storage; obstructed intakes; long closed feed pipes; contracted feed pipes; short bends in feed pipes; slanting draft tubes; draft tubes too large or too small; loss or gain of vacuum. The first eight of these defects are mechanical; the last six, hydraulic.

The requirements of a good water-wheel governor are stated to be as follows: It should be simple and easily managed; it should be carefully and compactly designed; it should have a powerful and exceedingly sensitive control governor; it should embody a powerful and reliable gate-moving element, whose every movement is gradual or of a differential character; it should be limited in its velocity of gate movement to the hydraulic and mechanical conditions of the power unit; it should have enough temporary and differential drop to make it adjustable to the present day power unit conditions; it should have an adjustable permanent drop, so that this factor can be reduced to a minimum in the plant governed; it should be provided with means for temporarily changing the speed for synchronizing purposes, and this feature should be controlled from the operating board of the modern power plant; it should be built as accurately as present-day methods will permit; all of its important bearings should be self-oiling; it should be noiseless in all of its actions; it should require a minimum amount of power for the performance of its duties, and when it is not laboring but is waiting for inspiration, the energy required should be reduced to a mere driving of empty belts; the ideal governor should be mechanical in its every detail. The author describes a governor said to comply with the foregoing requirements.

In his paper on "The Regulation of High-pressure Water-wheels for Power Transmission Lines," Mr. Henry says that a modern high-pressure water plant is usually exposed to the danger of a break in the pressure pipe. Such a pipe frequently carries a large volume of water at from 200 to 1,000 lbs. per square inch pressure; and a break in this line in many instances would mean the complete wrecking of the power house. It is, therefore, necessary that the security of this pipe line be guarded in every way; and the old method of regulating turbine wheels by throttling the water is one that should not be adopted without installing suitable protecting devices, and even, then, only when it is the only available method. Of course in many instances, particularly where a large storage reservoir is available at the inlet of the pipe or at the outlet of the flume, or where the peak load is likely to exceed the normal capacity of the flume, or where it will exceed the normal flow of the stream, it becomes advisable to save all the water possible; and this can only be done by proportioning the water flow to the station load requirements. Some form of regulating nozzle is, of course, the best way of accomplishing this result, but it does not follow that the regulation of the speed should be coincident with the regulation of the water flow. It is necessary, in modern power transmission plants, to maintain the speed within close limits, and 1½ to 2½ per cent. is readily obtainable with well-designed and constructed apparatus. It is not customary to maintain voltages at the end of a transmission line by varying the speed, and therefore the voltage at the generator; modern practice invariably requires the maintenance of a constant speed and voltage. Fluctuations in voltage are then taken care of by varying the generator field or by accessory apparatus, as, for instance, the Tirrell regulator.

Governors of excellent design and machine construction are to be had, so that the problem which confronts the engineer of to-day is usually that of adapting the apparatus obtainable to the conditions to be met with in any individual plant. The general practice among turbine builders is to control the speed of their turbines by cylinder or wicket gates, either device aiming to limit the orifice of discharge without varying the spouting velocity, and therefore maintain high fractional load efficiencies, although neither of these devices do this perfectly. Both are open to the defect of causing a variation in the velocity of flow in the pipe line, and therefore a corresponding water ram every time the governor checks the velocity. There is not, ordinarily, any trouble experienced, except in cases of extremely low head, due to the governor opening the gates too quickly and the water not getting up to spouting velocity quickly enough; but there is frequently great damage caused by the governor shutting the gates so fast that the pipe or the turbine case is ruptured by the resulting water ram. In order to guard against this, it is customary to install safety valves, which usually are out of commission, owing to their requiring too great an increase in pressure in order to actuate them, or due to their freezing or becoming stuffed with leaves, sticks, etc., carried by the water. Where there are a number of turbines fed by the same penstock, the water ram, due to a single machine closing, is not so serious as where there are but one or two on the same line; but the resulting change in spouting velocity, due to the monetary water ram, is then an objectionable feature, tending to cause a further increase of speed variation.

The author describes the Pelton type of water-wheel where a stream of water issues at full spouting velocity from a nozzle and enters the double-curved surface of a suitably designed bucket. This type of wheel is said to lend itself to a construction utilizing a deflection of the stream of water from the buckets in order to reduce the load that the wheel will carry at any instant of time, the stream being diverted off or on to the buckets. The paper describes in detail the practice followed by the Pelton Water Wheel Company in making installations.

Mr. Sturgess in his paper presents certain aspects of the problem of regulating water power plants, which are usually passed over with little consideration. These relate to certain fundamental elements of design in the water-wheel itself, and to characteristics of governor action as obtained in the best practice of the day.

In regulating a water-wheel it is not sufficient to confine attention to the governor only, since the problem is intimately connected with other important features of the plant. While the ultimate function of the gate is to control the power output of the wheel, opening or closing it slightly will not cause the power developed by the wheel to vary in like manner, for the reason that any sudden restriction cannot instantly check the velocity of the volume of moving water extending throughout the whole hydraulic system. The immediate effect is to cause the same volume of water to be ejected on the wheel, but with a higher velocity, thus actually increasing the power at the moment when it should be decreased or vice versa. In plants where the pipe line is long and the velocity of the moving water high, the gates cannot control the power output of the wheel within several seconds of the instant that the gate is moved, and no perfection in a governor can prevent momentary variations in speed. The reason for this is that the gates are placed immediately before the water-wheel, which takes up the energy of the stream. Attempts have been made to obviate this by placing the regulating gate elsewhere, as in one of the plants at Niagara Falls where the butterfly regulating valve is placed in the draft tube. At Shawinigan Falls on ordinary gate valve connected to an unusually powerful governor is placed in the penstock. While these minimize the deleterious effects referred to, they possess other drawbacks which make the automatic regulation of these wheels difficult.

Relief valves and stand pipes offer some advantages, besides removing the danger to the pipe line due to a sudden closing of the gate.

The best forms of relief valves are undoubtedly those which do not depend on a rise of pressure to set them in action, but which are mechanically opened synchronously with the closing movement of the gate, afterwards gradually closing automatically. By properly proportioning the discharge of such a valve to the discharge of the water wheel, the gate can be closed very quickly without producing an appreciable rise in pressure. A plant at St. Catherines, Canada, equipped with Voith relief valves and having pipe lines several hundred feet long, head being 298 ft., has been found to give remarkably good results when suddenly throwing off large amounts of power. The exact figures are not obtainable, but it is stated on good authority that the maximum momentary rise in speed on throwing off 75 per cent of the full load was under 4 per cent, an extremely good figure for such a plant. The units are of 7,000 horsepower, revolving at a high speed and having a large momentum factor. Further improvement in speed regulation depends greatly on the design of gates, but commercial reasons render it unlikely that any great departure in the principle of gate construction will be made.

The author then passes to a consideration of the governor, the most successful, he claims, being of the hydraulic type. The design and operation of a governor of this type is described at length.

Mr. Buvinger prefaces his paper on "Turbine Design as Modified for Close Regulation," with the remark that American manufacturers of water wheels have, as a rule, adopted the practice of connecting to the turbine a governor which is guaranteed by its builder to meet the requirements of the electrical machinery with which it is to be installed. This practice has left to the turbine builder the problem of fitting his wheels with gates that are as nearly balanced as possible, and that are connected to the governor by simple and strong gate work. As a result turbine builders have labored to keep all gears and wearing parts on the outside of the flume, where they are removed from grit in the water, and where they are easily accessible for observation and repair.

Among the many types of gates now in use, some are so nearly balanced that they may be used under great variations of head, while others are only suitable for low heads. The majority of manufacturers adapt their wheels to the specifications submitted, remaining partial to the type most generally supplied with their standard wheels. The cylinder gate and the swivel or wicket gate are the two types most used with the inward flow reaction turbine. The former in its simplest form is a plain iron ring fitting closely on the inside of the chute case and opening a part of all the chutes as it moves parallel to the axis of the shaft. Its part-gate efficiency is not so high as the swivel gate; but it is practically balanced on a horizontal wheel and is subject to little wear. For a number of years lips have been added to these gates to improve the part-gate efficiency; but this throws added work on the governor. The swivel gate can be almost entirely balanced, and has a slight tendency to close which is considered an advantage in case any part of the governor mechanism should become damaged. The part-gate efficiency of this type of gate is good, as the opening of each chute is reduced in such a manner that there are no eddies formed as with cylinder gates.

The draft tubes and feeders depend on the layout determined by the engineer who is governed by local conditions. Regulation is often rendered difficult by the character of the draft tube whose area should be such that at full gate the draft head is approximately equal to the distance of the shaft above tail water less the resistance in the pipe and the velocity head of the water leaving the draft tube. To decrease this velocity as much as possible the diameter of the draft tube is often increased at the lower end. As the quantity of water discharged decreases, the vacuum head also decreases and if the change be sudden the vacuum may be broken. To decrease this tendency the draft tube should be designed so that the water at the top has the same velocity as the water leaving the runner and the tube then tapered to the bottom, so that the water will leave with a velocity of from two to three feet. When wheels are placed in an open flume, or with a very short feeder from the turbine to head water, and a correct draft tube is installed, everything is favorable for good governing.

Where turbines are supplied by long feeders, the latter must be protected from violent shocks. The addition of a standpipe has given better results than any other method, and has been used successfully under heads as high as 250 ft. It should be placed as near the power house as practicable and should be of sufficient size to supply water to the plant during the time necessary for the column of water in the feeder pipe to change from one velocity to the other under changes of load as high as 50 per cent at least. This water should be supplied without drawing down the head in the pipe more than a few feet, and the pipe should be supplied with an overflow a foot or two above the level of the head water. When thus designed, the head will not vary greatly in the feeder pipe and a rapid and close regulation is obtained with perfect safety to the feeder. In northern climates great care must be taken to keep the standpipe open and free from ice in winter, and this is usually done by lagging and sometimes by the introduction of steam pipes into the standpipe. In several plants installed with no protection to the feeder very grave defects have been overcome by adding this pipe after the plant had been in operation. If the feeder is almost vertical at the power house and then has a long portion with little slope, a much shorter pipe can be put at the beginning of the drop with very good results.

Where the head is so great that a standpipe is not practical, it is sometimes possible to arrange a by-pass that opens as the gates of the turbine close. There is no objection to this in places where the water is used for irrigation and must be supplied whether used by the wheel or not. With this device operated by the governor the velocity in the feeder remains constant and regulation is very simple. It is not, however, economical where it is desired to store the water, as in many plants where water is scarce.

In such cases the pipe is protected against the rise in pressure by adding relief valves which keep the pressure within a few feet of the normal head, but nothing can be done to accelerate the water when the gates open. Those operated by hydraulic pressure regulators are very satisfactory, but whether of this type or of the spring type they should be tested at least once a day.

Mr. Webber's paper is a record of a series of consecutive tests under uniform conditions of four water-wheels, with the same apparatus and the same observers, to determine their efficiency, and ascertain the effects of corrosion and wear upon the relative efficiency of the wheels; also to determine whether more modern wheels would show greater relative efficiencies, and whether it would be more economical to operate all of the wheels at part gate all of the time, or some wheels at full gate part of the time.

The tests, which were made on wheels of the mixed inward and downward flow type, are instructive because of the wide range of speeds and gate openings covered systematically and consecutively. They show conclusively that water-wheels should be run at the speed for which they are designed under any given load; that modern wheels, with coarser buckets having a spoon-shaped discharge depending below the guide ring of the wheel, and with the outer periphery of the bucket at discharge of greater diameter than the bucket at entrance, would give much more power, higher speed, and greater efficiencies from the same water than from wheels of older design without these modern improvements.

Oil Required for Lubrication.

By Charles N. Bain.

Not infrequently engineers are approached by oil agents who claim that wherever their oil is used only one drop per minute is required to lubricate an engine regardless of speed, load or pressure and condition of steam. Since there may be some question as to exactly what is meant by one drop per minute, the writer presents some ideas that naturally are suggested by a consideration of this important subject in connection with long experience along these lines.

Fig. 1 shows a single connection lubricator in use on a pump. This lubricator works as well as others having double connections although the latter type of lubricator usually proves more satisfactory in practice. When the sight feed glass is filled with water according to common practice, and the feed started, each ascending drop of oil has a diameter equal to the inner diameter of the glass, resulting in a large drop. This, however, is unsatisfactory, since the oil moves slowly and leaves small particles clinging to the glass. Better results will be obtained if the plug is removed, the glass cleaned and the water replaced by glycerine. The drops of oil will then be smaller and follow each other in rapid succession, as shown by Fig. 2. One of the drops of oil as illustrated in Fig. 1 is equal to about six of those shown by Fig. 2, so that the one drop a minute argument will not hold.

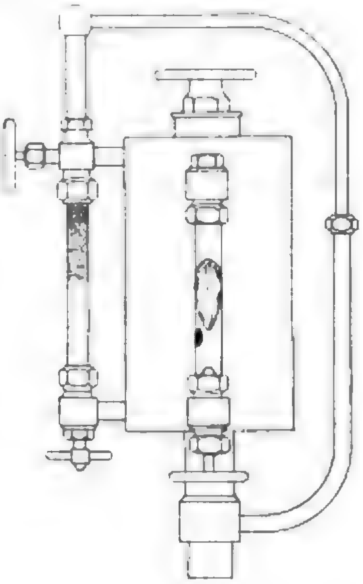


Fig. 1.

Fig. 3 illustrates a lubricator in which there is neither glycerine or water, the oil dropping from above to the steam pipe through the lower connection. The sight feed glass is filled with steam, and owing to this fact it is possible to regulate the feed of the lubricator by the valve above the sight feed glass; but more attention is required in the regulation because the oil being at a temperature above that of boiling water will go through a very small opening, making it necessary to keep the regulating valve almost shut. It is impossible to feed large drops of oil through such a lubricator because if the feed is increased the oil flows in a stream and not in drops. The writer had such a lubricator in use near a window where in winter the location is quite cold; but on account of the principle which caused it to operate it was not entirely satisfactory,

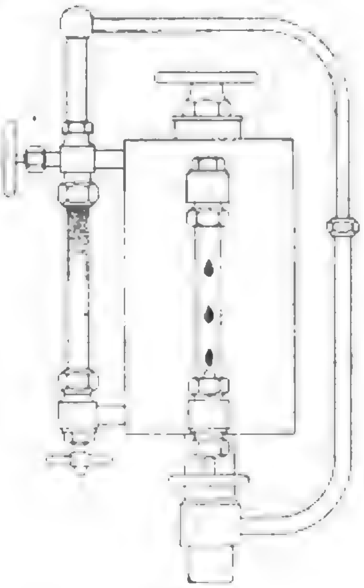


Fig. 2.

and a lubricator like that shown in Fig. 4 was substituted. In this lubricator the oil ascends in large drops, each of which is four times as large as that delivered by the lubricator illustrated in Fig. 3.

Another point to be considered in this connection is that one drop of a certain oil per minute may be sufficient for an engine, while two drops of another oil may pass through in the same time, although both feed a pint of oil in ten hours. This is due to the fact that some oils will rise in larger drops than others under exactly the same conditions. When making comparisons of this kind, care should be taken to know that the conditions are alike, as some engineers ignore small differences which may or may not give different results.

The sight feed glass in Fig. 5 is located so that it is shielded from the direct radiation of heat from the steam pipe, consequently the water standing in this glass is not very hot, making the drops of oil large accordingly.

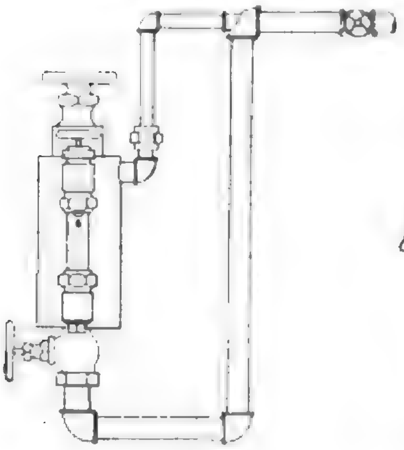


FIG. 3.

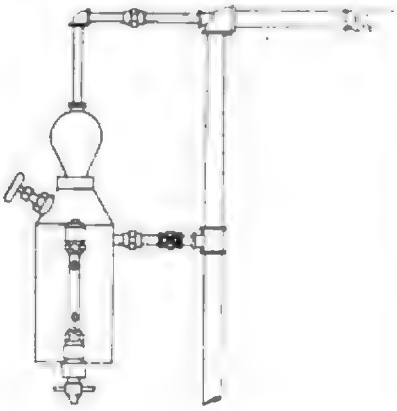


FIG. 4.

In Fig. 6 the sight feed glass is close to the steam pipe, hence the drops are smaller than they otherwise would be. If these two lubricators were located in comparatively cool places, this difference will be more marked as the glass nearest the steam pipe will be comparatively warmer than if both were placed in a very hot room.

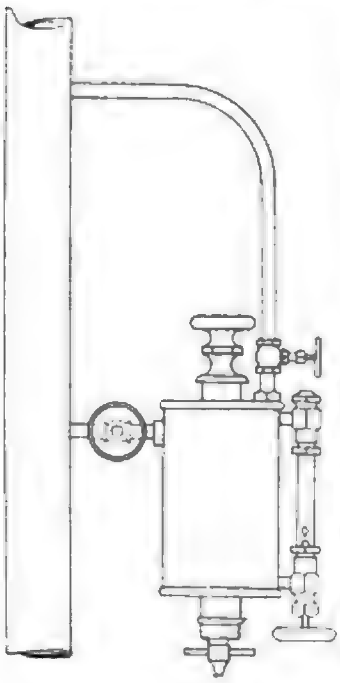


FIG. 5.

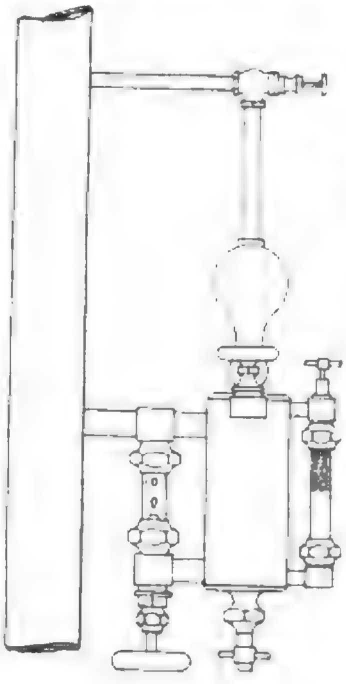


FIG. 6.

Fig. 7 illustrates a lubricator in which it is impossible to tell how large the drops are, because they slowly pass between the little round sight feed glass shown, and a nickel-plated reflector placed directly behind it. The brightness of this reflector is clouded for a moment as the dark colored oil passes over it, but this gives only a faint idea of the size of drop which is passing.

Fig. 8 illustrates a lubricator that was located in a place that was cool on winter mornings, but later in the day became much warmer. It is plain that cold oil requires much more pressure to force it out through a sight feed nozzle, than warm oil. On a cold morning the valves, 2 and 3, should be opened, and valve 4 closed, thus making available the high column of water in the condenser pipe; but on a warm day it is difficult to regulate the feed as desired, on account of the pressure. It is then proper to close valves 2 and 3, and open valve 4 thus reducing the pressure forcing the oil through the delivery valve 5. In this connection it may be well to state that the only pressure operating to force the oil into motion, is the unbalanced pressure due to a column of water standing above the body of oil in the lubricator; therefore it would feed just as well if the machine were not connected to a steam pipe, provided the stand pipe be kept full of water.

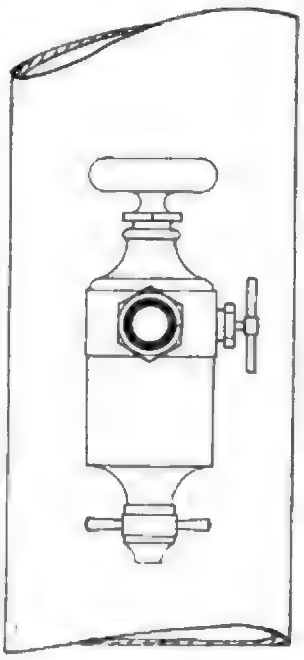


FIG. 7.

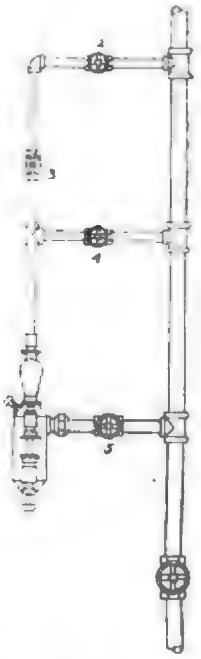


FIG. 8.

Another fallacious statement made by some oil agents is that one drop of oil per minute will lubricate any style of engine without regard to design. Several years ago the writer had charge of a Corliss engine, which if not given sufficient oil would grunt and groan at the valves, although the piston emitted no sound. In contradistinction to this the writer is at present operating an engine fitted with double beat poppet valves which require no lubricant at all, and during 12 years of service the piston of this engine never gave a sound, although some days it received but a small quantity of oil. It is not sensible to claim that the same quantity of oil is sufficient for both of these engines, although they are nearly the same in size and have practically no difference in the piston speed.

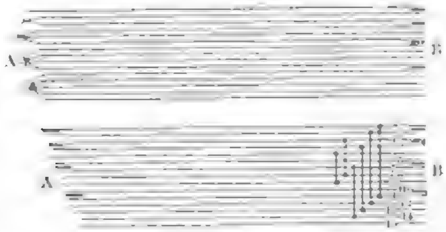
A certain engine was fitted with unbalanced, semi-rotary valves that worked hard, requiring thorough lubrication. An oil agent sold the proprietor cylinder oil one drop of which was guaranteed to lubricate this engine for one minute. The engineer found that two or three drops were needed to secure satisfactory results, but the proprietor would come into the engine room and reduce the feed to one drop. The result was a battle of words in which the engineer was victorious, after which he used his best judgment about oiling his engine without interference from his employer. If an engineer is not competent to decide on the quantity of oil required for his machinery, he cannot be considered a proper man to have charge of a plant, therefore a better engineer should be secured for the place, and given full charge of it. One of his duties consists of deciding how much oil each engine under his care requires, as no cast iron rule can be laid down for this purpose.

LETTERS ON PRACTICAL SUBJECTS.

A METHOD OF TESTING OUT AND NUMBERING WIRES.

In these days of many conduits and cables it is sometimes desired to identify wires at both ends of long conduits or cables when reliable assistance and suitable signaling apparatus are not at hand. The method outlined below has been devised and put to practical use by the writer with satisfactory results. In use it does not prove as complicated as would appear by an inspection of the sketch. With almost any number of wires it is only necessary to make one trip to the distant station to identify every wire.

Commencing at station A, Fig. 1, the wires are connected together in groups, as shown, each group containing one more wire than the preceding one. Proceeding to station B, the ends are carefully separated so as not to be in contact with each other at any point. Taking any suitable testing instrument, as a bell and battery, magneto, or galvanometer, a test is made between any one wire and all the others remaining to ascertain the members of that particular group. By this means the wires are readily separated into groups corresponding to those at station A. The wires can now be numbered, commencing with the separate wire, and numbering the wires in each group in the order shown.



FIGS. 1 AND 2.—TESTING AND NUMBERING WIRES.

It is now desirable to make a sketch as shown at Fig. 2 One wire from each of the smaller groups is connected to a wire in the largest group, and such other connections as are necessary are made between the intermediate groups, being careful not to have more than one wire in any group connecting any other one group. Proceeding to station A, the groups are kept separate by tying a string or wire around each group. The ends are then disconnected, and taking any wire in any group, test until the only other wire connected with it is found The diagram will indicate what number should be placed on each wire. For instance, if we find a circuit between a wire in group 2 and group 5, the diagram shows that the wire in group 2 should be numbered 2, and the wire in group 5 should be numbered 12 The two wires connecting groups 3 and 4 are shown to be 5 and 9 respectively. Those not connected, of which there must not be more than one in each group, are also indicated by the diagram.

Philadelphia, Pa. Leslie Griscom.

QUESTION IN THE PARALLEL OPERATION OF ALTERNATORS

Many of the accidents which occur in power plants escape investigation especially if the results have not been particularly disastrous to the machinery or have not disturbed the system to any great extent. Yet it is often these minor disturbances which are instructive and their study brings out many interesting points. The plant in which the following accident occurred has an output of 15,000 horse power, the generators being 3,000 volt two-phase machines direct-driven by the engines. The generators operate in parallel and are excited from a common bus to which are connected four engine-driven 220-volt compound-wound exciters of 75-kw capacity each The first intimation of trouble was the sudden diminution in the intensity of the light given by the lamps, these gradually becoming dimmer and dimmer until they were finally extinguished. There was no flashing or noise to indicate where the trouble lay; but one of the exciter ammeters indicated a short-circuit on the direct-current system. Several minutes were spent in darkness inspecting the several exciter units scattered about the place until one was found that was not running at all due to the breaking of a valve stem. This machine was still connected to the bus-bars; but when the breaker was opened the lamps on the alternating-current system began to brighten up and the alternators pumped violently. Fully a minute had elapsed before the full voltage of the system was restored and the machines were again running quietly, and during that time four of the breakers had opened.

The puzzling part of the matter was what kept the machines in step during the period in which the system was practically dead, as indicated by the recording instruments. The exciter breakers are not automatic in this plant, it having been found preferable to allow the operator to use his judgment in opening them in case of trouble, than run the risk of permitting the breakers to open on a momentary short circuit. To those who have never experienced trouble of this kind, the problem should prove both interesting and instructive. The writer is of the opinion that the machines were not in step during the short circuit and were forced together as the exciters slowly built up their field excitation; but would be pleased to have the opinion of others on this matter.

New York. Lewis C. Reynolds.

PECULIAR BEHAVIOR OF INCANDESCENT LAMP.

Referring to Mr. C. A. Carpenter's trouble with an incandescent lamp as noted in the April 7 issue, I would suggest that this particular lamp which flickers while the others burn apparently steady, is adapted for a 55-volt circuit instead of a 52-volt circuit; and I believe that if he would burn his lamp on a circuit of higher voltage the flickering will disappear. The cause of his trouble is poor regulation which affects the candle-power of the higher voltage lamp to a greater extent than it does the other lamps which are designed for 52 volts. In the process of manufacture it is impossible to make all lamps come out at the voltage aimed at. The lamp while possibly marked 52 volts is better adapted for a circuit of higher voltage. If the main supply drops to 51 volts, the 52-volt lamps will not suffer the same decrease in candle-power as the lamp intended for a higher voltage, and greater drops in voltage affect the high-voltage lamp still more.

Philadelphia, Pa. W. D. C. Dodge.

With reference to Mr. Carpenter's flickering lamp, I would suggest that he examine the lamp closely for defects. I had a somewhat similar experience some time ago with a lamp having a T.-H. base. I examined the lamp and found that the screw cap of the base was loose, and had cut the leading-in wire at the point where it was soldered to the cap. Possibly Mr. Carpenter's flickering lamp has a somewhat similar defect.

Iron Mountain, Mich. R. C. Lindahl.

THE ECONOMICAL PROVINCE OF ELECTRIC HEATING

The conditions and circumstances which determine the value of electrical energy as a source of heat are matters that have received the attention of the writer for a long time In every line of industrial enterprise there is a common goal toward which all must converge. It is not the sole aim of the central station man to grind out kilowatt-hours regardless of the methods employed or the apparatus made use of; if it were, many would be using the primary battery or the "thermo infant." The kilowatt-hour the finished product—has a particular value no matter how obtained, and this value is neither enhanced nor diminished by such things as the personal equation or the methods employed in its production The same laws and the same generalization apply to the production of heat. Long before the present generation the patient investigation of Joule had given the world a measure of the quantity of heat and a simple means of comparing a given quantity of heat with mechanical effect; demonstrating that a certain quantity of one was equal to a certain quantity of the other. Joule's experiments indicated that 772 foot-pounds was equivalent to one thermal (Fahrenheit) unit and this was long accepted as the mechanical equivalent of heat until a more exact determination made by the late Prof. Rowland, of Baltimore, established this value at 778 foot-pounds.

The relation between the heat unit and the foot-pound having been established, and the relation between the watt and the foot-pound being known, it is easy to express the heat unit in terms of the watt. This done, we are in a position to investigate the heating problems using the kilowatt-hour in the case of electricity as our unit of measure and the familiar ton when obtaining heat by the direct combustion of coal. We will make the price of the ton of anthracite coal $6.50 and the price of the kilowatt-hour at 10 cents; 1,0548 ÷ 3,600 watt-seconds = .0293 watt-hour = .0000293 kilowatt-hour = 1 heat unit. Calling the thermal value of our coal 14,500 heat units per lb. we obtain 14,500 × 2,000 = 29,000,000 heat units in one ton of coal, and multiplying the electrical equivalent of 1 heat unit by 20,000,000 × .0000293, we obtain 840.7, which, figured at 10 cents per kilowatt-hour gives $84.07 as the cost of a quantity of heat which can be obtained for the price of $6.50 by the direct combustion of good anthracite coal.

This article was suggested by reading a short item in the March issue of the ELECTRICAL WORLD under the heading of "Power in the Home." It is highly probable that the financial aspect of the matter had not received serious consideration and it is earnestly hoped that the economical side of the matter will be considered at least before electrical heating bills with exponents begin to come in.

The electrical heating of street cars is admissible and even necessary for good reasons; the practice of heating cars by stoves is too hazardous to even be considered and steam for this purpose is not available as in regular train service. Moreover, street railway companies when supplying power for their own use compute the cost at not much more than the extra quantity of coal burned to produce the power needed for heating purposes.

Electric heating has its own particular sphere of usefulness, and in certain cases its adoption will prove very economical. The adoption of electricity for general house heating, however, is a bold departure, to say that it would be extravagant is putting it mild. For such service as heating flat irons, soldering irons, etc., where only a small quantity of heat is wanted, and where it is very desirable that the heat shall be localized, electricity is the ideal agent for such work, as its use ceases as soon as the allotted work is performed. With the combustion of fuel (gas excepted) there is more or less waste because the combustion is allowed to go on when the heat produced is not needed, and in many instances this waste heat serves to make the surroundings uncomfortable. Apart from the heating of street cars (and other electrically-driven cars as well), electricity has a wide and extensive field of usefulness in electric welding, and in connection with the manufacture of such articles as calcium carbide, carborundum, etc.

The intense heat obtainable by electrical means only, bringing about the union of many metals dissimilar in character and effecting fusions of the most refractory substances. Without this potent agency several of our leading industries would not be commercial possibilities. The fact that electricity cannot be used economically for general heating should not discourage those that appreciate its very desirable features apart from the matter of its increased cost. It is only within recent years that the dynamo has attained commercial importance. Time was when entire dependence was placed on the wasteful and expensive primary battery. Who knows but what future discoveries will place the production of electrical energy on a basis as far in advance of the present, as the present is in advance of the past?

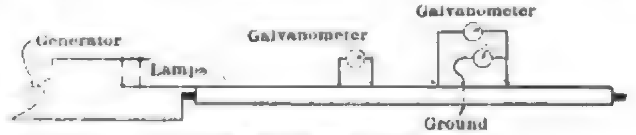
NORTH ADAMS, MASS. T. H. REARDON.

LOCATING GROUNDS IN CABLES.

In using the Varley or Murray loop test for locating grounds in cables, the results are not satisfactory, due to faulty resistances in the conductors and to the difficulty of making perfect connections for the test. In lead-covered cable a ground or grounds between conductor and lead or conductors and lead can be located exactly, in the following manner:

Connect the lead sheath to one side through an adjustable resistance (lamps can be used) and the copper to the other side of any direct-current circuit and regulate the resistance so that two or three amperes will flow through the lead, the short-circuit and the grounded conductor. Use a galvanometer with leads having sharp metallic points for contact terminals and place the contacts a few feet apart on the lead sheath.

When there is a deflection on the galvanometer the testing connection is at some point between the connections to source of current and fault. When the fault is passed, there will be no deflection on the galvanometer. This may be done in different manholes until the nearest two points which can be reached, between which the fault is located, are found.



LOCATING GROUNDS IN CABLES.

If the fault should be located at a point in a duct between manholes or where the cable cannot be reached, the section between the two manholes or points where the fault has been located must be pulled out and the same galvanometer test made every few feet, as the cable is being placed on reel, until the exact point of the fault is located.

In case of a foreign current flowing in the lead sheath due to defective return conductors of street railways system, etc., there may always be a deflection on the galvanometer. In such cases the test current may be cut in and out during each test, and if the galvanometer needle swings, the testing connection is at some point between the source of the test current and the fault, if the deflection of the galvanometer is constant, the fault has been passed.

The Gerard method, using an induction coil and a telephone receiver, gives good results when the distance between the surface of the short-circuited conductors is not less than 5/16 of one inch. This method is not very satisfactory in places where the cable is located near an external and variable magnetic field, which will induce currents in the coil connected to the telephone receiver.

PITTSBURG, PA. GABRIELE D'EUSTACHIO.

WIRING AND MAINTENANCE OF SHUNT AND COMPOUND-WOUND MOTORS.

In the article on "The Wiring and Maintenance of Shunt and Compound-wound Motors," which appeared in your April 7 issue, the author's method of determining the size of wire necessary to feed a motor of a certain size is not strictly correct. The Underwriters require motors to have a name plate giving the maker's name, the capacity in volts and amperes, and the normal speed in revolutions per minutes. The motor leads or branch circuits must be designed to carry a current at least 25 per cent greater than that for which the motor is rated, in order to provide for the inevitable occasional overloading of the motor and the increased current required in starting without overfusing the wires; but where the wires under this rule would be overfused in order to provide for the starting current, as in the case of many alternating-current motors, the wires must be of such size as to be properly protected by these larger fuses. All that is necessary, therefore, is to note the rating in amperes on the name plate and install wires which will carry that amount of current plus at least 25 per cent overload, preferably more. Many motors, however, are rated in horse-power, in which case the volts are given but not the amperes. It is necessary, therefore, in such cases to take into consideration the efficiency of the motor, and this is what Mr. Kavanagh overlooks, since his calculations are based on the assumption that the motor cited has an efficiency of 100 per cent, which is, of course, not true. The size of wire will, therefore, be too small. In the case cited by Mr. Kavanagh the wire with 25 per cent overload allowance would be No. 0 and not No. 3. The Underwriters inspectors have a quick method of determining the size of wire for a motor rated in horse-power. If the voltage is 110 and the motor is rated at 10 horse-power, the inspector multiplies 10 by 8 and increases the product 25 per cent, making the final number 100; he then refers to his table and notes that the proper wire is No. 1. If the voltage is 220, the multiplier is 4 instead of 8 and so on; so that if one has a 30-hp motor to be connected to a 220-volt circuit, it is only necessary to multiply 30 by 4, increase the product by 25 per cent, and find that a No. 00 wire will just pass. It would be better, however, to install at No. 000 wire in this case.

Newburgh, N. Y. C. N. Jones.

PEAT AS FUEL IN CENTRAL STATION OPERATION.

At this time, when there is so much interest centered in the outcome of the negotiations between the coal miners and operators, we thought that it might be assuring to the public, and to the users of power especially, to know the progress recently made in the manufacture of peat fuel near Fond du Lac, Wis., by the Lamartine Peat, Light & Power Company. The first problem was to remove the peat from a submerged bog by machinery. This has been worked out by forcing down a steel cage 18 in. by 36 in. by 8 ft. long, which will remove one ton of peat every 60 to 90 seconds. The second difficulty was to get a machine to work the peat and bring out the binder or adhesive quality when worked in a wet state direct from the bog. One of the best makes of brick machine was installed, but no peat would pass through the die. Castings were moulded from different patterns and tried until the desired result was obtained, when the company got up an entirely new machine that will turn out 120 tons of crude peat in ten hours. The peat as it comes from the machine is placed on racks under open sheds for natural drying. The product contains about 10,781 B.t.u. and sold readily in the city of Fond du Lac last winter at $6 per ton for domestic use. This fuel can be manufactured f.o.b. at the plant for $1 20 per ton.

Fond du Lac, Wis. Lamartine Peat, Light & Power Co.

SIX-PHASE POTENTIAL REGULATORS.

This is an account of a method, recently tried and found convenient, for selecting the proper primary terminals to be connected to the respective phases of the main six-phase circuit of a potential regulator in cases where the marks (if any) put on when the regulator was shipped from the manufacturers have been lost or defaced, as may occur in making changes in the original installation, moving apparatus to other locations, etc. The number of such cases which have arisen and the delay and trouble involved indicate the need of such a method.

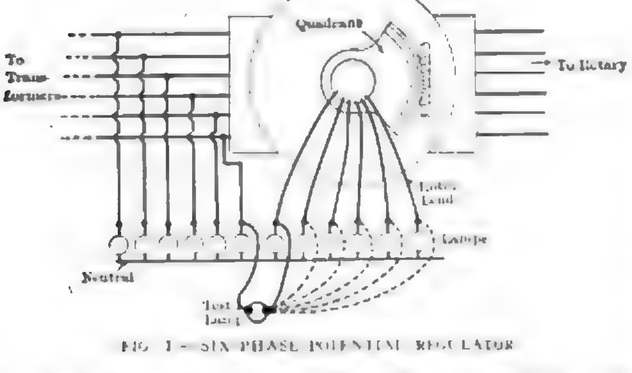


FIG. 1.—SIX-PHASE POTENTIAL REGULATOR.

The regulators referred to are of the "induction" type, commonly installed in connection with rotary converters and static transformers. The shunt or primary winding is on the rotor and the series or secondary winding is on the stator. The flexible leads connecting the primary to the secondary may easily be traced through the windings in some types, showing their phase relation; in other types this is not the case, and it is with these latter types that this method of test is needed.

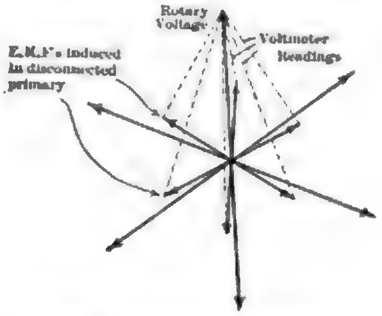


FIG. 2.—DIAGRAM OF E.M.F'S.

It is assumed that the rotary converter static transformers and the secondary of the regulator are properly connected to each other that the rotor is in place properly keyed to the quadrant by which it is to be turned; and that the six primary terminals, are disconnected from the main circuit.

In the method here suggested the procedure is as follows: Turn the rotor to either end of its travel. Suppose it is desired to make the end selected the "maximum boost" position, the other end of the travel being the "maximum lower" position. Insulate the primary terminals from each other and from the frame. Make a six-phase star connection of lamps of equal voltage and candle-power, as shown in Fig. 1. Connect the center of this star to the neutral of the system. If the rotary converter is being operated on a three-wire, direct-current system with a grounded neutral, it suffices to ground the center of the star. If there is no neutral one may be made either on the direct-current end or the alternating-current end of the rotary converter with lamps all of the same voltage and candle-power. Fig. 1 shows a neutral formed by another six-phase star connection.

With the primary coils of the transformers open, start the rotary converter from the direct-current end and run the machine with full field and with all of the starting resistance in circuit, in order to obtain the lowest possible speed with full voltage on the armature. Exciting current now flows from the rotary converter through each phase of the primary winding of the regulator which is in circuit with a coil of the transformers. These small six-phase currents set up a rotating field in the regulator and the six-phase electromotive forces induced in the primary winding of the regulator will usually be high enough to light the lamps of the star connection. A diagram of these electromotive forces is given in Fig. 2. Connect an alternating-current voltmeter or a test lamp from one secondary terminal to each of the primary terminals in turn, noting the readings of the voltmeter or brilliancy of the test lamps. The dotted lines in Fig. 2 represent these readings and show their relative magnitude. The primary terminal giving the least voltmeter reading is the one to be connected subsequently to the secondary terminal chosen. Repeat this operation with each of the secondary terminals.

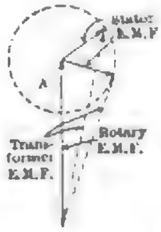


FIG. 3.—TRANSFORMER VOLTAGES IN DIFFERENT POSITIONS.

If the position in which the rotor is placed is to be made the "maximum lower" position instead of the "maximum boost," then substitute "greatest voltmeter reading" for "least voltmeter-reading" in the above directions.

Now bring the rotary converter to rest, and connect the primary terminals properly to the secondary terminals. During normal operation with the rotor in the "maximum raise" position, the direct voltage should be a maximum for a fixed transformer voltage; but in this test the direct voltage is fixed so that the transformer voltage is a minimum when the rotor is in the "maximum raise" position and should rise continuously as the rotor is moved toward the "maximum lower" position. Suppose that it first decreases a small amount before beginning to increase. Note the distance the quadrant has traveled when the actual minimum alternating voltage occurs; if it has moved less than one-sixth of its whole travel, then the only remedy is to move the quadrant back to its "maximum raise" end, keeping the rotor in the position of actual maximum raise; this of course would require a change in the keyways on the rotor shaft and quadrant. Fortunately the defect is usually small enough to be neglected. If the above distance is between one-sixth and one-half of the whole travel, shift each primary terminal to the next secondary terminal toward the "maximum raise" position; that is to say, if the rotor turns clockwise in going from "maximum lower" to "maximum raise," then the primary terminals should be shifted clockwise; the primary terminal originally on the clockwise end is put on the counter-clockwise end, that is each terminal is shifted one phase clockwise.

This rule assumes that the secondary terminals are in the same relative position as their respective coils, which is usually true.

If this trouble occurs at the "maximum lower" end instead of the "maximum raise" end, substituting "lower" for "raise," "maximum" transformer voltage for "minimum," etc., in the above directions.

The above distance will not be as much as one-sixth of the travel if due care is taken in the original test.

The effect of the defect is to cut off part of the range, as is shown in Fig. 3. If the line, *H*, is made equal to the alternating rotary voltage and the radius of the circle is made equal to one half the range, then the dotted lines are equal to the transformer voltages in the different positions.

The quadrants are usually built to give not more than 90° rotation in space, in a 4 pole regulator, which is the common type, corresponding to 180 electrical degrees and to 180° rotation of the radius in Fig. 3. Hence if the actual maximum occurs before the end of the quadrant is reached, part of the range at the other end of the travel is lost.

New York. Humphreys Milliken.

THE SOLUTION OF A PROBLEM IN CHIMNEY CAPACITY.

Some months ago the writer had occasion to install a boiler of 248 rated horse-power in a contracted space in a large manufacturing building, where the stack capacity was inadequate. The conditions were so unusual that it was doubtful whether successful operation of the boiler could be attained, although calculations indicated that it would. A Worthington water-tube boiler having a grate area of 65.35 square feet and a heating surface of 2,226 square feet was employed and was fired through three doors from the side. The boiler room was located under the sidewalk, and after the boiler was installed there was only enough room left for stoking and for a six hours' supply of coal. There was absolutely no means for ventilating the space. The area of the stack was 19 in. by 19 in., while the smoke opening at the top of the boiler, which was properly designed, was 26¼ in. by 9 ft. Some form of forced draft had to be employed, but to apply the draft under the grates would have been useless. The constricted stack area would force the gases in the fire-box through the fire door and out into the boiler room which would, of course, become uninhabitable; and the fire front and doors would become warped and cracked by the flames. Induced draft had to be rejected on account of the peculiar space conditions. The only available spot in which to locate the blower was also used as a cold storage room and the heat from an induced draft blower was therefore prohibited.

It was finally decided to make the boiler room air-tight and to force air into it with a steel plate fan. A direct-driven steel plate fan 4 ft. x 22½ in. equipped with a Ford regulating valve, was successfully employed. The cold-storage room was made cooler by the fan which drew cool air from without through the room. This was forced into the boiler room, making the heat in front of the boiler endurable. The boiler being under a pressure varying from three to five and one-half inches of water, no gases could escape into the boiler room; everything was forced up the stack. It was found possible to burn enough fuel under these conditions to obtain from the boiler a little over 300 nominal horse-power. The fire burned normally, and was such as would be expected with an ordinarily good stack having a draft of about ¾ in. The difference in pressure between the boiler room and the stack breeching in all probability did not exceed this figure. The difference in pressure between the products of combustion in the stack and the outside atmosphere was considerable, as was evidenced at the top of the stack where the gases shot some 10 ft. into the air before being carried away by the winds. It was also found that owing to leaks in the stack the surrounding rooms were quickly filled with the products of combustion, so that the stack had to be carefully gone over, the leaks stopped, and the stack sheathed. It is not the intention of the writer to recommend the foregoing as good engineering. It is simply an expedient into which he was forced by the conditions. The installation was of a temporary character and will probably remain for only a year or two pending the construction of a larger and modern boiler room. The stack which was employed was built into the walls of the building and could not be enlarged, nor could a new one be constructed without great expense which the owners did not think justifiable.

New York. G. T. Hanchett.

A COMMON FAULT IN POWER PLANT DESIGN.

The study of electrical power plant design is always a matter of interest to the engineer whose practice lies in the central station or isolated plant field. A careful analysis of the conditions surrounding each new installation generally suggests arrangements worthy of both imitation and avoidance, because the choice and disposition of equipment is in at least nine cases out of ten a compromise between conflicting requirements. In few plants are conditions duplicated, and methods undesirable in one may not be contrary to good practice in another; but with a clear understanding of the reasons governing a particular design much may be learned as to the proper course in other cases.

As a general rule, the practice of operating incandescent lamps and large motors upon the same bus-bars is of doubtful wisdom, and in view of the years of operating experience upon which designers of power plants may build, it is certainly surprising that so many defective installations are still in vogue. In some recent office building designs, the conditions in this respect are so bad that only the corridor lamps can be supplied by the plant on the premises, the fluctuations of half-a-dozen electric elevators rendering it necessary to resort to central station current. The load factor of the plant in such cases is largely a matter of the afternoon or evening peak, and the economies of operating on a good all-day average output are missed entirely. The relative costs and advantages of isolated plant versus central station service furnish the basis of a ceaseless discussion; but when an owner has committed himself to either plan, there is no doubt that the broadest economy lies in making the most of the means at hand. To divide the load between a power plant on one's premises and the local central station is therefore objectionable from the standpoint of efficient operation, for it means a large investment in idle equipment throughout the greater part of each day.

In a recent isolated plant installed for restaurant service, the lighting is worked out by the use of 16-cp 220-volt lamps, about 500 being connected to the circuits. Only one motor is used with the exception of fans in the summer season, but this motor is of 15 hp rating and it drives a freight elevator which is in constant use. As there is no separation of circuits it naturally follows that every time the motor starts the lamps flicker slightly on account of the momentary drop in speed of the engine and the consequent drop in voltage together with the rapid cooling of the thin filaments in the bulbs. The motor requires 40 amperes in starting under load and the voltage drops about 5 points each time the elevator is moved. Five volts in 220 is only about 2.3 per cent, but with the sensitive filaments used in 220-volt lamps this is enough to render the quality of light poor.

The generating plant consists of two machines rated respectively at 35 and 25 kw, and ordinarily the smaller one is operated in the daytime, the larger unit being held in reserve to handle the evening peak. Both dynamos feed a common pair of bus-bars, and the regulation is good as the load changes, the temporary fall in speed as the elevator is started lasting but a fraction of a second—just long enough, in fact, for the voltmeter to swing backward 5 volts and return to its original position. With 110-volt lamps the flickering would scarcely be noticed, but the use of 220-volt filaments is a different matter.

In the modern restaurant the attractiveness and steadiness of the lighting is an important factor in the retention of custom and no establishment of this kind can really afford to maintain lamps of irregular brilliancy.

In the case under consideration, the remedy is not far to seek. Considering the peak loads of restaurant "traffic," it would hardly pay to install a storage battery in this instance, or to rearrange the switchboard wiring to separate the loads. The simplest plan would naturally be to limit the hours of operation on the freight elevator; but as this is hardly possible it should be an easy matter to run leads from the elevator motor to the idle unit, disconnecting this unit from the switchboard and lighting circuits during the hours that the restaurant load is heaviest. As the elevator is in constant service the load upon the otherwise idle unit would be tolerably even and the advantages of thus smoothing out the flickering by supplying the light and motor loads from separate machines would be sufficient to establish thoroughly good service in all parts of the restaurant. To a certain extent the remedy is a makeshift, but in small plants the operation of lighting and power loads on the same bus-bars is never ideal practice.

Boston, Mass. James K. Reid.

ROTARY CONVERTER COMMUTATORS.

In the sub-station of to-day the operation of the rotary converter is of prime importance, as it is the connecting link between the alternating-current transmission system and the local direct-current distribution. Perhaps the most important points, requiring consideration in the operation of the rotary converter, are the care and vigilance necessary to keep the commutator in a condition consistent with the proper performance of its duties and with the maintenance of the general appearance of the installation of which it is a vital part.

Many papers have appeared in the electrical journals from time to time, treating of the commoner causes of commutator troubles, particularly those met with in the operation of motors and dynamos, such as unequal wearing of copper and mica, eccentrical commutator, unequal magnetic distribution, coils open or short-circuited, excessive voltage, vibration, and so forth, but little has as yet been written upon the care of rotary converter commutators in particular.

No attempt will be made to demonstrate the superiority of carbon brushes over those of copper as brushes of the latter type are entirely out of place in a rotary converter installation. The bad effects due to accidents, such as cutting a rotary in out of step, short-circuits and so forth, and also hunting, will be omitted for obvious reasons.

That cleanliness is a very important factor in sub-station maintenance is universally acknowledged by operating engineers, and it is safe to assert that nowhere else will the records show such large returns as for the time and patience spent on keeping the commutator clean.

The equipment of every sub-station should include an air compressor capable of maintaining a pressure of 60 lb. to the square inch, or more at the nozzle and should be motor operated, with the switches and starting box located conveniently for the operator.

At the end of each run the rotary should be thoroughly cleaned out by means of the air compressor, special care being taken to free the brushes and holders from the copper and carbon dust accumulated during the run.

In mixed sub-stations, that is, in stations with apparatus other than the rotary converter and its accessories, the practice of covering the rotary with a tarpaulin or other covering, cannot be too highly commended, but in the pure sub-station the aim should be to keep the station and apparatus so clean and free from dust that a covering would be entirely unnecessary.

While a strict regard for cleanliness will without doubt win half the battle, there are still a few other particulars which have to be taken into account before one can expect the commutator to operate entirely satisfactorily.

Very frequently the carbon brushes are themselves the cause of trouble, and extreme care should be taken in the selection of the brushes to see that all are of a uniform quality. Perhaps the best method of checking their selection is to watch the rate of wearing away of those brushes which have been put into service at the same time and under similar conditions. An examination should be made of all those which appear to wear at a slower rate than the average, and all brushes having a hard glazed surface or those badly pitted should be discarded.

At regular and frequent intervals the brushes should be sandpapered to remove any unevenness caused by inherent sparking, hard spots or other causes, and to provide a good bearing surface on the commutator.

The usual and perhaps best way of doing this is to slip a piece of sandpaper under the brushes without disturbing the tension springs, and with the plain side of paper pressed against the surface of the commutator, move the paper backward and forward in the direction of rotation of the commutator until assured of a good contact between the two surfaces.

Another very common cause of trouble—a sticky commutator—should be guarded against by keeping all parts of the machine clean, as already mentioned, and by restricting the use of commutator compounds to those known from experience to be harmless.

That the relative distribution of the positive and negative brushes over the surface of the commutator is largely responsible for the grooving of the commutator has only lately been proven.

The general practice in most sub-stations has been to stagger the positive and negative brushes so that the spacings between the several brushes of one polarity mounted on one holder are in line with the centers of the several brushes of opposite polarity mounted on the next holder. The intentions are to have the brushes so placed that the entire width of the commutator is subject to the wear of the brushes.

The above arrangement, together with a suitable amount of end play, would seem to be the ideal condition, and would be but for one reason. It is apparent that the brushes of like polarity are all in line; in other words, the positive brushes would tend to wear a series of rings, or grooves, in the commutator entirely distinct from those made by the negative brushes. Now, it is found in practice that while the brushes of both polarities are operating under like conditions, that at the point where the current leaves the commutator, or under the positive brushes, the commutator is worn at a greater rate than it is at the negative brushes.

The solution of this problem is to stagger the positive and negative brushes in pairs, and distribute the pairs evenly over the surface of the commutator; that is, in a six-pole machine there would be three pairs or sets of brushes, each pair consisting of a positive holder with its several brushes and a negative holder with its brushes, each brush of one polarity having a brush of the opposite polarity exactly in line with it.

It is safe to assert that with a reasonable amount of care combined with the proper arrangement of brushes, and with a slow oscillating motion of the armature produced by an efficient end play device, that the heart of the rotary converter attendant will be gladdened by the presence of that bluish, or bronze glazed surface on the commutator which is so pleasing to the eye of the engineer.

Riverton, Wash. A. B. Case.

QUESTIONS AND ANSWERS.

If I take a standard 220-volt motor and feed it with a variety of voltages from a balancing transformer, say 40, 80, 110 or 160, would this damage the machine and would the machine give the same horse-power at the different voltages? J. T. S.

You cannot obtain the same output from a 220-volt motor by reducing the voltage without correspondingly increasing the amperage, and to increase the latter means the destruction of your motor. The output will vary practically directly with the voltage.

We have a generator which has been shipped to us in an open car and which we believe has collected considerable moisture. Would there be any danger to the armature if the machine was started up at once at full potential? C. S. C.

Separately excite the generator with a weak current and run at a very low speed with brushes short-circuited. A large current at a low potential may thus be obtained which will dry out the armature in a few hours. Care should be exercised, however, not to permit this current to exceed the normal current of the machine.

Is alternating or direct current more fatal in its results, and what voltage is required to kill a human being? H. W. W.

Although alternating current is used for capital punishment, the effect of either alternating or direct current at ordinary voltages is practically the same. A sudden shock from either may suspend the animation or kill, but death from physiological action depends only on the current passing. Different individuals may withstand different current strengths, and the amount of current passing will depend upon the resistance of that portion of the human body in direct circuit, which resistance is largely localized at the surfaces of contact. This resistance may vary from a few hundred ohms to many thousand ohms, and for a fatal current the voltage will vary correspondingly.

What solution is used for nickel-plating and what would be the voltage of the supply? W. M.

The solution used in nickel plating is the double sulphate of nickel and ammonia. Twelve to sixteen ounces of this is dissolved in pure boiling water in a clean wooden vessel. After the solution has cooled, water is added until the density is about 1.03 to 1.06. The solution should be slightly acid or neutral. It will be necessary to add ammonia from time to time to replenish the solution when it is in use. From 3.5 to 6 volts is the potential required and .3 to .65 amp per sq. ft. of plating surface. Inasmuch as the solution is denser at the bottom than at the top, it will be necessary to reverse the plated article when the operation is about half completed, or else suspend the plated article longitudinally.

A central station supplies its customers with three-phase four-wire 50-cycle current at a normal secondary voltage of 25 volts between any phase and the neutral wire. Practically, however, the voltage varies between 119 and 106 volts, but generally it is between 128 and 134; 133-volt 3.5 watt lamps are used so as to give a reasonable life. Half of the time, of course, these lamps give an unsatisfactory light. The central station people will do nothing to keep the voltage steady. Could not a simple and not very expensive device be installed on the premises of two consumers which would keep the voltage steady on their premises? If so, where could such apparatus be procured and of what would it consist? A. H. B.

We do not know whether there is such a regulator as you desire manufactured or in use. One could, however, be made, employing a principle similar to that employed in the Tirrell regulator, only that instead of regulating the voltage of a generator by varying the field strength the regulator would vary the delivered voltage by varying the circuits of a transformer.

What is the voltage, size of wire and length of the longest power transmission circuit? (b) What is the length, voltage and size of wire of the highest voltage power transmission line? (c) What would be the necessary size of wire and the most economical voltage for a transmission line 250 miles long? W. W. W.

The longest transmission line runs from De Sabla to Sausilito by way of Cordelia, Cal., and is 232 miles long. The potential of this line is 60,000 volts, and the wire used is No. 00 hard-drawn copper, with a duplicate line of No. 0000 7-strand aluminum wire. This is not, however, a single line between two points. The longest continuous transmission line is from Necaxa to El Oro, Mexico, and is 171 miles long. The potential of this line is also 60,000 volts, and the conductor is 6-strand copper, ½ inch in diameter. We do not know of any transmission line working at a higher potential than 60,000 volts. The size of wire and the most economical voltage for a transmission line 250 miles long will depend upon the amount of energy transmitted, the cost of generating the energy, the price at which it is sold, the fixed charges and other factors.

I have a compound-wound generator running and wish to throw another compound wound generator in multiple with it. What is the proper procedure, and when both are running, how should one be shut down? E. N. N.

If one compound-wound generator is running and it is desired to place another in multiple with it, the procedure is as follows: Bring this latter machine up to speed and adjust its voltage as near as possible to the voltage of the other machine. Then throw in its circuit-breaker and close the three-pole switch. Note the ammeter reading to see whether the load is properly proportioned or not. If the other machine is taking too much load, throw resistance into its field regulator, or cut resistance out of the regulator of the machine just started. If this latter machine takes to much load, throw the regulators in the opposite direction. When cutting out one of the compound-wound generators, it will be necessary to throw in resistance in its field circuit until the load is very small. The circuit-breaker may then be opened, and then the three-pole switch, after which the engine may be stopped.

What is the action of the starting coils of the Holtzer-Cabot single-phase induction motor, and how do these determine the direction of rotation? R. H. S.

The Holtzer-Cabot motors are brought up to speed by an operation known as "splitting the phase." The stator is wound with two sets of coils, one known as the working coils and consisting of comparatively few turns of heavy wire which are in circuit continuously, and the other known as the starting coils. Current is simultaneously thrown on both sets of coils in parallel, and by reason of the difference in the self-induction, the currents in the two sets of coils will be out of phase with each other. The result is a sort of rotating field, and the rotor is dragged around with accelerating velocity until it attains normal speed, when the starting coils are cut out of circuit. The direction of rotation is dependent upon the mechanical position of the starting coils and the polarity sequence, the rotor revolving in a direction from that portion of a pole not surrounded by a shading coil toward the shaded side of the pole, or in other words, if the shading coil obtains a like polarity as the working coil but after the working coil, the rotor will revolve in that direction.

We would be obliged if you would inform us wherein the Burke three-wire generator differs from the three-wire generators already on the market. J. E. L. Co.

The three-wire generators on the market are provided with four collector rings in addition to the regular commutator and the leads from the collector rings are brought to two balancing transformers to which the neutral of the three-wire system is connected. In the Burke generator there is only a single collector ring besides the ordinary direct-current commutator, and the balancing transformer is incorporated in the armature winding. This auto-transformer, or so-called choke coil, is connected between certain points on the armature windings separated by 180 electrical degrees. The central point of this coil will maintain a mean potential between the positive and negative terminals of the machine. Connection to the central point is made with the slip ring. If it is desired to operate generators of this type in multiple it is necessary that the series coils be connected in both the positive and negative circuits. One-half of the series field turns is joined in circuit with the negative lead and the other half is connected with the positive lead. If it is desired to properly join the several sections of the series coils of the individual generators in parallel it will be necessary to connect five main cables from each generator to the switchboard.

CENTRAL STATION SALE OF CURRENT

USES FOR CENTRAL STATION SERVICE.

The following list of uses for electric central station service has been compiled for the convenience of the numerous central station companies which are at the present time preparing to get actively after new business. In organizing a new business campaign it is, in the majority of cases, necessary these days for a central station company to start with solicitors who have had little or no experience in the central station business. It is important, therefore, at the start to be able to place before them in definite form a fairly complete list of the possible uses of central station service in the various lines of business. It is also of value for the central station manager himself to glance occasionally over a list of this kind because it is likely to remind him of possible customers in his town who have been overlooked. It is important that the man going after new business, whether he be a manager or a solicitor, should have before him a clear idea of all the possible applications of electricity to be presented to the prospective customer.

In compiling this list ordinary lighting has been considered as a matter of course and not included; and for the same reason no attempt has been made to enumerate all the kinds of machinery that may be driven by motors in the various industries which employ numerous machines requiring power. Such an enumeration would add uselessly to an already long list. For example, in a machine shop or laundry it is unnecessary to enumerate all the machines that may be driven electrically, as even a novice at the business would naturally work to secure the operation by electric motors of all the machinery in any institution using considerable power. In cases where the possible chances for the use of central station service are likely to escape the attention of the inexperienced, the list goes more into detail in order that no points may be overlooked in determining possibilities. Although this list is doubtless incomplete, it is perhaps the fullest yet published, and is particularly adapted for practical use. It has been compiled from a number of different sources, including the lists of customers of several central stations and the lists provided for solicitors by the new business departments of several companies.

AUTOMOBILE AND BICYCLE SHOPS.

Tire pump motors.
Electric automobile charging.
Charging spark storage batteries.
Heating vulcanizer.
Motors for machine tools.
Electric soldering irons.
Enameling ovens.

BAKERIES

Motor-driven dough kneaders.
Motor-driven ice cream freezer.
Motor-driven biscuit cutters.
Motor-driven candy mixers.
Motor-driven revolving ovens.
Fans.
Ovens electrically heated.
Shredded candy machines.

BANKS, EXPRESS AND RAILWAY OFFICES.

Elevators.
Fans.
Motors for coupon cutters.
Sealing-wax heaters.
Ticket stampers.

BARBER SHOPS AND HAIRDRESSING PARLORS.

Vibrators for massage.
Electric hair dryer.
Fans for cooling or drying.
Cigar lighter.
Shoe polisher.
Nail polisher.
Sign and display lighting.

BLACKSMITH SHOPS.

Motor-driven forge blowers.
Motor-driven trip hammers.
Motor-driven drills.
Motor-driven emery wheels.

BOOK BINDERIES.

Motor operation for all machines.
Fans for cooling or drying.
Fans for ventilating.
Electrically-heated glue pots.
Electrically-heated lettering irons.

BREWERIES AND BOTTLING WORKS.

Motor-operated machinery.
Motor driven air compressor.
Bunghole lamps for keg interiors.

BUILDERS AND CONTRACTORS.

Electric lighting during construction.
Motor-driven hoists.
Motor-driven excavating machinery.
Motor-driven stone dressers.
Motor-driven stone crushers.
Motor-driven concrete mixers.
Motor-driven floor planers.
Motor-driven saws.
Floor polishers.

CHEMISTS AND ASSAYERS.

Electrolytic work.
Electric furnace work.
Electric heating for chemicals under analysis.
Annealing furnaces.

CHURCHES.

Fans to assist in cooling or heating.
Organ blower.

CLOTHING AND TENT FACTORIES.

Electric flat irons.
Motor-driven cloth cutters.
Motor-driven sewing machines.
Ventilating fans.

DRUG STORES.

Electric cigar lighter.
Sign and display lighting.
Fans for ventilating and for keeping frost from windows.
Motor-driven centrifuge.
Motor-driven shakers for soda fountain.

DRYGOODS AND DEPARTMENT STORES.

Advertising signs.
Window display lighting.
Show-case lighting.
Electric elevators.
Ventilating fans.
Motor-operated cash-carrier systems.
Fans for keeping frost from show windows.

ELECTROTYPERS AND ENGRAVERS.

Electric furnace.
Current for electrotype bath.
Arc lamps for photo engraving.

FARMS, GREENHOUSES, DAIRIES, ETC.

Electrically-heated incubator.
Motor-driven feed chopper.
Motor-driven corn sheller.
Motor-driven churn.
Motor-driven cream separator.
Motor-driven ice machine.
Electric pumps for general water supply.
Fly and ventilating fans.
Lighting of stables.
Lighting of greenhouses.
Lighting of chicken houses.
Irrigating pumps.
Motor-driven food mixers.
Arc lamps over oil tanks for bug extermination.
Incandescent lamps for bug extermination.

FIRE ENGINE HOUSES.

Motor-driven horse groomers.
Motor-driven horse clippers.
Pumps.
Hoists.

FOUNDRIES.

Fan blowers.
Emery grinders.
Rattlers.
Mercury vapor lamps.
Flaming arc lamps.

GROCERIES.

Coffee grinding.
Motors and electric heat for coffee roasters.
Egg candlers.
Fans for cooling and preventing flies.
Fans for keeping frost from windows.
Motor-driven refrigerator machine.
Display and sign lighting
Elevators.

HARDWARE AND TIN SHOPS.

Motor-driven punches.
Motor-driven drills.
Motor-driven grinders.
Motor-driven rolls.

HARNESS AND LEATHER GOODS MAKERS.

Sewing machine motors.
Pyrography burners.

HOTELS AND RESTAURANTS.

Display and sign lighting.
Refrigerating plant.
Compressed air and vacuum cleaning apparatus.
Motor-driven ice-cream freezers.
Plate warmers.
Electric broiling and toasting tables.
Fans.
Chafing dishes.
Coffee percolators.
Automatic pianos and music boxes.
Curling iron heaters
Additional bedroom lighting, portables, etc.
Dumb waiters.
Elevators.
Motor-driven dish-washing machine.
Dough mixers.
Laundry machinery.
Ventilating fans.
Cigar lighters.

ISOLATED ELECTRIC LIGHT PLANTS.

Operation by central station during light load periods.

JEWELERS.

Motor-driven lathe.
Electroplating.
Electrolytic reduction of metal.

LAUNDRIES.

Motors for operating all machinery.
Ventilating fans.
Drying fans.
Electric irons.
Electrically-heated rolls.

LIVERY STABLES.

Motor-driven horse groomer.
Motor-driven horse clipper.
Fans.
Carriage elevators.
Pumps.

MACHINE SHOPS.

Motor driving for all machinery.
Electric welding machinery.
Electric hoists and traveling cranes.

MEAT MARKETS.

Motor-driven meat grinder.
Motor-driven refrigerating machine.
Fans.

MINES.

Electric hoists.
Electric drills.
Motor-operated gold dredges.
Motor-operated mills and reduction works.

MISCELLANEOUS OFFICES.

Fans.
Addressograph motors.
Motor-driven adding and tabulating machines.

PAINT AND VARNISH MAKERS.

Electric heating for inflammable substances.
Motor-driven grinding and mixing machinery.

PHOTOGRAPHERS AND BLUE PRINTERS.

Arc and mercury vapor lamps for portrait work.
Arc and mercury vapor lamps for enlarging.
Fans for rapid drying.
Arc and mercury vapor lamps for printing.
Incandescent lamps for dark rooms.
Motor-driven circular blue print frames with arc lamps.

Physicians, Surgeons, Dentists, and Hospitals.

Heating pads.
Sterilizers electrically heated.
X-ray machines
Apparatus for light treatment.
Vibratory massage.
Electric needles.
High frequency electrotheurapeutic apparatus.
Fans.
Hot-air apparatus.
Electric furnace for dentists.
Dental motors.
Cooling of fever patients by fans blowing against wet sheets.

Planing Mills and Wood Workers.

Motors for driving all machinery.
Fan blowers.
Glue-pot heaters.
Steaming lumber.

Plating Works.

Motor-driven plating dynamo.
Motor-driven burnisher and polisher.

Printing and Newspaper Offices.

Motor-driven presses.
Motor-driven paper cutters.
Motor-driven plate saws.
Fans for ventilating and drying.

Railway Interlocking Plants.

Electric lighting of switch and semaphore signals.
Power for electric and electro-pneumatic switches and signals.

Renovating Works.

Motor-driven compressors for compressed air cleaning.
Motor drive for all machinery.

Residences and Apartments.

Heating Devices.

Flat irons.
Heating pads.
Curling iron heaters.
Chafing dishes.
Coffee percolators
Egg boilers and light cooking devices for apartments
Heavy cooking devices for kitchens.
Sealing-wax heater.
Hot needle for pyrography.
Cigar lighter.
Nursery milk warmer.
Pantry plate warmer.
Electric radiator.
Warm rug.
Foot warmer.

Residences and Apartments.

Additional Lighting.

Portable lamps.
Porch lamps.
Private yard lamps.
Stable lamps.
Tennis court lamps.
Decorative lighting for special occasions.
Lamps mounted on dressers.
Shaving mirror lamps.

Residences and Apartments.

Motor Applications.

Fans for cooling in hot weather.
Fans to force circulation and increase heating capacity of radiators in winter.
Fans over hot-air registers to help furnish circulation.
Fan in cold-air pipe of hot-air furnace to force circulation to entire house.
Fans to hasten drying in laundry.
Motor for ice-cream freezer.
Water pumping.
Motor-driven horse groomer in stable.
Motor-driven pump for vacuum or compressed air cleaning.
Refrigerator ice machine motor.
Sewing machine motor
Washing machine motor.
Dumb waiter.
Automobile tire pump.
Organ blower.

Saloons.

Decorative and display lighting.
Air compressors for pumping beer.
Refrigerating machinery.
Fans.
Cigar lighters.
Shakers.

Saw Mills.

Motor operation of all machinery.

Tailors, Hatters and Cleaners.

Electric pressing irons.
Sewing machines.
Cloth cutters.
Hat burnishers.
Blockers.
Hat cleaners.
Fans for drying.
Washing machines.

Telephone and Telegraph Offices.

Motor generator sets.
Fans.

Theatres and Halls.

Motor-operated curtains.
Motor-operated scene shifters.
Electric signs.
Additional lighting.

Starting a New Business Department.

By W. H. Winslow.

There is one point which the manager of a central station who intends organizing a new business department should carefully consider before adopting any so-called system. This is that the size of and local conditions affecting his station must determine largely the methods to be employed. In considering this question it will be advisable to divide central stations into three classes, each of which demands quite a different treatment of the new business problem, and, incidentally, of many others as well.

First, there is the very small or "one-man" station. Here any elaborate system of records, however good in itself, is likely to result in a waste of time which could be better employed in good plain "hustling." This must not be understood as meaning that the man in charge of a very small plant should not go after business systematically, but merely that his system should be a very simple one. All he needs is one of the outfits consisting of a pocket case containing cards 3 by 5 in. in size, with guide cards for the days of the week and a desk tray with daily and monthly guide cards. This equipment will enable him to see his "prospects" regularly and take almost no time to keep up. While blank cards will answer very well, quite a saving of time will result from having them printed with a form similar to Fig. 1. The back of the card can be used for memoranda of estimates given on cost of wiring, power, etc. It is not likely that he will conduct much of a mail campaign, or that such a course would be advisable. He should, however, distribute such circulars advertising electric cooking and heating utensils, turn-down lamps, motors, etc., etc., as can be obtained without cost from manufacturers, and while many of these can be left when he makes his calls, it is suggested that he occasionally mail them, using his cards as a mailing list.

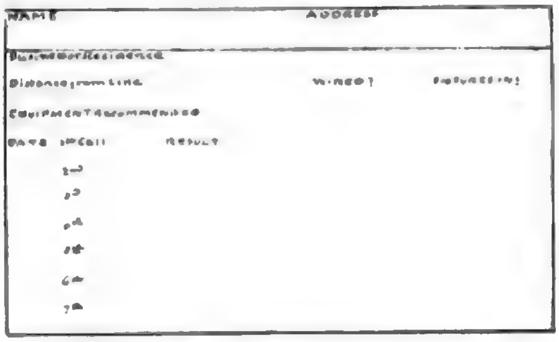


FIG. 1.—GUIDE CARD.

At the opposite extreme from the "one-man" plant is the very large station where a very elaborate system of records is necessary and where one or more men (in addition to the field force) give the new business department their undivided attention.

Between these extremes lie, perhaps, the majority of plants, the stations which are neither very large nor very small, "between a horse and a pony," as the old saying is; where no one man can carry all of the prospects under his hat, and yet where a regular department is out of the question. This third division should, as a matter of fact, be again subdivided, and it is in this class that mistakes are most likely to be made. On the one hand, the rather small station is apt to adopt a system which, as has already been suggested in these columns, is so elaborate and requires so much time that it will be a failure because it will not be kept up. On the other hand, the comparatively large station may fail to get the best results because its data are not complete and its prospects are not seen frequently enough. Disregarding all variations in local condition, however, there are a few underlying principles that apply to all alike. There is nothing like personal solicitation to get results and a beautiful office system without good solicitors will be a failure, more or less, while good solicitors will get results even with no system whatever. Unquestionably, however, this combination of good men guided and

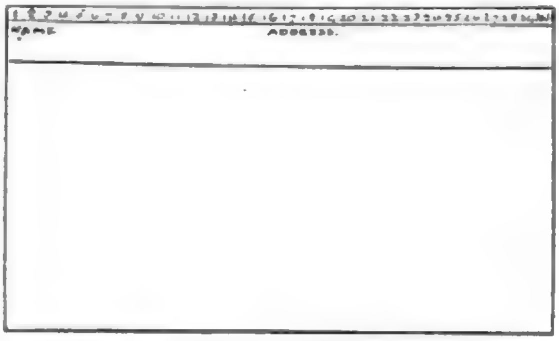


FIG. 2.—CARD INDEX OF PROSPECTIVE CUSTOMERS.

directed by a simple but efficient office equipment and backed up by a thorough follow-up system by mail is the only true method.

As involving the least clerical labor and therefore the greatest likelihood of being properly kept up, the following is suggested as a modification of the follow-up system outlined in an editorial in the monthly edition of the Electrical World for February.

First, an alphabetically kept card index of prospects, the cards to be numbered across the top from one to thirty-one (see Fig. 2) and bearing aside from this only name and address. By placing projecting metallic markers on the cards over the desired date, all prospects demanding attention on a given date can be at once located. Second, a series of manila folders, also alphabetically filed (Fig. 3) to be used as described in the editorial referred to, but having printed on the front a blank for such information as is desired, including the record of form letters and advertising matter sent, visits made, etc. It will be observed that this differs from the original plan in having all of the information in or on the folder, while the card record is a simple index and "tickler." The following will make clear just how the outfit is handled:

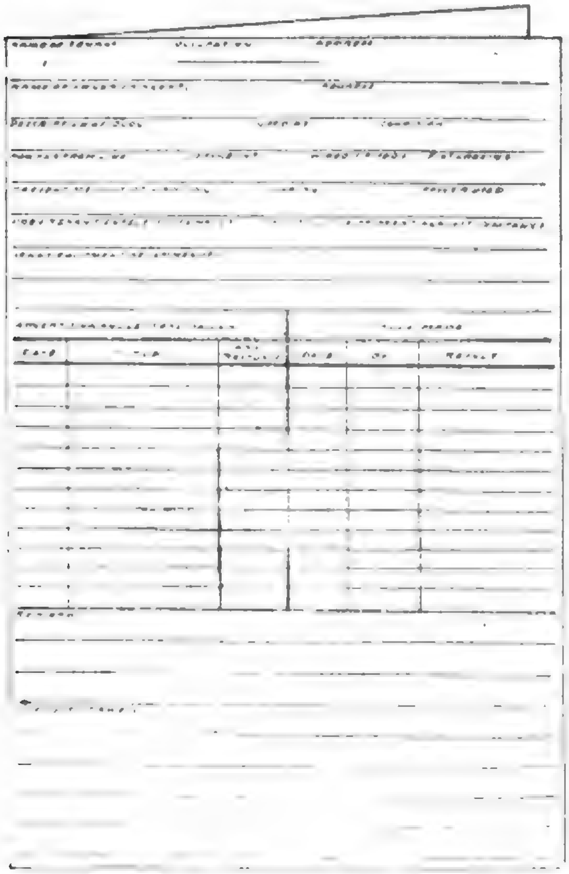


FIG. 3.—FILE WRAPPER

The files containing the cards and the folders are placed side by side on a desk and the first card bearing a marker over the current date lifted up far enough to reveal the name; the folder bearing the same name is then removed from the file and placed face downwards on the table; next the marker on the card is moved to the next date on which the prospect is to be approached, and the card pushed down into place. When this has been done with all the cards bearing markers over the current date, the folders are used as a mailing or "calling" list, proper notations made or copies of letters attached and the folder restored to its proper place in the file. Metal markers of different colors may be had so that if it is desired to keep separate the mail follow-up and the personal solicitation dates, the same card index may be used for both, each card bearing two markers.

The Over-Advised Central Station Manager.

By John Craig Hammond.

Pity the poor central station man. He is a victim of "advice," "suggestions," "expert knowledge" these days. "Do this; this is the way to increase your business." "Ah, no; that is not the way; it's this way." "Do it that way? No, my dear victim, not that way, but this way."

This is not in any way an attack on the methods of "expert advisers" in the advertising world—not in the least—rather it is an appeal to the central station man to do a bit of thinking on his own "hook." It goes without saying that advertising has become one of the arts. The average central station man has not the time or knowledge to properly carry on his advertising. But should he advertise? The "experts" with one voice will say yes. That does not make it so.

Here is the situation to-day in a few words: The average central station man wants to increase his business if he can. Henry L. Doherty was one of the first central station men to demonstrate it could be done by new business methods, and by advertising. Mr. Doherty made a study of advertising—he secured the advice of experts and when he did not like the advice of the "experts" he made it his business to point out where and why they were wrong. Every central station man cannot do what Mr. Doherty accomplished. The reasons are many.

The success of Mr. Doherty's efforts started the ball rolling; "advisers" came to the front by the score.

"If Doherty can do it, we can; we will follow his tip," was the comment of other central station managers and in the end they employed "experts." The "experts" worked on the theory that all cases were alike. They discovered that this was not true—the central station man paying for the knowledge.

One by one the "victims" were gathered in and "advised." Some grew weary of advice—gave it up and declared advertising was a failure. They were wrong. Advertising, if properly carried on, is a success.

The central station man must buy machinery. He buys other equipment, then he has to supply electricity to the consumer. There you have the start—what's it costing him to deliver a kw-hour?

He must sell electricity at a profit—he wants to sell all he can make. His demand under normal conditions is so much—if he could get other consumers he could increase his gross income, say, $50,000 a year.

The advice expert will outline a campaign—he will say that a year's campaign on the follow-up principle will cost so much. The cost, say, is $5,000 to $50,000 a year—more for larger stations, less of course for smaller ones. The figures look good—the words are sweet—the advice mysterious, the ads funny—maybe catchy, bright, and all that.

"My, those are clever ads," sighs the central station man. "I can see that $50,000 gross coming in and it will only cost me $5,000 to get it. Me for the $50,000."

Yes, there are cases of that kind—many of them. Did the advice expert stop to think what it was going to cost in the way of fuel—to use just one example—to make the extra current? Not he. Maybe the central station man did, but he was carried away with the glitter of words—the "catchy" sayings. They were "cute" and clever. "Cute" ads never won an extra dollar for a central station. The manager may think so, but let him dig deep and he will be surprised at the loss.

The average advertising expert knows nothing of the electric business. He knows he has accomplished certain things with other stations—he says he can with your plant.

Can he? He will answer and try to demonstrate he can. Very good. But don't take the advice the first moment. Let it rest in your desk for a week—two weeks are better. Things look very clever sometimes, at the first blush; they are silly a week later.

The advertising experts who are instructing the central station man to-day will feather their own nest—will make their business one of to-morrow rather than one of to-day—if they will stop, and weigh the situation.

Co-operation is a fine thing. But weigh matters—know—you can know. Go deep. Don't think all central station men are foolish. They are not. One advertising expert tried all kinds of advertising on the public. In the jumble the business increased. He confessed that it was luck.

"What I didn't know about the business was a crime," he said. "I had extra cute ads—I nearly laughed over some of my bright ideas and sayings—they were so funny. I should have been put in irons, but I learned. I studied. I know a bit different to-day."

That's all true; he should have been put in irons. But he had to learn—so do all central station managers. To-day some advertising managers are being "cute"; you don't have to be cute to get business. Rather give the central station man a bit more credit for having horse sense, and you, Mr. Central Station Man, don't be misled by bright ads. Weigh the campaign well; let the ideas and suggestions remain in your desk for a week. Ask questions; use the common sense that made you a manager.

Interior Organization of Lighting Companies.

The subject of company organization was taken up recently in an address to the agents of the Edison Electric Illuminating Company, of Boston, by Mr. R. S. Hale, the general agent. He made an analogy between such a company and that which is perhaps the oldest organization in the world—an army. This theory of an army organization had virtually been carried out in the Boston Edison system, President Edgar, the commander-in-chief, having besides his own staff or executive bureau, four bureaus under him—construction, auditing, purchasing and operation. In each bureau there are departments, each with its departmental head, and in each department there are divisions with a divisional head, while in some divisions there are what might be called subdivisions. The point was that while there was delegated authority and responsibility everything in the final analysis went back to the one head, so that every single thing is done subject to the chief's approval, and theoretically every order either comes from him direct or is given because he has authorized it.

The keynote of this work is as follows: "Decide for yourself everything you are authorized to decide, and whatever you do keep your chief in touch with what you are doing. And further, when you do decide for yourself, don't consider yourself alone or your department alone, but try to make things work smoothly for everybody in the company."

With regard to the work of the agents, Mr. Hale stated that they had divided the territory into districts and assigned one or two agents to each district. The district agents are supposed to look after every customer and prospect in their district. Formerly they looked only after certain classes of business specifically, but now the local agent is supposed to find and get every bit of business that there is in his district. It was too much, however, to expect the same man to close a contract with a big dry goods house, lay out the lighting of a saloon, or plan an installation of motors in a factory. Hence, in addition to the district agents, they had specialists. Thus, for example, if the district agent sees the chance to get in a big sign he can start the ball rolling, but can call in the sign specialist for assistance. He need not be worried about the credit, for the report will take care of that. In some cases it is easier that the special agent should handle the business exclusively since one man should so far as possible be solely responsible for the dealing with the individual customer. In like manner the specialist, if he sees the chance to get in a good piece of work, should not let it go by. In other words, the whole of the work should be team work. "We want all the business and we must help each other to get it. Never mind if the credit goes elsewhere, you will get it in time and it will count all the more if your chief thinks of you as a man who is keen after getting business for the company and has no recollection of your taking up his time with claiming credit for work that has happened to get in under another agent's name." Mr. Hale closed by insisting upon the utmost courtesy and consideration being shown to a customer or a prospect.

Lamp Hour Charges in Municipal Plants.

A study of electric lighting charges in municipal plants shows that the consumer is often obliged to pay a higher price per lamp-hour under the conditions of public ownership than a central station would charge in the same territory. An investigation recently made of the cost to the consumer per lamp-hour in several Massachusetts cities operating municipal plants brings to light some extremely interesting data, in comparison with the rates of the Edison Electric Illuminating Company, of Boston.

Tests upon representative lamps obtained from the different municipalities showed current consumption varying from 3.40 watts per candle-power to 3.66 watts in the 16-cp size. The standard 16-cp lamps supplied by the Boston Edison Company have a current consumption of 3.1 watts, so that the municipal plants examined all supplied lamps of from 9.7 per cent to 18 per cent larger energy consumption than the Edison lamps. In only two of the plants considered are lamps renewed free of charge to the consumer, the latter being obliged to pay from 20 to 25 cents in all the other installations for every new lamp put in service. The tendency of this policy is naturally toward hesitation on the part of the consumer to replace lamps whose useful life has passed, the result being that the actual amount of light purchased costs too much in comparison with the central station rate on the free renewal basis.

The actual cost per lamp-hour should include the expense of renewals as well as the electricity charge. In figuring the cost the life of each 16-cp lamp was assumed to be 600 hours. The following comparisons then obtain:

Municipality.	Net Rate per KW. Hour	Renewal Price Per Lamp.	Cost per Current.	Lamp Hour Renewals.	Burned Total.
A	$0.15	$0.20	$0.838	$0.033	$0.871
B	.20	.20	1.117	.040	1.157
C	.13	.25	.730	.045	.775
D	.12	.20	.670	.033	.703
E	.12	.20	.689	.033	.802
F	.15	.20	.898	.033	.931
G	.18	.25	.994	.045	1.039
H	.15	.20	.852	.033	.885
I	.135	.20	.767	.033	.800
J	.15	.25	.872	.045	.917
K	.15	.20	.877	.033	.910
L	.20	Free	1.129	...	1.129

The primary lamp non-contract maximum rate of the Edison Electric Illuminating Company, of Boston, is .9 cent. The secondary rate is .6 cent, making an average residence rate of about .8 cent. The company renews lamps free of charge. Stores burning lamps two hours per day or more can buy electricity on a contract basis giving a net rate of .7 cent per hour or less. The "economies of municipal ownership" do not seem to materialize extensively in the light of the above figures.

The investigation also included a series of recording voltmeter readings derived from commercial municipal circuits at points considered to be representative of average pressure conditions. In only two plants out of 16 examined was the regulation first class on the score of variations of short duration. The average variation in voltage from the mean throughout the day ranged from .2 volt to 3.8 volts. Extreme variations as high as 13 volts were noted in individual cases. Under such conditions the use of high-efficiency lamps is impracticable, which is only another way of saying that the actual cost of light is certain to be much larger with poor than with good regulation, as far as it bears upon the individual consumer. High voltage throughout the day is liable to be disastrous to the life of the lamps; low voltage during the early morning hours is not so objectionable, but during the maximum lighting load from 7 to 9 p.m. it means very unsatisfactory illumination. Lamps of 8 and 10 cp are more susceptible to the baneful influence of poor regulation and their delicate filaments are more easily broken, while for equal efficiency their life is shorter than the life of 16-cp lamps. These lamps should, therefore, be selected in comparatively low efficiencies if the regulation is inferior. The most satisfactory and economical lighting is not secured by forcing the lamps during the peak load. The influence of voltage variations upon the life of 3.1-watt lamps may be cited in connection with the question of regulation:

Percentage of Normal Volts.	Percentage of Useful Life.
96.8	158
98.2	126
100	100
101.5	78.5
103.2	60
104.5	49
105.5	40
107	32

The enormous importance of steady voltage at the consumer's end of the line is apparent from these figures. There is certainly room for much improvement in the plants studied.

Modern Methods of Advertising.

At the recent meeting of the Iowa Electrical Association, Mr. Frank B. Rae presented a paper with the above title, which is reprinted below:

A great deal has been heard within the past few months on this subject of advertising. The technical press has been full of it. Advertising agencies have bombarded you with it. In your personal meetings and conventions you have discussed and argued it. Advertising, in short, is the talk of the hour among electrical men—the fad. "Where will it all lead?" you ask.

It will lead to this: the business of manufacturing and marketing electric current will become as other businesses, and it will be advertised as other businesses. The trouble just now is that central station policy and practice is changing to meet new conditions. Heretofore, business has come to you. Hereafter, you must seek business. That is the meaning of all this furor.

Advertising, when stripped of its trappings and gilt, is a very plain, common-sense business proposition—a proposition of selling goods. While it would seem that this is simple enough, and obvious as the first proposition in geometry, it is a fact that only a very small percentage of so-called advertising conforms to this definition. On the contrary, the fundamental principle has been so hidden and befogged by a maze of high-sounding words, that not one man in a thousand of those who foot the bills knows what he is trying to accomplish, or is paying others to accomplish for him. He staggers along blindly, believing that any sort of announcement regarding his business is advertising, and the more startling the form and wording of this announcement, the better advertising he believes it to be. Just as idol worshippers of old clothed their religion in fearful mystery and expressed it in awe-inspiring pageantry and ritual, so the ad man of to-day shrouds simple truth in a garment of the inexplicable, and says much of nothing with pomp and ceremony.

There is just one mystery in advertising—the mystery of the personal equation. Advertising—real advertising—is good or bad, only as the man who prepares it is gifted or not gifted. Words are in every man's mouth, but every man cannot be a Patrick Henry. A pen is in every man's hand, yet every man is not a Shakespeare. The tools of advertising are within every man's grasp, yet very few men can write an effective advertisement. It is well for us to recognize at once that the gift to see and express in advertisements, the possibilities of a business is no more common than the gift to see and express in poetry the inspiring beauties of nature.

Advertising has been likened to salesmanship—salesmanship on paper is the expression of a clever ad man. For practical purposes this is a very good definition. Furthermore, it bears out what I have already said. You have all listened to the clever salesman. He came unknown, unasked, and unannounced. His dress and appearance were his credentials; a bright word his introduction. In terse, clean-cut English, he told his story; with convincing logic he drove home his argument; with undeniable assurance he solicited your business. Tact, courage, good breeding stamped each word. If he did not get an order, he left an indelible impression of the worth of his goods. Perhaps you did not want to buy them—for any one of a thousand reasons—but sooner or later his well-delivered arguments, his tactful insistance, will win you. You will buy.

What were this salesman's qualifications? He was tastefully, or at least decently, dressed; his introduction commanded your attention; his argument appealed to your reason; his tact and cleverness assured him a future opening if not an immediate sale. These are the qualifications of a successful salesman. They are the qualifications of the successful advertisement.

My paper was to be devoted to advertising method, yet I have spoken only of advertising matter. I have done this with purpose, for unless the matter is right no method will avail. Results of a sorry sort will come from almost any advertising, just as sales will be made from almost any salesman; but if you are to enter this field with an idea of profit, let me exhort you to pay the bulk of your attention to matter. The need of method will be self-evident.

It must be understood that the backbone of your business-getting department is the solicitor. Advertising can persuade a man of the advantages of your service; can convince him that he needs it; can crystallize his desire into an immediate demand for specific information touching his individual wants; but it cannot figure his installation, nor secure his signature to a contract.

Granted that you have intelligent and energetic solicitors, the advertising will be designed to bring the prospects to the point where it will require the least amount of the solicitor's time to close a contract. To do this is not the work of a single advertisement, nor of a number of diversified and disjointed advertisements. It is the work of a long-continued, regular, systematic advertising campaign.

It is here that the average lighting manager interposes objections. He is perfectly willing to take a "flyer"—to send out three or four mailing cards, perhaps, or insert a so-called "catchy" ad in the newspapers. Such advertising, if advertising it can be called, is the sheerest waste of money. Object as you will to this statement, if you but compare again your advertising campaign to the work of the accomplished salesman, you will begin to see the reason of the follow-up method; for your salesman does not always get an order on his first call, nor his second, nor the third. It may take a half dozen calls to educate a prospective customer to the advantages of his goods, and to win his confidence—in short, to bring him to the buying point. Had the firm employing this salesman sent a different man each time; had the various men employed radically different methods, it is probable that little, if any, attention, would have been paid to their solicitations. But the one man, the one method, the constant, aggressive, persistent follow-up, is what lands the order. And that is what will land orders from advertising.

The matter of such a follow-up campaign should be planned, prepared and systematized in advance with very strict regard to local conditions. It is in the planning and systematizing that such a campaign wins or loses—in the logical sequence of the advertising used. The system of handling inquiries, of checking and revising the mailing lists, of adapting the solicitors' labor and reports to the mutual benefit of both solicitors and the advertising—these are all vitally important points to be settled before a single piece of matter is issued. Having settled them the actual follow-up work resolves itself into the very simple proposition of seeing that the matter goes out promptly on the scheduled dates, that inquiries are carefully followed, and that the enthusiasm of the soliciting force is kept at fever heat. When it is understood that the chief object of the advertising is to pave the way, introduce and make definite appointments for the solicitors, the importance of having the latter always aggressive will be appreciated. The actual business-getting must, and always will, remain with the soliciting force.

"Modern Methods of Advertising," so far as the central station is concerned, means merely that you regularly and persistently keep the advantages of your service before every prospective customer within reach of your mains. That such methods can be profitably adopted by the smaller plants has been demonstrated.

But a warning should be sounded. Do not make your advertising too elaborate, or too voluminous, nor waste it upon ill-chosen lists. Above all, do not allow it to be designed by an advertising man ignorant of the ethics of the lighting business, or by a lighting man lacking in advertising genius and experience.

Shall Central Stations Sell Apparatus?

By T. M. Meston.

In view of the agitation now being made by various advertising companies and co-operative associations with a view to having central stations and manufacturers undertake extensive general publicity advertising plans so as to educate the public to the greater use of electrical apparatus, would it not be well to spend some time in analyzing the present trade conditions? Before spending large sums of money and a great deal of time and energy in endeavoring to build up business from the user, it would seem that the common sense thing to do would be to first put the business that is already developed on a business-like and profitable basis.

Commercial conditions in the electrical trade are extremely unsatisfactory, the dealer and contractor cannot make enough profit to eke out a bare existence; the jobber is not making enough money to pay expenses and the unsatisfactory profit made by these two classes of dealers re-acts on the manufacturer in a continual pressure for lower prices, which results either in an unhealthily low margin of profit to the manufacturer, or a reduction in quality.

The present unsatisfactory conditions are undoubtedly due to the fact that the electrical business as a whole is new. It has not been in existence long enough for the proper trade lines to become established and for the proper principles of trading to be understood and applied by the manufacturers, jobbers, retailers and central stations.

Even brief consideration of this subject will show any impartial investigator that almost every primary principle of correct merchandising is violated by all classes of electrical trade. These conditions have grown up naturally enough and while present practices were unavoidable in the infancy of the business, they are harmful in the present stage of development and unless corrected will work to the harm of every electrical interest.

At the present time manufacturers and jobbers are selling a greater or less proportion of their product direct to the consumer. It is no unusual thing to find manufacturers, jobbers and contractors all trying to sell to the same consumer. The jobber and manufacturer commonly quotes almost as low, and sometimes fully as low prices direct to the user as he quotes to the dealer or the jobber. Under these conditions how can a permanent and successful business be built up?

While it is necessary to sell certain kinds of apparatus and to certain large consumers direct from the factory, there is no reason for either the manufacturer or the jobber selling to the average user at any price, such material and apparatus as the retailer can handle to advantage. In all other lines of business the big outlet to the general public is through the retailers and the principles of distribution are no different in the electrical field than in any other line of merchandising. No electrical man would expect to go to a large collar manufacturer or dry goods jobber and be able to buy half a dozen collars at any price. He would be absolutely astonished if he found that he could buy these collars only at a price 10 or 20 per cent higher than the retailer paid for them, yet in every city in this country any private citizen can go to a jobber in electrical apparatus and buy anything he wants. There may be some exceptions, but the above is certainly the rule. Not only this, but many of the largest electrical manufacturers have retail prices and will sell even small supplies at retail. There is no doubt but that the wants of the general public should be supplied through the local retail dealer and the prices to the public should be sufficiently high so that the retail dealer can make a net profit above his expenses. On an average the cost of conducting a retail business will be at least 25 per cent of the sales and a retailer cannot exist unless there is an average margin of from 33⅓ to 50 per cent between the wholesale price named by the manufacturer or the jobber and the retail price.

The writer was for many years connected with the largest hardware jobbing house in the world and based upon his experience in that line will make bold to suggest a remedy for the present deplorable condition of the electrical trade. The manufacturers and jobbers should not sell at retail at any price, the class of supplies and apparatus that can be handled to advantage by the local retailer. This should cover all the small items such as are in daily use and such as can be handled by the retailer. The retailer is not in a position to handle large apparatus, neither is he in a position to sell to central stations, railways, telephone exchanges, who while strictly speaking are consumers, are still such large buyers of electrical merchandise that they properly should buy at wholesale and at wholesale prices from the manufacturer or jobber direct. The central stations if they sell merchandise should consider themselves retailers and should charge a retail profit.

A very pernicious doctrine has become current in electrical circles to the effect that the central station is interested in selling electricity and that it can afford to sell apparatus and supplies, and do construction work at cost or at a loss as the profit in the electricity evens matters. A moment's reflection will show the absurdity of this reasoning. If a central station is a retailer of merchandise as well as a producer of electricity, it is really in two separate businesses—it cannot expect to retail merchandise any more economically or with any less expense than any similar retailer handling the same volume. If the merchandising part of the business is carried on at a loss, the loss must be made good from the net profits of the manufacturing department and the proper thing to do will be to separate these two departments entirely, sell the electricity at what it is worth, make the profit on it and also sell the merchandise at the proper price and have each department bear its own burden. If the price for electricity is so high that there is a satisfactory profit after making up a large deficit on the merchandising department, the company should either reduce its rates, or it should retain the extra profit for the benefit of its stockholders. Aside from any arguments as to the proper accounting system to be employed the central station actually does itself injury by selling apparatus and supplies at unhealthily low prices to the general public. The most serious effect is to procure either the active or the passive opposition of every contractor and dealer that hopes to make a living from the electrical business.

In every large city there are a number of electrical dealers and contractors and there is no question but that if the central stations would either abstain from merchandising, or better still, handle merchandise, but handle it at a proper retail price, they would procure the active co-operation of the local electrical dealers and contractors. There is much to be said in favor of the central station handling apparatus, as at the present time the dealers and contractors have not sufficient capital to carry the stock. If the central station carried the stock of apparatus and did the purchasing, selling to the general public at an adequate retail price, the dealers could also sell at these prices and would gradually build up their business so that electrical dealers would be as prosperous and financially responsible as retail dealers in other lines. As this desirable result is gradually attained, the dealers would carry larger stocks and possibly would ultimately relieve the central station from the necessity of merchandising, allowing the central station management to confine itself entirely to its proper sphere of producing and selling electricity.

Another trouble with low retail prices named by central stations is the fact that very often the prospective purchaser is really afraid to buy at the low prices; numberless instances have come under the writer's notice where consumers have actually been afraid to purchase, feeling that a reliable and satisfactory piece of apparatus could not be furnished for the low price asked. The general public are so thoroughly imbued with the idea that there is a large difference between the wholesale and retail price that they are unable to realize that electrical people are so foolish as to sell at retail at prices little, if any, higher than the wholesale price.

When a consumer is told by his retail electrical dealer that the central station is selling apparatus and supplies at cost because the central station can afford to do this by reason of their making a profit on the energy consumed, the consumer is very likely to reason that there is an exorbitant profit in the energy sold and this is certain to react against the central stations by gradually building up a public opinion that the rates are too high with consequent agitation and possible legislation controlling and reducing the prices of electrical energy.

If space permitted, there are other minor abuses that might be mentioned, such as the same firm being at one time a manufacturer, jobber and contractor, thus competing directly with its own customers in every branch, but space will only permit mentioning the most important points.

As the largest interests are properly the ones to first study the situation and provide a definite remedy, let us hope that such large concerns as the General Electric Company, Western Electric Company and Westinghouse Company, working if possible in harmony with the jobbers, will in the near future take some definite action toward stopping the retailing of electrical merchandise at wholesale prices. The manufacturing interests mentioned above, together with the jobbers in the various cities are supposed to combine the best intelligence and judgment to be found in the electrical trade, and there is no doubt that these interests could make some division in their line of manufacture and in the class of trade which would enable the retail dealer and central station to understand exactly what classes of trade and what kinds of merchandise these large interests would sell at wholesale prices to the user, and on which side of the line the retailer would understand that the retail prices were left to be adjusted by the retailers in accordance with local conditions.

In order to avoid a possible misunderstanding, it is necessary to say forcibly that nothing in this letter is intended to convey the idea that the manufacturers and jobbers should form combinations to control or fix prices either at retail or between different classes of trade. If the manufacturers and jobbers will decide either individually or collectively that certain classes of goods will not be sold by them to the average user, the way is open for the retail dealer and central station to take the position that retail prices will be charged that are fair to the user and still provide a living margin of net profit to the retailer. This is not a matter to be arranged by associations or combinations, it is only necessary for each dealer, be he large or small, to take the common sense stand that, so far as he is concerned, he will procure a price that will leave him some margin of profit. If each individual will take this position, the benefit to the entire electrical trade would be very noticeable.

Electric Lighting in Theatres.

At the May meeting in Chicago of the National Fire Protection Association, a report will be presented by the committee on theatre construction and equipment. Advance copies have been sent out by the Underwriters' Laboratories of Chicago. The sections relating to the proposed provisions for lighting are as follows:—

Every portion of the building devoted to the uses or accommodation of the public, also all outlets leading to the streets, and including the open courts and corridors, shall be well and properly lighted during every performance and the same shall remain lighted until the entire audience has left the premises.

There shall be one light within a red globe or lantern, placed over each exit opening, on the auditorium side of the wall.

Gas mains and electric light wires supplying the building shall have three independent connections as follows. One for the stage, one for the auditorium, excepting the exit lights therein, and the third for the halls, corridors, lobbies, exit lights, including the exit lights in the auditorium, and such other portions of the building used by the audience outside of the auditorium proper.

All gas and electric lights in the halls, corridors, lobbies and other portions of the building used by the audience, with the exception of the auditorium proper, but including the exit lights therein, shall be controlled by two separate switches or valves, one to be located in the lobby and the other to be so located as to be operated from the outside of the building

Provision shall be made for shutting off all gas at a point outside of the building.

Interior gaslights must be lighted by electricity or other suitable appliances, to be approved by the underwriters having jurisdiction.

All suspended or bracket lights surrounded by glass, in the auditorium, or in any part of the building devoted to the public, shall be provided with proper wire-netting underneath.

No gas or electric light shall be recessed in the walls, woodwork, ceilings, or in any part of the building unless protected by fireproof materials.

All lights in passages and corridors in said buildings, and wherever else deemed necessary, shall be guarded with proper wire network.

The footlights must be electric, and in addition to the wire network, shall be guarded with a strong wire guard and chain drawn taut, placed not less than 2 ft. distant from said footlights, and the trough containing said footlights shall be formed of and surrounded by fireproof materials.

All border lights shall be electric, constructed according to the requirements of the National Electrical Code.

All ducts or shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between, or some other approved fireproof material may be used.

All stage lights shall be electric, installed in accordance with the requirements of the National Electrical Code.

The bridge calcium lights at sides of proscenium shall be enclosed in front and on the side by galvanized iron, so that no drop can come in contact with the lights. Electric calciums, so-called, are included in the above requirement.

LETTER TO THE EDITORS.

Good Taste in Central Station Advertising.

To the Editors of Electrical World:

SIRS:—I wish to express hearty agreement with the position taken by Mr. F. L. Rae in his article entitled "Good Breeding in Advertising," printed in your issue of April 7. It is doubtful if coarse and slangy advertisement writing appeals even to the lower social strata of Americans, and it certainly is woefully inappropriate when addressed to the select audience to which, under present conditions, the central station must confine its appeals. However little cultured a class may be which one desires to interest through an advertisement, it should not be lost sight of that the reading of books has fixed in their minds a literary standard which, though perhaps always lost sight of in conversation, yet recurs in reading the printed word. If in order to reach the masses it were actually necessary to descend to a degenerate English, it would appear equally necessary for the Stevensons and Kiplings, the Henry Georges and Jack Londons, to work in collaboration with a master of vernacular and slang who would, for popular editions, translate their sentences into the language of the "masses."

But that to violate all the canons of taste and to murder the Queen's English, is not a necessity in advertisement writing appears to be absolutely demonstrated by the success of those advertisers whose announcements are always in excellent taste. We need only to offer as examples the advertisements of Pear's Soap and Ivory Soap—which cannot be held to appeal only to the cultured—and to the daily announcements of the Wanamaker stores. The cause of the lapses to which this letter refers—leaving aside inherent low taste, which undoubtedly in some cases is a large factor—appears to be that the fundamental principles of advertising writing are too narrowly or entirely wrongly construed. As Mr. Rae states, an advertisement should be so written as to attract attention, but by many this principle is applied in the most primitive fashion, poverty of thought leading to the adoption of slang expressions or glaring impertinences. Then again, too often the principle of conciseness is thought to be met by the clipping of a letter from a word or the elision of particles from a sentence, while style is taken to mean merely oddity of expression.

That there is an art of advertising writing and a difficult one, cannot be disputed; but it is too frequently practiced as a house painter who exchanged his paint pot for a pallette, would practice the art of Raphael. Slangy expressions are no more apt to be factors of success in advertising than in other lines.

BOSTON, MASS. S. L. POWERS.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

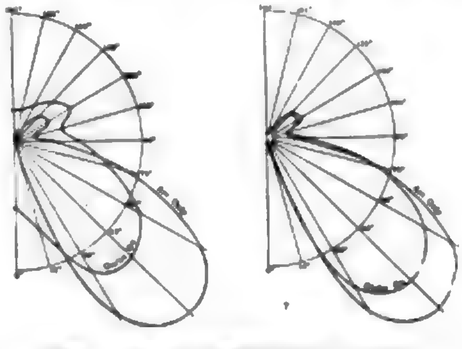
Flux Distribution in Machines with Commutation Poles.—WALL AND SMITH.—An account of tests of a bipolar machine provided with two commutation poles (interpoles) and designed for 110 volts at 42 amp. The distribution of flux due to a single commutating pole and that due to both commutating poles together are discussed. If the arrangement of the machine is symmetrical and if the commutation poles alone are excited the flux will simply pass through the armature yoke, none of it going through the main poles. In exactly the same way, if the main poles are excited and the commutating poles unexcited, no flux whatever will go through the latter. Hence if both sets of poles are simultaneously excited, the result is a superposition of the two fields; that is, each field acts as if the other was absent, the two fields being independent of each other. These results were fully confirmed in the experiments of the author. (In an editorial note in the same issue it is pointed out that the experiments were made with the armature at rest, and that the authors say nothing about the distribution when the armature is loaded and running. If we consider the armature ampere-turns in the direction of the brushes they will be found to correspond to back turns with regard to the turns on the auxiliary poles. It appears likely, however, that the flux distribution in the machine on load is not different in principle from that at rest. If this view is correct, the use of a separate magnetic circuit for the auxiliary flux should be unnecessary. However, in actual machines with commutation poles a separate auxiliary magnetic circuit is used so that perhaps there are some other considerations to be taken into account, such as the possibility of laminating the entire auxiliary system to accelerate the response to sudden changes of load.)—Lond. *Elec.*, April 6.

Lamps and Lighting.

Lamp Globes.—PRENTICE AND WESTERDALE.—A paper read before the Students' Section of the British Inst. Elec. Eng. on the determination of the polar curves of light distribution from arc lamps surrounded by globes. Four different kinds of globes were used and both the mean spherical and mean hemispherical candle-power were determined. The results are as follows:

Globe.	Mean spherical cp.			Mean hemispherical cp.		
	Arc only	Arc in globe	Mean spherical ratio per cent	Arc only	Arc in globe	Mean hemispherical ratio per cent
13-in. alabaster	346	339	98.0	592	473	79.9
13-in. clear	346	308	89.0	592	520	87.9
13-in. opalescent ...	342	343	100.0	288	238	82.8
12-in. prism	342	306	89.5	288	250	86.9

The photometric curves for an alabaster globe and for a clear glass globe are given in Figs. 1 and 2. In a general way the photometric curves for the opal globe are similar to those for the alabaster globe, while those for the prism globe are similar to those for the clear glass globe. In the case of the alabaster and opalescent globes the globe itself becomes to a certain extent the source of light, owing to dispersion, so that when the globe is used there is a measurable candle-power even up to 180°. The opalescent and alabaster globes cut off a large percentage of the light; this is not all lost, however, part being dispersed and a part reflected back to increase the candle-power in the directions where, for the arc alone, it would be either nothing or very small. For street lighting all light above the horizontal is useless, so that globes that disperse the light well through the 180° are unsuitable, although the mean spherical ratio may be great. The mean hemispherical ratio is the more important in this connection. The clear glass and prism globes have the highest mean hemispherical ratios, so that for street lighting these globes would be more suitable.—Lond. *Elec.*, April 6.



FIGS. 1 AND 2.—PHOTOMETRIC CURVES.

Arc Lamp Lowering Gear.—An illustrated description of a new suspension for arc lamps, which breaks contact when the lamp is lowered. It is shown in Fig. 3. Current is conveyed by the cables to the two hinged pieces, C_1 and C_2, which act at the same time as contacts and suspending hooks for the lamp. These suspenders are insulated with mica and have their hooked ends tipped with phosphor-bronze springs, which form the contacts. Each is provided with a releasing shutter, *R*, which when pushed up enables the hook to engage in the annular socket on the under side of the lamp insulator, but when down closes the hook so that the descending insulator passes by and pushes the suspender arm aside. The suspenders in the figure are shown in these two positions, but they will, of course, in reality both be always in the same position. Thus when the lamp is going into engagement the releasing shutters rise up and allow the suspenders to engage when the lamp is lowered after touching the stop. For disengaging, the lamp is raised high enough to free the shutters and cause them to fall, and prevent the hooks engaging. Thus the whole action depends on raising the lamp higher for disengaging than for engaging. This is done automatically by a stop, *S*, which contains a triangular piece, which is partly rotated by the act of lowering, so that it projects and prevents the stop passing into a slot when the lamp is next raised for engagement. The lamp spindle has a self-centering and self-locating device, consisting of a stud and a slot, which insures the right contact being made. The lamp contacts are well pro-

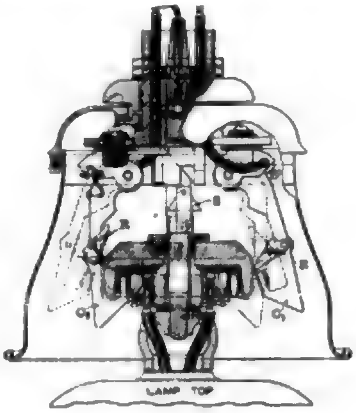


FIG. 3.—ARC LAMP SUSPENSION.

tected, as they are on the underside of the insulator.—Lond. *Elec.*, April 6.

Economical Life of Incandescent Lamps.—Wild.—When the average life curve of incandescent lamps is known and the price of the energy and of the lamps is also given, the point in the life of lamps can be calculated at which they should be renewed in order to get maximum economy. The author has made tests of a number of ordinary commercial 200-volt, 16-cp lamps and taking the cost of the lamp at 20 cents, he finds that the correct scraping point is 1,000 hours if the price per kw-hour is 2 cents, 650 hours for 4 cents, 500 hours for 6 cents, 450 hours for 8 cents, 400 hours for 10 cents and 350 hours for 12 cents.—Lond. *Elec. Rev.*, April 6.

Power.

Gas Producer Plant for Electric Stations.—Sowter.—A paper read before the Dublin Section of the British Inst. Elec. Eng. After some general remarks on gas producers, the author states that the first British apparatus for the conversion of bituminous small coal into combustible gas, and for the recovery of sulphide of ammonia, was put into operation at Brunner, Mond & Co.'s works at Northwich. Sulphate of ammonia is a valuable by-product. It is claimed that one ton of ordinary slack will yield from 140,000 cu. ft. to 160,000 cu. ft. of gas, and also furnish the ammonia equivalent to 90 lb. of sulphate of ammonia when manufactured upon a sufficiently large scale. In small plants, however, the quantity of sulphate of ammonia recovered is too small to warrant the capital outlay upon the necessary plant, and it is recommended that this part of the plant is better omitted when the quantity of fuel to be gasified daily amounts to less than 30 tons; moreover, in order to secure the most efficient and satisfactory results it is desirable that the process should be continuous during the whole 24 hours. After some remarks on other types, the author refers to suction gas producers which are shown to offer very many advantages in the case of quite small installations. He discusses some troubles with gas engines and remedies therefor. The type of engine most suitable for central station work is, in the author's opinion, the vertical, with three or four cylinders, the dynamo or alternator being direct-coupled to the shaft. Such a plant takes up little space, as compared with a horizontal engine, and compares generally very favorably with a steam plant. With this type of plant great cyclic regularity is obtained, and an immunity from vibration. The exhaust from an engine with several cylinders, and governed by throttling a constant mixture, is much more silent than that of a single-cylinder engine governing on the hit-and-miss principle. Finally some figures are given on the economy of gas plants, especially on the results obtained at the Walthamstow plant. The capacity of this plant now installed is close upon 3,000 hp, and it is by far the largest gas-driven station in the British Isles. The plant consists of 13 Westinghouse gas engines direct-coupled to continuous-current generators. The first installation consisted of four 115-hp engines; the first extension, three 250-hp sets, while recently six more 250-hp sets have been added, three of the latter being in daily use, supplying energy to the tramway system. The following are particulars of the cost of energy per kw-hour sold during the last year:

The number of kw-hours sold was 1,062,446; the load factor, 15.45 per cent.

	Cents	
Coals and other fuel	.84	
Oil, water and engine stores	.20	
Wages	.66	
Repairs	.18	
Works cost		1.88
Rent, rates and taxes	.04	
Management	.44	
		.48
Total cost		2.36

"No doubt, had the bituminous type of gas plant been further developed at the time the Walthamstow station was started, such a plant would have been installed in preference to the present anthracite plant, and this would probably have had the effect of reducing the coal bill to something like 0.4 cents per unit."—Lond. *Elec.*, April 6.

Portable Electric Drills.—Stewart.—A paper read before the Glasgow Technical College Scientific Society on the design and industrial application of portable electric drills. With a view to keeping down the rise of temperature, and therefore the linear dimensions, the fixed losses in an electric motor, subject to a variable load, should be relatively small in relation to the variable losses, because the average losses fix the temperature and these will be less the lower the fixed losses become. The author then speaks briefly on geared and gearless tools and discusses at greater length forced ventilation. With large portable tools gearing is necessary. A large ratio of reduction can, in most cases, be justified on the score of efficiency and light weight, as the weight of an increased gearing is not as great as the increase in the weight of a slower speed motor. The following figures show the speed, weight and efficiency of a standard motor, a light-weight automobile motor and a special electric drill motor.

	Intermittent rating "standard."	Intermittent rating "special."	Electric automobile motor.	Electric drill.
Hp	1⅛	1⅛	1⅛	1⅛
Speed	1,700	2,700	2,000	4,800
Efficiency	.70	.69	.69	.71
Weight	156 lb.	132 lb.	90 lb.	58 lb.*

*Including gear reducing to 100 revs.

As a matter of fact the machine marked "special" is on the verge of impracticability, as the variable losses, i. e., losses which increase as the square of the current, have become so great that the machine has passed the limit at which it can be kept cool without difficulty on loads where the periods of rest equal the periods of work, neither exceeding a few minutes, which is the usual interpretation of the term "intermittent rating," such as is usual for cranes, hoists, etc. Pillars for drilling are usually fixed by bolts and nuts in the desired position, but the author recommends the use of a magnet in the base of the pillar as a substitute for the bolts and nuts. He then speaks at some length on the efficiency of electric drills. Fig. 4 gives data on the power required for drilling mild steel and cast iron, the figures being the horse-power per pound of metal removed per hour for drilling holes of different sizes. By separating the machine losses and determining how much is left for work at the drill point the author found the latter power to vary from 0.07 to 0.1 hp per pound of metal per hour for mild steel, and 0.035 to 0.06 hp for cast iron; the first figure referring to holes of the order of two inches and the latter to small holes. Figs. 5 and 6 show the relative merits of ordinary and high-speed tool steel. The results were obtained during some tests when several holes were drilled in succession, the work done being measured by weighing the block after each hole and observing the time per hole, and also

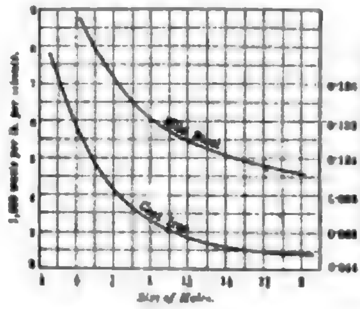


FIG. 4.—POWER CURVES.

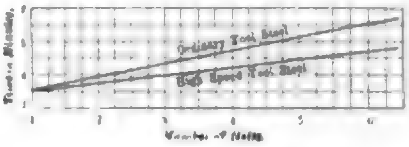


FIG. 5.—HORSE-POWER CURVES.

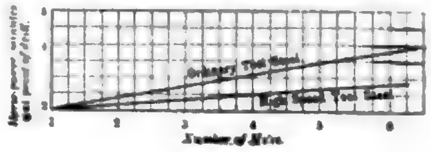


FIG. 6.—HORSE-POWER CURVES.

power used. It will be seen from Fig. 5 that there is an increase of 36 per cent in the time taken to drill the sixth hole when compared with the first with high-speed tool steel, and 58 per cent with ordinary tool steel, the power being maintained exactly the same in each case—the difference in favor of the high-speed tool steel being 14 per cent. Fig. 6 shows the striking difference when not only time but the power is taken into consideration. In this case the ordinates are horse-power minutes at the point of the drill, and show how great are the advantages of high-speed tool steel, necessitating, as will be seen, 38 per cent increase at the sixth hole, as against 90 per cent in the case of ordinary steel.—*Lond. Elec.*, March 30.

Steam Engines Versus Steam Turbines and Gas Engines.—Schoemburg.—An article giving an estimate of costs of equipping a mill with an electric power plant for supplying direct current to lamps and motors, the power needed during the day being 900 kw and during the night 250 kw. The following three systems are compared: Dynamos driven by steam engines; dynamos driven by steam turbines, and dynamos driven by suction gas engines. The estimate of cost depends, of course, on local conditions and on various assumptions which are made. The results are as follows, the figures giving the first cost per kilowatt and the cost of operation per kw-hour, respectively:

	First cost per kw.	Cost of operation per kw-hour.
Steam engines	$135.00	1.44 cents.
Steam turbines	104.50	1.30 "
Gas engines	112.75	1.15 "

The general conclusion is that the question which system is the best must be solved for each case and cannot be answered in a general way.—*Elek. Zeit.*, March 29.

Installations, Systems and Appliances.

Storage Batteries in Three-Phase Systems.—Schroeder.—A paper read before the Berlin Elec. Society. The simplest way to use a storage battery in connection with a three-phase system would be through the intermediary of a motor-generator consisting of a direct-current machine and a three-phase machine. With this arrangement, however, the storage battery begins to discharge into the three-phase system or to be charged from it only when the speed of the motor-generator decreases or increases. A much closer regulation may be obtained by an arrangement indicated in a general way in Fig. 7, where a relay, *R*, is provided, acting automatically on the shunt regulator, *N*, which determines the field, *F*, of the direct-current machine, *C*, of the motor-generator, *B C*, *B* being the alternating-current machine of the same set. *A* represents the three-phase generating plant. An application of this method made by the Allg. Elek. Ges. in connection with an electric winding plant at a mine is described. The relay used in this case is that of Tirrill, which is described in detail, as is also that of Entz, which is well-known in this country. The author then discusses several arrangements in which no relay is used. One of the methods is shown in Fig. 8. One of the conductors of the three-phase system contains the primary of the transformer, *T*, which feeds the converter, *D*. The direct current given out by *D* is directly proportional to the three-phase currents and is supplied to the exciting windings, *G*, of the direct-current machine of the motor-generator, *B C*. These exciting windings, *G*, are wound in a direction opposite to that of the shunt exciting winding, *F*. When the three-phase currents increase, the voltage of *C* is diminished so that the storage battery discharges into *C*. On the other hand, when the three-phase currents decrease, the voltage of *C* increases and the storage battery is charged. The converter, *D*, is placed on the same axle as the motor-generator, *B C*. It is stated that the Siemens-Schuckert Company uses this method in a recent installation which has proven satisfactory and that interpoles are advantageously used for the machine *C*. A modification is shown in Fig. 9 where the converter *D*, acts on a booster, *C*. In this case it is also preferable to place the motor-generator, *B C*, the converter, *D*, and the booster, *K*, on the same axle. A converter may be used here instead of the motor-generator. Other modifications are also described and illustrated and applications to the hauling problem in mines are especially dealt with.—*Elek. Zeit.*, March 29.

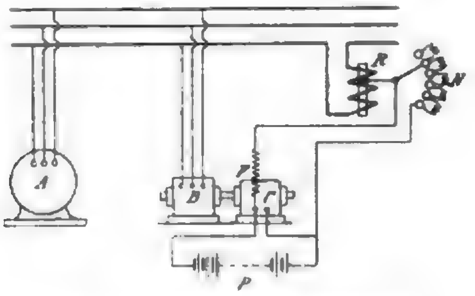


FIG. 7.—DIAGRAM OF CONNECTIONS.

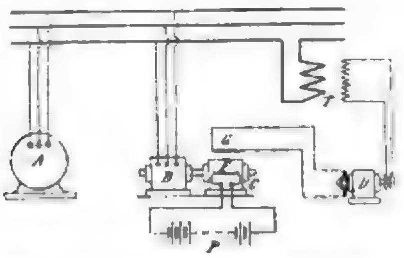


FIG. 8.—DIAGRAM OF CONNECTIONS.

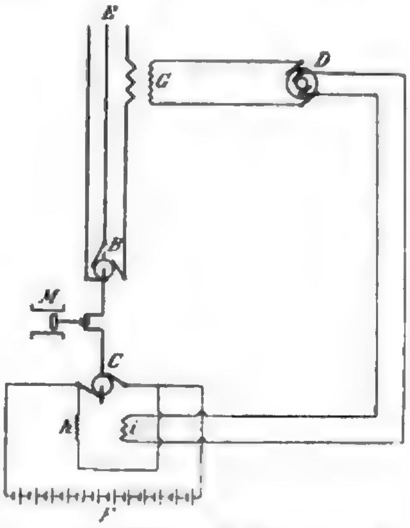


FIG. 9.—DIAGRAM OF CONNECTIONS.

Storage Batteries.—Salter.—A paper read before the Manchester Section of the British Inst. Elec. Eng., giving "economic considerations in the employment of storage batteries." The author emphasizes that a storage battery cannot be considered as an addition to the generating plant. If one wanted to use it in case of a breakdown in the generating plant, the battery capacity would have to be enormous. The only real advantage which the author acknowledges in favor of the storage battery, is that it gives some improvement in the load factor, "due to the fact that with batteries the generating plant in a given time has not only to supply the useful units in a system, but has also to supply the units which are lost in the battery; and as the total annual steam consumption is made up of two terms, the first dependent upon the number of hours the set is run, and the second dependent only upon the number of units generated, the cost of fuel per unit generated is bound to be less, owing to the greater number of units generated, and which are lost in the battery; but the cost per unit usefully supplied will not be so largely affected." The author states that a reduction in the cost of generation with a 33 per cent improvement in the load factor is only 8 per cent and that as the load factors are increased, the improvement due to the introduction of batteries reckoned as a percentage decreases to a point which becomes almost insignificant. Upon general grounds, therefore, the author is led to the conclusion that in moderate-sized stations the advantages to be obtained from the use of batteries are not justified by the capital charges involved. Two examples are given from actual plants in which the batteries do not prove valuable. In the discussion it was pointed out, however, that these two cases can hardly be recorded as typical.—Lond. *Elec.*, April 6.

Manchester.—A continuation of an illustrated article on recent extensions at the Manchester electricity works. The last additions to the generating plant at one station are two 750-kw direct-current turbo-units. The dynamos are four-pole machines with interpoles, and have a series winding in addition to the shunt winding, so that they may be used for lighting or traction. As shunt machines they supply 1,870 to 1,670 amp. at 400 to 450 volts, and as compound machines up to 1,360 amp. at 500 to 550 volts. The speed is 1,000 r.p.m. The interpoles in these machines belong to an entirely distinct magnetic system, comprising a separate yoke and four poles. This yoke is made up in two rings, rather less in diameter than the main yoke, and the poles, which have the same length, measured along the axis of the machine, as the main poles, and are laminated, project into the space between the main poles. The five-wire network (at 5 × 100 volts) has been retained in the central part of the area, but all the outer area is on the 2 × 200 volts, three-wire system.—Lond. *Elec.*, April 6.

Electrophysics and Magnetism.

The Positive Column.—Villard.—A paper in which the author discusses the deflection of the positive light in a vacuum tube, with a view to elucidating its mechanism. In the classical experiment concerning its deflection by a magnet, it is found that the beam is bent out towards the region between the poles of the electromagnet somewhat like an elastic band. It behaves like a filament carrying a current. In this phenomenon the walls play a prominent part unless the tube is very wide. In a wide tube the positive particles no longer behave like a conducting filament. Their paths twine round the lines of force of the magnet field in such a manner that they diminish the field. A conducting filament, on the other hand, rolls itself up in such a manner as to increase the magnetic field. When the field is increased the spirals described by a projected particle diminish in diameter, whereas those of a conducting filament increase. If the positive column consists of particles at rest, or in very slow motion, it may be regarded as a conducting filament. Its positive charge is evidenced by its attraction by a negative pole, and its repulsion by the walls. Its length is increased by increasing the current strength or narrowing the tube.—Lond. *Elec.*, April 6; from *Comptes Rendus*, March 19.

Radioactivity of Thorium.—Dadourian.—A Phys. Society paper giving the results of experiments which show that the radioactivity of thorium, and consequently the radiothorium in a mineral, is proportional to the quantity of thorium present in the mineral; further, that radiothorium is a disintegration product of thorium. The fact that commercially prepared thorium salts have lower specific thorium activity leads to the conclusion that about half of the equilibrium quantity of radiothorium is removed from these salts in the chemical process of their preparation. The results of the experiments strongly indicate the elementary character of thorium itself.—*Phys. Rev.*, April.

Polarization of Secondary Röntgen Rays.—Barkla.—An account of experiments in which the author succeeded in proving the polarization of secondary Rontgen rays by choosing carbon as a secondary and tertiary radiator.—Lond. *Elec.*, March 30; from *Proc. Royal Soc.*, 516, March 6.

Electrochemistry and Batteries.

Nitrogen from Air.—Guye.—A paper discussing the principles of the fixation of atmospheric nitrogen either in the form of calcium cyanamide by an electric furnace process or in the form of nitric acid by spark discharges through air. The latter case is discussed strictly on the principles of modern physical chemistry, whereby the author makes the fundamental supposition that there is no specific electric effect of the discharges, but that the reaction is simply determined by the temperature and the pressure. It is necessary to produce a high temperature in order to combine the nitrogen with the oxygen; this is done by the electric arc discharge. The second requirement is to cool the produced gas mixture quickly to a low temperature as otherwise a great portion of the obtained products would undergo the opposite reaction. It is finally suggested to use liquid air for the production of nitrogen and oxygen; the nitrogen gas to be used in cyanamide manufacture and the oxygen in the combustion of atmospheric air by arc discharges. Both industries should, therefore, work in harmony. The same issue contains an article giving recent commercial developments with the Birkeland-Eyde process in Norway, producing calcium nitrate which is called Norwegian saltpetre. It is reported that a large German chemical company will erect a water power plant for the production of nitric acid by the same process to make potassium nitrate for explosive purposes. An editorial in the same issue gives a concise review of all the different possibilities which have been suggested for fixing atmospheric nitrogen.—*Electrochem. and Met. Ind.*, April.

Containers for Accumulators.—Schoop and Liagre.—The conclusion of the illustrated article on various methods of constructing containers for alkaline and lead accumulators. In the present installment containers of sheet iron or steel are dealt with and the following methods are covered: folding, electric welding or welding with the oxyhydrogen flame, spinning, pressing with extremely high pressures (method of Huber), electrolytic deposition.—*Electrochem. and Met. Ind.*, April.

Units, Measurements and Instruments.

Measuring Voltages with the Aid of Nernst Lamp Ballasts.—Kallmann.—The iron wire resisters which are used as "ballast" in connection with Nernst lamps in order to keep the voltage at the filament terminals constant may be used in connection with other resisters for comparing and measuring voltages. The simplest arrangement is shown in Fig. 10, where $r_1, r_2 \ . \ . \ . \ r_{10}$ are the iron wire resisters (which are called by the author "variation resisters"). They are designed for 0.15 amp. and 10 to 30 volts. When the voltage between *a* and *c* varies between 210 and 230 volts, the voltage between *b* and *c* is practically constant = 200; since any voltage between 10 and 30 volts is consumed in the variation resisters, *r*. A voltmeter connected to *b* and *c* can, therefore, be calibrated, since the arrangement gives a constant tension for comparison. It is supposed here, however, that the internal resistance of the voltmeter is not too small. The arrangement shown in Fig. 11 enables one to get independent values of the resistance and of the measuring current. It is a zero method. Variation resister, *I*, is in series with a constant resister, *b c*, of 1,200 ohms. If *I* is designed for a current of 0.1666 amp., the voltage between *b* and *c* will be constant = 200, in spite of fluctuations of voltage in the network. The variation resister, *I*, consumes on the average 20 volts, i. e., if the network voltage varies between 210 and 230, the voltage consumed by *I* will vary be-

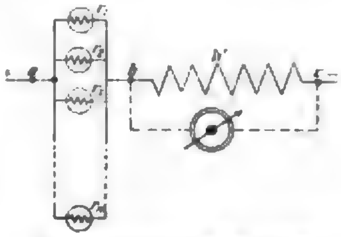


FIG. 10.—MEASURING VOLTAGES.

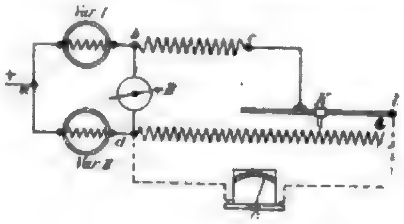


FIG. 11.—MEASURING VOLTAGES.

tween 10 and 30. A second equal variation resister, *I I*, is in series with a resister, *d c*, of about 2,500 ohms. A simple galvanoscope, *B* (or a telephone in case of alternating current), is inserted between *b* and *d*. The voltmeter, *G*, to be calibrated is connected between *d* and the sliding contact, *K*, which is moved along a uniform resistor, *d e*, until the galvanoscope, *G*, shows zero current (or the telephone gives a minimum of sound). Then the voltage between *d* and *l* is again exactly 200 volts, since the influence of the change of voltage due to resistance of the voltmeter itself has now been eliminated. While this method permits only a comparison of voltages, the following arrangement shown in Fig. 12 allows a complete calibration and a measurement of voltages by the Wheatstone bridge method; *a* and *b* are two variation resisters, r_1 and r_2 constant resisters. The largest part of the voltage, however, is consumed by the constant resistance, W_1 W_2 and *R*, the latter one being adjustable within certain limits. In a bridge between *a* and *b* on one side and r_1 and r_2 on the other side, there is a galvanoscope, *B*, or a relay or indicator in case of alternating currents and a telephone. The voltmeter to be calibrated would be connected directly to the terminals of the instrument, as shown in the figure. There is also in the bridge a switch with three positions, 1, 2, 3. The instrument acts as follows: The two variation resistors, *a b*, carry a constant current, each of 0.15 ampere. A current of 0.3 ampere, therefore, passes through *R* and W_1 and W_2 from the positive to the negative terminal. This current divides itself between the different branches of the Wheatstone bridge. If each of the two variation resisters, *a* and *b*, consumed between 10 and 30 volts when carrying a constant current of 0.15 ampere, the mean e.m.f. of each variation resister will be 20 volts corresponding to a resistance of 133 ohms. If all the branches of the bridge are made equal the constant resistances, r_1 and r_2, are also each 133 ohms With the proper mean voltage—220 volts—the e.m.f. consumed by *a*, *b*, r_1 and r_2 will be 20 volts in each case, so that the e.m.f. at the terminal of the bridge is 40 volts, while the balance of 180 volts is mainly consumed (say 160 volts) by the fixed resistors, W_1 and W_2, and to a smaller degree (about 20 volts) by the adjustable resister, *R*. If now the voltage between the two terminals is exactly 220, then the resistances in the four branches of the bridge are exactly equal and no current flows through the indicator, *B*, the switch, *U*, being in the position, 1. This would show that the voltage is correct, and the voltmeter, *G*, if accurate, would have to give a reading of 220 volts, whatever its internal resistance may be. If the voltage increases to 221, the excess e.m.f. of one volt would be consumed by the variation resistances, *a* and *b*, which each now consumes 21 volts, so that their resistance becomes 140 ohms. There is no longer equilibrium in the bridge, since r_1 and r_2 are only 133 ohms, and the indicator, *B*, will give a reading. By adjusting the resistance, *R*, the equilibrium may at once be reestablished so that *B* remains without current. For this purpurpose a change of resistance amounting to about 3.3 ohms is required. The resistance of *R* (designed for a change of 20 volts) must be about 66 ohms. It is, therefore, possible to read directly the voltage from a scale on *R*. With alternating currents the minimum of sound in the telephone enables one to get a very sharp reading. If switch *U* is placed on the position, 2, the resisters, $a + r_1$ and $b + r_2$ are simply connected in parallel. If there is no equilibrium in the bridge, another distribution of voltage between *a* and r_1 and between *b* and r_2 would take place in the case of short-circuiting the bridge by means of pushing the switch *U* to position 3. As long as *R* has not been correctly adjusted, movement of the switch *U* from 2 to 3 will cause variations in the brightness of these two variation resisters. It is, therefore, only necessary to adjust *R* until there are no longer any changes in the degree of brightness of *a* and *b* when the switch is changed from 2 to 3, and the voltage (for instance 222.4) may then be read directly from the scale of *R*. The degree of brightness of the variation resisters is, therefore, an optical means which makes any other measuring instrument like galvanoscope or telephone unnecessary in the bridge.—*Elek. Zeit.*, April 5.

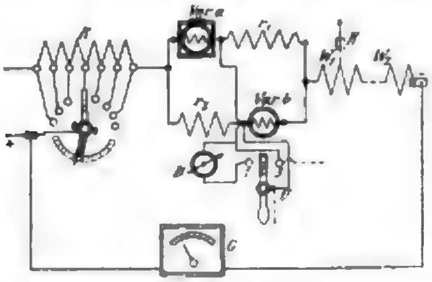


FIG. 12.—MEASURING VOLTAGES.

Telegraphy, Telephony and Signals.

Oscillation Valve for Rectifying High-Frequency Currents.—FLEMING.—An abstract of a (Brit.) Phys. Soc. paper. The author recalled the fact that as far back as 1890, when investigating the Edison effect in incandescent lamps, he had shown that the space between the carbon filament and an insulated metal plate placed in the vacuum bulb possessed a unilateral conductivity, negative electricity being able to pass from the filament to the plate, but not in the opposite direction. This led him to suggest an arrangement of the above kind for separating out or rectifying the oppositely directed waves in an alternating current. This effect is now recognized as due to the copious emission of negative ions or electrons from the incandescent carbon. In 1904, however, the author discovered that if the carbon filament in an electric incandescent lamp was surrounded with a metal cylinder connected to an insulated terminal by a wire sealed through the bulb, and if the filament was made incandescent by an insulated battery, then between the insulated terminal and the negative pole of the battery a unilateral conductivity existed which was operative with currents of any frequency, and the valve so made might be employed to render electrical oscillations measurable by an ordinary sensitive galvanometer. The author exhibited oscillation valves made on this plan, and also showed their uses. If placed in series with a galvanometer, and in the circuit of a coil of wire acted upon inductively at a distance by oscillations created in another circuit, the valve gives intrinsic information as to the damping in the primary circuit. The author referred to the employment of such carbon-filament oscillation valves as wave detectors or cymoscopes in connection with wireless telegraphy. Finally it was pointed out how, by the use of an electrodynamometer and galvanomter in series, the amount of rectification produced by the valve could be measured, and it was shown that it might reach 89 or 90 per cent.—Lond. *Elec.*, April 6.

BOOK REVIEWS.

HIGH-TENSION POWER TRANSMISSION. Two Volumes. Vol. I, Papers and Discussions of the American Institute of Electrical Engineers, under the auspices of the Committee on High-Tension Transmission. Vol. II, Papers and Discussions at the International Electrical Congress, St. Louis. Cloth. New York: McGraw Publishing Company, Vol. I, 500 pages, illustrated. Price, $3.00. Vol. II, 315 pages, illustrated. Price, $2.50.

It was an apposite saying that the civilization of a nation might be measured by its consumption of iron, though a modern paraphrase would aver, as a little consideration shows, that civilization is more truly proportional to the consumption of energy.

We are all engaged in making things for others: taking some relatively undesirable form of matter and by the skillfully directed application of energy transforming it into some more valuable shape. Thus the miller and the waterfall grind grain into flour, which by the baker and oven's heat becomes bread. The spinner's arm twists the cotton fibre into thread that the flying shuttle, driven by the weaver's wrist interlaces into a garment. Through the fiery ordeal of the furnace the stony ore runs into molten metal, to be rolled into the pillars and girders that support a palace. So matter is ever like Undine seeking energy as a soul to vivify it into usefulness. But energy is elusive and coy and difficult to decoy far from its chosen haunts in glancing waters of the cataract or the flickering flame of the fire. However, in electricity a Huldbrand has appeared and by its aid energy may be coaxed long distances away from its customary habitats and married to matter.

To accomplish this a special road must be provided, for electricity is royal and disdains all common paths and highways, even railways. Such a road the modern high-tension line provides, and of all of the engineering triumphs of the nineteenth century, probably few, if any, will exercise a more profound effect on future civilization than that closing achievement—the electrical transmission of energy over great distances.

To construct an adequate and sufficient electrical highway entirely transcended the experience of a quarter of a century ago. It presented new problems, demanded new materials, new processes of manufacture and the development of a new constructive skill along entirely novel and unfamiliar lines. There were no precedents and the electrical engineer, like his predecessors, had to feel his way blindly and stumblingly, through much painful evolution to the successful structure of to-day. In so young an art there has been little time to accumulate records, and the invaluable teaching of experience has existed chiefly in the minds and scattered notes of pioneer builders. To collect this information the American Institute of Electrical Engineers in 1902 appointed a High-Tension Transmission Committee, assigning to it the duty of securing in the form of papers and discussions a representative consensus of opinion as to standard practice in transmission line construction. The International Electrical Congress of St. Louis, 1904, afforded an opportunity to review this topic and subject it to the alchemy of the best engineering minds of both Europe and America; and now a publisher has collected the results of the deliberations of the High-Tension Transmission Committee and those of the Electrical Congress, in the what may be termed a general symposium of transmission line data.

Space would fail to adequately catalogue the papers and discussions, with the names of the authors, well known as authorities on this subject, so an idea of the scope and character of this work can be best gained by a brief consideration of the subjects it treats. It is equally impossible to attempt a critique in the ordinary book review sense, for as the papers are largely records of experience and simply truthful reports they are beyond criticism. In so far as they become prophetic, pointing the way to other constructors, they are based on records of past experience, and it is for the new designer to determine whether the data recited fit the cases with which he has to deal. There is no striving for literary effect. The writers have in all cases had something to say that is worth listening to, and have stated it tersely, to the point, and in plain engineering English—valuable attributes that more pretentious works might well copy.

The transmission line as a product of evolution has survived because it has successfully coped with the environment, and in its adjustment to circumstances the designer has been compelled to consider the laws of electricity so far as they bear on the transmission of energy; the limitations of constructive materials at command; the further limitations of those materials when in their manufactured conditions; and finally the question of competition with energy developed by other methods, for no engineering can be considered successful that is not remunerative. So in this collection of papers there appears a certain amount of theoretical matter, dealing with the questions of inductance, capacity, potential, frequency and wave forms in so far as these relate to transmission lines. It is gratifying to note that the authors have used the simplest language and have largely resisted the temptation to wander into higher mathematics. Next the various materials, such as copper and aluminum for conductors, glass, porcelain, etc., for insulators, wood and metal for pins, cross arms and poles are considered in the light of experience. Subsequently the limitations of manufacture are taken up, showing what experience has indicated as the best forms for transmission structural material.

There is perhaps less attention devoted to the commercial aspects of the electrical transmission of energy than the reader might desire, probably because so far most transmission lines have been located under circumstances that left no doubt as to commercial success; for naturally the most favorable locations would be first selected, leaving the narrower possibilities to a later period.

The volumes are fully illustrated both with photographic reproductions of actual conditions, and with line drawings of detail plans, and form the most complete and almost the only compendium of high-tension line practice. So they become a necessity to the transmission line engineer, and almost equally valuable to the library of every electrical engineer.

Das Funken von Kommutatormotoren. By F. Punga. Hannover: Gebruder Janecke. 142 pages, 69 illustrations. Price, 4.60 marks.

In most treatises on dynamo-electric machinery, the subject of sparking at the commutator is dealt with in connection with direct-current motors, and is taken up again independently in connection with series alternating-current commutator motors. The author of this treatise has, however, presented the subject of sparking at commutators in its general relation to motors or dynamos of any type.

The engineering theory only has been attempted. That is to say, the author deals with the subject from an engineering standpoint as distinguished from the purely physical standpoint. Numerous arithmetical and practical examples are offered. The work includes a consideration of the direct-current motor, the series alternating-current motor, the repulsion motor and the compensated commutator motor. The treatment is clear and abundantly illustrated by vector diagrams. The book will be of special interest to the designer of commutator motors of all kinds.

An Automobile Trip to Sell Motors.

By R. L. Caldwell.

I note that the Electrical World has been carrying on a vigorous campaign lately to increase the sale of current and the consumption of apparatus in the central station field. I think, therefore, that its readers might like to know what I did recently with my partner, Mr. Osterhoudt, on a novel automobile trip on Long Island, when with a "Century" single-phase motor mounted on the rear platform of the machine we spent several days in April traveling through the Island calling on central stations and giving a working demonstration of the motor's capabilities. As you are probably aware, this region has chiefly 60-cycle current, and in fact we encountered only one high-frequency plant, namely, that with 125 cycles, at Northport.

AUTOMOBILE WITH SINGLE-PHASE MOTOR.

First we would call on the superintendent or manager at the main office of the company and get him deeply interested in our motors. Then after considerable conversation, etc., we would surprise him by stating that if he would come outside with us we would go with him in our automobile to the plant and back our machine to the door and give a working demonstration of the motor, affording him the opportunity to use testing instruments with brakes, etc., so that he could judge exactly of the availability of the motor for his purposes. As our motors are built with an interchangeable winding, so that they can be operated on 104 or 208 volts, it was an easy matter to convince the managers of the many qualities embodied in the machine.

The novel way we had adopted of placing this machine before the different people interested was highly appreciated by them, and we believe the best exemplification of the fact that in order to sell goods you must display samples is shown by the success we achieved.

Our motor rode very easily on the machine, being mounted on the rear springs, and we lost no time due to its being there, as we ran rapidly over the roads, taking no notice of the ruts or rocks encountered. We thus subjected it to many a hard bounce, but found we were always able to give a highly satisfactory, practical demonstration without any adjustment owing to the fact that the motors are built very strong. The roads through Long Island as a general rule, however, are very fine, and the weather being excellent our trip was highly successful.

In addition to its being a fine advertising feature we had the pleasure of receiving orders and have shipped motors since. The expense entailed for this trip was very slight, being much lower than it would have cost us had we traveled by railroad, including only as it did hotel bills and the cost of oil and gasoline for operating the motor. I might add that as a precaution against bad weather the motor was encased in a rainproof and dustproof box, which, of course, was kept on it while traveling.

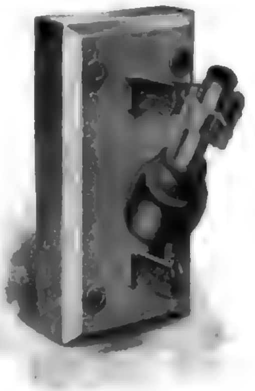
New Style of High-Potential Fuse Holder.

The General Electric Company has perfected a new device in the shape of a high-potential fuse holder, shown in the accompanying illustration. These fuse holders are designed to protect 2,300 and 6,600-volt systems, but can be made to suit special requirements for higher voltage. They supersede the "expulsion" type and will be used in the future on all General Electric switchboards requiring high-potential fuses. The device is of small size and is claimed to be capable of rupturing more energy under short-circuit conditions than any other similar device heretofore placed on the market.

The body of the holder consists of an insulated metallic chamber, into the upper end of which is screwed a fibre tube. That part of the fuse located in the chamber is of smaller cross-section than the remainder, to insure rupturing at that point. The expansion of the gases formed by the arc in the chamber expels the fused metal and effectually opens the circuit. New fuses can be readily inserted in the holder by removing a screw plug located in the bottom of the bulb.

The holder is connected in circuit by means of blades fastened to either end, which fit into clips mounted on a base or switchboard panel. The advantages of this method of support will be readily understood. Spare fuse holders can be kept on hand ready for the instant replacement of ruptured fuses. The complete device is compact, substantial, easy to handle, and may be located in any convenient place. The holders are made in groups of two, three or four, mounted on bases or in single elements without bases for switchboard mounting.

It is recommended that 2,300-volt holders be spaced on 12-in. centers and 6,600-volt holders on 18-in. centers, unless barriers are used between them, in which case these distances can be made 5 in. and 8 in., respectively. The ampere rating corresponds to the direct-current carrying capacity, and the rupturing point is approximately 60 per cent greater. Fuses for operating on small overloads can be made to order. The 2,300 and 6,600-volt fuse holders are made to carry 100-ampere fuses or smaller sizes. Holders of both voltages are made back-connected for switchboard use without bases, and either back or front-connected on base singly or in groups with barriers.



FUSE-HOLDER.

Light and Power Plant for Los Angeles.

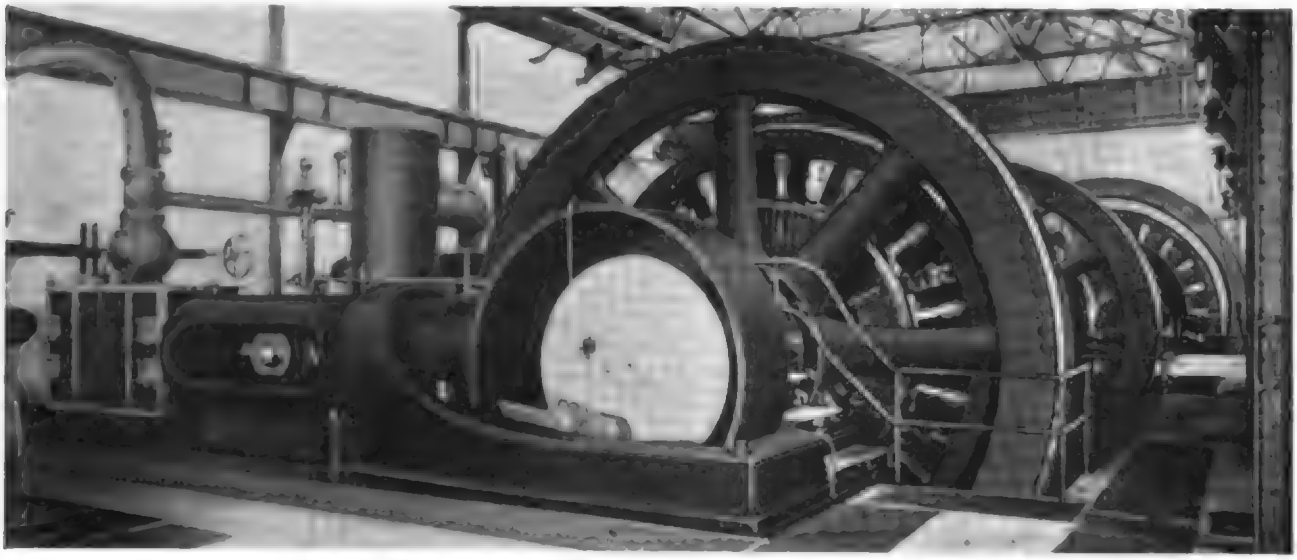
The Pacific Light & Power Company, of Los Angeles, Cal., has just contracted with Charles C. Moore & Co., engineers, of San Francisco, Cal., for the complete steam power plant to be delivered and installed at Redondo, Cal., on the ocean, a suburb of Los Angeles. This plant will be used for supplying power to the entire street railway system of Los Angeles and the various surrounding towns in connection with the various other power plants and water transmission systems. It will have a nominal capacity of 15,000 kw consisting of three 5,000-kw units; the overload capacity of plant will be about 30,000 indicated hp. The generating units consist of three McIntosh & Seymour combined double horizontal and vertical compound condensing engines, gridiron valve type, each direct-connected to a 5,000-kw fly-wheel General Electric 50-cycle, 18,000-volt alternator. The engines will operate under 175 lb. pressure, 100° F. superheat at throttle and 27½-in. vacuum. The engines, which are specially adapted for use with superheated steam, are equipped with powerful automatic shaft governors, and have a special equipment of electrical speed-changing devices and McIntosh patented time-delayed dash-pots to facilitate the synchronizing of alternators and the operation of alternators in parallel under variable load. The division of load between the engines and the speed of each engine will be controlled by the switchboard operator. Each engine has two horizontal high-pressure cylinders and two vertical low-pressure cylinders; each engine has two sets of condensing apparatus, one for each low-pressure cylinder, so that in case of breakdowns of either side of any main engine the other side may be operated under an overload.

Wheeler Admiralty surface condensers are to be used throughout, supplied by the Wheeler Condenser & Engineering Company. Connected to each condenser there will be one motor-driven Wheeler centrifugal circulating pump and one Edwards triplex vertical single-acting suction valveless air pump, motor-driven. The air pump and circulating pump motors are supplied with power from an auxiliary generator, or may be operated from the main generator. Each main generator has its independent engine-driven exciter. The auxiliary engine and exciter engines are tandem-compound, non-condensing, supplied by the Harrisburg Foundry & Machine Works. The exhaust steam from the auxiliary engines, together with the various drips and the exhaust steam from the feed pumps will be used for feed water heating purposes. Steam is supplied by eighteen 600-hp Babcock & Wilcox water-tube boilers, each having integral superheater to give 125° superheat at the boiler nozzle when operating between 190 and 200 gauge pressure. Each boiler is equipped with a Peabody fuel oil furnace. Weber steel concrete chimneys will be used.

Chapman gate valves will be used throughout, specially constructed for use with superheated steam. Electrically-controlled valves will be used at critical points. On the outlet from each boiler there will be a Pearson automatic angle steam stop and check valve. Oil fuel is supplied to the boiler by means of Snow pumps, heated by Goubert multiflow oil heaters. The feed pumps are horizontal duplex compound, outside center packed. The feed water is heated by Goubert vertical multiflow feed-water heaters. The entire plant is designed on the panel system, being in effect three independent plants of 5,000 kw each.

Heretofore the large steam plants on the Pacific Coast have been used in connection with water power transmission purposes, merely for purposes of reserve. In this instance it is the intention of the owners to operate the plant continuously by reason of the low cost of the production of power when using this plant. The plant is situated near the wells and oil will thus be secured at an exceedingly low rate.

One of the novel features of this contract is the provision for the contractors to operate the plant for a period long enough to insure all parts being in proper working order, and then to submit the plant to a 90-day test under actual working conditions, to determine the compliance with the guaranteed economy of the complete plant, the object being to determine the kilowatt-hours output of the plant swichboard per barrel of oil burned under the boilers.


Railway Generators, New Power House of the Central Pennsylvania Traction Company.

Power House of Central Pennsylvania Traction Company at Harrisburg.

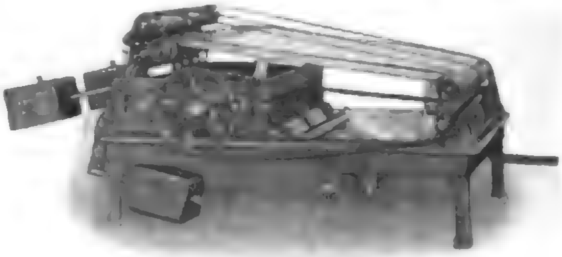
Excavations for the new power station of the Central Pennsylvania Traction Company of Harrisburg, Pennsylvania, were begun early in December and the construction of the building proper is now well on the way. The new plant adjoins the old No. 1 Station on South Cameron Street, Harrisburg, and when completed, will replace three separate plants which are now in service. The building, 175x102 ft. and one story in height, is of steel construction imbedded in concrete.

The steam and electrical equipment for the plant will consist of three Reynolds horizontal cross-compound, condensing, Corliss engines, heavy duty type, built at the West Allis shops of the Allis-Chalmers Company. Each engine will be direct connected to a 650-kw, 600-volt, direct-current generator mounted on the main shaft, the generators also being furnished by the Allis-Chalmers Company and built at its Bullock works, Cincinnati. These units will have a capacity of fifty per cent overload for short periods, giving a maximum capacity for the entire plant of approximately 4,500 hp. The main switchboard, which will consist of twelve panels, will be connected by a direct feeder line to each of the twelve different sections into which the traction company's lines are divided. The engine room will be 50 ft. wide, extending the full length of the building, 170 ft., and directly facing Cameron Street. An electric traveling crane with a lifting capacity of 30 tons, will serve the engine room for installing heavy apparatus.

An interesting engineering feature of the new plant will be the water supply tunnel. Plans have been drawn and the work will shortly be started on the boring of a 5-ft. tunnel in the solid rock 30 ft. below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron and Steel Company to the river. From the river bank a 36-ft. cast-iron pipe will extend to a point in the river where the best quality of water is to be obtained. This water supply tunnel will be built and used jointly by the traction company and the Central Iron and Steel Company.

All the work is being carried out from plans prepared by and under the direction of Mason D. Pratt, consulting engineer, of Harrisburg, and W. C. Gotshall and C. O. Mailloux, of New York City, acting as advisory electrical engineers. This plant, the cost of which will approximate $250,000, is expected to be ready for operation during this month.

The Crabb Transparentizer.


TRANSPARENTIZER.

An original labor-saving device for draughting rooms and engineering departments of manufacturing plants and offices has been brought out by C. L. Crabb & Co., 21 Lincoln Place, Brooklyn, N. Y. This device is known as the Crabb "Transparentizer" and is shown herewith. The purpose of the device is to make it possible to dispense with tracings from original drawings, the latter being made serviceable for uses where tracings have heretofore been employed. The machine accomplishes this result through a combination of heated chemical bath and calendering rollers. Drawings made upon white paper with pencil are placed on a feeder board between bands as shown. The bands convey the paper through the bath and between the calendering rollers, bringing it out again to the starting point. The operation consumes about 45 seconds and after it the drawing is at once ready for such uses as tracings would be ordinarily put. The treatment renders the paper as transparent as tracing cloth and blue prints made from it are said to be as clear as those obtained through the latter agency. A feature of the machine which should appeal to those who have experienced difficulty in preserving tracings is that the paper is made proof against water and mildew. The blue prints being made from the original drawing, the possibility of error due to tracing is eliminated. The maker claims that the paper is not shrunk by the treatment so that distortion of the drawing does not result, and that the machine is compact and simple in its operation. The bath and rollers may be heated by gas or by electricity, the machine shown being equipped with gas heaters.

Lippincott Steam Indicating Apparatus.

The accompanying illustrations show a new line of indicating instruments made by the Lippincott Steam Specialty & Supply Co., Newark, N. J. Fig. 1 is a section cut of the high-pressure pattern instrument, which embodies several improvements. The piston is known as the frictionless, and as will be seen, is carried loosely between two ground flanges, which permit it to move laterally, and thereby centralize itself in the cylinder regardless of any side thrust of the spring. The rod is held central at the top in the usual manner, and also at the bottom by means of a tail rod and a bearing therefor.

The steam cylinder is readily removable, and is kept in perfect alignment by means of steam tight bearings at the top and bottom. Below the piston a number of steam ports are provided which admit live steam to the annular space surrounding the cylinder, thereby providing an efficient live steam jacket. The standard size piston is one-half inch area, but with each instrument is provided an extra cylinder and piston of quarter-inch area made of suitable material for gas engine and ammonia compressor work; the change of cylinders being effected in two minutes. The leakage of steam by the piston is taken care of by means of a swivel discharge of the elbow shown beneath the drum carrying arm, which elbow may be turned in any direction to suit the convenience of the operator.

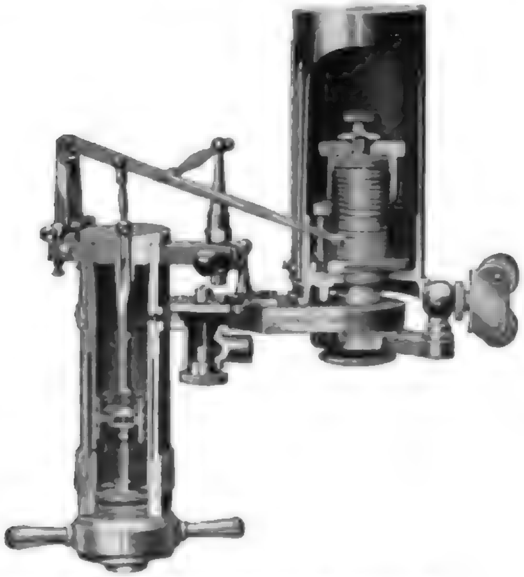


FIG. 1.—SECTIONAL VIEW OF INDICATOR.

The pencil mechanism is made on a true pantographic principle which guarantees absolutely correctness. This mechanism is carried in an improved manner upon adjustable standards which admit of perfect alignment in every direction. A perfect detent motion is fitted to each instrument, as shown. The drum spring is provided with permanent heads at either end, and the top head fits over a square, milled on the end of the shaft, so that the tension of the drum spring may be varied to suit any desired speed. When desired, an outside spring attachment, as shown in Fig. 2, may be obtained, the body of the instrument remaining the same.

In Fig. 3 the Lippincott reducing wheel is shown attached to the indicator just described, but it may be attached to any standard make of indicator with equal facility, and is suitable for all strokes from 6 in. to 7 ft. The pulley, *E*, may be replaced by one of smaller size for longer strokes, and for very short stroke engines the main cord wheel, *C*, is removed from the hub, *F*, and another aluminum wheel of smaller size, which is provided with the instrument, is readily screwed into place, thus obviating the necessity for very large stroke bushings.

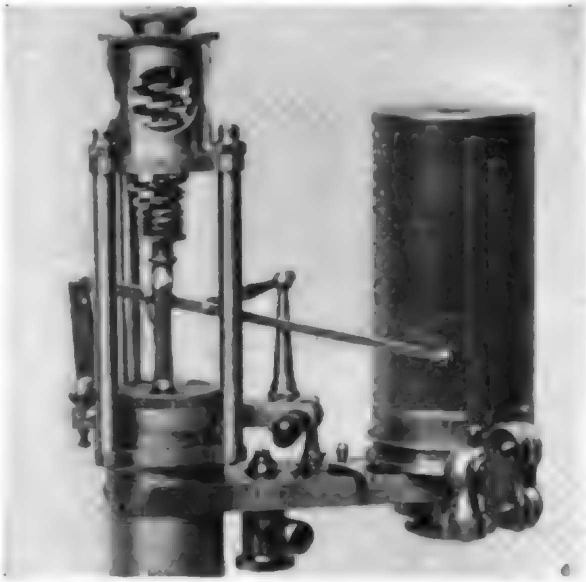


FIG. 2.—INDICATOR WITH REDUCING WHEEL.

The guide pulley is carried on an arm which is attached to a nut of coarse pitch which travels on the threaded spindle, *D*, so that every revolution of the main cord wheel raises or lowers the guide pulley a distance equal to the thickness of the cord, which prevents overlapping. The spring of this wheel is attached to a hub formed on a knurled disc, *B*, and by rotating this disc, which may be done even while the wheel is running, the spring tension may be increased to any desired extent. At the other end of the handle, *A*, is a double pawl which works in a substantial ratchet attached to the disc, *B*, and by vibrating this handle, one tooth of the ratchet is allowed to escape, which permits the release of the tension to any desired degree.

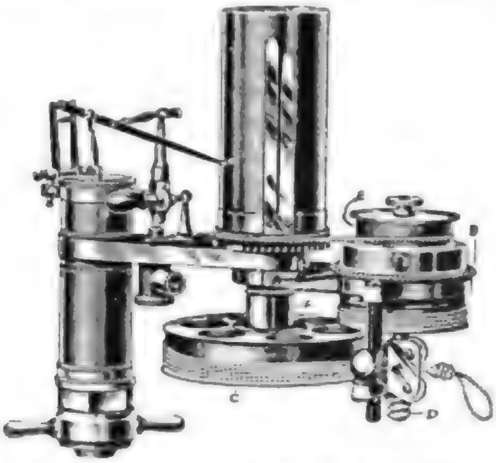


FIG. 3.—INDICATOR WITH SPRING ATTACHMENT.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Weather conditions were favorable for retail trade and building operations, while the crop outlook was bright on the whole, although some sections reported delay to planting on account of excessive moisture, and there was much complaint regarding the scarcity of labor. Manufacturing plants are working to their full capacity in the leading industries, especially iron furnaces and steel mills, and there is little idle machinery at foot wear factories or textile mills. Railway earnings thus far reported for April surpass last year's by 8.2 per cent, and foreign commerce at the port of New York shows a gain of $938,619 in imports and a small loss of $283,619 in exports, as compared with the same week of 1905. Steel-making irons are firm, car and implement makers buying freely, but basic and foundry grades for forward delivery are weaker in competitive territory, the disposition being to make concessions. Consumption is heavy, and large orders, particularly from malleable founders and cast-iron pipe makers, are pending. Bessemer and open-hearth billets and sheet and tin bars are still scarce, the paucity curtailing production. New business in structural material is not especially marked, but good contracts are pending. Prices for 1907 have been reaffirmed. Thus far no large orders for San Francisco account have been placed, though it is probable that some business will develop. Implement makers have bought heavily of steel bars. Copper is in good demand for domestic consumption. All copper working interests are operating at maximum capacity, and with assurances of insistent markets through the year and beyond. Prices are firm, with indications of an early advance. Lake is 18¾ @ 18⅞c. for July and August delivery. Electrolytic is 18½c, 18⅝ @ 18¾c. for July, August and September. Casting copper, prime brands, thirty days' delivery, is 18¼ @ 18½c. *Bradstreet's* reports 177 business failures during the week ending April 26, against 167 the previous week, and 193 in the corresponding week last year.

THE NEW YORK GENERAL METAL WORKS, with general offices and sales department at No. 9 East Twenty-second Street, New York City, were incorporated on April 11, 1906, with a capital stock of $1,000,000. The business of the company is to manufacture some new kinds of metal goods. It has taken over the business of the Nonick Company, owned by Lewis Rodman Schultz, C. F. Marsh, James Paul Gaylord and Dr. James H. Burtenshaw, who, after years of experimenting, have perfected the inventions of C. F. Marsh, inventor of "Nonick China" and "Nonick Glassware." The new company also acquired the patents, plant and business of Dr. John A. Daly, inventor of "Architects' Bronze" and "Metal Lace." The New York General Metal Works are now looking for a suitable property within a radius of 25 miles of New York City, in order that they may increase their manufacturing facilities five or six times. There is acquired a large amount of special electrical machinery and appliances. The chief product of the works at the present time is "Architects' Bronze," and large orders are being filled for architects and builders for columns and capitals for the United States and Canada, and local work on hotels, theatres and other large buildings. The company makes electrically metal grills, balustrades, newel posts, doors and window frames and walls and ceilings, all of which being of seamless metal are fireproof. The form may be anything, the product is metal. The form may be retained or removed, and if the latter, the metal construction is sufficiently substantial for all requirements. The process is entirely different from electroplating, particularly in the absence of layers or strata in the deposit, and the tensile strength of the metal is increased, giving a uniform electro-deposit of a gauge to sustain any required strain, independent of the form upon which it is built. Metal lace introduces a novel and practical method of decorating and electrically illuminating ceilings, walls and windows. Any and all metals are employed in the manufacture of the product, and in any color finish, metals are capable of showing. The "Nonick" patents are for methods of protecting the edges of china dishes, cups and saucers, and glassware, by an indestructible and seamless rim, which is ornamental and sanitary. The loss caused by nicking and chipping and the wearing away of paint in the present china decorations is enormous. One prominent hotel in New York expends more than $100,000 per annum for this item of maintenance.

THE COPPER MARKET.—The "Copper Gossip" of the National Conduit & Cable Co., of New York, says with regard to the copper situation: "Nearly all producers are doing their best to increase output, and notwithstanding the big gain in production there is a phenomenal demand for large supplies. The dimensions of domestic requirements are astonishingly great, and very much of the consumption is due to the magnitude of electrical expansion. The orders for wire are simply immense, and nothing like the present demand for this class of partly manufactured product has been known before. There are important plans for building new electric railroads, and the extensive additions to be made to interurban traffic will necessitate the use of large quantities of copper. The electrical equipment arranged for by different companies will show in the consumption of copper wire bars for months to come, as the rapidly growing business in electrical goods has developed into most striking proportions. Every once in a while the question is raised whether consumption is actually using up the large production now taking place. While there is no way of arriving at absolutely definite conclusions on the subject, particularly since the official monthly returns of production were suspended a few years ago, there is nevertheless sufficient data available by means of which a fair knowledge of the facts may be approximately reached. The exact figures of exports and imports are a known quantity, but the amounts of copper produced and consumed are not so easily determined. It is true the latter may be closely estimated, but there is the possibility of error in the absence of official returns. Exports for the first three months of this year have averaged 35,497,280 pounds monthly. Imports for the first two months of 1906 average 17,673,600 pounds a month. Supposing production and imports to be 100,000,000 pounds per month the recent rate of exports would leave about 64,500,000 pounds a month for home use. Domestic consumption in 1905 is put at about 600,000,000 pounds, but we figure that there is greater activity among consumers this year than last year, if that could be possible. If, therefore, there is solid reason to believe that the mills and factories of this country are using as much as 64,000,000 pounds of copper each month then there would appear to be good ground for concluding that production is being pretty thoroughly absorbed."

THE CANADIAN WESTINGHOUSE, LTD., has been awarded a contract by the Montreal Street Railway Company for a large amount of apparatus. This was necessitated by the rapidly growing traffic of the company. The order included 20 quadruple equipments of railway motors complete with controllers and details; also a 1,000-kw, 600-volt, direct-current engine type generators for installation in its main power house, and three 500-kw, three-bearing, motor-generator sets, with 550-volt, direct-current generators. These latter are similar in capacity to those now installed in its various sub-stations, which feed directly into the trolley circuits. The Canadian Westinghouse Company, Ltd., is furnishing the T. Eaton Co., Ltd., of Toronto, a 300-kw, direct-current, 550-volt, engine type generator, to be used as part of its present large power plant, which is considered one of the most up-to-date direct-current plants in Canada, and is equipped throughout with Westinghouse apparatus.

WESTERN ELECTRIC ORDERS.—Among recent switchboard orders received by the Western Electric Company is one for a 35-panel, 2,200-volt board to be installed at Crystal City, Mo., at the new plant of the Pittsburg Plate Glass Company. The contract for the generating sets, to be installed in the new building at the corner of Clark and Adams Streets, Chicago, which will be occupied by the Commercial National Bank, has been awarded to the Western Electric Company. The installation consists of two 125-kw generators and two 200-kw generators.

ABNER DOBLE CO. RESUMES BUSINESS.—The Abner Doble Co., engineers and waterwheel manufacturers, of San Francisco, informs us that its works and offices at Fremont and Howard streets were entirely destroyed by the fire of April 18. Temporary offices have been opened up at the residence of President W. A. Doble, 2611 Broadway, between Scott and Devisadero streets, San Francisco, where the business of the company will be conducted for some little time. Immediately after the fire, steps were taken to erect new permanent shops on the block bounded by Seventh, Hubbell, South and Sixteenth streets, in the Potrero District, where the company had planned previous to the fire to erect large shops and warehouses. Work on the new shops has already been started, and the company is rapidly getting into shape to carry to completion the large contracts which it has on hand. Prominent among these orders is that with the government of Kashmir, British India, for the complete hydraulic installation of the Jhelum River power plant. The Abner Doble Co. is besides being manufacturer, dealer in all kinds of iron and steel, and it is Pacific Coast representative of several prominent firms in the East, including the Bethlehem Steel Company, Firth-Sterling Steel Company, Morse Chain Company, Falk Company, Electric Controller and Supply Company, Kohler Bros., etc. Manufacturers of machine tools, foundry and shop supplies and equipment, and dealers in similar lines are requested to send catalogues and price lists to the Abner Doble Company, 2611 Broadway, San Francisco.

ENGINEERS FOR SAN FRANCISCO.—We are advised that in response to the appeal of Mayor Schmitz, of San Francisco, for architects, draughtsmen and superintendents of building construction to assist in rebuilding the city, Hapgoods, the national organization of employing experts, with headquarters at 309 Broadway, New York, has offered its services without charge either to employer or employee and will work in close co-operation with the city authorities in finding suitable men to go there immediately. As soon as the Mayor's appeal was received, President H. J. Hapgood, issued instructions to the twelve offices of the company, throughout the country to institute a special search for the kind of men desired, and within a few hours lists of the names and addresses of a large number of experienced men available were telegraphed to San Francisco. The number of men who have thus far signified their willingness to go to the stricken city is by no means large enough to meet the demand which has been created by the announcement that the city will be at once rebuilt. Hapgoods has placed its services at the disposal of the people at San Francisco, and will be glad to hear at once from every competent architect, draughtsman or construction superintendent in this city or vicinity who would be willing to go to the coast. Full details concerning the opportunities offered will be supplied as soon as they are received from San Francisco.

A MACHINERY CONSOLIDATION.—The stockholders of the International Steam Pump Company have been called to a special meeting on May 8 to pass on an increase of the company's stock for the purpose of buying the stock of the Power and Mining Machinery Company, owned by Benjamin Guggenheim. The directors have already contracted to purchase the property from Mr. Guggenheim, and to pay for it it is the directors' purpose, if the stockholders approve, to issue $2,500,000 additional preferred and $5,500,000 additional common stock. The company is now capitalized at $12,500,000 preferred and $18,500,000 common stock. The Power and Mining Machinery Company has a plant at Cudahy, Wis., and its products, the directors of the International Company advise their stockholders, can be advantageously marketed with their own output. Mr Guggenheim guarantees as a condition of the sale, according to the circular, that the net profits of his company in the next five years will aggregate at least $1,500,000. He further undertakes to act as chairman of the finance and executive committees of the International Steam Pump Company for the same period.

ALLIS-CHALMERS TROLLEY EQUIPMENT.—The Electrical Installation Company, Monadnock Building, Chicago, has been awarded the contract for the complete construction and equipment of the Indianapolis, Newcastle & Toledo Electric Railway Company's road. Work will begin immediately on the 43-mile division between Indianapolis and Newcastle. Allis-Chalmers Co.'s steam and electrical machinery and car equipments will be used. Among those interested in the company are D. M. Perry and W. E. Stevenson, of Indianapolis. The company's proposed system comprises 140 miles within the State of Indiana.

DUTY ON CARBONS.—The U. S. Customs Board of Appraisers, on the authority of a former decision on identical articles, has overruled the protest of R. F. Downing & Co., et al. on importations of carbon sticks intended for electric lighting. The importers contended that the sticks had to be cut to length and pointed to adapt them to use in electric lighting, whereas the articles in question were neither cut nor pointed, but were ½ to ⅝ inch in diameter and 12 to 28 inches long. Following an exhaustive opinion in a former well-known case, however, the board overruled the protest and affirmed the Collector's assessment of duty at 90 cents per hundred carbons.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Co.'s instrument statement for the month of March and since January 1, 1906, compares as follows:

	1906.	1905.	1904.	1903.
March output	188,102	169,159	126,522	84,280
Returned	66,596	47,645	35,043	38,172
March net output	121,506	121,514	91,479	46,108
3 months' gross output	526,484	434,094	301,568	305,961
Returned	178,662	132,922	108,990	116,646
3 months' net output	347,822	301,172	192,578	189,315
Total outstanding	6,046,080	4,781,730	3,972,095	3,339,653

This would give a total of 3,023,040 complete sets outstanding, or probably not far short of 2,500,000 subscribers.

TELEPHONE COMPANY RECEIVERSHIP.—The Court of Chancery last week at Trenton, N. J., appointed Charles M. Myers, of Newark, receiver for the Telegraph and Telephone Company of America, a large holding company, with $30,000,000 capital stock. The liabilities are placed at $925,562, made up largely of unpaid assessments on stocks. The assets are nominally $2,051,171. These are of uncertain value, it is said, because they are composed of stocks and bonds of subsidiary companies, most of which are inactive.

TELEPHONE CONSTRUCTION AT INDIANAPOLIS.—The Central Union Telephone Company has purchased the old church property, corner Meridian and New York Streets, Indianapolis, upon which it proposes to build at once an eight-story office and exchange building. In addition to this, the company has taken out building permits for the construction of three sub-station buildings in various parts of the city to cost $12,000 each. It is expected that these improvements will greatly improve the company's service.

ROBINS BELT CONVEYING COMPANY, Park Row Building, New York, has completed recently the entire cable road and hoisting tower coaling plant of the Long Island Railroad power station of the Pennsylvania Railroad Company; and the coal handling plant at the Marion station of the Public Service Corporation of New Jersey.

STEEL RAIL FOR BAHIA.—The United States Steel Products Export Company, which handles the foreign business of the United States Steel Corporation, will begin this month to carry out a contract for 7,000 tons of rail to be used in the construction of the electric traction system at Bahia, Brazil.

SAN FRANCISCO STANLEY OFFICES.—The Stanley-G. I. Electric Manufacturing Company has opened temporary offices at 67 Blake Block, Oakland, Cal. Several car loads of electrical apparatus have already left Pittsfield to take the place of machinery damaged or destroyed in the great catastrophe.

WIRELESS FOR STEAM YACHTS.—Mr. Paul J. Rainey has closed a contract with the Atlantic De Forest Wireless Company for the installation of its system on his steam yacht *Anona*. This, it is said, will be the first American steam yacht equipped with wireless.

BARNS AND SHOPS FOR CHICAGO.—The Chicago City Railway has bought three large tracts in Englewood and two corners at Seventy-ninth Street. It is spending $100,000 in car barns and shops.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was under pressure throughout the week, but rallied slightly after severe and general declines, caused by liquidation and bearish selling as an aftermath of the San Francisco disaster, presumed sales of securities by insurance companies being the chief disturbing factor. Money market conditions were, however, easy as a result of further large gold imports, enabling New York banks to supply money for San Francisco without strain. The United States Steel stocks shared in the general decline, but the excellent report of the company for the March quarter had a good effect in steadying these securities. On Friday, however, there was renewed selling of high-grade dividend-paying railroad shares, such as Great Northern, Northern Pacific and St. Paul, and the presumption was that fire insurance underwriters were actually liquidating. This caused a further assertion of bearish sentiment in the market, and prices in some cases reached the lowest level they have touched in some time. Traction stocks were the greatest sufferers in the decline in electric securities, Brooklyn Rapid Transit losing 11⅛ points net, the range of quotations being between 84½, the highest, and 72¾, the lowest. Metropolitan Street Railway declined 4 points net, closing at 111, and Interborough-Metropolitan common 1¼, the closing quotation being 50; while preferred closed at 85, also a net decline of 1¼ points. Allis-Chalmers common closed at 20½, a decline of ¾ point, and General Electric lost 6½ points, closing at the lowest quotation of the week, 162⅝. Western Union Telegraph closed at 93, a net gain of ⅞. There was general liquidation in outside securities, with all-around breaks, but the declines were less severe than on the exchange. The copper group was the worst sufferer. Following are the closing quotations of May 1:

NEW YORK

	Apr. 24	May 1		Apr. 24	May 1
Allis-Chalmers Co.	20¾	20½	General Electric	166⅛	163
Allis-Chalmers Co. pfd	56¼	55¼	Hudson River Tel.	...	...
American Dist. Tel.	*30	*30	Interborough Rap. Tran.	226	221
American Locomotive	64⅛	58	Mackay Cos	63½	62
American Locomotive pfd	113½	111	Mackay Cos pfd	72¾	71
American Tel. & Cable	92	90	Marconi Tel.	...	...
American Tel & Tel.	137½	131	Metropolitan St Ry	112¼	108
Brooklyn Rapid Transit	81¼	74	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel	93¾	91¼
Electric Boat pfd	65	65	Westinghouse com.	156	160
Electric Vehicle	16¼	15½	Westinghouse pfd	...	...
Electric Vehicle pfd	17½	17¼			

BOSTON

	Apr. 24	May 1		Apr. 24	May 1
American Tel. & Tel	137½	132¾	Mass. Elec. Ry. pfd	66	66
Cumberland Telephone	...	...	Mexican Telephone	...	...
Edison Elec. Illum.	...	245	New England Telephone	130½	...
General Electric	...	166	Western Tel. & Tel	...	...
Mass. Elec. Ry	18½	18	Western Tel. & Tel pfd	...	...

PHILADELPHIA

	Apr. 24	May 1		Apr. 24	May 1
American Railways	52	57½	Phila. Electric	8¼	7¾
Elec. Co of America	11¼	11¾	Phila. Rapid Trans	27¾	25¾
Elec. Storage Battery	76	71	Phila. Traction	99	98½
Elec. Storage Battery pfd	...	..			

CHICAGO

	Apr. 24	May 1		Apr. 24	May 1
Chicago City Ry	160	145	National Carbon	90	90½
Chicago Edison	...	...	National Carbon pfd	120	118
Chicago Subway	55¼	...	Union Traction	...	...
Chicago Tel. Co.	107½	...	Union Traction pfd	...	...
Metropolitan Elev. com	26	26½			

* Asked

MANILA ELECTRIC EARNINGS.—The first annual report of the Manila Electric Railroad & Lighting Company for the twelve months ending December 31, 1905, shows the subjoined results:

Gross earnings:		
Light and power	$328,417	
Railway	347,316	
Trucking	47,793	
		$723,526
Operating expenses:		
Light and power	$168,458	
Railway	165,234	
Trucking	36,285	
		369,078
Net		$353,547
Miscellaneous sources		1,122
Net income		$354,670
Interest on bonds		195,109
Surplus for 12 months		$159,561

The railway service went into operation April 10, 1905, so that the figures for the railway cover less than nine months.

MASSACHUSETTS ELECTRIC LIGHTING.—The twenty-first annual report of the Massachusetts Board of Gas and Electric Light Commissioners gives the subjoined comparative figures as to the earnings of the electric light systems of the State:

Gross	$8,108,265	$7,663,961	$7,206,189	$6,642,309
Expenses	4,777,248	4,632,043	4,638,991	4,109,816
Net	$3,331,017	$3,031,918	$2,567,198	$2,532,493
Ded. gas prof	634,690	515,579	425,170	389,572
Balance	$2,010,340	$2,516,339	$2,142,019	$2,142,921
Other inc.	223,012	491,876	85,745	420,838
Total inc.	$3,242,352	$3,008,215	$2,227,764	$2,563,759
Charges	1,523,300	1,929,782	1,102,111	1,626,015
Balance	$1,396,040	$1,078,433	$1,125,653	$937,744
Dividends	1,489,247	1,543,775	1,225,480	1,207,458
Surplus	$93,207	*$465,342	*$99,827	*$269,714

*Deficit.

The gas companies earned gross $9,885,674 and $2,739,145 net on operation.

GEORGIA RAILWAY AND ELECTRIC is doing very well. The earnings of the first quarter of the current year were $676,302, compared with $550,108 in the same period of 1905. This is a gain of $125,294, or 22.78 per cent, and net earnings show considerably large percentage of increase. Many improvements and betterments have been effected to meet the growing needs of Atlanta, and last year alone there was expended for improvements and betterments about $300,000 from earnings equivalent to nearly 5 per cent. on the common stock. All the important lines in the city proper are double-tracked, but single-track lines running outside the city limits are found inadequate and the management proposes double-tracking several of these lines this year. This, with certain minor improvements, is expected to cost about $600,000, and this amount will be largely supplied from earnings. The lighting system is in excellent shape, also.

HUDSON RIVER POWER.—George N. Freeman and others of Troy have conveyed to Elmer J. West, of Glens Falls, the property on the north side of the Hudson River, near Glens Falls. The purchase consists of a hundred or more acres, with a river frontage of about three miles, and is the Zenas Van Duzen sawmill property. The State maintains a dam at this point for the purpose of supplying the summit levels of the Champlain Canal, and a head of eighteen feet is obtained. The purchase carries the right to the surplus water of the river, and it is estimated that by hydro-electrical development 5,000 horse-power can be obtained. The generating station will be linked with the Hudson River Electric Power Company's transmission lines, and will add its quota.

MASSACHUSETTS ELECTRIC BONDS.—The constituent companies of the Massachusetts Electric Cos. have sold to a syndicate composed of H. W. Poor & Co., Hayden, Stone & Co. and Bond & Goodwin $2,048,000 4 per cent refunding bonds as follows: $932,000 4 per cent Boston & Northern refunding bonds dated July 1, 1904, and maturing in 1954; $1,116,000 Old Colony refunding bonds dated July 1, 1904, and maturing in 1954. The entire proceeds are to be used in retiring the floating debt of the two companies incurred for betterments, equipment and new construction. The bonds are issued under a general blanket mortgage which authorizes a total of $15,000,000 bonds for the Boston & Northern and $10,000,000 for the Old Colony.

TELEPHONE MERGER AT FORT WAYNE.—The final steps are being taken for the merger of the Home and National Telephone Companies, of Fort Wayne, Ind. The capital stock of the merger company, to be hereafter known of the Home Telephone Company is to be $600,000, of which $100,000 is to be put upon the market to raise funds for extensions of the toll lines. One of the extensions is to be a direct line to Indianapolis so as to care for the large volume of business now refused because of inadequate facilities. Application has been made already for $25,000 of the new issue of preferred stock at par. The Home Company directors have just paid a semi-annual dividend of 1½ per cent.

PEEKSKILL GAS AND ELECTRIC.—The Peekskill, N. Y., Lighting & Electric Company, capitalized at $1,400,000, and furnishing gas and electricity to Peekskill on the Hudson, and operating ten miles of electric railroad, has been acquired by interests associated with F. A. Stratton, of Westchester County. A merger with the Northern Westchester Lighting Company, of which Mr. Stratton is president, is a possibility. Mr. Stratton was formerly president of the Westchester Lighting Company, now controlled by the Consolidated Gas Company.

MEXICO CITY TROLLEYS.—The Mexican Tramway Company, which has been formed by Canadian capitalists to take over the tramway lines of the City of Mexico from Messrs. Wehrner, Beit & Co., is offering $8,000,000 bonds at 90 with 35 per cent bonus stock. The entire amount was first underwritten by a syndicate most of the members of which are directors of the Mexican Light & Power Company.

INTERNATIONAL STEAM PUMP.—Directors of the International Steam Pump Company have decided to increase the capital stock of the company by the issue of 55,000 shares of common stock and 25,000 shares of preferred stock, bringing the total capital stock from $31,000,000 up to $39,000,000.

THE CHAMBLY DAMAGES.—The Montreal Light, Heat & Power Company has been condemned to pay the Quebec government $40,000 damages caused by the disasters to the company's big dam at Chambly.

GRAND RAPIDS-MUSKEGON POWER.—Perry, Coffin & Burr are offering $700,000 of the Grand Rapids-Muskegon Power Co first mortgage 5 per cent gold bonds. The new power development will consist of a series of large storage reservoirs and masonry dams of 30 to 40 feet in height. The first development of 6,000 hp has already been completed at Big Rapids, and within a year a second station of 16,000 hp will be completed further down the river at a place called Croton. The cost of the Croton station will be materially reduced by the use of electric power for the operation of all construction machinery and the further fact that the bulk of the materials for construction are obtainable in the immediate vicinity. The Big Rapids station is equipped with the most modern, direct-connected machinery and high efficiency waterwheels of the latest design, and the equipment of all additional stations will be of equally high standard. In anticipation of the completion of the Croton plant, the steam stations of the two interurban lines above mentioned will be operated under lease to generate power in addition to that now being developed at Big Rapids. The company is now delivering power in Muskegon and Grand Rapids over high-tension transmission lines located upon private right of way, and operates under ample and satisfactory franchise rights extending well beyond the maturity of its first mortgage bonds. It owns practically all the water power rights on the Muskegon River, capable of 50,000 hp and all within 60 miles of Grand Rapids A number of large contracts for the sale of power have been made, including contracts for all the current required in operating the interurban lines between Grand Rapids and Holland, and Grand Rapids, Grand Haven and Muskegon. The steam stations of these interurban lines have been leased by the Power Company and will be used until the second water power plant of 16,000 hp, now being constructed, is ready for operation. The actual cash investment over and above the bonded debt of the company is $600,000, and the company estimates that its annual net earnings from the sale of the 6,000 hp at Big Rapids, after paying all operating expenses and taxes, will be sufficient to pay over two and one-half times the annual interest charged on the $800,000 bonds now outstanding.

DIVIDENDS.—The directors of the Central District & Printing Telegraph Company declared the usual dividend of 2 per cent, payable April 30, to stock of record April 23. The directors of the Consolidated Gas Company have declared a dividend of 1 per cent on the stock, compared with 2 per cent in the previous quarter. The dividend is payable June 15. This cuts the dividend rate in two as a result of 80 cent gas. The directors of the Cambridge, Mass., Electric Light Company have declared a regular quarterly dividend of 2½ per cent, payable May 1. The Missouri & Kansas Telephone Co. has declared a regular quarterly dividend of 1½ per cent. The directors of the Georgia Railway & Electric Co. have declared a dividend of 1½ per cent upon the common stock, payable May 19, to stock of record May 15. This is an increase in the dividend rate from 4 per cent to a 6 per cent basis yearly. Directors of the Toledo Railways & Light Company have declared the regular semi-annual dividend of 1 per cent, payable May 3. The directors of the Pennsylvania Bell Telephone Company have declared the usual quarterly dividend of 1½ per cent, payable May 1. The Ohio Traction Company, of Cincinnati, has declared the regular quarterly dividend of 1¼ per cent, payable May 1. A semi-annual dividend of $5 per share has been declared, payable May 15, 1906, on the capital stock of Tampa Electric Company, to stockholders of record May 5. The directors of the Ashton Valve Company have declared the regular quarterly dividend of 1½ per cent, payable May 15.

ELECTRIC COMPANY OF AMERICA has issued its annual report as follows for the year ended December 31, 1905:

	1905.	1904.	1903.	1902.
Net	....	$465,402	$418,893	$366,588
Other income	....	5,163	15,726	26,955
Total income	$539,190	$470,565	$434,619	$393,543
Charges to sub. cos..	42,654	29,064	8,359	8,432
Balance	$496,536	$441,501	$426,260	$385,111
Exp. of management..	55,605	32,598	27,281	32,632
Balance	$440,931	$408,903	$398,979	$352,479
Dividends	285,505	244,719	244,716	203,079
Surplus	$155,426	$164,184	$154,263	$148,500
Previous surplus	772,223	608,039	453,776	916,194
Total	$927,649	$772,223	$608,039	$1,064,694
Extra div.	....	....	....	610,918
Surplus	$927,649	$772,223	$608,039	$453,776

WASHINGTON TELEPHONE EXCHANGE.—The Chesapeake and Potomac Telephone Company is about to break ground for the erection of a three-story and basement brick and stone exchange building at 629 B Street Northeast, Washington. This building will be utilized chiefly as a central office building, although there will be accommodations for branches of the contract and construction department. In this building will be placed a central energy switchboard of the latest type, large enough to accommodate 20,000 or 25,000 subscribers. Besides the operating room, which will contain the switchboard, there will be rest and retiring rooms for the operators, a dining-room, etc. The building will cost $100,000, and the equipment approximately $300,000 more. The contract for building has been let to John McGregor, of Washington.

EARNINGS AT SAO PAULO, BRAZIL.—The Sao Paulo Light & Power Co., of Brazil, operated by Canadian and American interests, has issued its annual report for the year ended December 31, 1905. The income account compares as follows:

	1905.	1904.	1903.	1902.
Total gross earnings	$1,908,406	$1,419,338	$1,303,175	$1,123,285
Expenses and taxes..	669,932	*477,556	*403,747	*417,916
Net	$1,238,474	$941,782	$899,428	$705,369
Charges	275,847	293,782	286,885	250,000
Surplus	$962,627	$648,000	$612,543	$455,369
Dividends	599,594	520,027	391,379	239,019
Surplus	$363,033	$127,973	$221,164	$216,350

*Taxes not included.

TELEPHONY IN MINNESOTA.—The Twin City Telephone Company, of Minneapolis, has transferred all its property to the Tri-State Telephone & Telegraph Company, for $4,000,000. This is an amalgamation of the two companies. The Twin City is the Minneapolis urban operating company, and the Tri State has been its country and long-distance connection. The Twin City had $1,500,000 stock and $1,000,000 bonds outstanding. The Tri-State is capitalized at $6,000,000. The Twin City stock had paid seventeen quarterly dividends at the rate of 7 per cent. per annum, and the Tri-State stock bears 6 per cent. Under the new plan $1,000 in shares of the Twin City will go into the Tri-State at a valuation of $1,117.67. Territorial extensions are proposed.

CONSOLIDATION AT MEMPHIS.—Isadore Newman & Son, of New York, are proposing to form a holding company with $20,000,000 common stock and $20,000,000 preferred, to take over the street, car and light properties of the Newman group in Memphis, Nashville, Birmingham, Knoxville, Little Rock and Houston. The stock issues of the properties amount to $8,745,000 common and $13,000,000 preferred. A schedule is submitted to the stockholders, giving a basis of exchange. The firm has expended large sums in improving the properties and it is supposed it proposes to issue stock to cover the entire expenditure.

INDIANA TELEPHONE MERGER.—A special dispatch from Wabash, Ind., of April 29, says: The merger of important Indiana telephone companies, controlling a dozen exchanges and 500 miles of line, has just been agreed upon and at a meeting to be held at Fort Wayne the Telephone Company of Indiana, with $5,000,000 stock and $5,000,000 bonds, will be organized. The independent companies take bonds and stock in payment of the purchase price. This is the forerunner of the combination of northern Indiana independent exchanges by the St. Louis syndicate which has options on the property.

CHICAGO PNEUMATIC TOOL.—The Chicago Pneumatic Tool Co. reports for first quarter of 1906: Profits, $233,332; less depreciation, etc., $36,327; bond interest, $28,750; sinking fund $12,500. Left for dividend, $155,744; less dividend, $61,087; balance for surplus, $94,656. Total surplus, $605,949. The net profit available for dividends is at the annual rate of 10.20 per cent, as compared with 9.82 per cent for same quarter of 1905.

CHICAGO ELEVATED BONDS.—This week the South Side Elevated, of Chicago, will deliver to the syndicate headed by the Illinois Trust Co., $1,500,000 more first mortgage 4½ per cent bonds, the proceeds of which are being used for extensions. The amount voted was $8,000,000. This will leave $1,000,000 unissued.

PHILADELPHIA KEYSTONE TELEPHONE.—The Keystone Telephone Company, of Philadelphia, reports March business as follows: Gross, $69,730; net, $29,146; surplus over charges, etc., $5,452. Nine months gross, $604,772; net, $271,849; surplus over charges, etc., $60,601.

GENERAL NEWS.

Construction Notes.

MOBILE, ALA.—A syndicate headed by the H. M. Byllesby & Company, of Chicago, Ill., has purchased the electric light plant of the Electric Lighting Company, of Mobile. It is stated that the new management will make immediate improvements and extensions to the system. The company has already placed orders for additional equipment to the plant which includes two 500-hp water-tube boilers, two 500-kw steam turbines and additional condensing apparatus, switchboards, etc. S. C. Schaffner, the present superintendent, will be retained by the new management. C. E. Groesbeck, constructing engineer for H. M. Byllesby & Company, will have charge of the construction work.

HOPE, ARK.—The Hope water and light plant contemplates installing a fan system soon. Charles M. Richards is superintendent.

ANAHEIM, CAL.—At a recent election the citizens voted to issue $23,000 for water works and $25,000 for an electric light plant. A. L. Lewis is engineer.

SAN FRANCISCO, CAL.—The North Beach generating station of the United Railroads was out of the fire zone and electric car service was resumed on Fillmore and Devisidero Streets to Golden Gate Park, April 23, after four days of suspension.

UKIAH, CAL.—Arrangements have been made by the Board of Trustees with the Snow Mountains Power & Water Company to furnish power to the city electric lighting plant as soon as its transmission line is completed. The company expects its plant completed and in operation by November, 1906.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company is making every possible effort to resume lighting service, as soon as it is considered safe. Large gangs of men have been put to work on overhead wires and underground conduits. Although every one of the sub-stations taken over from the Independent Electric Light & Power Company on the alternating-current system were burned, it is found that the 11,000-volt underground cables leading from the undamaged main generating station in the Potrero District to the master sub-station at 8th and Mission Streets were intact. New transformers only are needed to resume business. The fated Jessie Street station, between 3rd and 4th Streets, was again a victim to fire, after being damaged by the earthquake. Additional motor generator sets are being constructed for this station. F. V. T. Lee, assistant to the general manager, is doing all in his power in co-operation with other officials to rehabilitate the city system.

BOULDER, COL.—It is reported that the Boulder Electric Light & Power Company has sold its property to the Henry Company of New York City.

CRESTED BUTTE, COL.—A special election will soon be held to ratify the action of the Council in regard to the purchase of the plant of the Crested Butte Light & Water Company. The company has agreed to sell the plant to the town for $24,000 to be paid in installments.

BRIDGEPORT, CONN.—The New York, New Haven & Hartford Railroad Company will soon begin the work of installing a large lighting and power plant in the new station here. It will furnish power to operate the elevators and rolling lift bridge, and will also light the interiors and platforms of the stations and the wharves from Stratford Avenue south to the Naugatuck dock, including the railroad and steamboat sheds. The company has a contract for one year with the United Illuminating Company to furnish light and power, which will soon expire.

GLASTONBURY, CONN.—Work will soon begin on the construction of the hydro-electric plant of the Glastonbury Power Company. Lewis W. Ripley is treasurer.

WILMINGTON, DEL.—Work has commenced on the construction of the new power house of the Wilmington Traction Company. J. and T. Oliver have the contract for construction of the building.

WASHINGTON, D. C.—The Chesapeake and Potomac Telephone Company has let the contract for the erection of its new eastern exchange to John McGregor, of this city. The building will cost $100,000, and will be located at 629 B Street northeast. It will have an equipment costing more than $300,000, making a total investment of $400,000 to $500,000.

WASHINGTON, D. C.—The Winchester and Washington City Railway Company will, according to reports, supply power to the Shenandoah Ore & Iron Company, recently chartered, and that a railway will be built from the mines of the company to Millville, W. Va.

WASHINGTON, D. C.—Bids will be received until May 22 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards, at Mare Island, Cal., and Puget Sound, Wash., naval supplies as follows: Schedule 527—Transformers, steel plates, tool steel, safety valves, etc. Schedule 528—Searchlights, pig iron. Schedule 529—Motor, motor hoists, cylinder, dynamo, expanded metal, bar steel, American and Norway bar iron, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster General, U. S. N.

ATLANTA, GA.—The Georgia Railway & Electric Company will expend about $20,000 in remodeling its building on Alabama Street.

LAGRANGE, GA.—The new electric lighting and power plant, owned by the city, has been completed and is ready to take the place of the old plant.

TALLAPOOSA, GA.—Rapid progress is being made on the electric lighting plant for the city. A. J. Radcliffe is superintendent of construction.

ALTUS, GA.—The McQuatters Plumbing & Machine Company, of Hillsboro, Tex., has secured the contract for water works and an electric light plant, for $28,000.

DUBLIN, GA.—A petition has been filed by the owners of the Dublin Telephone & Manufacturing Company to change the name to the Dublin Telephone & Telegraph Company.

MACON, GA.—Atlanta and Macon capitalists are figuring on a new electric plant at Macon. The city is at present lighted by the Macon Railway & Light Company, at $75 per lamp per year.

ATLANTA, GA.—The surveying corps of the Georgia Railway & Electric Company is mapping out the route proposed for the new suburban line between Atlanta and Stone Mountain, a distance of 11 miles.

ATLANTA, GA.—The North Georgia Electric Company has secured franchises for the distribution of electric power throughout the city. Its power is transmitted by a tower line from the shoals at Gainesville, about ninety miles distance. The company will put up a building here to cost $15,000.

BUSHNELL, ILL.—The Bushnell Electric Light & Power Company has just completed extensive alterations to its plant.

AURORA, ILL.—The Independent Telephone & Telegraph Company has petitioned for a franchise for entrance into Chicago.

LINCOLN, ILL.—Contracts have been let for much of the work of the Springfield-Lincoln branch of the Illinois traction system.

VIRDEN, ILL.—The Virden Electric Light Company has made arrangements to enlarge its plant and also its scope of business.

PANA, ILL.—The Southwestern Traction Company, recently organized, will construct an electric railway connecting Springfield and Pana.

JOILET, ILL.—The City Council has granted a fifty-year franchise to the Joilet & Southern Traction Company and the Channahon Light & Power Company.

BLOOMINGTON, ILL.—Geo. K. Marsh has offered to the City Council $10,000 a year for twenty years for a franchise to operate a street railway in this city.

GALESBURG, ILL.—The People's Electric Power Company has asked for a franchise to operate an electric plant and power house for the purpose of furnishing light, heat and power to this city.

CAIRO, ILL.—Mulcahy & Yates will petition the county board of Alexander County for right-of-way along the eastern side of the county road from the city limits of Cairo to the Cache bridge, for an interurban railway.

CANTON, ILL.—Contracts between the Illinois Central Electric Railway Company and the Cleveland syndicate have been signed for the construction and operation of an electric interurban between Canton and Lewiston.

CAPRON, ILL.—At a recent meeting of the stockholders of the Capron Home Telephone Company it was voted to increase the capital stock to $10,000. A central will be established in Capron and work will soon begin on the lines.

CHICAGO, ILL.—Bids will be received until June 13 by the Board of Trustees Sanitary District of Chicago, for furnishing transmission line poles along the right of way of the said Sanitary District. Bids will be received on both metal and wood poles. I. J. Bryan is clerk.

ROCKFORD, ILL.—A deal is being negotiated between the owners of the Rockford & Interurban Company and an eastern syndicate, and it has been announced that the Rockford Street Railway Company and the street lines of interurban service controlled by it will pass into the hands of a company now organized and securing the plants of other systems in this vicinity.

EAST ST. LOUIS, ILL.—At a recent meeting of the East St. Louis City Council the St. Claire Light & Power Company, of East St. Louis, asked for an extension of its franchise from one year to eighteen months. The company was granted a franchise last May to erect a plant and to furnish electric current for light and power, but up to the present time it is stated nothing has been done by the company.

WALKERTON, IND.—An electric light plant, to cost about $5,000, will be erected here.

RICHMOND, IND.—The City Council is about to ask for bids for the construction of a 48-duct conduit system in Main Street; probable cost, $40,000.

INDIANAPOLIS, IND.—The Central Union Telephone Company is contemplating the erection of an eight-story building in this city for its general and local offices.

LOGANSPORT, IND.—The Indiana Rapid Transit Company has made application to the board of public works for a franchise to enter the city. The company proposes to build an interurban railway from Terre Haute to Logansport via Crawfordsville and Frankfort.

EVANSVILLE, IND.—The Evansville Gas and Electric Light Company, the Evansville Electric Railway Company and the traction lines from this city to Princeton, Boonville, Rockport and Mt. Vernon will be consolidated under one management and a traction line built from this city to Indianapolis.

EVANSVILLE, IND.—A movement is on foot to establish another electric light plant in this city. A petition for a franchise has been filed with the board of public works asking for the right to furnish light and power to the people of Evansville. Morgan Babcock is the petitioner, and agrees to lay all service wires under ground in conduits, and give the city 5 per cent of the gross receipts each year.

MARLOW, I. T.—An electric light plant will be installed in connection with the water works system in this town.

CHICKASHA, I. T.—The electrical engineer of the new street railway line arrived in this city with complete plans and specifications of the eight miles of line to be built together with plans and specifications of the big power house to be erected in connection with the same.

OTTUMWA, IA.—The Ottumwa Railway & Light Company will erect a new power house.

BURLINGTON, IA.—The Iowa Telephone Company is preparing to erect a new exchange in this city.

MUSCATINE, IA.—An interurban railway will be constructed in this city to run between here and Iowa City.

BOONE, IA.—The Fort Dodge, Des Moines & Southern Railroad Company of this city, which is building the interurban line from Des Moines to Fort Dodge for the Newton & Northwestern Railroad Company, has filed amended articles of incorporation with the Secretary of State, increasing the capital stock to $1,000,000. The directors are Frederic A. Farrar, S. D. Loring, Homer Loring and Henry W. Poor. The company has let additional grading contracts for the line running from Lanyan to Fort Dodge, a distance of 21 miles.

CALDWELL, KAN.—The citizens of this town have voted to issue $15,000 bonds for the construction of an electric light plant.

ELDORADO, KAN.—The Eldorado Light Heat, Ice & Power Company has secured a franchise for a gas and electric light plant.

TOPEKA, KAN.—A new electric lighting and power plant is to be established in this city. C. R. Maunsell is reported to be interested in the enterprise.

BARTLESVILLE, KAN.—The Bartlesville Interurban Railway Company has completed arrangements for the construction of the interurban railway between this place and Dewey. It is estimated that the cost will be about $100,000.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company has asked the Council for a new franchise. The company has commenced extensive improvements to its system, and will expend about $150,000 before the work is completed.

LOUISVILLE, KY.—The Board of Aldermen has adopted an underground wire ordinance.

COVINGTON, KY.—Owen Ford, St. Louis, Mo., is preparing plans for a municipal electric light plant here.

LOUISVILLE, KY.—The Board of Aldermen of the city of Louisville, Ky., has defeated the Atherton electric light franchise ordinance. The Louisville Lighting Company has on the other hand granted important concessions in prices.

EMINENCE, KY.—By order of court the Eminence Electric Light Company has been placed in the hands of a receiver, with instructions to begin the operation of the plant at once. Claims amounting to $50,000 have been lodged against the plant.

OLYMPIA SPRINGS, KY.—An electric lighting plant is to be installed in the new hotel, which has just been completed. The plant will be large enough to light the hotel, cottages and grounds of the resort. Smith, Watkins & Co. will install the plant.

LOUISVILLE, KY.—The Louisville Lighting Company has filed amendments to its charter, granting it permission to furnish hot water for heating purposes, and to establish a plant to furnish steam and electrical power in Louisville and elsewhere.

NEW ORLEANS, LA.—The Cumberland Telephone Company is remodeling and rebuilding its telephone system and is considering the purchase of a building in this city for its exchange.

THIBODAUX, LA.—The citizens are considering doubling the capacity of the municipal electric light and water works plant by installing a 100-kw, 125-volt machine with balancing set to replace the two 37½-kw, 125-volt machines, on the Edison three-wire system now in use. The lighting system also includes one Western Electric series arc machine of 60-light capacity. A. R. Staunton is city electrician.

BINGHAM, ME.—The Messalonskee Electric Company, of Waterville, Me., contemplates installing an electric lighting plant in this place soon.

CARIBOU, ME.—The Caribou Water, Light & Power Company has recently added a new generator and made other extensive improvements to its plant.

PORTLAND, ME.—The Maine Light, Heat & Power Company has been incorporated with a capital stock of $250,000. The incorporators are Philip J. Deering and others.

SOUTH PARIS, ME.—At a recent meeting of the village corporation held for the purpose of considering the question of a municipal electric light plant, it was decided not to construct a plant.

EASTPORT, ME.—A new boiler is now being installed in the electric lighting plant of the Eastport Electric Company. The company also contemplates making other improvements to its plant in the near future.

HYATTSVILLE, MD.—Bonds to the amount of $12,000 have been sold, to be used for the construction of an electric light plant.

BALTIMORE, MD.—The Maryland Telephone Company is contemplating installing the automatic system in its exchange in this city. D. E. Evans is president.

GREAT BARRINGTON, MASS.—The town has reduced the appropriation for street lights this year from $4,600 to $3,500.

SOUTH DARTMOUTH, MASS.—H. K. Wilson, of New Bedford, writes that the question of constructing an electric light plant at South Dartmouth has been abandoned.

NANTUCKET, MASS.—The Citizens' Gas, Electric & Power Company will soon install another gas engine, made by the Westinghouse Machine Company. R. W. Coleman is superintendent.

HOLYOKE, MASS.—The power plant of the Holyoke Water Power Company is now completed and will soon commence operation. It is expected to be able to supply its customers by May 1.

HUDSON, MASS.—The municipal electric light board has made an announcement that there will be a reduction in the price of electricity after July 1. The board is not ready to state what the reduction will be.

FITCHBURG, MASS.—The Fitchburg & Leominster Street Railway Company contemplates making extensive additions to its power department, and is considering moving the power plant from South Fitchburg to Ayer.

PITTSFIELD, MASS.—It is reported that the Pittsfield Electric Company will increase its capital stock from $150,000 to $225,000. The company will soon erect a large power house and make extension additions to its plant.

WOBURN, MASS.—On recommendation of Mayor Linscott, a council committee, comprising James H. Connolly, chairman; Caleb H. Jaquith and G. William Buchanan, has been appointed to investigate the matter of a municipal lighting plant.

BROCKTON, MASS.—The city recently has made a contract with the Edison Illuminating Company for lighting the city hall and the central police station. The city hall lighting plant will not be operated after the contract takes effect.

BALDWINSVILLE, MASS.—A special town meeting will be called in May for the second vote on the matter of establishing a municipal electric lighting plant in this town. If the plant is voted for an appropriation will be made at the same meeting, and the plant will be installed this summer.

RUSSELL, MASS.—The power plant which is being constructed on the Westfield River in this place will soon be ready for operation. The company expects to generate from 500 to 700 hp and will supply the Western Massachusetts Street Railway Company with power, as soon as the plant is completed.

MILFORD, MASS.—The power house of the Norcross plant of the Milford Stone Company was recently destroyed by fire. The loss on the machinery and tools, which included two large boilers and engines, dynamo, lathes, etc., is estimated at $7,000. The plant will be rebuilt as soon as possible.

MIDDLETON, MASS.—At a recent meeting held by the town to hear the report of the electric light committee, the citizens voted not to build an electric light plant. The committee found that the town would have to appropriate about $10,000 for the plant, and consequently reported unfavorably on the matter.

HUDSON, MASS.—The trustees of the municipal electric light plant will soon commence work on the extension of its lines to Gleasondale for the purpose of furnishing light, heat and power to that village.

EAST BRIDGEWATER, MASS.—At a recent town meeting it was voted to appropriate $600 for electric lighting for the rest of the year. The Selectmen are instructed to make a contract with the Edison Company for the erection and maintenance of 69 lamps of 25 cp. each for a period of three years, at a cost of not more than $18 a lamp per year.

SALEM, MASS.—The street lighting committee has made a contract with the Salem Electric Lighting Company to light the city for five years at $95 per year per arc light and $22 per year for each incandescent light. The City Council also passed an order to make a contract with the electric light company to pump sewage by electricity at 1½ cents per kw-hour.

MATTAPOISETT, MASS.—It is reported that this town will soon have an electric light service. Negotiations have been in progress for some time between the Selectmen of the town and the New Bedford Gas & Edison Light Company, and a number of interested summer residents. Things have so far progressed that little remains to be done except for the Selectmen to grant the electric company the right to certain pole locations in the town.

LOWELL, MASS.—Under a proposition made by Mayor Casey the contract for electric lighting which calls for $120.45 per lamp will probably be declared void and a new contract made at $100 per lamp. In consideration of this change the Lowell Electric Light Corporation is to receive the contract for lighting 400 lamps that are now lighted by gasoline. The gasoline lighting contract expires June 1. At present the city pays $27.75 per lamp for 400 lamps; under the proposition made by Mayor Casey, electricity will be substituted at a cost of $22.50. It is understood that the Lowell Electric Light Corporation will accept the mayor's proposition.

ELK RAPIDS, MICH.—The Village Council has granted a franchise for an electric lighting plant to A. P. Dougherty.

SAGINAW, MICH.—H. B. Slocum, of Hubbardstown, has been looking up the prospects for an electric railway from here to Grand Rapids.

PORT HURON, MICH.—Arrangements are now being made for the construction of the new power house for the Grand Trunk Railroad to be located on Military Street.

FLINT, MICH.—The Flint Light & Power Company has purchased the old Lewis flour mills, four miles west of the city, for $12,000, and will improve the property for power purposes.

GRAND RAPIDS, MICH.—The Edison Company has been awarded the contract for the furnishing of all the light and power required in the new furniture exposition building constructed by the Manufacturers Building Association.

FLINT, MICH.—R. O. Hart and H. R. Loranger have applied to the Council for a light and power franchise, and are contemplating the development of a power plant on the Flint River of 2,000 hp, which will cost about $100,000.

DANBY, MICH.—The Michigan Power Company has filed a petition with the county clerk of Ionia County asking permission to build a dam across Grand River on section 4 in this city, for the purpose of generating electricity for power and lighting purposes.

ROCKLAND, MICH.—The citizens residing in the vicinity of the Victoria mine are agitating the question of a lighting plant. The Victoria Company is about to install a dynamo for the purpose of generating power for its mine, and may furnish light for the village.

ONTONAGON, MICH.—The village has awarded a contract to the Lane & Bodley Company of Cincinnati, Ohio, for a new electric lighting plant. The equipment will consist of a 140-kw dynamo, 225-hp Corliss engine, switchboard and 16 arc lamps. The cost of plant is $8,165, including installation. The plant is to be ready for operation in 40 days.

ORION, MICH.—The Lake Orion Power & Improvement Company, which is successor to the Orion Light & Power Company, contemplates making extensive improvements to its plant. The company intends to put in a larger water wheel and generators and build a new power house, also to put in a 150-hp steam-driven unit as an auxiliary to the water wheel.

DETROIT, MICH.—The Detroit Railway Company is considering the construction of an extension of its line from Romeo to Almont, and possibly to Imlay City. It is reported that the company is negotiating for the purchase of the Pontiac, Oxford & Northern Railroad running from Pontiac to Caseville, a distance of 100 miles, and that if the purchase is made, the road will be equipped as with electricity.

GRAND RAPIDS, MICH.—The Muskegon Power Company has filed notice of an increase of capitalization from $1,000,000 to $3,000,000. The name of the company has also been changed from the Grand Rapids-Muskegon Water Power Electric Company to the Grand Rapids-Muskegon Power Company. The company has filed in Muskegon County a $7,500,000 twenty-five year trust mortgage issued to the First Trust and Savings Bank of Chicago as trustees. The mortgage covers all the property owned by the company and covers the expenditures that will be incurred in building the second dam. A similar mortgage deed was filed about six months ago when dam No. 1 was in process of completion.

WILLMAR, MINN.—The Willmar Telephone Exchange Company will make improvements to its exchange; estimated cost, $11,000.

MINNEAPOLIS, MINN.—The Mississippi River Power Company has been formed to generate electric power at dams to be built at Clear Water and Monticello. Geo. A. Moore, of St. Cloud, Minn., is interested

DULUTH, MINN.—The Zenith Telephone Company contemplates extensive improvements and extensions to its system in this city. The wires will be put underground and cable substituted for overhead wires wherever practicable. The cost is estimated at $75,000

PERRYVILLE, MO.—A company has been recently organized by several prominent business men of this place to build an electric railway from Perryville to Clearyville, on the Mississippi River. The officers are Dr. D. F. Morton, president; S. C. Marks, secretary, A. E. Doerr, treasurer.

ST LOUIS, MO.—The Maplewood Improvement Association and Suburban Railway system have announced their intention to extend the road to Greenwood as soon as a franchise can be obtained from the county court. Julius S. Walsh is vice-president and general manager of the Maplewood Improvement Association.

LIVINGSTON, MONT.—The Livingston Water Power Company has received the contract for lighting the streets of the city.

HOLDREGE, NEB.—The City Council has granted a twenty-year franchise to the [illegible] and Mill Creek Telephone Company.

CONCORD, N. H.—The contract has been awarded to the Hub Construction Company for the building of the Hudson, Litchfield & Toff Falls Electric Railway, and work on the road will commence at once.

SWANZEY, N. H.—At a recent annual meeting of the town of Swanzey, it was voted to appoint a committee to secure electric street lights for West Swanzey for a term of five years. The contract has been awarded to the Keene Gas & Electric Company, of Keene, N. H.

PORTSMOUTH, N. H.—Bids will be received until May 26 by Mordecai T. Endicott, Chief of Bureau, Yards and Docks, Navy Department, Washington, D. C., for furnishing two 8-inch motor-driven centrifugal pumps, at the Navy Yard, Portsmouth, as per specification No. 1,494. The estimated cost is $3,500.

LACONIA, N. H.—The Laconia Electric Light Company is to make extensive improvements in its power station within the next few months. The power house is to be enlarged so that it will accommodate three Deisel engines of 250 hp each. There is at present in the station one 250-hp Deisel engine in addition to the water power. A second engine has been ordered and will be installed as soon as it arrives, and important changes will be made in the plant.

RUTHERFORD, N. J.—The question of constructing a municipal electric light plant is under consideration. A. H. Brinkerhoff is mayor.

ATLANTIC CITY, N. J.—The City Council has passed an ordinance authorizing the issue of $30,000 bonds, for placing the city wires in conduits.

HIGHLANDS, N. J.—The McCay Engineering Company, of Baltimore, Md., has secured the contract for constructing water works and an electric light plant. T. H. Lane is borough clerk.

BRADLEY BEACH, N. J.—Borough Engineer Rogers has presented a preliminary report to the Council on the construction of a municipal water works and electric light plant, which he estimates at $63,000 for a combined plant.

GALLUP, N. M.—Maynard Gunsel has purchased the electric light plant and will improve the same.

SAVANNAH, N. Y.—The Syracuse, Rochester & Eastern Railroad has been granted a franchise by the Board of Trustees.

NEW YORK, N. Y.—The New York Edison Company contemplates erecting a two-story brick power house, which will cost $60,000.

YONKERS, N. Y.—The Mayor has signed the ordinance providing for the issue of bonds to construct a municipal electric light plant.

GENEVA, N. Y.—At a recent meeting of the Council a committee was appointed to investigate the cost and advisability of constructing a municipal electric light plant.

LOCKPORT, N. Y.—The Lockport Gas & Electric Light Company is now stringing wires for the installation of its new lighting system of double-enclosed arc lamps.

FT. WOOD, N. Y.—Bids will be received by Captain G. C. Burnell, Constructing Quartermaster, U. S. A., until June 1 for constructing an electric light and power system at this post.

BUFFALO, N. Y.—The grant to the International Railway Company for the right of way to lay a crosstown line in Fillmore Avenue will result in the expenditure of about $1,500,000.

NORTH TONAWANDA, N. Y.—Work has commenced on the building for the telephone exchange for the Niagara County Home Telephone Company on Oliver Street. It will cost about $6,000.

WHITESBORO, N. Y.—The Utica Gas & Electric Company will soon make an application to the Board of Trustees here for a franchise to lay its conduits and open mains on certain streets in the village.

COLONIE, N. Y.—The Schenectady Illuminating Company has secured the contract for lighting this village, and preparations are now being made for equipping the village and vicinity with electric lamps.

NEW YORK, N. Y.—The Atlantic Telephone Company has appealed to the Board of Estimate and Apportionment for a speedy decision on its application for a franchise to operate a telephone system in the city of New York.

BINGHAMTON, N. Y.—A strong sentiment is developing among the citizens and the Board of Aldermen in this city for the construction of a municipal electric lighting plant, to be run in connection with the city pumping station.

TROY, N. Y.—The city of Troy is contemplating establishing a municipal electric light plant. The bids submitted by the two electric light companies were considered exorbitant, and the council immediately set to work for plans for a plant of its own.

LIMA, N. Y.—The Lima & Honeoye Electric Light & Railroad Company contemplate the extension of its line to Rochester on the north, a distance of eleven miles, and to the lakes, a distance of eleven miles on the south. E. D. Watkins is manager.

SANFORD, N. C.—The town of Sanford has under consideration the purchase of the local electric lighting plant, owned by H. I. Thompson.

LEXINGTON, N. C.—The town commissioners have granted the Southbound Railway Company a franchise to operate a street railway system in and around the city.

BREVARD, N. C.—The Brevard Light & Power Company will develop a water plant on the Little River to take the place of its steam plant. J. W. Chapman is manager.

WILMINGTON, N. C.—It is reported that the Consolidated Street Railway Company is endeavoring to secure control of an extensive dummy freight line in this city and operate same by electricity.

CLINTON, N. C.—Franchises and other inducements are offered for private ownership, also plans and estimates are wanted for municipal ownership of water works and electric light plant for the town of Clinton. Address R. H. Hubbard, Mayor.

CONCORD, N. C.—The Cannon Company, one of he largest cotton mill concerns in the South, with offices at Concord, is reported to have decided to use electrical power from the Whitney Company's plant under construction on the Yadkin River.

GOLDSBORO, N. C.—At a recent town meeting W. J. Matthews was appointed to visit several municipal plants to secure information concerning the operation of electric light and water plants. The citizens are contemplating installing a municipal plant.

RALEIGH, N. C.—The Electric Bond & Share Company of New York, of which Marsden J. Perry of Providence, R. I., is president, has purchased a controlling interest in the Raleigh Electric Company, operating the city railway and light plant here. Mr. Perry and his associates are lessees of the Atlantic & North Carolina Railway and own the Norfolk & Southern and other railroads in Eastern North Carolina.

GARRISON, N. D.—A survey will be made at once, with a view to constructing a water works and an electric light plant.

TOLEDO, OHIO.—The Toledo Gas, Electric & Heating Company is preparing to make extensive improvements to its plant.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Valley interests are contemplating the extension of its line from New Castle to West Pittsburg.

WADSWORTH, OHIO.—The Northern Ohio Traction & Light Company has applied for a franchise in Wadsworth for its new extension from Barberton to this place.

FINDLAY, OHIO.—Engineers have begun the survey of the proposed Findlay-Marion electric line at Mt. Blanchard, and work will be pushed from Mt. Blanchard to this city.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company contemplates extending its Euclid Heights line for a distance of about three miles to Center Road in Warrensville.

GIRARD, OHIO.—C. F. Brotherton, of Ashtabula, O., has secured a franchise for an electric lighting and a water works system and will erect a plant to take care of both lines of business.

MORROW, OHIO.—The survey has been completed and the plans and specifications are now in the hands of the contractors for the construction of an electric railway from South Lebanon to Morrow.

BELLEFONTAINE, OHIO.—The Board of Public Service is installing American Diesel engines and making other improvements in the city electric light plant. M. D. Ehrhart is city electrician.

DAYTON, OHIO.—The Dayton & Northern Traction Company is preparing to make a number of improvements to its line. A storage battery substation is being built at Haines Station, six miles from Dayton.

LIMA, OHIO.—It is stated that the Lima & Eastern Railway has secured practically all the right of way from Lima to Marion, and that work on the road will start early in May. W. H. Wyke is general manager.

SHILOH, OHIO.—Citizens of this place have secured a right of way from Shiloh to Shelby, which they are offering to the Shelby-Mansfield Company to induce it to extend to that town. The matter is under consideration.

BOWLING GREEN, OHIO.—A franchise has been granted to the Lake Erie, Bowling Green & Napoleon Railway Company for its proposed extension westward from this place. The line eventually will be extended to Napoleon.

PORTSMOUTH, OHIO.—The Portsmouth Street Railway & Light Company has increased its capital stock from $125,000 to $500,000. The company has recently made improvements to its power station and equipment and is planning extensions.

CLEVELAND, OHIO.—The Cleveland & Southwestern Traction Company has under consideration a large number of improvements which will be made within the next year, including the purchase of additional boilers for the main power stations.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has placed a contract with the Cleveland Construction Company for the immediate construction of the extension of its road from Barberton to Wadsworth, a distance of six miles.

DAYTON, OHIO.—The Dayton Citizens' Electric Company has accepted the franchise granting the right to install a system in Dayton which was passed some time ago. A bond for $100,000 has been deposited with the city for the faithful performance of the contract.

SPRINGFIELD, OHIO.—The Washington Traction Company has secured all the right of way for extending the line from Charleston to Washington, C. H., and will let contracts at once. The company is planning to build a power station and repair shop at Washington, C. H. E. W. Christy is president.

DELAWARE, OHIO.—The Richmond & Magnetic Springs Railway Company has purchased the right of way for its line between Delaware Magnetic Springs and Richwood, and is planning to begin the construction. Christopher Magee, Jr., of Pittsburg, is president, and H. E. Buck, of Delaware, is general manager.

CLEVELAND, OHIO.—Bids will be received until May 4 by the Board Public Service for an engine of at least 750 hp, and an alternating-current generator of at least 500 kw capacity, and appurtenances, including switchboard, for the enlargement of the municipal electric light plant. A. R. Callow is secretary.

TIFFIN, OHIO.—The Farmers' Mutual Telephone Companies, of Seneca County, has closed a contract with the Tiffin Home Telephone Company, to connect its lines with its exchanges. It will be afforded long-distance service through the lines of the United States Telephone Company. About 3,000 farmer's homes will be connected.

CLEVELAND, OHIO.—The Lake Erie Terminal & Southern Railway Company states that a contract has been placed with the Terminal Construction Company, of Cleveland, for building the line from Independence to Akron, a distance of 30 miles. This is part of the line that the company proposes to build from Cleveland to Akron.

DEFIANCE, OHIO.—E. C. Bell, of Cincinnati, and Dr. D. A. Rigrish, of Defiance, are promoting an electric railway from Defiance to Bryan and Montpelier. This project is believed to be for an extension of the Columbus & Lake Michigan Railway, a steam road which was recently acquired by the Schoepf syndicate and which is to be converted to an electric line.

COLUMBUS, OHIO.—The Newark Telephone Company has announced that steps will be taken at once to provide for 1,000 new main line telephones. About 45,000 ft. of new cable, or nine miles, will be laid. Over 9,000 feet of new cable will be under ground. The improvements will be made from the proceeds of the new preferred stock, the majority of which was sold in Columbus.

CLEVELAND, OHIO.—J. W. Holcomb and C. F. Morley, chief promoters of the Cleveland, Ravenna & Alliance Railway, state that they have secured nearly all the right of way between Alliance and Clevland city limits. The promoters are also considering the question of building a spur line from Hudson to Warren, which will give to the company an excellent route from Cleveland to Youngstown.

STEUBENVILLE, OHIO.—The Wellsburg, Bethany & Washington Street Railway Co., recently formed to build a line from Wellsburg to Bethany and Washington, W. Va., has secured the right of way for its line. The company has purchased a coal mine near Underwood, and a power station will be erected so that coal will run direct from the mine to the power station. A. Cramblett is president.

NEWKIRK, OKLA.—Thomas Smith, of Newkirk, who is at the head of a company promoting a project for the construction of an interurban electric railway to extend from a point in Kansas southward to Oklahoma City, has secured the right of way through Kay, Noble and Logan Counties.

RAINIER, ORE.—The plant of the Rainier Electric Light & Power Company is completed and in operation. The company has but one street lamp in operation at the present time, but more will be put up immediately. The majority of business houses are now using electric lamps.

PINE CREEK, ORE.—The California & Oregon Light, Heat & Power Company is contemplating the installation of a new and larger power plant, for the purpose of furnishing light and power to the towns of Surprise Valley and Goose Lake Valley. The company expects to spend about $20,000 in improvements.

COTTAGE GROVE, ORE.—The Willamette Valley Electric Company has asked the City Council for an extension of its franchise for the electric light plant from 12 to 30 years. The Council deferred the matter for final action until May 7. The company has recently acquired this plant, and is making preparations for the installation of a large plant. It is reported that the company is preparing to put in a larger system of electric roads. The improvements under way will cost about $10,000.

NEWCASTLE, PA.—The Citizens' Telephone Company is preparing to place its wires in conduits.

MT. HOLLY, PA.—The Carlisle & Mt Holly Electric Railway will be extended this summer from Mt. Holly to Gettysburg.

NEW CASTLE, PA.—The New Castle Electric Street Railway Company contemplates the extension of its lines from this city to West Pittsburg.

MORTON, PA.—The Philadelphia Suburban Electric Light Company has purchased the plant of the Faraday Heat, Light & Power Company in this city.

WASHINGTON, PA.—The Washington Electric Light & Power Company has secured the contract for lighting the town for five years, at $70 per lamp per year.

DOYLESTOWN, PA.—The Bucks County & Willow Grove Transit Company will commence work May 1, on the construction of the electric street railway from this place to Perkasie.

SHIPPENSBURG, PA.—Bids will be received until June 7 by the president of the Town Council for lighting the streets of the Borough for one year from October 1, 1906. S. A. Angle is chairman of the light committee.

DANVILLE, PA.—The Trustees of Danville Hospital for Insane have awarded Buchanan & Company, of Philadelphia, the contract for the power house, electric generator plant, engine, boilers, etc., and for the necessary wiring for $73,702.

ERIE, PA.—It is reported that the Bell Telephone Company contemplates making some improvements in the local system in the near future.

It is now rushing the work on the new lines and system, made necessary by a large increase of business.

OIL CITY, PA.—The boiler and power houses of the Citizens' Traction Company and Oil City Light & Power Company at West End were destroyed by fire last week. The city was temporarily in darkness, and Franklin, Rouseville, Reno and suburbs, as well as Oil City, were without street car service. The loss is estimated at $250,000 to $300,000.

PHILADELPHIA, PA.—James N. Vandergrift, of Syracuse, N. Y., has been commissioned to prepare plans for the proposed electric railway tunnel under the Delaware River, which will connect Camden, N. J., and Philadelphia, Pa. The work calls for 2,700 ft. of tunnel under the river and a mile of subway approaches. The promoters of this undertaking are the Wolf Brothers, of Philadelphia and New York. Plans for the construction, it is said, will be ready by September.

READING, PA.—The Nolde & Horst Company has recently placed a contract with the Brown Engineering Company, of this city, for a complete power plant. The contract includes a 375-hp Fitchburg high speed engine, a 300-hp General Electric generator, together with switchboard, 40 General Electric motors and other machinery. Each department will be individually driven by the electric motors, doing away with belts, line-shafting, hangers, etc. Sixteen departments will be driven by Morse silent chain drives in connection with electric motors.

YORK, PA.—The York Haven Water & Power Company has awarded to Spahr Bros. a contract for the erection of a sub-station at Harrisburg for the transmission of current from the York Haven plant to the capital city. Work on the station will begin at once and the equipment will be installed immediately after the erection of the building so that Harrisburg will be supplied with electric current from the York Haven plant this summer. Current from the big hydro-electric plant near the falls of the Susquehanna is now being supplied to Middletown, Steelton and this city. Other towns will be added to the company's lighting and power system within the next year and additional machinery increasing the capacity of the plant will be installed at York Haven.

CHARLESTON, S. C.—A contract has been signed with the Consolidated Electric Company of Charleston, to supply electric lights to Sullivan's Island, which will be made a principal resort place this summer.

GREENWOOD, S. C.—The commissioners of public works of Greenwood have made a contract with the Savannah River Power Company to furnish the town of Greenwood with an unlimited amount of electric power for a period of ten years with an option for ten years more at the same price. The city of Greenwood still owns a first-class electric light plant, and this will be maintained in its present high state of efficiency to be used in case of an emergency. The price of current obtained from the power company will be much cheaper than it is possible to furnish it here, owing to the high price of fuel. The power company's plant will not be completed for several months, and pending this the plant here will operate a day current by steam from May 15.

LAFOLLETTE, TENN.—The power plant of the Lafollette Water & Light Company is nearly completed and will be ready to light the city in June. The company is also installing a modern telephone plant, which will be in operation in May.

JACKSON, TENN.—A Louisville syndicate composed of Attilla Cox, John L. Helm, George Gaulbert, J. W. Gaulbert, William Jarvis, Henning Chambers, Oscar Fenley, C. E. Claggett, Harry Weissinger and S. S. Bush, has purchased the electric railway and lighting properties at Jackson, Tenn. The new company will be called the Jackson Electric Company, and will make immediate improvements and extensions to the system. The company will abandon the present power plant and rebuild an up-to-date plant at a new location, and will give particular attention to lighting and power. The company will add at once 7 miles of track to the 3½ miles acquired, and will build a suburban line to Bemis, a distance of three miles. S. S. Bush, general manager of the Pascagoula Street Railway & Power Company, of Scranton, Miss., is also general manager of the Jackson Electric Company, and will build and manage it, with his general office for both companies at Louisville, Ky. The same syndicate owns both properties.

STRAWN, TEX.—Eugene Moore is interested in the construction of an electric light plant at Strawn.

GAINESVILLE, TEX.—The Southwestern Telegraph & Telephone Company is making plans to put its wires underground in the business portion of the city.

MARSHALL, TEX.—The Arkansas & Texas Consolidated Ice & Coal Company contemplates changing the frequency of its circuits from 125 to 60 cycles this fall, and also contemplates changing the primary voltage to 2,000, and establish a power circuit with 24-hour service.

TEMPLE, TEX.—It is learned that the improvements contemplated by the Southwestern Telephone & Telegraph Company contemplate practically rebuilding the entire plant at a cost close to $50,000, instead of $20,000, as at first reported. The system will be entirely changed, a new central office established, and extensive cabling will be done.

PARK CITY, UTAH.—The Summit Electric Company, which was given a franchise some time ago, will begin work at once on the installation of its new plant. This company is part of the Utah Electric Company, and it will furnish power to the local company from its plant at Cottonwood Canyon. According to the contract the Summit Electric Company is to have light in the city hall on or before July 1.

SALT LAKE, UTAH.—The Bingham Metal Mining Company has made application at the State Engineer's office for an appropriation of water to be used for power purposes. The plant is to be built near Tooele City and the water diverted from the near-by canyon. A rock-crib dam is to be built and a pipe laid a distance of 5,570 feet. One eighteen-inch impulse wheel operating under a head of 700 feet will be installed.

RICHMOND, VA.—The Citizens' Rapid Transit Company of Richmond, which has been organized for several years with the purpose of building a street railway system in Richmond, has applied for a change of charter increasing the capital from $500,000 to $1,000,000.

RICHMOND, VA.—It is stated that the Southern Bell Company is contemplating the construction of a new building and putting its wires underground. Work will commence on the new building in May. The cost of the building and other improvements will be about $250,000.

CHRISTIANSBURG, VA.—The sub-station of the Grayson Electric Company was destroyed by fire April 18. The building was erected and equipped last January at a cost of $25,000. The town will be without electric light until a new station can be built and equipped, which will be a month or more.

SUNNYSIDE, WASH.—Prof. O. L. Waller, of Pullman, has secured a franchise for water works and an electric light plant.

SEATTLE, WASH.—The City Council has passed an ordinance directing the city comptroller to advertise for sale $600,000 lighting bonds.

BREMERTON, WASH.—Paul Mehner, city clerk, writes that there is some talk of constructing a municipal electric light plant, but nothing definite has yet been done. S. H. Berry is city engineer.

SEATTLE, WASH.—R. H. Thomson, city engineer, is preparing the plans and estimates for a city street railway system, covering the whole city of Seattle, and the proposal to construct the system will be submitted by the City Council to a vote of the people without delay.

SPOKANE, WASH.—The Spokane-Pend d'Oreille Rapid Transit Company, of Spokane, is rapidly arranging the preliminaries preparatory to constructing its proposed line, which will be operated on the single-phase system, and will be 30 miles in length. The company has made arrangements to purchase 1,000 hp from the Washington Water Company, to be taken from its new power station at Post Falls, Idaho, to be delivered at Rathdrum. C. H. Reeves is president.

SPOKANE, WASH.—The property, franchises, rights and interests of the Centralia-Chehalis Electric Railway & Power Company have been acquired by C. H. Weeks, Cyrus Bradley and Benjamin J. Weeks, of Spokane, and W. W. Cannon, of Centralia. The company owns a water power on the Chehalis River, and it is planned to construct a power plant there to furnish power for its lines, but power for the Centralia-Chehalis link, which is the first to be constructed, will be furnished from a smaller plant to be established at Centralia at an early date.

SOUTH BEND, WASH.—The Raymond-South Bend Electric Company, which has been recently incorporated, will soon construct an electric light plant to furnish electric lights for Raymond and South Bend, and will also construct and operate an electric railway between the two places. It is stated that a power house is to be erected at the Siler switch junction, for which the machinery has already been ordered, which includes two 200-kw dynamos, two 125-hp engines and three boilers. W. S. Cram, of Raymond, and M. C. Welsh, of South Bend, are among the incorporators.

BLACK RIVER FALLS, WIS.—E. E. Moore and Ray Gilfillan are interested in the construction of an electric power plant on Hall Creek.

RACINE, WIS.—The Milwaukee Light, Heat & Traction Company has purchased a site for a new power house. The company contemplates increasing its power and other improvements, involving an expenditure of about $50,000.

FERGUSON, B. C.—The Lardeau Light & Power Company contemplates increasing the capacity of its plant and extending the transmission line to Trout Lake City, a distance of four miles.

GRAND FORKS, B. C.—The West Kootenay Power & Light Company has changed its name to the British Columbia Construction & Distributing Company, Ltd. It is stated that the company does not contemplate making a deal with the Cascade Power & Light Company, but will continue to construct its line as far west as Boundary Falls, which is the western limit of its 50-mile charter.

STRATHCONA, CAN.—The citizens of this town have voted to appropriate $35,000 to construct a new municipal lighting plant. Address Will Godson.

OWEN SOUND, ONT.—The citizens of Owen Sound have voted to issue $45,000 to enlarge the electric light plant.

TORONTO, ONT.—The shareholders of the Toronto Street Railway have authorized the issue of $1,000,000 on new shares to provide for new equipment, extension of lines and other improvements, to be made at once.

ST. CATHERINES, ONT.—The contracts for the extension of the Niagara, St. Catherines & Toronto Electric Railway have been awarded to Joseph Battle, of Thorold, Ont., by President Fred Nichols. The proposed extension is from Thorold to Welland and Fonthill.

WESTMOUNT, QUE.—The municipal electric lighting plant is nearly completed and will soon be in operation. The plant will furnish light to houses in the municipality in June, but will not furnish any street lamps until December. The plant when finished will cost about $194,000.

Company Elections.

FALL RIVER, MASS.—At the annual meeting of the Automatic Telephone Company held recently, the following board of officers was elected: Clerk and treasurer, Bradford D. Davol; directors, Edward B. Jennings, Edmund W. Wakelee, John T. Swift, P. A. Mathewson, Joseph Watters, Martin Feeney and Brandford D. Davol.

COLUMBUS, MISS.—At the annual meeting of stockholders of the Columbus Light & Power Company, the following directors were elected for the ensuing year: Walter Weaver, W. H. Lee, C. F. Sherrod, C. A. Johnston and R. T. Williams. The directors held a meeting and elected the following officers for the above mentioned period: Walter Weaver, president; W. H. Lee, vice-president; C. F. Sherrod, secretary.

CANAAN, CONN.—At a recent meeting of directors of the Berkshire Power Company, held in Hartford, the following officers were chosen: President, J. Henry Roraback, of Canaan; vice-president, M. R. C. Corson, of Hartford; treasurer, Francis R. Cooley, of Hartford; secretary, Henry Lyles, of Canaan. Mr. Lyles will also continue as general manager of the plant.

New Incorporations.

LITTLE ROCK, ARK.—The Pan Long-Distance Telephone Company, of Fort Smith, has been chartered with a capital stock of $1,000,000. The company proposes to build a long-distance telephone system over Arkansas and other States in this section.

TELLURIDE, COL.—The Institute Electric Company has been incorporated with a capital stock of $1,000,000, by Charles S. Rudner, A. L. Woodhouse and others.

DENVER, COL.—The Denver Northern Railway Company has been incorporated with a capital stock of $3,000,000. The enterprise is said to be backed by W. C. Brown, vice-president of the New York Central lines, and others. Robert Law, of Denver, will be president and Captain Charles P. Brown, of Ottumwa, Ia., secretary and treasurer.

LAMAR, MO.—The Missouri Exchange Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are B. M. Gunney, S. F. Snodgry, Maybelle Gunney and others.

SPRINGFIELD, MO.—The Springfield Home Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are W. B. Scruggs, R. W. Adams, J. L. White, L. L. Clemments and others.

ST. LOUIS, MO.—Application for articles of incorporation have been filed by the Independent Electric Company, with a capital stock of $10,000. The incorporators are John Dowd, George J. Clark and F. F. Cunningham.

ANACONDA, MONT.—The Belt Valley Telephone Company has filed articles of incorporation with a capital stock of $25,000. The incorporators are C. E. K. Vidal and others.

LINCOLN, NEB.—The Smithfield Mutual Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are C. A. Powell and others.

NEW YORK, N. Y.—The House Hill Telephone Company has been incorporated with a capital stock of $2,500, by Frank Ellison and others.

MANGUM, OKLA.—The Mangum Telephone Company has been incorporated with a capital of $100,000. The incorporators are A. Gordon and others.

NEWKIRK, OKLA.—The Newkirk Commercial Mutual Telephone Company has filed articles of incorporation with a capital stock of $12,000. The incorporators are C. A. Johnson and others.

OKLAHOMA CITY, OKLA.—The Oklahoma City & Shawnee Traction Company has been incorporated with a capital stock of $1,200,000. The incorporators are Douglas Crane and others.

CLEVELAND, OHIO.—The Northern Light Company has been incorporated with a capital stock of $10,000, by E. M. Cloves, R. S. McConnell and Samuel H. Kleinman.

JEFFERSONVILLE, OHIO.—The Jeffersonville Home Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Jacob Eberts and others.

BIRMINGHAM, OHIO.—The Riverside Telephone Company, of Birmingham, has been formed with $10,000 capital stock by S. Shissler, J. W. Ross, W. H. Funk, Z. C. Heald and G. W. Baker.

SCIO, OHIO.—The Doe Run Telephone Company, of Scio, has been formed with $10,000 capital stock by A. N. McCombs, W. H. Henderson, W. N. Henderson, F. S. Edger and W. B. Turner.

FLUSHING, OHIO.—The Stillwater Mutual Telephone Company of Flushing has been formed by A. J. Murphy, F. A. Groves, J. C. Groves, H. W. Howell and A. W. Collins. The capital stock is $10,000.

ELYRIA, OHIO.—The new local street railway company, which is under process of formation, will be incorporated, with a capital stock of $300,000. The promoters are A. L. Garford, J. C. Crist, T. M. Brush, E. T. Allen, J. C. Hill, E. W. Williams, R. W. Hill, Henry Ingersoll, S. B. Rawson and W. G. Sharp.

COLUMBUS, OHIO.—The Cleveland, Ashland & Mansfield Railway Company has been incorporated with a capital stock of $500,000. The incorporators are G. A. Bartholmew, T. C. Latham, A. N. Stentz, E. G. Avery and W. H. Kees.

EAST TOWNSEND, OHIO.—The Townsend Telephone Company has been incorporated by C. L. Moore, C. B. Canfield, G. N. Helling, A. D. Bargus and G. E. Stacey, with a capital stock of $10,000. The company will build a telephone exchange at East Townsend. It will have connection with the Norwalk exchange.

ARNOLD, PA.—The Arnold Light & Power Company has been incorporated with a capital stock of $5,000.

ASPINWALL, PA.—The Aspinwall Light & Power Company has been incorporated with a capital stock of $5,000.

CHESWICK, PA.—The Cheswick Light & Power Company has filed articles of incorporation with a capital stock of $5,000.

ERIE, PA.—The Northeast Heat & Lighting Company has been incorporated with a capital stock of $24,000. The incorporators are John Inglis and others.

ALBION, PA.—The Albion Light & Power Company has filed articles of incorporation with a capital stock of $5,000. The directors are R. P. Flower and others.

SHARON, PA.—The New Castle Telephone & Electric Company has been organized, with a capital of $200,000, and the following officers, William M. White, president, W. T. Herrington, secretary, and J. E. Duff, treasurer.

CHAMBERSBURG, PA.—The Chambersburg, Greencastle & Waynesboro Electric Street Railway has been incorporated with a capital of $500,000. The incorporators are Dr. R. W. Ramey and others. The company will build a street railway line from Greencastle to Foltz by way of the turnpike through Mercersburg.

SUMTER, S. C.—The Sumter Power, Light & Water Company has been incorporated with a capital of $80,000. The incorporators are Marion Moise, of Sumter, and G. E. Ladshaw and F. T. Bryant, of Spartanburg.

SOMERVILLE, TEX.—The Somerville Light & Manufacturing Company has been incorporated with a capital stock of $10,000. The incorporators are J. W. Landerdale and others.

HUBBARD, TEX.—The Union Central Light & Ice Company has been incorporated with a capital of $35,000. W. Aug. Bass is president, Allen & Scott, Waco, are the architects and engineers.

YORKVILLE, TENN.—The Yorkville Telephone Company has been chartered with a capital of $5,000. The company already has about 50 miles of lines connecting a number of towns in the vicinity.

JOHNSON CITY, TENN.—The Thompson Power Company has been incorporated, with a capital of $30,000 by T. M. Thorne, Robt. Martin and others, to improve and develop the water power of several East Tennessee streams.

RYEGATE, VT.—The Ryegate Light & Power Company has filed articles of incorporation with the Secretary of State, with a capital stock of $25,000. The company proposes to furnish light and power in the towns of Ryegate, Newbury and Groton. The incorporators are M. F. Sargent, F. J. Tewksbury, R. Farquharson, A. D. Grant, George H. Roben, Alexander F. Beaton, James Craigie, Charles H. Taplin and H. W. Goodine, of Ryegate.

SEDIO-WOOLLEY, WASH.—The Skagit Independent Telephone Company has been organized with a capital stock of $20,000.

SPOKANE, WASH.—The Empire Electric Company has been incorporated with a capital stock of $25,000. The incorporators are A. C. Rice and others.

BEAVER, WIS.—The Unity Telephone Company has been incorporated with a capital stock of $650 by George Stone and others.

New Industrial Companies.

THE NOVELAND COMPANY, of Bridgeport, Conn., has filed articles of incorporation with a capital stock of $30,000. The incorporators are William F. Schweiger and Alfred Warren. The company will manufacture electrical apparatus.

THE VULCAN ELECTRIC HEATING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $50,000, for the purpose of manufacturing electrical appliances. The incorporators are L. P. Brown, Frank C. Holmes and Granville M. Cox.

THE CONSOLIDATED STREET LIGHTING COMPANY, of Portland, Me., has filed articles of incorporation with a capital stock of $1,000,000. The company proposes to manufacture and deal in all kinds of appliances for lighting purposes. The officers are Harry C. Weber, president, and Harry L. Cram, of Portland.

THE SANDWICH POLE CHANGER COMPANY, of Sandwich, Ill., has been incorporated with a capital stock of $5,000, to manufacture electrical apparatus. The incorporators are S. P. Sedgwick and E. C. Hennis.

THE LITCHFIELD ELECTRICAL SUPPLY COMPANY, of Litchfield, Conn., has filed a certificate of incorporation with the Secretary of State, with a capital stock of $25,000. The incorporators are Edwin B. Peck, Theron J. Loveland and Thomas P. Conroy.

Legal.

STREET CARS PERSONAL PROPERTY.—The supreme court of North Carolina has decided that the street cars are personal property and not real property. The decision grows out of an appeal in The State vs. Martin, in which the defendant had been convicted of throwing a stone into a car at Winston-Salem, N. C.

THE ST. LOUIS LIGHTING MERGER.—A decision has been handed down by the United States Circuit Court of Appeals in the case of the Missouri Edison Electric Company. The case hinges on a $10,000,000 merger of the light and power companies of St. Louis, and granting the statements of the plaintiff, an attempt had been made to freeze out certain minority stockholders. This decision reverses that of the lower court and is regarded as admitting the legality of the merger under the laws of Missouri.

WATER POWER DISPUTE.—The Grand Ledge Electric Power Company has begun suit in the circuit court asking that the Michigan Power Company be enjoined from erecting and maintaining any dam across Grand River which would cause the water to overflow the lands owned by the complainant company, or which will interfere with the value of the water privileges owned by the Grand Ledge Electric Power Company, of Grand Ledge. Among other things, the complainant sets forth that the Michigan Power Company is conducting its operations in Eagle township without any expectation of building a dam without trespassing on the rights acquired by the complainant company. It is claimed further that the defendant's purpose is to hinder the Grand Ledge Company from carrying out its plans and compel a sale of such rights to the Michigan Power Company.

NEW YORK FRANCHISES.—At Albany on April 24 the Court of Appeals sustained the constitutionality of the law passed by the last Legislature taking from the Board of Aldermen in New York City the power to grant public franchises and conferring it upon the Board of Estimate and Apportionment. The decision was given in the cases of Clermont H. Wilcox, appellant, vs. George B. McClellan, as Mayor of New York, and others, constituting the New York City Board of Estimate and Apportionment, and Franklin Pettit, appellant, vs. the same. The appellants' first case was from a judgement of the Appellate Division, First Department, which unanimously affirmed a judgment entered upon a decision made by Justice James A. Blanchard, at Special Term, sustaining a demurrer to the complaint interposed by the defendants on the ground that the complain did not state facts sufficient to constitute a cause of action. The action was brought by the plaintiff as a taxpayer to prevent the defendants from granting certain franchises for underground railways in New York for the reason that the defendants had no right under the Constitution to grant such franchises, notwithstanding that the Legislature has conferred on the defendants the right to do the thing against which the plaintiff protested.

Obituary.

MR. ROBERT J. SHEEHY, a well-known inventor of electrical appliances of various kinds, died in New York, April 26, after a surgical operation for cancer. He was born in Ireland and was 64 years of age at the time of his death. The body was cremated.

MR. HENRY E. HAWLEY.—It is with great regret that we note the sudden death of Mr. Henry E. Hawley, general manager of the Hudson River Telephone Company at Albany on April 27. He had suffered for some time with heart trouble and about two weeks ago he returned from a trip taken for the benefit of his health and appeared much improved. He was born in Troy, August 16, 1861. He was educated in the public schools of Troy and took a course at the Troy Business College. His first work was for the New York Central Railroad at Troy, where he filled a clerical position. After other business engagements, he became connected with the telephone company and was assistant to General Manager A. B. Uline, whom he succeeded January 1, 1892. Mr. Hawley married twice. His first wife was Miss Josephine Robinson, whom he married in 1883. His second wife, Miss Dora E. Uline, daughter of A. B. Uline, he married in 1888. He is survived by her and four children. There is one daughter by his first wife, and a daughter and two sons by his second. Mr. Hawley was a member of the Albany Club, the Troy Club and the Transportation Club of New York. He was also a member of the First Reformed Church. Mr. Hawley was prominent in Masonic circles.

Educational.

BROOKLYN POLYTECHNIC INSTITUTE.—The Polytechnic Engineering Society held their first annual dinner at the Brevoort Hotel, New York, on Friday evening, April 20th. Many of the faculty, the alumni and the student body were present. Dr. Samuel Sheldon, as toastmaster, introduced Dr. Fred W. Atkinson, who spoke on the "Future Policy." Dr. Atkinson stated in substance that it was the purpose of the trustees of the Polytechnic to concentrate their energies on the subjects of electrical, civil and mechanical engineering with a view to establishing in Brooklyn an engineering school of the highest type. Furthermore they proposed to limit the number of students in the day courses to 250, establishing an extensive waiting list. With this system they hoped only to graduate engineers of the highest standing and who could in time occupy positions of the greatest trust. They also proposed to continue the extension courses now given in the evenings so as to afford ambitious young men an opportunity to take advanced courses. Dr. Sheldon then introduced Dr. Nichols, president of the Board of Trustees, who corrobrated Dr. Atkinson's statements. The third speaker, Mr. Baker, editor of the *Engineering News*, spoke very enthusiastically upon "The Future of the Civil Engineer in the United States." Mr. T. D. Lockwood, of the American Bell Telephone Company, then spoke in his usual entertaining manner, upon the subject of "Electrical Articulation." Difficulties in the profession at the present time reside in getting to the top and also in staying at the top when near there. In other words, there is only room at the top for those who hustle. Mr. Bolton was the last speaker of the evening, expressing himself upon the subject of "The New York Central Terminal." Mr. Bolton strongly emphasized the fact that all modern facilities of life are based upon "pipes," telling of the water pipes, sewer pipes, electric conduits, ventilation, etc. The dinner terminated with cheers on the part of the student body for Mr. Sydney W. Ashe, who was responsible for the great success of the affair.

Personal.

MR. P. G. GOSSLER, vice-president of J. G. White & Co., of New York, has reusmed work after an illness of nearly a month, due to a severe attack of grippe.

MR. V. R. LANSINGH delivered a lecture on Illuminating Engineering, illustrated by lantern slides, before the convention of the Western Gas Association, held in Chicago, on May 11.

MR. F. R. CORSON, superintendent of the Winnepiseogee Gas & Electric Company, of Laconia, N. H., has resigned to become superintendent of the St. Johnsbury, Vt., Gas Company.

MR. H. A. LARDNER, of the electrical engineering staff of J. G. White & Co., New York City, was dispatched last week to the Pacific Coast on a special mission in connection with electrical interests of the firm and its clients.

MR. W. H. ACKER, who has been with the Piedmont Electric Company, of Anderson, S. C., as local manager, has secured a position with the Westinghouse Company in Pittsburg, in the engineering department, assuming his new duties May 1.

MR. M. M. REID, of Springfield, Ohio, has been appointed superintendent of the municipal light plant at Columbus, Ohio. He was formerly chief engineer and master mechanic of the Appleyard system of traction lines centering at Columbus. He assumes charge, May 1.

MR. N. J. NEALL, consulting electrical engineer, has opened an office at 12 Pearl Street, Boston, Mass., where he will make a specialty of work in regard to lightning protective apparatus, in design, development and application; high tension alternating-current installations, and the rehabilitation of electrical plants of all kinds.

MR. OWEN M. BURGESS, of Nashville, Ill., has been appointed district manager of the Central Union Telephone Company, with headquarters at Centralia. His district embraces all of Illinois south of Decatur, and is the largest in the State. Mr. Burgess has been special agent for the company and was formerly connected with the Bell Telephone Company in St. Louis. He succeeds C. R. Stanhope.

MR. A. VENNING, an English consulting electrical engineer, has just returned to this country after an absence of over eight years, during which time he was connected with British Thomson-Houston central station interests and with London underground railway work. It is understood that he expects to stay permanently in the United States, where he has already had experience and has a wide circle of acquaintance.

NEW YORK ELECTRICAL SOCIETY.—The following named gentlemen were elected members of the New York Electrical Society at its meeting on April 25: Charles N. Green, New York; A. E. Mitchell, Baychester, N. Y.; Alex. Cameron, Brooklyn; Frederic A. Coolidge, Yonkers, N. Y.; Archer M. Huntington, New York; Leigh S. Keith, New York; Ainslie A. Gray, New York; Dr. Emil Heuel, New York; S. S. Dickinson, New York; C. B. Fairchild, Jr., New York.

GILMARTIN-HENDERSON.—On April 25, at the Church of the Holy Name, New York City, Miss Eva MacLeod Henderson, daughter of Mr. and Mrs. Alexander Henderson, was married to Mr. David Joseph Gilmartin, of the same city. The father of the bride is well known in electrical circles, and the large gathering at the church and home included a numerous and representative body from the electrical engineering and supply fields. The wedding was a very pretty affair and congratulations were showered upon the happy pair and upon the parents.

MR. H. A. REED, the veteran manufacturer, has resigned as treasurer of the Bishop Gutta Percha Co., and his oldest son, Mr. W. Boardman Reed, has been elected as his successor, while Mr. D. Reed has become vice-president. Mr. H. A. Reed has been with the enterprise 27 years and is to-day in his seventy-eighth year, hale and hearty, and will remain president. During the last three years he has seen the factory capacity increase 50 per cent, and he is now increasing it again in the shape of a new building 50 ft. by 100, five stories.

MR. ROBERT L. WEST, for the past six years district superintendent of the state of Georgia, for the Southern Bell Telephone Company, has tendered his resignation. Mr. West started telephone work in Richmond, and when only 19 years old he was manager of the Danville, Va., exchange, later managing the exchanges at Charlotte, Birmingham, and Richmond. During Mr. West's administration in Georgia the system has increased from 13 to 50 exchanges. Mr. West was a valuable man to the Southern Bell, and his severance of business relations by resignation is generally regretted.

MR. R. W. BAILEY, of East St. Louis, has been appointed superintendent of properties for the new East Side Corporation, which has consolidated the East St. Louis and Suburban with the Alton, Granite and St. Louis lines, to succeed Mr. J. F. Porter, in charge of the Alton lines. Mr. Bailey has been given charge of the Alton electric lighting and gas systems and the street railway, the interurban lines operated by the Alton, Granite and St. Louis and the Edwardsville, Alton & St. Louis companies. He will have his office at Alton. Mr. Porter will complete the work of reorganizing the Alton Water Works Company and then go elsewhere to look after the interests of J. G. White & Company.

SAWYER-TOBEY.—At Boston, Mass., on April 28, Mr. Edward Sawyer, president of the Atlantic Insulated Wire & Cable Company, of Stamford, Conn., and New York, was married at Emanuel Church to Miss Leslie Tobey, daughter of Mr. and Mrs. Phineas Sprague Tobey. The wedding was very largely attended, many well-known electrical people being present. The bride was given away by her uncle, Mr. Frank E. Peabody. After the wedding, a reception was given at the home of the aunt of the bride, Mrs. Peabody, on Commonwealth Avenue. Mr. Sawyer is the son of ex-Governor Sawyer, of New Hampshire, and has been connected with the electrical field for some years. The happy pair are now on a prolonged wedding tour, and will upon their return live at Stamford, where the company's factory is situated.

MR. JOHN W. LIEB, JR., past president of the American Institute of Engineers and associate general manager of the New York Edison Company, sailed for Europe with Mrs. Lieb, on the "Deutschland," for a trip of some ten weeks' duration, including England, France, Germany, Austria, Switzerland and Italy. Mr. Lieb will spend some time in Milan, where he installed and managed for ten years the first European Edison station; and then he and Mrs. Lieb will join in the trips of the British Institution of Electrical Engineers; returning about July 15. This is the first holiday for Mr. Lieb in several years, and in the intervening period he has done a great deal to make American hospitality the admiration of visitors from the other side of the Atlantic, so that a warm welcome awaits him. The trip would be prolonged but for the important work awaiting his return.

MR. LOUIS J. MAGEE, resident director in New York of the Allgemeine Elektricitaets Gesellschaft, was at the Hotel Del Monte, Monterey, Cal., at the time of the great earthquake, but fortunately he and Mrs. Magee escaped injury, although two people in the hotel were killed. He says of the occurence: "My most vivid impression was the feeling that everything was boiling and seething. As I looked out into the fog of the early morning, through the window-screen, the screen seemed to be moving in all directions, and reminded me of a badly adjusted kinetograph. The floor was like the floor of a car on a very rough railway journey. What seemed to be at first low rumbling soon gave place to terrific crashes, and we thought the house was coming down about us. We did not think at the time of the chimneys. In reality the house was oversupplied with chimneys, having about forty-three, of which thirty-one fell in the shock or were so badly injured that they had to be pulled over immediately." Mr. Magee secured instantly with his camera some interesting photographs of the scenes of destruction.

Trade Publications.

FIRST AID.—The P. L. Abbey Company, Kalamazo, Mich., is distributing an illustrated circular calling attention to its emergency accident cabinets as an always ready and reliable first aid to the injured.

ELECTRIC PYROMETER.—W. H. Bristol, New York, has issued a well-prepared description of electric pyrometers, for measuring the temperature of molten metals or of ovens, stacks or annealing furnaces.

ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., has issued Bulletin No. 21 devoted to direct current multipolar generators, for direct connection to high-speed engines. It is a four-page quarto folder and is illustrated in half-tone and in the dimensional diagram.

CEILING FANS.—The Hunter Fan & Motor Company, Fulton, N. Y., has issued a well prepared descriptive catalogue dealing with Tuerk alternating-current ceiling fans. The catalogue will be found unusually interesting by central station managers at this season of the year.

RAILWAY GENERATORS.—The Allis-Chalmers Company, Cincinnati, Ohio, has issued as bulletin No. 1049 a photographic description of numerous installations containing its type of direct-current railway generators and a detailed discussion of the component parts of the generators.

BRICK FOR BOILER SETTINGS is the theme of a neat booklet compiled for free distribution by the Harbison-Walker Refractories Company, Farmers' Bank Building, Pittsburg. It discusses the subject, shows some bricks, and cites the experience of several customers in the electric lighting and traction fields. Our readers should secure a copy.

WATT-HOUR METERS.—Instruction book No. 3,023 of the Fort Wayne Electric Works deals with type K, polyphase induction watt-hour meters. The book gives a general description of the instruments, and contains much valuable information on installing and testing the meters. Diagrams are given of the various connections that may be used in measuring the energy in polyphase circuits.

WIRES AND CABLES.—Catalogue No. 4 of the Indiana Rubber and Insulated Wire Company, Jonesboro, Ind., is intended to present the advantageous features of "Paranite" and "Peerless" rubber-covered wires and cables. It contains also a reprint of that section of the National Electrical Code dealing with fittings, materials and details of construction, and has numerous tables of value to the electrical wireman.

TRANSFORMER FUSE BOXES.—The Fort Wayne Electric Works, Fort Wayne, Ind., has issued as flyer No. 4,504 a brief illustrated description of porcelain fuse boxes for protecting transformers designed for an e.m.f. not exceeding 2,500 volts and a current not more than 30 amperes. The fuse boxes are mounted on the cross arms on the two sides of the transformer. Owing to their shape, they may be substituted for the usual extra insulators.

RUNDLE CHART SYSTEM.—G. M. Gest, the expert subway contractor, has obtained control of the Rundle patented graphic chart system for recording underground and overhead cable data. This system of charts has been adopted by the largest conduit users in the United States. A descriptive article was published sometime ago in the technical papers. Further data regarding this cable chart and its uses can be had by writing to anyone of G. M. Gest's several offices.

THE AMERICAN INSTRUMENT COMPANY has recently issued Bulletin No. 53, which describes a new line of switchboard voltmeters and ammeters that must appeal very strongly to engineers and others who appreciate really high-class workmanship. The instruments embody new features of importance and should be thoroughly investigated by all who have need for such apparatus. A copy of the Bulletin can be obtained from James G. Biddle, general sales agent, 1114 Chestnut St., Philadelphia, Pa.

TIMBER PRESERVING.—The value of preservative treatment for timber which is to be exposed to the elements is well recognized. Railroad ties, poles for telephones, telegraph and trolley wires, and the timber used in piers, wharves and bulkheads are particularly subject to decay unless they are treated beforehand with creosote or other chemicals. The Allis-Chalmers Company builds all the larger kinds of apparatus for this work. Its product includes the retorts in which the timber is treated, cars and other necessary accessories.

"THE ELEVATOR TRUST."—Messrs. A. B. See and W. L. Tyler, owners of the A. B. See Electric Elevator Co., 220 Broadway, New York City, have issued a circular attacking the Otis Elevator Company in connection with the suit of the Government against the "elevator trust" for violation of the Sherman anti-trust law. The circular quotes the Washington dispatch of March 7 giving news of the suit, and then comment is added by the gentlemen above named discussing the subject very freely and acrimoniously, and making certain allegations.

MULTIPLE-VOLTAGE SYSTEM.—The Allis-Chalmers Company, Cincinnati, Ohio, uses bulletin No. 1044 to present a well-prepared description of the multiple-voltage system of control for variable-speed, direct-current motors. In the three-wire system two balancers are used giving 90, 160 and 250 volts as desired. In the four-wire system there are used three direct-connected balancers wound for 60, 80 and 110 volts, respectively, so there are obtained 60, 80, 110, 140, 190 or 250 volts as desired. Descriptions are given of the controllers and of the motor-generators used in the balancer sets.

PICTURE LIGHTING is the title of a dainty pamphlet issued by I. P. Frink, 551 Pearl Street, New York City, dealing with the famous Frink reflectors as applied to the illumination of art galleries. It is not an exposition of the features of merit in these reflectors, but gives views of three or four celebrated galleries where the reflectors are to be found with a few pithy observations on the subject. Then follow several closely printed pages giving a list of private and public collections where art lovers are enabled to enjoy the pictures and statuary to the fullest degree because they are properly illuminated.

VOLTAX.—The new insulating material of the Electric Cable Company, of Bridgeport, Conn , is the theme of a most artistic little brochure prepared for the company by Bruce & Banning, the publicity experts. It is a 16mo in boards with red cloth backing, and roxburghe label on the front cover. The one illustration is a pretty tint view of the works. The pamphlet is no mere pretty toy, but it contains an admirable digest of data in regard to tests, uses, etc., of the insulation, all printed in good bold type. No engineer who gets this will throw it aside carelessly, but will first admire and then peruse diligently.

THE STURTEVANT ECONOMIZER is the title of catalogue No. 130 just issued by the B. F. Sturtevant Co., of Boston, Mass., in its Engineering Series. This finely illustrated pamphlet of 48 pages, 6½x9 inches, is suggestive of the rapid progress made in the installation of this important factor in economic steam generation. It comprises a detailed description of the economizer, with statements of its advantages, instructions regarding installation, operation and repairs, a discussion of mechanical draft as an adjunct to the economizer and a series of valuable tables relating to the flow of air, efficiency of fuels, etc.

STEAM ENGINES.—A neat little catalogue recently received from the Ball Engine Company, Erie, Pa., gives a brief outline of new engine designs including side-crank, single-cylinder, belted and direct-connected engines, tandem and cross-compound, side-crank engine, and both horizontal and vertical simple and compound Corliss engines with improved valve motion. Each of these types is represented by a full-page illustration. Catalogue O, of the same company, gives a more elaborate discussion of the design, features and operating characteristics of the standard engines. It is interesting to observe that with the exception of the single-cylinder, belted type engine each engine illustrated is shown driving an electric generator. A prominent feature of these engines is found in the Robb-Armstrong-Sweet governor, to the detailed description of which the Ball Engine Company had devoted a special pamphlet.

News of the Trade.

THE STAR ELECTRIC COMPANY, of Youngstown, has leased temporary quarters in Warren, where it will manufacture storage batteries.

THE AMERICAN VITRIFIED CONDUIT COMPANY is moving its offices to the Fuller Building, Fifth Avenue and Twenty-third Street, New York.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., announces the opening of a branch office in Pittsburg, located in the Frick building annex

H. B. CAMP COMPANY, vitrified clay conduit manufacturer, is moving its New York offices to the Flat Iron Building, Broadway, Fifth Avenue and Twenty-third Street, New York.

THE DEFOREST WIRELESS STATION will establish a new station on the twelfth floor of the National Bank of Commerce at Norfolk, Va., and will handle messages to a distance of about 1,000 miles.

THE NEW ENGLAND ELECTRIC COMPANY, manufacturer of electrical appliances, making a specialty of porcelain goods, has moved its plant from Denver, Col., to Trenton, N. J. The company will maintain a branch in Denver.

THE WISCONSIN BRAKE & ELECTRIC COMPANY, successor to the National Electric Company, notifies us that its general sales offices will be located hereafter at No. 519 First National Bank Bldg., Chicago, instead of in Milwaukee

ANDERSON LINE MATERIAL.—The Universal Railway Supply Company, of Baltimore, Md., has been appointed sales agent for Anderson line material in Maryland, Delaware, District of Columbia, Virginia and North Carolina, by the Albert & J. M. Anderson Mfg. Co., of Boston.

THE ENGINEERING SPECIALTY COMPANY, of Meriden, Conn., has acquired the property of the Max Riddell Hardware Manufacturing Company, in Stamford, Conn., and will construct a plant on the site. The company manufacturers motors, generators, sparking dynamos and magnetos, and dynamotors for telephone and annunciator systems.

GREGORY ELECTRIC CO.—The Gregory Electric Co. has removed to very largely increased quarters at 16th and Lincoln Streets, Chicago, the general offices, warehouse and works all being now at this new location. This was made necessary by the large growth in this company's business, and the concern is now equipped to handle the heaviest apparatus advantageously.

WHITE & MIDDLETON, of Baltimore, are constructing dynamos for submarine boats for Russia and Germany. They will install in the boats gasoline marine engines, and while the boats run at the surface of the water, the engines will be used to store electricity from the dynamos. While running under the surface, the boats will be driven by the electric motors fed from the batteries.

THE BOSTON INSULATED WIRE & CABLE COMPANY is the new name for the business formerly known as the Clark Insulation Company, Boston, Mass. The business of this company has grown so rapidly within the last year that a change of location has been found necessary, and negotiations are under way for a most modern and complete factory to take care of the rapidly increasing business.

OIL ENGINES.—Burk Bros. & Co., merchants of Kirksville, Mo., are installing a refrigerating machine and a 28-hp "Hornsby-Akroyd" oil engine to drive same. Both the oil engine and refrigerating machine are supplied by the De La Vergne Machine Co. Mr. John B. Eyres, Paterson, N. J., is installing a refrigerating machine, also one 7-hp and one 13-hp "Hornsby-Akroyd." The 13-hp oil engine is to drive the refrigerating machine. Both the refrigerating machine and oil engines are supplied by the De La Vergne Machine Company.

VIELE, COOPER AND BLACKWELL is a new firm of consulting electrical and mechanical engineers, with offices at 49 Wall Street, New York City. The firm comprises Messrs. F. O. Blackwell, Hugh L. Cooper, M. A. Viele and H. W. Buck, all of whom are already well known in the American engineering field. They have already some very large projects in hand, and will specialize as to transmission and hydro-electric enterprises—in connection with which work their individual names have already become associated closely, as to successful plants now in operation in the United States, Mexico and elsewhere.

"BRILLIANT" LAMPS.—Mr. E. J. Kulas, the secretary of the Brilliant Electric Co., of Cleveland, O., has just returned from an extensive trip through the Southern States and Mexico. The object of the trip was largely the appointment of agencies throughout that section of the country. Mr. Kulas made satisfactory arrangements with some thirty supply dealers to carry Brilliant lamps in stock. These agencies, together with the large number previously arranged for, makes it possible to purchase these lamps in any part of the country and have orders promptly attended to.

STURTEVANT MOTORS.—Although standard Sturtevant motors are built for independent service, a specialty is made of attaching them to fans which demand special combinations of speed and power. These motors are built in a line of bi-polar, four-pole and eight-pole types, dependant upon size and requirements. The enclosed type prevails for fan propulsion where there is considerable dust. They range in output up to 125 horse-power. The rigid specifications of the U. S. Navy Department, under which many fan motors have been constructed, have established an exceptionally high standard which is maintained in all work.

THE AMERICAN CONDUIT COMPANY announces the removal on May 1, 1906, of its Chicago offices to more central and more commodious quarters in the Marquette Building, where Mr. A. L. Waterbury, general manager of the sales department, will be glad, as in the past, to receive the friends and patrons of the company, and where all inquiries by mail or otherwise will receive prompt and careful attention. The increase in the business of the American Conduit Company is decidedly gratifying, and gives satisfactory evidence, both by the volumne of business and by the class of customers being served, that the merits of bituminized fiber conduit as an underground conduit have had practical demonstration and are being accepted with rapidly increasing favor.

THE GEO. H. GIBSON CO. advertising engineers, Park Row Building, New York City, which conducts the advertising of a number of the leading machinery manufacturers, has recently taken up the subject of disposing of inventions. This concern acts as commission agents in the selling of inventions and uses personal representation and correspondence in bringing about a sale. The three members of the organization are engineers with practical experience in civil, mechanical, mining and electrical work and have made, patented and sold inventions of their own. Their client's inventions are presented in a bulletin, entitled "Engineering and Manufacturing," which has just come to hand and which contains, in addition to descriptions of several new inventions, articles of interest to manufacturers and inventors.

OIL FILTERS.—Among those who have purchased White Star oil filters recently are: Sears, Roebuck Co., Chicago; Mandel Bros., Chicago; American Steel & Wire Co., Waukegan, Ill.; Youngstown Sheet & Tube Co., Youngstown, O.; Boston Elevated Railway Co., Boston, Mass.; Merchants' Ice & Coal Co., St. Louis, Mo.; City Electric Light Plant, Easton, Pa.; Utica Industrial Co., Rome, N. Y.; Northern Mfg. Co., Detroit, Mich.; Mutual Light & Water Co., Brunswick, Ga.; Indiana County Gas Co., Indiana, Pa.; Elk Lick Library Co., Hambleton, W. Va.; New England Cotton Yarn Co., New Bedford, Mass. One of the chief features of the White Star oil filter is the ease with which it may be taken apart and cleaned without interrupting the operation of purifying dirty oil. This and its other many advantages are shown in booklets which the Pittsburgh Gauge & Supply Co., Pittsburg, Pa., will be pleased to mail all engineers.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York. Next meeting, Chattanooga, Tenn., May 1-4, 1906.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York. Next convention, Columbus, Ohio, Oct. 15-20, 1906.

Association of Edison Illuminating Companies. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting, September, 1906.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors Association of New York State. Secretary, J. Fish, [illegible] Mill St., Rochester, N. Y. Next meeting, New York City, June 10, 1906.

Electric Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary-Treasurer, Geo. H. Krich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings second and fourth Thursdays each month.

Electrical Trades Association of Canada. Secretary, Wm. R. Staveley, Royal Insurance Building, Montreal, Can. Next annual meeting, January 14, 1907.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electrical Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, New Haven, Conn., Aug. 16-18, 1906.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., Oct., 1906.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electric Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

Missouri Independent Telephone Association. Secretary, James F. Barnett.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn. Next meeting, Chicago, June 26, 27 and 28, 1906.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

New York State Independent Telephone Association. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Elmira, N. Y., June, 1906.

Northwestern Electrical Association. Secretary, B. C. Adams, Madison, Wis.

Ohio Electric Light Association, Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, O.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, F. W. Bullard, Cleveland, O. Next meeting, Pittsburg, Pa., May 17, 1906.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, O.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore. Next annual meeting, June 19, 1906.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D.

Southwestern Electrical and Gas Association. Secretary, Frank J. Duffy, Beaumont, Tex. Next meeting, Galveston, May 16, 17 and 18, 1906.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchield, Jr., 114 Liberty St., New York.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt. Next meeting, July 10 and 11, 1906.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 24, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

818,424. SAFETY DEVICE FOR ALTERNATING-CURRENT DISTRIBUTION; George N. Eastman, Chicago, Ill. App. filed Sept. 17, 1904. An automatic safety device for alternating currents consisting of a plurality of circuit-conductors arranged on different sides of the system and their electromotive forces differing from each other in phases; a group of independent windings insulated from each other, one for each of the circuit-conductors, arranged in close proximity and bearing the same inductive relationship to each other, whereby the inductance is neutralized when the vectorial sum of the currents in the circuit-conductors is zero; and an extra coil for controlling an electrosensitive device, said extra coil being in position to be inductively energized by any one of the first-mentioned coils.

818,449. PORTABLE ELECTRIC LIGHT; Conrad Hubert, New York, N. Y. App. filed May 10, 1905. A miniature pocket lamp including a pair of dry batteries and a lamp bulb disposed therebetween. Has a switch which can be slid sidewise so as to be locked in one position and avoid exhausting the battery by accidental displacement.

818,477. PRINTING TELEGRAPH; Robert J. Sheehy, New York, N. Y. App. filed May 22, 1903. A printing telegraph having the usual sunflower wheel and keys which complete electrical circuits to various segments thereof. The invention lies particularly in the means for disengaging the trailer from the sunflower wheel when receiving.

818,480. BINDING POST; Clyde Slusser, Charleston, W. Va. App. filed Mar. 17, 1905. A spring binding post constructed entirely of malleable iron and having prongs at one end which are adapted to be bent up so as to conveniently engage the base of any article to which the binding post is to be attached.

818,495. SYSTEM OF OPERATING RAILROAD SWITCHES; Aldred K. Warren, New York, N. Y. App. filed June 24, 1905. A central station instrument for operating track switches. Includes a plurality of keys which directly work the switch levers in an oil bath. At the same time certain magnets move switches on a miniature track in front of the operator so as to show the condition of the actual track.

818,515. ELECTRIC SIGNAL SYSTEM; Victor W. Bergenthal, Chicago, Ill. App. filed July 21, 1904. The usual trolley wire has contact plates adjacent thereto which are engaged by the trolley wheel under certain circumstances. The circuit closed thereby operates relay magnets which control the lamp circuits.

818,527. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed July 14, 1902. The combination with a trunk-line adapted to connect with a calling telephone-line at its outgoing end and with a called telephone-line at its incoming end, a signal at the incoming end of the trunk, a trunk-relay at said end actuated by current over the trunk when connection is established at the outgoing end for preventing the operation of said signal, means actuated when the called subscriber responds for entirely depriving said relay of operating-current, and means whereby said relay still remains in operated position although deprived of operating-current through any of its windings and prevents the actuation of said signal during conversation, substantially as described.

818,534. APPARATUS FOR INDICATING THE CHARACTER OF ELECTRICAL EFFLUVIA; Leon Gerard, Brussels, Belgium. App. filed June 14, 1905. The rays from a vacuum tube are directed through a small perforation in a lead screen and subsequently through a prism against a continuously moving photographic film. In this way the character of the rays is investigated.

818,540. TELEPHONE-EXCHANGE SYSTEM; Edmund Land, Grand Rapids, Mich. App. filed Mar. 20, 1905. In a telephone system, the combination of a substation-telephone, a central office, a trunk-selecting switch in said central office, a line connecting said substation-telephone with said trunk-connecting switch, speech-transmitting elements forming a part of said substation-telephone and adapted to receive electrical energy for speech transmission from said connecting telephone-line, a source of electrical potential in said central office and connected to said line, a trunk in said central office, a visual signal, and a circuit including said source of potential, said relay, said line, said speech-transmitting elements, a conductor in said trunk and said visual signal, substantially as described.

818,561. SWITCH; Edward P. Robbins, Mansfield, O. App. filed Oct. 20, 1905. An electrically operated switch having a pair of shoes adjacent the usual trolley rail which are engaged by separate trolley pole connections when desired. These are in circuit with a pair of solenoid coils which move an armature directly connected to the switch point.

818,589. ELECTRIC HAMMER; William F. Wegner, New York, N. Y. App. filed Sept. 9, 1905. Details of an electric hammer having a solenoid with two coils, and an armature reciprocating therebetween. The armature impinges against the tool at each reciprocation.

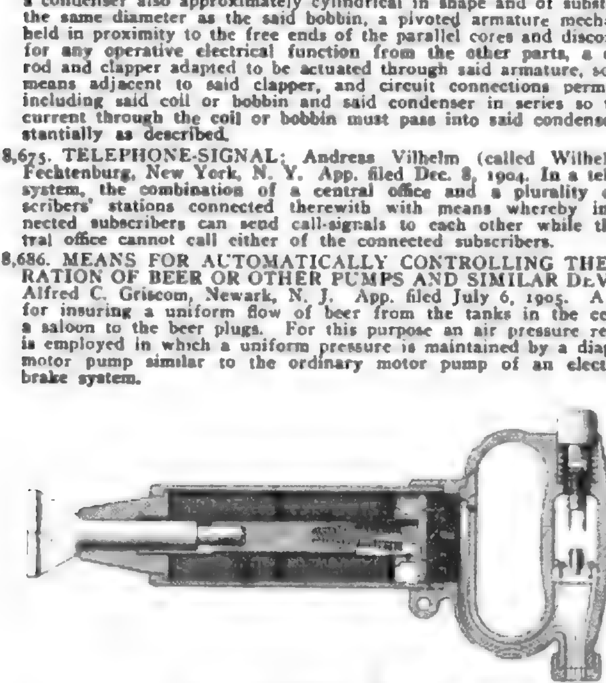
818,614. ELECTRICAL SWITCH AND CUT-OUT; Charles M. Dorman, Reginald A. Smith and Herbert G. Baggs, Salford, England. App. filed Mar. 28, 1905. A form of magnetic circuit-breaker having two separate circuit breaking blades or levers which must be closed and opened in a predetermined order by reason of certain intermediate lever connections.

818,631. TROLLEY WIRE SUPPORT; Ames H. Land and Uriah Gulnick, Newark, N. J. App. filed May 4, 1905. A form of support or hanger for trolley wires having laterally projecting flanges and central lips depending therefrom. The lips are arranged to be bent inward so as to embrace the usual trolley wire.

818,673. SIGNAL-BELL FOR TELEPHONE SYSTEMS; Charles E. Egan, Columbus, O. App. filed Feb. 27, 1903. In a signaling apparatus for telephone instruments, a combined ringer and condenser comprising a frame, a yoke of magnetic material, a pair of elongated cores extending from the said yoke parallel to each other, an insulated wire winding or bobbin upon one core, in approximately cylindrical shape, insulated conducting-sheets rolled and compressed upon the other core to form a condenser also approximately cylindrical in shape and of substantially the same diameter as the said bobbin, a pivoted armature mechanically held in proximity to the free ends of the parallel cores and disconnected for any operative electrical function from the other parts, a clapper-rod and clapper adapted to be actuated through said armature, sounding means adjacent to said clapper, and circuit connections permanently including said coil or bobbin and said condenser in series so that all current through the coil or bobbin must pass into said condenser, substantially as described.

818,675. TELEPHONE-SIGNAL; Andreas Vilhelm (called Wilhelm) R. Fechtenburg, New York, N. Y. App. filed Dec. 8, 1904. In a telephone system, the combination of a central office and a plurality of subscribers' stations connected therewith with means whereby interconnected subscribers can send call-signals to each other while the central office cannot call either of the connected subscribers.

818,686. MEANS FOR AUTOMATICALLY CONTROLLING THE OPERATION OF BEER OR OTHER PUMPS AND SIMILAR DEVICES; Alfred C. Griscom, Newark, N. J. App. filed July 6, 1905. A device for insuring a uniform flow of beer from the tanks in the cellar of a saloon to the beer plugs. For this purpose an air pressure reservoir is employed in which a uniform pressure is maintained by a diaphragm motor pump similar to the ordinary motor pump of an electric air brake system.



818,589.—Electric Hammer.

818,698. TELEPHONE; Samuel P. Levenberg, New York, N. Y. App. filed Jan. 16, 1905. In telephony, in combination, transmitting mechanism, a member mounted adjacent said transmitting mechanism and provided with an opening, a mouthpiece adapted to fit said opening and provided with a flange resting against said member and an adjustable collar adapted to hold said flange against said member.

818,715. MEANS FOR TRANSMITTING POWER BY ELECTRIC CURRENTS; William Stanley, Great Barrington, Mass. App. filed July 19, 1904. In a system of power transmission, the combination of means for producing a plurality of sets of currents of differing frequencies, a motor having a rotor and a stator each energized by one of said sets of frequency-differing currents so as to have rotating magnetic fields impressed upon them respectively and means for changing the relative direction of rotation of said fields.

818,744. SIGNAL APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Feb. 6, 1905. A mechanism for operating a semaphore arm to any one of three positions. Includes an electric motor and gear connections therefrom to the main rod of the semaphore arm. A special lever and switch arrangement is used so as to insure the required movement of the semaphore arm under different conditions.

818,750. CLUSTER LAMP-SOCKET; John H. Dale, New York, N. Y. App. filed Feb. 4, 1905. Relates to a construction of mounting the threaded shells upon the contact plate of a lamp socket in a flexible manner, so that when the cluster is assembled the shells can be swung out of their normal position to admit them easily into the various openings of the cap.

818,767. TELEPHONIC DEVICE; Isidor Kitsee, Philadelphia, Pa. App. filed June 15, 1903. In telephony a connecting-cord consisting of the cord proper, two plugs electrically connected to said cord, each of said plugs embracing an electromagnet and a source of current, said source of current connected in multiple arc as to the two conductors of said cord.

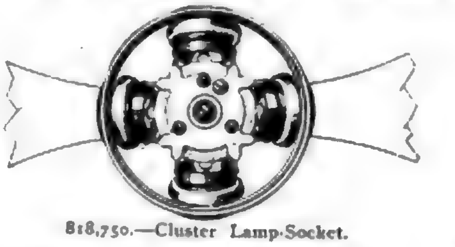
818,768. ELECTRICAL CONTROLLER FOR ELECTRIC VEHICLES; Karsten Knudsen, Chicago, Ill. App. filed Jan. 13, 1902. Details of a controller system in which the controller segments are adapted to have an abrupt movement from point to point regardless of the movement of the controller arm. For this purpose a special arrangement of cam and detent rollers is arranged within the controller box.

818,773. SWITCH THROWING DEVICE; John H. Meyer, New Kensington, Pa. App. filed Dec. 21, 1905. Device for operating a track switch involving a pair of arms or tappets projecting from the roadbed and mechanically connected to the switch point. The movement of the switch point closes different lamp circuits.

818,791. PLUG SOCKET FOR ELECTRIC LAMPS, ETC.; Frank J. Russell, New York, N. Y. App. filed July 12, 1905. Details of construction of a plug socket having a metallic casing and certain internal parts of porcelain.

818,793. LOCK-OUT TELEPHONE SYSTEM; Louis A. Schmidt, Chicago, Ill. App. filed Aug. 21, 1905. In a telephone system, a central station, parallel conductors therefrom, a plurality of normally open telephone sets bridged between said conductors, and in association with each such set means for controlling the continuity of a conductor therebeyond comprising a relay having its normally open armature arranged to control the continuity of the line, and having a winding in shunt between the said conductor and the bridge connections, whereby current flows therethrough in one direction to cause the attraction of the armature, and opening of the line therebeyond when the bridge is closed at such station, and in the other direction to leave the armature unattracted, and the line closed when a circuit is completed at a point more remote from the central station than such station referred to.

818,795. RAILWAY SIGNALING DEVICE; Charles T. Smith, Lebanon, Pa. App. filed Mar. 30, 1905. A semaphore system for trolley roads having a switch box at each turn-out with a lever which is moved by the car contactor into one of two extreme positions. At each turn-out there is a solenoid magnet with two armatures which establish certain lamp circuits according to the position of the operating arms.



818,750.—Cluster Lamp-Socket.

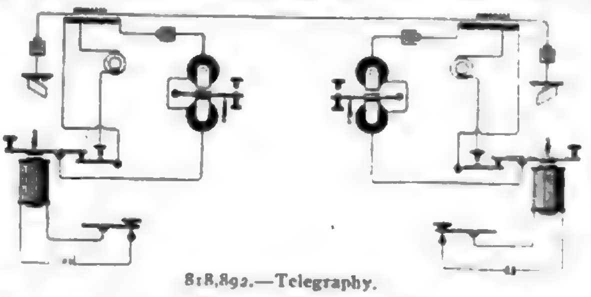
818,855. RAILWAY SIGNAL SYSTEM; Alfred L. Ruthven, Topeka, Kan. App. filed Sept. 1, 1905. A railroad signal system designed to notify an engineer of the presence of another train on the same track, and whether the train is moving in the same or in the opposite direction. Special trolley circuits are provided which include alarm devices on the separate cabs, and certain tappets along the roadbed are also operative to indicate the direction of the respective trains.

818,892. TELEGRAPHY; Sterns F. Jones, New York, N. Y. App. filed Nov. 21, 1905. Relates to that form of telegraphy in which short and rapid alternations of current are divided into groups of varying length under the control of a key or circuit changer. The patentee aims to strengthen the transmitted impulses and strengthen the received impulses without changing the electromotive force or the strength of current of the alternating-current generator. For this purpose special local circuits are arranged including transformers and condensers.

818,897. TELEPHONE SYSTEM; Ray H. Hamson, Elyria, O. App. filed June 25, 1904. In a telephone-exchange system, a central station and a subscriber's station with a line-circuit interconnecting them, a source of current for the line at the central station, a telephone receiver and transmitter at the subscriber's station and a Wheatstone bridge circuit connection for the receiver, having its alternate arms containing inductive resistance, those intermediate thereof non-inductive resistance, the receiver in the bridge-wire, the extremities of the bridge to line, and the transmitter in series with the line and bridge, whereby battery-current may flow through the transmitter in considerable volume without producing any difference of potential across the terminals of the receiver, while voice-currents produced in the line will be forced practically all through the bridge-wire and the receiver.

818,918. PROCESS OF MANUFACTURING IRON AND ITS ALLOYS; Marcus Ruthenburg, Lockport, N. Y. App. filed Nov. 28, 1903. The continuous process of reducing ore to the metallic state, which consists in fritting comminuted particles of ore in coherent porous lumps, collecting the lumps in a confined heated atmosphere, then before said lumps have fallen below a reducing temperature, subjecting them to the action of reducing media in said confined heated atmosphere and reducing them without fusing them, and then increasing the temperature of said lumps, until the reduced metal is melted, substantially as set forth.

818,947. SHOE CONTACT; George H. Fretts, Springfield, Mass. App. filed May 13, 1905. An insulated shoe or section for a trolley wire suitable for the purposes of track switches and the like. Has metallic plates secured to the trolley wire by bolts. The metallic plates have holes beneath the bolts so that the latter may drop to the ground in case they become loosened and not interfere with the passage of the trolley wheels.



818,892.—Telegraphy.

818,982. EXTENSION-ARM TELEPHONE; Thomas J. Skelley, Collinwood, O. App. filed Apr. 25, 1904. In an extension-arm telephone, the combination of a base, an extensible arm pivoted thereto and carrying at its outermost end an upwardly-projecting pivot-pin, and a tubular telephone pedestal having at its lower end a member which substantially closes the tube and is provided with a socket engaging such pivot-pin.

819,009. ELECTRIC INCANDESCENT LAMP; Otto Feuerlein, Charlottenburg, Germany. App. filed June 14, 1904. An electric incandescent lamp comprising a continuous metallic filament, and insulating means to support the same in a plurality of substantially straight lengths or sections, each length or section being supported by said insulating means, at both its ends.

819,028. METHOD OF TRANSMITTING POWER BY ELECTRIC CURRENTS; William Stanley, Great Barrington, Mass. App. filed July 19, 1904. The method of transmitting power at varying speeds by alternating currents which consists in impressing upon the rotor element of a motor a field due to alternate currents of one frequency, and impressing upon the stator element a field due to alternating currents of a different frequency and varying the relative direction of rotation of the impressed fields.

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NEW YORK, SATURDAY, MAY 12, 1906.

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The Engineering Building.

The progress on the new home for the national engineering societies is well evidenced by the fact that when the cornerstone was laid this week by Mrs. Andrew Carnegie the completed walls towered a dozen stories above the little concourse, and the statement was made unofficially that occupancy is hoped for by January 1. Indeed there is no good reason why the building should not be in every way complete before that date, but in these days of strikes and other earthquakes, "you never can tell." At any rate, the Conference Committee and the United Engineering Society that have been giving strenuous days and nights to the work for the past two years are to be congratulated upon the attainment of the present stage of their task. The building is proving to be far more beautiful and stately than even the drawings of the architects promised, and the interior arrangements—society headquarters, offices, library, museum, auditoriums, reception rooms, etc.—have been laid out with painstaking study and care. The fact that a dozen bodies and some 20,000 engineers have already concentrated on the spot for their official work is more than justification of the simple pregnant little sentence of Mr. Carnegie when he said that the money given was to create a "home for you all." It is believed the city will contain no more fruitful benefaction than this.

Growing Electrical Exports.

It is with great satisfaction that we note how the growth in electrical exports this year has been maintained. The figures for January and February have already been published, showing gains, and now we have corresponding improvement brought to note in the March statistics of the United States Department of Commerce and Labor. The exports of electrical machinery in March were $705,037, as compared with $620,496 last year. The exports of electrical instruments and apparatus were $590,328, as compared with $505,705. Both classes thus exhibit substantial advances, which are brought out even more clearly in the returns for the nine months of the fiscal year. Thus the total of instruments and apparatus is $4,654,800, compared with $3,616,648, while the total of electrical machinery is $5,736,935, compared with $5,290,091. We thus get a total for the nine months of $10,391,735, a gain only a few dollars short of $1,500,000. Such trade is well worth fostering, and that branch of it relating to small apparatus appears particularly responsive to judicious effort.

Gas Versus Electric Store Lighting.

A walk down the business streets of some towns, especially in Ohio where natural gas is cheap, is not conducive to great pride on the part of the electric light man as to the industry he represents. It must be admitted that in too many cases the general appearance of the gas-lighted store as compared to those lighted by incandescent electric lights is much superior. Where this is true it is due in a large measure to the out-of-date lighting arrangements of the electrically-lighted stores. The incandescent electric lamp, when seen in stores on a street where other stores are lighted with gas mantle burners, looks yellow and sickly when clear glass bulbs are used. The incandescent lamp filament, never a thing of great beauty, looks still worse when in comparison with the whiter and better diffused light given by gas mantle burners within opal glassware. This is not written to boom gas lighting but to point out how electric lighting can be greatly improved. The general appearance of the electric incandescent lamp can be radically changed by the use of roughed or frosted glass bulbs or globes. By this simple change this crudity is at once removed and the electric incandescent lamp can be used on a street where diffused gas lighting is in vogue without causing the electrical man to hang his head in shame.

THE STARTING CURRENT OF MOTORS.

The *Elektrotechnische Zeitschrift* has recently published the resolutions of the German Machine Standardizing Committee in regard to the starting of motors connected to city mains. The resolutions contain a number of rules for the control of such motors. The existing conditions in German cities have given rise to some dissatisfaction, when polyphase motors have been installed in considerable numbers on city electric lighting mains. The large and copious starting currents that such machines insist upon cause heavy and sudden drops of potential in the supply mains, and a correspondingly noticeable winking on the part of the sensitive incandescent lamps operating on these mains in the neighborhood. If the motors had only to be started once a day—that is, if they ran continuously during working hours—the disturbance to the lamps would not be so serious. Such motors, however, are usually applied either to elevators, or to machinery which has frequently to be started and stopped. Consequently, the lamps connected to mains in the neighborhood of a number of motors are apt to be kept see-sawing in candle-power, to the great discomfort of all who may be reading by them. The remedy for a distress of this character is found either in more copper in mains, more numerous feeding points, or less current in motors. Where a number of motors are actively taking current a good income from the sale of electricity is to be expected and a reasonable expenditure in the reinforcement of mains or feeders may be thereby partly guaranteed. On the other hand, however, a reasonable range of restriction should be laid upon the thirst of the motors for current, and motors which take an unduly large starting current should not be permitted to take power from the mains.

The new rules require that all alternating-current motors to be connected must have on their nameplate a statement of the power factor of the machine at full load. It is required that this power factor must reach a certain magnitude according to the power of the motor and the number of phases. Polyphase motors are required to have a full load power factor of 65 per cent in 1-hp size, increasing by steps up to 85 per cent in sizes of over 20 hp. Single-phase motors are allowed a somewhat smaller power factor, commencing with 65 per cent in 1-hp and ending with 82 per cent in sizes over 20 hp. The starting current requirements are similarly graded. In the case of direct-current motors the power taken from the mains at starting may not exceed 2 hp per horse-power of normal capacity in 1-hp size, nor 1 kw per horse-power of capacity in capacities of over 15 hp, unless the starting torque has to be in excess of the full-load torque, when extra allowance is made. Similarly graded requirements attach to the starting currents of alternating-current motors. The volt-amperes taken from the mains in starting must not, for example, exceed 1,500, in single-phase motors, per horse-power of normal capacity in sizes of 5 to 15 hp, unless a starting torque is required greater than the full-load torque. The testing of the starting current is to be made with such ammeters as permit of the pointer being supported in a position slightly below the maximum value attained by the starting current. Hot-wave ammeters are excluded. The power factor is to be determined by joint use of the voltmeter, ammeter and wattmeter at terminals, and at the normal full-load current of the motor. The test is to be made at normal main voltage; but a five per cent reduction in the same is to be permitted. There can be no doubt that where the selection of motors is left open and is subject to close and general competition, there is a considerable variation in electrical quality, and such rules are not only called for, but may exert a wholesome influence upon all sides of the business.

THE REACTANCE VOLTAGE OF DIRECT-CURRENT DYNAMOS.

When a simple single-phase alternator is connected to a circuit containing inductance its own inductance included, it is well known that the rapid reversals of current in the circuit develop a reactance voltage which must be supplied by the generator in order to establish the alternating current. When a direct-current generator is employed, the external current is steady, and devoid of reactance voltage, but unless the generator be homopolar it has an alternating current in all parts of its armature winding. This alternating current in an armature coil gives rise to a certain internal reactance voltage, which plays an important part in the phenomena of direct-current commutation. During recent years the analysis and comparison of direct-current generators has given rise to the establishment of reactance voltage as one of the criteria of sparkless commutation. It is found that the reactance voltage of a machine for a given output varies only slightly with the armature length. It is open to some discussion at the present time how great the reactance voltage of a machine may be, consistent with satisfactory commutation, but as a limit it seems to be 4 volts. It usually varies with the type of commutator brushes used, between 1.5 and 3.8 volts. The limiting value also varies somewhat if auxiliary or intermediate poles are used to assist commutation, or if the brushes are permitted to be shifted with the load. Nevertheless, if the limiting value of the reactance voltage can be set even roughly and a simple formula can be given for computing it, a distinct advance in the art of designing commutating machines is thereby established.

In a recent issue of the London *Electrician*, Mr. H. M. Hobart offers a simple rule for determining by inspection the reactance voltage of any ordinary direct-current machine. Find the continued product of the gross armature core length in centimeters, the number of armature face conductors, the speed in revolutions per minute and the load current strength per pole in amperes. This product divided by two hundred and fifty millions is the reactance voltage of the machine at that load. If, however, there be more than one turn of armature conductor per commutator segment, the result must be multiplied by the turns per segment. There is also a relatively small correction for the ratio of armature core length to polar pitch, which correction may generally be neglected. This simple formula requires no data to be secured for the machine under consideration other than those capable of being obtained by direct inspection with the aid of a measuring tape. It would be interesting to ascertain the reactance voltage by this rule at full load for as large a number of direct-current machines as possible.

TWO NEW PHOTOMETERS.

Of making photometers there is no end, and much color is a weariness to the flesh. With due apologies to Solomon, we direct the attention of our readers to a couple of photometric papers noted in the Digest with a recommendation to read the originals in full. As we have remarked times without number, no branch of industrial photometry is in so unsatisfactory a state as photometry. Without reliable standards as a basis, and handicapped by the yearly increasing color differences among our commercial illuminants, the art of photometry needs improvement sadly. It is not the instruments that are at fault so much as the methods, involving as they do the almost hopeless comparison between physical and physiological values. The latest form of Lummer-Brodhun screen, or the flicker instrument, allows of making the actual photometric settings with a precision that really leaves little to be desired, but the trouble comes in interpreting the quantity thus found, in translating photometric readings into illuminative values. When the sources are of differing colors this difficulty increases very seriously indeed, and hence arc photometry is especially troublesome. The Lummer-Brodhun screen, although beautifully sensitive, leaves a wide margin for individual differences of judgment in matters of color; and the flicker instrument, if it be true as has been stated, that it can be used by a color-blind observer and a normal observer with coherent results, leaves grave doubts as to the real value of the comparison between colored sources.

The first of the papers here referred to is directed not at color photometry, but at the evaluation of spherical candle-power, and gives a good description of the working of Prof. Ulbricht's spherical photometer, which is merely a large globe coated on the interior with a diffusing surface of white paint. The illumination at a peep-hole in such a globe, the direct rays being cut off, is strictly proportional to the spherical candle-power. Such a globe actually integrates the luminous effects very successfully, although the result has to be obtained by rather complicated instrumental means, including a Brodhun screen, rotating disc and prisms, and an osmium secondary standard. If frequently calibrated by reference to a known source, however, the apparatus affords a very ready means of evaluating the spherical distribution as far as it can be freed from the inevitable color difficulties. It can also be used for determining the mean hemispherical candle-power if anybody wants that value, which may generally be regarded as an apology for a bad spherical distribution. In some few cases it has value—these being with reference to illuminants which are structurally difficult to determine on the spherical basis. Even so, the lower hemispherical candle-power is derived in part from diffuse reflection and should be compared not with the similar distribution from another radiant, but from this as reinforced by a reflector. Apparently the sphere photometer is an accurate and useful instrument within its limitations, and on the whole easier to use than any other form of integrating apparatus. Its agreement with point-to-point readings is certainly very satisfactory indeed, and the measurements can be rapidly taken. We should think that in arc photometry it might be decidedly valuable.

The second paper considered is one by Dr. Torda on a portable selenium cell photometer designed especially for the rapid testing of incandescent lamps. The idea of a selenium photometer is an old one and has been many times tried in one form or another. Quite obviously it is unsuited for the comparison of lights of difficult color since the visible luminous effects are far from being proportional to the effects produced on the cell if the color varies. But for lights varying as little as do incandescent lamps it is no difficult matter to determine an arbitrary relation between light and effect on the cell that will permit easy and fairly accurate comparisons. Selenium cells have a rather bad reputation for inconstancy, so that this relation can hardly be assumed as a constant. By dint of much study, this evil feature has been reduced; but even now the cells would have to be recalibrated from time to time. The apparatus as worked out by Dr. Torda is compact and rather simple to operate, the reading being taken directly from a milliammeter to a relative precision of one or two percent under ordinary conditions. We think that the author rather overestimates, however, the difficulty of lamp comparisons by the ordinary methods. Certainly, the difference in efficiency between an ordinary secondary standard and the commercial lamps usually checked against it is insufficient to introduce any material color difficulty; and in using the same circuit method the effects of difference of efficiency are completely negligible, within the range of voltage variation which can readily be secured in practice. Nor does the selenium cell device have any advantage in speed. The time of a reading, including an automatically obtained period of rest for the cell, is given as 45 seconds. This assumes apparently an assistant to insert and replace the lamp, although at a pinch this could be done by the operator in the period of rest. It is quite certain that this speed could be equaled or beaten, with at least as great precision, on an ordinary photometer bar with a Lummer-Brodlun screen and conveniently arranged for changing the lamps.

Yet both the new photometers here described are useful additions to the resources of applied science within their limits, and we hope to see them find considerable practical application. The real difficulties of the present situation lie far back of the instruments. They begin in fact at the standard of light itself. In spite of all the research which has been spent on the subject, the practical standard used to-day for ultimate reference is the Hefner lamp. The emission spectrum of this radiant is decidedly different from that of commercial illuminants, and in fact it is so distinctly reddish as to involve very serious color-difficulties, rather aggravated by the low intensity of the lamp itself. In this country the English candle is generally the legal standard, so that the Hefner would be of very dubious standing in case of litigation. We have long had a certain regard for the larger pentane lamp as a standard. Used in connection with a Methuen screen it should give exceedingly good results, and both in color and magnitude would be a considerable improvement upon anything we now have. Even given a really first-class standard, the color difficulty is still with us in an aggravated form. It is a tough problem, but since the facts as to normal color vision are fairly well known, it should not be an impossible task to settle on standard conditions of measurement. After all, the radiation which is useful for normal vision under practical conditions of intensity is the only thing which counts. For purposes of illumination ultra-violet light and light of relatively very non-luminous colors have no value and should not be included in the salable candle-power. We hope that at the first opportunity there will be an effort made to get light and photometry upon a really international basis, and to secure uniformity of laws relating to the subject. Here is a good steady job for the Illuminating Engineering Society and allied bodies in this and other countries.

A. I. E. E. Election.

Much comment and no little indignation has been excited among the membership of the American Institute of Electrical Engineers by the issue of another election circular calling upon those who voted for Mr. E. W. Rice, Jr., for president to write to the secretary of the Institute for the return of their ballot, and asking that a ballot enclosed with the circular and headed by the name of Professor Sheldon be substituted for the one returned. The circular is undated and no place of issue is given. It appears to have been mailed to a selected list of names, and its issue did not become generally known until some days after it had been sent out, thus, as in the case of the Philadelphia bogus nomination circular, precluding action to counteract its effect prior to the closing of the balloting for officers. Another extraordinary characteristic of the circular is that signatures were attached to it without the consent or knowledge of those whose names were thus made use of.

We have received the following communication from Mr. L. B. Stillwell, who informs us that he did not see the above-mentioned circular, to which his name is appended.

About two weeks ago I consented to the use of my name as a signer of a printed circular advocating the election of Dr. Sheldon to the presidency of the Institute. At that time I stated to the gentlemen who prepared the circular that, in my judgment, it was so worded as to emphasize overmuch the idea of service in Institute work as a necessary preparation for the office of president, and in view of the fact that several gentlemen, whose names appeared with mine as signers of that document, have since published letters in which this view is still further emphasized and elaborated, I deem it proper to say that, in my opinion, in the selection of candidates for the presidency professional eminence should come first and service to the Institute should be a secondary consideration. In expressing this opinion I do not mean to imply that service to the Institute is unimportant. My feeling, however, is that service in enlarging the science of electricity and in advancing the art of its application, whether such service be rendered inside or outside the Institute, is properly the primary and controlling consideration, provided, of course, that the man who has rendered such service is qualified, by ability and willingness, to make an efficient president.

When it happens, as in the present case, that each of two candidates is well qualified by professional standing, their comparative ability to advance the interests of the Institute as an organization should be taken into account; but I do not find myself at all in accord with the idea apparently entertained by certain members that the office of president should be reserved exclusively for those who have risen from the ranks by attending to committee work.

I am supporting Dr. Sheldon in the pending election and hope to see him elected, but I am not doing this primarily because of his long and useful service as a vice-president and manager of the Institute and chairman of the Committee on Papers.

The following communication has also been received from Mr. Herbert A. Wagner:

It seems necessary for me to ask again for a little space in your columns to express my disapproval of the methods being used in the present campaign for the presidency of the A. I. E. E.

Yesterday I was surprised to hear that a second circular letter had been sent out to a limited number of Institute members enclosing a secret ballot bearing the name of Dr. Sheldon and suggesting that members who had cast their votes for Mr. Rice could change their votes by using the enclosed ballot and signing certain papers and documents also enclosed. I have not seen one of these circulars, but am informed that my name appears among the subscribers thereto.

This use of my name is entirely without my sanction and a total surprise to me. I did assent to the use of my name in connection with a certain circular letter sent out early last month asking members to work for Dr. Sheldon's election, as stated in my letter appearing in your last issue. This consent, however, was specific and did not permit the use of my name as an endorser of any other communication.

As to the suggestions said to be made in the recent circular, I am most strongly opposed to them and consider it a decidedly improper and undignified proceeding to try to withdraw and change a vote once cast, or to endeavor to induce others to do so. It detracts greatly from the dignity and honor of an office which ought to be thrust upon one, as it were, almost without the seeking, to have it made the object of a heated and acrimonious contest resembling an ordinary political campaign.

The welfare, dignity and influence of the Institute are being sacrificed by these campaigning methods instead of being protected against outside influences as alleged.

Local Sections of the Illuminating Engineering Society.

A New England Section of the Illuminating Engineering Society has been organized with the following officers: Chairman, Mr. John Campbell; secretary, Mr. J. H. Stickney; managers, Mr. E. N. Writington, Mr. C. L. Edgar, Dr. Louis Bell and Mr. A. T. Sampson. Local sections will also be organized in Chicago and Philadelphia. Two meetings of the New England Section have been held, one in March, at which the papers presented earlier in that month in New York were read and discussed; and another on April 24, when the papers presented April 12 in New York on interior illumination were considered. At this later meeting the reading of the New York papers was prefaced by a paper by Mr. N. W. Gifford entitled "Some Suggestions from the Gas Side," and a talk by Dr. Louis Bell on "Illumination," in which he outlined the problems which concern illuminating engineers, and particularly the Illuminating Engineering Society.

Corner Stone Laid of United Engineering Building.

Last December Mrs. Andrew Carnegie laid the cornerstone of the new Engineers' Club on West Fortieth Street. On May 8 she performed the same ceremony for the new United Engineering Building on West Thirty-ninth Street. The two great structures stand back to back "four square," between Fifth and Sixth Avenues, and are already very far advanced toward completion. The exercises in both instances were quite informal, as no extensive celebration will be attempted until both buildings are actually finished and available for occupancy.

Last Tuesday at 5 p.m. a small party assembled at the foot of the beetling wall of the new home of the national engineering bodies, to witness the modest function. Mr. E. E. Olcott, president of the United Engineering Society, made a few brief, pithy remarks, and then asked Mrs. Carnegie to address herself to the task. She first placed in the box to go into the stone a number of new coins, a Bible, copies of the daily papers, copies of the latest year books and transactions of the three "founder" societies, and a gold plate whereon was inscribed Mr. Carnegie's terse letter giving $1,500,000 for the enterprise. The box being sealed and deposited, Mrs. Carnegie was handed a beautifully inscribed ivory mallet and silver trowel, and the big stone being slid into place she dabbed the mortar, tapped it and declared it well and truly laid, amid cheers. Little Miss C. Olcott then presented her with flowers, while Mr. Carnegie, in response to enthusiastic calls, climbed on a kitchen chair and got off a witty speech in his best vein. He declared his happiness in making a gift to the professions, of such a building, where all would be at home, for Americans were the "best mixers on earth," and the need of engineers was great. He quoted Kipling's "McAndrews' Hymn" with due emphasis on the line, "O, Lord, ye ken ye need an engineer." He concluded with the remark that he looked forward eagerly to being present at the early opening of both the Building and the Club House.

The space being so limited only those directly concerned in the work were present, including the architects, Messrs. Hale and Morse, C. H. Haswell, John Fritz and Messrs. C. Wallace Hunt, F. R. Hutton, S. S. Wheeler, R. W. Pope, G. H. Guy, R. A. Franks, J. M. Dodge, T. C. Martin, R. W. Raymond, C. W. Rice, W. H. Fletcher, C. Kirchhoff. A telegram of regret at absence was received from Mr. C. F. Scott, who for two years past has presided over the unintermitted labors of the Conference Committee, responsible for the execution of the great undertaking, which in the two buildings will involve a total expenditure of about $2,750,000.

Convention of the Southwestern Electrical and Gas Association.

Final arrangements have been completed for the annual convention of the Southwestern Electrical and Gas Association, which is to be held at Galveston, May 16, 17, 18. A very interesting and attractive program has been prepared by the committee, and the papers to be presented are unusually instructive.

Mr Stichter, editor of the "Question Box," reports that although this is the first year of the inauguration of this feature, widespread interest has been shown by the members of the Association and outside electrical, gas and telephone companies, and that he has received numerous questions concerning each branch of the Association, the answers and discussion of which at the convention should prove both valuable and interesting.

A pleasing entertainment has also been provided for each day of the convention, including a tour of inspection of the grade raising work of the city, the sea wall, and the dredging apparatus used in connection therewith, the latter through the courtesy of the engineers in charge of the work having been retained so that its operation might be seen by those at the convention.

On the night of the 17th, the Sons of Jove will hold a grand rejuvenation and initiate their new members into the mystic orders of their association, and will have their parade, which is to be more spectacular than on any previous occasion.

The Galveston Business League's rooms in the Tremount Hotel have been selected as headquarters of the convention, and many applications for reservation of rooms have already been received. Special prices have been obtained and those expecting to attend it are requested to make application for accommodations, stating number of rooms, whether with or without bath. These should be addressed to Mr. H. S. Cooper, chairman of the Entertainment Committee, care of the Galveston Electric Company, so that all may be provided for and avoid confusion and misunderstandings upon arrival. Arrangements are being made by the committee for special rates on all railroads.

Fuel Testing at the University of Illinois.

The personnel of the committee having the direction of the important fuel testing work to be conducted at the University of Illinois is composed of representatives from various State engineering and commercial organizations as follows:

Mr. H. Foster Bain, director State Geological Survey, representing the State Geological Survey. Mr. A. Bement, consulting mining and mechanical engineer, representing the Western Society of Engineers. Mr. Edwin H. Cheney, president Fuel Engineering Company, representing the Building Managers' Association of Chicago. F. H. Clark, general superintendent of motive power, Chicago, Burlington & Quincy Railroad, representing the Western Railway Club. Mr. Adolph Mueller, president H. Mueller Manufacturing Company, representing the Illinois Manufacturers' Association. Mr. Carl Scholz, president Coal Valley Mining Company, representing the Illinois Coal Operators' Association. Mr. A. B. Schroeder, general manager of Springfield Gas & Electric Company, representing the State Electric Light Association. Mr. William L. Abbott, chief operating engineer of Chicago Edison Company, representing the Board of Trustees, University of Illinois. Prof. L. P. Breckenridge, professor of mechanical engineering, University of Illinois, representing the Engineering Experiment Station, University of Illinois.

Central Station Earnings at Red Oak, Iowa.

Mr. D. F. McGee, manager of the Red Oak (Iowa) Electric Company, has brought about a remarkable development of the central station business in that little city which is of about 5,000 inhabitants. The gross earnings of the plant including electric central station service and hot water heating are $7.35 per capita of population per annum. Of this about $6 per capita is from electric service. The company is running practically all of the machinery in town. It has a contract for city water pumping, and has entirely driven out the small steam and gasoline engine plant. So much all day power business has been secured that the average load for the day is 90 per cent of the maximum peak load. This is accomplished by securing power contracts which are not on during the peak period. The company has 600 residence customers connected, which also is a remarkable showing for a town of 5,000 inhabitants. An average of about 6 new residence customers are connected per month. Mr. McGee, as manager, does all his own soliciting. A large power business is secured by making low rates for non-peak users. Since a hot water heating system is operated it is important to have a good day load, and this the company has. In soliciting residence business Mr. McGee's general policy has been to make it a point to secure as customers certain residence owners in every neighborhood which are likely to set the pace for others and whose example is likely to be followed. The plant affords an excellent example of what can be done in the development of the central station business in a small town by properly directed effort, and a sound business policy. The property is paying a fair profit on the investment and is laying aside regularly a certain amount for depreciation and retirement of its bond issue. This sinking fund is placed in the bank and can be used by order of the directors to purchase securities of the company issued to pay for profitable extensions or enlargements of plant.

Damage to Electrical Interests in San Francisco.

By C. W. Whitney.

It is very hard, indeed, to form even an approximate estimate of the damage to electrical and allied properties in San Francisco. At this writing, 13 days after the earthquake and eight days after the fire burned itself out, no one can get a fair idea of the extent of the devastation. It is true that business firms are making every effort to resume, but it will be not only weeks and months, but years before conditions can be brought to a normal state. The spirit of the citizens and business firms, backed up encouragingly by the daily press, is a splendid evidence of an unfailing faith in San Francisco, and is, of course, necessary in the trying times that are now being experienced, but these enthusiastic hopes cannot conceal from those on the ground the actual conditions of affairs.

ELECTRIC LIGHTING PROPERTIES.

To speak of the damage to electric light and power interests, means to refer almost exclusively to the properties of the Pacific Gas and Electric Company, the large holding company, capitalized for $30,000,000, which was organized early in the year to take over the California Gas & Electric Corporation and the San Francisco Gas & Electric Company. This company had its offices on the eighth, ninth and tenth floors of the new Shreve Building, at the corner of Grant and Post Streets. These offices were entirely burned out, although the building, being a Class A structure, still stands. Only those few records which were hastily removed and those which were placed in the vaults were saved. Temporary offices have been located in two or three points in Oakland and the engineering staff under Superintendent F. G. Baum, is temporarily occupying the old power station in Oakland at Grove and First Streets on the water front.

The greatest damage to the Pacific Gas & Electric Company's plants was in San Francisco, the hydro-electric stations of the California Gas & Electric Corporation not being damaged in the least—in fact the earthquake was not felt in most sections in the mountains.

In San Francisco, the San Francisco Gas & Electric Company lost eight sub-stations and two power stations, including the station near the center of the city which was nearly destroyed but a few weeks before by fire. The old Independent gas and electric plants in the Potrero district, were not seriously injured and the electric station is now ready for operation. As soon as the necessary permit is issued jointly by the lighting committee, of which Rudolph Spreckels is chairman, and Chief Hewitt of the Department of Electricity, the Independent plant will furnish current for street arc lights along three different routes, covering the principal section of the unburned district. Light and power will also be supplied to various industrial concerns that have already been granted permits to resume operation when power is available.

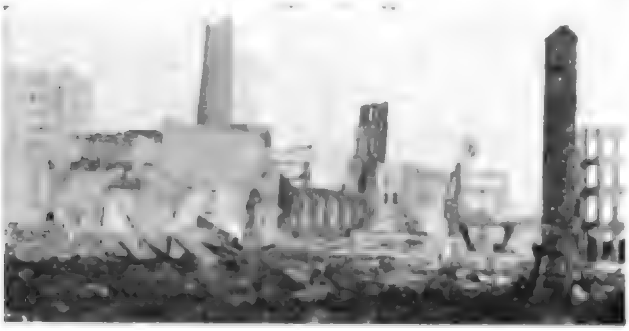

FIG. 1.—RUINS OF JESSIE STREET STATION.

The only other electric generating station not crippled by the earthquake and fire is that of the Mutual Electric Light & Power Company on Shea Street, near the water front. The Mutual Company is in a position to resume operations on a large scale, the only damage it suffered being confined to one of its water mains, which has already been repaired. Over 30 permits have thus far been granted to industrial concerns in the burned district in the vicinity of the Mutual plant. Just when the power will be turned on cannot be learned at present. A careful inspection of the wires throughout the usual power circuits must first be made, as in many sections the wires are lying on the ground and in other places are hanging within reach of pedestrians and workmen, so that great precaution must be taken before any power can be turned on.

When one realizes that for 12 days not an electric or gas light has burned in San Francisco, one can appreciate the unfortunate position in which the citizens and business houses are placed. Candles and oil lamps reign supreme and even they must be extinguished by 10 p. m. by order of the military officials in control. Of course, with no water supply, or at least a very inadequate one in a limited section of the city, no chances can be taken that might permit another conflagration.

The gas works and systems of the San Francisco Gas & Electric Company suffered an enormous loss. While the Potrero plant is practically ready for business, the mains over the entire city are in a questionable condition. The North Beach gas plant was not touched by the fire, but was badly wrecked by the earthquake. The large gas holder, however, escaped serious injury and can be used.

The prospect of securing gas for lighting and heating purposes seem to be quite remote as compared with the prospect for resumption of electric lighting. The underground conduits of the San Francisco Gas and Electric Company are believed to be in fairly good shape, but the gas mains, like the water pipes, were greatly damaged by the earthquake. That innumerable leaks occurred in the gas mains as a result of the earthquake was pretty well demonstrated on the first day of the disaster, as well as on the succeeding day, when countless explosions, due to the accumulation of escaping gas, occurred beneath the street pavements. It will take some time to repair all the breaks in the gas mains, while on the other hand, temporary wires for carrying electric power can be strung on poles, and are now being so strung quite generally throughout the city.

As already mentioned, at this writing, it is extremely hard to estimate the amount of damage to the electric light and power systems in San Francisco. Mr. F. V. T. Lee, assistant to the president of the Pacific Gas & Electric Company, places the figure conservatively at $1,000,000, but other estimates run as high as $3,000,000, to say nothing of the loss of revenue from the light and power consumers.

The new Marti station in the Visatacion Valley, south of San Francisco, was also quite badly shaken up by the earthquake. The frame of one of the 5,400-hp gas engines being installed there was cracked, the walls and roof trusses were twisted somewhat, the small exciter battery was completely wrecked and some of the other machinery was damaged. The generators seemed to have received no damage whatever. It is probable that the total loss on the station will not greatly exceed $25,000, although this estimate is only very approximate.

THE TELEPHONE SITUATION.

Although the loss to the telephone system is great enough it is not as large as the public was led to suppose at first. General Manager Glass announced that the losses, as far as they can estimate them are approximately $1,800,000, against which an insurance of $1,060,000 was carried.

The entire underground system is practically intact, which fact will simplify, in a great measure the restoration of the telephone service throughout the city. The lateral cables, where they entered the block, were burned off, and forces of men are now at work cutting off these laterals in the manholes and soldering them up to keep out moisture. In regard to the condition of the Sunset Telephone and Telegraph Company, General Manager Glass says: "We have lost, so far as we can estimate, about 33,000 subscribers out of 52,000. We lost six operating buildings, in addition to our main executive building on New Montgomery Street.

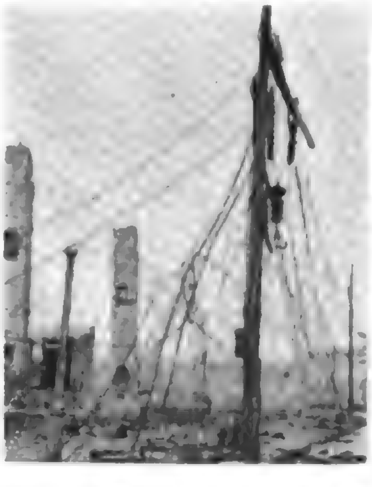

FIG. 2.—FALLEN TELEPHONE AND ELECTRIC LIGHT WIRES.

"All our outside systems, including our long distance lines, were unaffected by the earthquake, and since we restored connections through the burned district we have handled more long distance telephone business than ever. We have been doing a tremendous business. The fire seems to have created a boom in telephoning."

TELEGRAPH SERVICE.

For the first time in its history San Francisco was absolutely without telegraphic communication with the outside world for three hours on the morning of April 18. Following the earthquake, which occurred at 5:14 a. m., and for three hours thereafter, not a single wire of the score or more usually in operation was in service. The central office buildings of the Western Union and Postal Telegraph Companies were both partially wrecked by the earthquake, and later in the day were laid in ruins by the terrific fire. You have already given many details of the events that followed.

To illustrate the heroic efforts made by the companies to restore service and communication with the outside lines, the following graphic description from the San Francisco *Chronicle* is given of one incident: "Quick to realize the havoc which could be wrought by so mighty a trembler as that which preceded the big fire, Harry Jeffs, wire chief of the Western Union Telegraph Company, who lives in Oakland, lost no time in reaching the Southern Pacific mole for the purpose of testing the scores of wires which emerge from the water at that point. It took the expert but a few moments to ascertain that communication in San Francisco beyond the Ferry building was entirely cut off Not an instrument responded to his efforts. Turning his attention to the wires extending from the end of the pier to the various stations leading out of the State, Jeffs found that they had been hopelessly 'killed' by the great shake.

"The seriousness of the situation called for quick action, for aside from the great monetary loss to the company resulting from even a short interruption of the service, was the seriousness of being entirely cut off from the outside world. Securing an engine, the wire chief started out from the mole, and climbing poles at intervals along the way, tested the wires to locate the break. In this way he covered the entire pier until he reached the shore at West Oakland. Here, at a pole almost at Land's End, after calling on each dead wire separately, he at last received a response from Sacramento. and knew that he had at last found the point of severed communication.

"Perched upon a thirty-foot pole, Jeffs gave the capital the first story of the disaster sent out by wire at 8:30 o'clock in the morning. In quick succession, by means of relays, Los Angeles, Salt Lake, Denver and other places heard of the calamity that had befallen the metropolis of the Pacific Coast. For eighteen hours Jeffs stuck to his lofty perch."

Massachusetts Central Station.

The report of the Board of Gas and Electric Light Commissioners of Massachusetts, which has just been issued, shows that on June 30, 1905, 68 companies in that State were engaged in the supply of only electricity and 26 in the supply of both gas and electricity. In addition 19 towns and three cities have municipal plants.

Of the municipal plants, the largest is that of Holyoke, the investment being $1,840,040; next in size are the municipal plants of Taunton, Wakefield, Westfield, Howell, Chicopee, Braintree, Marblehead, Middleborough, Peabody and Concord, the investment in each case exceeding $100,000. In 1905 the Legislature passed an act requiring that municipalities should not fix the price of electric light at a rate less than cost, plus 5 per cent per annum for depreciation. The Board reports that while charges for depreciation at this rate have been reported, no actual provision to meet depreciation has been made, the moneys not being required to be set apart and invested to accumulate, but may be used for actual renewals and reconstruction or invested in new and additional plants. The Board asks that the act be so amended as to give it authority to direct what disposition shall be made of the fund.

While official inquiries relative to the establishment of municipal plants have been received from all the cities and substantially all the towns in the State in which the population exceeds 1,500, no municipal plants were established during the year.

The income of all the municipal plants of the State during 1905 was $287,189, an increase of $51,000 over the previous year; the expenses were $352,019, an increase of $31,000 over the previous year. Adding interest on boards, depreciation charges and minor items, the total expenditures for town and city lighting were $222,382. The balance sheets of the municipal plants show a total of assets of $3,488,373.

The total income of the private electric light stations during 1905 was $8,108,265 and the expenses $4,777,248. The apparent profits of the electric light companies were $2,696,327; against this sum are charges for interest, dividends, depreciation and sundry items amounting to $3,012,547, leaving an apparent deficit for the year of $93,207. These statistics apply to 83 companies, of which four did not earn expenses and 30 did not earn sufficient to warrant the declaration of any dividend. The assets of 62 companies supplying electric light only are $33,520,122. Of these companies 50 show an aggregate surplus of $1,262,710, and 12 an aggregate deficit of $274,347, leaving a net surplus of $987,362, which, added to $918,408 of reserved and depreciation funds, gives a total reserve of $1,905,770, or an equivalent of 10.4 per cent on the aggregate capital. The private plants during the year paid taxes to the amount of $598,035. This may be compared with total station wages of $585,504, and the total cost of fuel of $991,698.

The total electric lighting capacity of all the companies in 1905 was as follows: 1,555,496 16-cp lamps, an increase of 254,000 over the previous year; 10,058 2,000-cp arc lamps, which is exactly the same figure as for the previous year; 10,068 1,200-cp arc lamps, a decrease of 180 over the previous year.

The above figures do not include small numbers of 10, 20 and 32-cp lamps, and 140 800-cp arcs. There has been a steady decrease in 2,000-cp arcs, which in 1902 numbered 1,279; and in 1,200-cp arcs, which in 1902 numbered 13,238.

Annual Report of the General Electric Company

The fourteenth annual report of the General Electric Company to the stockholders has just been issued, and is a most striking evidence of the great prosperity enjoyed by the corporation and by the electrical industry in 1905. The company received orders for apparatus worth $50,044,272; billed out, $43,146,902, and collected, $44,419,613—all these figures far exceeding in its previous history—an average rate of increase of 13 per cent. being shown for the last ten years. President C. A. Coffin in his report said: "The profits of your company for the past year (including $173,389.52 from securities sold, and $798,539.27 from royalties, dividends, sundry profits, etc.) after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and $1,838,362.46 from factory plants and machinery, were $7,319,160.61.

"The sales billed by your company to its customers for the past year were about $4,000,000 more than for the previous year, showing an increase in business done of about 10 per cent.

"It will be observed that the amount written off factory plants and equipment is substantially 78 per cent. of the cash expended thereon during the year."

Vice-President Eugene Griffin in his report recapitulated some of these data. He stated that during the year the company had received orders for 300,000 hp of heavy traction motors and 750,000 hp of all classes of railway motors. The number of cars equipped with Sprague-G. E. multiple unit control was 4,026. The operation of the New York Central direct-current electric locomotive was reported by the railroad to involve a total maintenance cost one-fourth that of a steam locomotive. At the end of January it had made 29,568 miles in 172 days of actual running time. The average daily run was 171; the maximum for one day was 347 miles in 8¾ hours. Meantime numerous orders had been received for single-phase apparatus for railways. In the Curtis steam turbine department, up to February 1, 1906, orders had been received for 535 turbines and 346 had been shipped. From 11 foreign countries orders had come for 44 turbines.

General Griffin reported that 208,229 separate supply orders, not including contracts, had been received, an average of 694 per working day, or 124 more per day than in the previous year. He added: "The outlook for the coming year is promising. The orders for February and March exceed the orders for the same months of 1905. There is every indication that our business for this year will tax our maximum factory capacity to the utmost. Our unfilled orders to-day are considerably in excess of such orders at any other date in the history of the company."

Third Vice-President E. W. Rice, Jr., makes a full report on the operations of the company from the factory and technical end, and gave numerous details as to extensions to the different works. "Expenditures aggregating $2,338,362 have been made during the year for real estate, erection of new factories, extensions to existing buildings, additional machinery, patterns, special tools, furniture, etc. The following table shows approximately the floor space and the number of employees during the last five years:

	Floor space.	Employees.
1902	2,500,000	15,000
1903	3,000,000	18,000
1904	3,700,000	17,000
1905	4,100,000	18,000
1906	4,350,000	22,500

"The land area of all three plants is now about 439 acres. The total book value of the Schenectady, Lynn and Harrison factory plants, including both land and buildings, is $4,843,812.88 or about $1.10 per square foot of manufacturing floor space."

Mr. Rice makes note of the important long-distance power transmission plants of the company, and says as to newer apparatus: "The size of the transformers used in lowering and raising the voltage in alternating current work has steadily increased until we are now regularly manufacturing units of 10,000 hp capacity. Our line of steam turbine generators has been extended and improved. We have designed and sold a number of turbines of 12,000 hp rating, each capable of delivering a maximum output of some 18,000 hp. We have delivered to the New York Central Railroad four of the eight 7,000 hp turbo-generators ordered last year.

"The first of the New York Central locomotives has been subjected to a mileage test under the control of the New York Central; on April 2, the total run to that date was 40,324 miles. The performance has been extremely satisfactory.

"One of the notable contracts taken during the past year is for the electrification of the West Jersey and Seashore Railway, between Camden and Atlantic City, N. J., a distance of 64 miles. This is the first instance of the electrical equipment of an important steam railroad from terminus to terminus. The contract covers the complete installation including buildings for power house and sub-stations, motors, car equipment, and everything pertaining to an electric railway system."

Treasurer H. W. Darling, in his report, says: "During the year there was expended in acquiring sundry patents, for the use of patents, and in patent litigation, $431,247.13, which has been treated as ordinary expenses of the year.

"In addition, the amount of $1,000,000 has been charged to profit and loss, leaving the company's patents, franchises and good will standing at $1,000,000.

"The company has no note payable. During the past year the company has not borrowed money or incurred obligations; nor has its credit been used either by issuing notes, indorsing customers' paper for discount or lending its name in any way."

During thirteen years there has been written off $15,370,901 for factory depreciation, leaving the book value of the three huge plants only $8,000,000. The company owns $10,104,450 in stocks and bonds of other companies, not inclusive of 89 blocks of securities carried at $1 per lot. The company has 17,000 customers on its books, and had $16,287,018 in notes and accounts receivable. Its accounts payable were $2,106,683.

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American Society of Model Engineers.

This society held its second meeting at the Berkeley Lyceum, 19 West Forty-fourth Street, New York, May 2. There was a good attendance and several new members were enrolled. Mr. Barclay gave a half hour's talk on "Shop Work with Lathe and Shop Tools." This was followed by a discussion on various subjects, including the slide valve. Mr. Stoye gave a concise explanation of the locomotive slide valve and the link motion. Members present were requested to bring samples of their work for exhibition at the next meeting. Mr. W. E. Spon, 123 Liberty Street, New York, is secretary of the Society.

CURRENT NEWS AND NOTES.

A. I. E. E. ANNUAL ELECTION.—The annual meeting of the American Institute of Electrical Engineers will be held in the library of the New York Edison Company, 44 West Twenty-seventh Street, New York, on Tuesday, May 15, at 8.15 p.m. No papers will be read or discussed at this meeting. The secretary will present the annual report of the Board of Directors, and the Committee of Tellers will announce the result of the election of officers of the Institute.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—Convention Circular No. 2 of the National Electric Light Association relates to traveling and hotel arrangements for the Atlantic City convention. Special arrangements have been made with about 50 hotels, a list of which is given in the circular, together with their rates. Arrangements may be made directly with the hotels or through the chairman of the convention committee, Mr. Arthur Williams, 55 Duane Street, New York. Mr. George F. Porter, master of transportation, has made favorable arrangements regarding railroad rates from all parts of the country.

THE METRIC SYSTEM.—The American Chamber of Commerce of Paris at a recent meeting adopted resolutions commending the campaign of the *New York Herald* in favor of the adoption of the metric system by the departments of the government of the United States. At the same meeting Mr. James Gordon Bennett was unanimously elected an honorary member. The resolution states that the disadvantages arising from the confusion of American weights and measures are known to all students of the question, and especially to those engaged in international trade; and that while the importance of profitable foreign trade in national development is questioned by none, it should be recognized that weights and measures remain a factor in the strenuous competition prevailing for the rapidly increasing world commerce.

SUBSTITUTE FOR PLATINUM IN ELECTRIC LAMPS.—In a patent granted May 1 to Mr. H. F. Wood, a description is given of a method of constructing incandescent electric lamps by which, instead of securing the vacuum-tight joint by platinum, use is made of a band of copper shrunk tightly about a portion of the glass envelope to form therewith a vacuum tight joint. Each conductor which supports the usual filament passes radially outward to a copper ring which is shrunk about a tubular portion of the bulb. The rings are such diameter that they may be easily passed over the tubular portion. After the rings are in position, the parts are heated until the glass becomes soft. Air pressure is then exerted to force the glass into intimate contact with the rings. When cool, the rings, having a higher coefficient of expansion than the glass, necessarily contract faster, and thus shrink tightly about the glass, and form an air-tight joint. The rings are made exceedingly thin—about one one-hundredth of an inch—in order that the glass may not be cracked or sheared by the force of contraction of the ring.

"THE GREAT WHITE WAY" is the popular name for that section of upper Broadway, New York, which is the heart of the shopping, restaurant and theatre district, extending from Twenty-third to Forty-second Street. According to the *New York Herald*, whose building is midway on the line of route, there are along the street, in that distance 118 arc lights and 36,872 incandescents. It is the most brilliant and concentrated illumination in the world. "These are on the walls and over the doors of sixteen theatres, telling of the play that is expected to allure the lover of the drama; they appear where the clicking balls of the billiard table and the rumbling spheres of the bowling alley make their appeal; they are displayed where the soothing tobacco weed is for sale, where the appetite for food and drink can be satisfied, and where nearly every need of the inner and outer man can be supplied. All of this expenditure of light means a heavy cost that now amounts to about $875,000 annually when all the lights of the great district are considered."

TELEPHONE RATES.—The International Telegraph Bureau of Berne, Switzerland, has issued the second edition of its compilation of telephone rates. This consists of a volume of 498 pages containing the telephone charges of all the principal countries of the world, in which the telephones are operated by the government.

CANADIAN WATER POWERS.—The Ontario government has notified parties who may be interested in water to be utilized for power purposes, not to make any further arrangements, as it is its intention to take over all the electric power developed in the province and arrange with the municipalities for the sale of the electricity at cost.

AMERICAN PHYSICAL SOCIETY.—The next meeting of the American Physical Society will be held in Ithaca, N. Y., in conjunction with the meeting there of the American Association for the Advancement of Science, beginning on June 29. At this time also the new physical laboratory of Cornell University, which has just been completed, will be formally dedicated.

TELEPHONY IN NEW YORK.—The telephone system of New York has continued to grow rapidly in the last four months. Since January 14,807 new telephones have been installed, making the total number in service and under contract 256,962. This is two and a half times as many telephones as London has, more than five times the number of telephones in Paris, and nearly four times as many telephones as Berlin has.

MARDI GRAS ILLUMINATION.—In honor of the annual Mardi Gras celebration at New Orleans, the New Orleans Railway & Light Company has published a handsome booklet containing views of some of the finest electrical lighting decorations used during the festival and operated by power furnished by the company. It is a good indication of what can be done in the way of utilizing electrical facilities on such special occasions.

CALCIC HYDRATE FOR BALLOONS.—M. Moissan has presented to the French Academy of Sciences a note by M. Jaubert proposing the use of calcic hydride (hydrolithe) for the inflation of balloons. By the simple action of water pure hydrogen is released in enormous quantities in the same manner that acetylene is released from calcic carbide. One kilogramme of this material will give 1,000 litres of gas at atmospheric pressure. It is stated that hydrolithe is now made on a large scale in French electrochemical works.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION.—The annual convention of the Texas Independent Telephone Association was held at Waco on April 26 and 27. Representatives of about 30 of the independent telephone companies of the State were present. A feature of the meeting was the organization of a telephone clearing house association, of which Mr. J. B. Earle, of Waco, was elected auditor. The following officers for the ensuing year were elected: President, Mr. J. C. Casler, of Fort Worth; vice-presidents, Mr. C. W. Roberts, of Aberline, Mr. C. A. Wilson, of Granger, and Mr. Thomas O'Rourke, of Shreveport; secretary and treasurer, Mr. C. A. Shock, of Sherman.

WIRELESS AND TELEPHONY.—According to the Wyoming *Tribune* of Cheyenne, Wyo., the city lines and long distance toll lines out of Cheyenne of the Rocky Mountain Bell Telephone Company were rendered inoperative during business hours for several days owing to wireless telegraph interference from Denver, Col. Although Cheyenne is 100 miles distant from Denver, the wireless messages were transferred to all the telephone wires in Cheyenne and the toll lines running out of the city. The dots and dashes of the Morse code could be easily read and sounded in the telephone receiver like the buzzing of bees, the noise being so loud that it was impossible to talk over the lines. The station at Denver is stated to employ 50 kw in wireless transmission.

RADIOACTIVE STANDARD.—At the April meeting of the British Roentgen Society, the need of a radioactive standard was discussed, and the council of the society instructed to appoint a committee to study the question. One of the standards mentioned at the meeting, that of Mr. Phillips, who proposes to define the c.g.s. unit of radioactivity as that radiation which in dry air at standard pressure will, in unit time, diselectrify a metallic sphere of unit radius charged to unit potential, the sphere being placed at unit distance from the source of radiation. It was further suggested that the practical unit should be a specimen of radium whose radioactivity should be some multiple of the absolute unit, and that this practical unit should be deposited in the National Physical Laboratory. It was brought out that a solution of iodoform and chloroform has been used for the measurement of radiation. Another method consists in the use of a gold leaf electroscope of defined capacity entirely insulated from all external sources. The rays are measured by the leak which the irradiated air causes in the gap between the supporting rod of the electroscope and an earthed plate. The number of free ions in this air gap which carry the electricity across depends only upon the activity of the ionizing rays which penetrate into the chamber containing the air gap.

ELECTRICITY IN PRINTING.—Mr. John Norris, business manager of the New York *Times*, gave out recently some data as to the economy of the central station service from the New York Edison mains. He says: "The consumption of electricity in The Times Building is less than 40 per cent of that estimated by the engineers in planning for our new building. By adopting central station service and avoiding the use of the isolated plant, we saved $80,000 on cost of installation. The cost of operation for 1905 was $10,000 less than the engineers' estimate of what outside service and heating would cost. We saved $14,000 as compared with the engineers' estimate of what the operation of an isolated plant would cost. We saved at least 800 ft. of space in the basement. We saved the operating expense of keeping the basement cool in summer. We saved the use of coal, or steam, for six months of the year. We avoided the nuisance of taking in coal and taking out ashes, and we saved the cost of breakdown connections." The consumption of energy for newspaper uses by the journal appears to run about 200,000 kw-hours per year. He gives the cost of energy as 2 cents per 1,000 sheets of 8 pages. The lighting is done by 2,056 incandescent lamps of 16-cp equivalent, and includes Nernsts and 44 Cooper Hewitt mercury vapor tubes. One of the electric elevators has the highest rise in the world—326 ft.—and has traveled 42 miles a day.

COLLEGE SUMMER SCHOOLS.—Mr. A. G. Mayer, in a letter to *Science*, protests against the establishment of summer schools by colleges. Among the objections urged are that formerly the college teacher looked upon his summer vacation as a season for research and broadening study, and that now fully one-half of this once cherished period must be sacrificed to the labor of dissemination of superficial and elementary instruction in summer schools. The development of the summer school in connection with the college is, he said, surely cutting down the precious hours when the teacher himself becomes a student. Correlated with the growth of the summer school system is the tendency of the college to maintain low salaries for instructors, relying upon the fact that by teaching in the summer school the young instructor may earn sufficient for his maintenance. Mr. Mayer states that in his official connection with the Marine Laboratory of the Carnegie Institute, whose purpose it is to afford unrivalled facilities for research to those best fitted to avail themselves of the opportunity, he finds that fully one-half of the ablest investigators feel obliged to decline invitations to pursue research work free of all expense, for the reason that in order to provide adequate support for a wife and family they must teach in the summer schools. Mr. Mayer concludes that not the least of the evil is the fact that our colleges are putting into the high place the ideal of mere money getting.

A WIRELESS CONGRESS.—It is announced in a special dispatch from Berlin that Germany has issued invitations to 29 States to take part in an international wireless telegraph conference at Berlin June 28. Among those invited in the Western Hemisphere besides the United States are Argentina, Brazil, Chile, Mexico, Peru and Uruguay, and among the European States are included Monaco and Montenegro. Japan, Siam and Persia have been invited, but China has not been asked to send representatives.

THE MEN OF '88.—A reunion of the foremen, assistants and electricians of the Thomson-Houston Electric Company of 1888 was held at the Revere House, Boston, on April 28. Eighty-three persons were formerly eligible, but 11 have died, leaving 72. Of these 29 are still at the Lynn factory, 11 at Schenectady, one at Harrison, N. J.; one at the Canadian General Electric Company and 30 have left the company. Forty-two were present at the exercises. The committee of arrangements were George H. Alton, Ambrose H. Sarsley and A. L. Rohrer. W. C. Fish was the special guest of the occasion. During the afternoon there was an automobile trip through Lynn, Nahant and Swampscott and lunch was had at the house of Prof. Elihu Thomson. At the banquet at the Revere House A. L. Rohrer officiated as toastmaster, and there were remarks by the toastmaster, Prof. Thomson, E. W. Rice, W. C. Fish, I. F. Baker and others.

THE TELEPHONE IN EUROPE.—In discussing the limited development of telephony in Europe, the London *Times* says: "The reason for the wide gulf between the position of the telephone service in America and that which it occupies in Europe lies in the difference of the attitude of the public—and of the representatives of the public—of the two continents toward the telephone service. In America the telephone service has been treated as a friend, or as a promising youngster capable of effecting vast improvement in the conduct of affairs. The American public, although occasionally it has grumbled about prices, has in the main always been willing to pay for efficiency. In Europe the telephone service has never been treated as a legitimate business enterprise and has never had a fair field. From the very beginning it has been treated as a mere offshoot of the telegraph, and it has occupied the position of Cinderella in the family of methods of communication placed under government control. As a result, not only have all sorts of harrassing restrictions inseparable from bureaucratic control been brought to bear, but telephony as a science, telephone engineering as a specialty, and telephone administration as a distinct branch of organized effort have been neglected."

AUTOMATIC TELEPHONY.—Mr. M. W. Littleton, counsel for the Atlantic Telephone Company, seeking a franchise and entrance into New York City, said in a recent interview: "Much has been said about the disadvantages of having two telephone systems in operation in the city, but there are a few phases of the situation that have been overlooked by the public. In the first place, the Atlantic Company is seeking entrance into an almost virgin field. Strange as it may seem to many, only 5 per cent of the residence of this city have telephones in their homes, and only 20 per cent of the business houses have telephone connections. Of course it is true that the business houses comprising this 20 per cent are the important concerns in the city's life, but it is nevertheless true that 80 per cent of the merchants and business houses here are without telephones because they are unable to stand the expense that the service would entail. Our company would offer service to 95 per cent of the residents and 80 per cent of the business concerns at rates within their reach and without entering, strictly speaking, into the field occupied by the New York Telephone Company. The majority of the business concerns using telephones of the existing company would of course be compelled to install our telephones in addition, but the number of persons they would be able to reach through our telephones would be sufficient to make it a paying investment for them."

Mr. A. S. Richey.

Albert Sutton Richey was born in Muncie, Indiana, on April 10, 1874. After graduating from the Muncie High School in 1890, he took up the electrical engineering course at Purdue University, from which he was graduated in 1894, the subject of his Purdue graduating thesis being "The Use of Storage Batteries in Electric Railway Power Stations." He was elected to the honorary society of Tau Beta Phi before graduation.

After leaving Purdue, Mr. Richey assisted in the installation of electric lighting plants in several small towns in Indiana and Illinois, and in January, 1896, entered the employ of the Citizens' Street Railway, at Muncie, Ind. In 1898 he was made chief electrician of this company, having in charge the mechanical and electrical equipment. In April, 1899, he went to Marion, Ind., as chief electrician of the Marion City Railway Company, and this company being absorbed by the Union Traction Company of Indiana, he was made chief electrician of the latter company in September, 1899. This company during the following year built its main power station at Anderson, and replaced its various direct-current power stations by rotary-converter substations, and during this work, Mr. Richey took charge of the rebuilding of the old overhead lines for the accommodation of the high-tension circuits, and also of the building of the new lines and sub-stations. In March, 1901, he was made electrical engineer of the Union Traction Company of Indiana, and given charge of the operation of the power station, sub-stations and electrical lines, as well as the design and superintendence of these parts of new construction and reconstruction.

MR. A. S. RICHEY.

As electrical engineer of the Indianapolis Northern Traction Company, Mr. Richey had charge of the design and construction of the doubling of the capacity of the Anderson power station and of the overhead lines and six sub-stations, located on the 150 miles of 30,000-volt transmission lines of this company. After the completion of the construction of the Indianapolis Northern Traction Company, this company was merged with the Union Traction Company of Indiana, these properties being leased by the Indiana Union Traction Company. Mr. Richey was made electrical engineer of the new company, and, in January, 1905, was made chief engineer, having in charge the design, construction, maintenance and operation of the entire power equipment and track and roadway.

In October, 1905, Mr. Richey resigned his position with the Indiana Union Traction Company, in order to accept the position of Assistant Professor of Electric Railway Engineering at the Worcester Polytechnic Institute, and is at present engaged in the development of the Electric Railway Engineering courses and the design of equipment for the Electric Railway Laboratory, which is to be a part of the new Electrical Engineering Building which the Institute is now erecting. Professor Richey is a full member of the American Institute of Electrical Engineers.

A Japanese Steam Turbine Electric Station.

THE Osaka Electric Light Company, of Osaka, Japan, presents an interesting example of electrical development which has taken place there in the past ten years. Organized in 1888, with a capital of 400,000 yen (about $200,000), this company has expanded until its present capital is nearly a million and a half dollars. A still further increase in capital is about to be made, so that with its larger plans the company will represent an investment of nearly two and a half million of dollars.

This growth is represented by four separate generating stations located at distributing points in the city, corresponding to wards in American nomenclature, and called respectively, the Nishidontonbori, Nakanoshima, Saiwaicho and Honden stations. The electrical equipment of the stations mentioned indicates the progressiveness of the Japanese engineers in following modern engineering practice, for the design of the stations is carefully worked out and the latest methods and most improved machinery are embodied in the generating plants. Both reciprocating engine and steam turbo-units have been installed; the latter type of prime-mover being a part of the more recent additions to equipment.

At the Nishidontonbori station the principal apparatus consists of two 500-kw, 2,300-volt, 60-cycle, two-phase Curtis turbo-generating units, a 150-kw, 2,300-volt, three-phase, engine-driven generator, and a 90-kw, single-phase generator operating at the same potential. The exciting current for the main generators is furnished by two 25-kw, 125-volt marine type generating sets driven at 450 r.p.m. by compound engines. In the second station, the Nakanoshima, there is a varied equipment. The principal apparatus consists of four monocyclic generators, one of 150 kw capacity, and three 120-kw machines. There are in addition three 75-kw, single-phase generators, and three 75-kw, Brush arc machines, each of which will supply current to 45 lamps. The Saiwaicho station also contains monocyclic machines as well as single, two and three-phase apparatus. There are five 150-kw, monocyclic generators, three 120-kw, single-phase and one 150-kw, two-phase generators, engine-driven. The largest unit in the station is a 1,000-kw, 2,300-volt, 60-cycle, two-phase Curtis turbo-generator with the customary exciting sets. These latter consist of two 25-kw, 125-volt marine units with compound vertical engines. All of the electrical equipment in the three foregoing stations was manufactured by the General Electric Company.

The Honden station may be taken as a type of these stations and also representative of the more modern Japanese power plant design. The interior arrangement of this station is shown in Figs. 1 and 2. The power house is constructed of reinforced concrete with trussed steel floor. The entire floor of the station is served by a 20-ton crane running the length of the building. As can be seen in the photograph, the natural lighting is excellent and the principal artificial illumination is secured by arc lamps swung out from the wall to secure even distribution of light. Portions of the machinery are individually lighted by incandescent lamps so that the attendant can work to the best advantage. All station wiring, with the exception of the necessary lighting circuits, is laid below the floor, so that the station presents a neat and spacious appearance. The compactness and business-like aspect of the vertical turbines adds greatly to this general effect.

The station proper is divided into two sections, the boilers being separated from the generating room by a partition through which connection is made with engines and turbines, on the opposite side, by short lengths of steam piping, thus doing away as far as possible with condensation losses. At one end of the generating room are two 600-kw, two-phase, 60-cycle, 2,300-volt generators direct-connected to McIntosh & Seymour engines with the exciting units as shown in Fig. 2. Each engine is a horizontal cross-compound, condensing machine, the cylinders being 22 in. and 46 in. in diameter, respectively, with 36-in. stroke. Each is rated at 900 hp at 120 r.p.m. The cylinders are equipped with tail rods, the pistons being thus supported between two crossheads and relieving the cylinder walls from the weight of the pistons. In this way the cylinder wear is decreased and the life of the engine lengthened. The engines are also equipped with electrically-operated speed changing and synchronizing devices.

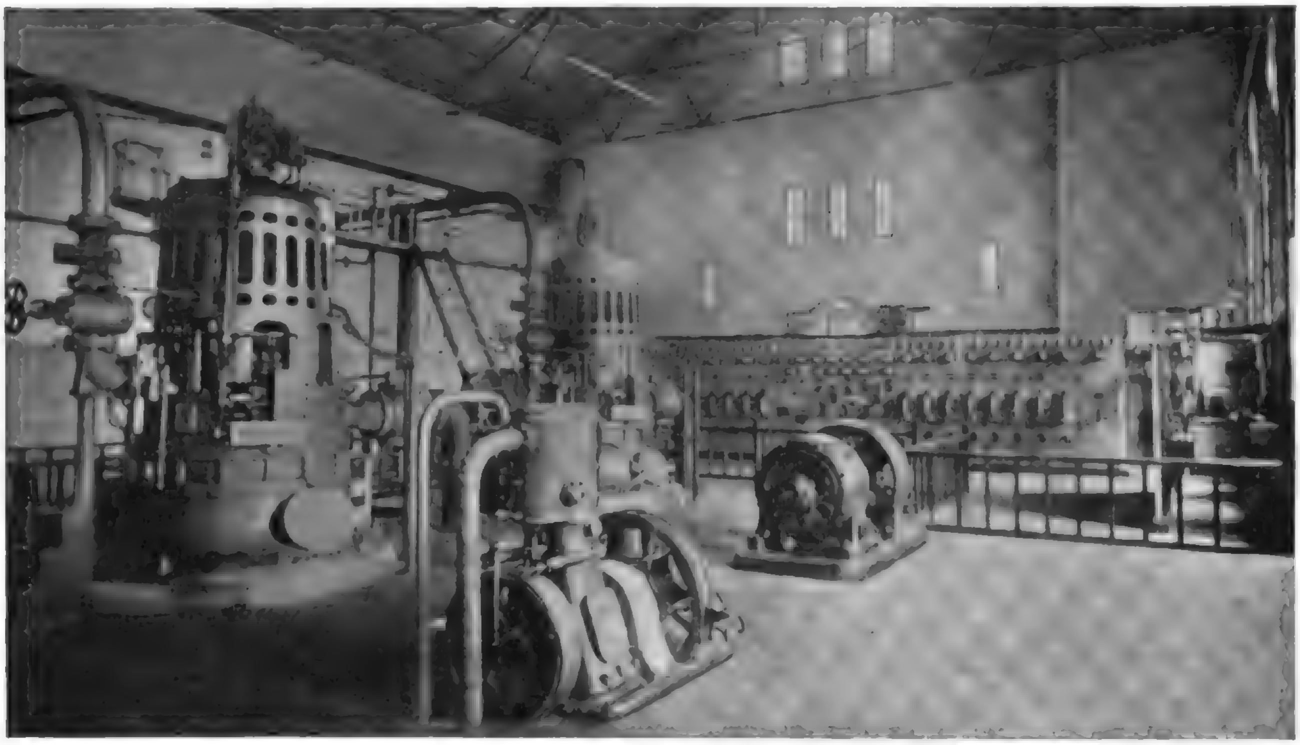


FIG. 1.—VIEW OF INTERIOR OF OSAKA, JAPAN, ELECTRIC LIGHT PLANT.

Two Curtis steam turbine units are grouped with their exciters at the other end of the building. Each unit consists of a 500-kw, 2,300-volt, 1,800-r.p.m., 60-cycle, three-phase generator mounted vertically on the same shaft with the turbine. For field excitation of the turbines a duplicate direct-current generator equipment is provided; one a steam, the other an induction motor-driven set. The steam set comprises a 25-kw marine engine unit, the engine being of the cross-compound type. The motor-driven set is a similar generator driven by a 40-hp induction motor.

Across the end of the station is the main distributing switchboard shown in Fig. 1. This main board is made up of twelve panels constructed of blue Vermont marble and equipped with the necessary instruments and switches. There are eight distributing or feeder panels, two generator panels, one exciter panel and one induction motor panel.

The turbine switchboard is located at right angles to the main board, as seen in Fig. 1. The board is constructed of blue marble and consists of eight panels, including a 30-kw exciter panel, two 500-kw generator panels for governing the turbines, and five three-phase, 2,300-volt feeder panels. The switchboard is very completely equipped with instruments and oil type switches, including synchroscope and polyphase ground detector on a swinging bracket, and electrically-tripped oil switches.

Current from the various stations is used principally for lamps, although a few motors are in use. There are at present about 85,000 lamps in circuit, 90 per cent of the electricity for lighting being sold to customers under the contract system and not by meter. As is customary in Japan, all wires within the city limits are laid underground. In this respect the practice in Japan is far ahead of that in the United States. Government inspection and supervision of all electrical work, whether of a public or private character, tends to insure a high standard in all electrical construction and operation, and renders Japanese cities free from the tangles of unsightly wires so noticeable in many American cities. Government control also regulates the use of ground circuits. These regulations require a complete insulated circuit on trolley lines within the city limits, and all Japanese cars within the city have, therefore, a double trolley line with no ground return.

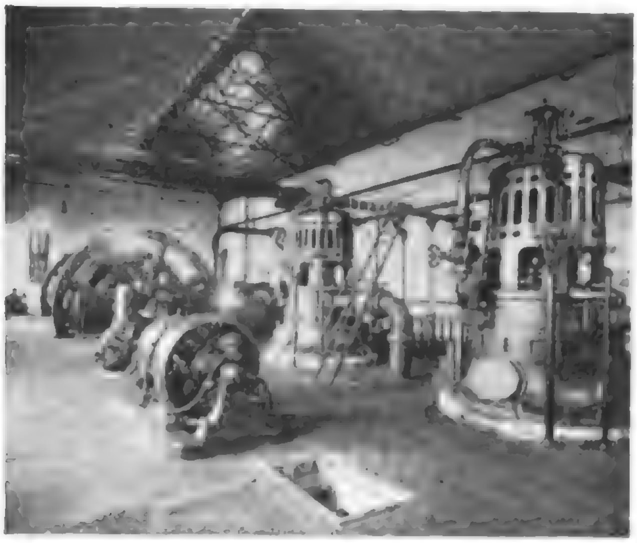


FIG. 2.—TURBO-GENERATORS AND EXCITERS, OSAKA.

In the preceding description an idea has been gained of the present equipment of the Osaka Lighting Company, but the company is planning for a large extension in the immediate future. The city of Osaka with the nearby suburb of Sakan and vicinity, has a population of about 1,000,000. That this population is rapidly taking advantage of the convenience of electric service as extended to them by the Osaka Lighting Company, is shown by the fact that the company finds it necessary to build another central station with a capacity sufficient to operate 300,000 16-cp lamps. The 1,000-kw steam turbines of the Curtis type have already been ordered for this purpose.

The design and execution of the plans for the electric plants have been most successfully carried out by the company's engineers, under the direction of Mr. T. Ikeda, chief electrical engineer, assisted by Mr. K. Kimura, Mr. S. Kitaura and Mr. W. Minomiya, without any assistance whatsoever from foreign engineers. The organization of this progressive eastern lighting company is as follows: Mr. M. Doi, president; Mr. S. Akizuki, managing director; Mr. K. Noda, Mr. T. Kameoka, Mr. S. [illegible], directors, and Mr. B. O[illegible], auditor.

Another Tungsten Filament Lamp.

According to our London contemporary, *The Electrician*, another tungsten filament lamp will soon be exploited in Europe. This lamp is distinct from the one being developed by Dr. Kuzel, of Vienna, references to which have recently appeared in these columns, and the term wolfram seems to be applied to it by its inventors instead of the synonym tungsten. An English patent (No. 11,949 of 1905) has been granted on this lamp to Dr. Alexander Just and Frank Hanaman, of the Vereinigte Elektricitäts Werke, of Budapest, and the German rights have been acquired by the Wolfram Lampen Actiengesellschaft, of Augsburg. The following particulars of the process of manufacture are from the British patent:

"Experiments, it is said, have demonstrated that when carbon filaments, which are provided with coats of wolfram (tungsten) or molybdenum of sufficient thickness, are submitted in highly rarefied gases or in vacuo, in order to prevent oxidation of the metal under the action of the electric current, to an adequate temperature, the carbon combines with the metal surrounding it with the formation of a carbide. The carbon becomes completely dissolved in the metal in such a manner that a filament formed in accordance with this process is entirely homogeneous, so that under the microscope no carbon core can be distinguished at the point of fracture. This process, which may be termed 'dissolving' the carbon, occupies but a few minutes, and takes place the more speedily the greater the excess of metal above the carbon.

"Carbon filaments of the greatest possible fineness (of a diameter of, say, from 0.02 mm. to 0.06 mm.) are submitted to the action of an electric current in an atmosphere of chlorides of wolfram or molybdenum (preferably WCl_6 = wolfram hexachloride, or molybdenum pentachloride = $MoCl_5$) in the presence of hydrogen or of some other gas exercising a reducing action, whereby the wolfram or the molybdenum is metallically deposited upon the surface of the carbon. When the metallic coating is of sufficient thickness, which may be ascertained by the current indicated by an ammeter (say 1 amp. when carbons of 0.04 mm. diameter are employed), the filaments are brought to incandescence by an electric current in an atmosphere of very highly rarefied inert gases, such for example as hydrogen gas at a pressure of 20 mm. The solvent process referred to above then takes place in a very brief period, a few minutes being usually sufficient. The filaments so obtained, which contain the carbon in a bound form (mostly as carbide) present a glittering white metallic appearance.

"The incandescing filament is once more raised to a high temperature by an electric current in a mixture of steam with reducing gases, and the carbon is oxidized by a similar action to that which takes place in the manufacture of water gas. An alternative method given for the elimination of the carbon is to raise the incandescing filament to a high temperature in vacuo by the electric current for a long time (say 24 hours) in such a manner that the carbon volatilizes. Another method of decarbonizing described is as follows: The metal filaments containing carbide are embedded in a refractory crucible, which is then carefully luted, in very finely pulverized low oxides of these metals, such for example as WO_2 or MoO_2, which is then submitted to the heat of a blast furnace (about 1,600° C. are required) for several hours. By this process the carbon is oxidized as indicated in the following equations: (1) $WO_2 + 2C = 2CO + W$; (2) $MoO_2 + 2C = 2CO + Mo$. The reduced wolfram or molybdenum does not become deposited upon the filament, but remains comprised in the oxide mass, because the wolfram or molybdenum upon reduction at this temperature surrounds the filament as an amorphous powder, without being deposited upon the same. As soon as this oxidation process is completed (in, say, from 10 to 12 hours) cooling is allowed to take place, and the crucible is opened."

The metallic filaments obtained by one of these processes may, then, it is stated, be fused into the glass bulbs and employed for incandescent lamps without further treatment.

Residence Lighting and Other Central Station Work at Wabash, Ind.

ONE of the most notable things about the business of the Wabash Water & Light Company, of Wabash, Ind., is the large proportion of residence lighting. This is due partly to the fact that the management has realized the importance of residence lighting load and has taken pains to develop it, and partly because the gas business in Wabash has always been in an unsatisfactory state. Attention has frequently been called of late in these columns to the importance of residence lighting business as a revenue producer. It has been pointed out that the trouble with residence lighting in the past in many cases has been that central stations have not secured a sufficient quantity of it. At Wabash the company is doing residence business on a scale which makes it profitable.

Wabash has a population of about 9,000 and the number of residence customers is about 600 out of a total of about 800. The company does most of the wiring that is done in the town at cost, employing first-class wiremen. This avoids dissatisfaction with poor wiring by irresponsible wiring contractors. By this means the company is able to see that customers are equipped properly to get all the advantages of electric service and to get the best illumination possible for their money. The company's best wiremen are educated from the ranks of good mechanics, as a good workman in one mechanical trade will usually make a good workman in another.

RESIDENCE DISTRIBUTION.

The principal residence districts have secondary mains running through them which are continuous for blocks, transformers being located about one to each block. Very neat pole line construction with Idaho cedar poles is employed in the residence districts, as can be seen from an inspection of Figs. 1, 2 and 3. Figs. 1 and 2 show a pole line of very high poles running up one of the principal streets. As shown in Fig. 2, transformers are mounted about half-way up the pole, thus obviating hoisting the transformer to the top of the pole and also making it possible to replace transformer fuses without going up among the live wires. On some parts of the street shown in Figs. 1 and 2 there are shade trees, the tops of which reach almost to the line wires.

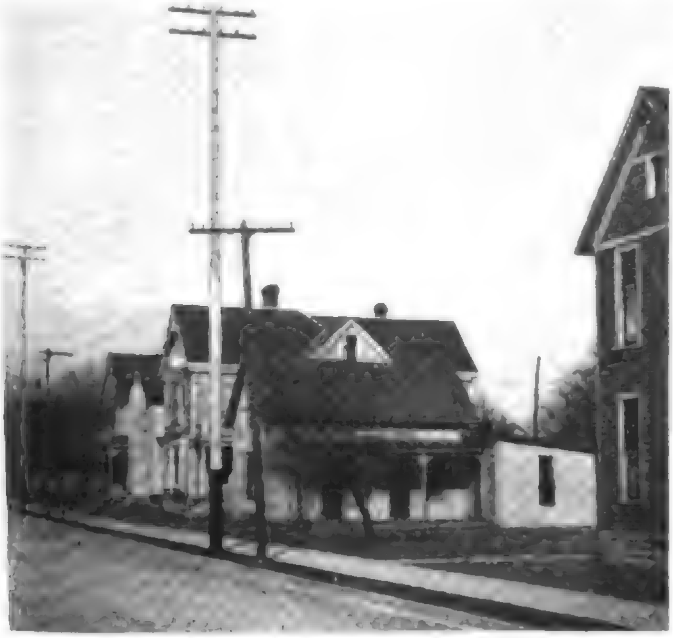


FIG. 1.—HIGH POLE LINE ON RESIDENCE STREET.

TREE TRIMMING.

A method of tree trimming has been adopted which disfigures the trees but little and insures wires being kept fom the branches. A cable is stretched between poles and a lineman is sent out on a traveler hanging from this cable. He can then trim the trees just at the places necessary to keep them from the wires, while when the lineman must climb a tree and do his cutting where the branches are heavy the reverse is apt to be the case. Fig. 3 shows the construction in alleys and gives an idea of the number of service wires running to residences. On these short poles the transformers are placed at the top. Branch lines of the primary circuit are fused with enclosed fuses.

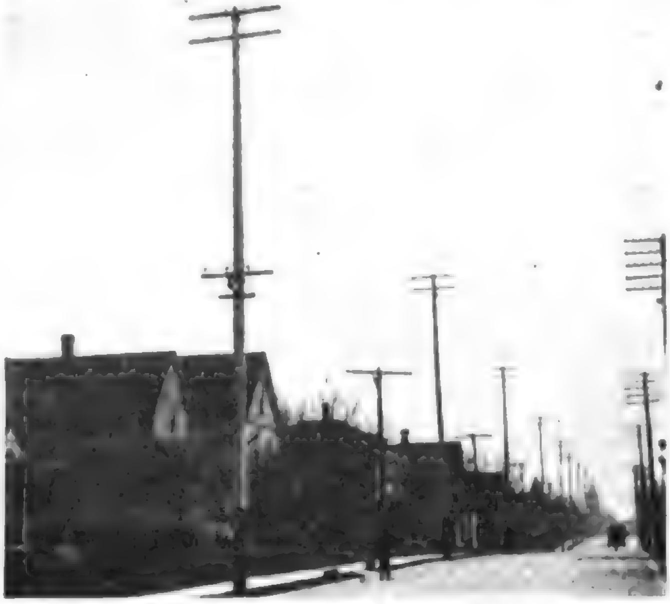


FIG. 2.—SHOWING LARGE PERCENTAGE OF RESIDENCES CONNECTED ON A WABASH STREET.

RESIDENCE RATES.

The rates for residence lighting are 12 cents per kw-hour up to 30 kw-hours' consumption per month. Where a customer's consumption is over 30 kw-hours per month, the rate is 10 cents per kw-hour. This would make the customer's bill less for a consumption between 25 and 30 kw-hours per month than for a consumption of 30 to 36 kw-hours per month. To provide partially against this discrepancy the consumption between 28 and 30 is figured at a lower rate than 12 cents. The minimum bill is $1.25 per month.

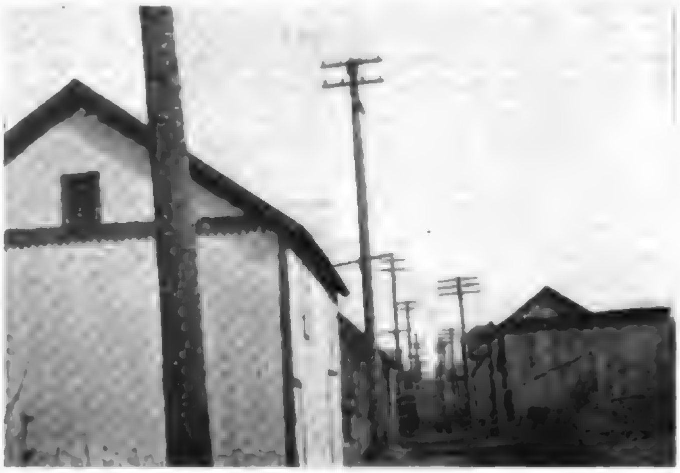


FIG. 3.—ALLEY POLE LINE CONSTRUCTION.

YEARLY RESIDENCE CONTRACT.

A somewhat unusual contract is offered to customers in this connection. A residence owner can pay $15 per year in advance, or in other words, the amount of his minimum monthly bills. He will then be billed yearly for all energy consumed in excess of a value of $15. This, it will be seen, gives the customer the advantage of some saving because in many cases during the summer his consumption will be less than the minimum bill, while in the winter it will be considerably more. Under a monthly payment plan he never pays less than $1.25 per month, and in the winter he will usually pay considerably more. Under the yearly payment plan it is possible to bring the average payment per month down almost to $1.25 if the consumption is small. This plan proves popular.

PARK LIGHTING.

Besides residence lighting the company has, during the summer, a very desirable class of lighting on its residence circuits, namely, that of a city park, which contains 200 Meridian lamps, each of 125 watts. Fig. 4 is a winter view taken in this park, showing the way the wires are run and supported on unobtrusive brackets from the trees. The lamps are screwed in water-proof sockets, these sockets being connected between the outer and neutral wires of three-wire secondary mains running through the park. As this park lighting is done in summer when there is little commercial lighting, it is a most desirable class of business. This park occupies an area equal to about two city blocks.

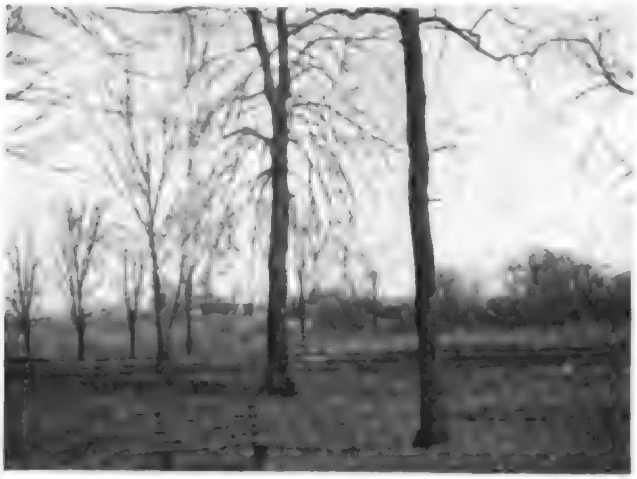


FIG. 4.—PARK WIRING.

WELL-LIGHTED CHURCH.

A fine example of good illuminating engineering on the part of the company is to be found in a large church recently wired. The church had been previously lighted with large gas chandeliers which were exceedingly trying on the eyes. The company was given a free hand in designing the electric lighting. The principal illumination is secured by small clusters of Meridian lamps with sockets pointing straight downward and placed high up on beams which form a part of the roof architecture. The reflectors on these lamps throw the light downward where it is needed, and their frosted bulbs as well as the fact that but few lamps are placed in a cluster, make the lighting arrangement easy on the eyes. To bring up the illumination around the sides, upright wall brackets were used with open shades of a type which diffuses the light and distributes it principally at angles below the horizontal. The intensity of the light is sufficiently reduced by the globes on these side wall brackets to have a minimum tiring effect on the eyes. Lamps placed low around the pulpit and organ have been avoided as not only detracting from the general effect, but as being trying to look at through an evening service. The illumination of the choir and organ is obtained from Meridian lamps placed high up as in other parts of the church. For pulpit lighting a lamp of the bunghole type is placed close down to the surface of the pulpit with a shade fitting closely over it so that the light shines only on the surface of the pulpit, the angle being such that there is practically no glaring reflection of the light from the smooth surface of a book or paper on the pulpit.

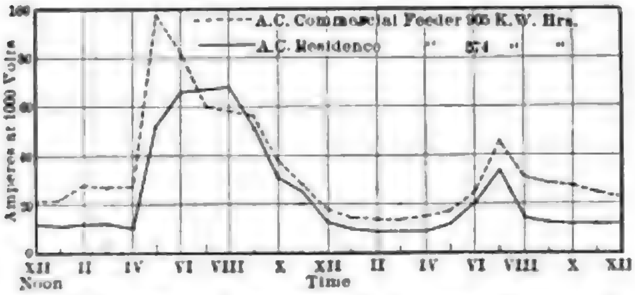


FIG. 5.—COMPARISON OF RESIDENCE AND COMMERCIAL LIGHTING.

LOAD CURVES ON RESIDENCE AND OTHER BUSINESS.

In order to show the relative importance of residence lighting to other lighting in Wabash, a curve has been plotted, Fig. 5, the solid line of which shows the load in amperes on a feeder supplying residence lighting almost entirely, and the dotted line the load on a commercial lighting feeder, from noon, January 3, to noon, January 4. The voltage is 1,000. The total output on the residence feeder for that 24 hours was 574 kw-hours. On the commercial lighting feeder the output was 905 kw-hours. The load factor is much the best on the residence feeder. Fig. 6 shows the kilowatt output by months on the residence feeder. It should be explained that the company's motor load is only by 500-volt direct-current service, so that the outputs given represent lighting almost entirely.

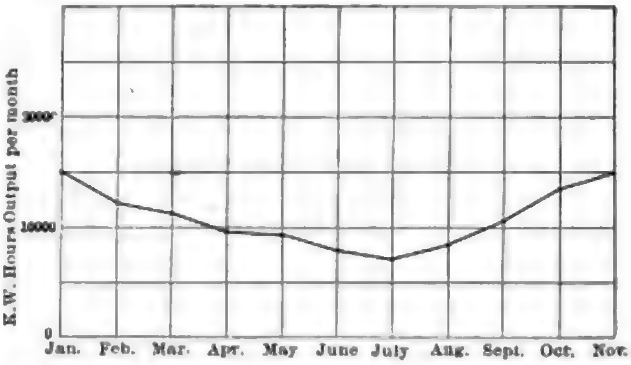


FIG. 6.—ENERGY OUTPUT PER MONTH ON ALTERNATING-CURRENT CIRCUITS.

The electrical output of the company's plant for the same day January 3 to 4, 1906, for all circuits was as follows:

Series incandescent lighting	224 kw-hours
Alternating current residence lighting	574 kw-hours
Alternating current commercial lighting	905 kw-hours
500-volt motor load	300 kw-hours
Direct current series street arcs	471 kw-hours
Total	2,474 kw-hours

The influence of stores being kept open Saturday evening instead of closing at 6 o'clock as usual is shown by the curve, Fig. 7, giving the load in amperes on the commercial alternating-current circuit for 24 hours beginning at noon on January 6, 1906.

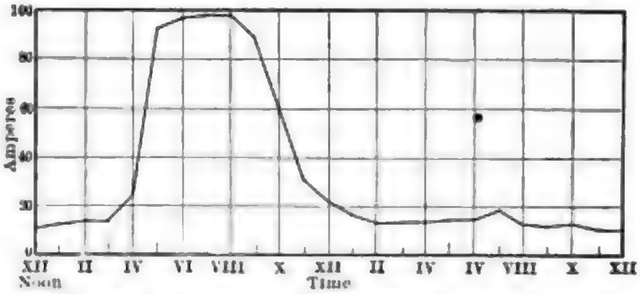


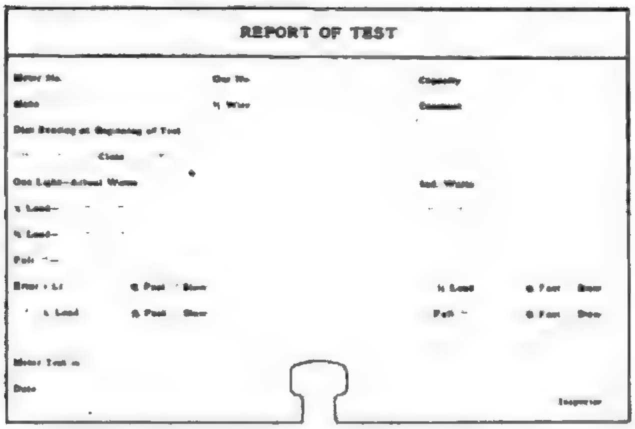
FIG. 7.—LOAD ON COMMERCIAL ALTERNATING-CURRENT CIRCUIT.

ELECTRIC FLATIRON BUSINESS.

The company has between 30 and 40 electric flatirons in use by its customers. It is the intention to push this business actively and put irons out on 30 days' trial. The iron which the company is now purchasing and putting out on trial is the Pacific, made in Los Angeles, and was selected on account of its ease of repair and the fact that it is provided with an inexpensive inverted holder so that the iron can be used for light cooking.

OFFICES AND ATTENTION TO BUSINESS.

One very creditable thing about the company's business methods is the excellent attitude maintained by clerks in the office toward the public. It is sometimes the case that clerks who are constantly meeting the public at the window of a public service corporation's office get unconsciously into the habit of being indifferent or rude. This may be partially brought on by listening to unreasonable complaints. However this may be, the complainer in most cases believes he has a cause of grievance. To handle all customers courteously and have them leave the office feeling better than when they came in is indeed a fine art, but it has been well developed in the Wabash Water & Light office.


REPORT OF TEST

Meter No. Our No. Capacity

Make Wire Constant

Dial Reading at Beginning of Test

Close

One Light—Actual Watts Ind. Watts

Load—

Load—

Full —

Error Load Fast Slow Load Fast Slow

Load Fast Slow Full Fast Slow

Meter Test

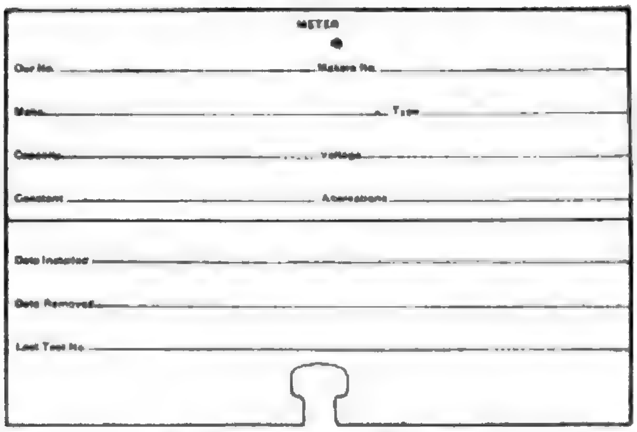
Date Inspector

FIG. 8.—CARD FOR REPORT OF METER TEST.

The company has an office on one of the principal business streets and maintains an attractive show window. At the time of the visit of the writer, this show window was fitted up with a pair of small dark rooms with sides open toward the street for the purpose of showing the comparative value of different reflectors. Samples of heating devices are kept in the rear of the manager's and bookkeeper's office. Back of this is the store and repair room.

SIGN LIGHTING AND FREE SIGNS.

The sign business has been little developed, but an active sign lighting campaign is to be begun, probably under a form of contract whereby the company will furnish signs free, renting and maintaining them on a two-year contract at a price sufficient to pay for the kw-hours consumed and the sign.


METER

Our No. ________ Makers No. ________

Make ________ Type ________

Capacity ________ Voltage ________

Constant ________ Alterations ________

Date Installed ________

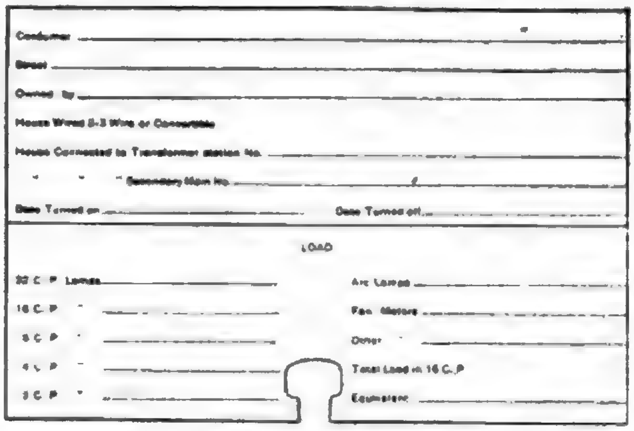
Date Removed ________

Last Test No. ________

FIG. 9.—OFFICE RECORD OF METERS.

METER TESTING AND CARD RECORDS.

The company has about 800 meters. The Westinghouse meter is now the standard used. These meters are taken care of and read by one meterman, who brings in each meter for test once a year. Fig. 8 is a reproduction of the 4 by 6-in. card used in reporting tests on meters. The test number is placed at the top right-hand corner. In connection with this another meter card is used (Fig. 9), the latter card giving an office record of the meters owned by the company. The test number on the latter card refers to the test card (Fig. 8). With the meter card (Fig. 9) is kept a customer's card (Fig. 10), on which is kept a record of each customer, his installation and to what transformers and mains the meters are connected.


Consumer ________

Street ________

Owned by ________

House Wired 2-3 Wire or Convertible

House Connected to Transformer station No. ________

" " " Secondary Main No. ________

Date Turned on ________ Date Turned off ________

LOAD

32 C. P. Lamps ________ Arc Lamps ________

16 C. P. " ________ Fan Motors ________

8 C. P. " ________ Other " ________

4 C. P. " ________ Total Load in 16 C. P.

2 C. P. " ________ Equivalent ________

FIG. 10.—CUSTOMER'S METER CARD.

POWER STATION.

The power plant is a combined water pumping and electric light station. The engines are all belted to a line shaft from which generators and water works pumps are belted. The engines are of the Corliss type. There are two water-tube and two shell-type boilers. The whole output of the station is measured by meter, electric meters being placed on the switchboard for each class of service and water meters being used.

MEASUREMENT OF HOT WATER.

The water supplied to the boilers has been heretofore measured by meter, but on account of the well-known unreliability of hot water meters a new plan is about to be tried. The feed water pump is of the outside packed plunger type. A small pump which has a capacity exactly 1/10 that of the feed water pump is to be connected directly to it so that each stroke of the feed water pump will operate the small pump. This small pump will pump water into a tank with but little head and the amount of water pumped into this tank multiplied by 10 will be assumed to give the amount of water pumped by the large pump.

The evaporation of water per pound of coal is watched very closely as there is considerable difference in different veins of the Indiana coal used. The average evaporation is 7½ lb. of water per pound of coal. On account of water pumping and dynamo driving being done from the same shaft, the kw-hours per pound of coal cannot be determined. Boilers are cut in and out according to the load on the station, as this is found more economical than running boilers with a slow fire. The power house operating force consists of two engineers, one fireman and one coal passer in the daytime, and one engineer, two firemen and one coal passer at night. The reason for two engineers in the daytime is that repairs are made then. The power station is in charge of Mr. O. H. Young, chief engineer.

MOTOR BUSINESS.

The relative amount of motor business done by the company has been already noted. Motor rates are as follows:

0 to 187½ kw per month	4½ cts. per kw-hour
187½ to 375 kw per month	4 cts. per kw-hour
375 to 750 kw per month	3¾ cts. kw-hour
750 to 1,875 kw per month	3½ cts. kw-hour
1,875 and up kw per month	3 cts. kw-hour

No motor bill is made for less than $2.00 per month.

WHISTLE CALLS.

A very useful wrinkle in the company's practice is that of having a system of power house whistle signals for the officers and principal employes of the company. By telephoning the power house almost anyone connected with the company within hearing of the power house whistle can be notified to call up the general offices by telephone at once. In this way the manager and men can be brought into quick communication at any hour of the day or night when they cannot be reached otherwise.

The company is under the management of Mr. T. W. McNamee.

Electrical Engineering at Cornell.

Electrical engineering has been taught at Cornell University as a sub-division of mechanical engineering for twenty years, or since the accession of the late Prof. Robert H. Thurston to the directorship of Sibley College in 1885. The foundation of this work was laid by Prof. Wm. A. Anthony, who has always been keenly alive to see and utilize advances in the science of physics. He had been interested in the applications of electricity in connection with his courses at Cornell and as soon as the state of the art warranted he established, in 1883, a course in Applied Electricity. This was naturally a scientific course, and led to the degree of B.S. in electrical engineering. Four men were granted this degree in 1885, and two more degrees were conferred in 1886, by which time the engineering course had become well established.

Although not an undergraduate, Mr. James G. White did a great deal of work in the electrical engineering department during these pioneer years, receiving the degree of Ph.D. in 1885. Three men received the degree of M.E. in electrical engineering in 1886, one being Prof. Ernest Merritt, now a distinguished physicist. Another was Mr. George B. Dusinbere, manager of the Cleveland District of the Westinghouse Electric & Manufacturing Company. In the following year seven men completed the course, and among them was Prof. Harris J. Ryan, now of Stanford University, who afterward succeeded in developing the course to a remarkable degree, and who was head of the department from 1889 to 1905, a total of fifteen years. Prof. Dugald C. Jackson completed two years of graduate work in 1887. He had received the degree of B.S. from Pennsylvania State College in 1885, and was thus prepared to take immediate advantage of the course in electrical engineering.

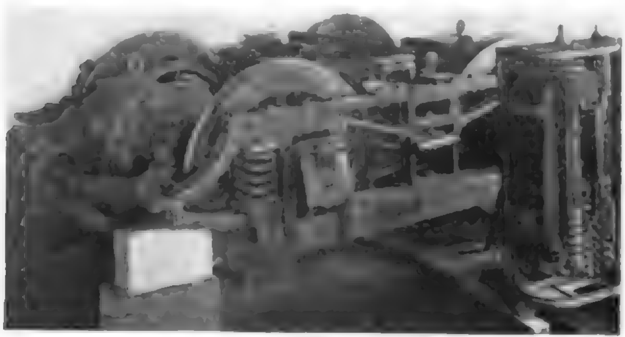


FIG. 1.—APPARATUS ARRANGED FOR EXERCISE IN CONNECTING ELECTRIC RAILWAY EQUIPMENTS.

Of the eight men graduating in 1888, several well-known names are found, including Edward Caldwell, manager of the book department, McGraw Publishing Company, and I. J. Macomber, of Westinghouse, Church, Kerr & Co. From this time on the classes became very large and included scores of men who are now leading in practical and scientific work and in electrical instruction. The numbers continued to increase until 1896 and 1897, when 69 graduated each year. After this a depression occurred, in common with all other schools, as was shown in the exhibit prepared by Prof. B. V. Swenson for the Land Grant College exhibit at the Louisiana Purchase Exposition. At the present time the rate of increase is again large, as is shown by the fact that last year 78 men completed the course and this year there will be 108. The latter figure is abnormally large and the indications are that the class of 1907 will not surpass the present class in size. These figures and the careers of the 786 men who have completed the course indicate the quality of the work done by Prof. Ryan in Cornell University.

Year.	M. E. Degrees Granted.	Graduates in E. E.	Per cent of Electrical Engineers
1886	8	5*	62.5
1887	19	7	36.8
1888	22	8	36.4
1889	32	19	59.4
1890	54	28	51.9
1891	52	28	53.8
1892	85	44	51.8
1893	93	46	49.5
1894	81	43	53.1
1895	87	51	62.7
1896	110	69	62.7
1897	125	69	55.2
1898	87	46	52.9
1899	89	33	37.5
1900	100	43	43.0
1901	110	29	26.4
1902	110	36	32.7
1903	157	51	32.5
1904	140	53	37.8
1905	205	78†	38.1
Total......	1,766	786	Average....44.5

* Includes two degrees of B. S. in E. E.
† Includes two graduates taking undergraduate work.

The accompanying table shows in detail the proportion of electrical engineers in each class, this proportion fluctuating between 26.4 per cent and 62.7 per cent, the average for twenty years being 44.5 per cent.

As is well known only one undergraduate degree is given in Sibley College, that is M.E. The fundamental features of all the courses in the college are the same, specialization occurring slightly in the junior year and more completely in the senior year, although, even in the latter, many courses are taken by all students. In the second half of the junior year the electrical engineers take a course of four recitations per week which prepares them for the analytical and practical study of electric circuits and machines, and which is continued through about one-half of their senior year. This amount of preparatory work will soon be increased to include elementary laboratory instruction. The plan of the senior year, as far as electrical instruction is concerned, consists of three essential divisions:

(*a*) Laboratory instruction in the characteristics of operation of electrical machines and other devices;

(*b*) Analytical study of methods for predicting machine performance;

(*c*) Graphical study connecting the work of the laboratory and the classroom.

The senior laboratory work consists of approximately 60 experiments arranged to illustrate the modern electrical applications, each experiment requiring three hours for its completion and from three to six hours for the preparation of a report. A recitation is held in advance of each two experiments in order to insure a proper experiment. A part of this recitation is written so as to insure an advance study of the assigned text prepared in the department. The laboratory is under the joint direction of the Department of Experimental Engineering, headed by Prof. Rolla C. Carpenter, and the Department of Electrical Engineering.

The analytical work is founded on the junior course and it is given by lectures and by the solution of practical problems. The modern theory of each type of machine is discussed and illustrated mathematically and graphically and the student is made acquainted with the appearance of machines of all sizes and makes. The lectures are merely instructions for solving problems which form the principal part of the work and upon which the student puts from six to ten hours per week. In this, as well as the laboratory course, the student is directed to the sources of correct information in the literature, and he is encouraged in every way to familiarize himself with the best books on engineering subjects and the best of the current technical papers.

The third phase of instruction, and the one which is in many ways most important is the drafting room course in which the theoretical and the practical instruction are blended. A certain amount of time is spent in the designing room, not for the purpose of producing original designs, but to plot curves from the laboratory data and to work analytical problems bearing on the same class of machines, so that the students will gain confidence in his theory and so that he will be able to fall back upon actual results when the theory apparently fails. All of this is done under competent instruction and the results have been exceptionally satisfactory.

Up to the middle of the senior year the work deals largely with fundamentals, but after this a certain amount of time may be spent in advanced study of electrical applications. Among these are applied electricity in physics, electrochemistry, electric railways, telephone engineering, generation and distribution of electric energy and the design of electrical machinery. As the preparation of a thesis is optional, many seniors prefer to substitute an equivalent amount of time in these advanced electrical courses or in courses of a similar grade. Thus each student goes out with special preparation in some subjects. This preparation is not intended to make him an expert in any specialty, but it gives him an appreciation of the nature of the specialty and of the manner in which it is related to his fundamental studies.

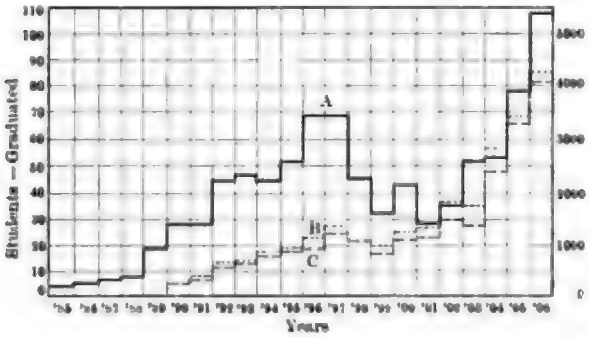


FIG. 2.—STUDENTS GRADUATED AND THE HOURS OF INSTRUCTION.

It is interesting to note not only the increasing number of students in the technical schools, but also the amount of electrical instruction given to each. The accompanying diagram illustrates this growth. In this diagram the curve *A* represents the number graduated, *B* the hours of instruction in required and elective courses, and *C* the hours of instruction in required courses. The unit in which the amount of instruction is measured is the "student-hour," a term which requires some explanation. A university hour at Cornell is the amount of instruction for one-half year represented by one lecture or recitation per week or by two and one-half hours in a laboratory, shop or drafting room. Each course is rated at a certain number of hours per term and each student is expected to complete approximately eighteen of such hours per term. By reference to the chart it will be noted that the number of student-hours of instruction per student graduated in electrical engineering rose from nine in 1890 to forty-two in 1905. Not all of this instruction was given to electrical engineers, as in recent years the non-electrical engineers have in large numbers taken the elementary electrical courses. However, as an indication of the amount of work done by the department the comparison is fairly satisfactory. The corresponding figure for 1906 does not allow a similar comparison, from the fact that during this year the electrical laboratory work, formerly given by the Department of Physics has been transferred to Sibley College. Also during the present year for some unknown reason the number of seniors graduating in electrical engineering forms an unusually large proportion of the whole, and it is also large compared with the total amount of instruction given. The value of 39.4 student-hours per student graduating indicates that the junior classes are not as large proportionately as during last year. They are more nearly in line with the natural growth as indicated by the chart.

Sibley College has for a long time supported a successful electrical society managed entirely by the students. This society now meets once a month in comfortable quarters away from the college, and the members discuss general topics of interest to themselves. In some years lectures by faculty members and others were given, but the present plan is found to be much more satisfactory. There are also monthly meetings of the local branch of the A. I. E. E. which are largely attended, and these meetings are greatly enjoyed by the students, who thus come into touch with actual practice. There are always present students and teachers who have had actual experience with the subjects presented which enable them to contribute materially to the discussion. As the function of these meetings is more thoroughly understood, they have become less formal and more enjoyable, and they supplement the class instruction in a helpful manner. As in the case of the electrical society, the meetings are held away from the college in order to remove the classroom restraint which would otherwise be felt.

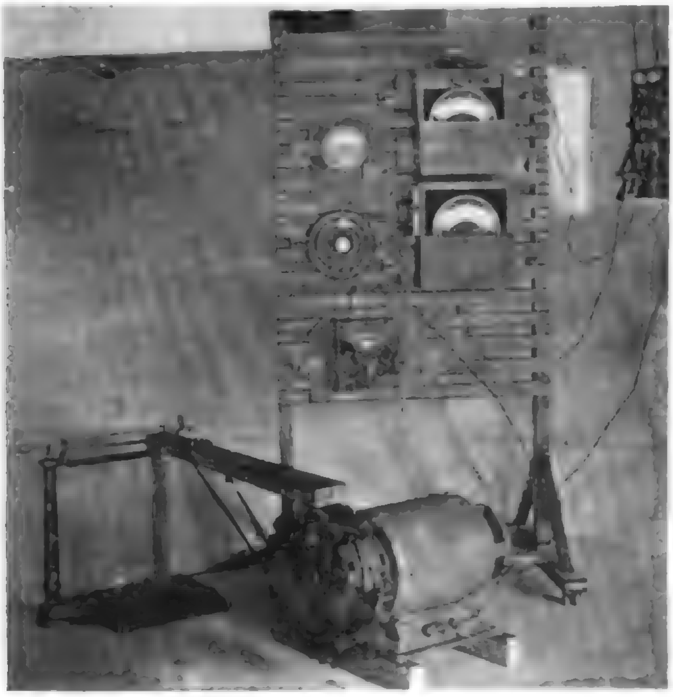


FIG. 3.—APPARATUS ARRANGED FOR MOTOR TEST.

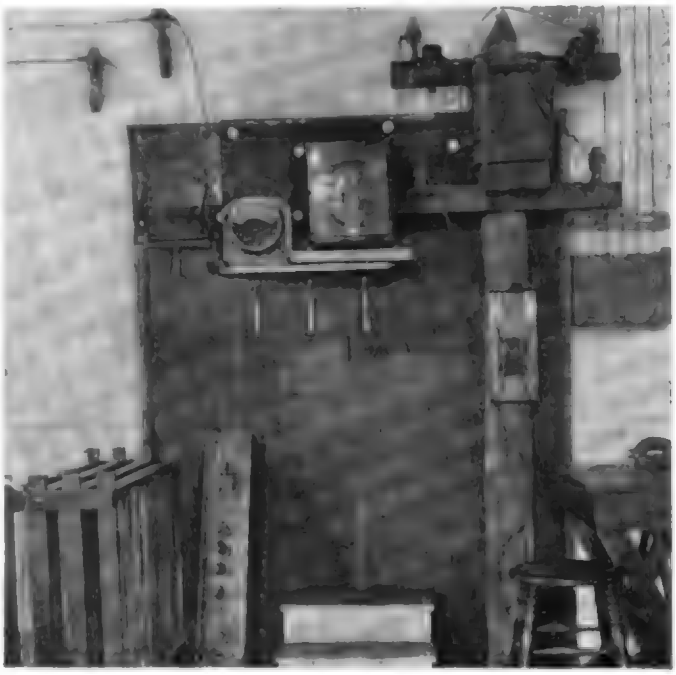


FIG. 4.—APPARATUS ARRANGED FOR TRANSFORMER TEST.

The Department of Electrical Engineering is in charge of Prof. H. H. Norris, who served as superintendent of the electric railway test commission, which conducted an exhaustive series of tests on railway equipments under service conditions during the Universal Exposition at St. Louis, Mo., in 1904. Prof. Norris was engaged as special expert in connection with the reorganization of the American Street Railway Association in 1905. The experimental work of the Department of Electrical Engineering is under the immediate direction of Assistant Professor V. Karapetoff.

The Depreciation of Electrical Properties.

Prof. G. W. Bissell, of Ames, Iowa, read a paper at the convention of the Iowa Electrical Association, Des Moines, April 19, 1906, on the above subject. The following were some of the points he brought out:

As a preliminary to the preparation of this paper, the writer sent to each member of the association a letter propounding and asking replies to the following inquiries:

1. In computing the total cost of your output, do you make allowance for depreciation?

2. If the answer to No. 1 is affirmative, how much depreciation do you charge off, and how do you arrive at this amount?

3. How do you invest your sinking fund?

Twenty replies were received. Three answered questions 1 and 3 in the negative without explanation or other sign of interest in the matter and they of course gave no answer to question 2.

Four members answered question No. 1 in the negative, but explained that circumstances, such as pressure for dividends, prevented the practice, or regretted that extensive renewals of deteriorated property had prevented, or that the plant was not yet old enough to be affected by depreciation; but all four evidently appreciated the importance of the subject.

Two members took issue against the recognition of depreciation as an account to be considered in making a true book showing of the property. Attention will be called to these arguments later.

One member answered question No. 1 in the affirmative and No. 3 in the negative and evidently confused depreciation and maintenance.

The remainder, ten in number, gave affirmative and more or less complete answers to the three inquiries, and quotations from the letters are here presented.

1. "We set aside about 5 per cent of gross investment each year for maintenance of property."

2. "We use the replacement value of the plant equipment as a base on which to figure depreciation. . . . The fund derived from these amounts is deposited in the bank as a time deposit and draws interest. It can only be withdrawn by consent of our board of directors. All amounts realized from sale of replaced machinery, scrap, wire or any part of our equipment, is credited to this account. Sinking fund is for bond redemption only."

3. "Upon the actual cost of our plant we figure a depreciation of 8 per cent and invest the amount where we can find and receive the best interest rate."

4. "Charges of 8 per cent annually, investing not to exceed one-half in improvements and the balance in the bank at 4 per cent per annum for replacements."

5. "We figure 6 per cent for depreciation in computing the cost of energy, but have never been able to create a sinking fund to take care of the item. We consider 6 per cent a low figure."

6. "We charge 5 per cent of our total investment each year for depreciation. Ten years' experience shows that this is not enough, and hereafter the charge will be 7 per cent.

"Depreciation is the one thing that makes electric lighting in a small town a poor business."

7. "As a rule electric installation is without sufficient capital. They soon find themselves face to face with the proposition of providing for their extensions and depreciation, and at the same time meet the expectations of the stockholders for dividends. It has been our custom to put sufficient money into the plant each year in the way of repairs to maintain its value. The objection to this plan of providing for depreciation is that it is not uniform. One year we have little or no repairs, while next year the repairs are excessive.

"In the present state of the business I should think a fair allowance for depreciation would be from eight to ten per cent on the cost of construction. While it is true that electric apparatus as built to-day perhaps has a life of more than ten years, still in the readjustment of things occasioned by the growth and development of the business and the growth and development of appliances, our past experience will indicate that we will rarely ever use a piece of machinery more than ten years.

"We believe that a fixed per cent on original cost should be placed in the sinking fund each year to provide for depreciation, and that this sinking fund should be invested to the best possible advantage; but we think you will find very few companies in this State providing a sinking fund.

"It is not wise for a manager to overlook this item because it is something that must be provided for, and while he may be able to evade it for a few years, it will finally present itself in an aggravated form and there is no escape."

8. "We had no bonded indebtedness until May, 1904, when a mortgage of $650,000 was given to secure a bond issue in like amount. The entire proceeds from the sale of bonds, with an additional $100,000 advanced by the stockholders on the company's note, was put into the reconstruction of the property. The physical condition of the plant previous to the reconstruction was exceedingly bad, and the entire income was required for repairs and operation, leaving no surplus for dividends or other purposes.

"Under Article XIII of the general trust deed the following provision is made for a sinking fund:

"'A sinking fund shall be created and maintained during the uncancelled existence of this mortgage for the payment in part of the principal of the bonds hereby secured, and shall consist of the payment in the sum of $15,000 on the 30th day of April in each year on and after April 30, 1908, by the company to the trustees, which annual payment company agrees to make to the trustees.'

"'It is further provided that the trustees shall hold the annual payments until the disbursement thereof, allowing the company interest thereon; this interest to be added to the sinking fund annually. The money so accumulating shall be used from time to time for the purchase by the trustees of the bonds as a price not to exceed 5 per cent par; the bonds so purchased shall be cancelled and delivered to the company.'

"You will note that the annual payment of the $15,000 is not effective until 1908. We are with the commencement of the year, however, charging off 20 per cent of the gross receipts each month to depreciation and maintenance. From this amount we subtract the actual maintenance cost for the month, the balance being charged to depreciation.

"In my opinion there are few companies in the State which have a broad provision for depreciation and sinking fund. This provision should undoubtedly be made, otherwise at the expiration of the life of the bond issue, the property will be sadly depreciated in value and no funds in hand to put the same in the physical condition which attained at the issuance of the bonds.

"Capital is becoming more insistent that sinking fund provisions be made, although the majority of bond issues now in effect carry no such provision."

The above quotations and other information contained in the letters of the members who believe in and practice the recognition of depreciation as a factor in central station finance are from cities of from 3,000 to 50,000 population widely distributed over the State. Evidently some plant managers are thinking hard over the question.

Reference has been made to members presenting arguments against depreciation as an element of productive cost. One member writes, "In regard to depreciation, I will say that I differ from most people on this subject. We do not charge off any depreciation. When any part of our machinery gives out we repair it or replace it with new and charge it to expense. If a pole is decayed and unsafe we replace it with a new pole and charge it to expense, and so on through the entire system. In this way we pay for our depreciation as it comes. We classify our accounts to a certain extent. We have an account for meters, transformers, coal, repairs to boilers, station supplies, equipment, etc. Meter repairs are charged to expense, and new additional meters are charged up to meters. A new meter to replace an old one is charged to expense. Same with transformers, etc. Annually, or as often as desired, we can balance up our accounts and see how we stand."

But he concludes with this statement, "If a plant is making more than a fair dividend I would set aside some of it for a surplus and put it in a good bank at interest. Then in case of a breakdown or extension of plant there would be some ready money."

It would seem as though the last statement qualifies materially the non-belief in depreciation accounts and that the writer really would charge off depreciation if his business would pay him well enough to enable him to do so.

Another member writes, "If a plant is earning sufficient money to take care of the maintenance which must include all replacements and renewals, and interest on the investment, and has anything left it would seem better to pay it to the stockholders in extra dividends than to run the risk of holding it in a sinking fund. Keeping the fund safely would be a problem. Keeping it profitably invested, still more of one; but when it is paid to the stockholders as it accumulates all this is avoided."

To this view of the case there might be presented the question, How will these same stockholders feel if extraordinary expense, such as replacing obsolete equipment, necessitate an assessment? and how much worse will their heirs or assigns feel who have not directly received the previous large dividends? Is it not better to anticipate such a contingency by having a fund to meet it?

The author then takes up the theory of depreciation calculations as laid down by Matheson in his book on "Depreciation of Factories," and figures on a concrete example of factory depreciation. He also quotes percentages of depreciation from Dawson's "Engineering and Electric Traction Pocket Book."

As to the method of investment of the depreciation sinking fund, there are several avenues for ready money. Improvements in the plant or extensions are legitimate if they will pay the interest on which the annuity is based. Otherwise not. A line 10 blocks long to supply light to one or two houses at the end would not be remunerative enough for this purpose. It should be constantly borne in mind that the depreciation allowances are each specific and their use for other purposes should not be tolerated.

Repairs and maintenance must be regarded as distinct from depreciation sinking fund, and it is necessary that they be otherwise provided for.

Test of a Curtis Turbine at Waterloo, Iowa.

At the Iowa Electrical Association convention at Des Moines, April 18, figures on the official test of a 500-kw Curtis steam turbo-alternator at Waterloo, Iowa, were given by Austin Burt, superintendent, and Niels Christensen, chief engineer of the electrical department of the Citizens' Gas & Electric Company, in which company's station the turbine was installed. The tests were carried on entirely by the operating company. The steam consumption was determined by weighing the condensed water. The report is as follows:

The turbine is of the latest four-stage type and was placed in service February 9, 1906.

Steam is supplied at 150 lb. pressure without superheat, and efficient means is employed for removing moisture. The step-bearing is furnished with water under 300 lb. pressure by a pair of duplex pumps, one being held in reserve. No accumulator is used. Oil for the middle and the top bearings is supplied by small duplex pumps. The condensing apparatus is of the surface type, and the air pump is of the Edwards type, and is driven by a 12-hp motor. A centrifugal pump driven by a 30-hp motor is employed for supplying circulating water to the tubes of the condenser.

The condensed water for measurement was discharged into a tank arranged with compartments so that the step bearing water can be taken from the first compartment and returned to it, thus eliminating entirely the correction for the step-bearing water.

Excitation current is furnished by a 25-kw horizontal Curtis turbo-exciter, the steam from which is used for heating feed water in an enclosed heater. The steam from the feed pump is also used in the same heater. By means of by-pass valves it was possible to determine the steam consumption of both of these auxiliaries. The steam used by all of the step-bearings and the oil pumps was condensed by coils immersed in cold water, and thus the amount of steam which was consumed by these pumps was ascertained.

All of the instruments and weighing scales were carefully checked and calibrated before the test and may be relied upon within one per cent.

The conditions of the test are as follows: First, one-half load; second, variable load; third, full load; fourth, 50 per cent overload. (All without auxiliaries.)

The normal load on the station varies from 300 kw to 500 kw, and a water rheostat was provided in order to secure sufficient load for overload test and maintain uniform operating conditions.

Following the tests on the turbine a series of three tests was made on two reciprocating engine-driven units: These units are: One 450-hp cross-compound condensing Buckeye engine, direct-connected to a 300-kw General Electric alternator. One 200-hp cross-compound condensing Buckeye engine direct-connected to a 133-kw General Electric alternating-current generator.

The condenser for this equipment is of the Wheeler admiralty type, with water, steam and air pistons on one rod. These units are excited by the turbine exciter. The conditions of the tests are as follows: First, 300-kw engine alone, full load; second, both engines in parallel, full load; third, both engines in parallel, variable load. In each of these tests no account was taken of the steam used by the auxiliaries.

The results of these various tests are as follows:

Table I.

	A Length of test, hours.	B Average load, k.w.	C Per cent of capacity.	D Steam pressure, lbs.	E Vacuum in ins.	F Total steam used, lbs.	G Steam per k.w. hour, lbs.	H Builders' guarantee, lbs. per k.w.-hour.
1. Turbine; ½ load......	1	253	50.6	150	27.87	5,487	21.67	23.5
2. Turbine; variable load.	8	366	73.2	149	26.01	63,955	21.82	23.0
3. Turbine; full load.....	2	518	103.6	147	27.81	20,370	19.61	21.
4. Turbine; 50% overload	1	750	150.	144	28.02	14,635	19.52	21.5
5. 300-k.w. engine, full load.	1	301	100.5	147	21.70	6,432	21.34	24.15
6. 300-k.w. engine, full load and 133 k.w. engine in parallel.........	1	432	100.0	141	20.42	10,084	23.34	24.82
7. 300-k.w. engine and 135 k.w. engine in parallel on variable load....	2	292	67.4	129	22.29	15,423	26.52	...

The vacuum under column E is absolute, and the steam per kw-hour under column G is connected for moisture and vacuum on the basis of 1.25 lb. for each inch of variation from 28 in. absolute.

Table II.

	Average, k.w.	Step and oil pumps, lbs.	Circulating and air pumps, lbs.	Exciter, lbs.	Total auxiliaries, lbs.	Generator, lbs.	Total generator and auxiliaries, lbs.	Total coal per k.w.-hour, lbs.
8. Turbine; ½ load......	253	.47	2.86	1.61	4.94	21.67	26.61	4.09
9. Turbine; variable load	366	.31	2.01	1.05	3.37	21.82	25.19	3.87
10. Turbine; full load....	518	.24	1.28	.95	2.47	19.61	22.08	3.27
11. Turbine; 50% overload	750	.18	.88	.65	1.71	19.52	21.23	3.34
12. 300-k.w. engine; full load....................	301	..	1.46	3.32	4.78	21.34	26.12	4.03
13. 300-k.w. engine and 133 k.w. engine at full load and in parallel....	432	..	1.28	2.36	3.64	23.34	26.95	4.24
14. 300-k.w. engine and 133-k.w. engine on variable load in parallel....	292	..	1.89	3.25	5.14	26.52	31.68	4.88

In Table II will be found the combined results of the generator and auxiliaries together with totals used per kw-hour. The results are all referred to the kilowatt load on the generator, thus giving the relative amount of steam required to operate each auxiliary.

Ithaca Meeting of the American Electrochemical Society.

The ninth general meeting of the American Electrochemical Society was held in Ithaca, N. Y., from May 1 to 3. In our last issue mention was made of the fact that the first session was opened by a felicitous speech of the president of Cornell University, Dr. Schurmann, who pointed out the interests which Cornell University and the American Electrochemical Society have in common in applying science to the wellfare of mankind. Prof. Bancroft replied as president of the society.

In the short business meeting of the society which followed, the results of the election of officers were announced, Mr. Carl Hering having been chosen president. Some other announcements of general interest made during the following days were to the effect that the Frenzel prize for a paper on rare metals has been given to Mr. Gin, of Paris, and that the first grant of $100 out of the society's funds for special research work has been awarded to Dr. Lincoln, of the University of Illinois, for an investigation on the electrolytic corrosion of brass and special bronzes.

The mornings were devoted to the reading and discussion of papers, the afternoons to visits and excursions. On the afternoon of May 2 the chemical laboratory, the dynamo laboratory, the engineering laboratories and shops of Cornell University were visited. On May 3 excursions were made to the filtration plant of the university, to the hydraulic laboratory, the power plant in the gorge and to the works of the Ithaca Gun Company, while in the afternoon of May 4 an excursion was made to the very interesting works of the Remington Salt Company.

On the evening of May 2 a most enjoyable smoker was held in the rooms of the Town and Gown Club, while the next night a subscription dinner was served at the Ithaca Hotel, Mr. H. B. Coho distinguishing himself as toastmaster.

On the afternoon and evening of May 3 many of the Electrochemical Society party attended a lecture of Mr. E. G. Acheson on "Discovery and Invention" in the Sibley Dome, while in the evening of the same day Dr. Wiley lectured on some special points of the pure food problem.

The general feeling of good fellowship and the excellent quality of most of the papers presented rendered the Ithaca meeting one of the most successful ones in the history of the society.

In the following we give concise abstracts of all the papers presented in the afternoon:

AN INSTRUCTIVE LABORATORY EXPERIMENT IN APPLIED ELECTROCHEMISTRY.

The first paper of the session of May 2 was presented by Prof. W. H. Walker, of the Massachusetts Institute of Technology, who pointed out that one of the most important functions of a laboratory experiment in applied chemistry, as distinguished from an experiment in general or pure chemistry, is to enable the student to acquire an economic point of view. The principal requirements of experiments of this nature for laboratory work were discussed and as an example of a method meeting the chief requirements more or less perfectly was mentioned the preparation of bleaching liquor by the electrolysis of brine without a diaphragm.

The author described in detail how to arrange the experiments relating to this problem and how to plot instructive curves from the experimental results. The last of these curves gives the cost of the process and the minimum point of the curve indicates the best conditions under which the process may be carried out. Dr. Walker recommended the division of a class of students into different groups working under slightly different conditions and the final summarization of the whole work of the class in curves so as to find the best possible method of operation.

SOME PRINCIPLES OF THE RESISTOR FURNACE DESIGN.

A highly mathematical paper, making free use of calculus, was presented on this subject by Mr. C. L. Collens, Jr., whose analysis resulted in the following practical conclusions for the design of electric resistance furnaces in which the current passes through the resistor only. Increase as far as possible the ratio that the surface of productive heat diffusion bears to the surface of non-productive heat diffusion. Increase up to the economical commercial limit the rate of energy supply per unit of surface of productive heat diffusion. Avoid as far as possible in the furnace design, shapes or conditions which give lines of flow of heat which are widely diverging. Surround the productive zone of the furnace with materials which are as refractory as possible both as regards thermal conductivity and thermal capacity, and which will still withstand the conditions to which they are exposed. The application of the principles evolved in the mathematical analysis to actual design of various electric resistance furnaces formed the conclusion of the paper.

ELECTROLYTE DENSITY IN STORAGE CELLS.

A paper on this subject by Mr. Lamar Lyndon was then presented in abstract. The author stated that the ordinary formula for the reaction in the lead cell according to which two molecules of lead sulphate and two molecules of water are formed during discharge from one molecule of lead peroxide, one of lead and two of sulphuric acid. But in practice it appears that the higher the rate of discharge the less is the abstraction of sulphur and oxygen from the electrolyte between the plates and the smaller its diminution in density. This fact, however, does not contradict the above theory since the electrolyte which undergoes the chemical reaction is essentially that acid which is contained in the pores of the plates and not outside between the two plates.

The author then discussed at some length the best density in storage cells. This depends, of course, on other factors. For instance, a plate in which the active material is thin and very porous, gives the maximum amp.-hour efficiency with an electrolyte of lower density than a plate with a thick layer of active material. The proper theoretical density of the electrolyte for any cell is that which will most nearly average 1.224 specific gravity (maximum of conductivity) throughout the range of operation. The author further gave a formula for computing the quantity of electrolyte required in cells. The paper was concluded by the following table giving averages of general practice in the United States concerning the electrolyte in storage cells, its initial and terminal densities and average quantities.

Kind of plates.	Character of service.	Discharge rate in hours.	Density initial.	Density terminal.	Lbs. electrolyte 100 amp-hours.
Pasted positive and negative.	Motor car propulsion	4	1.300	1.160	4
Plante positive pasted negative.	General use small sizes	8	1.210	1.187	--
do	General use large sizes	8	1.210	1.177	15
Planté positive and negative.	General use small sizes	8	1.200	1.180	25
do	General use large sizes	8	1.200	1.165	15

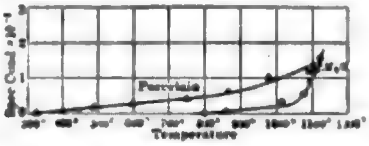
ELECTROLYTIC CORROSION OF STRUCTURAL STEEL.

A paper by Mr. Maximilian Toch deals with the important problem of protecting the steel structures of buildings, etc., against the electrolytic effects of stray currents. While such destruction goes on, the author emphasized that it is not nearly as bad as some people think. He had made extended tests in which two pieces of steel of known high-grade quality were immersed in wet earth and a small current from an outside source sent from one plate to the other for a long period. In every case the anode plate rusts very rapidly while the cathode plate remains in good condition and free from corrosion. The first oxide which appears on the anode is the green oxide. When a third plate, not connected to the circuit, was inserted in the earth between the other two plates, it showed corrosion almost midway between that of the two others. Electrolytic rust is a totally different oxide of iron than chemical rust. Steel cannot be protected against corrosion by simply embedding it in concrete, but the proper way is to first cover it with an insulating paint and then place it in concrete. This method has already found application in the power house of the Pennsylvania Railroad in Long Island City and in other places.

In the discussion Mr. Carl Hering suggested to connect the steel structure with a large piece of zinc so as to make the steel structure naturally cathode. (The same method is already used with boilers.) Mr. Acker spoke at some length on the destruction of gas pipes from stray currents from a railway system. In the special case referred to the remedy consisted in improving the bonds between the rails and installing special return feeders. Mr. Hering pointed out that it is not proper (as is usually done in investigating the stray currents of railways) to assume a large current with a large difference of potential since this method does not take into account at all the conductivity of the ground, which may vary immensely.

FUSED MAGNESIUM OXIDE.

A paper by H. M. Goodwin and R. D. Malley gave the results of an experimental investigation of the physical properties of fused magnesium oxide, as well as some notes on the construction of articles from this material. The specific gravity is about 3.5 to 3.6, the melting point about 1,920° C., while the specific conductivity may be seen from the adjoining diagram, which also gives a comparison between the conductivity of porcelain and magnesia at different temperatures. As Mr. Hering pointed out in the discussion, the specific conductivity is evidently given here in meter-square millimeter-reciprocal ohm units. At temperatures below 1,100° C., magnesia is a much better insulator than porcelain. There is a close agreement between the value efficiency of fused magnesia and that of platinum, and this should prove a valuable property in the construction of apparatus involving joints of the two materials. Fused magnesium oxide possesses in a remarkable degree the ability to withstand chemical action of many neutral salts at high temperatures.



COMPARATIVE CURVES OF ELECTRIC CONDUCTIVITY OF PORCELAIN AND FUSED MAGNESIA

In the discussion Messrs. FitzGerald and Bennie pointed out the very large effect which the addition of small impurities has on the properties of the material. Mr. Hering called attention to the fact that at 1,500° C. the resistivity of magnesia is 700,000 times as great as that of copper at ordinary temperatures, while the Nernst lamp has a resistivity 400,000 times that of copper.

CATHODE DISINTEGRATION OF CARBON—REDUCTION OF METAL SULPHIDES—A NEW SILICIDE OF MOLYBDENUM.

Three papers with the above titles were then presented together in abstract by Prof. C. F. Burgess, all three papers emanating from the University of Wisconsin. The first paper, by G. I. Kemerrer, on the cathodic disintegration of carbon in an electrolyte of fused sodium chloride, calls attention to the fact that carbon remains unattacked as anode and is rapidly consumed when used as cathode. Some experimental results were given.

The second paper, by O. W. Brown, refers to the reduction of metal sulphides to metal, when mixed with lime and carbon and heated in an electric furnace. This process is successful with zinc sulphide and with molybdenite, the reduction being complete. On the other hand, reduction and distillation of antimony from a charge of stibnite, lime and carbon is incomplete.

The third paper, by O. P. Watts, refers to a new silicide of molybdenum having the formula $MoSi_2$.

A NEW SODIUM PROCESS.

The last paper of the Tuesday session was presented by Mr. Edgar A. Ashcroft, of London, England, on his new electrolytic sodium process, which is to be worked in a plant in Norway. Its chief commercial advantage rests in the fact that the metallic sodium is here obtained from the cheap sodium chloride, while in the Castner process, now in commercial use, the more expensive sodium hydroxide is electrolyzed. The equipment consists of two cells: in the first fused sodium chloride is electrolyzed with a fused lead cathode (just as in the Acker process); the molten lead-sodium alloy is passed over into the second cell, where it forms the anode, fused sodium hydroxide being the electrolyte and metallic sodium being set free at the cathode as in the Castner cell. The sodium hydroxide in the second cell is not consumed. The author described a device for stirring the solution by an electromagnetic device. In the discussion which followed, several speakers questioned the efficiency of this electromagnetic stirring method, but Mr. Ashcroft pointed out that this requires so little power that the efficiency has comparatively no effect.

PRESIDENTIAL ADDRESS.

At the last convention Prof. Wilder D. Bancroft had presented an experimental lecture on the chemistry of electrochemistry in which he emphasized that in many cases it is useful to consider electrochemical reactions (especially secondary reactions) from a purely chemical point of view. His address as retiring president, which was presented on the evening of Tuesday, dealt with the electrochemistry of chemistry and showed how electrochemical methods may be made use of for studying problems which are apparently strictly chemical. This point of view was illustrated by many examples relating to chemical and electrolytic corrosion. It is a general rule that if a metal becomes passive as anode in a solution it cannot chemically rust in such a solution. To study the chemical corrosion of iron, steel and other alloys would require a very long time during which it would be most difficult to keep the conditions constant, while the parallel case of electrolytic corrosion can be easily and exactly investigated.

LABORATORY RESISTANCE FURNACE.

The first paper of the Wednesday session, by Mr. G. R. White, described laboratory furnaces for the production of calcium carbide and carborundum. Two types of resistor were used, one a carbon rod and the other a core of crushed pressed carbon. The furnaces are cheap and instructive and may be used to advantage where not too much power is available in a laboratory.

ELECTROCHEMICAL PROCESSES AS STATION LOAD EQUALIZER.

Mr. E. A. Sperry pointed out the possibilities of central stations giving off electric energy at times of low load to electrochemical industries for cheap rates. He divided the central stations into three classes, according to the length of time during which they can guarantee to deliver energy to the electrochemical plant. In the first class energy for 98 per cent of the whole hours in the year can be guaranteed; in the second class 96.5 per cent and in the third class 92.6 per cent. To avoid transmission cost, it would be useful to erect an electrochemical plant which intends to take energy from the central station near the same. Mr. Sperry had inquired concerning the price at which central stations would be willing to supply energy at times of low load; this price varies between 0.28 cent and 0.41 cent per kw-hour. In the discussion Dr. J. W. Richards emphasized that almost all electrolytic processes are continuous, but that some electrothermic processes are intermittent, and these latter ones could be utilized in this connection. Mr. Howard called attention to the availability of exhaust steam which could be sold from large power stations to chemical industries for evaporating purposes. Dr. Bancroft remarked that at the Remington salt plant (which was visited) electricity is generated for light and traction purposes, while the exhaust steam mixed with some live steam is used for evaporation.

VACUUM FURNACE.

A very interesting paper on an electric vacuum furnace was presented by Mr. W. C. Arsen. The furnace is of the resistance type and is very well worked out in detail, the resistor being a helix of graphite inside of which a crucible containing the articles to be heated is placed. The estimation of the temperature in the furnace is easy since temperature and current have a fixed relation to each other. It is possible to reach 3,100° with the furnace, but the life of the resistor is short in this case; 2,700° C. seems to be the evaporizing point of carbon in a vacuum.

ELECTROLYTIC CORROSION AND ELECTRODEPOSITION OF BRONZE.

Two papers by Mr. B. C. Curry gave very interesting applications of the general principle of chemical and electrochemical corrosion, explained the night before by Dr. Bancroft. Mr.

Curry's experiments related to the special case of copper-tin alloys. The author experimented with sodium nitrate, sulphate, acetate, chloride and other solutions. The results confirm the parallelism between lack of chemical corrosion and anodic passivity. In the case of bronze the passivity is due to a film which was found to consist practically of tin oxide. All the bronzes dissolve in the chlorides. The results were checked by parallel tests with chemical corrosion. The second paper presented by Mr. Curry somewhat later during the same session referred to the reverse problem, namely the electrodeposition of bronze. In this case it is impossible to get good deposits from the chlorides; the best results were obtained with ammonium oxalate, made slightly acid with oxalic acid.

CORROSION OF IRON.

A paper by Prof. C. F. Burgess and Mr. S. G. Engle gave the results of a study of the corrosion of iron by acids. Of course the rate of solution depends largely upon the elements with which the iron is associated. But the percentage of purity is not the controlling factor, as is shown by the observations of the authors that the heated and unheated specimens of electrolytic iron, essentially the same as far as chemical composition is concerned, exhibited the widest possible variations in rate of solution. The crystalline or granular structure of iron seems to influence rates of corrosion in a marked degree.

The rapidity with which unheated electrolytic iron liberates hydrogen in a dilute acid solution suggests a useful application of this material in the production of pure hydrogen by replacing zinc which is now commonly used. Electrolytic iron liberates hydrogen about four times as rapidly as does pure zinc and twice as rapidly as the commercial grade. Another advantage in the use of electrolytic iron for hydrogen generation lies in the greater purity of the resulting gas as compared with that obtained from zinc.

Traces of arsenic exert such a marked influence in protecting iron from the corroding action of acids that the employment of this element for protection against ordinary corrosion appears worthy of further investigation.

NICKEL PLATING.

A brief paper by Mr. Isaac Adams gave a sketch of the development of the nickel plating industry in the sixties. His remark that the art is to-day carried on substantially as it was in 1869 and 1870 with the same solutions, the same anodes, and the same details of shop manipulation, was resented in the discussion. Prof. Bancroft suggested to add a slight percentage of nickel chloride to the usual electrolyte and use rolled copper anodes.

LEAD FROM ACETATE SOLUTIONS.

In a brief paper on this subject R. C. Snowdon showed that it is quite possible to get a good plating deposit of lead even from an acid solution (by using a revolving cathode and a slight addition of gelatine to the solution and proper conditions of current density and temperature). The favorable conditions are the same for lead as for the other metals, but the method is not intended to be commercial.

STRUCTURE OF ELECTRODEPOSITS.

A paper by Prof. C. F. Burgess and Mr. O. P. Watts was essentially an exhibition of numerous lantern slides showing the structure of electrolytic iron deposits and pointing out some analogies in the structure between electrolytic deposits and geological deposits. While the photographs were extremely interesting, it is of course impossible to abstract the paper without the illustrations.

CADMIUM STANDARD CELL.

The next paper, by Dr. G. A. Hulett, on the Weston standard cadmium cell, brought an almost sensational announcement with respect to the important question of the Weston cell as a primary standard. Dr. Hulett was formerly Prof. Carhart's co-worker on the cadmium cell and has more recently continued this research at Princeton. He produced in his paper a great amount of evidence showing a drifting of the cadmium cell's e.m.f. in the course of time. It is slight, but it is there, and the trouble is not due to the mercurous sulphate. It appears that the cathode leg, as at present constructed, is not a system in equilibrium. While the cadmium cell is an ideal secondary standard, the above observations would seem to eliminate it as a primary standard. The paper was discussed by Messrs. Patten, Miller and Bancroft.

FERRO-MANGANESE ANODES.

The last paper of the Wednesday session, by G. R. White, referred to ferro-manganese anodes in caustic potash and especially to the secondary reduction of the permanganate to the green manganate under certain conditions.

COLLOIDS.

The first paper of the Thursday session was on colloids, Dr. H. E. Patten, of the Bureau of Soils of Washington being the author. The paper was not experimental, but philosophical, and discussed the migration of colloids as an adsorptive phenomenon with as few hypotheses as possible.

REGENERATION OF AIR BY OXONE.

A paper by Dr. R. von Foregger and Mr. G. F. Brindley gave reports of experiments with fused sodium peroxide ("oxone") for the regeneration of air in submarines. Oxone when acting with water forms sodium hydroxide and oxygen, which is given off as gas. If there is carbon dioxide in the air it is absorbed by the sodium hydroxide in solution, forming sodium carbonate. The experiments of the authors show that it is decidedly practical to use oxone for the regeneration of air in enclosed spaces, which are to support animal and human life. The process is, therefore, specially applicable for submarine boats, but was also recently advocated by Dr. von Foregger for the purification of air in the New York Subway.

SWITCHBOARD.

A brief paper by Prof. W. D. Bancroft gave a description of the very convenient lecture room switchboard used by him for his electrochemical lectures.

ALTERNATING-CURRENT ELECTROLYSIS.

A paper by G. R. White discussed alternating-current electrolysis of a solution of sodium hyposulphite with cadmium electrodes yielding cadmium sulphide. The efficiency is, however, too low for a commercial process. The author found that the efficiency depends almost entirely on the electrode surface exposed and is practically independent of current strength, of temperature and of stirring.

ELECTROLYTIC CHROMIUM.

A paper by Prof. Max Le Blanc, of Karlsruhe, Germany, was essentially a reply to some criticisms in a former paper by Carveth, and also gave the results of an experimental investigation made in the author's laboratory. He concluded that thin deposits of chromium of finest quality can be applied on brass, carbon and copper from a chromium alum solution, but he did not succeed in getting a thicker deposit than 0.13 mm. In the discussion it was stated by Dr. Carveth and Prof. Bancroft that it is quite possible to get thicker deposits, and it was suggested to use chromium acid as electrolyte.

FREE ENERGY.

A highly theoretical paper by Dr. M. deK. Thompson, Jr., gave a summary of calculations of the free energy of some halogen and oxygen compounds computed from the results of potential measurements. The paper was read in abstract by Prof. Miller.

ELECTROLYSIS OF CAUSTIC SODA.

A paper by Prof. J. W. Richards on this subject gave a historical review of the various processes for electrolyzing caustic soda for the production of sodium, which have been either proposed or introduced into practice. The full paper when printed will be useful for reference.

POTENTIAL DIFFERENCES.

A paper by Prof. L. Kahlenberg and Mr. A. S. McDaniel gave the results of an experimental determination of the potential difference between manganese and lead peroxides and various aqueous and non-aqueous solutions. The general conclusion of the authors is that the difference of potential between the peroxide electrode and the solution into which it dips is to be ascribed to the chemical affinity; that is, chemical strain or potential between electrode and liquid.

SILVER COULOMETER.

A paper by Prof. H. S. Carhart and Mr. F. S. Willard recommends the use of silver perchlorate as electrolyte in the silver coulometer (or voltameter) and it is stated that this electrolyte eliminates all the disadvantages of the nitrate solution.

ERRORS IN PYROMETRY.

The last paper of the convention, which was by E. S. Shepherd, related to errors in pyrometry. With the thermo-electric pyrometer it is necessary to avoid the contamination of the element, to take care that the galvanometer needle does not stick and to make sure that the cold junction is kept at constant temperature. The thermo-electric element and the material to be investigated must be in very intimate contact. The author emphasized the importance of the time factor in such measurements. In the radiation pyrometer errors are sometimes due to the body not behaving strictly as a black body, while in certain cases dense vapors are given off which prevent exact measurements. In the discussion Mr. F. F. Schuetz pointed out that the new thermoelectric pyrometer of Prof. Bristol avoids many of the disadvantages mentioned by the author, especially by the automatic compensation for the error due to changes of temperature of the cold junction.

On a motion of Prof. Richards resolutions were passed expressing the thanks of the society to the authorities of Cornell University and to all those who had made the meeting such a pleasant and full success.

Accuracy in Wiring Calculations.

Mr. Albert Scheible read a paper before the electrical section of the Western Society of Engineers of Chicago, April 20, on the subject, "What Degree of Accuracy Is Feasible and Necessary in Wiring Calculations?" Mr. Scheible showed that many of the common refinements in wiring calculations were entirely unnecessary in practical work because of the inherent inaccuracy of many of the factors in any ordinary wiring problem. He suggested that for rough work wiring tables could be used in which the figures were not carried out as many decimal points as is usual. An interesting discussion followed the reading of the paper. Chairman Junkersfeld said that the difference in heat radiation from conductors in different locations will make enough difference in results to upset many fine calculations. Mr. George A. Damon brought out the many variable factors entering into the calculation of feeders, especially feeders for railway work. The permissible drop may vary so greatly, according to the ideas of the builders and the condition of the company's treasury that an intelligent guess is often better than fine calculations. He thought, however, that the young engineer should guess with considerable caution, especially at first, and that only after having done some careful calculation in advance. His company had probably been responsible for the installation of several million pounds of feeder copper in the last few years and yet out of all that only one test had been made for conductivity. Perhaps greater attention should have been given to this matter, but there were other factors which would throw calculations off even more than a slight difference in conductivity, especially in railway work.

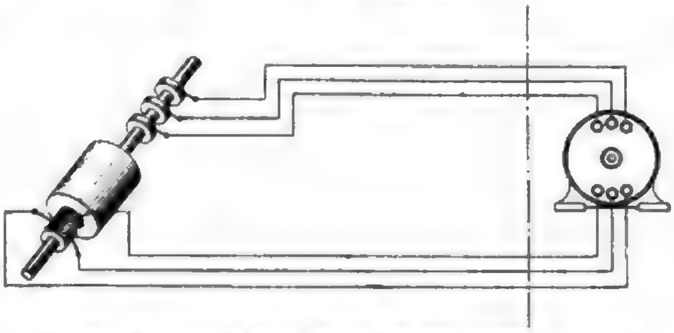
Mr. Junkersfeld, in speaking of the conductivity tests, said that his company—the Chicago Edison—had been averaging an installation of approximately one million pounds of copper per year for several years, in which time only two tests of conductivity had been made. This he believed due, however, not so much to indifference to this matter as to the fact that commercial copper of such purity is now turned out that the conductivity is in any event so high that it is not necessary to subject the material to test.

Prof. Morgan Brooks, of Urbana, Ill., who at one time had charge of the wire testing for the Bell telephone interests of the country, gave a long list of possible errors in the appraisement of conductivity of copper wire and in the calculation of wiring. The determination of copper wire conductivity is extremely difficult because of the trouble in measuring the diameter of the wire. Wire is usually not round after it has been wound into coils. He had sometimes found wire which, according to all tests, he could make, had over 100 per cent conductivity. Being fearful of losing his job, however, he was careful never to make such a report, but to simply say the wire was up to specifications.

Prof. P. B. Woodworth told of a similar experience in finding a wire of 101 per cent conductivity. He had not been so diplomatic as Prof. Brooks, however, and had made an exact report, with the result that he got no more tests to make for that customer. He did not altogether agree that all commercial copper wire is good enough so that it does not need testing. He had tested some which looked as good as any but which had only 70 per cent conductivity. Some of the brasses used in lugs and switch terminals are most deceiving, having frequently such low conductivity that they cause overheating and melting of switchboard fuses. He always urged upon his students not to let their mathematics run away with their common sense in making calculations and cited some amusing examples where calculations were carried out a number of decimal points, while the accuracy of measurement could not be even within one decimal point. The ethics of the wiring table are bad because a table purports to give exact figures on matters which are necessarily approximations. It would be better if a table should give the upper and lower limits within which variation might reasonably be expected or within which authorities differ, and then a student would know within what limits of error he was working.

A Variable-Speed Power Transmission System Using Induction Motors.

The accompanying diagram illustrates a method of operating an induction motor at four different speeds, as disclosed in a patent issued April 24 to Mr. William Stanley. A double-frequency generator supplies 5-cycle current to the stator winding and 15-cycle current to the rotor winding of the induction motor, one or both, as may be desired. Assuming a two-pole induction motor, it will operate at 300, 600, 900, 1,200 r.p.m., according to the connections of the stator and rotor windings to the supply systems. When the stator winding receives 5-cycle current and the rotor winding is short-circuited on itself, the speed will be 300 r.p.m., less the slip. A synchronous speed of 600 r.p.m. is obtained by energizing both the rotor and the stator simultaneously, the revolving fields in the two members being arranged to travel in the same direction. When the rotor winding receives 15-cycle current and the stator winding is short-circuited on itself, the speed will be 900 r.p.m., less the slip. A synchronous speed of 1,200 r.p.m. is obtained when the revolving fields in the two members are arranged to travel in opposite directions.



STANLEY VARIABLE-SPEED POWER TRANSMISSION SYSTEM.

The Electric Furnace in Iron and Steel Manufacture.

At the April meeting of the Faraday Society in London, several papers were presented on the use of the electric furnace in the manufacture of iron and steel. Mr. C. A. Keller describes an installation of his process by J. Holtzer & Co. at Unieux (Loire) France. This is a 1,500-hp plant, and will utilize in a single furnace the current from a 20,000-amp. Westinghouse alternator. The furnace, which rests on a steel cradle and can be tilted, weighs about 50,000 kilos; the various mechanical and electrical controls are obtained by hydraulic motors. The steel obtained from a Siemens-Martin furnace will be run into the electric furnace immediately after the oxidizing melt, and for the remaining operations of deoxidizing and refining, the current exclusively will be used. It will be possible to operate on 8,000 kilos of metal at one time, and the operation will be repeated three or four times in the twenty-four hours. The steel produced by this furnace is intended for cannons and projectiles. The author promises at a future date to furnish details of the results obtained.

Some experiments made at Livet comparing the metal obtained in a 1,000-hp Keller furnace with that obtained in the blast furnace, to show the proportions of carbon and silicon in castings produced in both ways. It appears that the Keller furnace allows of ready desulphurization and of easier variation in the proportions of the above elements than does the blast furnace; it would thus be advantageous for the production of soft castings and castings for mill work. The author has just set up at Livet a 2,000-hp furnace utilizing a current of 25,000 amperes, and capable of producing 20 tons of castings in twenty-four hours. This will be used specially for the industrial working of the process. Referred to the freezing of the metal in the central passage in the first furnace that had been erected, Mr. F. W. Harbord said the freezing trouble was probably only due to the special conditions of the first tests recorded, and in any case could be avoided by coupling two or four furnaces together. Regarding variation of silicon content, as a rule this was easily brought about by adding a little silicon pig, but it might conceivably, under special circumstances, be useful to vary it in the way described for the production of good castings. Professor A. K. Huntington described some experiments he carried out in 1881 with the Siemens electric furnace in which he was able to vary the silicon content from ½ to 9 per cent. He had also succeeded in volatilizing copper and in making solid tungsten.

A paper contributed by Signor M. E. Stassano described a furnace being installed by the Forni Termoelettrici Stassano Company for the Italian War Office. It is of the author's well-known arc type, and absorbs 140 kilowatts yielding 2,400 kilos of steel in twenty-four hours. The currents are polyphase with 80 volts between each phase. The consumption of electrodes is under 5 kilos per ton of steel, and the cost of renewing the refractory covering of the furnace to francs per ton of metal made. The furnace is principally used for refining pig-iron and smelting scrap. The product ordinarily made is used for artillery projectiles. Mr. F. W. Harbord said the efficiency as stated was somewhat greater than in the other furnaces. For special castings there might be advantages in heating by radiation only. The figures given for carbon consumption were smaller than in the Keller or Héroult furnaces. He thought the radiation was the weak point in the furnace.

With regard to the general question of electric steel smelting, a maker had recently told him that he had sold 300 tons of such steel as crucible steel, and the buyers were so pleased with it that they were asking for more. That was strong evidence that good steel could be made in the electric furnace, but it was only high-priced steel that could be commercially made in England by such means.

A paper contributed by M. Gustave Gin described the author's canal type of furnace as now installed at the Plettenberg Works, Westphalia. Unlike in the canal form originally suggested, the electro-thermic heating and refining now take place separately, the latter in chambers which communicate with each other and with the hearth by the canals, now used exclusively for heating. The construction of a 7,200-kw furnace, utilizing 60,000 amperes at 120 volts and designed to yield over 350 tons in the twenty-four hours, was described in detail. The author claims that the furnace combines the advantages of the Martin and Talbot furnaces, the separation of the operations making exact control of composition possible.

The author's combination furnace consists of a melting and oxidizing crucible, a deoxidizing and recarburetting compartment, and a final mixing chamber. The author made suggestions for various types of induction furnaces. The use of multiple canals is proposed, so that if steel is being produced, oxidation can be carried out in one canal and reduction in the other. In another suggested type, more intimate circulation and mixing of the product is brought about by means of lateral conduits connecting the respective ends of the open flues of which the channel crucible is made up.

A paper by Mr. H. S. Coleman dealt with "Cleaning of Work by Means of the Electric Current." The work to be cleaned (usually preparatory to electroplating) is suspended in a hot solution of equal quantities of brown Montreal potash and sodium hydrate contained in a wrought-iron tank. The work and the tank are connected to a dynamo, and the tank used as the anode for five to ten minutes, the voltage being about 2.5. The current is then reversed for a short time, until the surface of the work is clear and bright. The operation is repeated as many times as may be necessary. The process causes the grease, consisting chiefly of tallow, to become saponified and go into solution. The lighter dirt is thrown upon the surface of the bath and may be skimmed off; the remainder falls to the bottom. The author pointed out the economies effected by the process as against hand-scouring.

New Telephone Patents.

SWITCHBOARD IMPROVEMENTS

The divided multiple switchboard developed by Kellogg for magneto working has been adapted to central energy working by H. M. Post, of Chicago. In this system the answering jacks are placed upon two switchboards, each having multiple jacks for its own portion of the lines. The signals are lamps controlled by relays responding to grounding push keys on either side of the line. The relays are so disposed that both operate and lock when a plug is inserted in a jack of any line, and they are thus made to serve the dual function of line and cut-off relay. One relay operated effects the proper line signal while both operated extinguishes all signals. The circuits are well developed. The patent has been assigned to the Kellogg Switchboard & Supply Company.

A second patent assigned to this company is one granted to J. G. Roberts, of Detroit, for a switchboard system providing automatic ringing. There is associated in each cord circuit a set of relays and a rotating cam device such that the insertion of a calling plug in a subscriber's jack performs all the functions of signaling. The scheme provides the following functions enumerated in the patent:

First, to effect the automatic switching of signaling current upon the line; second, to have this signaling current switched automatically on the called line at specified intervals of time, not continuously, and for a specified number of times; third, to provide for automatically signaling back to the calling party indicating a "don't answer"; fourth, to provide a visible signal that there was a "don't answer" or that the called party has answered and "hung up," which in either case serves as a disconnect signal under the control of the calling party; fifth, to automatically discontinue the ringing current when a call is answered, until after the plugs have been cleared of the jacks.

H. E. A. Andre has also patented a switchboard improvement, which is in the form of a secrecy device to prevent the operator listening in. In order to accomplish the desired result, each cord circuit is provided with a magnetic listening key which disconnects the operator as soon as the calling plug of any cord pair is inserted in a line jack. This provides for everything except that case where the operator attempts to listen in with the answering plug of a second cord pair. To prevent this Mr. Andre uses the potential differences employed for a busy signal. To this end he connects normally to the tip of the answering plug a relay which in turn controls the listening relay in a manner such that the operator not only becomes cut off upon the attempt to plug a busy line with an answering plug, but she remains cut off until the plug is returned to its seat. The Western Electric Company has been assigned Mr. Andre's patent.

CENTRAL OFFICE APPLIANCES.

The patent for the ratchet wheel rotating shaft heat coil shown in so many recent protectors of F. B. Cook, of Chicago, has now appeared. It is shown in Fig. 1 in several views. It will be understood that at normal temperatures the shaft is locked in the coil by solder. If the coil heats, the solder softens and permits the turning of the shaft and wheel. The springs of the mounting tend to turn the shaft, and release themselves to open the circuit, by snapping off and away from the teeth if the ratchet turns under their impulse.

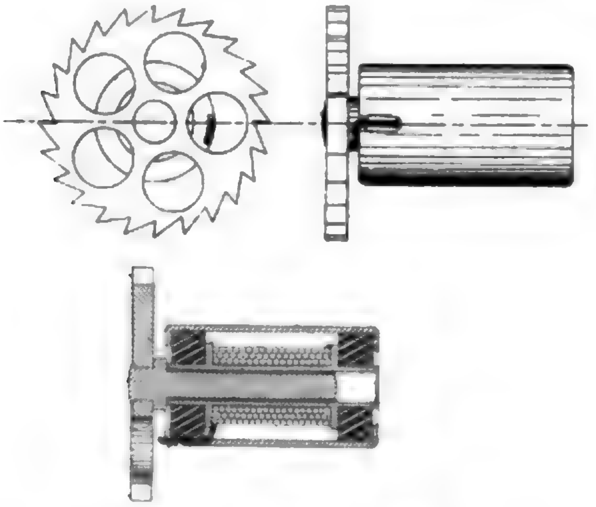


FIG. 1.—COOK HEAT COIL.

Another patent just granted to Mr. Cook is for his main distributing frame wherein he obtains the advantage of horizontal shelves, without introducing a horizontal terminal strip which interferes with earlier patents. The cable side terminals are short, vertical, wooden strips carrying the usual rubber strip and metal punchings. These strips are shorter than the vertical spacing between horizontal planes of the framework, and thus a long horizontal opening is left to permit the ready placing of wire upon the horizontal shelves. In order to keep the wire close to the shelves each terminal block must have a fanning ring. The combination of this, the horizontal rows of vertical terminal strip and the framework form the basis of the patent.

STATION DEVICES.

A new form of controller, or sending switch for automatic systems upon the Strowger circuits, has been invented by A. E. Stevens, of Fall River, Mass. Mr. Stevens evidently finds mistakes being made with the present type of rotary dial. He substitutes a key for depression, each key to correspond to the proper digit. He combines a cam and follower driven by the key levers, which suffices to drive the contact arm over a number of contacts corresponding with the number on the particular actuating key. He introduces refinements in the form of interlocks to prevent overlapping of successive digits.

H. Tideman, of Menominee, Mich., has been granted a patent for a desk stand of the general appearance of the present-day cylindrical upright knock-down stands. He makes his parts accessible, however, by forming the upright of two semi-cylindrical parts. One is stationary and is secured to the base and transmitter support and serves as a mounting for the switch parts. The other piece is nothing but a cover for these switch parts.

Two patents have been issued to J. Silverman, of San Francisco, for receiver supporting arms. This arm is similar to its many predecessors, but having as a special feature a cam and lever to operate the switch hook manually.

TELEPHONE INSTRUMENTS.

Fig. 2 shows what may be called an inverted solid-back transmitter, which has been patented by W. W. Dean, the patent being assigned to the Kellogg Company. The button casing, in the form of a ring of hard rubber, is secured to the diaphragm about one of the circular electrodes, which is also secured to the diaphragm. The mounting of the latter is at the diaphragm center, while the ring is concentric with the diaphragm and thus has little stiffening effect upon it. An auxiliary mica diaphragm serves to mount the rear electrode and close the chamber. It is claimed that by this arrangement of parts any tendency to packing is reduced by the extra agitation of the carbon granules.

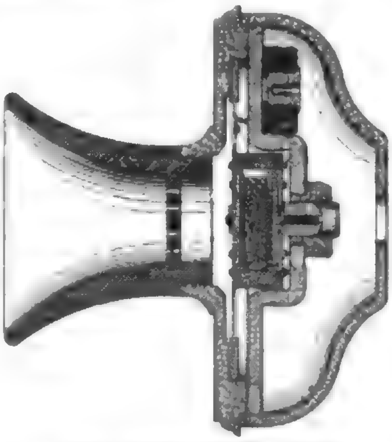


FIG. 2.—DEAN TRANSMITTER.

K. M. Turner, of New York City, has patented a folding head receiver for the use of those requiring telephonic devices to aid the hearing. Both the head band and the attaching clamp fold so that the band may be readily placed in the pocket when not in use.

PARTY LINE SYSTEMS.

Mr. E. A. Reynolds, of New York, has patented and assigned to the Iron Telephone Company a lock-out system for party lines. The grounded side of a central energy line is connected through controlling magnets at each station to earth. If the line is carrying a current, i. e., is busy, then the grounded side will be at a potential different from that of the earth, provided, of course, the battery is grounded and there be resistance at the exchange between the ground and the grounded line limb. The circuit of the magnet is carried through the switch hook contacts so that as the hook rises the magnet circuit is momentarily closed. If the line is not busy no current will flow to earth and the circuits will all be normal. If, however, the line is busy the magnet becoming energized and thrusts its armature in the path of the hook switch, thereby displaying a busy signal and opening the local telephone circuit.

Another lock-out system has been patented, this the work of C. B. Smith, of New York. This system requires three wires throughout and thus does not seem to be on a competing basis with other systems.

LETTERS TO THE EDITORS.

Liquid Barretter Litigation.

To the Editors of Electrical World:

SIRS:—As the present status of the litigation on the liquid barretter patent has been greatly misrepresented, we would be greatly obliged if you would kindly give publicity to the following statement of the facts in the case:

The following decisions have been rendered:

1. *October* 16, 1905.—National Electric Signaling Company vs.

De Forest Wireless Telegraph Company, A. White, Le De Forest, et al. Decision in favor of the National Electric Signaling Company holding that De Forest Company infringes patent and ordering an accounting for damages.

2. *November* 8, 1905.—National Electric Signaling Company vs. De Forest Wireless Telegraph Company, A. White, L. De Forest, et al. A decree of injunction against De Forest Company, A. White, L. De Forest and the officials of the De Forest Company restraining them from using, manufacturing or selling the liquid barretter.

3. *January* 27, 1905.—National Electric Signaling Company vs. Gesellschaft für Drahtlose Telegraphie, m. b. H., et al. Decree of injunction against Slaby-Arco or Telefunken Company restraining them from the use of the liquid barretter in any of its forms.

4. De Forest Wireless Telegraph Company vs. National Electric Signaling Company. Charging the National Electric Signaling Company with infringement of the Neugschwender-Schaefer-De Forest "Goo" receiver. Suit dismissed.

5. *April* 7, 1906.—National Electric Signaling Company vs. De Forest Wireless Telegraph Company, A. White, L. De Forest, et al. Decision in favor of the National Electric Signaling Company to the effect that the "Spade" electrode used by the De Forest Company infringed the National Electric Signaling Company's liquid barretter patent, enjoining the De Forest Company against further use of this type of receiver and ordering an accounting for damages.

6. *May* 1, 1906.—National Electric Signaling Company vs. De Forest Wireless Telegraph Company, A. White, L. De Forest et al. Motion brought for contempt of court. White, De Forest and De Forest Company adjudged guilty of contempt of court and arrest ordered and bail fixed at $10,000.

WASHINGTON, D. C. REGINALD A. FESSENDEN.

Temperature Effects in Spans.

To the Editors of Electrical World:

SIRS:—My attention has just been called to a slight error in my article on "Temperature Effects in Spans" which appeared in your issue for December 9, 1905. The right-hand member of equation 12 on page 988 should contain *y* cubed instead of *y* squared; also the corresponding numerical equation in the middle of the left-hand column, page 989, should read 300 cubed instead of 300 squared. The calculation has actually been made with 300 cubed, so that the result is correct as it stands.

PHILADELPHIA, PA. C. P. NACHOD.

Efficiency of Lighting Balancers.

To the Editors of Electrical World:

SIRS:—Referring to Mr. Budd Frankenfield's interesting article on "Regulation and Compounding of Lighting Balancers" in your issue of December 23, to my letter of January 13 on the above subject and to Mr. Frankenfield's reply in the issue of February 3, I note that this subject has been opened again by Mr. B. F. Jakobsen in the issue of March 24. Mr. Jakobsen has brought up a point of some interest, but considerably removed from the question at issue. When a customer purchases any piece of electrical apparatus the question of conveying energy to or from it is generally settled by other conditions, and is frequently the determining factor in its purchase.

In my letter of January 13 I dealt entirely with the efficiency of the balancer set, and the losses in the wiring should, in my opinion, be more satisfactorily considered as a separate problem, since such combined results are apt to lead to some confusion or misunderstanding between the manufacturer and customer.

The writer is of the opinion that a typographical error appears in Mr. Jakobsen's formula, for throughout he appears to consider transmission efficiency of a direct-current line as the ratio.

$$\frac{\text{Watts input} - \text{Volts lost}}{\text{Watts input}}.$$

If, however, we insert the missing current symbol the second equation becomes as follows:

$$\eta_B = \frac{I_n \times V - I^2_n\,(R + R_n)}{I_n \times V} = 1 - \frac{I_n R}{V} - \frac{I_n R_n}{V}$$

$$= 1 - \%\text{ volts lost in } R - \%\text{ volts lost in } R_n$$

Mr. Jakobsen's over-all efficiency is, therefore, simply the efficiency of the balancer set including the copper losses in the line.

Now, in the practical testing of a balancer set thick heavy cables are used, and the voltmeters connected directly to the brushes. The losses in R and R_n may, therefore, safely be neglected, in which case the value of the last "bracket" in the final equation is unity and the equation becomes exactly that given in my letter. I am, therefore, still of opinion that the statements contained in my letter of January 13 are substantially correct, and such apparently is the view courteously taken by Mr. Frankenfield in his letter of February 3.

SCHENECTADY, N. Y. C. T. WILKINSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Reactance Voltage.—HOBART.—A description of a very simple method of estimating the reactance voltage of a direct-current dynamo, when, as is usual, the machine has only one turn per segment. In such a case one merely requires to count the number of poles and the number of segments and to know the gross core length, the revolutions per minute, and the rated kilowatts and voltage. The curve in Fig. 1 gives values for K for varying ratios of λg to τ, where λg = gross core length in centimeters, τ = polar pitch at air-gap in centimeters. (If D = air-gap diameter and P= number of poles, then $\tau = \frac{\pi D}{P}$). Having obtained K, the reactance, r, per pole in ohms may, for machines with one turn per segment and multiple-circuit single windings, be obtained from the following formula: $r = K \times \lambda g \times R \times F \times 10^{-8}$, in which R = speed of armature in revolutions per minute and F = total number of face conductors on armature. When the dynamo is loaded with a current of 1 amp., then the reactance voltage is equal to $I r \div P$. When, as will generally be the case, it is not worth while bothering about greater exactness, there may be substtiuted for K the mean value of 0.4, and the formula for the reactance per pole will then read: $r = 0.4 \times \lambda g \times R \times F \times 10^{-8}$. Several numerical examples are given and it is pointed out that this method of calculating the reactance voltage brings out clearly the influence of the three main components, namely, first, the gross length of the armature core; second, R, the speed of the armature in revolutions per minute, and third, F, the total number of phase conductors.—Lond. *Elec.*, April 20.

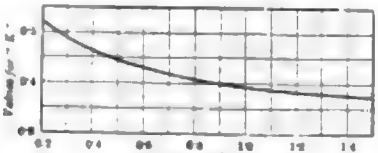


FIG. 1.—CURVE OF REACTANCE VOLTAGE.

Periodic Variations in the Magnetic Field of a Generator.—WORRALL AND WALL.—A paper read before the Manchester Section of the British Inst. Elec. Eng. on the results of an investigation into the periodic variations in the magnetic field of a three-phase generator by means of an oscillograph. The periodic variations were observed by means of the e.m.f's induced in search coils attached to the pole pieces and to the armature, and the periodic variations in the e.m.f. induced were recorded by one pair of strips of a Duddell high-frequency double oscillograph and revolving-film camera.—Lond. *Elec.*, April 13.

Unipolar Single-Phase Machines.—A fully-illustrated reprint of a British patent specification for unipolar single-phase motors and generators of the British Thomson-Houston Company.—Lond. *Elec.*, April 20.

Single-Phase Induction Motor.—BETHENOD.—A mathematical article on an exact diagram for the single-phase induction motor. The author shows that an exact theory of this motor may be based geometrically on a circular diagram analogous to that for polyphase motors, the ohmic resistance of the rotor, however, playing a more complex part. On the basis of this diagram it would perhaps be interesting to establish a method of testing which would be more exact than that now in actual use.—*L'Eclairage Elec.*, January 27 and April 14.

Rewinding Electrical Machinery.—MEADE.—An article, illustrated by diagrams, on the windings and insulation of direct-current machinery.—*Power*, May.

Power.

French Power Transmission.—BOURGNIGNON.—A fully-illustrated description of the electric transmission system by which power generated from the Sioule Falls is transmitted over a distance of about 30 km. to Clermont-Ferrand. The power house is designed for six 1,200-hp generating sets, one of which will be for reserve. Three sets and two exciters have been actually installed. Double Francis turbines with horizontal axles drive three-phase alternators delivering a current of 400 amp. at 1,000 volts. Two sets of bus-bars are arranged in order to keep the current for power purposes separate from that for lighting. The installation is made by the Westinghouse Company, and Wurtz lightning arresters are used on the line, the transmission voltage being 22,000. At the sub-station in Clermont there are two groups of three transformers of 375 kw. The e.m.f. at the distributing network is 3,000 volts.—*La Revue Elec.*, April 15.

French Hydro-Electric Plant.—SOLIER.—An illustrated description of the Var hydro-electric plant in the southeast of France. Water power is available to the extent of about 2,500 hp. There are three 600-kw generating sets, each consisting of a double Francis 900-hp, 600-kw turbine with a horizontal axle, driving directly a three-phase alternator, which generates 11,000 volts with a frequency of 25 periods per second. Three transmission lines start from the plant. The installation was made by the French Thomson-Houston Company.—*L'Eclairage Elec.*, April 14.

Coal Testing.—HOLLIDAY.—A paper read before the Dublin Section of the British Inst. Elec. Eng. describing methods and apparatus used for coal testing. The author recommends to insert the following clause in any specification. "The coal shall be delivered in a reasonably dry state, free from stones, dirt and fine slack, and shall contain on delivery —— per cent of large, which shall be that retained on a metal screen of —— meshes to the linear foot, and shall develop when tested in a ——— calorimeter not less than —— thermal units per pound of the dry coal, and shall leave not more than —— per cent of incombustible matter when completely burned in a muffle furnace.—Lond. *Elec.*, April 13.

Electricity in Mines.—LABROUSTE.—A discussion, with the aid of diagrams, of different systems of electric winding at mines, with a discussion of their advantages.—*La Revue Elec.*, February 28, March 30, April 15.

Turbine.—LOEWY.—A mathematical article giving characteristic constants of various water turbines for the sake of their classification, together with detailed information on the Francis turbine.—*Elek. u. Masch.*, April 15.

Traction.

Single-Phase Traction.—SPRAGUE, MCCLELLAN, DEMURALT.—Three contributions to the discussion of single-phase traction. Sprague, in a letter, criticises sharply the performance of the New Haven single-phase locomotive. His criticisms are directed principally toward the performance of the locomotive at slow speeds and yard work, in which he believes it will show low efficiency and abnormal heating. He also calls attention to the great weight in proportion to the capacity of the locomotive, when compared with the direct-current New York Central machine. The criticisms of McClellan and DeMuralt are in form of discussions of the recent paper of Lamme and are abstracted in an editorial. McClellan's notes relate to the entire subject under consideration, and he is in favor of single-phase traction. He pleads for a high distributing voltage and against the third rail. He refers to the desirability of operating motors in parallel to keep the load on the motors balanced. DeMuralt advocates polyphase traction. The polyphase locomotive has a constant speed characteristic which may ultimately prove valuable when fully utilized. The series motor in its output characteristics resembles the steam locomotive. He refers to the effect of difference in diameter of drivers upon the loading of the motors. "As DeMuralt explains, the difference in loading from this cause can be corrected, while a 6 per cent or 7 per cent variation would also be likely to play the mischief even with continuous-current motors." In the matter of weights the polyphase motor has the advantage, so far as experience now goes. He thinks a single-phase locomotive will be very likely to get into trouble in starting on grades from the burning out of the short-circuited coil in spite of the high-resistance leads. All of the writers agree in advocating a higher working potential.—*St. R'y Jour.*, April 28.

Recording Meter for Tramways.—DE KERMOND.—An illustrated description of a recording meter for tramways which shows the time during which a car uses current. Since the total length of time of a trip is known, the ratio of the time during which current is used to the total time can be found, and from this the ability of the motorman may be estimated. (The good results obtained with this kind of meter in the Frankfurt system were recently noticed in the Digest.) The meter consists essentially of a clockwork which is stopped and started by means of an electromagnet actuated by the current supplied to the car.—*L'Electricien*, April 21.

Installations, Systems and Appliances.

Conditions for the Connection of Motors to Lighting Networks.—SCHUELER.—A discussion of the conditions under which different central stations in Germany permit motors to be connected to a lighting network. The author thinks regulations of this kind should fix nothing but the maximum permissible starting current and the minimum permissible power factor. Differences in the regulations of various stations are very troublesome. For instance, for a 5-hp induction motor three different stations require a power factor of 0.8, 0.85 and 0.89, respectively. The motor manufacturer is thereby forced to build the standard 5-hp type with such a weak field and such a narrow air-gap as to get a power factor of 0.89 or to design a special type. In view of the advisability to get uniform regulations, committees of the Association of German Electrical Engineers and of the Association of Electricity Works have prepared a set of regulations which is published in the same issue. The starting current of direct-current motors is fixed as follows:

Capacity of motors.		Watts per hp.
0.5 to 1 hp		3500
1 to 2 hp	For small starting current.	1500
2 to 15 hp		1250
Above 15 hp		1000
1 to 15 hp	For large starting current.	2500
Above 15 hp		2200

"The torque which can be obtained with the small starting current is, as a rule, the normal torque for motors of 1 to 15 hp, and three-fourths the normal torque for motors of more than 15 hp. The torque obtainable with the large starting current is, as a rule, twice the normal torque." The starting current of polyphase motors is fixed as follows:

Capacity of motors.		Volt-ampere per hp.
0.5 to 1 hp		3500
1 to 1.5 hp		3000
1.5 to 2 hp		2500
2 to 5 hp	For small starting current.	1600
5 to 15 hp		1400
Above 15 hp		1000
2 to 5 hp	For large starting current.	3200
5 to 15 hp		2900
Above 15 hp		2500

The starting current of single-phase induction motors is fixed as follows:

Capacity of motors.		Volt-amperes per hp.
0.5 to 1 hp		3500
1 to 1.5 hp		3250
1.5 to 2 hp		3000
2 to 5 hp	For small starting current	2000
5 to 15 hp		1500
Above 15 hp		1250
2 to 5 hp	For large starting current	3500
5 to 15 hp		3000
Above 15 hp		2500

In this case the torque obtainable with the small starting current is, as a rule, one-fourth the normal torque for ordinary induction motors and equal to the normal torque for commutator motors. The torque obtainable with the large starting current is, as a rule, two-thirds the normal torque for ordinary induction motors and twice the normal torque for commutator motors. The minimum power factor is fixed as follows for polyphase motors of different ratings:

Up to..........	0.5	1	1.5	5	10	15	20	Above 20 hp.
Power factor..	0.60	0.65	0.70	0.75	0.77	0.80	0.82	0.85

The minimum power factor for single-phase motors is fixed as follows:

Up to..........	0.5	1	1.5	5	10	15	20	Above 20 hp.
Power factor..	0.60	0.63	0.70	0.73	0.75	0.77	0.80	0.82

The committees appointed for the drafting of the regulations have approved them and the regulations are now to be submitted to the two associations.—*Elek. Zeit.*, April 12.

Small Electric Lighting Plant.—An illustrated article on installation and maintenance of the electric lighting plant of Jordan, Minn. It contains a 45-kw, three-wire engine-type generator giving direct current at 115 and 230 volts. Installation and operation costs are given in detail.—*Power*, May.

Electrophysics and Magnetism.

Conductivity of Flames for Alternating Current.—Wilson and Gold.—An account of experiments on the electric conductivity of a Bunsen flame containing various alkali salt vapors, the currents used being alternating ones with frequencies of from 70,000 to 6,000,000 per second. The conductivity was measured between two platinum electrodes immersed in the flame and the variation of the conductivity with the amount of salt present in the flame and with the nature of the salt was investigated. The results obtained enable a comparison to be made between the conductivities of the various alkali salt vapors for alternating currents and their conductivities for steady currents. It appears that the relative conductivities for rapidly alternating currents are nearly proportional to the square roots of the corresponding conductivities for steady currents. The flame is found to behave for very rapidly alternating currents more like a dielectric of high specific inductive capacity than like a conducting medium. These results confirm the view that the negative ions from all salts have the same velocity. The apparent capacity varies nearly inversely as the square root of the maximum applied potential difference. The apparent capacity is nearly independent of the number of alternations per second. The apparent capacity is nearly independent of the distance between the electrodes. The foregoing results are in agreement with the ionic theory of the conductivity of the flame for rapidly alternating currents when the velocity of the positive ions and the inertia and viscous resistance to the motion of the negative ions are neglected in comparison with the effects due to the number of ions per cubic centimeter. Not more than one molecule in 30 salt molecules is ionized at any instant in the flame, but each molecule is probably ionized and recombines several million times per second. The steady currents observed through salt vapors in flames are very far from the maximum possible currents corresponding to the number of ions produced per second.—*Phil. Mag.*, April.

Corpuscular Theory of Matter.—J. J. Thomson.—An abstract of his last lecture before the Royal Inst. on the corpuscular theory of matter. He had reached the conclusion that the number of corpuscules in an atom cannot be a very large multiple of the atomic weight. This result seemed to be contradicted by the existence in many spectra of an enormous number of lines, if each spectrum line is supposed to be due to a charged particle in orbital motion. But the author explained why the number of corpuscles in an atom cannot be calculated from the number of spectrum lines. He referred further to the remarkable discovery that if the secondary radiation emitted by elements under the influence of Röntgen rays may be measured by the ionization it produces within a millimeter of the surface of the substance, numbers are obtained that rise steadily with the atomic weight. If the ionization be plotted on an atomic weight base a curve of such definiteness is obtained as may prove useful in the future in fixing doubtful atomic weights. The application of the corpuscular theory to the explanation of the electrical conductivity of metals has shown that we must admit that a kind of corpuscular dissociation is continually taking place in a conductor, so that there are always numbers of free corpuscles ready to move under any e.m.f. applied. Further, if the free corpuscles be regarded as capable of carrying heat, then the ratio for different materials of the thermal to electrical conductivity can be calculated. It is remarkable that the calculations on this basis agree very closely with the experimental results.—Lond. *Elec.*, April 13.

Retardation of Alpha Particles in Passing Through Matter.—Rutherford.—A short communication on experiments in which he obtained photographic effects from alpha particles the velocity of which had been reduced to less than one-half the original velocity with which they were thrown off from an active wire coated with radium, C. The velocity was reduced by their passage through aluminum. The photographic effect observed was very feeble and less than 4 per cent of that found for the unscreened wire. This result suggests that the ionization produced by the alpha particle falls off rapidly when its velocity falls below a certain critical value. The ratio of the charge to the mass, however, remains the same as for the alpha particle emitted from the bare wire.—*Phil. Mag.*, April.

N-Rays.—At a recent meeting of the Société Française de Physique, Turpain described the results of a year's experiments undertaken to prove the existence or non-existence of N-rays. In those cases in which the experimenter knew whether the N-rays acted on the sulphur or not, the observed effect agreed in about 80 cases out of 100 with the expected results, but when the investigator had to rely solely on his observations, not knowing whether the N-rays were acting or not, the correct and incorrect guesses were approximately equally divided. "The obvious conclusion is that they were guesses. On the other hand, Gutton recently published some photographs showing the effect of N-rays on the sparks from a Hertzian oscillator. The N-ray remains a mystery."—Lond. *Elec.*, April 13.

Magnetization of Iron Powder.—Trenkle.—An account of an investigation in which the author studied the magnetism of powdered iron by means of a modified yoke method, which gives more complete results than that of Börnstein. He finds that with a given field the magnetization and the susceptibility of pure iron powder is always greater than that of a mixture of iron powder and some non-magnetic substance. Hence, the saturation point of pure iron powder is always higher than that of the dilute powder. The saturation value of the magnetic intensity is about one-fifth of that of solid iron. Generally speaking, therefore, the saturation value of the magnetization is the smaller the less the density of the iron. Thus cast iron, which has a smaller average density than steel or wrought iron, has a relatively small intensity of maximum magnetization. The field required for saturation is greater in the case of diluted iron powder than in the case of the pure powder, but this rule cannot be extended to solid iron. The effect of the change of density is entirely independent of the effect of a change in length, and must not be taken as amounting to the same. The relation between the changes produced by altering the various dimensions is very complicated.—Lond. *Elec.*, April 13; from *Wiedemann's Ann.*, No. 4.

Magnetic Ageing of Iron.—MAZZOTTO.—A paper on the magnetic ageing of iron and the molecular theory of magnetism. When it is important that the iron in a machine should not age during use, the author recommends to age the iron employed in advance by heating it from 15 to 20 hours to a temperature near 131° C. Cores thus treated will not age afterwards, whether they continually remain at normal temperature during use or are heated to temperatures permissible in practice.—*Phys. Zeit.*, April 15.

Electrochemistry and Batteries.

Storage Batteries.—GAHL.—An abstract of a paper presented before the Colorado Scientific Society. The main part deals with the present status of lead cell manufacture. Attention is called to a new type of negative plate recently brought on the market which permits the use of material of high expanding power, the falling off of active mass being prevented by a kind of perforated lead wrapper cast together with the grid. This plate is called box plate, and means a vast improvement over the negative plates made before, and it evidently seems to solve the problem of negative plates, for now the negative plates have a longer life than the positive plates, while formerly the life of the battery was always limited. The construction of this box plate is a result of theoretical considerations on the necessity of accelerating the diffusion of fresh acid into the plates during discharge. The author sees a bright future for alkaline cells when it will be commercially possible to use cadmium. He appears to consider a cadmium-silver alkaline cell as the most promising one for automobiles.—*Electrochem. and Met. Ind.*, May.

Electric Lead Smelting.—ASHCROFT AND BETTS.—Two long illustrated articles. In the article of Ashcroft the Swinburne-Ashcroft process is described consisting essentially in the decomposition of zinc sulphide in suspension in a fused electrolyte of mixed zinc chloride and sodium chloride, and also in the electrolysis of lead sulphide dissolved in a fused electrolyte of lead chloride. A diagram is given of the arrangement of a plant for this purpose and a modified system of magnetic rotary agitation in a fused electrolyte cell is described. The extended article of Betts first deals with the use of fused lead chloride as electrolyte and then with the production of a refined lead sulphide—practically lead matte to feed to the electrolytic lead cell in order to prevent the accumulation of impurities during operation. Extended thermochemical analyses are given with a comparison of cost with the old smelting process. In an editorial the two processes of Betts and Ashcroft, together with a process recently patented by Townsend, are discussed.—*Electrochem. and Met. Ind.*, May.

Leblanc and Electrolytic Alkali Works.—KERSHAW.—A discussion of the commercial development of the alkali industries in Europe in recent years. The author thinks that the Leblanc works will continue to produce caustic and carbonated alkali and bleaching powder, but in diminishing quantities, and the dividends earned by manufacture of these staple products (which once yielded large profits) will decline. Compensation for this loss, however, will be found in the manufacture of sulphuric acid, sodium sulphate, hyposulphite, sulphide and other derivatives from these sulphur salts which cannot be manufactured by the processes of either of their rivals—and even the impurities of the pyrites burned in the kilns for the lead chamber process of sulphuric acid manufacture, may be looked upon as an important source of revenue in years to come. The Leblanc alkali works will then depend more and more upon by-products, and less and less upon the staple products, soda and bleach, for their future profits. The electrolytic works, when operating a good process, and when under wise financial management, will gradually take the place of the Leblanc works as producers of bleaching powder, chlorates and other chlorine products. The manufacture of metallic sodium and of its derivatives such as cyanides and peroxides, will also most probably fall into the hands of the electrolytic manufacturers. The cost of operating the electrolytic process of alkali manufacture is, however, greater than was at first estimated, and only the best processes and best equipped works will survive in the struggle for existence.—*Electrochem. and Met. Ind.*, May.

Ferro-Vanadium.—An illustrated description of the new reduction plant of the Vanadium Alloys Company, which is the first of this kind in the world. The first steps of the process consist in crushing and leaching vanadiferous sandstone with the production of a vanadate of iron containing from 50 to 75 per cent of vanadic acid. This vanadate is then reduced in the electric furnace to ferro-vanadium.—*Electrochem. and Met. Ind.*, May.

Electrochemical Laboratory.—TUCKER.—A fully-illustrated description of the equipment of the laboratory of applied chemistry at Columbia University.—*Electrochem. and Met. Ind.*, May.

Units, Measurements and Instruments.

Selenium Photometer.—TORDA.—An illustrated description of a portable selenium photometer for incandescent lamps. It is based upon the action of light on selenium, which alters its electric resistance with variations of the intensity of light in accordance with a certain physical rule. The principal parts of the photometer are: A light-tight box containing a selenium cell, a constant e.m.f. produced by dry cells, a milliammeter, a push button contact, a lampholder with flexible leads and an automatic shutter, which covers the hole of the partition placed between the selenium cell and the lamp. The lamp, fixed in the holder, is properly centered to the hole at a certain distance and faces the selenium cell. Fig. 2 illustrates the arrangement diagrammatically and shows the connections of the photometer. *S C* represents the selenium cell and *E* the dry cells. In closing the small switch, *S*, an electric current will flow through the circuit, corresponding to the dark resistance of the selenium cell, and produce a deflection on the milliammeter, *M*. If the lever of the shutter is depressed it will be opened, and the light rays passing through the hole of the partition will cause a decrease of the resistance of the selenium to take place, whereby the deflection shown by *M* increases. This reading, which is a measure of the light intensity, is taken, and the screen closes automatically after a definite period and owing to the action of the clockwork remains locked for a time, in order that a certain period of rest in darkness shall be given to the selenium cell. Under normal conditions the time of exposure is about two seconds, enabling a reading to be taken easily on the dead-beat ammeter, while the period in darkness before a new reading can be taken is 40 seconds. The calibration of the scale is simple and consists in noting the deflections on the dead-beat instrument when the selenium is exposed to the effect of the source of different lamps which have been previously tested on a standard photometer. A calibration curve of a selenium photometer is shown in Fig. 3. The calibration is as permanent as in any other similar apparatus. The instrument may be used for years, though it is recommended to recalibrate the photometer about every three months and to renew the dry cells every six or nine months, while the selenium cell may be used for one or two years or more. The instrument requires a different calibration for lamps giving light of different colors.—Lond. *Elec.*, April 13.

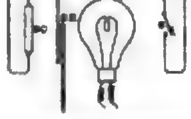


FIG. 2.—SELENIUM PHOTOMETER.

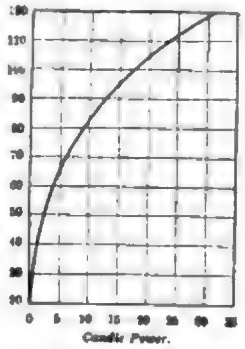


FIG. 3.—CALIBRATION CURVE OF SELENIUM PHOTOMETER.

The Cooper Hewitt Mercury-Vapor Lamp for Industrial Lighting.

The Cooper Hewitt mercury vapor lamp, invented by Mr. Peter Cooper Hewitt, of New York, as the outcome of a long study of electrical vacuum phenomena, has come into a wide commercial prominence in the past year in many interesting and important installations in the field of industrial lighting. Recent improvements in design and construction have increased its general utility, and the perfection of a new type of lamp adapted to practically all alternating-current lighting circuits has doubled the field of its possible usefulness.

The records of the performance to date of mercury lamps installed in 1904 and 1905 have demonstrated that the operating life of Cooper Hewitt tubes exceeds 5,000 hours in numerous instances. The New York Transportation Company recently renewed four tubes, each of which had been operated for more than 10,000 hours, and three of them were in fair operating condition when returned to the factory, but somewhat blackened from long service. As the only cost of maintenance in mercury lighting is for tube renewals—about one-third the original cost of the complete lamp—the demonstrated long life of the tube gives a new importance to the figures of its high efficiency. Tubes continue to operate perfectly until the vacuum becomes impaired, with no consumption of the light-giving element.

In the Cooper Hewitt lamp, a long glass vacuum tube, one inch in diameter and from 17½ to 45 in. long in the standard types, mercury vapor is excited to a high degree of incandescence by the passage of the electric current with a generation of heat that is reduced to a minimum. The radiant heat from mercury lamps, therefore, is in proportion to lighting capacity a very small part of that given off by incandescent globes or arc lamps, and this high efficiency, which means an all-important saving in power consumption, has incidentally meant also a material reduction in the temperature of work rooms in many installations in which the heat from the former lamps had been very noticeable in hot summer weather. The operating economy is well established—a candle-power of light for a power consumption of from .55 to .64 watt, proportionately one-sixth the power required by an incandescent globe, one-third that required by an enclosed arc, and one-half that required by an open arc.

In the growth of Cooper Hewitt lighting, considerable attention is being attracted to the peculiar merits of its illumination—the even diffusion of light from a luminous surface of great extent, which prevents the formation of sharply defined lights and shadows or the contraction of the pupil of the eye caused by the concentrated luminous points of other lamps; and the freedom of the mercury spectrum from red rays, attributed physiologically as the chief cause of eye fatigue in work under other artificial illuminants. Light is emitted in even intensity from every portion of the tubes, and there are no dazzling or bright moving spots. The distortion of some color values under the mercury lamp because of the absence of red rays is a matter of no consequence in the bigger part of industrial lighting, where the accurate determination of natural color values is not necessary.

The Cooper Hewitt lamp has been extensively adopted during the past two years in large machine shops and foundries, where the saving effected in power consumption has been very great; in business offices, in which the superior working quality of its light has dictated its use, apart from the consideration of its economy; in the press and composing rooms of many of the largest publishing houses in America, where the disadvantages of wiring around machinery are avoided by its use; in railroad repair shops; in drafting rooms; in pier sheds and freight houses; in textile mills, where the searching character of its light is of special value; in automobile garages and shops; in piano and organ factories, leather and paper mills, glass and rubber factories, copper and sugar refineries, hat factories, navy yards and wood working plants; and in many other industries in which its illuminating value and economy have peculiarly recommended it.

Among prominent recent installations are those at the enlarged Newark works of the Westinghouse Electric & Manufacturing Company, where 470 lamps are in use; at the new model factory of the J. L. Mott Iron Works, at Trenton, equipped with 113 lamps; at the new Baring Cross shops of the St. Louis, Iron Mountain & Southern Railroad, at Argenta, Ark., equipped with 105 lamps, and at the new Attica works of the Westinghouse Machine Company, where 86 lamps are used. Five of the largest river piers in New York are lighted by them. All the United States Government currency and internal revenue stamps are printed under their light in the Bureau of Engraving and Printing at Washington, and the Automobile Club of America will use 96 lamps in its new garage building in New York.

Other interesting installations are the lighting of the presses and make-up tables in the new building of the New York *Times*, with 48 lamps; of the offices and pressrooms of the Butterick Publishing Company, with 120 lamps; and of the polishing and action departments of the large new piano works of William Knabe & Son, Baltimore.

Notable examples of office lighting are to be seen also at the Washington Post Office, where 30 lamps, requiring 105 amp. in all, are in use in the high-vaulted mailing room, 100 by 200 ft., on the ground floor, in the place of 1,000 incandescent globes requiring 500 amp. with which the room was formerly lighted; at the New York Post Office, where 53 lamps are in service in the carriers' and foreign money order departments; and at the New York auditing offices of the American Tobacco Company, where rooms in which several hundred bookkeepers are employed are illuminated with 48 lamps.

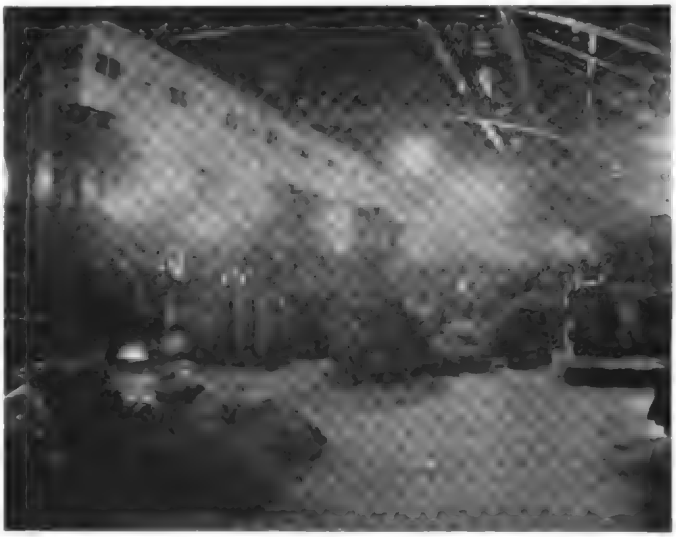


FIG. 1.—WASHINGTON POST OFFICE MAILING ROOM.

All but a few of the installations of the past year have been with the 300-cp Type H and the 700-cp power Type K direct-current lamps, but the 425-cp Type C lamp, for alternating-current circuits, recently put upon the market, is now being delivered for various installations where the advantages of mercury lamp lighting have not before been possible. The H lamps are generally operated in series—two in series on circuits of from 98 to 122 volts, or four in series on circuits of from 196 to 244 volts. The K lamps are operated singly on circuits of from 98 to 122 volts, and two in series on a 196-244 voltage. Series lamps are arranged with extra shunt resistances so that either lamps of a pair in series may be operated singly if desired. Each type of the direct-current lamps is run at 3½ amp., two H lamps in series on a 110-volt circuit consuming 385 watts, one K lamp installed singly on a circuit of the same voltage consuming the same power, and two K lamps in a series on a 220-volt circuit consuming 770 watts. The new alternating-current lamp consumes 275 watts on either 110 or 220-volt circuits, or .64 watt to a candle-power.

The complete Cooper Hewitt lamp outfit, in its latest form, consists of the glass vacuum tube, the holder and reflector, and the auxiliary. The tubes of direct-current lamps have a positive electrode, of iron, at one end, and a negative electrode, of metallic mercury, in a bulb at the other end. The tubes of the new alternating-current lamps have two positive electrodes, of iron, at one end, and a negative electrode, of mercury, at the other end, the alternating current entering the vacuum by the positive electrodes and leaving by the negative electrode. The alternating-current lamps thus really operate as a converter, in application of the principle of negative electrode resistance discovered in the first invention of the mercury lamp. They are started as the direct-current lamps are started, by a temporary tilting to permit the flow of mercury from one end to the other in a small stream which momentarily bridges the vacuum, the resulting arcing of the current vaporizing some of the mercury, and the subsequent steady current flow increasing the vapor pressure and exciting it to a high degree of incandescence. Many Type H lamps are now made with a small solenoid or magnet on the suspension bar just above the holder, for accomplishing this tilting automatically when the circuit is closed. These automatic lamps are used in installations in which it would be inconvenient to reach the tilting chain with the hand or a hook.

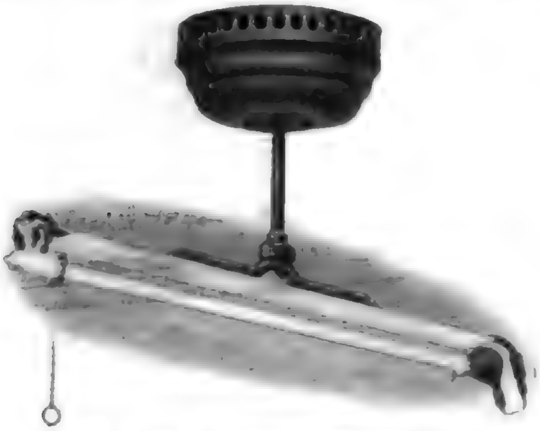


FIG. 2.—NEW ALTERNATING-CURRENT LAMP.

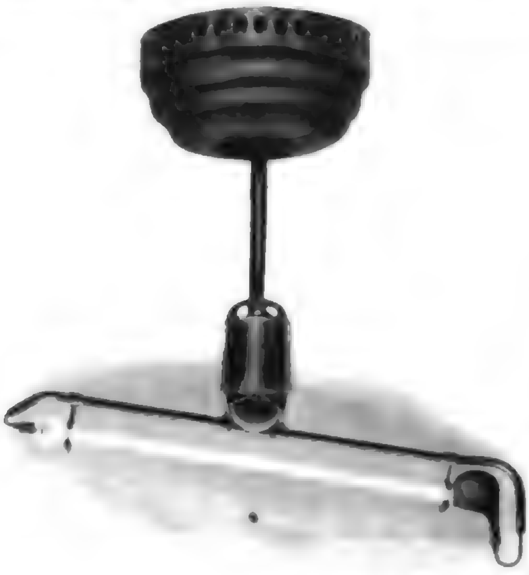


FIG. 3.—AUTOMATIC LAMP.

The auxiliary, consisting of two or three coils of resistance wire, an inductance coil and usually a ballast bulb to correct abnormal voltage variations, all connected in series with the tube, is enclosed in the new lamps under a neat 12-in. metal canopy, and fastened securely to the ceiling above the lamp on a plate attachment having a crowfoot into which the lamp suspension bar is screwed, thus becoming a part of the lamp fixture. The special auxiliaries for series lamps have, in addition, an automatic cut-out and shunt resistance. The new ballast bulb, an interesting feature of the auxiliary, provides economical protection against undue voltage rises by means of a fine iron wire mounted in a small glass tube somewhat resembling a miniature incandescent globe, with an inert atmosphere to prevent oxidation of the wire. This iron wire possesses to a peculiar degree the property of increasing its resistance very rapidly as its temperature is increased, so that a lamp protected by such a ballast becomes operative through a considerable range of voltage.

Self-Starters for Alternating-Current Motors.

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., is placing on the market a complete line of self-starters for alternating-current motors, several of which are shown in the accompanying illustrations. The starter shown in Fig. 1 is designed for those installations where the motor is comparatively small, and may be thrown directly across the line without starting resistance. The device consists of a double-pole, oil-immersed solenoid-operated switch, which may be controlled by either a pressure regulator or float switch, depending upon the system used. The magnet frame is of cast iron and supports the entire switch. The plunger is laminated and is arranged to give to the switch parts a hammer blow, both for closing and opening. This starter may be used with single, two or three-phase motors of suitable type, a two-pole starter being employed for either style of polyphase motor.

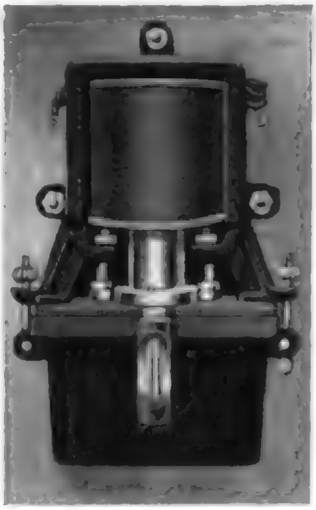


FIG. 1.—AUTOMATIC STARTER FOR SMALL MOTORS.

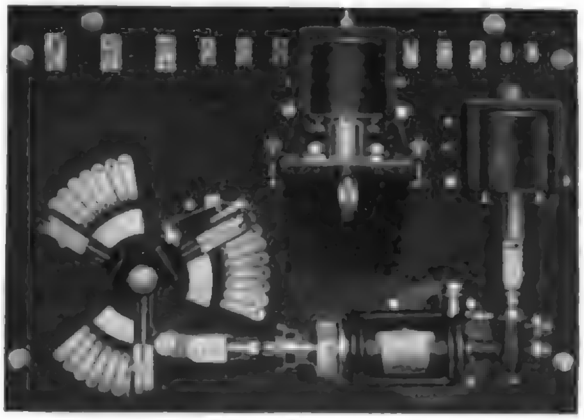


FIG. 2.—STARTER FOR LARGE SQUIRREL-CAGE MOTOR.

For larger polyphase motors the starters illustrated in Figs. 2 and 3 are recommended. Fig. 2 shows a starter for use with a motor provided with a squirrel-cage secondary winding, resistance being inserted in the primary circuit during the starting period. The starter shown in Fig. 3 is used for inserting resistance in the secondary winding of a polyphase induction motor under starting conditions. Each of these latter starters consists of a slate panel containing a double-pole, oil-immersed, solenoid-operated line switch, a resistance commutator and a resistance, a device for moving the rheostat lever and a solenoid for the control of this device. The mechanical device for operating the rheostat lever consists of a cylinder and piston arranged for operating both ways with power, and its operation is controlled by a valve, in turn controlled by an alternating-current solenoid. Water taken from the city mains may be used to operate this device. The main line solenoid switch is electrically interlocked with the rheostat lever controlling the starting resistance so that the main line circuit to the motor cannot be closed unless the lever is in the starting position, thus providing that the motor will always be started with the proper resistance in circuit.

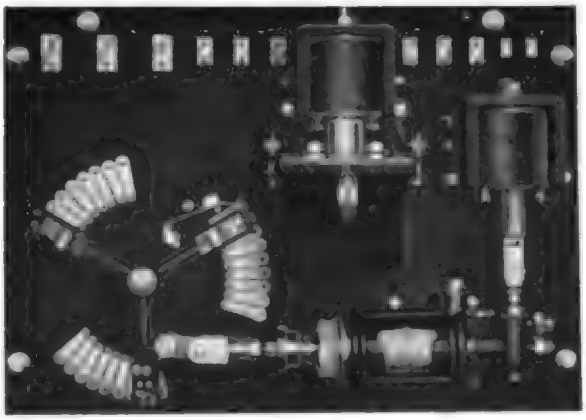


FIG. 3.—STARTER FOR MOTOR WITH FORM-WOUND SECONDARY.

Hydro-Electric Power for a Cement Plant.

The Washington Portland Cement Company's new plant, located in Skagit County, Washington, has its entire equipment, both for power and cement making, furnished by a single concern, the Allis-Chalmers Company, of Milwaukee. It is the intention of the building company to bring the capacity of the plant up to the capacity of 3,000 bbls. per day by adding two kilns at a time. The initial installation will consist of a complete machinery equipment for a two-kiln plant, using the dry process by means of water power and electrical drive. The raw material to be used consists of limestone and shale, the former located in deposits 1,500 ft. from the plant and the latter 500 ft., both connected by an electric road over which the material will be transported. The company has three side tracks from the main line of the Great Northern to the works. A dam across the Baker River, at a distance of a mile from the power plant, is being constructed to be connected by a flume 6 by 10 ft. from the dam to the power house. The water power, which is capable of developing 3,000 hp, will operate a 1,150-hp Allis-Chalmers twin turbine with center discs and cantilever bearings, from a fall of 50 ft. The discharge will be 250 ft. per second and the speed 360 r.p.m.

Each principal machine, such as the crusher, disintegrator, dryer, ball mills, tube mills, etc., will be driven by direct-mounted individual Allis-Chalmers motors. The auxiliary machinery, such as the elevators, conveyors and feeders, will be driven in groups by motors. As far as possible, the object has been to avoid the use of shafting belts and pulleys.

Motors of 20 hp or over are not enclosed, and the smaller motors are enclosed. The electrical equipment will be very complete. The generator, direct-connected to the turbine, will be a 750-kw Allis-Chalmers water wheel type alternator, three-phase, 60 cycles, 600 volts, excited from a direct-coupled exciter of 20 kw capacity. There will be 34 induction motors installed in capacity from 1½ to 100 hp and aggregating 870 hp. In addition to the interior equipment for the mill, an electric locomotive will operate between the mills and the shale and limestone deposits. The locomotive will haul sixteen 1½-yard cars and be capable of a speed of six miles per hour.

Producer Gas Power Plant at Worcester, Mass.

Producer gas power has recently been adopted by the Norton Emery Wheel Company for extending their present steam plant at Worcester, Mass. The horizontal double-acting heavy-duty type gas engine built by the Westinghouse Machine Company, of Pittsburg, has been adopted with Loomis-Pettibone producers using bituminous coal. The new gas engine will be 500 b.hp rated capacity, direct connected to a Westinghouse 250-volt, 300-kw generator running at a speed of 150 revolutions per minute. This unit will operate in parallel with two belted steam units, the entire plant supplying current to the various motor drives in the factory, and also for lighting. The Westinghouse engine will be of the tandem cylinder single-crank style; water jacketed throughout.

The pistons of the engine will be supported practically clear from the cylinder by front, middle, and rear crossheads. All valves are located directly in the cylinder body in a vertical line; inlet at the top and exhaust at the bottom. A sensitive governing system of the relay type, places each inlet valve independently under the direct control of the governor, by which arrangement extremely close speed regulation is secured. At the Norton Company's plant the gas used will be a mixture of two gases averaging about 125 B.t.u. per cu. ft. The producer process is intermittent, water gas being made during a short run, and "blast" or "air" being made while the producers are being blown preparatory to the succeeding water gas run. After a thorough cleansing in wet and dry scrubbers, the gas is sent to a holder of sufficient capacity to secure a thorough mixture of the alternating charges of the two different gases. In this case a 20,000 cu. ft. holder will be used—sufficient to run the engine for about 25 minutes.

Entrance Switches and Cut-Outs.

In the accompanying illustrations, Fig. 1, shows a combined switch and a plug cut-out which can be used to advantage in many different ways where switch and fuse connections are required. Combinations of these blocks may be employed in the place of panel or tablet boards, and can be so arranged as to take off branches from one or both sides of the mains as may be required.

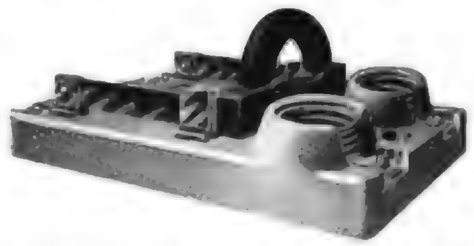


FIG. 1.—ENTRANCE SWITCH AND PLUG CUT-OUT.

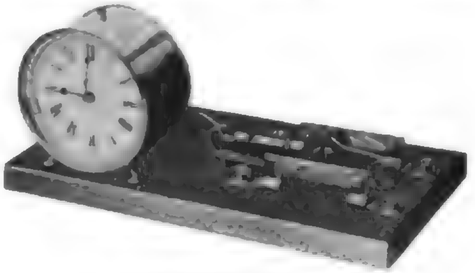


FIG. 2.—AUTOMATIC TIME SWITCH.

The automatic time switch, shown in Fig. 2, is provided with an effective quick-break spring, which eliminates the detrimental effect of continued arcing. The tripping device which is operated by the clock is automatically brought into position in closing the switch. The complete outfit, which is mounted on an enameled slate base, is easily installed and operated.

These cut-outs are built by the Specialty Manufacturing Company, Youngstown, Ohio.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Highly satisfactory reports of general trade were made last week. Retail and jobbing business is very large; building operations are extensive and crop reports are excellent. Continued favorable weather has allowed good progress in planting, the germination of crops, the enlargement of country retail trade, improved reorders for summer goods and the placing with confidence of a volume of fall orders fully equal to those of a year ago. Collections have also measurably improved. Railway earnings are large; clearings still make records for this season of the year, and the call for replacement at San Francisco is a feature helpful to trade in many lines. The coal strike still hangs fire, and minor troubles, due to unionistic movements on the lakes, and in a few cities the recrudescence in a mild form of May-day strikes, are all elements to be reckoned with. Minor developments of the week are the continued strength of nearly all staple products. Cotton has been very steady, considering the good crop reports, indications of enlarged acreage and reports of freer offerings of spots at the South. Buying of new stocks of goods for San Francisco is a feature at Chicago and other points. Building material is very active. Lumber sells at the highest prices on record at Chicago, and hardware is also in demand. Outside of the Central West pig-iron markets present irregular features, with some weakness in prices, largely in foundry grades. The United States Steel Corporation has taken all the surplus Bessemer available in the Pittsburg district for May delivery. New business in steel rails for 1907 delivery, together with additional orders for shipment, the current year, makes up a large aggregate, and further heavy contracts are pending. Demand for structural material is not especially marked, nor has business on account of replacement in San Francisco developed to any extent as yet, though one interest is said to have booked orders for 6,000 tons. The April failure report to *Bradstreet's* is very favorable, showing the smallest number of casualties and one of the lightest aggregates of failure damage of which there is record in April for 13 years past. Failures are 15 per cent fewer in number and liabilities are 22 per cent smaller than in March, while 9 per cent fewer in number and 17 per cent smaller as to liabilities than in April a year ago. The business failures for the week ending May 3 numbered only 139 against 177 in the corresponding week last year. Copper was steady to firm, with offerings moderate. Exports for the month of April were 14,778 tons, these exports being the smallest in two years. The domestic demand for lake, electrolytic and casting copper required for deliveries in June and July is in excess of the capacities of producers. Five large producers of lake and electrolytic are sold out till September. One interest closed out its June and July electrolytic at 18¾ @ 18⅞c. A round lot of lake for delivery in the last of July brought 19¼c. Casting copper, prime brands, thirty days, is held at 18½c. Eastern markets are absorbing copper in jobbers' hands at 19⅛ @ 20c for lake in good-sized lots. There is no visible supply of electrolytic, and the stocks of casting copper are down to a few casks in this market. The belief is held among the large copper consumers hereabouts that the coming week will see an upward trend in active buying and higher prices for all grades of copper.

GAS PRODUCERS.—The Power and Mining Machinery Company, Milwaukee, Wis., has recently closed contracts for its Loomis-Pettibone gas generating plants for an aggregate of approximately 12,000 horse-power. These include an installation for the Pittsburg Plate Glass Company, at their Crystal City, Mo., plant, to produce gas for operating a large Allis-Chalmers gas engine; the Norton Emery Wheel Company, Worcester, Mass., for operating Westinghouse gas engines; the Charlotte Consolidated Construction Company, Charlotte, N. C., for operating Snow gas engines in connection with street railway work, and an increase in the present installation at Sayles' Bleacheries, Saylesville, L. I., for the operation of American-Crossley gas engines. These producers will be operated on bituminous coal, but are capable of gasifying a great variety of fuels, and their adaptability to the use of different fuels without any alterations being made in the apparatus enables the users to change instantly from one to another and to use the most economical fuel that is available. Over 150,000 hp capacity of Loomis-Pettibone plants have been installed, and are now in operation in this and foreign countries. Some of the installations are at distant foreign parts, which fact attests the wide reputation of the apparatus and the confidence shown in its reliability.

SALES OF REYNOLDS-CORLISS ENGINES are reported as follows by the Allis-Chalmers Co., of Milwaukee, Wis.: The Union Stock Yards & Transit Company, of Chicago, recently purchased a 28-inch and 50-inch x 48-inch as an addition to the present power outfit. The Michigan Copper & Brass Company, of Detroit, Mich., is a recent purchaser of a 24-inch and 48-inch x 42-inch. The Union Iron Works Company, of Springfield, Mo., will install a 14-inch x 36-inch. The Drummond Packing Company, of Eau Claire, Wis., is a purchaser of a 14-inch x 24-inch. The Peninsula Lumber Company, of Portland, Ore., has purchased a 22-inch x 36-inch. The Maryland Brick & Supply Company, of Frederick, Md., will install a 14-inch x 24-inch, and the Black River Woolen Company, of Ludlow, Vt., will install a 20-inch x 42-inch

DEMAND FOR COPPER WIRE.—The Bell Telephone Company, it is stated, has placed orders with all the domestic copper wire drawers for all the wire they can make for six months. These orders have been provided for by the purchase of 12,000,000 pounds of electrolytic copper from Western and Southwestern producers, and deliveries of the finished product are to be accelerated by double shifts in several mills in the Eastern States. The entire amount of wire is for use in underground telephone conduits in cities in which pole lines are being displaced. It is stated that additional orders will probably be placed that will consume 10,000,000 pounds of electrolytic copper to be delivered in the winter and spring of 1907. It is stated that the building of new lines is hindered the country over by the lack of copper wire.

THE CANADIAN WESTINGHOUSE COMPANY, LTD., is being called upon to supply apparatus for the operation of a number of single-phase railway lines. A recent contract is for furnishing alternating-current, single-phase railway equipment for approximately 35 miles of track, for the Windsor, Essex & Lake Shore Rapid Railway Company. For the present, five cars equipped with two 100-hp motors each, will be operated. The order covers a 500-kw, single-phase, 25-cycle generator to be installed in the main power house near Essex, together with switchboards, exciters and transformers, for operating the system. A trolley voltage of 6,600 will be used, and catenary line construction will be installed throughout.

NEW SCHENECTADY SHOPS.—Ground will be broken immediately for an extension to building No. 86 at the General Electric Schenectady plant. This shop is the turbine department. The addition will make the building 300 x 800 feet and give floor space of eleven acres, the largest of the Schenectady buildings. Contracts have been let calling for the completion of the building in ten months. The American Bridge Company has the contract for the steel work. It is said that the General Electric Company has bought a large quantity of Edison cement for its work.

COLLECTIONS OF TRADE CATALOGUES.—The Free Public Library of Newark has established a Trade Catalogue Department and will be glad to be placed upon the mailing list of manufacturers. Manufacturers are also invited to place the Library of American Institute of Electrical Engineers, 95 Liberty Street, New York, on their mailing lists.

APPARATUS FOR SAN FRANCISCO.—The Stanley-G. I. Electric Company is shipping considerable machinery to San Francisco. It sent two car loads a few days ago and it is now getting ready transformers and motors to send on to take the place of those which were destroyed in the great disaster.

ORDERS FOR EXPORT.—The American Trading Company, of New York, has ordered a 75-kw Allis-Chalmers Type I generator for re-shipment, and has also ordered a 30 x 36 Reynolds heavy-duty Corliss engine, for export, from the Allis-Chalmers Co., of Milwaukee.

VULCAN ELECTRIC HEATING COMPANY.—An important announcement to the trade and the central station industry has been made as follows by the L. P. Brown Co., of 71 West Jackson Boulevard, Chicago, who have done original and ingenious work in the electric heating field: "We take pleasure in announcing the incorporation of the business of L. P. Brown & Co., under the laws of the State of Illinois, to be known hereafter as the Vulcan Electric Heating Co. Additional capital will be used in the business and the plant and facilities will be enlarged to meet the rapidly increasing demands of our customers. The Vulcan Electric Heating Company assumes all obligations and has acquired all accounts, stock, equipment, patent and trade-mark rights and manufacturing processes of the old firm. Having established the utility of two of the most difficult applications of electric heating, by the introduction of our Vulcan electric soldering and branding appliances, we offer our goods to the trade with confidence of giving satisfaction. We will take up practical designing and engineering in connection with our electric heating specialties, and will be glad to consult with our agents or with possible customers regarding the best means of accomplishing desired results." The circular is signed by Mr. F. J. Holmes as president.

ALLIS-CHALMERS INDUSTRIAL ORDERS.—The hydraulic turbine department of the Allis-Chalmers Co., Milwaukee, reports the sale of a 2200-hp horizontal turbine, equipped with twin runners, to the Consolidated Lighting Company, of Montpelier, Vt. The outfit will also include a 60-hp exciter turbine and two hydraulic governors for the equipment. The Railway Steel Spring Company, of Latrobe, Pa., will install a 20-inch and 34-inch x 42-inch Reynolds heavy duty cross compound Corliss engine, direct connected to a 500-kw Allis-Chalmers generator. The Gayan Valley Fuel Company, of Huntington, W. Va., has recently purchased a 50-kw Allis-Chalmers generator to be installed in connection with a Chandler & Taylor engine and boiler and a Bissell switchboard. The Chandler & Taylor Co., manufacturers of high-speed engines, recently purchased a 100-kw Allis-Chalmers generator, for its engine works at Indianapolis. The Nevada Consolidated Copper Company has recently purchased nine additional Allis-Chalmers Standard induction motors and a 100-kw induction motor generator set for installation at Ruth, Nev. The E. I. Dupont Co., of Fontanet, Ind., will install two 75-kw generators. The H. C. Frick Coke Company, of Yorkrun, Pa., has ordered a 400-kw generator, and the Bates & Clark Co., of Seattle, Wash., has purchased a 100-hp standard induction motor.

PENNSYLVANIA POWER PLANT.—A company composed of Delta, Pa., capitalists has taken charge of the old Castle Fin Forge property along Muddy Creek Forks, upon which it will build a hydro-electric power plant. The property was purchased from R. F. Tabor for $12,500. Castle Fin Forge and Furnace originally was established for the smelting and working of iron in 1810, and at one time employed one hundred men. It was abandoned many years ago. The new power plant will furnish electricity for towns in the lower end of the county.

Financial Intelligence.

THE WEEK IN WALL STREET.—Prices on the stock market rallied after severe declines and enormous liquidation by pools and other large speculative holders, caused by tight money and restriction of bank credit to interests of that character. Foreign buying and absorption of stocks by bargain hunters made the recovery easy, and a rather sharp upward turn on Friday gave an appearance of decided strength. Electric securities were stronger and in most all cases closed at higher quotations than those last given. Allis-Chalmers common gained ½ point and preferred ⅛, the closing quotations being 21 and 55⅞, respectively. There was active trading in these stocks, the sales of the common aggregating 22,300 shares, and of the preferred 10,000 shares. General Electric's highest quotation for the week was 167½ and the lowest 161½, the closing quotation being 166½, which is a net gain of 3⅜ points for the week. The annual report of this company was issued Friday. It is an interesting statement, showing profits of over $7,000,000. The report is covered fully on another page of this issue. Westinghouse is recorded as having lost 6 points net at the close, the final quotation being 158. Western Union lost 1½ points, closing at 91½. A large business was done in Brooklyn Rapid Transit, 371,800 shares having been sold at prices ranging between 72 and 78⅝, the closing quotation being 78, a net advance of 4½ points. Metropolitan Street Railway made a gain of 1⅜, closing at 112½. Interborough Rapid Transit, on the curb, closed at 218¼, after having touched 222, the closing quotation representing a net loss of 3¾ points. Mackay Companies made a net gain of 1¼, closing at 63¼. There was a decreased volume of operations on the curb market attended with extreme weakness during the first half of the week, followed by partial recoveries. Following are the closing quotations of May 8:

NEW YORK

	May 1	May 8		May 1	May 8
Allis-Chalmers Co.	20½	21	General Electric	163	166½
Allis-Chalmers Co. pfd.	55¾	55⅞	Hudson River Tel.	...	...
American Dist. Tel.	*30	*30	Interborough Rap. Tran.	221	222¼
American Locomotive	66	69¾	Mackay Cos	62	63¼
American Locomotive pfd.	111	113	Mackay Cos pfd.	71	71½
American Tel. & Cable	90	91	Marconi Tel.	...	...
American Tel & Tel.	131	133	Metropolitan St. Ry.	109	112½
Brooklyn Rapid Transit	74	81⅝	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	91¼	91½
Electric Boat pfd	65	65	Westinghouse com.	140	150
Electric Vehicle	15½	15½	Westinghouse pfd.	...	...
Electric Vehicle pfd.	17½	17½			

BOSTON

	May 1	May 8		May 1	May 8
American Tel. & Tel.	132¾	134¼	Mass. Elec. Ry. pfd	66	64½
Cumberland Telephone	...	...	Mexican Telephone	...	3½
Edison Elec. Illum.	245	247	New England Telephone	...	130
General Electric	166	...	Western Tel. & Tel	...	13½
Mass. Elec. Ry.	18	19	Western Tel. & Tel pfd.	...	...

PHILADELPHIA

	May 1	May 8		May 1	May 8
American Railways	57½	51½	Phila. Electric	7⅛	8⅛
Elec. Co. of America	11½	11⅝	Phila. Rapid Trans.	25⅜	26⅜
Elec. Storage Battery	71	73½	Phila. Traction	98⅛	99⅜
Elec. Storage Battery pfd.	...	..			

CHICAGO

	May 1	May 8		May 1	May 8
Chicago City Ry.	145	160	National Carbon	90½	90
Chicago Edison	...	145	National Carbon pfd	118	118
Chicago Subway	...	54	Union Traction	...	...
Chicago Tel. Co.	...	115	Union Traction pfd	...	..
Metropolitan Elev. com.	26¾	26			

* Asked

MERGER AT PORTLAND.—A consolidation of traction and other public service enterprises in the vicinity of Portland, Ore., is being carried out. It will involve between $30,000,000 and $35,000,000. New York financial interests control all of the properties in the merger. J. & W. Seligman & Co. have owned the street railway system of the city for some time past and about a month ago came into control of the interurban system, which operates along the Williamette Valley within a radius of forty miles of the city. E. W. Clark & Co. and Pratt & Co. control practically all of the other public service enterprises producing or using electricity in this territory, and it is their properties that are to be united with the Seligman holdings. The Portland Consolidated Railway Company, which operates the traction system of the City of Portland, has franchises running to 1933. Some of its power is obtained from the Portland General Electric Company, which will be one of the parties to the combination. The Oregon Water Power & Railway Company is another of the companies included. Mr. W. S. Barstow has been consulting engineer on a large part of the work.

DIVIDENDS.—Directors of the Washington Railway & Electric Company have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable June 1. The Philadelphia Electric Company's directors have declared the regular semi-annual dividend of 2½ per cent, payable June 15. Directors of the Pratt & Whitney Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 15. Directors of the Niles-Bement-Pond Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 15. The Washington Railway & Electric Company has declared its semi-annual dividend of 2½ per cent on its preferred stock, payable June 1. The Philadelphia Electric Company has declared its regular semi-annual dividend of 2½ per cent, payable June 15.

MERGER IN BALTIMORE.—It is stated that negotiations are well advanced for the merger of the Consolidated Gas, Electric Light and Power Company with the Consolidated Gas Company of Baltimore. The merger of these two companies has been made possible by recent act of the Legislature of Maryland, permitting such a merger, and it is understood that a plan is now under consideration with this object in view.

TELEPHONE MERGER.—The Keystone Telephone Company, of Philadelphia, has acquired control of 80 per cent of the stock of Eastern Telephone & Telegraph Company, of Camden, N. J. The Eastern Telephone Company has 2,500 subscribers and the share capital has a par value of $250,000.

CHICAGO LIGHTING MERGER. The Commonwealth and Chicago Edison Companies seek authority from the city to merge with any similar company now existing or that may be organized in Cook County.

GENERAL NEWS.

Construction News.

ANNISTON, ALA.—The House of Representatives has passed the bill authorizing Roswell H. Cobb and associates, constituting the Coosa River Power & Development Company, permission to construct the dams and the contemplated power house at Lock 2 on Coosa River. It is proposed to furnish power in Anniston, Gadsden and Birmingham.

HOT SPRINGS, ARK.—The Hot Springs Telephone Company will expend $20,000 for putting in conduits.

MERRYVILLE, CAL.—The General Electric Company has purchased a tract of land in this city upon which it will erect a large plant, which is to be its permanent headquarters.

PALO ALTO, CAL.—John J. Lewin, superintendent water works and light plants, writes that plans and specifications have not yet been completed for the improvements proposed.

SAN FRANCISCO, CAL.—The Home Telephone Company has been granted a franchise for a telephone system in this city, and its bond for $250,000 has been approved by the board of supervisors. The company binds itself to expend $4,000,000 in two years in establishing its system.

SAN FRANCISCO, CAL.—The department of electricity, acting in conjunction with the joint emergency committee on light, power and telephone service, of which Rudolph Spreckles is chairman, is busy passing on applications for permits for the resumption of lighting and power plants. Thus far thirty-four permits have been granted. Most of these are for operation of motors in the district close to the Mutual Electric Company's power station, on the water front, from which plant they have arranged to obtain power, or in the Mission district, in the neighborhood of Folsom, Harrison, Sixteenth and Eighteenth Streets, where power is obtainable from one of the power stations of the San Francisco Gas and Electric Company.

NEW HAVEN, CONN.—The Southern New England Telephone Company will lay about forty miles of underground cable in the State this year.

PUTNAM, CONN.—The town has made a contract with the Putnam Light & Power Company to light the streets for one year from June 1, 1906, for $416.16 per month. The company will soon extend its line to South Woodstock.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Light Company has secured a controlling interest in the Thompsonville Electric Light Company, of Thompsonville. As soon as the necessary changes can be made in the plant at Windsor Locks the production of electricity at the Thompsonville plant will be discontinued, and that plant will be used as a sub-station. Ultimately it is the intention of the promoters to organize a company that will combine the powers of the charters of the various light and power companies in the towns of Windsor Locks, Enfield and East Windsor. It will install a 175-kw Allis-Chalmers type "A" generator and a 6-kw exciter, recently purchased from the Allis-Chalmers Company, of Milwaukee.

WINDSOR LOCKS, CONN.—The George P. Clark Company, manufacturers of trucks and rubber rolls, has decided to equip its entire plant with electric power to be generated on the premises with steam as the motive power. An 80-hp Slater engine of the Corliss type has been purchased and the contract has been let for a 90-kw, three-phase induction motor, 240 volts and a 1.5-kw exciter to the Stanley-G. I. Company of Pittsfield, Mass. In all, 23 motors will be used, ranging in power from one to 15 hp. The new generator will also light the factory. The work is being done under the direction of George E. Clark, secretary and treasurer.

WASHINGTON, D. C.—Bids will be received until May 22 by the Treasury Department (H. A. Taylor, acting secretary) for supplying to the United States buildings under its control east of the Rocky Mountains, as the requirements of the service may demand, during the fiscal year ending June 30, 1907: Electrical fittings and materials; also electric wires and cables.

WASHINGTON, D. C.—Bids will be received until May 22 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 532—Incandescent lamps, Gonda cells, wire, electrical supplies, sheet copper, etc. Schedule 533—Crane and hoist, bar steel, sheet copper; also May 29 to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 538—Arc and incandescent lamps, electrical supplies, etc. Schedule 541—Electrical equipment for launches, electric drill, track trolleys, tool steel, copper pipe, etc. Schedule 542—Electrical supplies, pumps, steel cement, copper pipe, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

BRADENTOWN, FLA.—The Manatee Light & Traction Company has recently purchased of the Allis-Chalmers Company, of Cincinnati, Ohio, one 150-kw and two 115-kw Allis-Chalmers generators and three 4-kw exciters.

WASHINGTON, GA.—The plans for the development of Anthony Shoals, 18 miles from the city, is progressing favorably, and power of from 25 to 30,000 hp will be developed. Thomas Ludlow is city engineer.

SAVANNAH, GA.—The Savannah Lighting Company has contracted with the Standard Underground Cable Company of Philadelphia to do the underground wiring in the new conduit system which will soon be completed.

SANDPOINT, IDAHO.—The City Council has granted Mr. Humbird a franchise for an electric light plant.

PAYETTE, IDAHO.—The Council has granted the Idaho Light & Power Company a franchise for an electric light and power plant.

WEISER, IDAHO.—The Interstate Electric Power Company has been organized to construct a dam and power plant at Eagle Rock on Snake River, capable of developing 20,000 horse-power. Mr. Wiley is chief engineer.

MILAN, ILL.—S. S. Davis is interested in the construction of a dam on Rock River for developing electric power.

CAIRO, ILL.—The Cairo Electric & Traction Company is planning extensive improvements to its power plant on Ninth Street.

SHELBYVILLE, ILL.—The Central Union Telephone Company and the Mutual Telephone Company have been consolidated and will be operated under one management.

ELGIN, ILL.—The Elgin & Bloomington Railroad Company has decided to change its name to the Chicago & Elgin Electric Railway Company, and to increase its capital stock to $800,000.

FAIRBURY, ILL. The Fairbury Electric Light, Heat & Power Company has consolidated with the Chatsworth Electric Light Company and new machinery will be purchased and the plant remodeled.

AURORA, ILL.—The City of Aurora has contracted with the Western Electric Company for a 300-kw. two-phase alternating-current generator and 300 series enclosed alternating arc lamps for the new municipal lighting plant.

CHICAGO, ILL.—Bids will be received until May 16 by the South Park Commissioners for furnishing and delivering within the South Park system, 130,000 electric light carbons and 10,000 feet electric light cables. E. R. Shumway is secretary.

EVANSTON, ILL.—The North Shore Electric Company, of Evanston, Ill., has filed a certificate of increase of authorized capital stock from $2,000,000 to $3,000,000, preparatory to purchasing outright the Lagrange Water, Light & Power Company, and to complete unfinished construction work started by that company. Only $500,000 of the new stock will be issued at present.

CAMP POINT, ILL.—The Camp Point Electric Light & Power Company has recently installed a new 75-kw, 60-cycle, revolving field General Electric generator; also new transformers and Westinghouse meters. The present owners have offered the plant for sale. The village board prefers to have the plant run by private parties, but will submit the proposition to the citizens to vote on municipal ownership, providing the plant is not sold soon.

FORT WAYNE, IND.—The National Telephone Company and the Home Telephone Company have been consolidated under the name of the Home Telephone Company.

FORT WAYNE, IND.—The Fort Wayne & Springfield Railway Company has increased its capital stock from $300,000 to $500,000. The company will build an electric railway from Ft. Wayne to Springfield.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has recently purchased a 150-kw Allis-Chalmers belted generator, 2,300 volts, 2 phase, 60 cycles, with direct-connected exciter.

BLUFFTON, IND.—It is reported that steps have been taken to build an air line railway from Bluffton to Norwalk, Ohio. The road will connect with a number of Ohio lines at Norwalk. It is stated that the Riggs & Sherman Company, of Toledo, Ohio, will make the surveys.

RUSHVILLE, IND.—Plans have been prepared for the installation of a modern electric light plant in this place. Alvin Middleton and others will construct a building and are ready to correspond with dealers in material and equipment for the installation of a light plant. It is the intention to begin work at once.

INDIANAPOLIS, IND.—The "Pasadena Park Association" is having plans prepared for the construction of apartment buildings, including a central electric light, steam and hot water plant for service to these buildings. The Pasadena Park buildings will furnish homes for 5,000 people. Geo. V. Bedell is the architect.

RICHMOND, IND.—Prof. Matthews, head of the department of Electrical Engineers in Purdue University, has been secured to make an examination of the building, engines, generators and other apparatus of the municipal lighting plant, for the purpose of ascertaining the actual depreciation of the plant, now about to be sold.

INDIANAPOLIS, IND.—The Moore-Mansfield Construction Company, of Indianapolis, has been awarded the contract to complete the Indianapolis, Crawfordsville & Western Traction Company's line between this city and Crawfordsville. It is rumored that the McKinley syndicate of Illinois has purchased the line, and that it is to be part of the through line from Indianapolis to Peoria.

IDA GROVE, IA.—The Farmers' Mutual Telephone Company has been organized by A. C. Garner, Robt. Todd and others to put in telephone lines throughout the county.

CEDAR RAPIDS, IA.—The New State Telephone Company will string copper wire from Correctionville to Carroll, which will improve the service between Sioux City and Des Moines.

MASON CITY, IA.—The Western Electric Telephone Company contemplates making extensive improvements to its system, involving an expenditure of about $200,000. All the present lines will be rebuilt with copper and iron wire, and several new lines will be built. A new equipment will be installed in the head office in this city.

FORT DODGE, IA.—Child, Hulswit & Co., of Detroit, Mich., has purchased the property of the Fort Dodge Light Company, of this city, and a company has been organized to take it over with a capital stock of $300,000, and an authorized bond issue of $400,000, of which $225,000 has been issued.

HAYS CITY, KAN.—Justus Bissing contemplates installing a new dynamo and making other changes and improvements to his electric light plant in this city.

INDEPENDENCE, KAN.—It is reported that A. C. Smith and a company of capitalists will organize a company for the purpose of erecting an electric light plant, which will cost about $10,000.

OSAGE CITY, KAN.—It has been decided by the Council that the site of the electric light plant here will not be changed. The enlarging of the plant, the purchase of new machinery, the selection of lamps and many construction details are now receiving consideration. The committee has decided to invite Morris Dunsworth, superintendent of the Emporia electric light plant to make an investigation of local conditions and needs. Unless some unexpected complications should arise the new light plant for this city should be ready for use by July 1.

PADUCAH, KY.—The Paducah Light & Power Company, Inc., has recently purchased a 500-kw Allis-Chalmers generator.

LITCHFIELD, KY.—W. W. Mauzey, city clerk, writes that R. L. Moorman, of Litchfield, has secured the franchise for an electric light plant.

DANVILLE, KY.—Bids will be received until May 15 by the Commissioners of the Kentucky School for the Deaf at Danville for wiring the buildings and installing an electric light plant in the said school. Augustus Rogers is superintendent.

AUGUSTA, ME.—The Kennebec Light & Heat Company has recently purchased from the Westinghouse Electric & Manufacturing Company a 500-kw turbo-generator set, and a condensing apparatus from the Deane Steam Pumps Works. W. H. Williams is superintendent.

BANGOR, ME.—The Bangor Railway & Electric Company contemplates making extensive improvements in its power plant at Veazie and the substation on Park Street; also to improve the facilities for transferring current from the main lower power station to the street railway in the city and to the Bangor & Northern. The cost is estimated at $30,000.

CUMBERLAND, MD.—The three electric railway companies now operating in Alleghany County namely, the Cumberland & Westernport Electric Railway Company, the Westernport & Lonaconing Railway Company and the Midland & Frostburg Electric Railway Company, embracing thirty-two miles between Cumberland and Westernport—have been consolidated. The consolidated company will be known as the Cumberland & Westernport Electric Railway Company. DeWarren H. Reynolds has been elected president; D. P. Hartzell, secretary.

LINDEN, MASS.—A petition is in circulation in North Revere for the extension of gas and electricity to that part of the town.

PITTSFIELD, MASS.—The Pittsfield Electric Company will put 90 new Stanley arc lamps in place of the street lamps now in use in different parts of the city.

CAMBRIDGE, MASS.—At a recent meeting of the Common Council a committee was appointed to investigate the question of establishing a municipal electric lighting plant.

SOUTH LAWRENCE, MASS.—The Boston & Maine Corporation has recently installed a large dynamo in its car shops for the purpose of operating the machinery by electricity.

ACTON, MASS.—At a recent meeting the committee on public lighting reported a bill to permit the American Woolen Company, of New Jersey, to furnish light and power to the town of Acton.

GREAT BARRINGTON, MASS.—A meeting of the voters of the fire district will be called May 10 to consider the lighting question and to make satisfactory arrangements for a suitable system during the year.

SALEM, MASS.—The Salem Electric Lighting Company will build an office building and store house on Lafayette Street. The company also will install an additional McIntosh & Seymour compound engine of [illegible] hp and a [illegible]-kw General Electric generator.

NORTH EASTON, MASS.—The present contract of the North Easton Village District for lighting the streets expires the first of next August. Many of the residents and business men are in favor of installing a municipal electric plant. The amount appropriated for the lighting and maintaining of street lights in the district is [illegible].

BROCKTON, MASS.—The question of municipal lighting is now being investigated by the city. It is claimed that the city could buy the local electric lighting and gas plants for about $800,000, and there are many who are in favor of the city buying the plants. Meanwhile the electric light company holds a contract for street lighting until 1910.

CHICOPEE, MASS.—The Chicopee Manufacturing Company has decided to have another power plant erected at the lower end of the canal. The new plant will be erected over the wasteway near the lower end of the canal and will consist of two 1,000 hp turbines directly connected to a generator made by the General Electric Company, which will be located in the new power house.

WORCESTER, MASS.—The Mayor has accepted the terms made by the Worcester Electric Light Company to furnish arc lamps to the city for 25 cents per night without a contract. Beginning May 1 the price will be $91.25 per arc lamp per year. The former price was $109.50. The company contemplates putting in new enclosed arc lamps in place of the open arcs now in use.

ATHOL, MASS.—The Greenfield Electric Light & Power Company has substituted for its flat rate, 15½ cents per kw-hour for lighting, a sliding scale of rates which will give a reduction of 12.6 per cent on its entire business. Beginning with those whose bills total 16 kw-hours or less, the rate will be 15 cents, ½ cent reduction. All bills of 600 kw-hours will be at a rate of 10 cents, and charges over this amount will be billed at eight cents. The company will still keep in force its discount of 10 per cent on all bills in excess of $1.50, provided payment is made before the 10th of the month.

HASTINGS, MICH.—The Thornapple Electric Company has changed its name to the Thornapple Gas & Electric Company.

FLINT, MICH.—A company has been formed here by H. R. Loranger, of Flint, and R. O. Hart, of Flushing, to construct electric light plants at Flint and Flushing.

MEMPHIS, MICH.—The Council has granted a franchise to S. R. Lester, of Sandusky, for the erection and operation of an electric lighting plant and a system of waterworks.

DETROIT, MICH.—The Home Telephone Company has been given a permit to lay six-duct conduit on Howard Street. This is the initial step in the construction of its $3,500,000 system.

HASTINGS, MICH.—A petition has been made to the City Council for a franchise for an electric railway to run from Grand Rapids to Battle Creek. John E. Moore is promoting the proposed line.

SAGINAW, MICH.—An effort is being made to organize a company for the purpose of building an electric railway from Saginaw to Farmington, connecting at Farmington with the Detroit United Railway for Detroit.

SAGINAW, MICH.—A committee of business men from the towns interested recently met in Saginaw and made arrangements for the survey of the proposed electric railway from St. Johns to St. Louis. All the towns along the line will contribute toward the construction of the road.

IONA, MICH.—The Board of Supervisors has granted the Michigan Power Company a franchise to build a dam across Grand River in Danby Township. The company also proposes to erect at some future time a power plant on Grand River at Dudley. O. Watson, of Coopersville, and L. E. Rowley, of Lansing, are interested.

LANSING, MICH.—The new building for the Commonwealth Power Company has been completed, and the equipment is now being installed. It consists of three rotary converters of 300-kw capacity each, with transformers and switchboards. The company will furnish power for the Lansing-St. Johns line as soon as the station is completed.

NEWAYGO, MICH.—The Grand Rapids & Muskegon Power Company has commenced work on its new dam, to be built near Croton, six miles above Newaygo. This dam is to be 35 feet high and will have eight flood gates, eight wheels and generators double the capacity of the Rogers dam recently built near Big Rapids. It is expected that it will be a year before the dam is completed.

BAY CITY, MICH.—The Bay City Traction & Light Company has submitted the following proposition to the Council to light the streets of the city: If the company is allowed to use the present pole and wire lines of the city and avail itself of the city's privilege to use poles of other companies for public service, it will install modern high-class lamps rated at 2,000 candle-power in place of the old style open arc lamps now in use, and any such additional lamps as the city may order during the term of the contract to be agreed upon, for $50 per lamp per year on moonlight schedule, or $60 per lamp per year on an every night schedule, subject to a deduction for outages equal to twice the rate received per lighting hour. At the expiration of the contract, which shall be 10 years, the city may at its option purchase the lamps and wire extensions at a value to be determined by agreement or arbitration. The proposition has been referred to the committee on electric lighting.

GREENBUSH, MINN.—H. Fant, of Thief River Falls, Minn., will install a local telephone exchange.

ALBERT LEA, MINN.—The Albert Lea Light & Power Company has filed an amendment to its charter increasing its capital stock to $400,000.

MANKATO, MINN.—The Northwestern Telephone Exchange Company contemplates an expenditure of about $15,000 for improvements to the local system.

ST. PAUL, MINN.—The City Council has passed the ordinance requiring all wires to be placed underground in the business portion of the city this year.

ST. PAUL, MINN.—The Twin City Telephone Company has transferred all of its property to the Tri-State Telephone & Telegraph Company for a consideration of $4,000,000.

ST. PAUL, MINN.—The Western Gas & Supply Company, of Chicago, will build an additional dam for power on the Apple River, located a mile below the one now in operation near Somerset, Wis.

LITTLE FALLS, MINN.—The Little Falls Power Company has let contracts for the development of an additional 2,500 horse-power at the electric station. S. Morgan Smith Company, of York, Pa., will furnish two water wheels. A new electric generator will also be installed.

EVELETH, MINN.—The Mesaba Telephone Company has let the contract for the construction of its building in this town to cost $4,000. The company will also expend $10,000 in rebuilding its lines, substituting aerial cable in place of wire, and other new equipment. F. E. Lister is district superintendent.

STANBERRY, MO.—The Stanberry electric light plant, which was owned by A. C. Frisbie and T. D. Hussey, has been sold to the General Public Service Company, of Kansas City, of which George S. Marshall is president.

LIVINGSTON, MONT.—J. L. Bright has secured the contract for lighting the streets for five years at $90 per light per year.

HELENA, MONT.—O. H. Crumb & Co. have applied for a franchise for a local telephone exchange.

HELENA, MONT.—The dam which is being constructed on the Missouri River, 18 miles above Helena, is rapidly nearing completion. The dam will develop about 25,000 horse-power, which will be transmitted to Anaconda, Butte and Helena, for use in the mines, smelter and manufacturing plants. The pole line has been completed and everything is in readiness to use the electricity as soon as the power plant is completed. The plant is expected to be in operation in July.

GRAND ISLAND, NEB.—At a recent election the citizens voted to issue bonds for the construction of a light and power plant in connection with the water works system.

PLATTSMOUTH, NEB.—The Nebraska City Telephone Company will spend $25,000 in improvements this summer The lines between this city and Lincoln are being replaced with copper wire.

FALLS CITY, NEB.—The Falls City Telephone Company has reorganized and increased its capital stock. The new company will be known as the Southeastern Nebraska Telephone Company, with $100,000 capital stock. It will take over the business of the Falls City Telephone Company and will establish a through toll line from Kansas City to Lincoln and Omaha.

ROCKAWAY, N. J.—The Council has decided to issue $30,000 lighting bonds.

PASSAIC, N. J.—The Keystone Electric Company has increased its capital stock from $10,000 to $100,000.

NEWARK, N. J.—The Common Council on May 14 appointed a committee to act in co-operation with the Board of Public Works in an investigation into the question of the establishment by the city of an electric light plant to supply lights for the streets; also the public buildings of the city. It is stated that it has been decided not to install an independent electric lighting system in the new City Hall.

YONKERS, N. Y.—The city has appropriated $300,000 to establish a municipal lighting plant.

OSWEGO, N. Y.—A franchise has been granted to the Empire State Telephone Company to build subways.

PHELPS, N. Y.—The village trustees have granted J. C. Howes' Sons Electric Light Company permission to operate an electric light plant for a period of 20 years.

WATERVLIET, N. Y.—The Hudson River Telephone Company has purchased a plot of land on First Avenue and will soon construct an exchange building. Fuller & Pitcher are the architects.

PEEKSKILL, N. Y.—The Peekskill Lighting & Electric Company, capitalized at $1,400,000, and furnishing gas and electricity to Peekskill, and operating ten miles of electric railway, has been acquired by F. A. Stratton, of Westchester County, who is president of the Northern Westchester Lighting Company.

ROCHESTER, N. Y.—The Whitley lighting bill was unanimously approved by the Mayor and the sixteen aldermen who attended the special council meeting held April 30. This is the bill whereby it is hoped Rochester will obtain competition in electric lighting. The Mayor will advertise the new lighting contract about June 1.

SYRACUSE, N. Y.—The Central New York Telephone Company has let contracts for the construction of twenty miles of subways, involving an expenditure of more than $200,000. The Warner-Quinlan Asphalt Company was awarded contracts for about sixteen miles of the work, and R. F. Lewis for the remaining four miles. The work will commence at once. H. F. Stevens is general manager.

NEW YORK, N. Y.—Bids will be received until May 29 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yard, New York, N. Y., naval supplies as follows: Schedule 538—Arc and incandescent lamps, bells, etc. Schedule 541—Electrical equipment for launches, tool steel, copper pipe, etc. Schedule 542—Electrical supplies, pumps, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

GLENS FALLS, N. Y.—The Hudson River Electric Power Company has secured an additional property for the development of electrical energy in the purchase of the Zenas Van Dusen saw mill property on the north side of the Hudson River near Glens Falls. The plot comprises over a hundred acres with a river frontage of three miles. The purchase carries the right to the surplus water of the river, and it is estimated that under the modern methods of hydro-electrical development 5,000 hp can be obtained. The property is to be improved at once.

AMSTERDAM, N. Y.—The Hudson River Electric Power Company is constructing a new sub-station at Amsterdam. This station is designed to meet the requirements of the increasing business at Amsterdam and to handle the power coming from the water-power stations at Spier Falls, Mechanicville and Schoharie Falls. The plans call for a brick and steel structure, with concrete foundations, 127 by 91 feet and 48 feet high. The high tension lines from the power stations at Spiers Falls, Schoharie Falls and Utica will enter the station. The installation contemplates caring for 10,000 horse-power.

MINNEWAUKON, N. D.—J. Mahany, Fred. Snore and others are interested in the construction of an electric light plant.

AVONDALE, OHIO.—A building permit has been issued for a $5,000 power house for the Jewish Hospital.

GEORGETOWN, OHIO.—The Georgetown council has granted a franchise to the Independent Telephone Company.

CLEVELAND, OHIO.—The Rush Creek Telephone Company has increased its capital stock from $5,000 to $10,000.

SHARON, OHIO.—The Shenango Valley Traction Company is planning to extend its line from South Sharon to New Castle.

ASHTABULA, OHIO.—An election will soon be held to vote on issuing $50,000 bonds for rebuilding the electric light plant.

PORTSMOUTH, OHIO.—Fire at this place last week destroyed cables of both the Bell and independent telephone companies, throwing their systems out of service.

HAMILTON, OHIO.—A 300-hp engine was wrecked recently in the Hamilton municipal electric light plant. The accident was caused by a defect in the condenser system.

OBERLIN, OHIO.—The Oberlin Gas & Electric Company has just placed contracts for machinery to double the capacity of its plant, to meet the requirements of its increasing business.

BOWLING GREEN, OHIO.—The car house of the Lake Erie, Bowling Green & Napoleon Railway was recently destroyed by fire, causing a loss of about $50,000. The power station adjoining it was saved.

MEDINA, OHIO.—The Medina County Farmers' Telephone Company has increased its capital stock from $10,000 to $25,000. A large number of farmers all over Medina county are installing telephones.

MARIETTA, OHIO.—Col. A. E. Boone, who has promoted a number of roads in Southeastern Ohio, states that he has arranged with a New York syndicate for financing the proposed line between Pomery and Belpre.

BENWOOD JUNCTION, OHIO.—The Baltimore & Ohio Railroad Company is planning to double the capacity of its shops at Benwood Junction, and will erect a plant to furnish electricity for lighting and power.

RICHWOOD, OHIO.—The Board of Trade at Richwood has offered to secure a right of way and grade it providing the Delaware & Magnetic Springs Railway Company will build an extension to that place and operate cars this summer.

BELLEFONTAINE, OHIO.—The Central Union Telephone Company is preparing to run toll lines to all parts of Logan County and will establish a number of small exchanges. Important improvements are to be made at the Bellefontaine exchange.

CINCINNATI, OHIO.—The light committee of Newport has recommended the installation of 32 additional arc lamps and eighteen 32-cp incandescent lamps Current is furnished by the Cincinnati, Newport & Covington Traction & Light Company.

TORONTO, OHIO.—The East Liverpool Traction & Light Company has obtained the right of way for a double-track extension of the road from Wellsville to Yellow Creek Junction through this city, where a connection is to be made with the Steubenville & Ohio Valley Railroad Company.

FOSTORIA, OHIO.—The City Council has decided to correspond with prominent manufacturing concerns with a view to determining the cost of installing a municipal plant for arc and commercial lighting and for steam heating. A proposition to bond the town will then be considered

XENIA, OHIO.—The Citizens' Light & Power Company, which was formed some time ago, has started its plant and is now supplying a number of residences and business houses. It gives a day service, something that the competing company has never given, and the service is much appreciated.

CLEVELAND, OHIO.—The lowest bid opened on May 4 by the Board of Public Service for a turbine, engine and generator for the municipal electric light plant, to be established by the city in the gully near the South Brooklyn bridge, was submitted by the Allis-Chalmers Company, of Milwaukee, Wis., for $16,172.

ELYRIA, OHIO.—C. Clough and H. Schibley are securing right of way for an electric railway from Elyria to South Amherst and North Amherst touching a number of large stone quarries. In addition to handling passenger service, cars especially designed for the purpose will transfer stone to the steam railroad, passing through Elyria.

COLUMBUS, OHIO.—The Columbus Citizens' Telephone Company has placed orders with the Automatic Electric Company of Chicago for a large amount of additional equipment for the automatic exchange in operation in Columbus. The company now has 7,500 switches in operation and will increase its capacity to 10,000 as soon as possible.

MANSFIELD, OHIO.—The power plant of the Mansfield Electric Railway, Light & Power Company was practically destroyed May 2 by the bursting of the fly wheel, causing a damage of from $75,000 to $100,000 and leaving the city for the present without power for the local street railway and the Mansfield & Shelby interurban line. The city will be without incandescent or arc light or power for electric motors for several days.

MASSILLON, OHIO.—The Massillon Light, Heat & Power Company has closed a contract with the Board of Public Service to light the streets of Massillon for ten years from May 1, 1906, with 180 Wood enclosed-arc 460-watt lamps to burn on "moonlight—all dark hours" schedule at $69.50 each per year; also for 50 graphitized filament 50-cp incandescent lamps to burn in series with the street arcs on the same schedule at $12 each per year.

TOLEDO, OHIO.—The electric light committee of the Council has been instructed to advertise for bids for street lighting. Bids will be received for terms of three, five and ten years so that a short time contract may be made if desired, in order that the municipal light project may be revived. The Toledo Gas, Electric & Heating Company is expected to bid in opposition to the Toledo Railways & Light Company, which has held the contract for a number of years.

CINCINNATI, OHIO.—Local telephone rates will be reduced after July 1. To bring about necessary changes, the local Bell Company will have to spend about $75,000 and increase its number of employes in the operating department ten per cent. The City Council has indefinitely postponed action on ordinances whereby certain independent telephone companies seek franchises. This action is on the theory that the present telephone service is ample and satisfactory and that the rates are fair. This is equivalent to refusing franchises to the independent companies.

TOLEDO, OHIO.—Mr. A. K. Detwiler, of Toledo, with associates, has been awarded a franchise for an independent telephone system at San Francisco. Before the disaster the city had agreed to give the contract to the highest bidder, but it was thought that the almost total destruction of the city would prevent any definite action at this time. Mr. Detwiler, however, succeeded in getting the council together with the results mentioned. As the Bell company's plant was destroyed, the new independent company will have an even chance with its rival in the solicitation of business.

CANAL FULTON, OHIO.—The Massillon Light, Heat & Power Company has closed a contract and is operating under the same, to light the streets of this town, 9 miles distant from Massillon for ten years, with 22 Wood enclosed-arcs, 400-watt lamps to burn on "moonlight—all dark hours" schedule at $70 each per year; also 7 graphitized filament 65-cp incandescent lamps to burn in series with the street arcs at $21 each per year. Power to operate the Canal Fulton service is furnished from the central station in Massillon. This latter service went into operation April 17.

PORTLAND, ORE.—The Pacific States Telephone & Telegraph Company will build three new sub-stations to relieve the congestion of the telephone service on the East Side. Plans are now being made for the buildings, which will cost about $25,000 each. The company will also spend about $200,000 in extending its system of underground cables throughout the city streets.

PORTLAND, ORE.—The Mount Hood Electric Company proposes to construct and sell to the city of Portland for the sum of $1,250,000 a water-power plant, the initial installation of which shall be capable of developing 10,000 horse-power, with 15,000 additional horse-power for future increase of plant. To install this additional horse-power will cost but $400,000. An additional $250,000 in bonds should be provided for the construction of the distribution service within the city limits. The Mount Hood Electric Company will enter into a contract with the city to pay to the city for the surplus current which will not be used by the city, the sum of $60,000 per annum, leaving the net cost of the plant to the city of Portland, including interest upon bonds and operating expenses of $15,000 per annum, or a saving to the city of $65,000 per year, which sum deposited in a sinking fund will pay off the bonds issued in 30 years. Under the proposal of the Mount Hood Electric Company the number of arc lamps in the city can be increased from 1,156 to 5,000 without additional cost to the city for the current supply. It will enable the city to light every public place and building without additional cost, excepting wiring for the same.

MEDIA, PA.—Plans have been made for an exchange building in this town for the Bell Telephone Company.

MARION CENTRE, PA.—The Farmers' Telephone Company contemplates increasing its capital stock from $15,000 to $25,000.

HAMILTON, PA.—The Lehigh Valley Transit Company contemplates the construction of a new power house on Front Street north of the city.

PITTSBURG, PA.—The Allegheny County Light Company has recently purchased twelve more Allis-Chalmers induction motors, ranging from 7½ to 15 hp and an 18-hp type "N" direct-current motor.

MECHANICSBURG, PA.—The Hershey Electric Company, of York Haven, has secured the contract for lighting Mechanicsburg at $55.92 per year per arc lamp, and $15 per year per incandescent lamp.

YORK, PA.—The new management of the York Street Railway and allied companies is planning to extend its suburban lines. It is stated that the loop from Bittersville to Hellam will be constructed during the summer.

SUNBURY, PA.—The Middlecreek Electric Company has purchased the steam plant of the Northumberland Electric Light, Heat & Power Company. The Middlecreek Company will also light Selinsgrove and Middleburg, Pa. George W. Wagenseller is secretary.

ALLENTOWN, PA.—Engineer H. V. Hunt estimates the cost of constructing a municipal electric light plant to be located at and operated in conjunction with the Crystal Spring pumping station, for the purpose of lighting the streets and public buildings, at $140,000.

WASHINGTON, PA.—A contract has been made with the Washington Electric Light & Power Company for lighting the borough for a term of five years at $70 per year per arc lamp, of which there are 184. Under the old contract the price was $83 per arc lamp.

IRWIN, PA.—Pittsburg, Irwin and Greensburg men have applied for a charter for the Pittsburg, McKeesport & Westmoreland Railways Company. This road is intended as a connection with the line from Irwin to McKeesport, and the Manor Valley road from Manor to Irwin and Herminie.

PHILADELPHIA, PA.—The Keystone Telephone Company of this city has obtained control of the Eastern Telegraph & Telephone Company, the independent company in Camden. It is said the Keystone will in a few months institute several improvements. The Eastern Telephone Company has about 2,500 subscribers.

SOMERSET, PA.—The Quemahoning Electric Power Company has been organized by Jonathan E. Giffen, of Stoyestown; C. W. Weigle, of Hooversville; J. L. Barcnus, of Salisbury, and D. S. Martin, of Pittsburg. It is the purpose of the promoters to install a large electric power plant in the vicinity of Hooversville, and, by a system of high-potential transmission, to furnish electrical energy for lighting, heating and power purposes to the towns of Hooversville, Stoyestown, Sprucetown, Jenners, Holsopple, Davidsville, Foustwell and the new mining town of Jerome.

TERRE HILL, PA.—The citizens are considering the question of lighting the town by electricity, and a committee has been appointed. Mr. Eli W. Martin, the promoter of the project, wants to install the plant in his mill. He asks the town to build the line from his mill to the town and will give 5 per cent on the money invested, and if the town is incorporated, will purchase the line. A committee consisting of Jacob Davidson, S. F. Foltz and J. C. Lesaley was appointed to solicit the town and try and secure the money to build the line. This committee was also instructed to see the property holders about having this town incorporated into a borough.

WESTERLY, R. I.—A charter has been granted to the Westerly Power Company, with a capital of $700,000 to sell electricity and gas.

OLNEYVILLE, R. I.—Plans have been prepared for the Olneyville Telephone exchange, which is to be located on Bough Street, and a contract will be awarded in a few days.

WESTERLY, R. I.—One of the 250-hp Diesel oil engines that are to be used to generate electricity for the Westerly Power Company, has arrived. This engine is one of eight that the new company contemplates installing, five of which have been ordered. The contract for the erection of the new power house has been let to R. A. Sherman's Sons' Company. The power house is to be 80x40 feet, of brick, and the specifications call for its completion in 40 days. The company will also practically rewire the town for electric light and power.

MATTHEWS, S. C.—Bids will be received until June 1 by Leonidas Cain, Secretary Board of Public Works, at the office of the Town Council, for $20,000 water works and electric light bonds.

CLINTON, S. C.—Bids will be received until May 29 for the installation of a system of water works and an electric light plant. J. A. Bailey is chairman water works committee; Chas. C. Wilson, engineer, 1302 Main Street Columbia, S. C.

FT. MEADE, S. D.—Bids will be received until June 1 by Major George K. Hunter, Constructing Quartermaster at Fort Meade, for furnishing and installing electric light fixtures in six sets of officers' quarters, two sets of noncommissioned officers' quarters and one double barrack; also constructing secondary and service lines, furnishing transformers and wattmeters.

ABBEVILLE, S. C.—The Abbeville Light & Power Company has signed a contract with the Savannah River Power Company, which is making an important development 20 miles away, to supply it with 150 horse-power at 40 cents per hp-hour. The Savannah River Power Company expects to furnish unlimited power to Abbeville and Greenville, S. C., also to Elberton, Ga.

CHATTANOOGA, TENN.—It is reported that the Great Falls Power Company will develop the water power of the great falls on the Caney Fork River and that an electric railway is to be built from Nashville to Chattanooga. C. H. Fisk, of Detroit, Mich., one of the promoters of the scheme, has had a corps of engineers surveying a line through the mountains in the vicinity of Oates' Island.

LAREDO, TEX.—The Southeast Telephone Company contemplates overhauling and rebuilding its system in this city.

WACO, TEX.—The County Commissioners have decided to put an electric lighting plant in the court house, jail and other buildings belonging to the county. The contract has been let, and the plant will be installed as soon as possible.

WACO, TEX.—W. V. N. Powelson, a director and general manager of the Union Electric Light & Power Company, and a director in the

Laclede Gaslight Company and United Railways Company, of St. Louis, Mo., has purchased the Mutual Electric Company's franchise and lighting property in Waco, Tex., and will install a large electric light, power and gas plant there. Mr. Powelson and associates are considering installing lighting, power and gas plants in other cities in Texas and Kansas.

OGDEN, UTAH.—The Shoshone Power Company has petitioned the county commissioners for a franchise. It proposes furnishing Ogden, Salt Lake City and other cities in Utah, with power for heating and lighting purposes.

FRONT ROYAL, VA.—The old municipal electric light plant, which had been abandoned by the village, was destroyed by fire May 2.

FREDERICKSBURG, VA.—A new telephone company has been organized and will run a line from Louisa Courthouse through Spotsylvania, Hanover and Goochland Counties. The company will be a competitor of the Bell Telephone Company, which recently purchased the Louisa Company.

LYNCHBURG, VA.—The council committee on electric light will make a report recommending the establishment of a municipal electric light plant in the pumping station of the water works at the May session of the City Council. The pumping station will be available for this purpose after the installation of the gravity water system, which will be ready for use next fall. The plant, it is estimated, will cost $50,000.

SEATTLE, WASH.—The Seattle Electric Company contemplates extending its system to West Seattle.

NORTH YAKIMA, WASH.—This city is preparing to construct water works and an electric light plant.

SEATTLE, WASH. The Seattle-Tacoma Power Company has made application to the City Council for a franchise to lay and operate pipes and conduits on certain streets of the city which are north of its present district of franchise rights. The application has been referred to the corporations committee.

ANACOTES, WASH.- The Mayor has signed the franchise ordinance granting E. G. English, Lester W. David, Albert Tozer, W. V. Wells, W. F. Robinson, R. C. Welts and D. H. Moss the privilege of building and operating an electric street railway in this city for a period of 30 years. The petitioners have not yet filed their acceptance of the franchise.

WHEELING, W. VA.—The Wheeling Traction Company has commenced work on the improvements on the road at Kentucky Heights, Benwood and South to Jim's Run. The company also contemplates the extension of the City Railway to Benwood in the near future.

KAUKAUNA, WIS.—The Council is considering the question of establishing a municipal electric light plant.

MILWAUKEE, WIS.—The Mayor has selected Irving B. Cary as one of the five commissioners who will oversee the erection of a municipal electric light plant. The term of appointment is five years. Mr. Cary was formerly employed at the Milwaukee electric plant.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has recently purchased three 22-kw exciters for direct-mounting on the shafts of the three 1,500-kw turbine generator units ordered some time ago from the Allis-Chalmers Company, of Milwaukee.

MILWAUKEE, WIS.—The Mayor has appointed five lighting commissioners for the purpose of taking charge of the construction of the new municipal electric lighting plant. The members of the commission are Irving B. Cary, Robert Hill, Michael J. Kruszka, Fred A. Landeck and Casper H. Kroeger. The term of appointment is five years. Mr. Cary was formerly employed at the Milwaukee electric plant.

BELOIT, WIS.—The Beloit Traction Company, which has been organized by business men of Chicago and Beloit, and will apply for a franchise at once. The company proposes to build six miles of track, and operate the system in conjunction with the Rockford, Beloit & Janesville Interurban Railway. The officers are J. B. Dow, president; C. A. Gault, vice-president; O. S. Baylies, secretary and treasurer. The company has a capital stock of $50,000, all of which has been subscribed.

NANAIMO, B. C.—The Hamilton Power Company has decided to spend $250,000 this summer in improving its plant here.

VANCOUVER, B. C.—The contract for supplying a series of alternating-current arc lamps for this city, has been awarded to the Canadian General Electric Company, for $20,400.

VANCOUVER, B. C.—The British Columbia Telephone Company will spend about $55,000 in installing switch boards, etc., in its new exchange now being erected. Address Superintendent Kent.

GREENWOOD, B. C.—W. S. Smith, of Greenwood, states that an electric plant is being installed on the Prince Henry, a high-grade silver property, located between Greenwood and Phoenix, B. C.

NEW WESTMINSTER, B. C.—The Burrard Power Company has received a grant from C. C. Fisher, Government water inspector, Vancouver, of 25,000 miner's inches of water and will develop 20,000 hp from Lillooet Lake and River at a cost of $1,000,000. Messrs. Herman and Burwell, of Vancouver, are interested.

CARNDUFF, CAN.—A local syndicate is being formed for the purpose of installing a telephone system. W. T. Lockhart is interested.

INDIAN HEAD, CAN.—The new municipal electric lighting plant has been completed and is in operation. The plant complete, cost about $28,000.

WINNIPEG, MAN.—The Kensington Land & Development Company, of Winnipeg, has offered to build an electric railway ten miles in length in Brandon, Man., at an estimated cost of $200,000.

WINNIPEG, MAN.—The Ogilvie Flour Mills Company is installing electrical machinery in its mills at Fort William and Winnipeg. This apparatus, which is to displace steam power, will be operated at 2,000 volts.

FT. FRANCES, ONT.—The Town Council has decided to install a complete system of water works, sewerage and electric lamps at a probable cost of $57,000. John Galt, of Toronto, is engineer.

KENORA, ONT.—Kelly Bros. & Company, of this town, have secured the contract for developing an extensive power plant at the inlet of the Lake of the Woods. Work will be commenced at once.

KENORA, ONT.—The town has decided to construct a power plant and develop from 5,000 to 7,000 horse-power at a cost of $150,000. T. Pringle & Sons, of Montreal, Que., are consulting engineers.

DRUMMONDVILLE, QUE.—The Standard Construction Company, of Montreal, Que., has secured the contract for installing the municipal electric lighting and power plant in this town.

Company Elections.

RIDGEFIELD, CONN.—At a recent meeting of the stockholders of the Ridgefield Electric Company the following officers were elected: President, Henry B. Anderson; vice-president, George P. Ingersoll; treasurer, A. H. Wiggins; secretary, Harvey P. Bissell; assistant secretary and superintendent, George Kirk, Jr.; directors, G. G. Haven, Jr., John A. Mitchell, Russell W. Lowe, M.D. Work on the plant of the company is progressing rapidly.

NEW ORLEANS, LA.—At a recent meeting of the directors of the New Orleans Railway & Light Company the following officers were elected for the ensuing year: President, E. C. Foster; first vice-president, R. M. Walmsley; second vice-president, Joseph H. DeGrange; third vice-president, A. S. Gibbs, of New York; secretary, Joseph H. DeGrange; assistant secretary, C. Marcel, of New York; treasurer, H. A. Ferrandeu; assistant treasurer, H. J. Jumonville; general counsel, Messrs. Denegre and Blair.

New Incorporations.

DOVER, DEL.—A charter has been issued to the Wilmington & Edge Moor Railway Company, with a capital stock of $200,000. The incorporators are Davis Ott and others.

WILMINGTON, DEL.—The Philadelphia Light & Equipment Company has filed certificate of incorporation with a capital stock of $300,000. The company proposes to furnish light, heat and power and equipments for the same.

STAR, IDAHO.—The Local Telephone Company, of Star, has filed articles of incorporation with a capital stock of $20,000 for the purpose of constructing and operating 19 miles of telephone lines throughout the rural districts surrounding Star. The incorporators are William A. Lawrence and others.

GALESBURG, ILL.—The Home Light & Power Company has been incorporated with a capital stock of $10,000 by W. S. Cameron and others.

PEORIA, ILL.—The Peoria Railway Company has been incorporated with a capital stock of $1,000,000. The incorporators are W. H. Tazewell and others.

EAST ST. LOUIS, ILL.—The Dupue Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Lewis Beauman and others.

PEORIA, ILL.—The Salem, Peoria & Springfield Railroad has been incorporated with a capital stock of $100,000. The incorporators are Jonathan P. Reeves and others.

TAMAROA, ILL.—The Tamaroa Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are: C. O. Winthrop, C. R. Rice, J. T. Marlow.

MURPHYSBORO, ILL.—The Murphysboro Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are A. B. Minton, Thomas M. Logan and W. C. Alexander.

BELLEVILLE, ILL.—The West Dosen Telephone Company has filed articles of incorporation, with a capital stock of $1,000. The incorporators are R. J. Wilson, W. H. Miles and John Fauth.

MILLSTADT, ILL.—The St. Clair Farmers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $2,000. The incorporators are Daniel A. Haas and others.

NEW ATHENS, ILL.—Dutch Hill Telephone Company has been incorporated with a capital stock of $480, to operate a telephone line. The incorporators are John H. Feurer, Peter Knewitz and Henry Wildy.

CHAMPAIGN, ILL.—The Springfield & Northeastern Traction Company has been incorporated with a capital stock of $1,000,000. The incorporators are Chas. Zilly and others. The company will construct a line from Springfield to Bloomington.

CHAMPAIGN, ILL.—The St. Louis, Champaign, Decatur Railway Company has been incorporated with a capital stock of $100,000 to build and operate an electric railway from Litchfield to Champaign. The incorporators are Charles Zilly and others.

CHICAGO, ILL.—The Chicago & Milwaukee Power Company has been incorporated with a capital stock of $100,000. A. C. Frost, F. S. Monroe and others are interested. This company was organized by the officers of the Chicago & Milwaukee Electric Railway to build a power plant to furnish power for the railway and to sell electricity.

OAKLAND CITY, IND.—The Oakland City Telephone Company has been incorporated, capitalized at $10,000. The company is in the market for material, equipment and bids for the construction of a modern telephone plant in Oakland and Gibson County. J. M. Vanderveer, J. W. McGowan, Alvin Wilson and R. S. Mason are the incorporators.

FT. GIBSON, IND. TER.—The Fort Gibson Development Company has been incorporated, with a capital of $200,000 by L. J. Marlin, W. P. Moore and B. F. Rice. The company proposes to furnish heat, light and power and to build electric plants and railways in Ft. Gibson.

OTTUMWA, IA.—The Ottumwa & Southeastern Iowa Interurban Railway Company has been incorporated with a capital stock of $750,000, to succeed to the property of the Ottumwa Light & Traction Company. The incorporators are Charles E. Coffin, Lew V. Uhey, Charles A. Walsh, Herman J. Ostdeik and Harry Miesse.

DURHAM, IA.—The Plymouth Farmers' Mutual Telephone Company has been incorporated under the laws of Iowa.

LOOMSBURG, PA.—The Roaringcreek Valley Telephone Company will apply for a charter to start with a capitalization of $5,000.

ROYALTON, MINN.—The Pike Rapids Power Company has been incorporated, with a capital stock of $100,000.

EAST ORANGE, N. J.—The Providence Light & Equipment Company has been incorporated with a capital stock of $100,000 for the purpose of operating lighting plants. The incorporators are Edward E. Buren, Harry E. Crandall and James McIntosh.

JERSEY CITY, N. J.—The Fort Dodge Light Company has been incorporated with a capital stock of $350,000. The incorporators are Howard A. Thornton, H. O. Coughlin and John R. Turner. The company is to act as a holding company and deal in all kinds of securities.

BUTLER, N. Y.—The Butler Independent Rural Telephone Company has been incorporated with a capital stock of $1,000 by J. B. Atkins and others.

OSWEGO, N. Y.—The Southwest Oswego Telephone Company has been incorporated with a capital stock of $600. The incorporators are F. McBride and others.

CLARKSVILLE, N. Y.—The Lake Valley Telephone Company has been incorporated with a capital stock of $300. The directors are William H. Van Nalton and others.

NEW YORK, N. Y.—The Consolidated Water Powers Corporation has been incorporated with a capital stock of $500,000 to manufacture electricity. The directors are H. L. Brightman, New York; W. S. McClelland, Eustice, Fla.; F. J. Collier, Hudson, N. Y.

LITTLE FALLS, N. Y.—The Little Falls & Canada Lake, Railroad Company has been incorporated with a capital stock of $200,000 to operate an electric railway from Little Falls to Canada Lakes, a distance of 20 miles. The directors are R. S. Storrs, E. E. Witherby, S. R. Bertron, New York; H. P. Collins and M. G. Bronner, Little Falls.

ADAMSVILLE, OHIO.—The Adamsville Telephone Company, of Muskingum County, has increased its capital stock from $3,000 to $10,000.

CUMBERLAND, OHIO.—The German Telephone Company has been incorporated with a capital stock of $500. The incorporators are Christian Wielke and others.

WASHBURN, N. D.—The Washburn Water & Light Company has been incorporated with a capital of $25,000 by Karl Klein, W. A. Persey, Aug. E. Johnson and others, all of Washburn.

BARBERTON, OHIO.—The Barberton Telephone Company has filed articles of incorporation with a capital stock of $30,000. The incorporators are A. R. Henry, James McNamara and others.

STILLWATER, OHIO.—The Stillwater Mutual Telephone Company has been formed by A. J. Murphy, A. J. Groves, J. C. Groves, H. W. Howell and A. E. Collins. The capital stock is $10,000.

GALION, OHIO.—The Galion, Mt. Gilead & Delaware Traction Company has been incorporated with a capital stock of $10,000 by C. A. White, Harry S. Griffith, John McNeal, Newton Ruhl, W. P. Vaughan, W. M. Carlilse and C. L. Russel.

ALINE, OKLA.—The Aline Telephone Company has been chartered with a capital stock of $5,000. John Hartshorne and others are interested.

MOUNTAIN PARK, OKLA.—The Mountain Park Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are W. W. Watson and others.

SHATTUCK, OKLA.—The Shattuck Electric Light & Power Company has been incorporated with a capital of $3,000 by W. G. Shears, R. A. Moody and others, all of Shattuck.

PITTSBURG, PA.—The East Deer Light & Power Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are George S. Davidson and others.

PITTSBURG, PA.—The O'Hara Light & Power Company has been incorporated with a capital stock of $5,000. The directors are George S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

PITTSBURG, PA.—The Springdale Light & Power Company has been incorporated with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

BRACKENRIDGE, PA.—The Brackenridge Light & Power Company has been incorporated with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

TARENTUM, PA.—Articles of incorporation have been filed by the Tarentum Electric Light & Power Company, with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

PITTSBURG, PA.—The Harrison Light & Power Company has filed articles of incorporation with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

WEATHERFORD, TEX.—The Home Telephone Company, of Weatherford, has been incorporated with a capital stock of $50,000. The incorporators are J. A. Murray and others.

New Industrial Companies.

THE ALPHADUCT COMPANY, of Toronto, Ont., has been incorporated with a capital of $40,000 to manufacture electrical supplies. The directors are F. B. Johnson, C. W. Bongard, A. J. Thomson, all of Toronto.

THE G. E. WATTS ELECTRICAL CONSTRUCTION COMPANY, of Baltimore, has been incorporated with a capital stock of $1,000, by Samuel M. Sachs, J. J. McNulty, D. Gray Elderkin, W. N. Hechheimer and Harry Hechheimer.

THE AJAX LINE MATERIAL COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $12,000. The company will manufacture electric specialties. The incorporators are Charles J. O'Connor, Ralph P. Polley and N. O'Connor.

THE BRIGHTLIGHT INVERTED GAS & ARC LAMP COMPANY, of New York, N. Y., has been incorporated with a capital stock of $200,000, for the purpose of manufacturing gas and arc lamps, mantles, etc. Gustav Reif, 202 West 114th Street; Martin W. Bethke, 208 East 21st Street, and others, are the incorporators.

THE ARC SPARK PLUG MANUFACTURING COMPANY, of Toledo, has been formed with E. A. Spark, president; H. J. Brubach, vice-president; P. S. Fancher, secretary and treasurer. The company will manufacture a new ignition device for gasolene engines. The device is now being manufactured in a Toledo factory, but the company is planning to erect its own plant.

Legal.

SAFETY ARMORITE CONDUIT COMPANY, of Pittsburg, Pa., has brought suit in the U. S. Circuit Court of the Southern District of Ohio against the Mark Manufacturing Company, of Chicago, Ill., and Zanesville, O., for infringement of its patent for a cleaning and enameling pipe for use in electric iron armored conduit.

NON-CONDUCTIVE TOOLS.—Alexander Smith, while cleaning snow from the Manhattan Elevated Road in December, 1902, formed a short circuit with his shovel between the third rail and an iron bolt which projected from the track. He alleged that his right eye was injured by the accident. Smith brought suit against the Manhattan Railway Company on the ground that it was the duty of the company to provide him with a wooden shovel or some other non-conductive tool for use near the third rail. Judge McCarthy, of the City Court tried the case, and a jury returned a verdict in favor of the plaintiff for $1,900. The Appellate Term of the Supreme Court set aside the verdict, holding that the plaintiff, having worked on the structure for six months, was well aware of the danger of the third rail, and the accident was due to his carelessness. Justice McLaughlin and his associates of the Appellate Division sustained the judgment of the lower court, with costs. The opinion handed down by Justice McLaughlin says that there is no special danger in the third rail, but that the company should not furnish iron shovels for use near it.

Educational.

UNIVERSITY OF WISCONSIN.—The sixth annual session of the Summer School for Artisans held under the direction of the College of Engineering of the University of Wisconsin begins June 25th, and continues for a period of six weeks. Courses of study are offered in the following subjects: Engines and boilers, applied electricity, mechanical drawing and machine design, materials of construction, fuel and lubricants, shop work, and manual training. The instructional force is taken from the regular faculty of the College of Engineering, and the entire laboratory and shop equipment belonging to the college is used by the students in the summer school. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work so that the student may take advantage of all the preparation he has obtained. This school offers to those unable to take a regular four years' course, an opportunity of obtaining a working knowledge of the methods of testing and the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. Correspondence students have found this school of value in giving an opportunity for laboratory practice along the lines in which they have had theoretical instruction. A bulletin describing the work of the School for Artisians in detail will be sent on application to Frederick E. Turneaure, Dean, College of Engineering, Madison, Wis.

Obituary.

MR. W. E. NEWHALL, for many years treasurer of the R. D. Wood Company, of Philadelphia, died on May 1 at the Pennsylvania Hospital, Philadelphia, as the result of an accident in falling through an open areaway in the sidewalk, that apparently had been left unguarded. He was 71 years of age, and his eyesight was defective. He was one of the oldest members of the Union League Club

Personal.

MR. FRANK N. WATERMAN, mechanical and electrical engineer, has removed his offices from 100 Broadway to 150 Nassau Street, New York.

MR. J. W. DUNTLEY, President Chicago Pneumatic Tool Co., sailed for Europe on May 3 in the interest of the company's business.

MR. C. L. LATHROP has been appointed superintendent of telegraphs and signals of the Pittsburg, Shawmut and Northern Railroad Company

MR. CECIL T. WILKINSON sailed for Europe on May 8, and will remain abroad for several months, during which he will visit the principal points of electrical interest on the Continent and in Great Britain.

MR. W. H. SCHOTT, engineer, designer and builder of central station heating plants, electric railway and light plants, has moved his offices from the Marquette Building, Chicago, to the newly erected American Trust and Savings Banks Building.

MR. HENRY D. JACKSON has removed his offices from 83 Newbury Street to 4 State Street, Boston, where he will continue to carry on business as consulting electrical engineer, making a specialty of electrolysis, power distribution and power plant economy.

MR. OREN ROOT, JR., who has been active in the Metropolitan Street Railway Company for 11 years, entering its service upon graduation at the age of 22, has been elected vice-president of the company. He has been general manager for about three years.

MR. R. D. TOMLINSON, president of the National Association of Stationary Engineers, delivered a paper at a meeting last week on "Power Station Design, Construction and Operation" before the Cincinnati branch of the National Association of Stationary Engineers.

MR. G. E. WATTS, formerly of the Watts & Uthoff Supply Company, of St. Louis, is now connected with the G. E. Watts Company at Atlanta, Ga. The company has made a thorough survey of the needs of the Southern field and is prepared to carry on an extensive business in electric railway and lighting supplies—especially the former.

MR. M. M. REID, of Columbus, O., has been appointed superintendent of the municipal electric light plant in that city. Mr. Reid was formerly master mechanic and chief engineer of the Appleyard system of traction lines centering at Columbus and before that he was with the Southern Railroad Company of New Jersey. He succeeds William Wilcox.

MR. NORMAN MARSHALL, president of the Marshall Electric Manufacturing Company, Boston, a graduate of the Worcester Polytechnic Institute of the class of 1886, has offered to give to the institute all electrical supplies manufactured by his company that may be required in the electrical equipment of the new electrical engineering building.

MR. EUGENE N. FOSS, of the B. F. Sturtevant Company, and leader in the cause of reciprocity and tariff revision, is in Europe, having sailed in March. He has gone abroad partly for rest, but particularly to meet some of the leading statesmen and merchants of England and the Continent, in connection with his studies of certain economic questions in their relation to the foreign trade of the United States.

MR. JULIUS S. JENSEN, of New Haven, Conn., has been appointed superintendent of the power stations and give charge of construction of the Consolidated Railway Company. The office includes all the lines of the company in Connecticut, Massachusetts and Rhode Island. Mr. Jensen has been a mechanical engineer in the electrical department of the railroad for the past few years, before which he was in the motive power department. He is a native of Copenhagen, and graduated from a technical school in that city.

MR. GRAHAM SMITH, formerly in charge of Westinghouse exposition and convention publicity, as the New York Westinghouse press representative, and recently engaged in advertising work under his own name, will sail next week for a journalistic tour of several months abroad. On his return he will assume the direction of the Eastern advertising interests of several corporations of the Middle West and West, with an office in the Flatiron Building, New York, and will make a specialty of the preparation of industrial books of the higher class. Mr. Smith was born in Buffalo on August 24, 1878, and was graduated from Harvard College, with high honors in English, in 1900. After a year's travel, he spent three years on the staff of the New York *Evening Sun*, as news reporter, assistant city editor, real estate editor, and writer on financial topics. The latest example of his literary work is the handsome souvenir book descriptive of the Westinghouse exhibits at last year's International Railway Congress at Washington.

Trade Publications.

BOILER FEED PUMPS.—Circular No. 54 of the Dean Bros. Steam Pump Works, Indianapolis, Ind., is devoted to boiler feeders or pressure pumps. These pumps are built with either simple or compound steam ends, and either in single units or in pairs.

SMALL POWER MOTORS.—A line of small power motors of both the direct-curent and alternating-current types is described in circular No. 1,128 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. These motors are rated at from .05 hp to .125 hp.

INCANDESCENT LAMPS.—One of the most interesting pieces of trade literature recently received is from the Boston Incandescent Lamp Company, Danvers, Mass., and is entitled "A Lamp Factory Fable." It makes interesting reading for the central station manager and the lamp buyer in general.

ELECTRICAL SUPPLIES.—In order to contribute to the convenience of its customers and to insure that its orders will be received in uniform style, the Central Electric Company, 207 Jackson Boulevard, Chicago, Ill., has been distributing an order book in which a duplicate is prepared simultaneously with the original.

TESTING LABORATORIES.—The paper by Dr. C. H. Sharp on "A Testing Laboratory in Practical Operation," which was presented at the November, 1905, meeting of the American Institute of Electrical Engineers, has been reprinted with numerous illustrations by the Electrical Testing Laboratories, New York.

THE BAY STATE LAMP COMPANY, of Danvers, Mash., is sending out a very interesting little booklet "How Bay State Lamps Are Renewed." This is very interesting literature for the lamp buyer, explaining clearly the process of renewing, and the tests used, and it appears to lay before the public facts which heretofore have not been given much publicity.

DIRECT-CURRENT MOTORS AND GENERATORS.—Bulletin No. 367 of the National Electric Company, Milwaukee, Wis., gives a description of the constructional features and operating characteristics of a complete line of direct-current generators and motors. These machines vary in size from 1 to 50 hp, and are designed for 110, 220 or 500 volts.

CIRCUIT BREAKERS.—The General Electric Company, Schenectady, N. Y., uses bulletin No. 4436 to present the constructional features and operating characteristics of direct and alternating current, automatic, carbon break circuit breakers. Descriptions are given of circuit-closing and circuit-opening auxiliary switches and of overload, overload low-voltage and shunt trip attachments.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has issued a circular in pleasant form, on "Spring Painting." It calls attention to its graphite and silica-graphite paints and shows how these can be utilized on all classes of work. It also issues an illustrated folder, "Colors and Specifications," containing practical suggestions for construction and maintenance painting.

ROCK CRUSHING PLANTS.—Catalogue No. 4 of the Power and Mining Machinery Company, Cudahy, Wis., is a 72-page publication dealing with machinery for rock crushing plants. A large portion of the catalogue is devoted to a detailed description of the McCally gyratory crushers, while numerous drawings are given of complete plants in which these crushers and auxiliary apparatus are used.

ATTACHMENT PLUGS.—A neat little folder issued by the H. T. Paiste Company, Philadelphia, Pa., which contains a few comments intended to bear the truth to the electric lighting man who wants the best, gives a brief list of brass-cap and porcelain styles of attachment plugs. These plugs have been designed for use where neatness is taken into consideration. The company has also issued price list No. 6, dealing with its complete line of electric lighting specialties.

STORAGE BATTERIES.—An interesting booklet containing complete instructions for the care of "Exide" batteries in electric vehicles has recently been issued by the Electric Storage Battery Company, Philadelphia, Pa. While a portion of the descriptive matter relates specifically to batteries for vehicles, the major portion is applicable to storage batteries in general, and the information contained in the booklet should prove of value to any one dealing with the operation of storage batteries.

ELECTRIC HOISTS.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has issued a well-prepared catalogue dealing with standard and special electric hoists. These hoists are arranged to be driven by means of either direct or alternating-current motors. Among the special electric hoists, may be mentioned one driven by a 150-hp and a 75-hp induction motor, and another driven by a 300-hp induction motor for hoisting 6,000 pounds at a speed of 1,000 feet per minute, and another hoist provided with an 800-hp alternating-current motor which delivers 17 tons of matter per minute at a height of 555 feet.

CARBON-BREAK CIRCUIT BREAKERS.—Bulletin No. 603 of the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., describes three types of circuit breakers, designated as type C-16, C-7 and C-11 respectively. Type C-16 breakers are intended for use with direct-current at from 250 to 650 volts, with from 15 to 1,200 amperes. Type C-7 may be used with either direct or alternating current at from 250 to 550 volts, and it will carry from 3 to 100 amperes. Type C-11 has been designed especially for heavy service. It is made in two styles, one for 250 volts and the other for 650 volts, and for all values of current from 2,000 to 6,000 amperes.

FAN MOTORS.—In an artistically executed catalogue designated as No. 1051, the General Electric Company, Schenectady, N. Y., gives outline descriptions of fan motors of both the alternating and the direct-current type and of small power motors for various purposes. The rotor of the alternating-current motor is of the squirrel-cage form while the stator is provided with projecting poles each of which is equipped with a "shading" coil for producing a revolving field. The direct-curent motor is built with axially sloping armature slots in order to render it noiseless in operation. The small power motors are designed for use with portable drills, bench drills, blowers, sewing machines, etc.

CENTRAL STATION ADVERTISING.—The Denver Gas and Electric Company has issued a booklet to which has been given the title "Boosts." The contents are made up of newspaper clippings in which Denver is referred to as the "City of Lights," a term which has been acquired through the energetic efforts of the Gas and Electric Company. The clippings have been taken from papers published in Philadelphia, Boston, Cleveland, St. Paul, Omaha, Detroit, Lincoln, Buffalo, St. Joseph, Milwaukee, Chicago and Binghamton, so that they come from disinterested observers and have not originated from self praise, although municipal pride has been to a large extent responsible for the existence of the conditions which justify the use of the term.

MOTOR CONTROLLERS.—An attractive bit of advertising matter entitled "Various Applications of Ward Leonard Rheostats, Circuit Breakers and Resistance Units," has recently been issued by the Ward Leonard Electric Company, Bronxville, N. Y. Illustrations are given of machine tool drives complete with controlling apparatus. With almost no exception the descriptive matter is so arranged that the service to which the electrical equipment is put can be learned readily, and much valuable information can thus be obtained as to the proper combinations for various installations. The rheostats are of the "fool-proof" type. It is stated that a poor motor will have a long life if protected by a good rheostat, but a poor rheostat will ruin even a good motor in a very short time.

HOTEL PIPE COVERING CONTRACTS.—The H. W. Johns-Manville Company, through its Philadelphia Branch, completed recently two of the season's largest contracts for the installation of its various pipe coverings, in the plants of the hotels The Marlborough-Blenheim and The Denis, Atlantic City, N. J. In the plant of the former all of the hot, salt and fresh water pipes are covered with its "J-M" moulded, and all steam pipes with its well-known "J-M" 85 per cent magnesia covering. In The Denis the entire heating system is covered with "J-M" three-ply asbestos air-cell covering, and high pressure work with 85 per cent magnesia. In the placing of these contracts none but manufacturers of the highest reputation were considered, and the H. W. Johns-Manville Company is to be complimented on securing these orders. The coverings referred to above are only a few of the many standard coverings manufactured by this company, which has recently gotten out a very neat and attractive booklet entitled "Pipe and Boiler Insulation," in which these materials are fully illustrated and described. A copy will be sent to interested parties for the asking.

News of the Trade.

THE OHIO BRASS COMPANY has moved its New York office from 136 Liberty Street to 43-49 Exchange Place, New York City.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, announces the opening of a branch office in Pittsburg. This office will be located in the Frick Building Annex.

HOLTZER-CABOT ELECTRIC COMPANY, of Boston, has severed its connection with W. Green & Co., 6 Maiden Lane, New York City, and will hereafter sell its motors to the jewelry trade direct.

THE KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, of New York, has moved its business from 93 Liberty Street to 55 Dey Street, where more extensive and commodious quarters have been secured.

THE B. F. STURTEVANT COMPANY, of Boston, Mass., has, among recent orders, furnished mechanical draft apparatus for 1,200 hp to the Lackawanna Lighting Co., Scranton, Pa., and 2,700 hp to the Edison Electric Illuminating Co., Williamsport, Pa.

ELECTRIC STORAGE BATTERY COMPANY.—The sales office of this company, located formerly in San Francisco, has been transferred to 525 Thirteenth Street, Oakland, Cal. All business connected with the Pacific Coast territory will be handled from that office.

THE LORD ELECTRIC COMPANY has recently moved its New York offices to the ninth floor of the Fuller building, where it has more commodious quarters for its rapidly increasing business. The company now has contracts for the electric construction work in many of the large buildings under construction in New York City, and there is an increasing demand for the electric railway specialties which it manufactures.

SPECIAL 100-TON FLAT CARS FOR MACHINERY. The Allis-Chalmers Company, Milwaukee, Wis., has placed with the C., M. & St. P. Railway an order for two 16-wheel flat cars capable of carrying 200,000 lbs. each, which are the first of their kind in existence. These cars were required for conveying a frame and side of a monster horizontal rolling mill engine built by the Allis-Chalmers Company for the Carnegie Steel Company's plant at Sharon, Pa.

ELECTRIC SIGNS.—A real estate company, which is developing a suburban town north of Dayton, O., has erected a mammoth electric sign calling attention to "Ft. McKinley," as the town is called. It is on high ground and can be seen for several miles. It is claimed to be the largest electric sign west of New York City, the letters being eight to ten feet high. So far as is known this is the first electric sign ever placed on a piece of suburban real estate in this country. The sign was built by the R. R. Sign Company of Dayton.

THE ELECTRIC CABLE COMPANY has moved its New York office from 42 Broadway to more commodious quarters at 17 Battery Place. The company has just received large orders for Voltax, the new insulating compound from the American Railways Company, of Philadelphia; S. Pearson & Son, contractors on the Pennsylvania Tunnel, and from the United Water Improvement Company, of Philadelphia. Reports show that this material has been used successfully both as an insulating compound and as a waterproofing. The company reports the sale of this compound in large quantities to 50 leading railways in this country and in England, France, Germany and Italy.

VULCAN ELECTRIC HEATING COMPANY.—The business of L. P. Brown & Co. has been incorporated under the laws of the State of Illinois, to be known hereafter as the Vulcan Electric Heating Company. The offices remain at 71 West Jackson Boulevard. Additional capital will be used in the business and the plant and facilities will be enlarged to meet the rapidly increasing demands of its customers. The Vulcan Electric Heating Company assumes all obligations and has acquired all accounts, stock, equipment, patent and trademark rights and manufacturing processes of the old firm. It will take up various lines of practical designing and engineering in connection with its electric heating specialties.

THE SHELBY ELECTRIC COMPANY, of Shelby, Ohio, received a novel message from C. D. Pierce, its representative in San Francisco, a few days after the big fire. The message was written on half of one of Mr. Pierce's collars. On one side he had written the address of the Shelby Electric Company, while the other contained the words, "Both safe. Stock and office gone. Pierce." The use of half of his collar showed the dire extremity to which Mr. Pierce had been put for writing materials in the confusion which followed the fire. There was no stamp upon the unique souvenir card as the post office issued an order immediately after the fire, making postage from San Francisco collectable from the receiver. The Shelby Company's loss was about $5,000.

THE CENTRAL ELECTRIC COMPANY, Chicago, is now well established in its new quarters at 264-270 Fifth Avenue. This is in the same location as the building previously occupied by it, which was totally destroyed by fire. It now has the best appointed electrical supply house in the down-town district of Chicago. It occupies four floors of a building with 100 feet frontage, giving it an aggregate of about 60,000 sq. ft. floor space. The city sales department, which is splendidly arranged and organized, occupies the first floor. The general offices occupy the second floor, where also are the miscellaneous supplies in broken and unbroken packages. The third floor and basement are given to wire and heavy material. The offices and city sales department are handsomely finished in oak and the appointments are all of the best.

THE ARNOLD COMPANY on May 1 moved from the quarters in the Marquette Building which it has occupied for many years to the sixteenth and seventeenth floors of the Borland Building, corner La Salle and Monroe Streets, Chicago. Although the company's old offices had been frequently extended from time to time, they were entirely outgrown. In the new quarters the company occupies an entire floor for its offices and has its draughting room on the next floor above. A structural steel department has recently been added to handle the building problems which arise in connection with construction work. The company as engineer and constructor is building the Elgin & Belvidere Electric Railway, a 35-mile road; is making preliminary reports and estimates on several electric railway properties; has just finished the construction of shops for the C., H. & D. Railway at Ivorydale, Ohio; and is designing several other steam railroad shops; is drawing plans for two more hydro-electric plants for the Spring River Power Company near Joplin, Mo., besides much other work. The company's policy of handling certain parts of the work as engineer and then as actual constructor on a basis of cost plus a percentage has a broadening effect on its engineering work.

THE ENGINEERING AGENCY.—The controlling interest in the Engineering Agency, Inc., Chicago, which was organized in 1893 by Frederick A. Peckham, has been purchased by A. G. Frost. At the last director's meeting, Mr. Frost was elected president. Mr. R. D. Smith, vice-president, and Mr. P. W. Herring, secretary and treasurer, retain their offices as heretofore. The Agency has a branch office in Pittsburg and contemplates opening within the next thirty or sixty days offices in New York and Denver. The head of the mining department of one of the prominent western mining schools will probably take hold of the company's Western business. There has been an unprecedented growth in the securing of competent engineering assistants through this bureau by the better grade of employers; for instance, on an average of 250 men are placed monthly through the Chicago office, and the Pittsburg office has only been running about three months, and this month will place between 75 and 100 men. The salaries of these positions range from $75 to $500 per month and include all sorts of mechanical, electrical, civil, mining and architectural engineers and draftsmen, besides superintendents for contractors, managers of technical enterprises, etc. The demand at the present time for engineers and draftsmen is very great and good men are at a premium. It is no uncommon thing for employers to offer $10 to $25 per month more for a man than their present employer pays them for doing the same work. Through the J. G. White Company the Agency has sent a party of twenty men to the Philippines on the Government railroad work there. Men are constantly being sent to Mexico, South America and the Far West. The moderate commission charged by this bureau for its services is in a great measure the cause of its popularity.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 1, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St.,N.Y.]

819,049. ELECTRIC BELL; John Erickson, Chicago, Ill. App. filed Oct. 31, 1904. Relates to a construction of telephone bell with the usual polarized armature vibrating adjacent to the poles of a magnet. The armature is pivoted on a U-shaped spring or extension from the permanent magnet pole so as to permit an adjustment in the position of the armature.

819,050. INDICATING DEVICE FOR AUTOMATIC TELEPHONE-SWITCHES; John Erickson, Chicago, Ill. App. filed Dec. 30, 1904. An individual switch for automatic telephone systems, said switch being provided with an operative part under the control of the subscriber, and adapted to be given a plurality of positions, one of said positions being appropriated solely for the purpose of transmitting alarms or special signals, and an indicating device responsive to said appropriated position, and adapted to remain operated until manually restored and without interfering with the natural restoration and further use of said switch.

819,059. MOUTHPIECE FOR TELEPHONE TRANSMITTERS; Harry J. Guttman, Chicago, Ill. App. filed Oct. 21, 1904. As an article of manufacture, a mouthpiece for telephone transmitters, said mouthpiece consisting of a hollow body portion of drawn steel, having a bend or deflection in the metal providing external and internal shoulders, and a separately-formed perforated diaphragm secured within the base of said hollow body portion and against said internal shoulder, the said hollow body portion being externally threaded between its external shoulder and its smaller end, said threaded portion being cylindric and internally smooth, and means integral with the said bend or deflection for holding the diaphragm in place against the internal shoulder.

819,060. TERMINAL STRIP; Harry J. Guttman, Chicago, Ill. App. filed Nov. 9, 1904. A strip of insulation provided with openings, and a plurality of metal strips extending crosswise of said strip of insulation, each metal strip having end portions lying flatwise upon one surface of said strip of insulation, and having also an intermediate portion lying flatwist against the opposite surface of said strip of insulation, the said metal strips being suitably spaced apart and insulated from each other and provided with free ends adapted for connection with circuit-conductors.

819,061. TELEPHONE SWITCH-HOOK; Harry J. Guttman, Chicago, Ill. App. filed Nov. 25, 1906. A telephone switch-hook constructed from a single integral sheet-metal blank bent and folded into shape to provide a neck or body of double thickness, a hook or supporting prongs of single thickness, and attaching means of single thickness.

819,071. ELECTRICAL MEASURING INSTRUMENT; Frederick A. LaRoche and Maurice C. Rypinski, New York, N. Y. App. filed Nov. 8, 1904. Relates to details in the manner of supporting the movable element so as to surround a fixed core. The invention is claimed as a "F-shaped center piece for electrical measuring instruments having two pairs of forwardly extended arms."

819,073. MEANS FOR CHARGING STORAGE BATTERIES OF TELEPHONE SYSTEMS; Talbot G. Martin, Chicago, Ill. App. filed Dec. 12, 1904. A telephone system comprising a manual exchange, an automatic exchange, a trunk line extending between the two exchanges, a storage battery at the manual exchange, a source of current at the automatic exchange for charging the said storage battery, together with a charging-circuit including one side of the said trunk-line.

819,082. ELECTRIC RELAY; Michael Setter, Chicago, Ill. App. filed Oct. 31, 1904. Telephone relay having a L-shaped armature stamped of sheet metal with trunnions integral therewith. One arm of the armature is extended into connection with a blade spring having platinum contacts which is thereby displaced.

819,083. ELECTRIC BELL; Michael Setter, Chicago, Ill. App. filed Oct. 31, 1904. Details of construction of a telephone call bell relating particularly to the adjustment of the armature. This is disposed on a slidable extension from the permanent magnet and has its position determined by a beveled set screw.

819,084. TELEPHONE-TRANSMITTER; Michael Setter, Chicago, Ill. App. filed Oct. 31, 1904. A telephone-transmitter comprising a casing, a diaphragm, a support secured to the diaphragm, a vibratory front electrode secured to the diaphragm, a stationary back electrode secured to the said support, granular carbon between said electrodes, and means for holding or inclosing the granular carbon, the said diaphragm, support, electrodes, carbon-holding means and granular carbon being inclosed within said casing, and the same being organized into a structure which is removable as a unit from the interior of said casing the means for holding or inclosing the granular carbon being vibratory with the diaphragm and removable with the electrodes through an opening in the back of said unit.

819,085. STRIP OF LAMP-JACKS; Michael Setter, Chicago, Ill. App. filed Jan. 13, 1905. A strip of lamp-jacks having a body made of sheet metal bent into shape to provide an integral front plate having a plurality of lamp-openings, and lamps in said jacks.

819,095. COMMUNICATING ELECTRIC SYSTEM; Alexander M. Stark, Toronto, Canada. App. filed Aug. 9, 1902. A telephone exchange system having various detail features in the electric circuits and relays. One feature mentioned as novel is the use of a dynamo with storage battery bridging across its terminals to steady the current therefrom.

819,146. TROLLEY-WHEEL GUARD; James H. Lane and Uriah Gulnick, Newark, N. J. App. filed May 3, 1905. A pair of L-shaped arms are swiveled on vertical axis to the harp so as to normally close over and retain the trolley conductor in place under the influence of tension springs connected to the arms for this purpose.

819,160. POLE CHANGER; Roger M. Newbold, Louisville, Ky. App. filed July 8, 1905. The rotating shaft of a reversible dynamo has a worm and gear connection with a friction band which moves the switch to its alternate position when the direction of rotation is reversed.

819,190. ELECTRIC SIGNALING SYSTEM; Jean F. Webb and Clayton E. Frederickson, Denver, Col. App. filed Apr. 25, 1905. An automatic telephone system having a toothed wheel for every subscriber which is stepped around in the manner of an ordinary messenger call to make any connection desired.

819,195. ELECTRIC ELEVATOR; Parvin Wright, Los Angeles, Cal. App. filed Jan. 19, 1905. Complete elevator installation and circuits, including the mechanical features of the circuit breakers, and braking mechanism. Also the stop motions for the top and bottom of the shaft.

819,206. COMBINED FUSE AND SWITCH; Frederick H. Cheyne, Indianapolis, Ind. App. filed Jan. 12, 1905. The switch element has recesses on its face for the attachment of the ordinary form of incandescent lamp circuit fuse plug. This furnishes the means of connection with the stationary spring blades constituting the other terminal of the switch.

819,209. APPARATUS FOR TREATING LIQUIDS; Leon Dion, New York, N. Y. App. filed June 3, 1904. The combination with a vessel or reservoir, and means through which a liquid may be supplied to it, of a group of co-operating positive and negative electrodes, with which the liquid contained within the vessel or reservoir may be brought in contact, constructed in prismoidal form angularly bent transversely of their axes, and means through which a current of electricity may be supplied to such electrodes, substantially as described.

819,218. SUPERHEATING COMPOUND; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of calcium carbid, a superheating compound comprising calcium carbid, carbon, an oxygen-producing substance, and a metallic element, as and for the purpose set forth.

819,219. MANUFACTURE OF CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of carbid, the method which consists in first fusing lime and carbon containing elements to reduce the same to liquid or fluid condition, and finally supplying carbonaceous material to the mass while in a molten condition, to complete the conversion of metallic elements or particles of the mass.

819,220. METHOD OF PRODUCING CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of carbid, the method which consists in fusing lime and carbon containing elements to reduce the same to molten condition, and finally running off the molten mass into thin sheets to chill the same.

819,221. PROCESS IN THE PRODUCTION OF CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the production of carbid, the method which consists in applying to the interior surface of a suitable mold a material impervious to water, and then flowing the molten carbid in fluid state directly from the furnace into such mold, whereby the carbid is uniformly coated and impregnated superficially with the said material while fluid are in a state of incandescence, as and for the purpose set forth.

819,222. MANUFACTURE OF CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of carbid, the process which consists in calcining limestone in the presence of carbonaceous material, then adding to the calcined mass a mixture of calcium carbid, black oxid of manganese, bituminous coal, aluminium and chlorate of potash, to maintain the temperature of the heated mass and to expel or drive off any phosphorus present therein, and finally fusing to melting the mass.

819,224. ELECTRIC FURNACE; Herman L. Hartenstein, Chicago, Ill. App. filed July 26, 1902. In an electric furnace, a furnace-chamber, electrodes projecting into said chamber, means for adjusting the inclination of said electrodes, independent means for adjusting said electrodes laterally, and means for adjusting the extent of projection of said electrodes into said chamber, as and for the purpose set forth.

819,242. ALTERNATING CURRENT METER ON FERRARIS PRINCIPLE; Emanuel Morck, Frankfort-on-the-Main, Germany. App. filed May 10, 1904. Has an auxiliary coil containing iron, dependent on the main current and having approximately a quadratic curve of magnetization as long as the iron remains unsaturated by the current in question.

819,267. TELEPHONE-TRANSMITTER; William W. Dean, Chicago, Ill. App. filed Oct. 27, 1902. In a telephone-transmitter, the combination with a sound-receiving diaphragm, of a single flat shallow chamber containing comminuted conducting material and in which the said material may pass from one part to another, a positive, negative and an intermediate electrode in said chamber, and means to divide the current-path through the material in said chamber into several parts, the arrangement of said electrodes being such as to cause the current to traverse said parts in series, substantially as described.

819,268. ELECTRIC SPARKING DEVICE; Albert E. Doman, Elbridge, N. Y. App. filed Feb. 1, 1905. Instead of a short, thick core for the induction coil, as ordinarily used, the patentee makes the core of horse-shoe shape, in order that the vibrator may be more efficiently attracted.

819,293. ELECTRIC RAILWAY; Mathias A. Lazareff, New York, N. Y. App. filed May 19, 1905. Provides a third rail or conductor which is divided into sections along the roadway, the different sections of which are individually energized as the train approaches by means of mechanical connections moved by the train.

819,322. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Nov. 16, 1901. In order to avoid the actuation of signals by "wild" currents from the train motors during its passage, the patentee provides a special relay in the signal circuit which moves under the impulse of direct but not alternating currents, and which is effective to prevent actuation of the signals under such "wild" currents.

819,323. RAILWAY SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Mar. 12, 1902. Relates to an alternative construction for accomplishing the same purpose as in the preceding patent. In this case transformers are used which are affected by alternating but not by direct currents.

819,326. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; Matthias Van A. Van Wyck, New York, N. Y. App. filed Oct. 26, 1905. A diagram of circuits for the purpose of having the train stops normally in operative position. The train stops are first depressed by the approach of a train, and then again made operative after the train has passed.

819,327. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; Matthias Van A. Van Wyck, New York, N. Y. App. filed Nov. 10, 1905. Relates to modifications of the above.

819,355. POTENTIOMETER; Morris E. Leeds and Edwin F. Northrup, Philadelphia, Pa. App. filed Aug. 2, 1905. Has a fixed drum with a resistance wire spirally wound thereon and a casing having a brush which moves spirally over the resistance wire and continually engages the same.

819,360. ELECTRICAL SWITCH; Walter S. Mayer, Philadelphia, Pa. App. filed Mar. 22, 1905. Detailed construction of a circuit breaker having certain specified link and toggle connections.

819,380. ELECTRIC WIRE TERMINAL; Joseph D. Warren, Providence, R. I. App. filed Mar. 2, 1905. A terminal for dry batteries designed to prevent the terminals from working loose. The terminals have two spring leaves, and have protuberances to engage recesses on the nuts.

819,397. RAILWAY SIGNAL; Rollin A. Baldwin, South Norwalk, Conn. App. filed Feb. 16, 1904. A simple apparatus for accomplishing all the purposes of a block signal system on a trolley line with turn-outs. A special circuit wire fed from the trolley by the passage of a car has magnets which illuminate or extinguish the signal lamps as required.

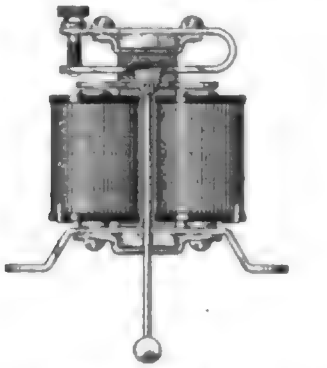
819,410. MANUFACTURE OF CHLORIN; Adolf Clemm, Manheim, Germany. App. filed Feb. 27, 1905. The herein-described process of manufacturing chlorin and at the same time phosphate soluble in a solution of citric acid which consists in first preparing a combined solution of acid phosphoric acid salt, and a chlorid and then subjecting the said combined solution to the action of an electric current, as and for the purpose set forth.

819,418. ELECTRICAL RECEPTACLE; Philip H. Fielding, New York, N. Y. App. filed Nov. 27, 1904. A very efficient form of incandescent lamp socket adapted particularly for the purpose of exterior wiring. The socket or receptacle is made wholly of porcelain, the parts of which are connected by a single screw. A ready means is provided for the attachment of the circuit wires to the metallic parts, and in addition to these features circuit wires are spaced away from the supporting structures so as to satisfy all fire regulations.

819,437. MEANS FOR PACKING JOINTS; James H. Jones, Chicago, Ill. App. filed Dec. 5, 1904. A rubber packing ring is placed around the incandescent lamp, and in engagement with the socket, so as to form a seal to preclude the ingress of moisture.

819,468. TOY FISH TANK; Ernest T. Sulzer, New York, N. Y. App. filed May 11, 1905. An apparatus for pleasure gardens embodying a large circular tank in which toy fishes containing magnets float. Other powerful magnets are rotated beneath the tank so as to impart motion to the toy fishes.

819,522. TELEPHONE-TRANSMITTER; Elmer R. Corwin, West Lafayette, and Frederick R. Parker, Lafayette, Ind. App. filed May 6, 1903. In a transmitter, the combination with the speaking-diaphragm thereof, of a projecting pin making contact therewith, an insulating-disk to which the projecting pin is secured, and a secondary diaphragm resting against the insulating-disk, substantially as described.



819,049.—Electric Bell.

819,524. OIL BREAK DEVICE FOR ELECTRIC SWITCHES AND CIRCUIT BREAKERS; James H. Delany, Wilkinsburg, Pa. App. filed Aug. 12, 1904. In order to obtain a circulation of the oil and thus insure destruction of the arc, the patentee makes the movable element of his switch in the form of a piston which impels the oil through special passages.

819,525. RAIN ALARM; Vincent A. Dever, Philadelphia, Pa. App. filed May 9, 1905. A device for alarming the sleeping occupants of a house when it rains on a hot summer night and the windows are open. Has a piece of blotting paper which gets heavy when wet and completes an alarm circuit.

819,531. MOUTHPIECE FOR TELEPHONES; Frank C. Fisher, Cheltenham, Pa., and Walter C. Culin, Camden, N. J. App. filed Oct. 30, 1905. A mouthpiece comprising a section of hard rubber or analogous material, and a metallic body carrying the said section and having one of its ends extended beyond the section and provided with means for effecting connection between the mouthpiece and a support and also having its opposite end extended beyond the section to protect the same against blows.

819,559. CIRCUIT BREAKER; Joseph La Cos, Schenectady, N. Y. App. filed Aug. 25, 1904. The usual detent of a magnetic switch is in the form of a small roller in order to avoid sticking of the switch by reason of frictional surfaces.

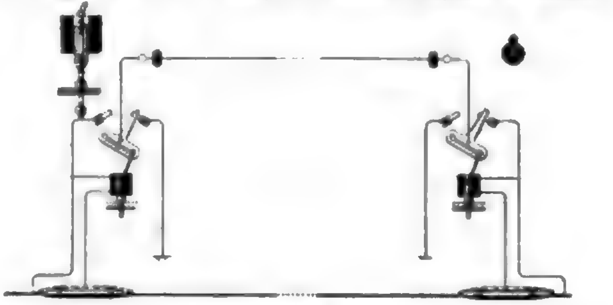
819,560. METHOD OF PRODUCING A CONSTANT MAGNETIZATION BY MEANS OF ALTERNATING CURRENTS; Marius C. A. Latour, Paris, France, App filed Sept. 10, 1904. The method of producing a substantially constant unidirectional flux in a magnetic circuit, which consists in producing therein a plurality of magnetomotive forces each varying as the square of a sine function.

819,563. ELECTRIC MOTOR CONTROLLER; John B. Linn, Schenectady, N. Y. App filed Mar. 1, 1902. Details of an elevator controller, the principal feature of which is the arrangement of nesting the various segments and the separating insulation together in a row so that they are obliged to turn with each other and with the controller shaft.

819,571. ALTERNATING-CURRENT MOTOR CONTROL; Maurice Milch, Schenectady, N. Y. App. filed Jan. 15, 1904. In combination, in an alternating-current motor, a rotor winding provided with a commutator, brushes short-circuiting the rotor winding on a line displaced from the line of magnetization of the primary member, a switch adapted to close the rotor circuit on a second line at an angle to the first, and electromagnetic controlling means adapted to operate said switch when the motor is up to speed.

819,572. ALTERNATING-CURRENT MOTOR AND STARTING-SWITCH; Maurice Milch, Schenectady, N. Y. App. filed Sept. 9, 1904. In an alternating-current motor, a rotor-winding provided with a commutator, commutator-brushes and connections short-circuiting the rotor on a definite line, a starting-switch for the motor having a movable switch member adapted to close the circuit of the rotor-winding on a second line at an angle to the first, and means for retarding the movement of said switch member.

819,608. FUSE BOX; Earl Sherwood, Honesdale, Pa. App. filed June 16, 1905. A fuse box for trolley cars designed to separate the terminals when the fuse blows. The terminals are formed by the extremities of spiral springs which are tensioned to separate from one another.



819,397.—Railway Signal.

819,613. CONTROLLING THE SPEED OF MOTORS; Charles P. Steinmetz, Schenectady, N. Y. App. filed Sept. 26, 1902. The combination with a multipolar electric motor, of means whereby the active armature circuit may be of the parallel-wound or series-wound type, at will, the number of poles of the motor remaining unchanged.

819,620. METHOD OF OPERATING CONSTANT CURRENT TRANSFORMERS; Matthew O. Troy, Schenectady, N. Y. App. filed Dec. 12, 1903. In order to avoid the inefficiency of a constant current transformer when used on light loads due to the excessive separation of the primary and secondary coils, the patentee cuts out portions of the primary on light loads, so that the coils can work nearer together and therefore more efficiently.

819,624. INCANDESCENT ELECTRIC LAMP; Howard I. Wood, Schenectady, N. Y. App. filed Oct. 31, 1904. The combination of a vitreous envelope, a thin metal band shrunk while the parts are hot about a portion of the envelope so as to make intimate contact therewith, and a metal conductor or wire passing through the envelope from the inside and making contact with the band or ring on the outside.

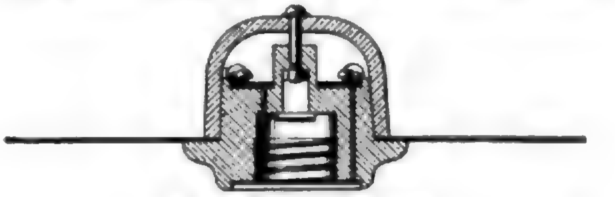
819,625. ELECTRIC MUFFLE; Erland Zell, Schenectady, N. Y. App. filed Oct. 28, 1902. In a furnace, an iron heating member and a heat-insulating packing therefor, containing calcium carbid in granular form.

819,626. MOTOR STARTING AND REGULATING RHEOSTAT; Paul H. Zimmer, Schenectady, N. Y. App. filed June 28, 1905. A combined motor starter and controller having starting resistances and controlling resistances. The starting arm returns to zero position after the motor is running normally, and thereafter the controlling arm can be manipulated.

819,627. PROTECTIVE MEANS FOR ALTERNATING CURRENT SYSTEMS. Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed July 16, 1903. An attachment to avoid the failure of the usual reverse current relays which protect A. C. generators in case of a short circuit. Patentee provides means for temporarily energizing the potential coil of the relay after the short circuit occurs no matter how absolute or serious it may be.

819,645. SNAP SWITCH; Henry Heisenhoner, Schenectady, N. Y. App. filed May 10, 1902. Construction of snap switch having a spring impelled switch element restrained by a detent, and cam means for displacing the detent after a predetermined rotation of the turn button.

819,650. ELECTRIC HEATER; Johannes Harden, Schenectady, N. Y. App. filed Mar. 27, 1905. In order to avoid the increase of resistance which ordinarily takes place when an ordinary metallic resistance medium is heated, the patentee combines an additional resistance of a negative temperature co-efficient so as to compensate for the increased resistance.



819,418.—Electrical Receptacle.

819,654. FLEXIBLE SHEET RESISTANCE; Harry E. Heath, Lynn, Mass. App. filed Dec. 12, 1904. A construction of C-shaped porcelain beads which can be woven together upon a resistance wire so as to make a complete resistance element of flexible character.

819,657. CARTRIDGE FUSE AND FUSE BLOCK; Harvey Hubbell, Bridgeport, Conn. App. filed Oct. 29, 1904. The fuse terminals are depressed below the surface of the switchboard panel, and the fuse has projecting extensions which engage said depressed terminals. The purpose is to avoid persons making improper connections with pieces of wire, etc.

819,677. ELECTRIC BLOCK SIGNAL SYSTEM; Paul J. Simmen, Chico, Cal. App. filed July 31, 1905. A series of conductors are disposed in over-lapped relation along the length of the roadway, and a shoe on the train makes connection with one or two sections ahead so as to determine the position of trains on the preceding blocks.

819,702. LOCKING SOCKET FOR ELECTRIC LIGHTS; Jeremiah Murphy, Chicago, Ill. App. filed June 11, 1904. An arrangement to preclude electric lamps from being stolen. The lamp shell has ratchet teeth embossed thereon and a special cap is included in the socket to engage such ratchet teeth and lock the shell against movement, unless such catch is displaced by the insertion of a suitably formed tool.

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Report of the A. I. E. E. Standardization Committee.

The Committee on Standardization of the American Institute of Electrical Engineers, after having worked for several months on the Standardization Rules with a view to bringing them up to date, has recently reported them in provisional form for criticisms or suggestions. The secretary of the Institute has issued copies of the report in galley-proof form to about seventy members of the Institute, and has invited suggestions thereon. A circular letter accompanying the proofs intimates that the committee desires to report the rules to the Institute at an early date. The matter contained in the provisional report now extends to 21 printed pages. Not only have amendments been made throughout the rules, in accordance with the results of latterday experience, but new matter has also been introduced, under the headings of Wave-Shape, Rheostat, Lightning-Arresters, Switchboard-Apparatus and General Recommendations. The committee has also indicated its desire to reclassify the substance of the rules. In their original form, when adopted by the Institute in 1899, the rules were classified according to a plan that then seemed convenient and desirable. At that time the report only extended over 13 printed pages. Additions were made from time to time by the committee, and these additions were naturally incorporated along the original lines of classification. The additions have finally become as comprehensive as to overwhelm the original substance in various directions, with the result that a new classification, according to a somewhat different plan, is now admitted to be desirable. The committee doubtless realized that this would be a somewhat lengthy undertaking, and decided to issue the substance of the rules for criticism prior to reporting to the Institute, so as to leave the reclassification to a later date.

An important amendment is offered in regard to the efficiency of large generators. Heretofore large generators have usually been tested in the factory while running on temporary bearings because the driving engines and permanent bearings were only set up in the central station. The result was that the mechanical journal friction of the alternator during the test for acceptance at the factory was perhaps very different from the journal friction of the same machine when ultimately installed. Consequently the journal friction in the factory test was omitted from consideration, thus slightly improving the generator efficiency, and leaving the generator journal friction as a fixed charge upon the prime mover. The introduction of the turbo-generator, however, has permitted the engine and generator to be tested together in the factory as a single unit. It is now proposed that the frictions of the unit be determined by measuring the retardation, or the time of coming to rest, after the stream has been entirely shut off; a vacuum connected to the turbine, and the speed first brought up to the full normal value. Half of the friction thus arrived at is then charged to the generator and half to the engine.

Another new proposal, which is of considerable importance to designers refers to the wave-shape of alternating impressed e.m.f. A standard alternating e.m.f. is now stated to be sinusoidal in wave form, and no wave is to depart from this standard form by more than 10 per cent. unless specially stated. The deviation from the standard form is measured by obtaining a record of the wave, to rectangular co-ordinates, by oscillograph, and superposing thereon a sinusoidal wave of the same length and same effective value. The maximum difference between the ordinates of the two waves, at any abscissæ divided by the amplitude, or maximum value, of the sinusoidal wave, constitutes the numerical value of the deviation. Lightning arresters and static protectors are stand- deviation. Lightning arresters and static protectors are standardized in regard to their capabilities under laboratory test. This is the first time that such devices have been placed in the rules. It is important that any comments or criticisms upon the proposals of the committee should be reported by the members as soon as possible, in order to aid the committee in drawing up a proper report to the Institute.

THE TRENTON FALLS POWER PLANT.

It is seldom that one finds in the East a hydraulic situation presenting so many points of interest as that found at Trenton Falls, the electrical development of which we describe elsewhere. To begin with, it is a case of mid-head, in the debatable ground between turbines and impulse wheels. More than this, the situation required long pipe lines carrying large volumes of water with the accompanying difficulties of regulation. The former situation was met by the construction of special vertical shaft turbines. The 264-ft. head made it relatively easy to adopt the sometimes clumsy vertical shaft generator, and thus considerably to economize space in the power house. The result is a very simple and convenient station. The second matter was more serious and some extreme measures had to be taken. Western precedents were followed and the main run from dam to power house was made with a 7-ft. wooden standpipe 2,900 ft. long. This type of conduit has been rarely used in the East within recent years, although a few old examples exist in New England. It is, however, cheap, reliable and durable for moderate inclines, and has been largely used on the Pacific Coast for many years. The lower end of the pipe is of steel graduated in thickness to meet the increasing pressure. Near the final plunge downward to the power house a standpipe 200 ft. in height and 7 ft. in diameter is inserted in the line to serve as a relief against sudden changes of flow. It is perhaps the most imposing structure of the sort yet erected, and renders possible a degree of regulation which could not otherwise have been obtained without added complications.

In addition relief valves are inserted in the line, but the standpipe is the main reliance against varying pressure. Most long pipe lines are used under conditions that permit the use of deflecting nozzles, and the use of turbines with quickly revolving gates rendered pressure control of extreme importance in this plant. The governing, under these conditions, should be good in spite of the great length of pipe line back of the wheels. The general design of the power house strikes one as excellent. It is very compact, owing to the form of the generating units, and the transformers and switchboard panels are where they can be cared for with the minimum of trouble, i. e., on the main floor at the end of the station from which the wires emerge. The lightning arresters are also where they should be, in a house by themselves adjacent to the station proper. It would be hard to find a station of equal capacity more conveniently arranged for easy operation. The transmission lines present no remarkable features, the distances involved being relatively short. It is an admirable example of intelligent use of nearby resources, and when the subsidiary plants are equipped the system will rank in output among the larger plants of the East. There are still many quite unutilized water powers which can be made similarly valuable. Most of them, to be sure, are further from a market than is Trenton Falls, but in these days of high-voltage work much longer transmissions than this can be made highly economical. And the fear of operating in parallel has now departed, so that there need be no hesitation in linking together as many plants as may be necessary to secure the required output. In fact, it is a common observation that a group of plants often work more smoothly than a single station, helping each other out and cushioning the effects of sudden changes of load. And other things being equal, a network gives more reliable service than can be obtained from a single plant, and it often affords a lower total cost of distribution on account of the decrease in the necessary line precautions.

SPECIAL LIGHTING OF BUSINESS STREETS.

There is at present in a number of cities in this country a movement to establish plans for the lighting of certain down-town business streets which will result in rendering such streets much more attractive at night than is the ordinary business street. The plan is one which not only interests central station companies that are awake to all opportunities, but is of equal interest to merchants and citizens who desire to see their respective cities classed among the attractive and the progressive. Such special down-town street lighting is by no means new, but the interest in such plans has never before been as widespread as it is now. The principal business street of Columbus, O., with its arches of incandescent lamps, has been a pleasing example of such special lighting for many years. Euclid Avenue, Cleveland, with arc lamps on ornamented posts every 50 ft. as well as some other streets similarly lighted in Cleveland are good examples in the arc lighting line. More recently Los Angeles has adopted for its business streets lighting by incandescent lamps in clusters on posts at frequent intervals, as described in a paper read last week by Mr. V. R. Lansingh before the Illuminating Engineering Society, abstracted elsewhere in this issue, and a similar scheme is being tried on a short stretch of Michigan Boulevard, Chicago. Arc lighting with posts 25 ft. apart has been begun in Minneapolis, while the business men of St. Paul are about to unite on an incandescent post-lighting plan. Less pretentious plans are being promoted in smaller towns. One village has a row of incandescent lamps over each sidewalk in certain streets, which is an inexpensive way of adding considerably to the attractiveness of a street.

These plans for special down-town street lighting are usually taken up first by some merchants' association or chamber of commerce. To be effective not less than an entire block of such lighting should be secured in a place, and preferably much more than this. It is sometimes possible to secure an unbroken stretch of such lighting by dealing with each merchant or property owner individually, but there are always likely to be breaks in the chain under such a plan. As to the relative merits of arc and incandescent lighting for this work, we are not disposed to take sides. Arc lighting produces an effect nearer to daylight. Incandescent lighting looks more festive—almost too festive and temporary, some think; but with good diffusing globes and substantial post design, the incandescent lighting can be given an appearance of stability and permanency equal to arc lighting. The problem of selecting the lighting equipment for business streets, therefore, settles down mainly to a question of color and quantity, which are so largely matters of personal taste.

The Properties of Electrically Prepared Colloidal Solutions.

The April number of the *Philosophical Magazine* contains an article by Mr. E. F. Burton on the properties of electrically-prepared colloidal solutions, which subject has a special interest at the present time in connection with the Austrian "colloidal filament" lamp, for which, as has previously been noted in these columns, great claims of efficiency are made. The term colloidal seems to be fashionable at present among physicists, and to be somewhat ill-adapted to the expression of the numerous properties that it now covers. Not long ago substances were divided into two classes, namely: crystalloids and colloids. Crystalloids include mineral acids and salts, can usually be obtained in definite crystalline forms, and when dissolved in water materially affect the physical properties of the water. Colloids are amorphous or non-crystalline substances. When dissolved in water they appear to be mechanically suspended therein in finely divided form. Common salt and sugar are typical examples of crystalloids. Jelly and gum arabic are typical colloids. A colloidal solution of a metal is a solution in which the metallic particles lie suspended in a very finely divided state, as distinguished from a metal in the condition of a dissolved salt, such as copper sulphate. An electrically-prepared colloid solution of a metal may be made by allowing an arc to form under water between electrodes of the metal under consideration. After such arcing the electrodes lose a small amount of weight, and the water becomes cloudy. This cloudy water may be filtered again and again without appreciably altering its color or translucency. It may remain for months unchanged. It contains suspended metallic particles of ultramicroscopic smallness. It is a colloidal solution of the metal.

The paper shows that the diameter of the metallic particles in colloidal solutions of platinum, gold and silver in water varies between 0.2μ and 0.6μ. No microscope can permit an image to be formed of an object smaller than one micron in diameter (1μ) because the wave lengths of light are too short, being comprised between 0.4μ and 0.8μ, and light cannot form an image of a particle that is not large by comparison with its wave length. Nevertheless, the presence of such particles may be rendered evident by the ultra-microscope, an instrument which can reveal the light scattered by a particle, when the particle is too small to form an image. A silver solution containing 0.68 milligramme of metal per litre revealed the presence of 3,000 particles of metal per cubic millimetre of solution, with the aid of the ultra-microscope. In the field of this instrument each particle appeared like a faintly bright moving star. Each particle was in constant zig-zag motion. The direction and velocity of the motion of any one particle constantly changed. This Brownian motion, as it is called, is generally admitted to be a consequence of the kinetic theory of gases and liquids, when the particle viewed is so small that the impacts of its neighbors from opposite directions do not balance, but leave a residual momentum that is constantly being altered by successive collisions. The most interesting electrical property of these ultra-microscopic particles is that they all persistently carry an individual electric charge. The electro-negative non-oxidizable metals, gold, silver and platinum, in water, are negatively charged. The electro-positive oxidizable metals, on the contrary, give solutions in water, ethyl alcohol and methyl alcohol, in which the particles are always positively charged. That is to say, colloidal metallic particles, which are much larger than the atoms, retain in their aggregation the atomic sign of the electric charge.

The Tungsten Incandescent Lamp.

A number of attempts have been made recently, as is well known, to improve the light-yield of incandescent lamps, by the selection of a suitable high-melting-point metal for the filament, in place of carbon. A considerable degree of success has been met with in the use of graphite, tantalum and osmium. It seems to be only a question of time and commercial process development when the ordinary carbon filament, now so widely used, shall disappear. Reports have recently come to hand concerning attempts to utilize two new elementary substances; namely, molybdenum and tungsten, particularly the latter. Tungsten is a rare metal, has an iron grey color and is so very hard that it can scratch glass. Its specific gravity is given as 19.1, and its atomic weight 184 (almost identical with tantalum), thus being one of the heaviest of metals. It was discovered by Scheele in 1780. It is sometimes called wolfram, particularly in Germany, but this term is also applied to a mineral consisting of a double tungstate of iron and manganese. Until recently, tungsten has only been known to most electricians as the metal which, when added to German silver to the extent of one or two per cent, produced the alloy platinoid, which possesses a remarkably high resistivity, the value of which varies only slightly with great temperature changes.

Like osmium and tantalum, tungsten has a lower resistivity than carbon, and consequently there is the same kind of difficulty in producing high-voltage lamps of tungsten that there is in producing high-voltage lamps of osmium and tantalum. Nevertheless, 110-volt tungsten tantalum lamps of 32-cp are stated to have been produced. A very high efficiency, and therefore a very low specific consumption, is claimed for them, namely, 1 watt per hefner, or .88 candle, while the lifetime at this specific consumption is reported as 1,500 hours. Moreover, it is said that the candle-power of the tungsten lamp remains constant during its lifetime and that it is not sensitive to fluctuations in terminal voltage. If all this is borne out in practice, and the lamp can also be produced at a reasonable cost, a very roseate future should be predicted for it. Up to the present time, however, the information offered is too meagre to admit of any reliable opinion being formed as to the merits of the tungsten filament. It is unquestioned, however, that its melting point is exceedingly high. In fact, according to the inventors in Austria, pure tungsten does not melt, but volatilizes directly at a temperature considerably in excess of that at which the ordinary carbon filament is supposed to volatilize. On this account a considerable improvement in the luminous efficiency of tungsten as compared with carbon filaments when employed in incandescent electric lamps may reasonably be expected.

A. I. E. E. Election.

The vote for president and officers of the American Institute of Electrical Engineers for the year 1906-7 was declared at the annual meeting, New York City, on May 15 as follows: Dr. S. Sheldon, president, 1,257 votes. Vice-presidents—A. H. Armstrong, 2,051; H. H. Humphrey, 2,020; F. G. Baum, 1,942. Managers—Paul Spencer, 2,077; Paul M. Lincoln, 2,089; John J. Carty, 2,060; A. M. Schoen, 1,903. Treasurer—G. A. Hamilton, 2,176. Secretary—R. W. Pope, 2,177. Mr. E. W. Rice, Jr., for president, received 907 votes.

The proposed new constitution failed to receive the necessary number of votes to make it effective.

Organization of Chicago Section of the Illuminating Engineering Society.

At a meeting held on the evening of May 7, at which about 65 were present, the Chicago section of the Illuminating Engineering Society was organized. The Chicago section starts with nearly 50 members and applicants for membership. Temporary officers were elected as follows:

President, Mr. George C. Keech; secretary, Mr. J. R. Cravath; managers, Messrs. J. F. Gilchrist, R. E. Heine, J. M. Morehead and Charles E. Ummach.

A paper was read on "Residence Lighting," by J. R. Cravath. This was illustrated with stereopticon views from photographs of various rooms with different lighting arrangements. Mr. Cravath explained at the beginning that the object of the paper was to lead to a discussion on some of the common questions which came up in residence lighting, that it would not be possible in the limits of one evening's paper to take up the subject of residence lighting either thoroughly or systematically, and that this subject had been taken up at some length recently in a series of articles by Mr. V. R. Lansingh and himself. The points made by Mr. Cravath in his paper being very similar to those made in the articles referred to, it will not be necessary to publish an abstract here.

Mr. John F. Gilchrist, in the discussion of this paper, said that one of the principal things it brought to mind is the great lack of properly designed fixtures. Fixtures are now made without any idea of the lighting effect to be produced, but simply for ornament. He thought we might be now at about the same stage in illumination that furniture making was at the time when William Morris began to teach the world that furniture could be at the same time comfortable, useful and artistic.

Mr. O. J. Bushnell said that the man who owned his own home could arrange electric light fixtures to suit himself, but the one who suffered most from poor illumination was the man in rented quarters. He had recently moved into a new apartment where one or two of the rooms had lighting well designed in accordance with the principles laid down by Mr. Cravath. In the kitchen, however, no electric lamp whatever had been provided. Upon commenting on this to the landlord, he was told that it was a common thing for Chicago architects to omit electric lamps in the kitchens of flats and apartment houses.

Mr. Cravath said that he considered the kitchen should as a rule have the best general illumination of any room in the house, because it is a work room requiring good light in a number of places. In other rooms in the house it is usually necessary to provide illumination in only one or two places, as for example for reading in the living room and at the dresser or over the bed in a bedroom. In the kitchen there must be a good light over the entire room.

Prof. P. B. Woodworth told his experience in designing the illumination of some 40 residence and apartment houses. In the residences there was no great difficulty in providing satisfactory arrangements to suit the owners, as the requirements were fairly uniform. In eight different apartments, however, there were as many different ideas as to the uses to which the various rooms were to be put, and consequently no lighting arrangements suited to one apartment could be duplicated in another. In the lighting of small bedrooms where only one outlet is available, the only way out of the difficulty seemed to be the use of a portable bracket which could be hung on the wall in various parts of the room where it was needed.

Mr. Cravath endorsed what Prof. Woodworth said about the usefulness of the portable wall bracket in bedroom lighting, and also called attention to the small number of satisfactory portable wall brackets to be found on the market at present.

Mr. S. M. Bushnell said that there is a tendency now away from the old idea of keeping down expenses as much as possible with electric lights, since the cost to the consumer is being constantly reduced. It will be the province of such an organization as this to arouse demand for better illuminating arrangements. In the old days it was difficult to get a hotel keeper to consent to more than one outlet in each bedroom, but times are now changing. There is a constant increase in the amount of light that is being used both for useful and display work.

Competitive Telephony in New York City.

The struggle of the Atlantic Telephone Company to secure a franchise to give service in New York City culminated last week in hearings on the subject before the Board of Estimate. The company was represented by Mr. M. W. Littleton. The opposing Bell interests were represented chiefly by ex-Comptroller Grout and Mr. John G. Milburn. There were warm arguments on both sides. The Merchants' Association of New York filed a letter against the proposed grant, on the ground that two telephone systems were unnecessary. The New York Telephone Company had definitely and explicitly committed itself to the regulation of its charges by the limitation of its earnings, to complete publicity of its affairs and to a supervision of its accounts by public authority. The association urges, therefore, that the telephone business be continued as a monopoly, subject to municipal regulation.

The first basis of arrangement proposed by the Atlantic Company with the city was a payment of about $3,000,000 for a 25-year franchise, and free telephones for the city. The latest offer, made more or less informally, is that if the Board of Estimate and Apportionment would give the company for 25 years what the city has given the New York Telephone Company for the last 25 years in the way of a monopoly of the ducts of the Empire City Subway Company, and about $300,000 a year, the equivalent of the city's telephone outlay, his company would give the city the use of 1,000 telephones without cost, and would guarantee a rate of only two cents a message, or $12 a year for 600 messages. A three-fourths vote of the board is necessary for the granting of any new franchise, and it is doubted in some quarters whether this can be secured. The Atlantic Company proposes to use the system of the Automatic Electric Company, of Chicago, already well known to our readers. Some three or four other competitive companies are seeking a franchise.

The Diversion of Water from Niagara.

President Roosevelt has sent to Congress the report of the International Waterways Commission on the preservation of Niagara Falls. In addition to suggesting that the amount of water to be diverted be limited either by treaty or by legislation, the commission recorded the following recommendations:

First, in the opinion of the commission it would be a sacrilege to destroy the scenic effect of Niagara Falls.

Second, while the commission are not fully agreed as to the effect of diversions of water from Niagara Falls, all are of the opinion that more than 36,000 cu. ft. a second on the Canadian side of the Niagara River or on the Niagara Peninsula, and 18,500 cu. ft. a second on the American side of the Niagara River, including diversions for power purposes on the Erie Canal, cannot be diverted without injury to Niagara Falls as a whole.

Third, the commission, therefore, recommends that such diversions, exclusive of water required for domestic use or the service of locks in navigation canals, be limited on the Canadian side to 36,000 cu. ft. a second, and on the United States side to 18,500 cu. ft. a second, and in addition thereto a diversion for sanitary purposes not to exceed 10,000 cu. ft. a second be authorized for the Chicago drainage canal, and that a treaty or legislation be had limiting the diversions to these quantities.

The Canadian section, while assenting to the above conclusion, did so upon the understanding that in connection therewith should be expressed their view that any treaty or arrangement as to the preservation of Niagara Falls should be limited to the term of twenty-five years, and should also establish the principles applicable to all diversions or uses of waters adjacent to the international boundary and of all streams which flow across it.

The Distribution of Energy from Niagara Throughout Ontario.

Early in the present year the Lieutenant-Governor of Ontario appointed a hydro-electric power commission to obtain information from various sources concerning the demand for electric power throughout the Niagara district of the Province of Ontario to investigate the undeveloped water powers in that district, to ascertain the rates which should be charged for electric service and to determine the cost of the hydraulic undertakings of existing companies. Using the reports of the commission as a basis for his estimates, the Hon. Adam Beck, chairman of the hydro-electric commission, has introduced in the Legislature a bill which would empower the commission to act as the arbiter of prices for electric service. According to the provisions of the bill, the Government will appoint a permanent commission to oversee the relations between the existing power companies and the municipalities. This body will be empowered to fix the rates at which electricity shall be sold in the various portions of the province, and may, with the consent of the Crown, expropriate privileges already granted to private companies. The province will borrow money to be expended by the commission on the construction of transmission lines and distributing plants. Municipalities desiring to participate in the plan may enter into contracts with the commissioners for the supply of electricity at rates which will include an allowance for transmission and transformer losses. The municipalities will eventually bear all the cost of the works. They will pay four per cent interest on the expenditure and an annual sum sufficient to form in thirty years a fund for the retirement of the securities issued to cover the cost. Lastly, they will contribute to the expenses of maintaining, renewing and insuring the works installed. Complaints that excessive rates are being charged for energy, or that municipalities are discriminating in favor of certain manufacturers, may be heard by the commissioners, who may direct what rates are to be paid.

Theses by Senior Electrical Engineers, University of Minnesota.

Following is a list of the theses by members of the graduating class of the University of Minnesota:

Messrs. Albrecht and Weber are completing a set of condensers which will be used in connection with a Braun tube for investigating the wave forms of high-frequency high-potential oscillating discharges. Mr. Bunce is making an electrolytic survey to determine the effect of street-railway currents upon underground cables and other conductors. Messrs. Calmeyer and Cohen are investigating electrolytic condensers. Messrs. Cooper and Hubbard are investigating the mercury vapor rectifier for obtaining direct current from alternating current. Messrs. Cornelius and Stenger are investigating the wave forms of electromotive force by means of a Duddell oscillograph, at the power station of the Twin City Rapid Transit Co. Messrs. Dunn and Schwedes are developing a new device for making automatic arc lamps suitable for operation on either alternating or direct-current circuits. Messrs. Englin, Roepke, Underman and Haeberle have set up an apparatus in the Northeast Pumping Station for removing bacteria and discolorations from the Minneapolis city water supply. This will be placed in operation as soon as certain repairs at the pumping station are completed. Messrs. Finchy and Shuck have completed an improvement upon the flicker photometer and are investigating the performance of flaming arc lamps.

Messrs. Glascock and Stone are testing and redesigning the electric light plant at Le Roy, Minn. Messrs. Gunther, Schow and Wiggins are investigating apparatus for lighting railway trains from the car axle. Messrs. Hoff, Lang, Mowry and Payne have nearly completed a new recording instrument by which simultaneous and continuous records may be made showing variations of the current, voltage and speed of an electric car; when this is completed they will test one of the Minnetonka cars. Messrs. Hokanson and Zimmer are investigating the relative values of different kinds of artificial light for photographic and photo-engraving purposes. Mr. Glascock is working upon a sectional transformer which will provide for 2,000 amperes alternating current for calibrating, testing and welding purposes. Mr. Kaufmann is remodeling a General Electric three-phase motor for use as a variable speed motor and frequency changer.

Municipal League Convention at Atlantic City.

The twelfth annual meeting of the National Municipal League was held at Atlantic City, N. J., in conjunction with the fourteenth national conference for good city government, April 24-27, under the presidency of Hon. Charles J. Bonaparte, of Baltimore, now secretary of the United States Navy. A large amount of interesting and valuable material was presented in the shape of papers and discussions. The subject of uniform municipal accounting was dealt with by Mr. L. G. Powers, of the United States Census Bureau, and Ohio's experience with uniform accounting and reporting by A. B. Peckinpaugh, of the State Auditors' Department, Columbus, O. The session of Friday, April 27, was devoted to the general subject of municipal ownership and operation in American cities, when a number of papers and reports were presented, chiefly by title. Data were given as to Logansport, Ind.; Jacksonville, Fla.; Detroit, Mich.; Duluth, Minn.; Lincoln, Neb., etc., claiming great economies in public lighting service from municipal plants, all the figures being, however, of the familiar character. Mr. F. F. Ingram, president of the Public Lighting Commission of Detroit, made in his report the extraordinary statement that "legal expenses" on the part of private corporations were virtually a cover only for bribery and corruption. An interesting comparison and discussion of conditions abroad—particularly in Germany—and in the United States, was given by Prof. L. S. Rowe, of the University of Pennsylvania, based upon his own observations abroad, and admitting that in most American cities the municipal plant is an impossibility. "It is both an interesting and significant fact that the same combination of causes is everywhere apparent, but particularly evident in Germany. The movement for municipal ownership of gas and electric lighting, and particularly of street railways, is directly traceable to the failure of private companies to furnish the kind of service which the inhabitants of the cities demand and have the right to expect.

"The indictment against the public service corporations in Germany and to a lesser extent in Great Britain is none too strong. Whatever lessons may be drawn from foreign experience—and they are numerous and important—no one will contend that this experience can do more than throw an interesting sidelight on the problems that confront our American cities. We must recognize in the first place that the attitude of the American people toward the city is totally different from that which prevails in the countries of Europe. With us city government is a negative factor. In Europe, on the other hand, the city is a far more positive factor in the life and thought of the people.

"The immediate bearing of this contrast on the question under consideration is that municipal ownership in the United States is regarded as a last resort. This of itself is an assurance that any experiments that may be made will be conservative. It is a grave mistake—especially on the part of the representative of the public service corporations—to decry such experiments as socialistic and as foredoomed to failure.

"We must also bear in mind that in most of our large cities municipal ownership is practically impossible. It is possible that we shall find a way out of this difficulty through the Chicago plan of purchasing mortgage certificates, but it is evident that the sentiment of our American communities is still so strongly opposed to an increase in municipal indebtedness that even this plan is not likely to receive general acceptance."

President Bonaparte entered at some length into a discussion of the address of Prof. Rowe. He said that the fundamental laws of England favored the development of municipal ownership in England, while in the United States the laws in some States were opposed to the idea. There would have to be important changes in some of the constitutions of the States before the idea of municipal ownership could be tried on a large scale. He did not express an opinion for or against the plan, which is seemingly gaining in popularity in this country.

The League decided to make a thorough study of municipal ownership with a view to reaching some definite conclusion at a future convention as early as the wide range of investigation will permit.

Improving Electrical Situation in San Francisco.

By C. W. Whitney.

Electrical interests in San Francisco can hardly be said to be rapidly assuming their usual condition, but great progress, nevertheless, has been made toward supplying the public with telephone, telegraph, light, power and trolley service. On the evening of May 1 several residences throughout the Western Addition were lighted for the first time by electricity. Property owners are keeping the Department of Electricity extremely busy, inspecting wiring in residences and business places, and the San Francisco Gas & Electric Company announces that as fast as inspections are made and permits granted the company will turn on the current. Arc lighting has been resumed in the Mission and Potrero districts and other limited sections in the southern part of the city.

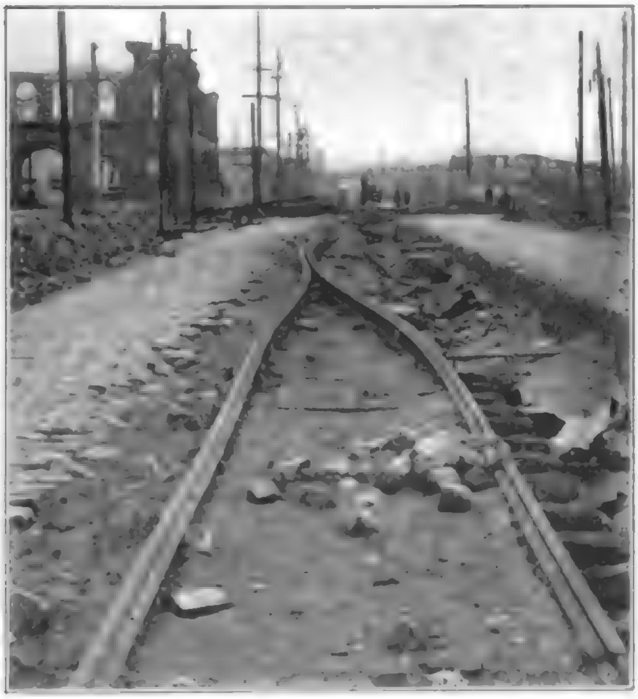


FIG. 1.—CURIOUS EFFECT OF HEAT UPON RAILS.

Louis Glass, general manager of the Pacific States Telephone & Telegraph Company, states that his company now has 18,000 or 19,000 telephones throughout the burned district to which service can be restored as soon as relations can be established with the subscribers. Applications for the installation of telephones in new locations are receiving immediate attention, he says, and a new telephone directory is soon to be issued. It will prove valuable as a directory for the city as it now stands.

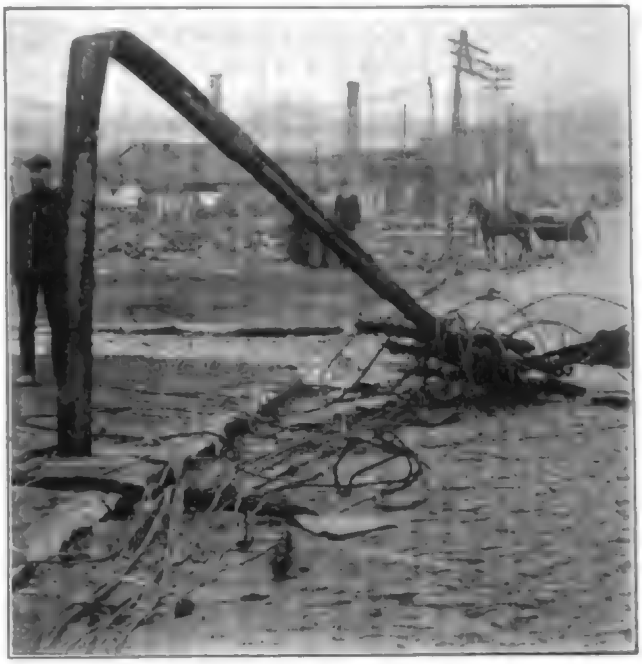


FIG. 2.—TROLLEY POLE BENT BY HEAT.

Enthusiasm over the utility of the automobile in San Francisco's days of dire need has caused many to overlook the invaluable service rendered by another modern invention, the telephone. It was the latter that scored the greater triumph, for in the face of obstacles that seemed insurmountable it brought the various sources of organized effort into touch and hastened relief at a time when every second's delay meant the loss of life and property.

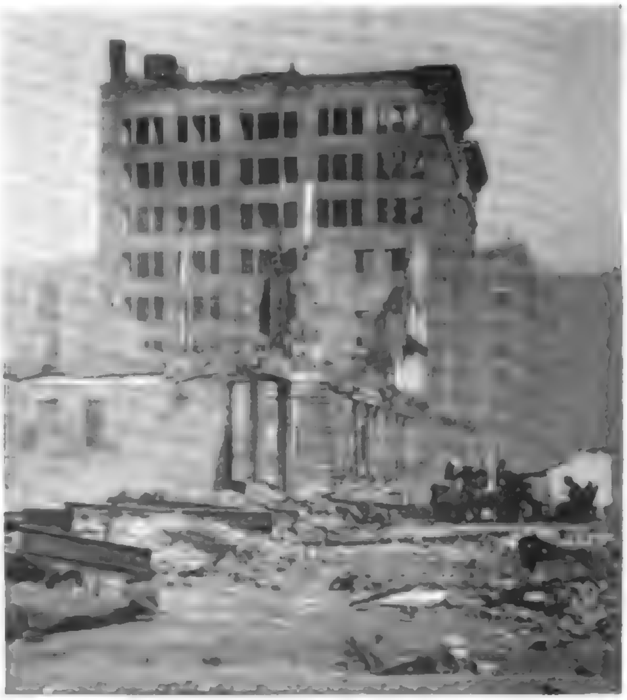


FIG. 3.—RUINS OF "ELECTRICAL ROW."

The company is now connecting up new and old subscribers at the rate of about 100 per day, and it is expected that 75 per cent of the volume of its exchange business will have been returned in about nine months, with a very large increase in territorial development. The cities about the bay, Oakland, Berkeley, Alameda, Sansalito, San Rafael and San Jose, are housing many of those driven out of San Francisco and the applications for the best class of telephone service in those cities are quite up to the company's ability to install. It cost about $10,000 for the Pacific States Company to repair the damage done to its lines in Oakland as a result of the earthquake. Six hundred men were kept busy for three days making the necessary repairs. The business done by the corporation since the shake-up has amply repaid the company for its expense, however. As a result of the migration of people from San Francisco 1,000 new telephones have been installed, and of this number 600 are purely for commercial purposes. The company has increased its staff to 260 operators.

The Western Union Telegraph Company has installed a new and complete operating plant in a building located at Seventh and Pine Streets, West Oakland, near the water front. In a pavilion-like structure, 50 by 100 ft., which was constructed in four days, is housed an equipment even more up-to-date than that destroyed by the fire in San Francisco. The building is necessarily a rough affair of wood and corrugated iron, but it answer the present needs of the company admirably. While building an entirely new operating department the Western Union has also had to handle a business the volume of which has increased rather than diminished since the fire. To keep its force of 171 employes together the company has established a boarding-house near the new operating department, where the men and women are served regularly with good substantial meals. Several tourist sleeping cars have been switched onto a side track and are used as sleeping quarters by many of the operators.

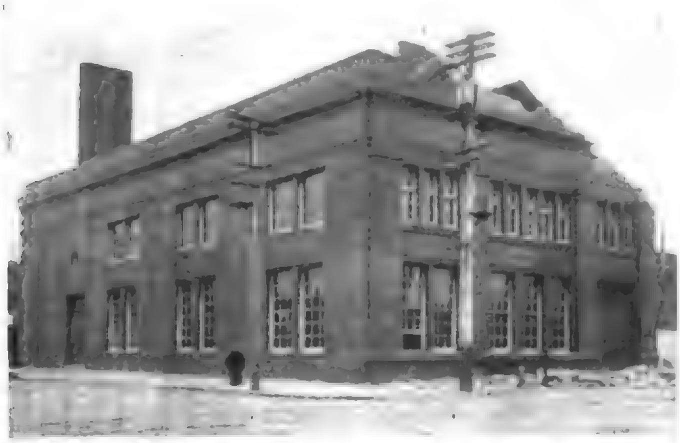


FIG. 4.—POWER HOUSE OF MUTUAL ELECTRIC LIGHT & POWER CO., DAMAGED BY EARTHQUAKE.

The cable steamer *Burnside*, which arrived from Seattle with a cargo of relief supplies, will repair the cables in the harbor before returning to Seattle.

Now that the great excitement is over, the meritorious deeds of many individuals and organizations are being recorded, but none are deserving of more praise and credit than the members of the United States Signal Corps, commanded by Captain L. D. Wildman. It was through their aid and perseverance that General Funston was able at all times to handle efficiently his 2,500 troops. General Greely, who is now in San Francisco, and who was once at the head of the Signal Corps, has spoken of their work in highly complimentary terms. Other officers active were Captains Black and Mitchell and Lieutenants Beacham, Grimm and Kumpe.

Against Municipal Lighting in Toledo.

A committee of the Toledo, Ohio, City Council has decided to strike out the three-year clause which was inserted in the new city lighting ordinance as a provision to enable the city to do its own lighting in case it desired to do so. The council committee does not think the city is ready for a municipal lighting plant, and will not favor it.

CURRENT NEWS AND NOTES.

THE CZAR AT THE TELEPHONE.—It is reported from Russia that the Czar is following closely by means of the telephone the proceedings of the Douma, the National Parliament. This sounds rather apochryphal, for it would be a very tedious job to sit out the proceedings of any parliament, even of the excited Russian national assembly at this thrilling juncture.

TELEPHONE AGENTS IN MEETING.—The annual meeting of the contract agents of the American Bell telephone system was held last week at Atlanta, to discuss methods of business getting, etc. The sessions were held with closed doors. The attendance was some sixty strong. Mr. E. J. Hall, vice-president of the American Telephone & Telegraph Company, was present and participated. Hospitalities were extended by the Southern Bell Company.

BRANCH INSTITUTE MEETING.—Thursday, May 10, the Pittsfield Branch of the American Institute of Electrical Engineers held its last regular meeting for the season. Mr. W. S. Barstow gave a most interesting and instructive talk on "Power Development in the Pacific Northwest," and the meeting was voted one of the most successful that has been held since the local branch was started. Mr. Barstow touched upon the Coeur d'Alene transmission at Spokane, the Snoqualmie plant, the Puyallup station, the Oregon Water Power & Railway Company's plant on the Clakamas River, and the old installation on the Willamette. The branch has held meetings every three weeks throughout the winter and has frequently had an outside speaker of standing in the profession to address it.

ZULU'S AND SEARCHLIGHTS.—Advices from the colony of Natal, South Africa, state that in dealing with the natives now on the warpath, searchlights promise to prove as effective in subduing the sedition of the Zulus as British guns, judging from the display given this week by Native Commissioner Saunders before a huge gathering of Zulus at the N. Kandhala headquarters of the punitive force. The natives were awestruck, and regarded the searchlight as the eye of the Almighty. They said that God had turned it upon them in his anger. The flashing of the light on the surrounding hills, bringing in plain view the Kaffir trails as far as the horizon, powerfully impressed the Zulus, who, when the light was suddenly flashed in their faces, cowered and fell on the ground before what they termed the "latest witchcraft of the whites."

ALASKAN TELEGRAPHS.—It is stated from Washington that orders have been issued by Gen. Allen, the chief signal officer of the army, for the installation of the duplex system on the Alaskan cables. The commercial business of the cables has become so heavy that even by working night and day the operators are not able to handle all the dispatches. In April the receipts from the business of the Alaskan telegraph and cable lines was $18,500, and it is estimated that if the Government had paid for official cable dispatches, the income of the line would have averaged at least $1,000 a day. An appropriation is now pending in Congress for the construction of feeders to the main Alaskan cable, which will connect with Ketchikan, Wrangell, and Prince Edward's Island. As the country these branches would reach is rich in fisheries and the seat of many canneries, the War Department's view is that the business of the cables will be greatly increased. Many changes in the telegraph lines in Alaska are also in contemplation by the signal corps. The lines reaching north from Valdes to Eagle City, and extending to the western coast of Alaska, are very crooked, as the country is so rough that it was necessary to follow the streams with the telegraph system. Now, it is the purpose of the signal corps to straighten out these lines and shorten them wherever possible. In this manner it is believed the telegraph service will be improved, and the lines made capable of yielding greater income.

MR. MARCONI'S ILLNESS.—A great many friends of Mr. Marconi who have been expecting his arrival here for some months past will be glad to learn that at last his malarial fever shows signs of breaking. His temperature has been gradually falling, and it is expected he will now recuperate in health rapidly. It is believed that a trip to this country will be one of his first moves upon recovery.

NEW YORK ELECTRICAL SOCIETY.—The next meeting of the New York Electrical Society will be held at the Edison Auditorium, 44 West 27th Street, New York, Wednesday evening, May 23. Mr. F. B. Behr will deliver an address on "A Monorail Solution of the Rapid Transit Problem," and Mr. Max Schmidt will make some remarks on "The Moving Platform in City Transportation."

ELECTRICAL CONTRACTORS' CONVENTION.—The National Electrical Contractors' Association has carried out the arrangements for its sixth annual convention, at Cleveland, Ohio, on July 18, 19 and 20, and Mr. Alex. Henderson, master of transportation, has just issued notice as to fares and the reduction to be obtained by those securing convention certificates. The meeting promises to be large and well attended.

ATLANTIC WIRELESS.—Dr. Lee De Forest, on his return from the other side, asserts that actual transmission of signals with the system has occurred across the Atlantic. "My Irish experiments," he says, "were very satisfactory. They were conducted with the Bell kites and elevated conductors, and I am able to vouch absolutely for the truth of the story that messages were flashed across the ocean from Manhattan Beach to Bantry Bay, Ireland, where the receiving station was located. The distance over which the message traveled was a little more than 3,000 miles."

NATIONAL FIRE PROTECTION.—The tenth annual meeting of the National Fire Protection Association, will be held at the Auditorium Hotel, Chicago, May 22-24, when a number of important topics and reports will be considered. These include fire-proof construction, car houses, automatic sprinklers, theatre construction and equipment, lightning, signaling systems, etc. The new buildings of the Underwriters' Laboratories, under the direction of the National Board of Fire Underwriters, will be open for inspection, and on May 24 a series of tests will be conducted there. The membership of this body comprises insurance boards, associations and institutes.

SIGNAL CORPS WORK.—Reference has been made more than once to the work done by the U. S. Signal Corps in San Francisco. In a recent article on the subject, the *Chronicle* says: "When the work of the army in San Francisco in the days of the fire is told by those who know whereof they speak, there is one branch of the service which will receive praise that will be as unstinted as it is merited. Without the men of the Signal Corps, commanded by Captain L. D. Wildman, the 2,500 troops under General Funston would have worked like so many scattered individuals, without orders and without a head. 'I was once at the head of the Signal Corps,' said General Greely yesterday, 'and I feel a delicacy in speaking of their work here as I would like to do. But you may say from me that for three days the only electrical communication in the down-town section was over the wires that Captain Wildman's men strung over ruined walls through the heart of the burning district.' At 10 o'clock on Wednesday morning they had a wire from the Presidio to the edge of the burning district. Until 3 o'clock that afternoon, when the Postal Telegraph building went down, they kept one wire opened to Washington. General Funston, who was directing the troops from Market Street during those hours, was in communication with his base and with Washington all the time, when a newspaper man could not get a message out of the city for love or money, and the city telephone plant was down and out."

SWISS ALPINE TRACTION.—United States Consul Keene writes from Geneva that the Simplon tunnel is about to be opened to traffic, and the subject of the lines of access to the new international railroad is being constantly discussed in Switzerland. Besides the "Faucille" line through the Jura range, near Geneva, which has been talked about for years past, a new tunnel through the Bernese Alps between the Canton of Berne and the Canton of Valais, from which the Simplon line passes to Italy, is under active and practical consideration. The board of directors of the committee having that new enterprise in charge held a general meeting on March 5 and unanimously approved the project submitted by Chief Engineer M. Zollinger for a line to pierce the Bernese Alps under the Lotschberg. Electrical traction will be used, and the new tunnel will be 8⅔ miles long. The total cost is estimated at $10,984,000 at the outside. A Franco-Swiss syndicate of leading bankers and engineers, at the head of which is the firm J. L'Hoste & Co., of Paris, have pledged themselves to submit within two months from now their formal contract for executing the work. The electrical features of the Simplon tunnel installation have been described in these columns.

WORLD'S RUBBER PRODUCTION.—United States Consul Halstead, of Birmingham, quotes an estimate by two French experts, MM. Brenier and Claveric, that the total annual production of rubber throughout the world is 57,000 tons. Of this total 55 per cent comes from South America and Africa. The French possessions on the west coast of Africa produce 7,000 tons, and the French Congo 3,000 tons, while the output of the Belgian Congo does not exceed 6,000 tons. The consumption of rubber by the principal countries of the world in 1904 was as follows: The United States, 26,470 tons; Germany, 12,800 tons; Great Britain, 10,000 tons; France, 4,130 tons; Austria-Hungary, 1,320 tons; Holland, 1,218 tons; Belgium, 748 tons and Italy, 588 tons. Consul-General Seeger writes from Rio de Janeiro that the rubber shipments from Brazil for the year 1905 were valued at $64,588,406, the average price per long ton being $2,044 for the 31,600 tons exported. The rubber exports and per ton value have both been steadily advancing since 1902, when they amounted to $34,186,564 and $1,241, respectively.

THE CURIES AND RADIUM.—The Council of the Faculty of Sciences has confirmed the initiative of the Minister of Public Instruction in appointing Mme. Curie to the chair of the University of Paris occupied by her late husband, with whom she was associated in the discovery of radium. An interesting letter from Paris to the New York *Evening Post* says, in regard to the late Prof. Curie: "Now that Pierre Curie has lost his life in a commonplace accident, the world begins wondering that it knew so little of him. He had the will not to be advertised, not to waste his time in talk and 'producing himself.' He lived in absolute retirement, answered questions and invitations as little as possible, certainly much less than is conventional. Face to face with him, you found a man very gentle, seemingly timid, and thawing at most into the simple, unceremonious talk of a student about subjects which preoccupied him, with extraordinary frankness, scrupulous to credit others with the discoveries they had made in his lines, and to refuse assent to hypotheses beyond what the facts warranted. He was intensely interested in the revolutionary physical theories which his discoveries started up, but he would always conclude, 'We have not yet all the facts; we must observe and experiment.' This singlemindedness was the most striking characteristic of one who will surely be more and more recognized as among the very greatest men of science of the generation now passing. All his mind was to learn and to help others to learn, without putting what he learned to personal profit, and without jealousy of that part of learning which he might rightly claim as his own. He accepted money prizes, high professorships with laboratories, because they helped him and others to learn by procuring the means of study. Decorations like the Legion of Honor, which would only accredit his person in that world which he avoided, he refused with simplicity and without noise."

WIRELESS CONFERENCE.—Secretary Metcalf, of the Department of Commerce and Labor, has designated John I. Waterbury, president of the Manhattan Trust Company, of New York, as the representative of that department at the International Wireless Telegraph Conference to be held in Berlin on June 28.

LONG-DISTANCE WORK.—Mr. A. C. Rice, consulting electrical engineer of Worcester, Mass., is at work on plans that are said to involve the delivery in that city of 50,000 horse-power from a point distant 250 miles from the city. No details of the enterprise have yet been made public, but the scheme is said to contemplate the distribution of an additional 65,000 hp along the line of route.

"THE EDISON WEEKLY" is the name of a new bulletin issued by the New York Edison Company. It is a "house organ" of a more intimate character than usual, being intended only for circulation among the staff and employes. "It purposes to foster a co-operative sentiment between the various departments with regard to business-getting and business-keeping. It aims to establish a belief in the minds of all that the company is interested in the efforts of each individual employe toward the furthering of the company's welfare. It intends to set forth impartially the result of satisfactory and effective work accomplished in any direction."

TROLLEYS IN SPAIN.—United States Consul R. M. Bartleman, of Seville, sends a report from the consular agency at Cadiz with reference to the electric street car line recently inaugurated in that Spanish city by the Campania Iberica de Electricidad Thomson-Houston, of Madrid. The electrical material came from the United States, the engines and boilers from Italy, and the 36 cars from Saragossa, Spain. The new line operates 12 miles of trackage, extending from Cadiz to San Fernando and Carraca, the Government arsenal. The site for an additional power house is being prepared with a view to ultimate extension of the line.

POCKET LAMPS AT THE OPERA.—Some enthusiastic Wagnerites have annoyed the orthodox Wagnerites at the Convent Garden Opera House, says a London dispatch, by using pocket electric lamps to enable them to see the printed score. During the Wagner performances the house is kept in darkness, in accordance with the system prevailing at Bayreuth, and the light from the little lamps suggested a swarm of fireflies. A protest was entered against the use of these devices and the management requested the enthusiasts to desist. It is stated that dealers in electric pocket lamps have done a brisk trade since the Wagner season began and prices for these lamps have soared.

NEW YORK TRAVEL.—The amount of passenger traffic in New York City under electrical conditions is something tremendous, and grows rapidly. The report issued by the State Railroad Commission gives the figures of the local passenger traffic for the three months ending March 31, 1906. Taking the city as a whole, there were 297,339,165 passengers carried, an increase of 37,061,250, or 14¼ per cent. In the entire city the number of surface transfers issued in the quarter was 68,212,755, an increase of 10,822,871, and the car mileage was 56,998,216, a gain of 6,522,434. The surface and elevated lines have fully recovered the patronage of which the opening of the Subway deprived them, but the Subway carried 41,000,000 in the quarter.

WIRELESS IN JAPAN.—It is semi-officially stated that the Japanese Government has adopted a wireless telegraph system, as the result of special investigation which has been in progress since 1000, which is unique and totally independent of other existing systems. A special dispatch from Tokio of May 12 says: "There is widespread indignation over the statement by the Berlin *Tageblatt* that Prof. Kimura, of the Imperial Navy, stole Reumer's wireless telephone method. The Admiralty officially denies the *Tageblatt's* allegation. It demonstrates that Kimura's system is radically different. Kimura ten years ago won distinction in pure mathematics at Yale. Later he developed the Japanese system of wireless telegraphy which contributed materially to Admiral Togo's victory over Rojestvensky's fleet."

CONDUITS FOR NASHVILLE, TENN.—The Western Union Telegraph Company has submitted plans to the Board of Public Works, of Nashville, Tenn., for underground conduits it proposes to construct for the reception of its wires in the city, according to the conduit ordinance. Plans have been submitted to the Board by the Cumberland Telephone & Telegraph Company, the Home Telegraph Company, Nashville Railway & Light Company and the Western Union Telegraph Company. By the ordinance the Board is required to act on the plans by July 1, 1906. Whether the Board is authorized to exercise discretionary powers in acting on the applications for permits to build underground conduits, or whether its powers in relation to these applications are purely administrative, is an important question. It is believed that the Home Telegraph Company will contend that the functions of the Board as far as the conduit ordinance is concerned is purely administrative, and that therefore it has no right to refuse to grant a permit to a company having an established telephone or telegraph system in the city, provided the company has complied with the provisions of the conduit ordinance. This is a general ordinance, and in it no person, firm or corporation, except the city and city officials, are specifically designated.

CENTRAL STATION ADVERTISING.—The plans of the National Electric Light Association for a general exhibit of central station advertising methods at the Atlantic City convention in June will result in a most interesting and useful display. Promises of contributions have been received from a number of companies including those in New York, Boston, Buffalo, Baltimore, Portland, Ore., Chicago, The Public Service Corporation of New Jersey, Brooklyn, etc. Mr. John Craig Hammond, who was formerly the advertising expert for Mr. H. L. Doherty at Denver, and did such good work there, has tendered his services for the exhibit to the chairman of the committee, Mr. T. C. Martin, and will take an active share in the work. Several of the companies are sending a large number of copies of their bulletins for distribution at the convention, and the Philadelphia Electric Company is preparing and will distribute a special Atlantic City edition of several thousand copies for the members, as well as for the general public. A large number of the companies are sending framed and unmounted original designs, plain and in color, used for the covers of the bulletins that are now such a feature of the campaign work in selling electricity, and these will be displayed on the walls, constituting a veritable art gallery.

OWNERSHIP INVESTIGATION.—A special cable dispatch to the New York *Tribune* from London, May 12, says: "The American experts of the National Civic Federation have been closely employed this week examining the plant and accounts of the South London tramways under the control of the County Council and the several private corporations, including the united tramways, the South & Metropolitan Gas and the Westminster, Metropolitan, City & London Electric Lighting Companies. The investigation of twelve municipal gas and electric tramway undertakings has been virtually finished, but the fourth private gas company remains to be selected, and the Dublin United and the Bristol tramways under private control have not yet been investigated, and another private street railway company is still unnamed. The preliminary survey will be closed by the end of the month and the results revised by the bulk of the commission from America. Messrs. Maltbie and Sullivan are not making premature disclosures. Probably gas will be found cheaper here than in America, whether supplied by municipal or private works, but of inferior quality. The electric plant, whether public or private, is not equal in efficiency to the American plant. The tramway circuits here are small in comparison with the American street railway systems, and passenger fares are not so low for long distances, although cheap for short distances."

RELIEF OF SAN FRANCISCO TELEGRAPHERS.—The New York Telegraphers' Aid Society last week forwarded $500 by telegraph for the relief of the members of the San Francisco Telegraphers' Aid Society.

WESTERN GAS ASSOCIATION.—The twenty-ninth annual meeting of the Western Gas Association will be held at the Hotel Hollenden, Cleveland, Ohio, on May 16, 17 and 18. Mr. Paul Doty, well known in the electric lighting field at St. Paul and elsewhere, is president.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION.—The fourteenth annual meeting of this society will be held at Ithaca, N. Y., June 29 to July 4., in affiliation with Section D of the American Association for the Advancement of Science. The present membership of the society is 400.

RESTRICTING PLATINUM EXPORT.—It is stated that the Russian Minister of Trade and Industry proposes to summon a conference—of whom, the report is silent—to discuss the prohibition of exports of raw platinum, the imposition of a duty on platinum exports, and the establishment of government work for refining platinum.

MEETING OF RAILWAY TELEGRAPH SUPERINTENDENTS.—The twenty-fifth annual meeting of the Association of Railway Telegraph Superintendents will be held at the Adams Hotel, Denver, Col., June 21 and 22. Papers on various topics relating to the use of electricity in the operation of railroads will be read and discussed, and an interesting sight-seeing programme has been arranged for the entertainment of the delegates. Mr. P. W. Drew, Milwaukee, Wis., is secretary of the association.

HEIGHO!—We reprint the following latest anti-metric gem: "But let the gentlemen at Washington have a care. The American citizen is patient, but the proverb about the anger of a patient man should not be altogether forgotten. If this pernicious and meddlesome paternalism is not dropped, and if the disposition to enact some sort of compulsory metric legislation is not abandoned, there is but one thing to be expected. The engineers and manufacturers of the United States and of Great Britain are not to be trifled with. The campaign will be carried into the technical press, into committee, on the floors of both houses of legislation, and especially among the constituents of the men who are short-sighted enough to persist, and the question will not be settled until it is settled right."

INDIANAPOLIS TELEPHONE RATES.—Finding that it cannot give good service at the present rates, the Indianapolis Telephone Company, independent, has wisely but vainly been striving to get permission to make an increase. In a typical "town meeting," held in the City Hall on the night of the 4th inst., the patrons of the Indianapolis Telephone Company argued and declared emphatically and almost unanimously against the city making any changes in the company's franchise, permitting an increase in the rates now charged. The Commercial Club has likewise declared against any modification of the terms of the contract or increase in the rate. The Commercial Club resolved in favor of competitive telephone service, and expressed the belief that the company, with good management, could accomplish all needful improvements, give good service and make money at the present rates

INCANDESCENT LAMP LEADING IN WIRES.—A patent has been granted to Herr Carl Schubel and assigned to the Watt Glow Lamp Company, of Vienna, describing a new method of leading in the wires of incandescent lamps The specification states that the present method of using a short platinum wire entirely sealed in and soldered at either end to the leading-in wires is apt to produce fine cracks in the glass, allowing outer air to penetrate into the interior of the lamps If, on the other hand, the soldering points are outside the seal, the leading-in wires are very apt to become bent It is stated that according to the present invention this objection is entirely obviated. The method consists in the use of a glass bridge soldered to the bottom of the lamp with a free space between the ends of the bridge and the lamp bottom. The leading-in wire is sealed in this bridge and the soldered joint is in the free space between the bridge and the bottom of the lamp.

ENGINEERING LECTURES AT UNIVERSITY OF MINNESOTA.—The programme of lectures delivered before the students of the electrical engineering department of the University of Minnesota, by practicing engineers, included fourteen topics for the current scholastic year. Ten of the lecturers have already been delivered, and the following will be presented before the end of the year: "The Design and Construction of a Steam and Hydro-Electric Power Plant," by Mr. Geo. A. Damon; "Underground Conduit and Cable Systems," by Mr. S. G. McMeen; "The Design of the Engineering Features of a Large Modern Office Building," by Mr. Chas. L. Pillsbury; "The Cost Estimation and Installation of the Engineering Features of a Large Modern Office Building," by Mr. A. L. Abbott. Those who previously delivered lectures are Messrs. E. P. Burch, J. M. S. Waring, Lee H. Parker, A. G. Wessling, E. B. Craft, J. A. Stewart, Chas. E. Downton, Truman Hibbard, J. R. Cravath and Prof. C. F. Burgess.

ELECTRICAL STUDY IN BELGIUM.—United States Consul-General Roosevelt states that in October, 1906, there will be placed at the disposition of Belgians the Laboratory-Museum of Electricity of Brussels, built, equipped, and will be offered to the public by Robert Goldschmidt, of Brussels. The object of this work is the development and extension of the use and application of electricity in Belgium by practical experimental instruction. The institution will contain all kinds of electrical models and appliances, which may be freely handled for study and experiment. Models and apparatus will be conveniently placed at the disposition of the public upon separate tables, and may be connected with the electric current at will. For example, a person desiring to familiarize himself with running an electric tramway, will find a complete model, about ten inches long, of an electric car, which he may freely handle for examination, and operate upon the diminutive rails. Reduced models of every part of an electric tramway system, various dynamos, etc., are to be found in the museum. Mr. Goldschmidt hopes to extend the knowledge of the great possibilities of electricity through these practical methods.

EXHIBITORS AT ATLANTIC CITY.—The following exhibitors have already secured space on Young's Pier at Atlantic City for the coming convention of the National Electric Light Association: Illuminating Engineering Publishing Company, American Electric Heater Company, Atlantic City Company, American Vibrator Company, Sangamo Electric Company, American Instrument Company, American Circular Loom Company, Curtis Advertising Company, Electric Storage Battery Company, H. W. Johns-Manville Company, General Storage Battery Company, Stanley-G. I. Electric Manufacturing Company, Simplex Electric Heating Company, ELECTRICAL WORLD, Dearborn Drug & Chemical Works, Addressograph Company, Allis-Chalmers Company, *The Electrical Review*, The Phelps Company, *The Central Station*, Southern Exchange Company, Standard Vitrified Conduit Company, Automatic Refrigerating Company, Wagner Electric Manufacturing Company, Beck Flaming Lamp Company, Standard Paint Company, Metropolitan Engineering Company, Westinghouse Publishing Department, Federal Electric Company, A. F. Moore, Mayer & Englund Co. (Electric Service Supply Company), General Electric Company, Excello Arc Lamp Company, Oneida Community, Fort Wayne Electric Manufacturing Company, John L. Gleason, The Philadelphia Electrical & Manufacturing Company, Niagara Tachometer & Instrument Company. This represents a total of 6,840 sq. ft. As a matter of fact, this is almost all the available space, and some eight concerns are now negotiating for the two small booths left. It is thus evident that the exhibit will be unusually large and interesting.

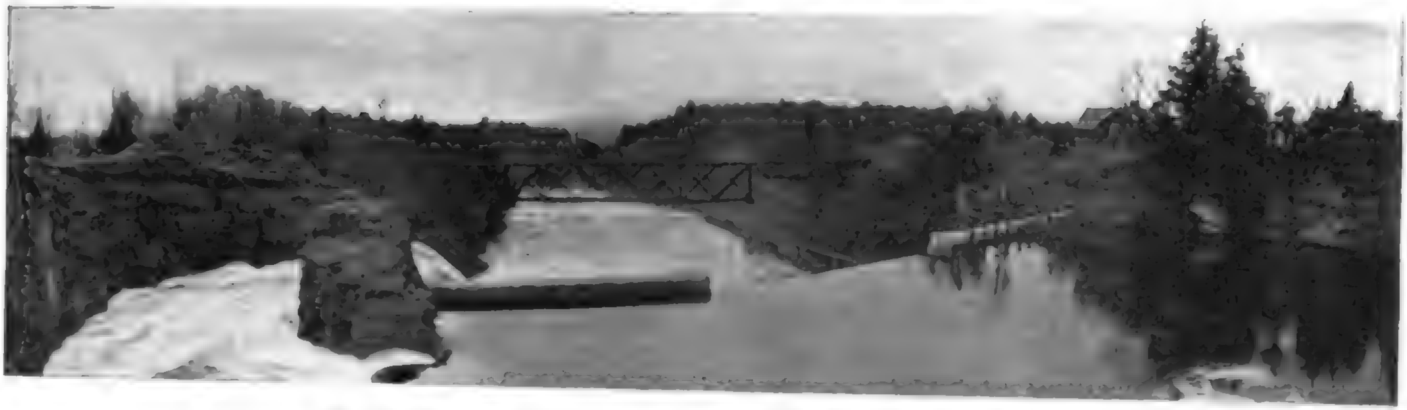
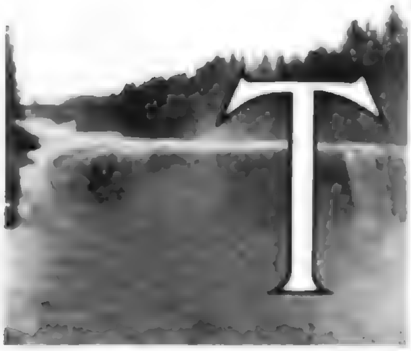


FIG. 1.—LOOKING DOWN FROM CLIFF ABOVE DAM AT TRENTON FALLS.

The Hydro-Electric Developments at Trenton Falls, N. Y.



THE waters of the Canada lakes in the Adirondacks of New York State find their way to the Mohawk River through two streams known as the East and West Canada Creeks. The former empties into the Mohawk at East Creek and the latter at Herkimer. The West Canada Creek is the larger, and near the village of Trenton Falls it has a descent of nearly 300 ft. in less than a mile. It is at this place that the 8,000-hp hydro-electric station of the Utica Gas & Electric Company is located.

THE DAM.

The dam, which is shown in Figs. 2 and 3, is a concrete structure of the gravity type, 300 ft. long and 60 ft. high, built across the Creek on the arc of a circle having a radius of 800 ft., at a point about three-quarters of a mile distant from the power house.

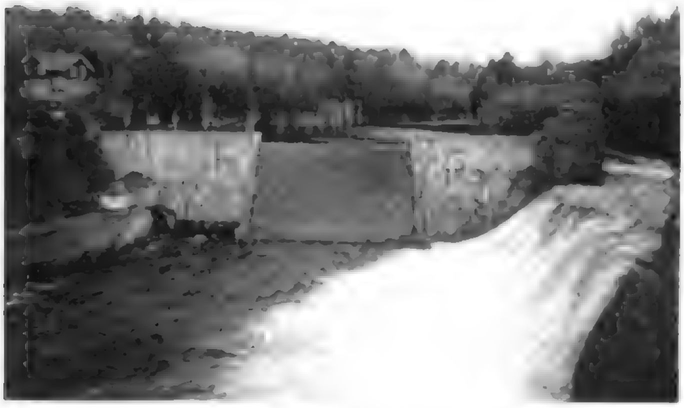


FIG. 2.—VIEW OF DAM FROM RAILWAY BRIDGE.

Eight 60-in. cast-iron pipes are built into the dam near the bottom, two of which supply the pipe line feeding the turbines now installed, two for the supply of a second pipe line when the power house is extended, and four to assist the waste weirs in carrying off the excess water in times of extreme floods. All of the 60-in. pipes are equipped with cast iron sluice-gates having bronze guides and are operated from the top of the dam.

The flood water weirs above-mentioned are two in number, one being built at right angles to the dam and close by it on a rock shelf on the east bank of the stream, the other forming a part of the dam proper. The first weir or spillway mentioned is 160 ft. long, the crest being 9 ft. lower than the top of the coping on the dam. The second weir is 100 ft. long and its crest is two feet higher than the crest of the former.

By this construction, the waste of flood-water in the reservoir will flow over the spillway first mentioned through a rock cut around the dam to the Creek below until the water flowing over it is two feet in depth, when the spillway on the dam will come into action and both weirs will then carry the waste water. The first weir mentioned can be provided with flash boards, so that the level of the water in the reservoir can be raised two feet during the dry season.

Both the dam and the weir on the dam are capped with heavy stone coping securely held by dowel-pins, while substantial stone wing walls are constructed on the downstream face of the dam to confine the flood water within the limits of the spillway and thereby protect the face of the dam from injury due to debris, etc., in time of floods.

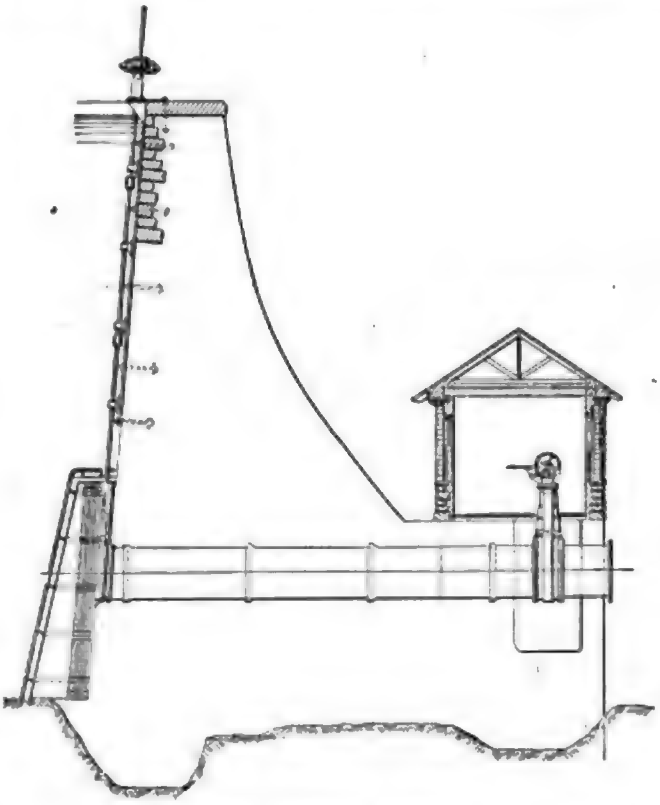


FIG. 3.—CROSS-SECTION OF CONCRETE DAM.

THE PIPE LINE.

The conduit which conveys the water from the reservoir to the turbines in the power house is 84 in. in diameter and about 3,700 ft. long. It is connected to the two westerly 60-in. pipes in the dam by means of a 60 by 60 by 84-in. cast-iron Y piece and two 60-in. gate valves enclosed in a gate house, the latter being used to control the flow of water in the pipe line.

The long pipe is composed of wooden stave and steel plate pipe, the major portion of its length being constructed of Texas pine staves securely held in position by round iron bands, and joined to the steel pipe 2,900 ft. from the dam (see Figs. 4 and 5).

Twenty wooden staves, each 2⅜ in. thick, sawed on radial lines, are used in forming the circumference of the 84-in. diameter circle, the lumber being the best of its respective kind that could be obtained.

The steel pipe, which is about 800 ft. long, is built up of plate varying from ⅜ in. to ⅝ in. in thickness, and thoroughly coated inside and out at the mill with hot asphalt pitch. All connections of plate are made with lapped joints, the circumferential seams being single riveted, while the longitudinal seams are double-riveted (Fig. 6). All pipe constructed of ⅝-in. material is stiffened by means of angle irons.

The wooden stave pipe is built on a light descending grade, and it winds in and out along the west bank of the Creek throughout its entire length. After its junction with the steel pipe, the grade becomes much greater and the pipe continues in a straight line for several hundred feet to a standpipe 84 in. in diameter and about 200 ft. in height, which is built into the supply conduit to relieve any pressure in the line caused by extreme load conditions. This standpipe, which is covered with shingled casing having a well-shaped cupola at the top, is 20 ft. higher than the dam.

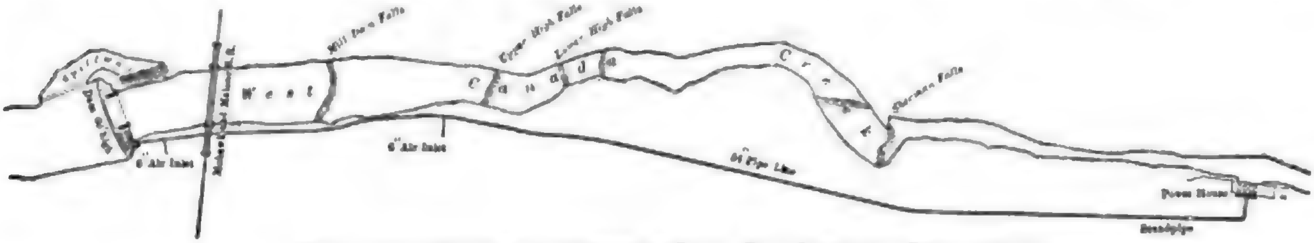


Fig. 4.—Map Showing Location of Dam, Pipe Line and Power House.

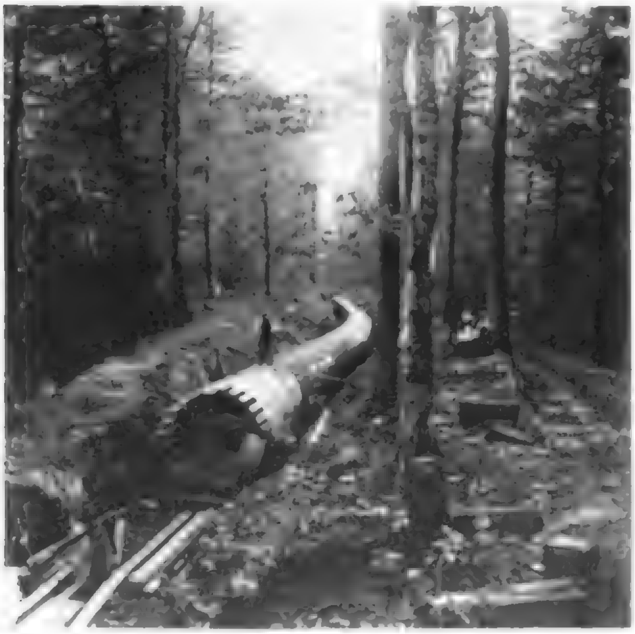


FIG 5.—WOODEN-STAVE PIPE UNDER CONSTRUCTION.

Just after passing the standpipe, the penstock descends along the cliff at a sharp angle to a reservoir near the power house, 125 ft. below the top of the bank. The reservoir is anchored on concrete foundations just outside the west wall of the power house. It is provided with four 84-in. outlets, each of which delivers water to a turbine wheel under a head of 264 ft. The flow of water to each turbine is controlled by a 48-in. gate valve, the arrangement being such that any or all valves can be operated simultaneously by hand, or by power furnished by a Pelton water wheel.

The penstocks to the turbines, the pipe line and receiver are all equipped with valves to assist in relieving any excess pressure which might come on them, and the main pipe line is provided with a number of air inlet pipes to allow for the escape or intake of air when the line is being filled or emptied.

HYDRAULIC AND ELECTRICAL MACHINERY.

The turbine units are six in number, four driving the large generators and two furnishing power to the exciter dynamos, as shown in Fig. 7. The former units are of a Fourneyron or out-flow type, the water from the wheel runners discharging into a draft tube. They have vertical shafts (Fig. 8), Porter-Allen hydraulically-operated governors, and are direct connected to the generators. They have a rated capacity of 2,000 hp at full gate opening when working under 264-ft. head.

The exciter turbines, which are of the Girard type, develop 100 hp at full gate opening when operating under the above-mentioned head. They also have vertical shafts, direct-connected to the dynamos, the speed regulation being under hand control. The supply pipes of each exciter turbine, which are twelve inches in diameter, are attached to the penstock of the units nearest them, the flow of water being controlled by a gate valve operated by hand power only.

The main generators are alternators of the internal revolving-field type, producing three-phase current at 2,300 volts, and 60 cycles when the field is rotating at 360 revolutions per minute. The exciter dynamos are 125-volt machines and revolve normally at 750 revolutions per minute.

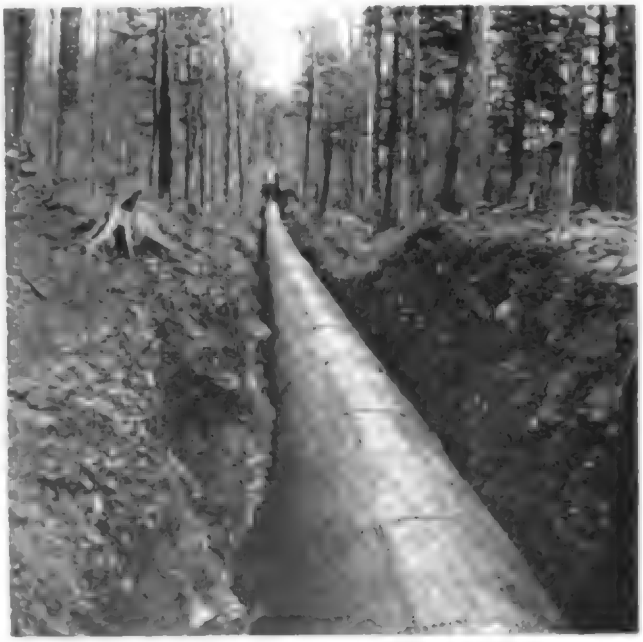


FIG. 6.—SEVEN-FOOT STEEL PIPE.

The switch-board (Fig. 10) is of the usual type, having a marble panel for each of the large units and one panel for the two exciter units. It also contains separate high and low-tension

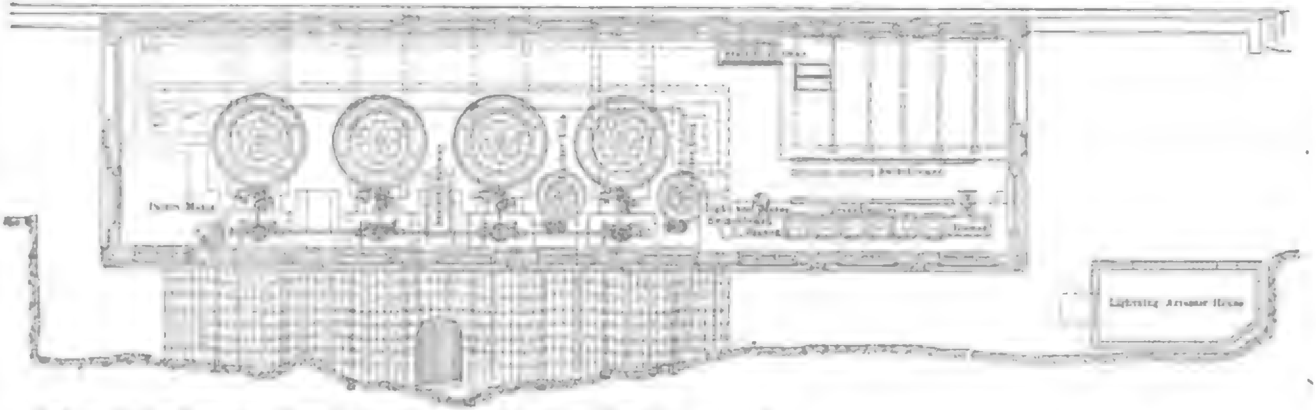


FIG. 7.—PLAN SHOWING INSTALLATION OF FOUR 2,000-HP UNITS.

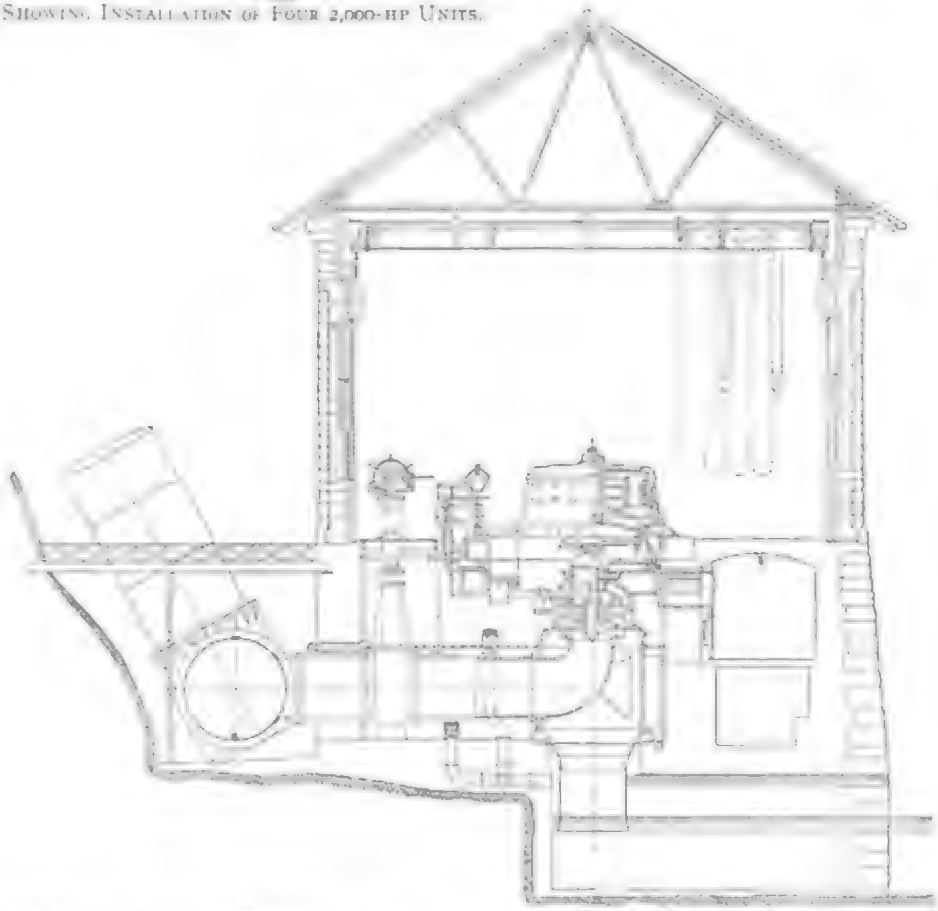


FIG. 8.—CROSS-SECTION OF POWER HOUSE.

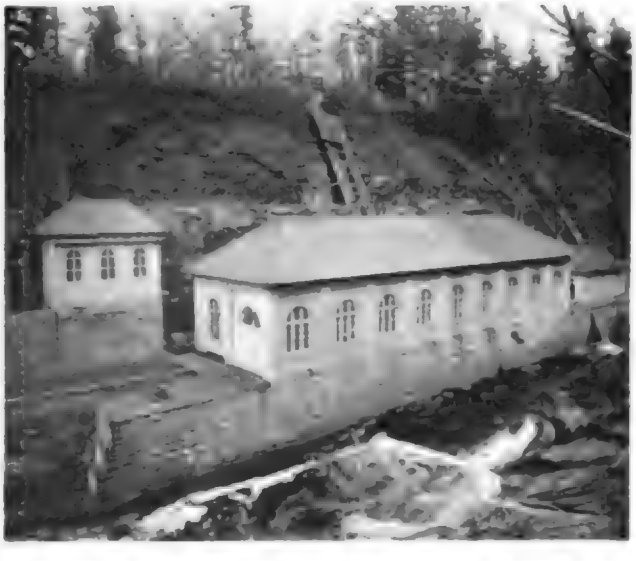


FIG. 9.—POWER HOUSE AND LIGHTNING ARRESTER HOUSE.

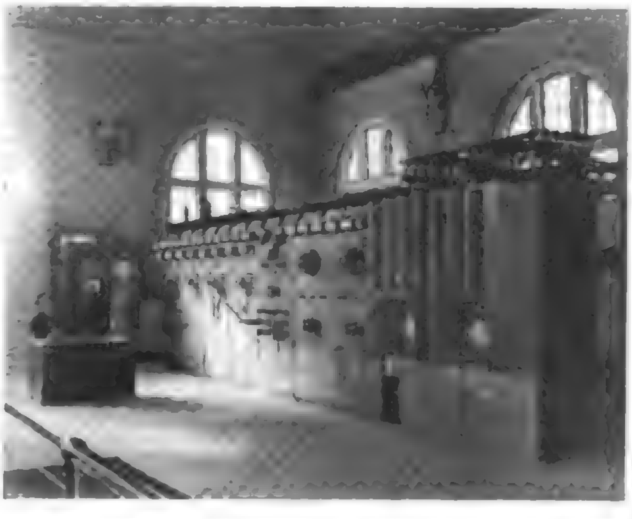


FIG. 10.—SWITCHBOARD IN POWER HOUSE.

HYDRO-ELECTRIC DEVELOPMENTS AT TRENTON FALLS, N. Y.

feeder panels. The potential of the current leaving the low-tension feeder panel is stepped up to 23,000 volts by air-cooled transformers, from which the current passes to the high-tension feeder panel out of the building through the lightning arresters located in a separate building (Fig. 9) near the power house, and finally along the transmission line to the sub-station in Utica, 12 miles away.

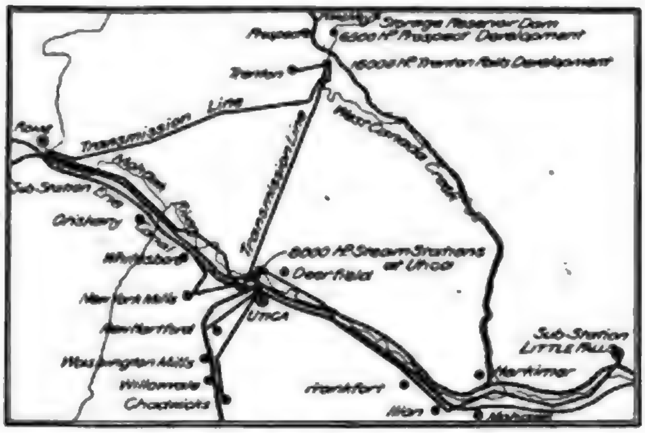


FIG. 11.—MAP OF TRANSMISSION LINES.

THE POWER HOUSE.

The power house, which is situated in a rocky gorge slightly more than 100 ft. in width and varying from 125 to 150 ft. in depth, is a well appointed building in all respects. It is 32 ft. wide and 128 ft. long inside, and around the skeleton steel framework are built walls of Governeur marble, while the interior is trimmed with white and brown enamel brick to the window sills and above this point with cream pressed brick to the roof. It is furnished with a 10-ton traveling crane for convenience in handling any part of the hydraulic or electrical machinery. A view of the interior of the power house is shown in Fig. 12. The turbines are all below the granolithic floor, in separate wheel pits.

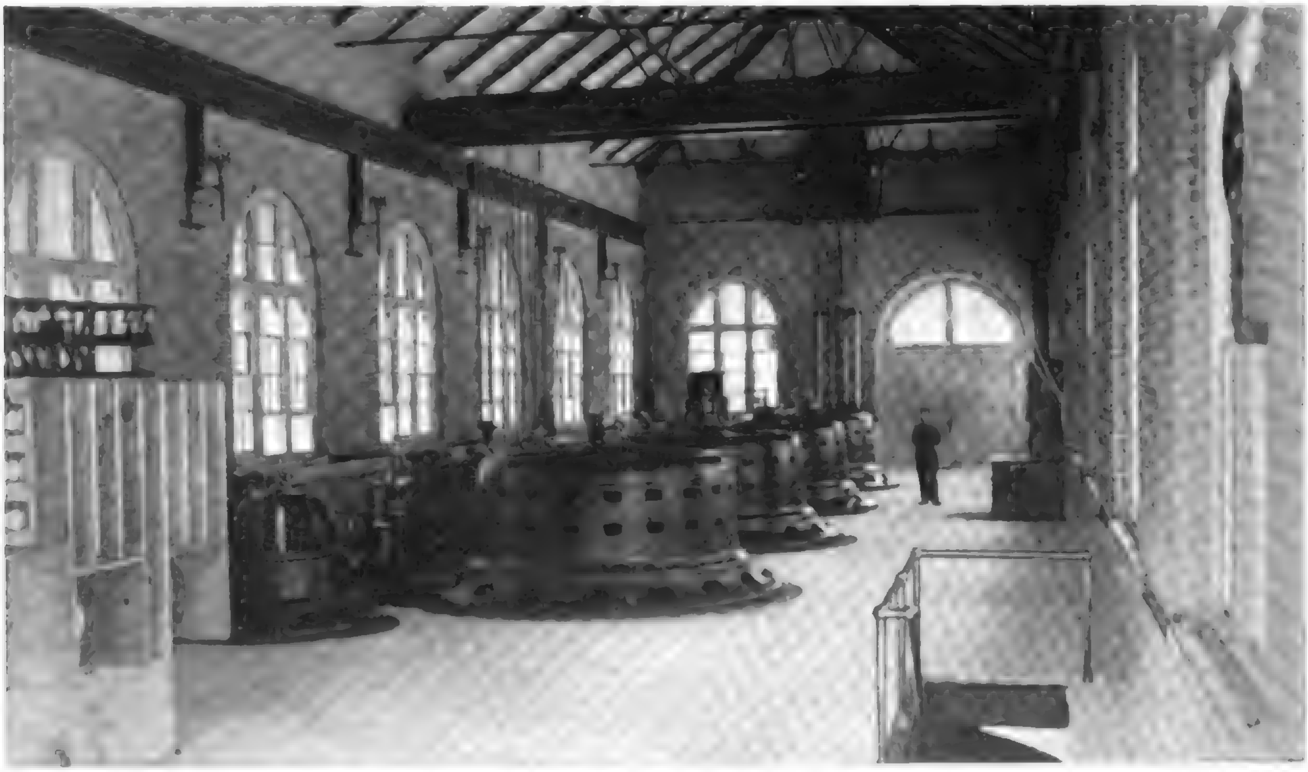


Fig. 12—View of Interior of Power House.

One important feature of the plant is there is no trouble from anchor ice, due to two precautions which were taken when the dam was built. First, the pipe line enters the dam 40 ft. below the surface of the water, and anchor ice does not sink to the level of the pipes. Second, the crest of the spillway which carries surplus water around the ends of the dam is 2 ft. lower than the spillway on the dam, and a strong current is thus established which carries the anchor ice around the end of the dam, and far away from the pipe line intake, which is on the opposite side of the stream.

At Utica there are two modern direct-connected steam stations, with a total capacity of 8,000 hp, which can be started at once in case of interruption of the transmission lines from Trenton Falls. The last steam unit, which was installed last fall, is a 3,000-hp steam turbine and Bullock generator of same capacity, furnished by the Allis-Chalmers Company.

EXTENSIONS.

The company proposes at once to add 8,000 hp to its Trenton Falls station, bringing its capacity up to 16,000 hp, and also develop its water power at Prospect, about one mile above Trenton Falls dam. At Prospect a plant having a capacity of 6,500 hp will be built, and at Enos on the Black River, nine miles from Prospect, the company will build a station having a capacity of 3,000 hp; thus the company will possess a grand total of 25,500 hp in hydro-electric generators.

TERRITORY SERVED BY THE COMPANY.

The territory served by the company lies mainly in the Mohawk Valley in Oneida and Herkimer Counties, and includes the cities of Utica and Rome and the villages of Trenton, Oriskany, Whitesboro, Yorkville, New York Mills, New Hartford, Washington Mills, Willowvale, Chadwicks and Deerfield, in Oneida County, and the villages of Frankfort, Ilion, Mohawk, Herkimer and the city of Little Falls, in Herkimer County.

The entire development was designed by Mr. W. A. Brackenridge, consulting engineer, Niagara Falls, N. Y., and the work carried out under his direction. The general contractors for the work were the Utica Gas & Electric Co., for the power house and transmission line; the Warren-Burnham Company, Utica, for the dam and power house foundations; the T. A. Gillespie Company, of New York and Pittsburg, for the 84-in. pipe line; the I. P. Morris Company, Philadelphia, for the hydraulic machinery, and the General Electric Company, Schenectady, for the generators and switchboard.

Electrical and Mechanical Equipment of the New Engineers' Club Building, New York.

THE new club house now being built in West Fortieth Street, New York City, and which is to be the home of the Engineers' Club of that city, will be provided with an electrical and mechanical installation well in keeping with the commodious and luxurious accommodations which the architect's designs will provide for the members. It embodies, moreover, a number of ideas which have not been tried to any considerable extent in buildings of a similar character, but which it was concluded would produce good results in this case.

As will be seen from Fig. 1, the architectural features of the club building provide a simple but dignified ornate exterior, and the interior will be equalled by but few buildings of a similar character in this country. The location on the south side of Fortieth Street gives a northward outlook upon Bryant Park and affords an advantageous view of the magnificent New York Public Library.

The first floor of the building will include the vestibule, reception rooms, administration office, coat room, grand stairway, foyer and main hall, in which latter will be three electric elevators and at the extreme rear of this floor will be the main café and grill room. On the second story the large clubroom will be in the front of the building and the library will be in the rear. On the third floor there will be the billiard room in front and the remaining space will be given up for the committee rooms and card rooms. The next six stories will be devoted to bedrooms and immediately above the bedroom floors will be the breakfast room, serving room and two private dining rooms with a large reception room adjoining.

The banquet room will take up practically the entire eleventh story, and the twelfth story will be entirely given over to the service work. On this latter floor will be the cooking range, plate warmer, dish washer, steam tables, etc., all of which require service from heating, ventilating or power systems throughout the building.

The front portion of the roof will be devoted to a roof garden and at the rear will be the laundry and a room in which will be located some of the machinery used in connection with the ventilating system.

In the basement will be the general toilet, barber shop, steward's office, storerooms, etc. In the sub-basement the machinery for the operation of the lighting, heating and refrigerating plant and elevator equipments, and also a portion of the ventilating machinery will be installed.

There will be two water-tube boilers set in battery, each having approximately 200 hp capacity. These will be located in the rear end of the sub-basement. A coal storage room adjoining the boiler room has been provided and, in addition, an even larger room in the front of the building for the storage of coal in quantity.

The boilers are connected by a steel plate flue and breechings with the steel smokestack, which passes up the rear of the building. The smoke connections will be provided with a hand damper at each up-take from the boilers. In addition there will also be a balanced swinging damper in the main connection. This will be operated by shafting controlled by a Locke automatic damper regulator. Each boiler will be equipped with an injector for feeding.

The power and exhaust piping will be briefly as follows: Branch connections will extend from the steam drums of each boiler to a main high-pressure line, and from the latter there will run a main line to the engine room connecting with the high-pressure distributing header for the engines. There are separate high-pressure branch connections going to each engine, with long sweep bends instead of fittings.

A branch main will be run from the high-pressure line near the boilers and will connect with all the steam pumps, the moistening apparatus, the kitchen and laundry service, the hot-water tanks, refrigerating apparatus, heating apparatus, air compressors, sewage ejectors, vacuum system exhauster, reducing valves, etc. All individual power branches are run from the top of the main.

The low-pressure steam and return piping of the heating system has been so designed as to give the proper circulation of steam under a one-pound pressure at the reducing valve. The steam lines for supplying the tempering coils of the ventilating apparatus will be carried individually from the boiler room and will be under separate control.

There will be three electrical generating sets in all, as shown in the sub-basement plan (Fig. 2). Each of the engines will be protected by a Cochrane vertical type steam separator in the branch pipe, and the drip connection from these generating sets will be through automatic discharge traps to the high-pressure receiver of the muffler tank. The high-pressure steam distributing header will be 18 in. internal diameter and its drip outlets at the bottom will discharge into the receiver of the muffler tank in the same manner as those from the engine.

The heating and ventilating apparatus and the kitchen apparatus, moistening apparatus, etc., will be protected by pressure reducing valves. A back pressure valve will be installed on the main exhaust pipe. The heating apparatus will have a 10-in. exhaust connection and will be protected by a grease extractor and provided with a valve.

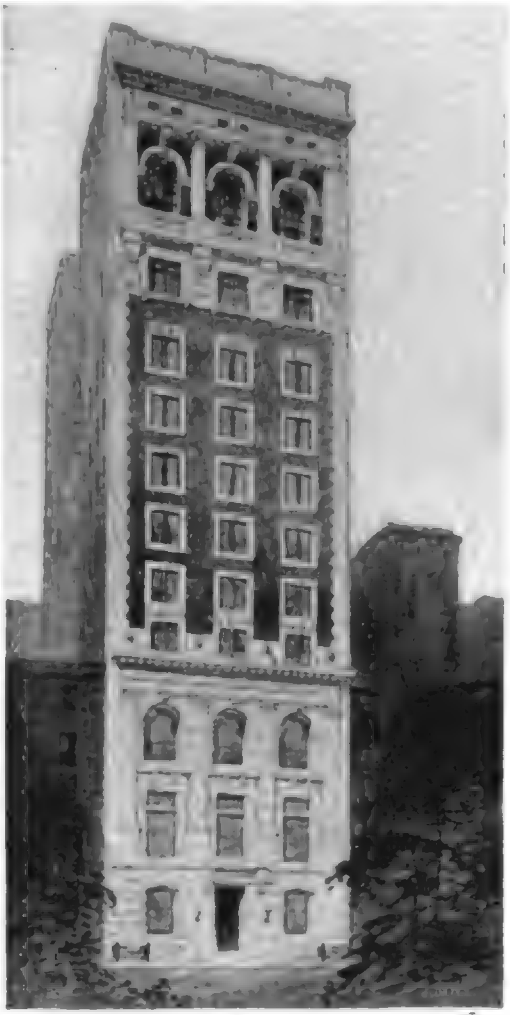


FIG. 1.—BUILDING OF THE ENGINEERS' CLUB OF NEW YORK CITY.

All of the rooms in the building will be warmed by direct radiation, the heating system being designed to provide a temperature throughout of 70° F. in zero weather with a steam pressure not exceeding 5 lb. in the heating main. There will be about 228 radiators and heating coils aggregating 9,600 sq. ft. of heating surface in all. The system selected for this building is so arranged that either live steam at reduced pressure or exhaust steam, or a combination of both may be supplied to all radiators as well as the tempering coils, hot water tanks, etc.

The ventilating system will supply fresh air throughout the building in general, and in all the important rooms direct, the system being that of forced air propelled by centrifugal fans passing over tempering coils. As already mentioned, vitiated air will be removed by centrifugal exhaust fans.

In order to simplify the equipments and to reduce the size of the air ducts otherwise required, the building as a whole has been treated as though it consisted of two separate structures the "upper" and the "lower," and the ventilation of each part has been taken up as a separate problem. An independent equipment of blower and exhaust fans will be installed in the sub-basement for the lower half, and a similar equipment in the machinery room on the roof will serve for the upper half of the building.

The fan supplying air for the lower stories will be located in the sub-basement and will have a blast wheel of 6 ft. diameter and 3 ft. 6 in. wide. The exhaust fan for the lower stories will be of the same dimensions as the blower fan. The upper stories will be provided for in a similar manner with a blower fan and an exhaust fan located in the machinery room on the roof. The dimension of the blast wheel of these fans, however, will be 5 ft. 8 in. diameter, and 3 ft. wide.

To insure positive and independent ventilation for certain rooms, there will be installed in the sub-basement a blast wheel exhaust fan 4 ft 6 in. in diameter, for removing the air from the engine room, sub-basement and certain toilets on the various floors. In the machinery room on the roof there will also be an exhaust fan of 4 ft. diameter for the removal of the air from the kitchen, kitchen service rooms and the toilets on the upper floors. Each one of the blower and exhaust fans will be driven by a motor on an extension sub-base, and connected directly by a flexible coupling with the shaft of the fan. Both the motors and the fans will be provided with ring oil bearings.

In all there will be 1,075 sq. ft. of heating surface in the tempering coils for the blower fan in the sub-basement and 762 sq. ft. in the coils of the roof blower fan. In each case the fresh air will, after leaving the coils, pass through a filter before being supplied to the interior of the building. A thermometer will be placed in each fresh air chamber and in each main tempering air duct. Also one wet and dry hydrometer will be placed in each main fresh air duct.

In such a club building no small amount of attention must be given to the question of refrigeration and proper storage of supplies, and as in a hotel, adequate facilities for carrying on this end of the business must be provided. For this installation the Carbondale Machine Company is furnishing an absorption exhaust steam refrigerating machinery capable of cooling 1,168 cu. ft. of refrigerator box space to an average temperature of 38° F., when using exhaust steam not over 1 to 3 lb. pressure, and with not over 12 gal. of water per minute at 70° F., or correspondingly less water at a cooler temperature in winter weather. This machine will be capable of cooling 20 gal. of brine from 10° to 0° F. per minute. It will be provided with the usual condenser and brine cooler and absorber, also an ammonia direct-acting pump of 10-in. stroke and 2½-in. diameter cylinder, and a duplex circulating brine pump. A brine tank will have a storage capacity of 2,000 gal.

The engineer's designs and specifications for the power plant called for three steam engines of suitable design for direct connection to engine type generators. Through the generosity of the Allis-Chalmers Company and the General Electric Company all three of the generating sets will be furnished the club without charge.

In this connection it should be stated that the generosity of manufacturers was not confined to engine and dynamo builders alone, but extended also to the manufacturers of the boilers, elevators and other items of equipment for this building, the boilers being given outright by the Babcock & Wilcox Company and the elevators furnished at cost by the Otis Company.

The working steam pressure at which the boilers will be operated was changed to 125 lb. to accommodate the turbine set to be referred to later.

The two 50-kw units will be given the club by the Allis-Chalmers Company and will each consist of a Corliss type simple horizontal engine direct-connected to a Bullock type generator. The speed at which they will run is 125 r.p.m. These units will be identical except that one will be right-hand and the other left-hand.

The 75-kw unit will be donated by the General Electric Company, and will consist of a Curtis steam turbine designed to operate non-condensing, and to run at a speed of 2,400 r.p.m. The generator will be directly connected to the extension of the shaft of the turbine, the complete unit being assembled on one cast-iron base and set horizontally.

All three of the generators will be compound-wound for 245 volts at full load current, and they will furnish current to a mixed motor and lighting load throughout the building. Two rotary balancing sets each consisting of two compound-wound, 120-volt, direct-current generators, mounted upon a common base and direct-coupled, will be installed in the engine room. Each of the machines in these two sets will have a full load current-carrying capacity of 40 amp.

These balancing sets will be used to furnish current to the neutral of the three-wire lighting system. The balanced portion of the current will be taken care of by the main generators directly, and one or both of the balancers will furnish any excess

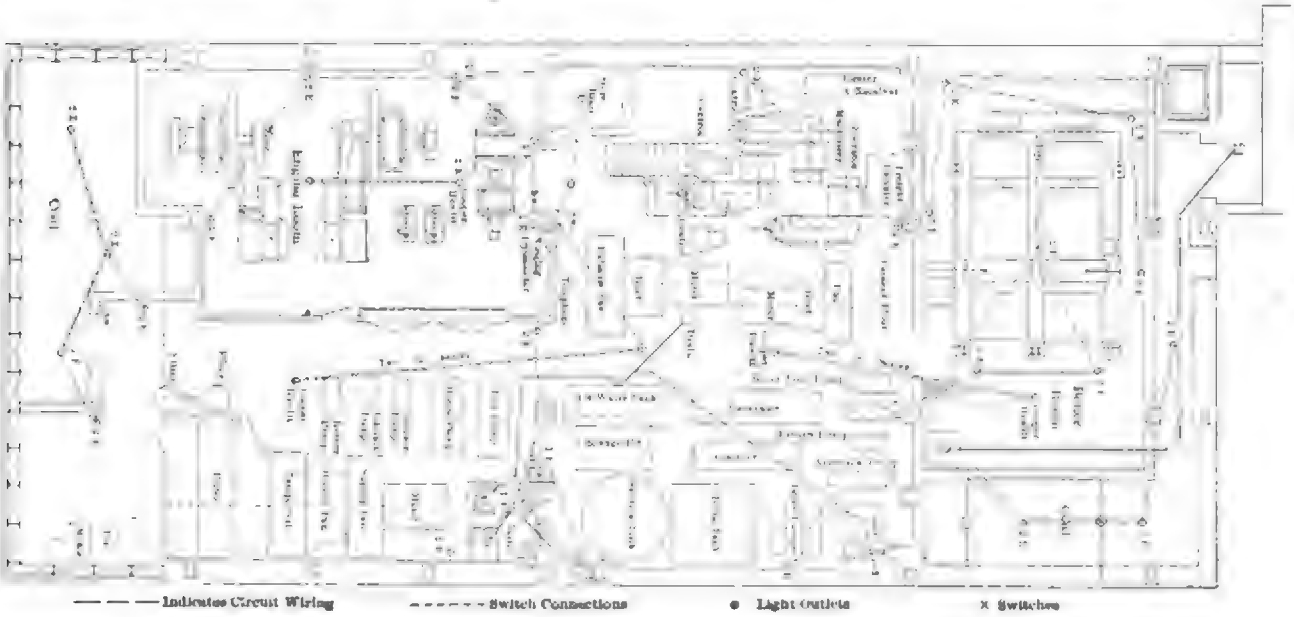

— — — Indicates Circuit Wiring
- - - - - - Switch Connections
● Light Outlets
× Switches

Fig. 2.—Arrangement of the Equipment in the Sub-Basement of the Engineers' Club Building.

of current which may be required by either side of the system, and thus maintain the neutral wire at a potential midway between the outside wires. Each balancer set will be provided with a back-connected rheostat which will be mounted on the switchboard and the starter for each set will be mounted on a small independent panel placed near the balancer.

The main switchboard will be set in an opening in the engine room wall, thus saving considerable valuable space in this room. The front will face the engines and the rear, which will be protected by fire-proof doors, will be accessible from the sub-basement passage, as shown on the plan herewith. This switchboard will consist of seven white marble ¼-in. bevel sided panels, each 72 in. high and 1½ in. thick. The panels will be as follows: three generator, one total output, one equalizer, one lighting feeder and one power feeder panel. A substantial angle iron frame will support these seven panels and the front of the board will be finished at the top and bottom with a white marble molding 4 in. deep. At the bottom under the molding will be a sub-base of marble slabs eight inches in width, finished to match the board.

The equalizer panel will be equipped with two overload alarms, one being for each balancer. These alarms will consist of a single-pole circuit-breaker of the overload type with the current opening switch omitted. The spring plunger, which ordinarily serves to open the breaker when the latch is liberated by the action of the plunger in the solenoid, is to be extended back through the end of the spring chamber, and will be equipped with an insulated metal ring. Two spring clips with binding posts for bell wire will be secured in such a manner that when the arm of the overload alarm is liberated by an overload the spring plunger will fly out and the metal ring will make contact with each side of the clips and thus instead of cutting the balancer out of circuit an alarm will be given and the attendant will then adjust the load properly, the balancer being designed to carry such overload as it might be subjected to for the period required for rectifying the excessive unbalance.

The power panel will have nine two-pole feeder switches and also three 200-amp., single-pole, double-throw switches. The function of these latter switches is to connect the three banks of feeder switches immediately below each to either the power or the lighting bus-bars at will. This is accomplished by having one side of all the power feeder switches connected with the common negative bus-bar and the other side with the middle point or hinge of the respective double-pole switches. The outer clips of these switches are connected to the power and light positive bus-bars, respectively. The construction of these double-throw switches is such that the circuit is not opened in throwing from one set of bus-bars to the other. Thus the three banks of power feeder switches may be fed from the independent power buses when two or more generators are running, or from the lighting buses during the hours of the day when it would not pay to run more than one machine.

The conduit system for the conveyance of the feeders and circuits to their respective outlets have been most carefully planned with a view to simplicity and convenience, due care being taken to avoid as far as possible the crossing of pipes or ducts. All conduit will be concealed in the walls, floors or ceilings. A panel box will be installed on each floor from which the conduits for the branch lighting circuits will be run to the various outlets.

The power feeders have been treated as an independent system from those for the lighting service. Conduit for these feeders will be run direct to the various outlets to be provided near the respective motors which will transmit the power to the elevator machines, sidewalk hoist, freight elevator, blower and exhaust fans, the dish-washing machine, silver buffing lathe, etc.

Current for the various motors throughout the building will be distributed at 240 volts by means of two wire feeders run directly from the various feeder switches on the power feeder panel. Seven of these feeders will be run, one each to the sidewalk hoist, and the three elevator motors, one to the fan motors located in the sub-basement, one to the fan motors located on the roof and one to the motors driving the dumbwaiter, buffing lathe, dish-washer and several machines in use in the laundry.

Separate lighting feeders will be run from the feeder switches on the lighting feeder panel to each floor of the building and to the roof and connected to distribution panelboards. These feeders will each consist of three wires and the current will be fed on the 120-240-volt, three-wire system.

The panelboards will each be of marbelized slate having three polished copper bus-bars running vertically up the center of the panel and two-pole branch circuit switches arranged symmetrically on each side. The feed connection will be made solid without switch or fuses. From the panelboards two-wire branch circuits will run to the various lighting fixtures throughout the building.

The lighting of the sub-basement will be accomplished by a combination of incandescent lamps with Cooper Hewitt mercury vapor lamps, each of the latter giving 300 cp when two are connected in series across a potential of 120 volts.

The call bell system throughout the building will be supplied with current by a motor-generator capable of supplying 7½ amp. at 8 volts, and by an auxiliary primary battery to be used when it becomes desirable to shut down the motor-generator for any reason.

The system will consist of seven distinct divisions or subsystems, namely, three annunciator call systems with annunciators in the office, bar and kitchen, respectively; an elevator call system; a door bell system, a fire alarm system and an overload alarm system for the rotary balancers in the engine room. These will all be supplied from a panelboard in the engine room by means of separate feed wires. All wires used in connection with the bell systems will be rubber-covered and will be run in metal conduit. Branch circuit boards will be installed on a number of the floors in cabinets from which the wires will run to the individual push buttons placed at convenient locations throughout the building.

A complete conduit system for the accommodation of the telephone wires will be installed. The telephone instruments and wires will be furnished and installed by the New York Telephone Company.

Two of the three elevators will run from the basement to the roof, and the third from the sub-basement to the roof. The elevator machines will be located in the sub-basement at the foot of the elevator shafts. Each will be of the worm-driven drum type with direct-connected motor of about 20 hp which will drive the cars at a speed of 300 ft. per minute. The maximum load which each elevator will carry is 2,000 lb.

The sidewalk hoist is of the well-known platform type driven by a worm-propelled drum machine with direct-connected motor of about 5 hp.

Each of the ventilating fan motors will be driven by a motor capable of having its speed varied through rather wide limits by means of controllers provided with both armature and field rheostats.

Motors will also be installed in the service portions of the building for driving a silver polishing buffing lathe, a dish-washing machine, a dumbwaiter running from the tenth floor to the roof, a clothes-washing machine, an extractor and a mangle of the last three going into the laundry on the roof.

It is expected that this installation when completed will not only perform its various functions in a most satisfactory manner, but will also on account of its somewhat novel features, prove a very interesting adjunct to the new and magnificent home which Mr. Carnegie has so generously presented to the Engineers' Club of New York City.

The architects for the building are Messrs. Whitfield & King, whose designs were selected as a result of public competition, and who under the advice of the club's building committee have had much to do with the selection and arrangement of the various equipments, as well as the actual design of the building itself. Mr. Putnam A. Bates is the consulting engineer and has charge of all of the electrical machinery and equipments throughout.

Three to Six Transformation and Connections to Rotary Converters.

By Guy J. Reynolds.

In transforming from three to six-phase current, there are three ways of connecting the secondaries of the transformers; namely, double Y, double delta and diametrical, with or without fixed neutral point. The primaries in either case may, of course, be connected either Y or delta, according to the pressure that each coil will stand, or to obtain a required secondary voltage. If the hexagonal voltage is not to be read, one transformer having at least three primary and three secondary coils or three transformers each having at least one primary coil and one secondary coil, are required. If the hexagonal voltage is to be read, there must be six secondary coils, or there may be three with central taps, and the method of connection must be diametrical.

Figs. 1, 2 and 3 represent, in the order named, the double Y, double delta and diametrical connection with fixed neutral point. In Figs. 1 and 2 the similar ends of the two coils of the same transformer or similar ends of any two coils bearing the same relation to a certain primary coil are at any instant of the same polarity. It may be seen that one set of three secondary coils are connected Y, or delta, in the ordinary way, but the leads from the second set are all reversed and then connected in a similar manner. This is done in order to obtain the proper phase displacement. In three-phase circuits, there are three coils with a phase displacement of 120 electrical degrees. In six-phase circuits there are six coils with phase displacement of sixty degrees. An armature coil must move through 180 electrical degrees from the position where the current begins to flow in one direction, before the current begins to reverse. Hence, if the ends of the transformer coils are reversed, the phase displacement of the current is in effect shifted 180 electrieal degrees. From an application of this theory six-phase currents may be derived from three-phase transformers.

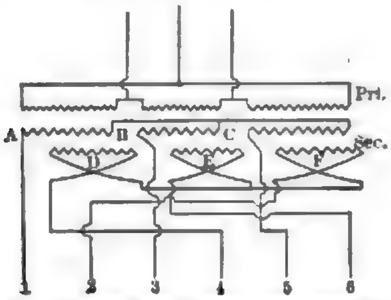


FIG. 1.—SECONDARIES CONNECTED DOUBLE Y.

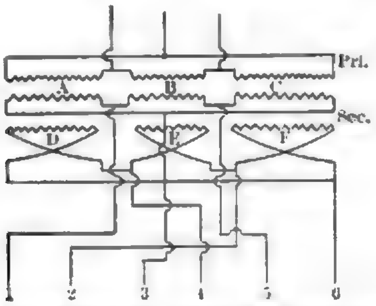


FIG. 2.—SECONDARIES CONNECTED DOUBLE DELTA.

Fig. 4 may assist in the graphical explanation of the phase displacement of sixty degrees. Let the heavy lines represent the waves of e.m.f. of the three-phase current taken from coils *A*, *B* and *C*. The currents, or e.m.f's, in coils *A* and *D* are in phase, considering similar ends of the coils, but if the connections from *D* are reversed, the phase relationship of the current will be changed 180 degrees with reference to that of *A*. Fig. 4 shows their new relationship by the use of sine curves. The wave of e.m.f. of the coil *D* is seen to be exactly in opposition to that of *A*. Now if coils *E* and *F* are also reversed, it may be seen from the Fig. 4 that there are obtained six waves of e.m.f. at sixty electrical degrees displacement.

In case it is desired to connect these six leads to a six-phase rotary converter it is necessary that each be connected to the proper rings. The connections must be so made that between rings 1 and 4, 2 and 5 and 3 and 6 there shall be diametrical voltages. Suppose the lines from coils *A*, *B* and *C* be connected to rings 1, 3 and 5. As has been stated, the e.m.f's of the opposite ends of similar secondary coils are 180 electrical degrees out of phase, hence the line from ring 4 should go to the actual opposite end of coil *D* from which 1 was taken from its similar coil, *A*. If ring 3 is connected to one end of coil *B*, then 6 would be joined to the actual opposite end of its similar coil, *E*. The remaining lead would then be connected to ring 2.

For the double Y or double delta connection, the secondary three-phase voltage taken from either of the two sets of secondary coils is determined in the usual way. Suppose a hexagon is inscribed in a circle whose radius equals to any scale the computed three-phase voltage divided by the square root of 3. If the six lines are now connected to the rings of a six-phase rotary converter, and the length of line, *A C*, in Fig. 5 represents to scale the three-phase voltage; the drop across any two adjacent rings as 1 to 2 will be represented by the length of line, *A B*. But *A B* is the side of a hexagon inscribed in a circle whose radius is *A O*; hence $AB = AO$. As the angle *A O C* = 120 degrees; $AB = AO = \frac{AC}{\sqrt{3}}$. The diametrical voltage 1 to 5, 2 to 4 and 3 to 6 each equals 2 *A B*.

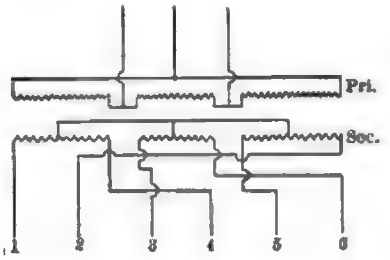
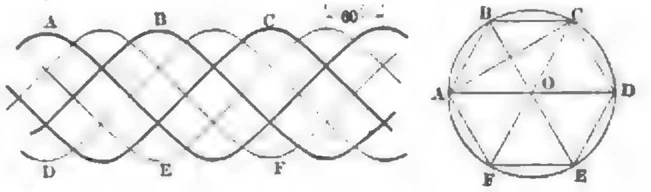


FIG. 3.—DIAMETRICAL CONNECTION WITH FIXED NEUTRAL POINT.

The diametrical connection shown in Fig. 3 is the one mostly used in practical work. By means of this connection the voltage can be read between any two leads before connections are made to the rotary collector rings. The diametrical voltage in this case is equal to the secondary coil voltage. Similar ends of the three coils go to rings 1, 3 and 5. The opposite ends of these coils are connected to rings 4, 6 and 2 in the order named. The neutral point is sometimes used in order to obtain a three-phase voltage for running a blower motor to cool the transformer coils, or to furnish current for running the rotary converter up to synchronism by an induction motor mounted on the same shaft. This three-phase voltage in this case would have a value equal to one-half the secondary coil voltage multiplied by the square root of three.



FIGS. 4 AND 5.—PHASE RELATION OF CURRENTS AND ELECTROMOTIVE FORCES.

Connecticut Railway & Light Company's System.

THE Connecticut Railway & Lighting Company lights Greenwich, Norwalk, New Canaan, Waterbury, Watertown, Naugatuck, New Britain, Plainville, Southington and Berlin, Conn. These towns are supplied from stations established at Greenwich, Norwalk, Waterbury and New Britain, the loads being apportioned as follows: The plant at Greenwich supplies electrical energy to Greenwich only; the plant at Norwalk also supplies New Canaan; the stations at Waterbury supply Watertown and Naugatuck in addition, while the remaining towns receive energy from New Britain.

The entire system was recently overhauled with a view to cutting down operating expenses, and as a result the old stations at Naugatuck and Southington were abandoned; the Norwalk station was vacated and the energy for lamps and motors supplied from the company's railway station at South Norwalk; the large steam station at Waterbury was practically abandoned and two new sub-stations erected which are supplied with high-tension current from Bulls Bridge; the steam station at New Britain as well as the railway plant at Mildale was also abandoned, substations being established at New Britain and Cheshire, which are also supplied from the Bulls Bridge plant. The overhauling also included a change from direct-current series arc lighting to alternating-current series arc lighting at Waterbury and New Britain, and a change over from 500-volt, direct-current for motor circuits to 200-volt, three-phase circuits, except in large installations where 400-volt is the potential of the supply.

The equipment at Greenwich consists of 600 hp in Babcock & Wilcox water-tube boilers and 975 hp in Ball high-speed engines. The generators are 125-cycle machines for incandescent lighting, Brush arc machines operating 5-amp., direct-current lamps for street lighting. The company also operate series incandescent circuits from reactive coil regulators and from tub transformers. The system is mostly overhead with the exception of a particular residential section of about a mile where the circuits are underground. The maximum load at Greenwich is about 295 kw. The base rate for lamps is 20 cents per kw-hour, subject to a discount of 10 per cent when under $20, 20 per cent when over $20 and under $100, and 25 per cent on all bills over $100. The base rate for motors is 15 cents per kw-hour, subject to the same discounts as for lighting. The amount of energy supplied for motor work is very small in Greenwich.

The Norwalk plant is equipped with 60-cycle monocyclic generators, the arc lamps being fed through reactance coil regulators. The maximum load is about 256 kw. The rate for lighting is 16 cents per kw-hour, subject to a discount of 5 per cent, and when the bill amounts to over $10 10 per cent. The base rate for motor circuits is 10 cents, subject to the following discounts: On bills of $1 to $25, 10 per cent; on bills of $25 to $50, 20 per cent, and on bills of $50 and over, 30 per cent. Both the Greenwich and Norwalk plants are old, and while the connected load is steadily increasing, the stations cannot be said to be very progressive. The Norwalk plant does not supply electrical energy for any service whatever in South Norwalk. In the latter city a municipal plant is in operation and the rates are much cheaper than those of the Norwalk plant.

At Waterbury the company has installed the most modern equipment and the management is very energetic. The entire output of the hydro-electric station at Bulls Bridge on the Housatonic River is transmitted to sub-station No. 1 of the Connecticut Railway & Lighting Company at Waterbury, and through Waterbury to New Britain and Cheshire, the latter sub-station being devoted exclusively to railway work. The hydro-electric station at Bulls Bridge has the distinction of being the largest electric generating station using water power in New England. It possesses the highest head of water, the highest transmission voltage and the longest transmission line of any of the many stations in New England. Two three-phase transmission lines run from Bulls Bridge to sub-station No. 1, which is located on the west bank of the Naugatuck River on the outskirts of the city of Waterbury. Each of these three-phase circuits is made up of three bare aluminum wires having a conductivity equivalent to No. 00 copper. Energy delivered to the line at Bulls Bridge at about 33,500 volts reaches substation No. 1 at Waterbury over 30 miles distant with a loss ranging from 4 per cent to 7 per cent, depending on atmospheric conditions. Transformers at this station reduce the voltage to 2,300 for overhead transmission through Waterbury to sub-station No. 2, situated in the center of the town. Current at a potential of 33,000 volts is also transmitted through sub-station No. 1 to New Britain and Cheshire as already mentioned, thus giving a transmission circuit over 40 miles long. The high-tension lines are carried in duplicate and on separate pole lines from Bulls Bridge to Waterbury, and the lines from Waterbury to New Britain are also in duplicate, but are carried on a single pole line.

The equipment in sub-station No. 1 consists of four 500-kw rotary converters, one 48-kw booster, four 550-kw, 33,000-volt, 60-cycle transformers with their reactance coils, eight motor-driven, high-tension oil switches, two motor-driven blowers, six single-phase transformers, six arc light transformers, a railway storage battery and an auxiliary storage battery, together with controlling switchboards. The transformers are all of the air-blast type, the primary and secondary voltages of the 550-kw units being 33,000 and 430, respectively. The primary and secondary voltages of the single-phase transformers are 33,000 and 2,300, respectively. The current from the rotaries is used entirely for railway purposes, the maximum load of which is 2,500 amp., which comes on at noon.

The six 500-kw transformers are arranged in banks of three and the 2,300-volt secondary current obtained from them is transmitted over two separate trunk lines of No. 000 copper to substation No. 2. The six constant-current transformers are used for series arc lighting; single-phase arc lighting circuits running to Naugatuck, North Willow and Highland Park, Waterville, East Waterbury, North Waterbury and Forest Park, Watertown, South Waterbury and Platt's Mills. The line to Watertown has a straight run of six miles before distribution is made. A three-phase feeder line also runs to Naugatuck, where it is split up into three single-phase circuits. The lighting load fed from substation No. 1 consists of about 450 series arc lamps and about 30,000 incandescent lamps.

Sub-station No. 2 is somewhat smaller in size and equipment than the sub-station just described. The equipment of the station consists of four 300-kw rotary converters, four 300-kw three-phase transformers and controlling switchboard and apparatus. The converters deliver direct current at 275 volts, which is utilized entirely for lamp and motor circuits operated on the Edison three-wire system. The territory fed by the station is about one mile square and the station is at about the center of the load. Overhead and underground distribution are both in vogue. The commercial multiple arc lamps connected number 900 and the incandescent lamps number over 25,000. The load in Waterbury was previously carried by a steam-driven central station on Bank Street bordering on the Naugatuck River. This station is now maintained as a reserve in case of any accident to the transmission plant at Bulls Bridge.

Up to within the last two years the management at Waterbury had never been in a position where it could accept new business; in fact, business was being constantly refused. With the establishment of the two new sub-stations with ample capacity and the consequent economy of production and operation, the company was finally enabled to accept new business which by a little canvassing came pouring in faster than was ever anticipated. The base rate for lighting is 15 cents per kw-hour, subject to a discount of 10, 20 and 30 per cent, according to the amount used, with a minimum bill of $1 per meter installed. The rate for motor power is 10 cents per kw-hour, which for amounts of $3 and under is net. For bills amounting to over $400 a discount of 25 per cent is allowed on this rate, the minimum for motor circuits being $1 per month with no charge for readiness to serve. The maximum load at Waterbury is about 2,157 kw. The New Britain station is similar to, but not so large as, the Waterbury sub-station No. 1. The maximum load is about 570 kw. The rates for energy for lamps and motors are the same as at Waterbury.

The company employs canvassers in the four districts and their work is directed and supervised by a business agent. Advertisements are carried in the local papers, but no literature is printed or distributed directly by the company. The company is controlled by the United Gas Improvement Company, of Philadelphia, so that it has no gas competition where gas plants operated by this company or by the Connecticut Railway & Lighting Company itself are installed. Gas competition is only met with in Waterbury and New Britain; in the former city it does not amount to much, but in New Britain there are quite a number of gas "arc" lamps installed. No attempt has been made as yet to fight this competition because the company has only recently been in a position to supply enough electrical energy to meet the legitimate demand and the growth is such as to permit gas competition to go unheeded for a season at least. An unostentatious show room is being maintained at Waterbury as an experiment, and if the results are at all promising the show room will be made permanent and more prominent with the possibility of show rooms being established in the other districts.

Free lamp renewals are made in all the stations with free first installations, also for all standard lamps. Meters are tested every six months, and complaints on account of service are carefully investigated and defects remedied as soon as possible. Where consumers feel aggrieved over the amount of the lighting bill a test is made of the meter in the presence of the customer if that be possible, and any errors in the meter are frankly acknowledged and the necessary allowances made. The working of the meter is also carefully explained to the customer at the time this test is made. In the matter of signs, the company had not many of any consequence until within the last six months. Waterbury does a very large sign business and there are also some signs maintained in New Britain. The company furnishes the sign and does all the work of installing it gratis on a guaranteed minimum consumption of electrical energy which varies with the different types of signs. With the No. 108 Federal sign the minimum bill is $2.50 per month; letter signs are charged a minimum bill of $1 per single face letter per month, and $2 per month per double face letter. All of this work is in the hands of the business agent and is billed at meter rates, there being no flat rates for this class of service or in fact for any class of service in the entire system. During the past year there has been a marked increase in the sale of electricity over the entire system. The records show that the increase during 1905 over 1904 was 19 per cent in Greenwich, 10 per cent in Norwalk, 10 per cent in New Britain and 40 per cent in Waterbury. This large increase at Waterbury is not the result of any special canvassing. Waterbury is a large and enterprising manufacturing city and a demand for electricity has existed there for some time, but as already pointed out the Connecticut Railway & Lighting Company was not in a position until recently to satisfy this demand. The officers of the company are as follows: A. M. Young, president; D. S. Plume, first vice-president; G. E. Terry, second vice-president; L. Lillie, secretary and treasurer; E. W. Poole, assistant secretary and assistant treasurer; W. Clark, managing director; J. A. Pearson, purchasing agent; J. E. Sewell, general manager; C. F. Bryant, auditor, and W. T. Oviatt, chief of the electrical department.

Recent Electrochemical Developments.

ELECTROLYTIC LEAD SMELTING.

Electrolytic lead refining with an aqueous solution of lead fluosilicate, containing an excess of fluosilicic acid (Betts' process) is now successfully established on a commercial scale. Besides the old original plant in Trail, British Colombia, a second plant was installed last year in New Castle-on-Tyne in England, while a third large plant is now about to be opened near South Chicago by the U. S. Mining, Smelting & Refining Company which also owns the DeLamar Copper Refinery. The Betts process of lead refining is entirely analogous to copper refining in so far as the process relates to a finishing reaction only, the product being a metal of great purity.

The bigger problem—the reduction of metallic lead from ore especially from galena—has also attracted numerous electrochemical inventors. The Salom process of reducing lead by making comminuted galena the cathode in an electrolyte of sulphuric acid has been used for some time at Niagara Falls on a large experimental scale, but has apparently not achieved commercial success. On the other hand five inventors have recently brought out processes using a fused electrolytic bath. One is C. P. Townsend whose patent on this subject was recently abstracted in these columns; second, James Swinburne and E. A. Ashcroft in England; third, Anson G. Betts and W. Valentine, to whom patents were recently granted in this country.

The Betts-Valentine process consists essentially of two stages; first, fusion of the ore into matte high in lead sulphide, to get rid of lime, alumina, silica, etc.; and second, electrolytic reduction of the fused matte under such conditions that the iron remains as a sulphide and does not contaminate the reduced lead or clog the bath. The bottom of the electrolyzing cell contains molten lead which forms the cathode. Above the cathode a layer of the molten matte is kept and above the matte a fused electrolyte in which lead sulphide is substantially insoluble, preferably sodium chloride containing sodium sulphide. A carbon anode dips into the fused electrolyte.

On passing a current of electricity through the cell, chlorine is liberated at the anode unless sufficient sulphide is dissolved in the electrolyte when sulphur is liberated instead of chlorine. The sodium ion appearing at the cathode reacts with lead sulphide, giving metallic lead and sodium sulphide. The sodium sulphide formed partly dissolves in the matte and partly in the electrolyte and accumulates therein, until eventually pure sulphur is given off at the anode. The evident advantages of such an electrolytic lead smelting process are that there is no loss in lead and that practically all the sulphur is recovered.

Another patent recently granted to A. G. Betts refers to the construction of an electric furnace which he considers specially suitable for this purpose. The principal feature of this construction is that the electrodes are not placed in the smelting zone itself but in separate conduits which are in connection with the smelting zone; the fused electrolyte being circulated through this conduit by means of an electromagnetic stirring device (somewhat similar to that recently employed by E. A. Ashcroft for analogous purposes). A full detailed description of the Betts process, with thermochemical calculations, has been given by the inventor in the May issue of *Electrochemical and Metallurgical Industry*, which also contains an article by E. A. Ashcroft on his own and Swinburne's work in the same field.

CALCIUM CARBIDE.

Seven patents recently granted to H. L. Hartenstein are interesting, as they refer to a process of manufacturing calcium carbide and to furnace constructions by which the Union Carbide Company is to receive competition for the first time in this country since the process of Hartenstein is reported to be in operation in a Western plant. The object is to produce a carbide having a comparatively hard stone or flint-like structure which is not objectionably porous and not nearly so hygroscopic in its nature as the crystalline product and which during crushing does not yield so large a percentage of fines. The carbide is made directly from limestone by pre-heating to calcine it, then mixing coke with the mass while highly heated and fusing the mixture in an electric furnace. The furnace is tapped and the molten mass run off into chilled molds to separate out into a comparatively thin sheet whereby it is enabled to cool quickly. Simultaneously a protective coating is applied to the carbon of such a material as coal-tar, glucose, etc., these materials being applied to the surface of the molds.

MISCELLANEOUS FURNACE PATENTS.

T. L. Willson reduces calcium oxide mixed with carbon in an electric arc furnace, the carbon crucible serving as one electrode. The reduced metallic calcium may alloy or combine with some other metal if the same is provided in the charge and may combine with an excess of carbon to form a carbide. The application for this patent was filed January 28, 1896, so that more than ten years elapsed before it was granted.

M. Ruthenburg has recently been granted another patent on his well-known treatment of comminuted iron ore. As will be remembered, the concentrates from magnetic separators are passed between rolls across which the electric current is passed, and thereby fritted together so as to form lumps. These lumps fall into a reservoir below where it is intended to reduce them (without fusion) by means of a reducing gas from a gas producer. The reduced iron then passes into a region at fusing temperature where it is melted and drawn off.

A furnace recently patented by C. O. Wingren is intended for fusing quartz in such a way that when it cools the fused quartz is free from air bubbles.

A patent of E. Zell refers to muffle furnaces in which the heat is produced by passing an electric current through the iron walls of the muffle. In order to protect the iron walls against corrosion he packs them in granular calcium carbide.

Two patents, recently granted to D. G. Steinecke and J. F. Hammond, respectively, refer to details of construction of electric furnaces for dental work.

New Telephone Patents.

SWITCHBOARD CIRCUITS.

In Fig. 1 there is shown a new switchboard circuit system which is extremely simple in its operation. The compound line relay, responding to a switch hook, will connect the line lamp in series with the resistances *e* and *f*, thus causing it to glow. Now upon the response of an operator, the supervisory lamp, which is of low resistance, shunts out the line lamp. It does not itself light because of the proportions of the various resistances. Now when the line relay armature is released the supervisory does light as the resistance, *e*, is cut out of its circuit. Mr. F. R. McBerty, of Evanston, Ill., has obtained the patent for this system, his patent being assigned to the Western Electric Company.

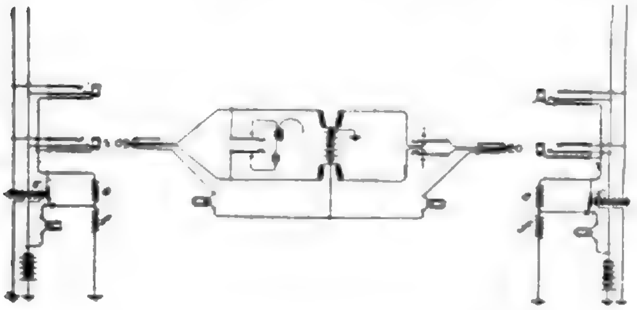


FIG. 1.—M'BERTY SUPERVISORY SIGNAL.

Mr. J. Kellogg, of Chicago, has obtained a patent for a circuit system for a switchboard designed to accommodate and interconnect grounded and metallic lines. The system was probably of more value at the date of application for the patent, 1891, than at present. The system hinges on a polarized drop, or a drop and coil, with a ground as the neutral point, and test batteries, one in each cord circuit, to provide a busy test. The Kellogg Company has obtained the patent by assignment.

JACK BOX.

There are numerous present day uses of the telephone which require a portable telephone adapted to be readily connected to a telephone line at intervals throughout its length. The plug and jack form the usual connection. It has disadvantages, for if the jack is stationary insects and dirt collect in it, while if the jack is portable, the weight of its mounting is too much for the cords.

G. H. Metheany, of Lima, Ohio, has produced a novel jack box, the plug aperture of which is normally closed by a metal ball. The box is arranged so that the plug is inserted from the bottom. The inner surface of this bottom is recessed toward the plug aperture and the ball, free to move, recedes ahead of the plug, and runs back into the aperture as the plug is removed.

FUSE AND ALARM.

In Fig. 2 is shown an improved fuse and alarm, the invention of E. B. Craft, of Chicago. The fuse, it will be noted, holds the alarm spring off the alarm bus-bar and at the same time holds an indicator in the non-operative position. When the fuse blows the battery bus is connected to the alarm and the indicator is thrown up as shown by the dotted lines.

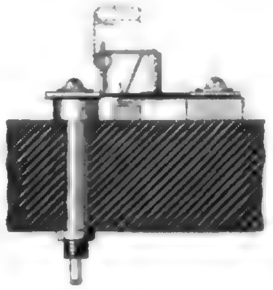


FIG. 2.—CRAFT ALARM FUSE.

SERVICE REGISTER.

C. E. Wright, of Cleveland, Ohio, has obtained a patent for an apparatus for registering the quality of service given by an operator. The register indicates time of call, plug-in connection, disconnection, etc., automatically, comparing these with the stroke of a timing pendulum or other timing device.

TELEGRAPH SYSTEM.

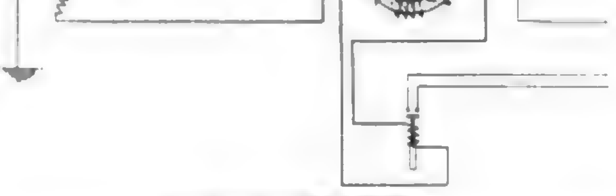
M. J. Carpenter, of La Grange, Ill., with the idea of making telegraph signals inaudible except to the operator, has combined the telegraph and telephone. In one scheme he mounts a dummy telegraph key on the base of a telephone set, the transmitter of which picks up the various clicks. In another variation the telegraph key contacts are included in the telephone transmitter circuit.

MESSAGE CHARGE INDICATOR.

A message charge indicator has been patented by I. Kitsee, of Philadelphia, by which at the end of a call the operator may indicate mechanically to the station what are the charges. A contact dial is used by the operator, an arm sweeping over the proper number of contacts causing the synchronous action of the subscriber's register to indicate the cost of the call.

Ground Detector for Polyphase Circuits.

A patent issued April 24 to Mr. G. N. Eastman describes an automatic safety device for polyphase systems, which is placed in operation when one of the conductors becomes grounded. The leads from the polyphase generator, the neutral point of



EASTMAN GROUND DETECTOR.

which is grounded in the usual manner, are wound around a laminated iron ring in such a manner that each will have the same inductive effect upon the core as the other. An independent conductor is also wound around the core in such a manner that any magnetic flux therein will generate an electromotive force in this conductor. In normal operation no flux will be produced in the core, since the instantaneous sum of the currents in the lead wires is zero. Even in a three-phase system when current flows in only two of the main conductors, the instantaneous resultant sum of the currents is zero. As soon as a ground occurs, however, part of the current fed through the transformer will return to the generator through the ground and thus destroy the balance in the current transformer. The unbalance will cause a magnetic flux to be set up in the core, which will in turn energize the winding in the independent conductor, thus operating a circuit-breaker or some form of current indicator.

The Lighting of Streets.

At the May meeting of the Illuminating Engineering Society, held on May 11, three papers were read on the general subject of street illumination. A paper by Mr. Western Underwood and Mr. V. R. Lansingh dealt with a method of street lighting by incandescent lamps. High-efficiency incandescent lamps for street lighting were treated by Mr. F. W. Willcox, and the lighting of streets by incandescent-mantle burners was the subject of a paper by Mr. F. Westermaier.

The paper of Messrs. Underwood and Lansingh described the street lighting system used in Los Angeles, Cal. It consists of ornamental poles placed on an average of 100 ft. apart, each pole being directly opposite the one on the other side of the street. The lamps are all placed upright, which, while undoubtedly not quite so efficient as if placed in a pendant position, nevertheless renders the liability to breakage less, and in case of breakage protects the passer-by from falling pieces of glass. The center ball used on the type of post employed along Broadway of that city is of ground glass, roughed on the inside, 18 in. in diameter, containing six 32-cp lamps in two tiers. Surrounding this are six eight-inch balls with one 32-cp lamp in each. All lamps burn from dark until midnight, after which hour the lamps on two of the four posts at corners of the streets are left burning. The voltage is 110. One of the difficulties in the first installation was the effect of the sun in the day time rendering the iron posts so hot as to cause trouble with the rubber-covered wire used. This has been rectified since by the substitution of asbestos-covered wire.

In all there are 134 posts on Broadway, covering a distance of 10 blocks in the heart of the business section. The cost of each pole set up complete was $100.

The type of post adopted for Spring and Main Streets has four arms with 12-in. roughed-inside balls with three 16-cp lamps in each, and one large center ball 16 in. in diameter with six 32-cp lamps. On Spring Street there are 134 of these posts, and on Main Street 164.

The illumination of the streets is remarkably uniform. In no case is the lighting really brilliant but the lighting is extremely good and very easy on the eye. The advantage gained in this respect by using roughed-inside balls is very considerable. Where the globes have been broken and the bare lamps are visible, the trying effect on the eyes is extremely noticeable; and while there is undoubtedly a reduction in the total amount of light, the ability to see well is greatly enhanced by the use of these balls. At the same time they make an extremely ornamental and dignified appearance, with the result that the amount of business on the streets so lighted has, it is claimed, been greatly augmented.

There is very little halation, and the light at all points is remarkably uniform. It is possible to stand half way between the posts and read the print of an ordinary newspaper, even when placed horizontally. When held normal to the light a newspaper can be read with ease.

One of the objections to the system is that too much light is thrown upward, and that therefore the system is not as economical as might be desired. Experiments are now being undertaken to see if it is possible to overcome this defect. If this can be done, an increased illumination can be given in the street at the expense of some of the upward light; or as the illumination of the street is ample at present, it will probably result in a reduction of the current used, by employing lamps of smaller candle-power.

The chief objection to the system is the cost of operation. As installed in Los Angeles, the consumption is practically 12 amperes at 110 volts per post; this means 12 amperes at 110 volts every 50 ft., or practically the cost of operating one arc lamp of six amperes every 25 ft., which is high. The results, however, from every other standpoint are very good.

The paper by Mr. F. W. Willcox dealt specifically with the General Electric graphitized filament lamp as applied to the lighting of streets. After discussing the advantages of using many lamps of low candle-power distributed over a considerable area rather than a small number of lamps of high candle-power separated by great distances, the author described briefly the improvements which have been introduced in the apparatus for supplying current to series lighting circuits. He considered that the best systems at the present time is one using constant-current transformers with high-efficiency incandescent lamps, each being equipped with a reliable device to short-circuit the fixture if the lamp should burn out. The graphitized filament lamp, which costs very little more than the ordinary carbon-filament lamp, is about 30 per cent more efficient for the same total life. On account of the higher temperature at which these lamps are operated, their brilliancy is satisfactory after they have lost more than 20 per cent of their initial candle-power. This result is attributable to the fact that only about 20 per cent of the loss of illumination is due to the blackening of the globe, the remaining 80 per cent being due to the change in the resistance. The author suggests that the lamps used in series for street illumination should be burned until the candle-power decreases to 75 or 70 per cent of its initial value, in which event the life will be many times greater than when the lamps are discarded after the illumination has dropped to 80 per cent. By making certain assumptions as to the cost of energy and the initial cost of the lamps, it was contended that for almost all kinds of street service the 2.7-watt lamp is the most economical. It has been found that the lower the current for which the lamps are designed the more satisfactory will be the performance. For best general service the e.m.f. of the series circuits should be from 3,000 to 5,500 volts, the current from 1.5 to 5.5 amperes, the rating of each lamp from 20 to 50 candles. More than 90 per cent of all lamps in use are rated below 40 candles; perhaps the standard unit should be a low-current 25-cp lamp.

For street illumination, the high-efficiency incandescent lamps should prove especially advantageous to central stations, on account of the fact that the income from street lighting is based on the lamp-hour and not on the kw-hour, and any saving in energy without decrease of illumination means a direct increase in the profits. In comparing the high-efficiency incandescent electric lamp with the incandescent-mantle gas lamps, the author stated that it permitted more readily of economic control, its initial cost is less and its maintenance cheaper; it withstands the weather more advantageously, and, on account of the fact that its location is not limited by the position of gas mains, it can easily be installed so as to afford any desired distribution of illumination.

In his paper on the lighting of streets by incandescent gas mantles, Mr. Westermaier stated that, in order to withstand the rough usage on the streets it has been found necessary to construct a mantle especially for street lighting purposes. These mantles are strong in structure, and, owing to special treatment and preparation, retain their efficiency longer than the average commercial mantle. The mantles are capable of producing from 20 to 24 candle-hours to a cubic foot of gas having a thermal value of 600 British thermal units; while, with gases of higher heating value, such as natural gas, the illumination rises to over thirty-five candle-hours to the cubic foot. In dealing with natural gas it is necessary that the mantle be specially treated to prevent the percentage of cerium being reduced. This treatment is most important, as without it the mantle loss would be very high and the service would not be efficient.

The intense illumination such as that produced by the electric arc lamps, is neither desirable nor necessary in residential sections of cities. The incandescent-mantle lamp diffuses its light over these sections to much better advantage. The most judicious arrangement of lamps is obtained when the broad avenues are lighted by arcs, while the cross streets and parks are lighted by mantle lamps.

In order to maintain the efficiency of the incandescent gas street lighting system, it is absolutely necessary that the lamps receive proper care and attention. As each lamp is in itself an individual plant, it must be adjusted to suit the conditions under which it operates. There is no doubt that the best possible service is to be had only where each individual lamp receives daily attention. Manual lighting will therefore not be replaced by the automatic unless great improvements are made. Moreover, the majority of automatic devices could not be used even if they were perfected.

DISCUSSION.

The discussion was opened by Mr. J. W. Cowling, who compared the illumination obtained from arc lamps spaced at great distances with that from small lighting units more widely distributed. In towns and small cities the best effects are secured by the use of 25-cp incandescent lamps, and in many places such lamps have replaced the electric arcs. He expressed the opinion that the initial cost of the equipment and the expense for the electricity used in the Los Angeles street lighting system were very excessive.

Mr. W. T. Morrison gave an account of the good results which had been obtained by selecting lamps of varying amperes for use in different parts of a lighting system. In discussing the Los Angeles installation, he remarked that it is unnecessary to place lamps in an upright position on posts in order to prevent breakage, because experience shows that almost no breakage occurs when the downward arrangement is used, while the latter method is far preferable with reference to the illumination obtained. He criticised the use of only two lamps at street corners 600 ft. apart after midnight in the business section of a town. The power used in the Los Angeles equipment amounts to about 26 kilowatts per 1,000 ft. of street, while along Fifth Avenue, in New York City, which is considered one of the best illuminated streets in the country, only 6.6 kw are used per 1,000 ft. The cost, therefore, must be extremely high in Los Angeles.

Mr. E. L. Elliott remarked that the lamp posts used in Los Angeles seemed to have been designed with especial reference to the handsome appearance and that incidentally they were used for holding electric lamps. From the point of view of illumination it would be difficult to conceive of a less efficient arrangement. The use of several incandescent lamps in a single globe is fundamentally wrong, and clusters of lamps are always disadvantageous with reference to the distribution of the illumination. No attempt seems to have been made to prevent the fixtures and the lamps themselves from cutting off a large part of the light, and yet no reflectors have been used. It would have been far better if the lamps had been placed in a downward position.

Mr. W. D'A. Ryan showed that the so-called reflectors used with street lamps serve well enough as a protection from the weather, but that they are failures as means for directing the light rays where they are needed. A reflector should collect the major portion of the light rays which tend to pass above the horizontal and re-direct them to an angle between 0 and 20 degrees below the horizontal. Such reflectors seem never to have been used, although their design offers no difficulties whatsoever.

Mr. F. W. Westermaier stated that in certain tests which had been conducted to determine the effectiveness of the illumination obtained from different types of gas and electric lamps, it had been found that a clipping could be read at a much greater distance from a gas lamp than from an electric lamp of the same candle-power rating.

Mr. T. J. Little, Jr., in discussing the rating of incandescent-mantle gas lamps, stated that numerous tests made on lamps in actual service showed that about 20 candle-hours are obtained per cubic foot of gas, so that a 3 cu. ft. burner can safely be rated as a 60-cp lamp. By the use of the proper reflectors the distribution of illumination from gas lamps can be rendered equally as satisfactory as that obtained from electrical lamps.

Mr. John Campbell said that it is not proper to judge of the illumination from lamps by the distance at which a clipping can be read, and that the only proper method is by the use of photometers.

President L. B. Marks thought that the subject of street illumination is of sufficient importance to justify the appointment of a committee to collect data or to make such tests as may be needed in order that more definite information may be available for the members. He suggested that the matter of selecting such a committee be referred to the council of the society.

LETTER TO THE EDITORS.

Soldering Fluxes.

To the Editors of Electrical World:

Sirs:—Serious charges have from time to time been preferred against linseed oil and the various gums used in the manufacture of insulating varnishes, by persons interested in the promotion of petroleum base compounds, and practically all the failures of electrical apparatus whose causes were not immediately apparent, have been conveniently laid at the door of the insulating varnish. An insulating varnish is not a perfect material at the present stage of its development although it has been improved very materially in the last ten years as a direct result of the rivalry of the various varnish makers to secure the business of the electrical trade whose demands as to quality have been increasingly exacting.

The writer having had occasion to investigate the charges referred to above, concluded, after considerable experimentation extending over several years and after discussing the matter with many of the most notable authorities on insulation, it would be necessary to look elsewhere for an explanation of practically all the failures of electrical apparatus arising from obscure causes.

Probably one of the principal causes of these failures is the use of soldering fluxes which are absolutely unfit to be associated with other materials accessory to the manufacture and repair of the apparatus. It is astonishing to note the carelessness and apparent indifference with which many manufacturers and the large majority of central station managers treat this small but extremely important article.

The fluxes used to solder joints which are afterward insulated, very often contain zinc or ammonium chlorides in large quantities which are anything but dielectrics and the former is strongly hygroscopic; not only are they conductors electrically, but they act chemically on the insulation, rapidly deteriorating both textile and insulating coatings with uniformly disastrous results. The corrosive action of these chlorides whether alone or compounded with other materials makes their use impossible for soldering all small gauge wires whether bare or insulated. A test recently brought to the notice of the writer strongly indicates the necessity of abandoning the use of all flux compounds containing metallic or other corrosive salts in the vicinity of insulation; on tearing down a multiple strap-wound coil that had had a terminal soldered to its starting end, it was found that the zinc chloride flux had, by capillary attraction, penetrated the coil over a foot from the soldered joint! Such a condition is liable to be obtained constantly in practice, is the probable cause of many obscure breakdowns in high-tension apparatus and should be forestalled by absolutely prohibiting the use of fluxes other than those composed exclusively of insulating materials.

The specification just named excludes the use of water solutions. The fire risk accompanying the use of spirit solutions, not to mention the inconvenience of the brush and cup method with its unavoidable waste caused by carelessness and evaporation of the solvent, is a factor to be seriously considered.

A soldering flux for general electrical use should, therefore, be in stick or paste form, preferably in stick form for convenience in handling, of sufficiently high flashing point to prevent its taking fire on contact with hot solder, and should contain none but insulating materials.

Elgin, Ill. L. Dwight Conger

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Commutator Motors.—Hospitalier.—The first part of a long article intended to give a classification and general theory of single-phase commutator motors with the aid of diagrams.—*L'Ind. Elec.*, April 10.

Single-Phase Motors.—Perret.—A note discussing some theoretical points concerning perfect commutation in single-phase commutator motors.—*L'Eclairage Elec.*, March 24.

Windings.—Goerges.—A long abstract of a paper read before the Dresden Electric Society on the classification of direct current dynamo windings and the principal laws governing them.—*Elek. Zeit.*, March 22.

Transformers.—Dalemont.—A highly mathematical note on determining the phase-difference in transformers.—*L'Eclairage Elec.*, April 7.

Calculating the Coefficient of Self-Induction.—Rosskopf and Wittek.—Several letters discussing some special points in the recent article of Wittek on the calculation of the coefficient of self-induction of coils embedded in iron.—*Elek. Zeit.*, March 22 and April 26.

Lamps and Lighting.

Tungsten Lamp.—Ross.—An abstract of a paper read before the Austrian Assoc. of Electricity Works. The author gives a review of the different firms and engineers which are trying to develop the tungsten lamp and molybdenum lamp. Just has two patent applications for two different methods of preparing tungsten and molybdenum filaments, of which the first one is stated to have met with difficulties while the second one is as follows: Compounds of tungsten or molybdenum which can be reduced to the metallic state by means of hydrogen (for instance, oxides, sulphides, chlorides) are powdered and mixed with a binding material which is free from carbon (for instance, water) and made into a plastic mass. This is brought into the form of a filament and is heated in a hydrogen atmosphere until the filament is reduced to the metallic state. Entirely different methods are those of Kuzel, who employs colloidal solutions and the paste method of Welsbach. The Welsbach Company is also working in this field, and its method is to treat the trioxides of tungsten or molybdenum with an excess of ammonia so as to form a tough paste and to work this upon filaments. Concerning the Kuzel lamps some tests have been made in an Institute in Vienna which were mentioned in Electrical World February 17, p. 354. The testing laboratories of the municipal Electricity Works of Vienna have so far examined only tungsten lamps of the Welsbach Company. The tests have not yet been concluded, but the results obtained so far with lamps lighted for about 1,000 hours are favorable. Up to the present only the Welsbach Company has furnished lamps consuming one watt per cp with voltages of from 100 to 120. The hall in which the lecture was held was lighted with such lamps of 60 to 80 cp, which gave a light which was specially pleasant by its beautiful white color. Such lamps may stand a considerable increase of voltage, as was shown by the lecturer who used one of the lamps at double the normal voltage.—*Elek. Zeit.*, April 12.

Tungsten Lamp.—A note on the new tungsten lamp of Just and Hanaman. So far the lamp has been made for voltages not exceeding 110 volts. In the 110-volt, 32-cp pattern, there are three exceedingly thin filaments of pure tungsten, the filaments being held in place by suitable stays of aluminum oxide or of a mixture of other suitable oxides. In size and form the new lamp is stated to be almost identical with the ordinary 110-volt, 32-cp carbon-filament lamp. According to the inventors, pure tungsten cannot be made to melt, but at the highest temperatures obtainable it volatilizes without passing through the liquid state. In this respect it is analogous to carbon, the difference being that the temperature at which carbon volatilizes is considerably lower than that for tungsten. It is stated that the average life of a 110-volt, 40-cp lamp when run at an illumination of one Hefner candle per watt is 1,500 hours. It would appear that the illuminating power of the lamp remains unaltered during its entire life, and that it is not at all sensitive to fluctuations in the supply pressure.—*Lond. Elec.*, April 27.

Improving the Light of the Mercury-Vapor Lamp.—Gehrcke and von Baeyer.—An account of an investigation made in the German Reichsanstalt. In order to produce red rays in the mercury-vapor lamp and thus improve the color of its light, the authors add zinc to the mercury. They use a lamp made from fused quartz with zinc amalgam containing 30 parts by weight of mercury for 100 parts of zinc. The spectrum shows not only the strong mercury lines 435.9, 546.1, 576.9, 579.0, but also the strong zinc lines 468.0, 472.2, 481.1, and 636.4 $\mu\mu$. Especially the last named red zinc line is very strong. The lamp was operated on a 110-volt circuit with a series resistance and its light was much more like ordinary daylight than the light from a lamp containing pure mercury. A stick of sealing wax appeared red and the human skin lost the deadly green color which it had when illuminated by the mercury lamp, and appeared rather a little too rosy. Only the color of yellow substances was incorrect, since they appeared either too red or too green. This last disadvantage was overcome by adding a small amount of metallic sodium and the light given out from the mercury-zinc-sodium lamp was then comparable to the color of some Bremer arc lamps. It is advantageous to add to the above mixture some bismuth (say about 10 per cent) since it happened that the zinc amalgam which is solid at ordinary temperature, when expanding with rising temperature, sticks to the walls of the lamp and made them crack. No cracking occurred after bismuth had been introduced while the spectrum of the bismuth is much too faint to change the color of the lamp in any considerable degree. The quartz lamp used in the experiments was designed for spectroscopic purposes only, and would not be suitable for commercial use. For this reason, and because the lamp needs further improvements before it can be made commercial, no data are given on the economy of the lamp.—*Elek. Zeit.*, April 19.

Power.

Direct-Current Power Transmission.—Adams.—With reference to the proposed direct-current power transmission from Victoria Falls to the Rand in South Africa the author points out the following advantages of this system: For equal effective voltages, the maximum voltage of a single-phase or two-phase alternating-current circuit is 1.41 times that of a direct-current circuit. In a three-phase circuit the maximum alternating voltage is higher by a large percentage than the voltage of a direct-current circuit for the same power and loss and weight of conductors. For these reasons the constant silent escape of energy from wire to wire of a transmission circuit is greater with alternating current than with direct current. In a direct-current transmission line the maximum voltage is on the line only at times of full load; at other times the voltage is proportional to the load. The line construction is simpler with direct-current than with three-phase current, and for a given weight of conductors per mile a direct-current circuit presents a stronger construction than a three-phase, because each wire is larger in the former case than in the latter.—*Cassier's Mag.*, May.

Power House Economics.—Hancock.—The conclusion of his article on the importance of details of operation in power houses. There should always be a sufficient number of each kind of tools on hand to admit of having others repaired without excessive cost. The supplies should be kept in a suitable place. Good care for the steam and electrical apparatus involves tests every month of the reciprocating engines or steam turbines, etc. To keep the auxiliaries in proper working order, labor and material of first-class kinds are necessary. The instruments should be periodically tested and standardized.—*Cassier's Mag.*, May.

Alternating-Current Motors.—Scott.—The second part of his illustrated article, of a general nature, on speed characteristics and the control of electric motors. In the present installment he discusses alternating-current motors.—*Eng'ing Mag.*, May.

Traction.

Vienna.—A note on the electrification of the Vienna City Railway. Motor cars cannot be used since it was required that at the terminals of the city road passengers should not be forced to change cars when going out of town on any of the suburban steam roads. In the city road electric locomotives have therefore been installed, the Krizik three-wire system being used. Each direct-current locomotive has two axles and four motors, two motors acting on one axle. Two such motors are in series and are connected across one-half of the three-wire network of 2x1,500 volts. The other two motors are connected across the other half. The earth forms the neutral conductor and generally carries no current on account of symmetric load. An exception is in starting which is accomplished with the four motors in series at 1,500 volts. With a tension of 3,000 volts two converter stations are sufficient for the whole city road; they are supplied with three-phase currents from the municipal electricity works. The locomotives for trains of from 5 to 10 cars weight 29 tons, the draw-bar pull being 8,300 kg. The ratio of adhesion weight to draw-bar pull is 3.5, which is the same ratio as for the new Valtellina road.—*Elek. Bahnen*, March 3.

High-Tension Direct-Current Railway.—An illustrated description of the 990-volt, direct-current railway between Cologne and Bonn in Germany, the motors being provided with interpoles. The chief features of the road were noticed and illustrated in the Digest of April 28.—*St. R'y Jour.*, May 5.

Single-Phase Railway at the Milan Exposition.—The Milan exposition, which is shortly to be opened, is built on two separate pieces of ground, but facilities for getting from one part to the other are provided by a double-track, single-phase railway built on a wooden structure at a height of about 16½ ft. from the ground, and nearly 1 mile in length. The gradient is 0.9 per cent practically all the way, but at one end the track lies in a curve of a radius of some 300 ft., the gradient here attaining 3.5 per cent. Single-phase current at 2,000 volts and 15 periods per second is obtained from a motor-generator set (600 hp, 3,600-volt, 42 periods, three-phase motor and single-phase generator) in a small station at one end of the line, and is fed directly into the two overhead trolley wires which are suspended centrally over the tracks by means of wooden poles and the customary span wire construction. Trains are to be made up of four cars. The end cars are equipped with transformers for reducing the trolley voltage down to 120 volts as a minimum, and are driven by two 30-hp Finzi single-phase motors. Each of the two inner cars has only one motor. A train weighs about 56 tons when carrying its full number of passengers.—*Lond. Elec.*, April 27.

French Interurban Railway.—Soltier.—An illustrated description of the network of electric tramways which extends without interruption over a length of about 50 km between Cagnes and Menton, passing through Nice, Monte Carlo and Cap Martin. The construction offered considerable difficulties. The 550-volt direct-current is obtained from six sub-stations which are supplied with 10,000-volt, 25-cycle, three-phase currents.—*L'Eclairage Elec.*, April 21.

Fremantle.—An illustrated article on the Fremantle municipal tramways which represent the latest electrical railway system in Australia.—*St. R'y Jour.*, May 5.

Gasoline-Electric Train.—Bifiov.—A brief illustrated description of a gasoline-electric train with which experiments have been made in Petersburg. The train consists of six cars of which the first one contains a dynamo coupled to a 35-hp gasoline engine. The dynamo can supply 142 amperes at 120 volts when running at 780 revolutions. Each car has four axles, of which two are driven each by an electric motor. The two motors on each car are connected in series. The three groups of the two motors on the first three cars are connected in parallel. The three groups of the two motors on the last three cars are also connected in parallel.—*Elek. Bahnen*, March 24.

Three-Phase Locomotives.—Herzog.—A fully illustrated description of the three-phase locomotives for the Simplon tunnel which have already been noticed in the Digest.—*Elek. Bahnen*, March 14 and 24.

Roller Bearings.—Schoerling.—An account of experiments made on a motorcar of the municipal tramway system of Hanover with roller bearings of the Moffet type. The results are stated to have been satisfactory, since the saving in electric power, oil and attendance was considerable and the life of the bearings sufficiently long to make up for the comparatively high first cost.—*Elek. Bahnen*, March 3.

Instruction Book for Motormen.—Bendix.—The conclusion of his serial on the training of motormen for electric tramways. The present installment contains a complete instruction book for hiring and training motormen.—*Elek. Bahnen*, March 3.

Failure of Brakes.—Kramer.—A long article, illustrated by numerous diagrams, on the reasons why brakes sometimes fail on street railways.—*Elek. Bahnen*, March 14 and 24.

Electric Vehicles.—Eames.—An illustrated article on electric trucks for city service. It can in general be stated that under some traffic conditions and surface requirements the superior mobility of the gasoline vehicle makes the saving in drivers great enough to compensate for the higher maintenance charges. Where the limitations are such, however, that the number of active vehicles required has to be about the same in each case, the electric vehicle becomes more economical on account of its lower maintenance charge. Of course, the gasoline vehicle has the advantage in all fields requiring mileage beyond that safely and conveniently obtained by the electric, but the greater proportion of city delivery service is well within the radius of travel of the electric vehicle. The expense of electric trucks is discussed with references to practical experience. In the expense of operation of electric automobiles the largest single item is the driver; the next most important item is that of maintenance, including the storage battery which should be treated as an expense account rather than an investment, as it is really slow fuel. A very considerable item in the maintenance lies in the rubber tires. Detailed cost sheets are given from experience in Pittsburg where considerable saving was obtained by the use of an electric wagon over horse traction. The author thinks that the time has come when the electric light and power companies can profitably consider the question of leasing individual charging apparatus especially suited to the proper use of their own electricity for charging private vehicles. If the electric light and power companies at present in existence do not take advantage of this active opportunity, it will certainly be done by independent capital, to their great disadvantage.—*Elec. Jour.*, May.

Motor Omnibuses.—Markham.—An illustrated article on motor omnibuses for public passenger service.—*Cassier's Mag.*, May.

Installations, Systems and Appliances.

Frequency for Converters.—Rouge.—A discussion of the best frequency to be used with rotary converters. If converters of a single-frequency are used for lighting, power purposes and traction, the best frequency is believed to be 42, since it is the highest one which permits a good conversion of current at 650 volts for traction purposes. If two frequencies are permitted, the best one for traction is 25 periods per second and the best for lighting and power purposes is 42 to 50 with machines with natural cooling and 60 to 75 with machines with artificial cooling.—*La Revue Elec.*, March 15.

Regulation of Rotary Converters.—Still.—An article giving some notes on the regulation of rotary converters and explaining with the aid of diagrams how the pressure at the slip rings increases with increasing field ampere turns, so that it will be seen that the rotary converter provided with a shunt winding across the brushes and a series winding carrying the load current may be made practically self-regulating at all loads, by suitably adjusting the amount of self-induction. In order to obtain this result, the ohmic resistance of the cables, transformer windings, etc., must be low.—*Lond. Elec. Rev.*, April 13.

Operation of Compound Dynamos in Parallel.—Jacobi.—When compound machines are operated in parallel it is almost general practice to employ an auxiliary connection between the machines in order to avoid the troublesome reversal of polarization of the machines. The author describes a special arrangement by which any such reverses of polarization may be effectively prevented.—*Elek. Zeit.*, April 12.

Regulation of Voltage in Transformer Stations.—Hinden.—The first part of an article, illustrated by diagrams, of various methods for this purpose.—*Elek. Zeit.*, April 28.

Electrophysics and Magnetism.

Constitution of the Electron.—Kaufmann.—The author, who formerly experimentally proved that the mass of the electron increases with its velocity, and that this mass is probably largely electrical, has been prompted by late theoretical discussions to repeat his work with a view of determining which theory best explains the experimental results. The theories he takes are those of Abraham, Lorentz and Bucherer. The theory of Abraham may be called the theory of the rigid electron, in which the field of the electron extends outwardly to infinity and within to the surface of a sphere of constant radius, a; and the Maxwellian equations relating to a solid sphere with surface or volume charge in space are employed. H. A. Lorentz assumes that the dimensions of all bodies, including the molecules and the electrons, change greatly with the velocity; and that mechanical mass changes in the same or analogous way as that of the electron. Bucherer supposes that the electron undergoes a deformation, keeping a constant volume. He makes use of the so-called "Heaviside ellipsoid," and can translate his theoretical results into those of Lorentz by this theory of deformation. Kaufmann employs in his experiments a crystal of radium bromide, submitting its beta-radiations to both electrical and magnetic fields; and carries out the research with remarkable skill. His entire apparatus can be clasped in a man's hand, and the almost microscopic details are carried to great perfection. He arrives at the result that Abraham and Bucherer's theories agree better with the experimental results than does that of Lorentz.—*Am. Jour. of Science*, May; from *Ann. d. Phys.* No. 3, 1906.

Thomson Effect.—Lecher.—An investigation of the variation of the Thomson effect with the temperature in the case of iron, copper, silver and constantan. The author used an electric furnace through which two wires of the metal to be investigated were drawn. Their ends projected from the oven and were joined across through three different thermocouples. Currents in opposite directions were sent through the two wires. The Joulean effect in the two wires compensates itself, but the two Thomson effects are added up, and their four-fold value may be obtained by reversing the current. To obtain a small gradient of potential, the wires are wound with asbestos. The Thomson effect is probably proportional to the gradient for small gradients. In iron, the Thomson effect at 52° is 27.8×10^{-7} gramme-calories per coulomb. The author corroborates Tait's observation that in iron the Thomson effect possesses a point of inversion. In copper the temperature coefficient of the Thomson effect is $+3.01 \times 10^{-7}$ gramme-calories per coulomb, in silver $+7.86 \times 10^{-7}$, and in constantan -4.73×10^{-6}. In iron and constantan the temperature effect follows a curve of the second degree, while in copper and silver it describes a straight line.—*Lond. Elec.*, April 13; from *Wied. Ann.*, April 14.

Electrochemistry and Batteries.

Storage Batteries.—Warschauer.—A German translation in abstract of a French paper, read by Jumau before the French Physical Society. The author first discusses the lead storage battery and emphasizes the importance of diffusion of the acid into the pores of the plates. The capacity depends on the momentary condition of the active materials. The acid concentration which gives the highest capacity depends on the discharge rate. The higher the discharge rate the greater the concentration for which the capacity is a maximum. This is shown in curves, for the total cell as well as for the positive and negative plates, separately. With respect to the last two curves it is interesting to note that the concentraion for which the capacity is a maximum is smaller for the negative plates than for the positive plates with the same discharge rate. This fact is in agreement with the condition of the lowest resistance of the acid in the pores. The large influence of the temperature on the capacity is also considered as an effect of diffusion. To heat the cells in order to increase the capacity is, however, not practical on account of the deleterious effect on the negative plates with respect to local action and shortening of life. The lead-zinc accumulator and the alkaline accumulator are also briefly discussed.—*Centralblatt f. Accum.*, April 20.

Cells Acted Upon by Light.—Wildermann.—A paper on the thermo-dynamics of cells acted upon by light. When one of two electrodes is illuminated an e.m.f. is produced directly by the light on account of the increase of the chemical potential and of the solution tension of the illuminated plate, and secondly a thermo-e.m.f. is produced due to the contact of this plate with the liquid heated by the light.—*Jour. de Chimie Phys.*, February 26.

Units, Measurements and Instruments.

Measurement of Resistance.—In the Digest of April 28 we noticed an English abstract of a German paper by Jaeger in the Lond. *Elec.*, the original German paper having been published in *Zeit. f. Instrumentenkunde*, March. Jaeger now corrects several inaccuracies in the abstract in the British paper. E is not the e.m.f.; in fact, the e.m.f. does not enter into the formulæ at all. E is the expression $C_0 e i \sqrt{A}$, where C_0 is the standard sensibility of the galvanometer (deflection for 1 ohm with 1 amp.), e the change in the resistance to be measured as fraction of the same, and i the current passing through the resistance. The sensitiveness of the measurement of resistance is proportional to E, and thus proportional to $i \sqrt{A}$; i. e., proportional to the electrical power which is converted in the resistance to be measured. The equations were deduced for needle as well as for moving-coil galvanometers. Further in the Thomson bridge the resistance to be measured need not be equal to the standard resistance; but it can also be measured in the ratio 1 ÷ 10, etc. The Thomson bridge is, in general, much less sensitive than the Wheatstone bridge.—Lond. *Elec.*, April 27.

Photometry.—Uppenborn.—An article in which the author first explains with the aid of diagrams the principles of the construction of photometers based upon the use of diffuse transmission and diffuse reflection. A photometer of the second type was used by the author for making photometric tests in a school room which was lighted by two special arc lamps for indirect illumination. The photometer used in this case was that of Martens, which is stated to be specially suitable for such purposes. The diffusely reflecting disc, F (Fig. 1), of gypsum is placed in the plane the illumination of which is to be measured. As comparison lamp a small benzine lamp, B, is used, the light from which is reflected by the mirror system, $s_1 s_2$, and the small reflection prism, p, and illuminates the frosted glass, m. By adjusting the position of the mirrors, $s_1 s_2$, the illumination of m by B is varied so that it can be measured. The two bundles of

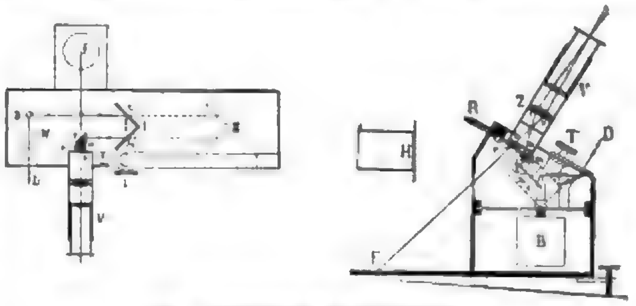


Fig. 1.—Diagrams of Photometers.

ight rays starting from F and m enter through the openings, b and a, into the tube, V, and illuminate the two halves, 2 and 1, respectively, of the twin prism, Z. The illumination of the two halves, 1 and 2, is made equal by adjusting the positions of the mirrors, $s_1 s_2$. A revolving disc, R, with smoked glasses of different transparencies serve for increasing the limits of measurement. The distance of the benzine lamp from the frosted glass, m can be measured on a scale, $M\ m$. A second scale, K, is so divided that the illumination of F may be read directly.—*Elek. Zeit.*, April 12.

Determining the Hemispherical Candle-Power.—HEIMANN.—A mathematical paper on the determination of the hemispherical candle-power of a source of light which is not a single point. If the closed surface which gives out the light is uniformly illuminated over all its points, whatever its form, it sends as much light upward as downward; in this case the mean hemispherical candle-power equals the mean spherical candle-power. If the surface giving out the light is not uniformly illuminated and if its configuration and the distribution of the light over the surface are known, the mean hemispherical candle-power may be determined from the mean candle-powers of the different zones of the surface. If the surface giving out light is not uniformly illuminated, and if its form is known, but the distribution of light is not known, the mean hemispherical candle-power may be determined by measuring the spherical candle-powers of the different zones.—*Elek. Zeit.*, April 19.

Spherical Photometer.—BLOCK.—An illustrated translation of his German paper on the Ulbricht spherical photometer, which was recently abstracted in the Digest.—Lond. *Elec.*, April 13.

Lampboard.—SELIGMAN.—An illustrated description of a simple and inexpensive lampboard which enables any number of lamps being thrown in or out of circuit by simply raising a frame.—*Electrochem. and Met. Ind.*, May.

Telegraphy, Telephony and Signals.

Telephone Relay.—TROWBRIDGE.—After a critical discussion of work done by others with respect to telephone relays, he describes a type of his own invention. He intended to accomplish especially two results: First, the prevention of the reaction of the magnetic parts on the crepitation of the microphone to obviate the excessive roaring or "growling"; secondly, to provide means for a separate adjustment of the magnetic moving parts and the transmitter. The relay consists of a small coil with a laminated iron core, which is balanced by two small diaphragms in a balanced magnetic field: the telephonic currents to be repeated or relayed enter the little coil and disturb the magnetic balance in the magnetic field. In the lower diagram of Fig. 2 $N\ S$ represent the poles of the magnetic field, C the moving coil actuated by the telephonic currents to be relayed, A and B the supporting diaphragms, $D\ E$ sound-communicating support of the microphonic contacts or transmitter. This can be a heavy disc: in some experiments the author has used a brass disc one-half an inch thick and has relayed loud and articulate speech. The main features of this relay are these: the magnetic field acts both in the direction toward B as well as toward A. The second important principle is the freedom of the central portion of the diaphragm, A, from the pressure of the transmitter, T. The third point is the transmission of the vibrations of this diaphragm, A, by means of the sound-transmitting support of the transmitter to the transmitter, T. The air enclosed in the chamber, $D\ E$, plays a very small part in the transmission of the vibrations of the diaphragm, A. A proof of this important fact is as follows: The upper left-hand diagram represents a front view of the support, $D\ E$, of the transmitter, which in this case consisted merely of a metallic bar. The upper right-hand diagram is a side view of this case. Here the air space between the transmitter and the diaphragm, A, is not enclosed, being open on both sides of the bar, which is connected at its edges with the diaphragm, A. The transmission of speech in this case is loud, while if the connection at D and E with the diaphragm are removed and the bar upon which the transmitter rests in the same position parallel to the diaphragm, A, a very feeble sound is transmitted through the intervening air. One can, therefore, adjust the transmitter without bringing a pressure upon the most sensitive portion of the diaphragm, A, its center, and without disturbing the adjustment of the moving coil, C. The relay is very sensitive; it is loud, and the articulation good. Moreover, it is free from the objectionable growling or enhancing effect of the crepitation of the microphonic contacts on the vibrations of the magnetic portion of the relay.—*Amer. Jour. of Science*, May.

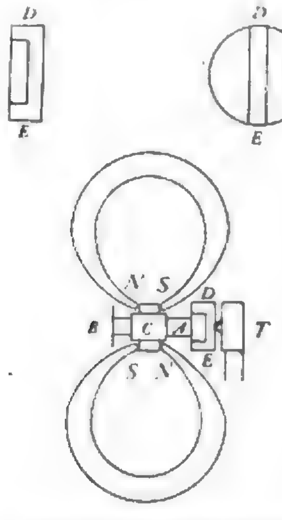


FIG. 2.—DIAGRAM OF TELEPHONE RELAY.

The Speaking Air-Gap of Induction Coils and Wireless Telephony.—MOSLER.—In Fig. 3, a is the armature of an alternator, b an induction coil and c the air-gap; d is the excitation winding of the alternator, e a transformer and f a microphone in series with a battery, g. The intention is that the oscillating currents produced by speaking into the microphone should be transmitted into the magnetic field of the alternator, a. In order to prevent the oscillations from passing through h, an inductance, i, is connected in series with h. The intention is to force the oscillations to pass over the condenser, k, directly to the excitation winding, d, and produce thereby oscillations in the magnetic flux of the alternator, a, so that the alternating currents produced in the armature, a, are correspondingly oscillating. This arrangement is essentially the same as that used with speaking arc lamps.

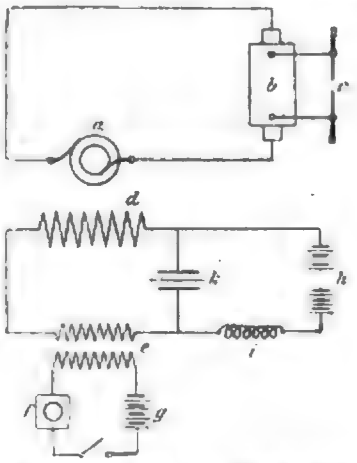


FIG. 3.—DIAGRAM OF CONNECTIONS.

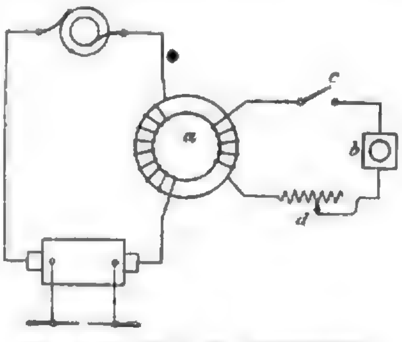


FIG. 4.—DIAGRAM OF CONNECTIONS.

Under these circumstances the air-gap at *c* reproduces all sounds spoken into the microphone, *f*, in a clear and exact way. In order to get as quiet a spark discharge as possible it is necessary to use sharply pointed electrodes. On account of the large choking effect of the field magnets the intensity of the sound is, however, considerably diminished. The author, therefore, recommends some modifications and states that the arrangement shown in Fig. 4 is especially effective, in which the secondary of the ring transformer, *a*, is directly inserted in the circuit of the alternator. If now one pole of the air-gap is earthed and the other pole is connected with a vertical wire, as in wireless telegraphy, and if the transmitting station is operated with an arc interrupter, the air-gap reproduces exactly the sound of the whistling arc with all its changes, and the same sound is reproduced in the receiving station at a distance of two kilometers, the detector being in the experiments of the author the Schloemilch (so-called electrolytic) detector. In order to base on these observations a method of wireless telephony, it would be necessary to increase the amplitude of the sound given off from the air-gap and to diminish the noise of the oscillatory sparks.—*Elek. Zeit.*, March 22.

Multiplex Telephony.—Giltay.—With reference to a former article of Ruhmer, the author discusses the possibility of multiplex telephony with the aid of Poulsen's telegraphone.—*Phys. Zeit.*, March 15.

Miscellaneous.

Mechanical Equivalent of Heat.—Rubens.—An illustrated description of a simple apparatus for determining the mechanical equivalent of heat with results of some measurements.—*Phys. Zeit.*, April 15.

Physiological Effects.—D'Arsonval.—The first part of an illustrated article on physiological effects of high-tension, high-frequency alternating currents.—*L'Electricien*, April 21.

Blast Furnace.—Richards.—In a continuation of his serial on metallurgical calculations he gives in detail the calculation of the charge of a blast furnace with a comparison of fuels, fluxes and ores.—*Electrochem. and Met. Ind.*, May.

BOOK REVIEWS.

Whittaker's Electrical Engineer's Pocket Book. Edited by Kenelm Edgecumbe, M.I.E.E., A.M.Inst., C.E. Second edition, thoroughly revised. London: Whittaker & Co. 541 pages, 161 illustrations. Price, $1.50.

The first edition of this handbook was exhausted in eighteen months, a fact that shows both its usefulness and widespread appreciation. A work of this nature is of little use unless kept up-to-date. A glance at such subjects as dynamo design, electric traction, and electrochemistry suffices to show that the editor has done his work of revision thoroughly. The modest title of "pocket-book" suggest that the work consists mainly of rules and formulæ derived from the best current practice, and as such must prove serviceable to the profession for which it was prepared.

Die Elektrischen Druckknopfsteurungen fur Aufzüge. By A. Genzmer. Hannover: Gebruder Janecke. 166 pages, 180 ills. Price, 6 marks.

The apparatus employed in the starting, stopping, speed-regulation and safety insurance of electrically-operated elevators is sufficiently diversified to call for systematic description and explanation. The author as an engineer has prepared this textbook for engineering students acquainted with the elements of electrotechnics and mechanics. It deals with the various types of controllers employed in Germany in connection with electric elevators. The style is clear, the illustrations simple and abundant. Practical examples of portions of the electromagnetic mechanism are selected for discussion. In many respects the apparatus described differs from that met with in standard American practice; although much is naturally found in common to both. The book will be found useful to electrical engineering students making a special study of electric elevator apparatus.

Steam Turbines. By W. Gentsch, translated by A. R. Liddell. New York and London: Longmans Green & Co. 375 pages; illustrated. Price, $6.00.

This handsome book is a useful addition to the literature of steam and to the data on the steam turbine, and with it in his library the engineer or student will hardly need much else on the subject, just at present, though the art is advancing so rapidly no turbine book can be regarded as a permanent classic. One thing that Gentsch has done that is of value is to group the design of turbines under two designations, namely, "velocity" and "pressure," a differentiation already recognized and as clean cut as that in the hydraulic turbine field. The author has also given special attention to dynamo operation as distinguished from that of steamships, etc. A vast body of fact is incorporated into the volume, and the only fault we would find with it is that, as usual in works written on the other side of the Atlantic, the turbine invention and engineering done in America is belittled by inadequate treatment. It is time we got away from Hero to the true heroes of the steam turbine. The author by his elaborate analysis of patents has made a step in this direction.

A History of the Stevens Institute of Technology. Edited by Prof. F. DeR. Furman, M.E. Hoboken, N. J.: Stevens Institute of Technology. 641 pages; illustrated. Price, $10.

This sumptuous volume was intended as a memorial to President Henry Morton, and was in turn the outcome of an idea of his in connection with the celebration of the twenty-fifth anniversary of the Institute. In its present form it is at once a history of the famous Stevens family; a history of the Institute and a record of the achievements of the graduates. The last section, while it has a direct personal interest for many, does not possess the distinct appeal to the technical and general reading public of the other two portions.

They who would know something of the foundations of engineering in America must become acquainted with the genius and deeds of the Stevens family, than which none has made a deeper imprint on the advance of the United States in the arts and sciences. We travel so rapidly nowadays from improvement to improvement the earlier work is overlooked and forgotten, and it is well that this memorial should be available alike to the present student and the future historians. The Stevenses were great engineers, in the full sense of the epithet.

The history of the Institute is largely that of the brilliant physicist and specialist, Dr. Morton, one of the most fertile and facile of men to occupy a college presidency. It was he to whom such infinite credit is due for the success of the institution whose graduates have from the first been peculiarly leaders in the field of mechanical engineering. A degree from Stevens is equal to a seat on the Stock Exchange; it means for the possessor a competency at the start. To Dr. Morton is due the high standard of the teaching at Stevens, and the notable proficiency of each class of young men as it came forward to take up the duties of life. His place is like that of Eliot at Harvard; his stamp is deeper cut on men and things.

As to the alumni, we have in this book the records of all the 1,088 men who received degrees up to 1904. This is interesting information and is all the more valuable for its inclusiveness of good, bad and indifferent. In fact, the wonder is that so many of the men show up well in their careers; there must have been pretty severe weeding in the undergraduate years. And yet, under the present régime of President Humphreys the standard has distinctly risen, foretelling even better records in the years which are yet to come.

This volume was prepared virtually for private circulation, but it would seem that a small part of the edition has been wisely placed on sale. It is a useful addition to any engineering library and especially to collections accessible to the public.

The Electrical Installation of the Providence Lithograph Company.

One of the most interesting electrical installations in Rhode Island is the power and lighting equipment of the Providence Lithograph Company, located on Prairie Avenue, at the corner of Reynolds Avenue. All the machinery is electrically driven, in most cases direct-connected motors being used. Power is supplied by the Narragansett Electric Light Company, of Providence. In every particular the installation bears the mark of careful designing and excellent construction. In its adherence to the direct rather than the group drive, the plant is a typical instance of the latest practice.

The building is a one-story brick structure consisting of a workshop section, 300 ft. wide by 100 ft. long and an office 100 ft. square. In order to provide a solid foundation for the heavy machinery, the floor in the press and cutting rooms was built of ⅞-in. maple planks laid on 3 in. of hemlock, the latter resting on 6 in. of concrete. No vibration is apparent when the machines are in operation. Beneath the floor of the work room on the Reynolds Avenue side of the building is a fire and moisture-proof vault for the storage of lithograph stones and plates. This vault is divided into sections, each section being lighted by two 16-cp, 250-volt lamps, so that any plate or stone can be quickly found in its numbered compartment. The temperature of the vault is kept at about 70° F. by steam heat, it being essential for the proper storage of the stones that no moisture be allowed to gather upon their surfaces. The building is lighted by 250-volt incandescent lamps, supplemented by enclosed arc lamps for general illumination. The current supply for the lighting circuits is single-phase. The lamp and switch fittings in the vault are of the marine type. The switches are operated by pendant cords of non-conducting material, so that there is no danger of shock in case an outside line becomes crossed. About 200 16-cp incandescent lamps are in service. The quality of work in the plant renders good lighting of the first importance; the larger part of the company's output consisting of colored illustrations for religious and secular educational work. Abundant natural light is, therefore, provided by saw-tooth skylights admitting north light and numerous large windows. In addition the interior walls are painted white.

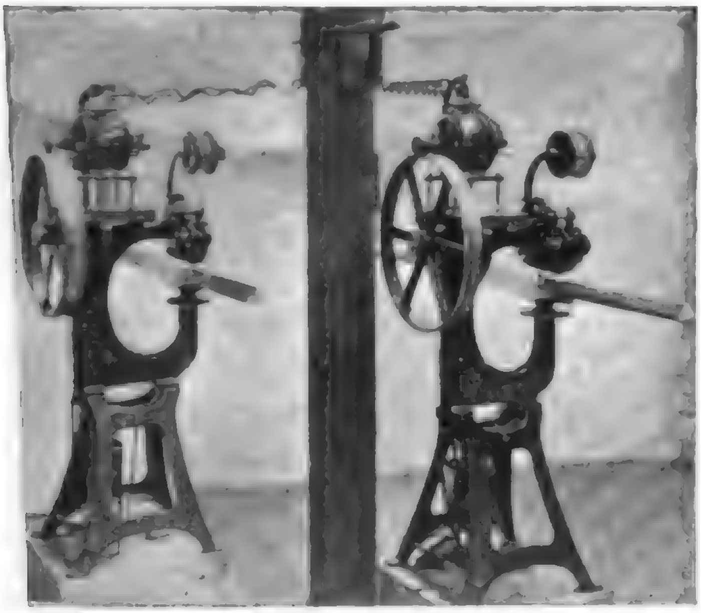


FIG. 1.—WIRE STITCHING MACHINES.

All the motors are of the direct-current type, and operate at a potential of 500 volts. Motors rated at ½ hp or less are of Holtzer-Cabot type "E" design; larger motors are of type "SE," design, characterized by extreme shortness along the shaft axis, and in the compound-wound form, by a large starting torque. The result is a very narrow motor, which in many cases can be set inside the floor area occupied by the driven machine and installed so that no part of the motor projects into the aisle space. The compactness of this motor can be seen in the accompanying illustrations of lithographic presses and cutters, comparing the size of the motor with the driven machine. The motor wiring is carried in iron conduit. Special care was taken to avoid introducing shadows caused by installing wires between the machines and the skylights.

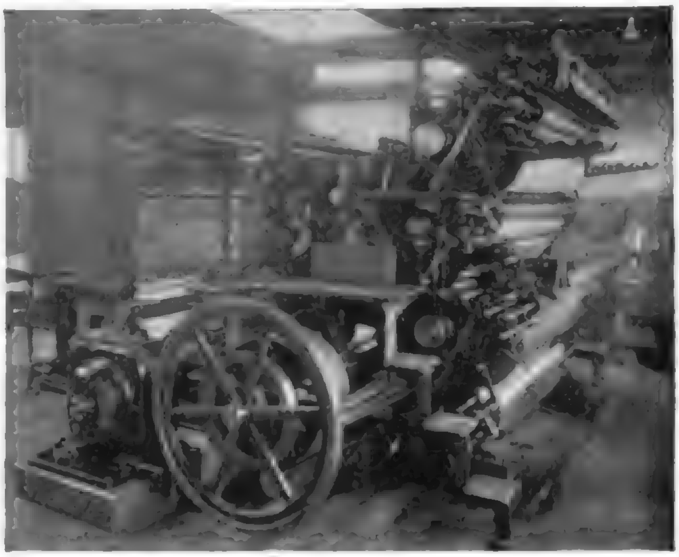


FIG. 2.—MOTOR-DRIVEN LITHOGRAPH PRESS.

The service wires are brought in on the Reynolds Avenue side of the building. The entering cables are carried in iron conduit through and down the wall to the floor and thence to two switchboard panels set up in one corner of the cutting room. The motor service is of No. 2 wire and the lighting service of No. 4 wire. The service boards are of slate, separately mounted. One is given up to motor service and is 32 in. high, 30 in. wide and 1½ in. thick. The lighting panel is of the same dimensions. The panels are mounted 12 in. apart, with a clearance of 24 in. between the panels and the nearest parallel wall. Terminal connections were specified for a minimum capacity of 100 amp. per sq. in. Each panel is equipped with ammeters, a recording watt-hour meter and the usual knife switches and enclosed fuses. All mains larger than No. 7 wire are held taut by strain insulators on runs of 50 ft. or more, straightaway. Motor-starters and controllers are placed within easy reach of each operator. On the presses the controller resistance is detached, and push buttons are provided, one at the head end and one at the opposite side

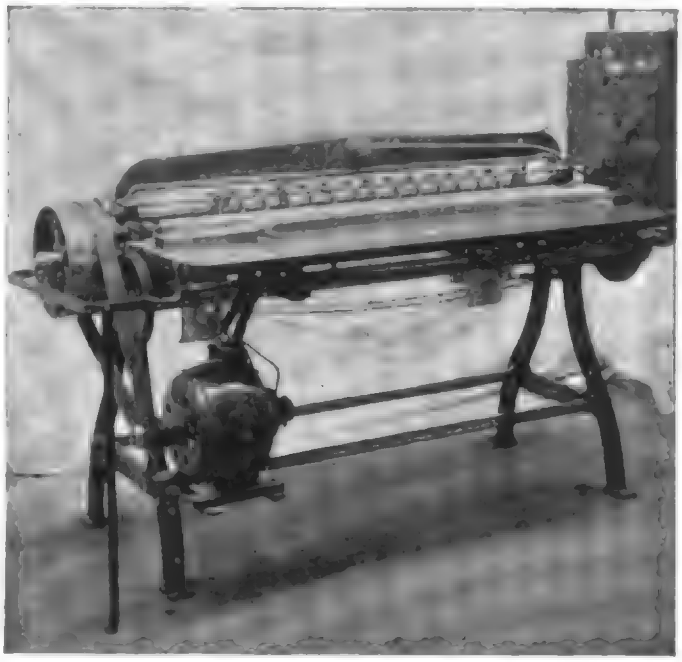


FIG. 3.—MOTOR-DRIVEN COLLATOR.

of each press, for stopping the presses quickly. Motors placed on the floor are set over zinc pans.

There are about 30 motor-driven machines in the plant, which is divided into a pressroom and a cutting room section, with subdepartments in addition. In the pressroom are seven direct-driven lithograph presses. One is a tri-color press, giving 1,200 impressions per hour. This is direct-driven by a 5-hp motor. The speed of the motor ranges from 700 to 1,000 r.p.m., and the full load current is 8 amp. The motor is capable of 100 per cent overload temporarily, in starting and "inching" with the brushes fixed. All the press controllers are arranged to give two reverse speeds and are fitted with four armature resistance points for use in forward starting and ten field points for running at different speeds. A novel feature of the control is the use of a variable resistance in parallel with the series winding for speed regulation, in place of the usual variable resistance in the shunt field circuit. No external armature resistance is used in regulating the speed, but the entire control is effected by the variable shunt around the series coil. In driving presses constant speed for any given class of work is important and the arrangement of altering a resistance in parallel with the series turns was introduced by Mr. Kelley's specifications as a better means of obtaining uniform control than the older plan of weakening the shunt field. It is undesirable to apply a motor having the characteristics of a series-wound machine to a press, on account of the variation of speed with load, and the plan of shunting the series coil makes the motor act more and more like a pure shunt motor as the shunt is made of less and less resistance. Each starting box is equipped with a no-voltage release and has sufficient resistance to start the motor from rest at full load without exceeding 1.75 times full load current. All the controllers are designed so that the attendant cannot get a shock in handling them from any point about the presses. A recent test of the motor driving the tri-color press showed a current consumption of 5 amp. on the first running point, the speed being 625 r.p.m. On the last running point the motor was making 900 r.p.m., the current being 7 amp. A two-color press is direct-driven by a 3.5-hp motor, having a speed range of from 700 to 1,200 r.p.m. This press will easily make from 1,000 to 1,600 impressions per hour maximum. The motor has a full load current of 6.25 amp. and an overload output of 7 hp. In a test of the power consumption of this press the motor took 4.1 amp., the press making 720 impressions per hour and the motor speed being 625 r.p.m. On the first speed point of the controller (second running point) the motor took 4.4 amp., the press making 900 impressions per hour, and on the second speed point the motor consumed 4.5 amp., 1,000 impressions being run off the press.

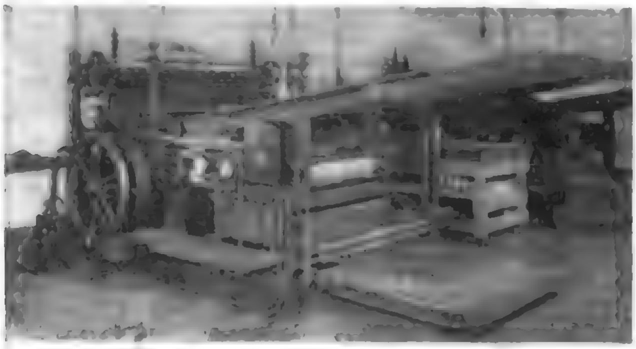


FIG. 4.—MOTOR-DRIVEN LITHOGRAPH PRESS.

Five single-color presses are each driven by a 2.5-hp motor, the full load current of which is 4.54 amp. These presses have a maximum capacity of 1,800 impressions per hour. In a test on one of these presses the motor consumed 3.4 amp. on the first running point, 1,200 impressions per hour; 3.7 amp., fifth running point, 1,440 impressions, and 4.4 amp., eighth point, 1,620 impressions.

On the five single-color presses mentioned, the motor overload output is 5.5 hp. An interesting feature of the press equipment is the arrangement of a tell-tale signal on the wall behind each press to show when a press is over or under-speeded. In each controller is a contact which the foreman sets at the proper speed for each job, and if the operator changes the speed two lamps on the wall are lighted, showing the foreman that something is wrong. The device is of considerable importance in keeping the production of each machine at a maximum. Each controller is fitted with an overload release and each motor with a dynamic brake, which short-circuits the armature when current is cut off from the motor, bringing it to an immediate stop.

The plant contains one 42-in. by 64-in. bronzing and one dusting machine, both of which are driven through belt and line shafting by a 3-hp motor running at a speed of 1,025 r.p.m. There is also a small washing machine in this equipment.

The cutting room contains a large assortment of machinery. There are two 60-in. paper cutters, each of which is direct-driven by a compound-wound, 3.5-hp motor, whose speed is 1,200 r.p.m.

Two 50-in. paper cutters are also in service, each direct-driven by a 2-hp compound motor, with 3.6 amp. full load current and 1,200 r.p.m. motor speed. In a test on one of these cutters 2.4 amp. were required to cut stock 36 in. wide and 1¾ in. thick, and 3 amp. for 36-in. by 2⅞-in. stock. Running free with shaft and fly-wheel the cutter required 1.4 amp. In this department are also one tube machine with a 36-in. roll, driven by a ⅙-hp motor; an embossing press driven by a 1½-hp motor of 725 r.p.m. normal speed; three wire stitchers, each driven by a ⅙-hp, 1,200-r.p.m. motor, one folding machine driven by a ½-hp motor; a circular saw driven by a 3½-hp, 1,150-r.p.m. motor; two cutting-out presses, each driven by a 1-hp, 600-r.p.m. motor; three collators, each direct-driven by a ⅙-hp, 400-r.p.m. motor, and a large collator, driven by a ½-hp, 600-r.p.m. motor at a speed of 3 r.p.m. The last machine is extremely useful in enabling the different lithographs in a series to be placed in order for binding. A vertically-revolving wheel contains fourteen carriages, twelve for illustrations and binding. On each carriage is a pile of similar lithographs, and as the wheel revolves an operator picks one sheet off each carriage in the order of rotation, so that at every complete revolution of the wheel a complete set is collated. The three collating machine motors are each built in a ½-hp frame and wound for ⅙ hp to give the slow speed required, 400 r.p.m. These and the wire stitcher motors are shunt-wound machines. There is also in this room a knife-grinder driven direct by a 3.5-hp motor making 1,200 r.p.m. The plant has in addition three graining machines and a stone planer group driven by a 3.5-hp motor, and a lithographic hand press driven by a 1-hp motor. In one section of the workshop is a stock room, in which is an ink mill driven by a 7.5-hp motor. The mill is used in grinding inks and is a notable time saver.

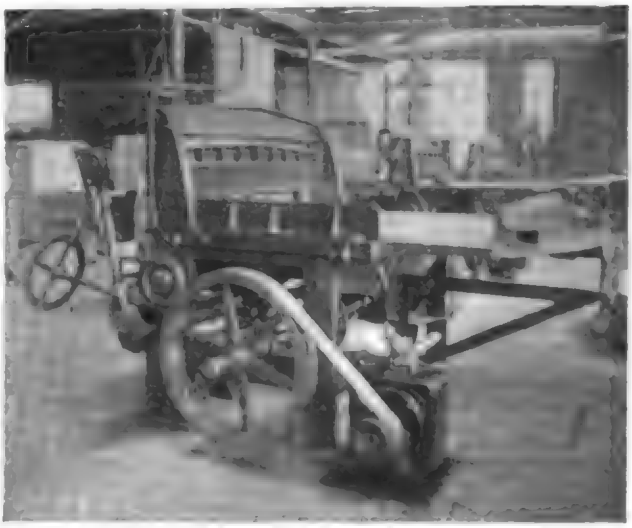


FIG. 5.—MOTOR-DRIVEN PAPER CUTTER.

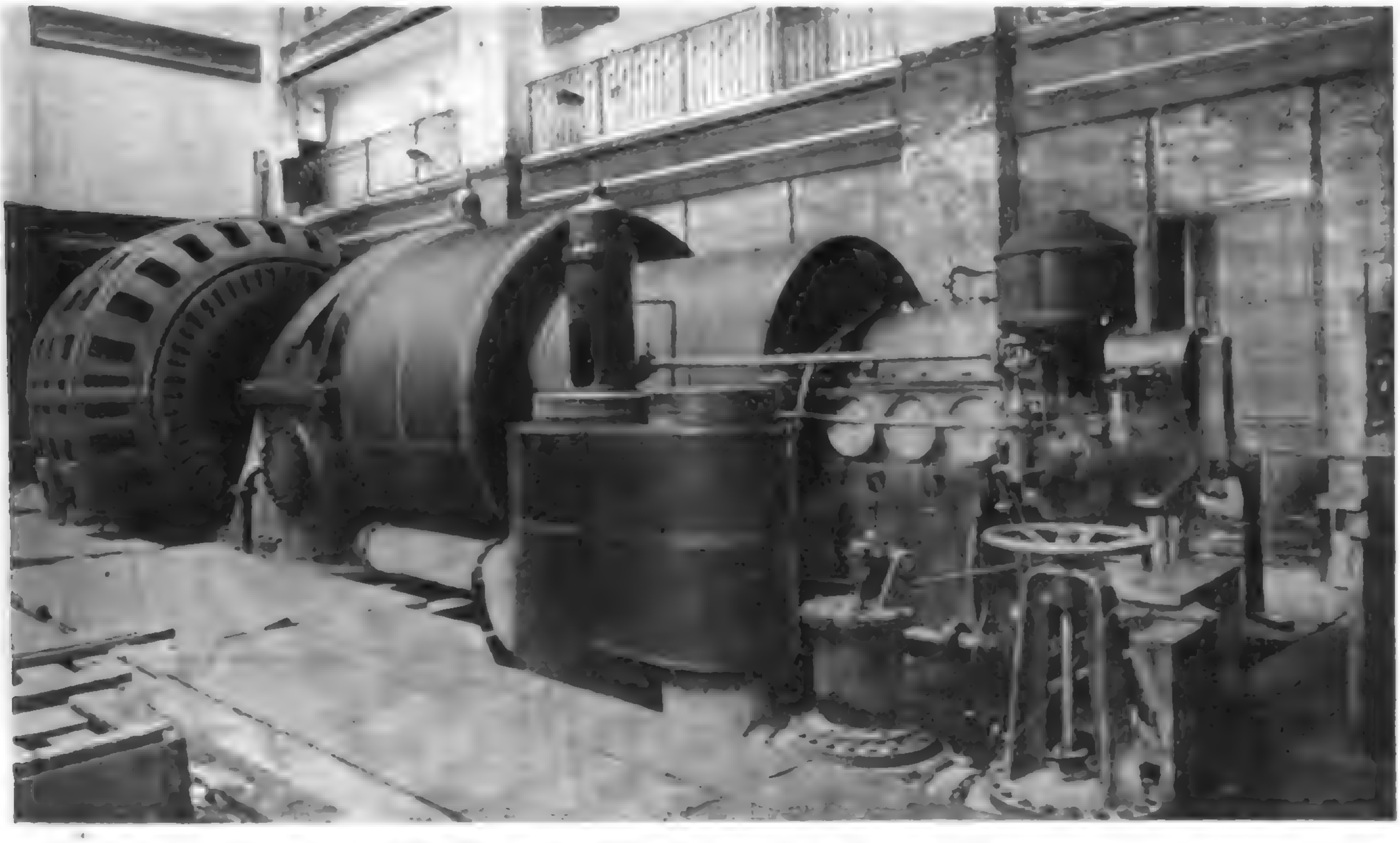
In one portion of the shop a room for photographic work is being fitted up, and to enable pictures to be taken on dark days or at night two 30-volt, 25-amp. automatic photo-engraving arc lamps built by C. J. Bogue, of New York City, are installed.

The entire plant is equipped with automatic sprinklers of the Grinnell type.

In the design of a motor-driven plant it is often difficult to estimate correctly the time a machine is in actual operation. The owner often believes his machinery to be in service a much longer time than is the case. As a matter of fact, it is frequently found that a machine to be used in a specialized industry is not in use more than 25 per cent of the year. In this particular case the estimates of the designing engineer were based on partial power tests, and the statements of the lithograph company as to the time it thought the various machines would be in operation. These data as modified by the judgment of the designing engineer resulted in a tolerably close estimate of the use of current. The great advantage of the direct drive in using power only when the driven machine is at work is plain from his figures of estimated hours' use per month for the following machines:

	Machine estimated hours per month.	Per cent of working time 212 hours (approximate) 1 month.
Ink mill	100	47
Bronzing machine	75	35
Cutting out machine	80	38
Knife grinder	50	24
Embossing machine	80	38
Circular saw	100	47
Graining machine	150	71
Collating machine	200	94
Mailing tube machine	150	71
Stitching machine	150	71
Transfer presses	50	24
Oswego cutter	75	35
Rotary press	105	49
Lithographing press	116	55
Combination press	86	41
Two-color press	150	71
Three-color press	120	57

The estimated maximum energy consumption in kw-hours for the first month's operation was 3,566, and the minimum, 2,559. The actual figures resulting were 2,680 kw-hours.



5,500-kw Turbine Unit in Williamsburg Power House.

The plant is owned and operated by Messrs. Harris, Jones & Co., of Providence. The liability insurance inspector pronounced it "the best arranged, most complete and satisfactory" from a liability standpoint of any that he had examined. The architects for the building were Messrs. Lockwood, Greene & Co., of Boston, and the installing electrical contractors were Lindsley & Allen, Inc., of Providence. All the motors were supplied by the Holtzer-Cabot Electric Company, of Boston (Brookline Station), and the controllers by the Cutler-Hammer Company, of Milwaukee. The lighting equipment was furnished by the General Electric Company through the Narragansett Electric Light Company, and the designing engineer for the installation was Mr. Walter Stuart Kelley, now chief engineer of the Holtzer-Cabot Electric Company. Mr. J. H. Smith is the superintendent of the plant.

5,500-Kw. Allis-Chalmers Turbine Unit.

In our issue of November 11, 1905, a preliminary description was given of the 5,500-kw steam turbine unit building for the new Williamsburg power house of the Brooklyn Rapid Transit Company, and in the issue of December 16, 1905 appeared a description in detail of the unit, which was then in process of erection in the power house. The accompanying illustration shows this unit as now finally installed.

The machine was ready for operation on February 1, but had to await the completion of boilers, condensing apparatus, etc., which were not ready for operation until late in March. On March 27, while the machine was being prepared for test, a mishap at another power house left the railway company short of power, and after a brief test run the new machine was connected in circuit and immediately took a load of about 3,000 kw, which was all the company needed at that time. Later the load was increased to 4,000 kw, and on the following day was run up to over 5,000 kw, and on the succeeding day the load reached 7,000 kw. On March 30 the disabled apparatus having been repaired, the machine was taken out of the circuit, and a careful examination made of the interior part.

In view of the fact that in the past numerous cases were on record of steam turbine cylinders, arching slightly from the effect of superheated steam, in the design of the present turbine the metal was so distributed as to cause nearly equal expansion of the top and bottom of the cylinder. When the turbine was opened up, however, it was found that this compensation had been slightly overdone, and the cylinder had sagged a small amount which had caused the blading to rub hard for nearly a third of the length of the turbine. In operation, however, there was no indication that the blades were rubbing and no damage whatever was caused, the only sign of contact being a slight wearing away of the flanges of the channel shaped shroud ring which protects the tips of the blades in the Allis-Chalmers construction. A few rows of blades at the inlet end of the turbine were found also to have rubbed owing to sand and other dirt having gotten into the turbine from the steam pipe, but in this case also the shroud ring prevented all damage. The only precaution taken before starting up again to help carry the Coney Island load on April 1 was to lower the drum a few thousandths of an inch at each end, which, so far as is known, has prevented all further rubbing and the turbine has been in daily operation ever since, not having been again opened.

The builders of the turbine are congratulating themselves, not only because the method of proportioning and constructing the turbine cylinders has overcome the previously experienced difficulties from excessive distortion with superheated steam, but also because the improved blade construction has proved itself all that has been claimed for it as regards safety of operation under adverse circumstances.

The design of the generator has proved equally successful, as it has carried large overloads each day with the greatest of ease. On one day from 5 to 6 p. m. the load averaged about 6,000 kw, from 6 to 7 p. m. 6,600 kw, and between 6 and 6.30 nearly 7,700 kw, with swings up to 9,300 kw. On April 21 for one and a half hours the load averaged about 8,000 kw, following a run at rated load, and with a temperature rise of only 22° C. On another day a load averaging 7,500 kw was carried from 5.40 to 6.40 p.m., with swings up to 9,800 kw; one swing of 9,000 kw was carried for 45 seconds and one of 9,800 kw for 15 seconds, this being 78 per cent above rated load. The highest temperature rise so far met with during any run, notwithstanding heavy overloads, has been 25.5° C.

Another interesting feature in the operation of the turbine is the remarkable coolness of the bearings, which follows in part from great care in the design of a number of points which are quite essential in high speed bearings; in part from the quality of the bearing metal, which is made specially for steam turbines in the Allis-Chalmers shops, and in part from the excellent operation of the system of flooded lubrication. The rotary oil pump which lubricates all the bearings is so noiseless and inconspicuous that the casual visitor would not notice it unless it were pointed out to him. The success of this turbine is more notable from the fact that it was the first one turned out complete from the Allis-Chalmers shops. A turbine of the same system had previously been in operation for some time at Utica, but this was built in England. A number of other Allis-Chalmers turbines built in Milwaukee are now being erected and will shortly be started.

Cook Self-Welding Wire Joint.

Wire joints (or sleeves or connectors, as they are called) and their uses have long been familiar to telephone men and to wiremen in general, but a new type now being placed on the market, and known as the Cook self-welding joint, differs in its construction and application, radically from other joints. The sectional view given of this joint and of other joints will serve to clearly illustrate the difference.

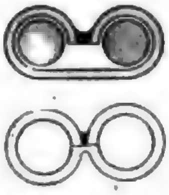


FIG. 1.—CROSS-SECTION OF JOINT BEFORE AND AFTER TWISTING

In the old style tubular joint the tube is made to fit the wire as closely as possible. When the joint is twisted the tube is not stretched around the wire, but is drawn close to some portions of it and bulges out at other portions, thus leaving a considerable part of the surface of the wire and the joint accessible to moisture and other atmospheric influences.

The Cook joint is made with one side flat. The tube fits the wires closely, and when the joint is twisted the flat side is forcibly and naturally drawn into the recess between the wires, thus stretching the joint tightly around both wires. This makes practically a cold weld joint, and moisture or air cannot penetrate the tube and corrode the wires or the inner surface of the joint.

When the wires are inserted in the joint, twisted three times, and the joint is then cut in two, it is almost impossible to discern the line where the inside of the joint and the outside of the wire come together. The tensile strength of the joint is much greater than that of the wire itself. Owing to the fact that the joint binds so tightly on the wire, it is unnecessary to turn back the ends of the wire after it has been inserted through the tube. The only instructions necessary for the use of the Cook joint are simply to insert the wires and twist three complete turns to the right. The joints are made of copper for copper wires, and of steel, heavily tinned inside and out, for galvanized-iron or steel wire. Cook's self-welding wire joints are manufactured by Frank B. Cook, 239 West Lake Street, Chicago, Ill.

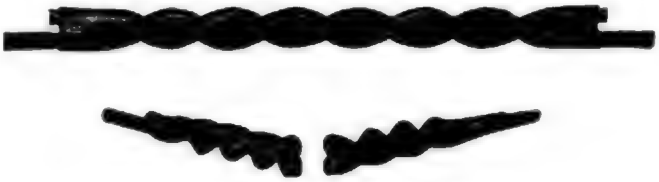
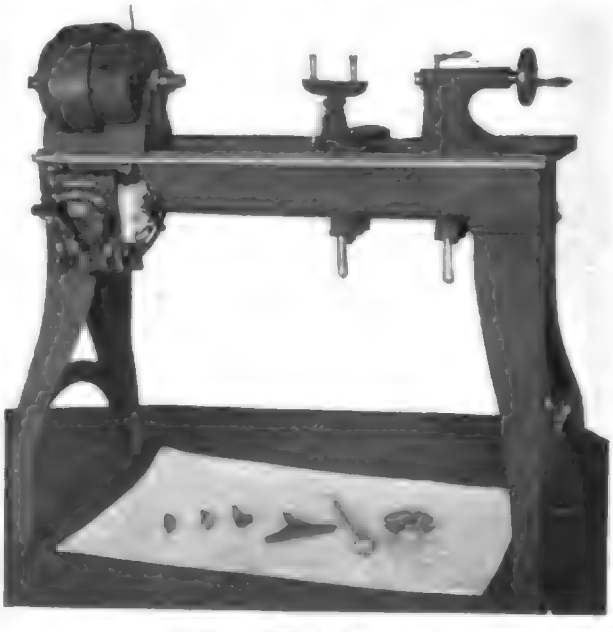


FIG. 2.—WIRE JOINT.

Motor-Driven Hand Lathe.

The accompanying illustration shows a motor-driven spinning or hand lathe, recently brought out by the Garvin Machine Company, of New York. The head stock is fitted with a 1-hp, 110-volt motor, direct-connected with the hollow steel taper spindle, of standard size, running in gunmetal boxes. The motor is equipped with a Cutler-Hammer controller and regulator, giving a range of feeds from 800 to 2,000 r.p.m. The machine itself is the regular standard 12-in. swing lathe, made by this company. The bed is wide and deep and is closed top and bottom, except for a narrow slot, for the binder bolts, and is ribbed internally to secure the utmost rigidity and freedom from twist. The tool stand and tail stock are bound by powerful cam binders.


MOTOR-DRIVEN HAND LATHE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The settlement of the anthracite coal troubles and the resumption of lake navigation have greatly improved trade conditions. Manufacturing plants operate close to their full capacity, with orders in the steel industry already running well into 1907, and structural work was never more active. Wholesale trade in fall and winter goods is on a large scale, but unseasonable weather causes much complaint regarding retail distribution of merchandise and retards work on the farms in several important sections. Railway earnings thus far available for April show a gain of 9.7 per cent over the previous year, and foreign commerce at the port of New York for the last week exhibits gains of $4,526,277 in exports and $428,538 in imports, as compared with the same week in 1905. Mercantile collections are still somewhat irregular, but show a slight improvement on the whole. Cold weather, with frosts of varying intensity, has retarded crop development, and may necessitate some replanting of cotton in the northern part of the cotton belt. The grain crops, however, have been uninjured. Exceptionally heavy orders were received in the iron and steel industry for steel rails for 1907 delivery, the Pennsylvania Railroad Company alone having awarded contracts for upward of 180,000 tons. Additional heavy business is pending. Preliminary estimates indicate a production of 3,500,000 tons in 1906, and perhaps 4,000,000 tons for 1907. Steel-making irons are scarce and active. Structural material mills are busy and a good deal of new business is in sight, but nothing has developed on account of San Francisco. Copper is firm and prices show a tendency to harden. The week was notable in the home copper market for the large demands booked from Europe. Buying for home account is continuously good under the unprecedented rate of consumption. The domestic copper market is firm at these prices: Lake, August delivery, 18⅞ to 19c.; electrolytic, August shipments, 18⅝ to 18¾c. Prime casting grades, thirty days, 18½ to 18⅝c. *Bradstreet's* reports 162 business failures during the week ending May 10, as against 139 the previous week and 158 in the corresponding week last year.

CROCKER-WHEELER ORDERS.—An order has recently been placed with the Crocker-Wheeler Company, of Ampere, N. J., for an engine type generator of 100 kw capacity to be used as exciter for a large turbo-generator. This outfit is to be installed at the Philadelphia Rapid Transit Company's power station, at Second and Grand Avenues, Philadelphia, Pa. A contract for two 500-kw generators has recently been placed by the Pittsburg & Lake Erie Dock Company, of Fairport Harbor, Ohio. The Public Service Corporation of New Jersey has recently awarded to the Crocker-Wheeler Company a contract for two 500-kw generators to be used for power purposes, at Paterson, N. J. The Elliott Laundry Company, of Baltimore, Md., has recently contracted with the company for an electrical equipment consisting of 20 motor outfits ranging from ⅓ to 15 hp, for driving various laundry machinery, and one generator of 80 kw capacity for additional power. This installation also includes three motor-driven ventilating fans which will mean a great improvement to their equipment.

OIL ENGINE CONTRACTS.—The De La Vergne Machine Company, New York, reports having recently closed, among others, the following contracts for "Hornsby-Akroyd" oil engines: Windsor Locks Water Company, Windsor Locks, Conn., 50 hp for pumping station; John McKesson, Chappaqua, N. Y., 9-hp engine; Bergstrom & Bass, Brooklyn, N. Y., 20-hp; S. Oppenheimer & Co., New York, 25-hp; Freeman, Daughaday & Co., Chartley, Mass., 50-hp; township of West Lebanon, Lebanon County, Pa., 44-hp for pumping station; Borst & Rockstroh, Middleburg, N. Y., 7-hp; the John Pirkl Iron Works, Brooklyn, N. Y., 50-hp; John W. Sullivan, New York, 75-hp; Dr. F. A. C. Perrine, New York, 7-hp; Houston Ice & Brewing Company, Houston, Tex., 16-hp engine to drive a De La Vergne ice machine.

THE CANADIAN WESTINGHOUSE COMPANY, LTD., is supplying the Provincial Light, Heat & Power Company with apparatus to be used in the development of another large water power plant near Montreal. The initial installation will consist of three 3,750 kw, revolving-field, alternating-current, water wheel-driven generators of 4,000 volts, three-phase, 7,200 alternations; also twelve 2,500-kw, 44,000 volts, oil-insulated, water-cooled transformers. This new power station will be used for supplying additional power to the Montreal Light, Heat & Power Company, at Montreal. The step-up transformers will be wound for 4,000 to 44,000 volts, and the lowering from 40,000 to 12,500 volts. The transmission line is about 40 miles in length.

FACTORY AT RAVENNA, OHIO.—Mr. H. T. Johnson, of the Manhattan Electrical Supply Company, is superintending the erection of a large plant in Ravenna for the manufacture of carbons and primary batteries. The foundations for four furnaces have already been built and there will be several other large buildings in the plant. It is stated that the original plan of incorporating the Ravenna plant as a separate concern under the name of the Electrical Products Company has been deferred and that the new plant will be operated as a branch of the Manhattan Electrical Supply Company, of New York City, which now has a large factory in New Jersey.

LARGEST FACTORY BUILDING IN THE WORLD.—A Pittsburg despatch states that plans are being prepared by engineers of the American Bridge Company for the largest single factory building in the world. The plant will be constructed at McKeesport for the National Tube Works and will cost more than $2,000,000. The one building will have a floor space, on one floor, of more than 1,000,000 square feet. The building will be 1,500 feet long and more than 600 feet wide and about 45 feet high. Four 15-ton electric traveling cranes will run the entire length of the building, and electric power will be utilized on the most extensive scale.

STEAM TURBINES IN COTTON MILLS.—The Francis Cotton Mills has recently adopted Westinghouse-Parsons turbines for their power plant at Biscoe, N. C. This plant adds one more to the list of cotton mills using steam turbine power. Some of the plants in this field are those of the Pelzer (S. C.) Manufacturing Company, 1,500 kw; the Oneita Knitting Mills, Utica, N. Y., 500 kw; Henrietta (N. C.) Mills, Gray Manufacturing Company, Charlotte, N. C.; Modena Cotton Mills, Gastonia, N. C., and the Lumberton (N. C.) Cotton Mills. These plants are now in highly successful operation.

DODGE & DAY, engineers, of Philadelphia, have been commissioned by the Kerr-Murray Manufacturing Company, of Fort Wayne, Ind., manufacturers of gas works machinery and gas holders, to design, erect and equip a new plant. The present factory is much too small for the requirements of their business and the Kerr-Murray Company has secured a plot of 30 acres close to Fort Wayne. Preliminary work is about completed and construction work will be started at once.

THE AMERICAN CAN COMPANY, of New York, N. Y., purchased recently through the New York office of the Allis-Chalmers Company a 20 and 40 by 42 heavy-duty, cross-compound engine, direct-connected to a 500-kw, direct-current generator, switchboard, etc. The electrical apparatus for the new outfit will be built at the company's electrical works, Cincinnati, while the engine will be built at the West Allis, Milwaukee, shops.

APPARATUS FOR 'FRISCO.—The Westinghouse Electric & Manufacturing Company has shipped to the Pacific Coast from Pittsburg 35 carloads of electrical machinery. In a week 30 cars more will leave for San Francisco. A temporary warehouse has been erected in San Francisco. The company also has signed a lease for three floors of a new steel building to be erected at National and Second Streets.

DUTY ON X-RAY TUBES.—In a decision by Sub-Board No. 2 of the United States General Appraisers, it was decided this week that foreign X-ray tubes must be assessed on a higher basis, with a correspondingly heavy duty. The tubes were from C. H. F. Muller, of Hamburg, and were invoiced at prices unsatisfactory to the appraising officers.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was moderately active and substantial recoveries from the recent declines are noted. Improved financial conditions and easier money seem to have given renewed confidence to bullish operators, the rise in prices being helped by covering of the extensive short interest. Bonds show a tendency to improve on the better money market conditions. Among the tractions, New York Metropolitan Street Railway and Interborough stocks were stimulated by the favorable showing which they made with regard to earnings for the March quarter. The United States Steel stocks tended to improve on scattered buying. The industrials generally participated in the improvement, a good deal of attention being again given to specialties like International Pump. Allis-Chalmers common closed at 21⅛ and preferred at 57, these figures being net advances of ⅛ and 1⅛, respectively, and General Electric made a net gain of 1¼ points, closing at 167¼. American Locomotive common closed at 67¼, a gain of 6⅝ points, and preferred at 114½, an advance of 2 points. The greatest activity in the tractions was in Brooklyn Rapid Transit, of which 298,700 shares were sold at prices ranging between 77½ and 84, the closing quotation being 83, which is a net advance of 5 points. Metropolitan Street Railway gained 3½ points, closing at 116, and the last quotations of Interborough-Metropolitan common and preferred were 54¼ and 86¼, these being net gains of 4½ and 1½, respectively. American Telephone & Telegraph closed at 135½, an advance of ¾, but New York & New Jersey Telephone lost 1 point, closing at 147. Western Union Telegraph is down 1⅝, the last quotation being 92⅛. Interborough Rapid Transit, on the curb, jumped to 231 from 218½, and closed with a net gain of 12¾ points. The curb market showed general recoveries, but the volume of business was not large. Following are the quotations on the stock exchange at the close of business May 15:

NEW YORK

	May 8	May 15		May 8	May 15
Allis-Chalmers Co.	21⅝	20⅝	General Electric	168⅝	167⅛
Allis Chalmers Co. pfd.	57⅞	56	Hudson River Tel.	...	...
American Dist. Tel.	*30	*30	Interborough Rap. Tran.	222½	222
American Locomotive	63⅝	67⅛	Mackay Cos	68⅝	72
American Locomotive pfd.	113	114	Mackay Cos pfd	71⅝	74
American Tel. & Cable	91	90	Marconi Tel.	...	...
American Tel. & Tel.	132	135	Metropolitan St. Ry.	112⅝	115
Brooklyn Rapid Transit	67⅝	83¾	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel	91⅝	92⅝
Electric Boat pfd	65	65	Westinghouse com.	150	153
Electric Vehicle	16⅛	11	Westinghouse pfd.	...	...
Electric Vehicle pfd.	17⅛	18			

BOSTON

	May 8	May 15		May 8	May 15
American Tel. & Tel.	134⅝	135	Mass. Elec. Ry. pfd	64⅝	65
Cumberland Telephone	..	117⅛	Mexican Telephone	3⅝	...
Edison Elec. Illum.	247	246⅛	New England Telephone	135	135
General Electric	...	168¾	Western Tel. & Tel.	12⅛	...
Mass. Elec. Ry.	18	18⅛	Western Tel. & Tel pfd.	...	90

PHILADELPHIA

	May 8	May 15		May 8	May 15
American Railways	51⅛	51⅛	Phila. Electric	8⅝	9
Elec. Co. of America	11⅛	11⅛	Phila. Rapid Trans.	20⅝	20⅝
Elec. Storage Battery	72⅝	73	Phila. Traction	98⅝	99
Elec. Storage Battery pfd.	...				

CHICAGO

	May 8	May 15		May 8	May 15
Chicago City Ry	160	160	National Carbon	80	80
Chicago Edison	165	...	National Carbon pfd.	118	120
Chicago Subway	64	...	Union Traction	...	.
Chicago Tel. Co	115	...	Union Traction pfd	..	..
Metropolitan Elev. com	26	27⅛			

* Asked

ELECTRIC PROPERTIES COMPANY.—One of the most important steps taken of late years in the domain of electrical finance and engineering is the formation of the Electric Properties Company, in regard to which rumor has been busy the past few months. It is in itself an indication of the growing magnitude of electrical operations, and is a further evolution of the process that has already created kindred institutions of prominence for the handling of electrical enterprises in the public service field. The new corporation will have a capital stock of $6,000,000 preferred and $6,000,000 common, and may also issue collateral trust bonds secured by a pledge of securities acquired in the course of the financing and development of plants of the character indicated. An important part of the initial programme has been the acquisition of the entire stock of Westinghouse, Church, Kerr & Co., whose engineering operations on a gigantic scale have been one of the features of modern light, power and traction, while inclusive also of work in railway terminal, factory and hotel construction. This work will all be continued without change, but with a large area of contact and opportunity under Mr. Walter C. Kerr, a president whose brilliant administrative and executive qualities have equaled his sound engineering judgment. As a matter of fact, no changes will occur in this underlying organization. The Electric Properties Company itself will afford a felicitous illustration of the newer close relations in finance and engineering, in having as its president Mr. John F. Wallace, the distinguished civil engineer, of Illinois Central and Panama Canal fame. He will give its affair his whole time and attention, and several large and important negotiations await immediate action. The company while thus rich in engineering talent of the first order will employ other engineering companies or individuals as occasion may arise. The directorate comprises the following: Charles H. Allen, vice-president Morton Trust Company; Paul D. Cravath, of Cravath, Henderson & De Gersdoff; H. D. Giddings; N. W. Halsey, of N. W. Halsey & Co.; George C. Smith, vice-president Security Investment Company; John A. Spoor, president Union Stock Yards & Transit Company, and president Chicago Junction Railway Company; Moses Taylor, Kean, Van Cortlandt & Co.; E. G. Tillotson, vice-president Cleveland Trust Company; F. D. Underwood, president Erie Railroad; R. B. Van Cortlandt, Kean, Van Cortlandt & Co.; John F. Wallace, president Electric Properties Company; George Westinghouse. It will be seen that while in a sense of Westinghouse origin and likely to be regarded by some as one more in the long list of concerns bearing the Westinghouse imprint, the new company is in reality an "open corporation," ready and prepared to deal with propositions of a desirable nature throughout the whole range of electrical engineering development.

INTERNATIONAL STEAM PUMP.—The new issue of stock of the International Steam Pump Company authorized last week will not be offered for subscription. The entire amount, consisting of 25,000 shares of preferred stock and 55,000 shares of common stock, will be taken by the Power & Mining Machinery Company in payment for its capital stock. The authorized and outstanding common stock of the Power & Machinery Company amounts to $1,500,000 and its preferred stock to $1,000,000. The company has been in existence since April, 1903. As a condition of the sale of its stock to the Steam Pump Company it is guaranteed that its net profits for the next five years will aggregate at least $1,150,000. This would be equal to 1,437 per cent on the Steam Pump Company's new stock issue of $8,000,000 for the entire five years, or at the rate of .287 per cent per annum. The issue of common stock is not taken into consideration, however, inasmuch as the Steam Pump Company does not pay dividends on its common. This would leave but $2,500,000, instead of $8,000,000, on which dividends would have to be paid. By the terms of the purchase the International Steam Pump Company also comes into possession of liquid assets of the Power & Mining Machinery Company to the amount of $2,750,000, independent of the plant. A portion of this amount, estimated at $1,100,000, can be used for working capital by the Steam Pump Company in its individual business.

DIVIDENDS.—The Northern California Power Company has just paid in San Francisco its twenty-sixth regular monthly dividend, despite earthquake and fire. The Rochester Railway & Light Company has reclared a regular quarterly dividend of 1 per cent, payable June 1. The directors of the American Railways Company have declared a regular quarterly dividend of 1½ per cent (75 cents per share), payable June 15. The regular quarterly dividend of the American Telegraph & Cable Company of 1¼ per cent is payable June 1. The Columbus Street Railway Company has declared a regular quarterly dividend of 1¼ per cent on the common stock, payable June 1.

TELEPHONE STOCK INCREASED.—At a special meeting of the stockholders of the New England Telephone and Telegraph Company last week it was voted to increase the capital stock from $30,000,000 to $50,000,000 for general purposes of the company. The regular annual meeting was held after the special meeting and retiring directors were re-elected. Francis H. Dewey was chosen in place of Stephen Salisbury, deceased. In the annual report Thomas Sherwin, the president, said that the growth of the business during the last year had been unprecedented. The entire number of exchanges and toll stations connected with the system is 203,821.

MANILA RAILWAY AND LIGHTING.—The operating department of J. G. White & Company reports the earnings of the Manila Electric Railroad & Lighting Corporation, for the month of April, by cable from Manila, as follows: Railway department, gross receipts, $46,750; net receipts, $24,750; light and power department, gross receipts, $28,000; net receipts, $13,900. The earnings of the railway department of the corporation for the week ending May 7 are $11,750, as reported by cable.

MICHIGAN STATE TELEPHONE REPORT.—The annual report of the Michigan State Telephone Company for the year ended December 31, 1905, shows gross earnings of $2,293,552, net earnings of $673,328, dividend payments of $137,100, and a net surplus of $322,752.

GENERAL NEWS.

Construction News.

PRESCOTT, ARIZ.—Two large power plants are being constructed near this city. One, which is known as the Arizona Power Company, will have a capacity of 6,000 hp and will transmit power to the mines at a voltage of 33,000. The other, the Prescott Power Company, will furnish 10,000 hp at about 22,000 volts.

YELLVILLE, ARK.—The City Council has granted a franchise to C. L. Morgan, of Detroit, Mich., to build an electric railway in the town.

RIVERSIDE, CAL.—J. D. Maxfield has the contract for installing the electric light plant at the Arlington mine in Arlington.

LOS ANGELES, CAL.—The Home Telephone Company will build a long-distance line between Los Angeles and San Francisco.

PASADENA, CAL.—Heman Dyer, City Clerk, writes that the citizens have voted to issue $125,000 to acquire an electric light plant.

ANAHEIM, CAL.—Engineer A. L. Lewis, of Anaheim, writes that the city will probably call for bids in about 3 months for the proposed electric light plant to cost $25,000.

FRESNO, CAL.—J. C. Drake, Edison Building, Los Angeles, writes that his company proposes constructing four power plants on Kings River, Fresno County, to cost in all about $8,000,000. Location surveys are now being made. F. C. Finkle, chief engineer, Edison Building, Los Angeles.

UKIAH, CAL.—Bids will be received until June 6 by the board of supervisors of Mendocino County, Cal., for a franchise for erecting and maintaining a line for the transmission of electric power, and for telegraph and telephone lines in the county of Mendocino. M. L. Gibson is chairman.

SAN FRANCISCO, CAL.—It is stated that the Valley Counties Power Company proposes to proceed at once with the development work which was planned and being prosecuted previous to the great disaster to San Francisco. The work of putting in a new pipe line, the widening of the ditch and the installing of another unit in the Centerville power house on Butte Creek, above Chico, will be resumed at once.

LOS ANGELES, CAL.—Work has commenced on the extension of the Vineland power station of the Los Angeles-Pacific Railway. Machinery will be installed immediately to double the capacity of the plant, which is to be finished in time for the summer season, when additional two units will be installed, to be finished within a year. The cost is estimated at nearly $1,000,000. The company also has other large extensions under way.

BOULDER, COL.—The plant of the Boulder Light & Power Company has been purchased by the Northern Colorado Power Company for $25,000. The new company is making arrangements to take over the electric plants at LaFayette, Col., and Cheyenne, Wyo.

ASPEN, COL.—D. R. C. Brown, president of the Roaring Fork Electric Light & Power Company, of Aspen, is interested in the construction of a new light and power plant a few miles below Aspen. It is proposed to harness the waters of Castle Creek and Roaring Fork and generate electricity to light the villages between Aspen and Carbondale.

THOMPSONVILLE, CONN.—It is reported that the Enfield Electric Light & Power Company will change ownership before June 1.

BRIDGEPORT, CONN.—An electric light plant will be installed in the Lincoln Building which is being constructed on Cannon Street for Thomas P. Tayler.

NEW HAVEN, CONN.—A 150-hp generator will be installed in the new plant of the F. P. Pfleghar & Company, which is now being constructed, to operate the machinery by electricity. The entire plant will cost about $100,000.

EAST HAMPTON, CONN.—Civil Engineers Ransom & Hoadley, of Providence, R. I., who are in the employ of the Salmon River Power Company, are preparing plans to bring about the completion of one of the best water privileges in the State. The company proposes to erect three dams, the rights of way having been secured along Salmon River and above in Marlborough, where a large reservoir will be built. At Comstock Bridge, a few miles further south, another dam will be built, just above the present dam of Brown Bros. Paper Company. At Leesville, four miles below, the big dam is to be constructed and the power house located there. This dam is to be built just above the present dam, which supplies power for the East Haddam Electric Light Company. It will extend from rock ledge to rock ledge, 550 feet, with a spillway of 160 feet. This will give a working head of 73 feet and develop 1,500 horse-power. The Rhode Island Contract Engineering Company has the contract for the work. As soon as they are running the East Haddam Electric Light Company, which supplies lights in the towns of East Haddam and Chatham, will be improved and extended.

WASHINGTON, D. C.—Bids will be received until June 2 by Mordecai G. Endicott, chief Bureau Yards and Docks, Navy Department, Washington, D. C., for furnishing 2 motor generator sets at the navy yard, New York, as per specification No. 1,405; estimated cost, $12,000.

WASHINGTON, D. C.—Bids will be received until May 29 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yard at Pensacola, Fla., and the Naval Station at Key West, Fla., and New Orleans, La., naval supplies as follows: Schedule 545. Electrical conductor and supplies, tube expanders, brass, etc.; also same time and place to furnish at the works of the New York Shipbuilding Company, Camden, N. J., and the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., electrical equipments. Applications for proposals should refer to Schedule 544. H. T. B. Harris, Paymaster-General, U. S. N.

DAVISBORO, GA.—J. T. Orr is planning to erect an electric light plant and will probably organize a stock company.

WAYNESBORO, GA.—It is reported that bonds to the amount of $60,000 have been issued for the construction of water works, a sewerage system and an electric light plant. F. L. Scales is mayor.

COMMERCE, GA.—The board of directors of the Harmony Grove Cotton Mills, Commerce, will take figures on May 18 for machinery and material for an electric light plant. Plans and specifications can be had by addressing Joseph M. Roman & Company, Engineers, of Atlanta.

MERIDIAN, IDAHO.—The Town Council has granted Seymour H. Bell, of Ontario, Ore., a franchise for the installation of an electric light plant.

KOKOMO, IND.—The Citizens' Telephone Company is making arrangements to increase the capacity of its plant; the switchboard will also be enlarged.

VINCENNES, IND.—The Vicennes Street Railway Company has been merged with the Vincennes Traction & Light Company. The capital of the company is $600,000. B. G. Hudnut, of Terre Haute, is president.

HARTFORD CITY, IND.—The Wayne Paper Company, of this city, contemplates making some improvements in its plant. The company is asking the City for a franchise to furnish a day system of electric lighting and power.

INDIANAPOLIS, IND.—At a recent meeting of the officers of the Indianapolis, New Castle & Toledo Railway Company it was decided to commence the construction of the power house at New Castle as soon as possible. The Electrical Installation Company and the Allis-Chalmers Company will build and equip the road.

INDIANAPOLIS, IND.—The Laycock Powerhouse Company has begun work on its power plant in this city. The building will be five stories high and occupy an entire block. The purpose of the company is to furnish space and power to a large number of small manufacturers. The company is now in the market for electrical equipment and power apparatus of all kinds to be installed in its plant.

KOKOMO, IND.—One of the first acts of the new City Council is a movement toward the construction, of a municipal light plant. Although the contract with the Kokomo, Marion & Western Traction Company to light the city has three years to run, General Manager McReynolds informed the Council that the city would be released from the contract as soon as a local plant was built and ready for operation.

RICHMOND, IND.—The experts who have been investigating and examining the municipal lighting plant have submitted a report to the Mayor, which, in substance, shows the municipal plant to be in good condition and that it has proved a success; that in addition to saving money in street lighting it has made an actual profit from commercial lighting during the last three years. This report has changed public sentiment greatly and the referendum vote is likely to result in favor of retaining the plant.

TAHLEQUAH, I. T.—The Pioneer Telephone Company has purchased the telephone line between Tahlequah and Muskogee and east to Fayetteville and is rebuilding the line.

RYAN, I. T.—The Red River Traction & Power Company is preparing to make the preliminary survey for an electric railway from Ryan to Marietta. It is the intention of the company to extend the survey as soon as possible from Lawson to Denison.

SCHLESWIG, IA.—It is stated that this city will construct a lighting plant.

FORT DODGE, IA.—The contract for the power plant to be used by the Newton & Northwestern road has been let to the White Electric Company of New York City. The plant, which is to be located at Frazier, will cost about $150,000.

OSKALOOSA, IA.—The officials of the Oskaloosa & Buxton Interurban Railway Company have made all arrangements for taking over the property of the Oskaloosa Light & Traction Company, which operates the street railway and lighting system in this city, on which options were secured sometime ago, and the increasing of its capital stock from $500,000 to $750,000, providing the plans are endorsed at the meeting of the stockholders to be held about May 20. Plans are also completed for the commencement of the construction of its line from Oskaloosa to Buxton.

CALDWELL, KAN.—The City Clerk writes that it is proposed to construct an electric light plant, at a cost of $15,000. E. E. Rogers is engineer.

TOPEKA, KAN.—The Independent Telephone Company has purchased a site on Jackson Street, on which it will erect a telephone exchange and office building, which will cost about $25,000.

OBERLIN, KAN.—The citizens of Oberlin have voted to appropriate $10,000 to build an electric light plant. E. E. Rogers, of Wamego, Kan., is consulting engineer, and has charge of the construction of the plant.

VINTON, KAN.—The Vinton & Cameron Mutual Telephone Association has been organized for the purpose of building a rural telephone line from Vinton by the way of Cameron to Arkansas City. The officers are G. W. Williams, president; Austin Gilstrap, secretary, and E. T. Payne, treasurer.

SHREVEPORT, LA.—The Shreveport Gas, Electric Light & Power Company has recently purchased a 26x36-in. Reliance engine as an additional power unit, from the Allis-Chalmers Company, of Milwaukee, Wis.

FT. WILLIAMS, ME.—Bids will be received until June 15 by Mayor A. W. Yates, Quartermaster U. S. A., Portland, Me., for furnishing and installing of electric light fixtures in the band barracks, Ft. Williams, Me.

HAMILTON, MD.—A contract has been awarded to White & Middleton for the machinery for the water works and electric light plant.

FT. WASHINGTON, MD.—Bids will be received until June 11 by the Constructing Quartermaster, U. S. A., Ft. Hunt, Va., for furnishing and installing electric light fixtures and wattmeters in the post exchange and gymnasium building at Ft. Washington.

PITTSFIELD, MASS. The Musgrove Knitting Mill is now using electric power in place of steam, for operating its machinery.

TEMPLETON, MASS.—A special town meeting has been called to consider the question of establishing a municipal electric lighting plant in this town.

FALL RIVER, MASS.—Work will commence June 1 on the new electric plant for the Fall River Electric Light Company. The plant complete will cost about $200,000.

ATTLEBORO, MASS.—The railroad company will install a power plant in connection with the new station to supply heat and light for the buildings of the railroad, and also for the platforms, yards and ways.

LOWELL, MASS.—The Electric Light Company has recently received some of the new metallized filament lamps which it has offered to furnish the city at $22.50 per lamp per year for all-night and every-night lighting. Ten of these lamps have been installed on Andover Street.

WRENTHAM, MASS.—At a recent meeting of the committee on electric lights and water, a sub-commitee was appointed to look into the advisability of lighting the town by electricity. The members of the subcommittee are Artemas Willard, E. Payson Bennett and Hiram A. Cowell.

CHESTER, MASS.—Owing to the refusal of the Chester Electric Light Company to furnish additional lights for Prospect Hill, the prudential committee of the fire district has notified the company that it will not be required to do any street lighting after May 2. For the present the town will be without electric lights in the streets.

CAMBRIDGE, MASS.—The new baking plant of the Ward-Corby Company, of this city, is equipped with electrical power. The power plant consists of two Heine safety boilers of 244 hp each and two Harrisburg engines direct connected to generators. Every machine in the building has its individual motor. There is also installed a 50-ton York ice machine.

NEW BEDFORD, MASS. The New Bedford Gas & Edison Light Company has petitioned the city for the privilege to put conduits in Kempton Street. The company is contemplating a general change in its electric light service at the north end of the city, and it is proposed to double the voltage, for that reason the company wants to put the wires underground. George R. Stetson is president.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is arranging to have its commercial lighting system run independently of the street railway power. The company has ordered a motor generator set for exciting the generators, and proposes to have the commercial lighting run by steam. The street lamps and the power motors will run by steam or water power, as needed.

WEST SPRINGFIELD, MASS.—A special town meeting will soon be called by the selectmen to take up the subject of electric lighting. The contract with the United Electric Light Company will expire in about seven months. As the town owns its poles and wires many of the citizens advocate installing a municipal plant, under the existing conditions no consideration is allowed for the use of them.

SAULT STE. MARIE, MICH.—This city has decided to appropriate $[illegible] for extensions and improvements to the gas and electric light plant.

DURNAD, MICH.—The Shiawassee Light & Power Company has completed arrangements for taking on the franchises and contracts of the Morrice-Perry Electric Company.

SAGINAW, MICH.—Geo. W. Seely, of Saginaw, is president of the Rifle River Power Company, which proposes developing Rifle River. H. von Schon, of Detroit, is engineer in charge.

HART, MICH.—A meeting will soon be held to vote on the proposition of contracting with the Pere Marquette Light & Power Company to furnish power to run the water works plant and furnish light for the village.

PONTIAC, MICH.—Probably sometime during the next two months bids will be asked for the construction of the proposed power plant for the Clinton River Power Company, of Pontiac, to cost about $125,000. H. von Schon, of Detroit, is engineer.

CLIMAX, MINN. Brasetti Brothers are interested in the construction of an electric light plant.

MANKATO, MINN.—The Northwestern Telephone Company will expend about $15,000 in improvements to its plant in this city.

DULUTH, MINN.—Bids will be received until May 28 by the Common Council for $375,000 bonds for the purpose of extending, enlarging and improving the water and light plant. H. W. Cheadle is city clerk.

ST. PAUL, MINN.—The Northern Heating & Electric Company, successor to the American District Heating Company, which has a franchise for heating the downtown district, has applied for a lighting and power franchise. The company has erected an electric plant and wishes to combine lighting and power with its steam heating business.

MERIDIAN, MISS.—The Meridian Home Telephone Company, of Meridian, Miss., has been given a charter to do business in Alabama, with Mr. D. S. Knight as agent.

IUKA, MISS.—The North Mississippi Traction Company contemplates the erection of a dam across Bear Creek, fourteen miles south of Iuka. The dam will cost about $50,000, and will furnish at low water, not less than 4,800 horse-power. The company also plans to build an electric railway from the mouth of Indian Creek to Columbus, Miss. The incorporators are J. W. Buchanan, A. H. Longine, A. J. Hackett, Newman Caeye, T. B. Franklin, T. L. Wainwright, J. W. Jourdan, P. E. Williams, John L. Buckley, B. W. Stratton, M. T. Bynum, J. J. Coman, Edward W. Yerger, F. T. Carmack and R. C. Lee.

ST. LOUIS, MO.—A franchise has been granted to Eugene Slevin and others by the St. Louis County Court to build a railway line from the city, limits at McLaren Avenue.

WEST PLAINES, MO.—The citizens of Pottersville and Crider have organized a telephone company to build a telephone line from Crider to West Plaines, by the way of Pottersville.

BUTTE, MONT.—The Council has granted a franchise to the new telephone company. Elmer B. Jones is interested.

OXFORD, NEB.—The question of issuing $20,000 light and water bonds is under consideration.

FREMONT, NEB.—The City Council has accepted the report of Engineer Chapman, of Chicago, Ill., which provides for the reconstruction of the municipal water works and electric light plant on a new site, at a cost of about $83,911. An election will probably soon be held to vote on the question of issuing bonds for the same.

NEWTON, N. J.—It is reported that an electric plant is to be built at Glenmere. Sufficient power will be developed to supply Goshen with light all the year, and to supply Chester, Warwick and Florida for six months of the year.

NEWARK, N. J.—The Public Service Corporation of New Jersey has made a proposition to the finance committee of the council to furnish light and power for all the municipal buildings, including the new City Hall, for a term of five years at a flat rate of five cents per kw-hour. The acceptance of the proposition is still in abeyance.

PLAINFIELD, N. J. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, has notified the Plainfield Protective Association, that beginning with May 1, the price for electricity in Plainfield will be 12 cents per kw-hour, with a reduction to 11 cents on January 1, 1908, and a further reduction to 10 cents in January, 1910.

SOUTH ORANGE, N. J. The special committee appointed by the Village Improvement Society to investigate into the practicability of the municipal ownership idea, has reported against the establishment of such a plant, but Charles H. Ingersoll, representing the minority, believes the plan feasible and offers facts and figures to offset those presenting the opposite view.

ROCKVILLE CENTRE, L. I., N. Y.—Bonds to the amount of $7,000 have been sold to be used for improving the lighting system.

WEST ALBANY, N. Y.—C. F. Karl and Chris. Frischknecht have been appointed to let the contract and supervise the construction of an electric light plant for the village.

WATERFORD, N. Y.—John Flynn, Troy, on May 7 submitted to the board of trustees of Waterford, plans and estimates for a municipal water works and electric light plant, the estimated cost is $113,875.

HARTFORD, N. Y.—The village board has granted the Hudson River Electric Power Company a franchise to erect poles and string wires on the streets of the village for the purpose of furnishing light and power.

SYRACUSE, N. Y.—The Syracuse Lighting Company contemplates putting in a new arc light system with improved lamps, at a cost of $187,424. It is stated that the company proposes to equip its system with magnetite lamps.

ALBANY, N. Y.—Bids will be received until June 2 by J. G. White & Company, Inc., 43 Exchange Place, New York City, for furnishing material, erecting and putting in operation in the State capitol boiler room and connecting tunnel, three direct-connected engines and electric generators, two of 25 kw rated output and one of 100 kw., two motor-generator sets of 20 kw each, substituting and installing ten motors of sizes ranging between 20 anl 7½ hp for old ones now in use, altering and improving boilers, piping and other incidental work in remodeling the present lighting and power system of the State capitol. Plans and specifications can be obtained on a deposit of $50.

ELLENDALE, N. D.—The Ellendale Light & Power Company contemplates erecting an electric lighting plant in this town.

WILMOT, OHIO.—The Valley Telephone Company has increased its capital stock from $1,000 to $5,000.

YOUNGSTOWN, OHIO.—The Bell Telephone Company is making arrangements to erect a new building in this city.

ELYRIA, OHIO.—Citizens Gas & Electric Company has applied for an extension of its electric lighting franchise in Elyria.

GEORGETOWN, OHIO.—The City has sold $15,000 bonds for the purpose of enlarging and improving the municipal light plant.

COLUMBUS, OHIO.—The board of public service has recommended to the council the appropriation of $140,000 for new machinery for the electric light plant.

COLUMBUS, OHIO. The sinking fund commission of this city has sold bonds to the amount of $35,000 for the purpose of enlarging and completing the municipal lighting plant.

GALION, OHIO.—The Galion, Mt. Gilead & Delaware Electric Railway Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are John McNeal and others.

LORAIN, OHIO.—The Black River Telephone Company has decided to purchase equipment and supplies for important extensions to its switchboard and lines. The work will commence in June.

CLEVELAND, OHIO.—The council adopted the resolution requesting the board of public service to have the wires of the Cleveland Telephone Company and Cleveland Electric Illuminating Company put underground.

KENTON, OHIO.—R. G. & E. M. Kerlin, of Toledo, who recently acquired a controlling interest, have been elected directors of the Kenton Gas & Electric Company. Important improvements are to be made to the plant this summer.

CINCINNATI, OHIO.—The Louisville & Eastern Railway Company, operating in Pewee Valley, in Kentucky, has been sold to F. M. Favure, Edgar Elliott and Harry B. Gates, of Indianapolis, Ind. The road is to be extended to Frankfort, Ky.

CLEVELAND, OHIO.—The Cleveland, Painesville & Eastern Railroad Company has increased its capital stock from $1,000,000 to $1,500,000. The company is making improvements preparatory to the consolidation of the property with the Cleveland, Painesville & Ashtabula Railway.

FOSTORIA, OHIO.—The City Council is securing estimates from a number of manufacturers on the cost of installing a municipal lighting system. It is thought that a plant to supply 150 arc lamps and some commercial lighting will cost about $75,000. Bids will be asked for in the near future.

AKRON, OHIO.—The Wadsworth & Western Traction Company has increased its capital stock from $10,000 to $500,000, and elected the following officers: Charles H. Lahr, president; I. L. Johnson, vice-president; T. W. Wakeman, secretary; W. H. Douglass, general manager; E. D. Eckrode, engineer.

BRYAN, OHIO.—A special election will be held in the near future to vote on a proposition to issue $30,000 of bonds for the purpose of enlarging the municipal lighting plant. The proposition is to install two oil burning or gas engines of about 120-hp capacity each. S. E. Folk is superintendent.

CLEVELAND, OHIO.—The Lincoln Park management, headed by Charles L. Gill, has just closed a contract for a $40,000 lighting plant to be installed in the new park. The apparatus is now on the way and will be put in operation within two weeks. The park was formerly lighted by the Lakewood municipal electric plant.

CINCINNATI, OHIO.—The Procter & Gamble Company, of Cincinnati, has let a contract to the Millikin Brothers' Company of New York, for a large plant to be erected on Staten Island, New York. There will be large docks with electrically operated conveying machinery and a large central power station, the entire plant to cost about $2,000,000.

CLEVELAND, OHIO.—The Everett-Moore syndicate has made arrangements for the consolidation of the Lorain Street Railway and the Avon Beach & Southern Railway. The new management contemplate extensive improvements including the building of the Avon Beach & Southern Railway. About $170,000 will be spent in double tracking and improving the Lorain Street Railway.

ALLIANCE, OHIO.—The Sandy Valley Traction Company has placed a contract for the construction of 13 miles of line. The company is to build an electric railway from Lisbon to New Philadelphia, with spurs extending from Magnolia to Canton, and from Minerva to Alliance, in all about 70 miles of road. The company is capitalized at $1,500,000, but contemplates increasing its capital to $3,000,000.

CLEVELAND, OHIO.—The N. Y. P. & O. Dock Company, of this city, has placed a contract with the Brown Hoisting Machinery Company, of Cleveland, for four large ore-handling outfits to be erected in Cleveland for the opening of navigation in 1907. Each leg of the equipment will be operated by 350-hp motors. A power plant to be equipped with two 500-kw generators will be purchased in the near future.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has increased its capital stock from $3,500,000 to $5,000,000. Part of the money will go to pay for improvements started, as well as those that are contemplated. The company is largely increasing its facilities at the main station. When completed the improvements will add 4,000 hp to the total generating power of the company. A new substation is also being constructed on West 28th Street S. W. Extensions of lines are also planned in addition to another substation.

CLEVELAND, OHIO.—H. T. Yaryan, of Toledo, president of the Yaryan Company, has applied for a franchise in Cleveland for power and lighting service. It is proposed to establish a number of plants about the city and furnish electric light and hot water heating. It is proposed to furnish electricity for light, heat and power at a cost not to exceed 10 cents per unit and the rate for arc lights for street lighting purposes is to be less than $60 each per year. The measure gives the city the right to buy the lighting plant at the end of 15 years at cost of reproduction plus 20 per cent.

GRESHAM, ORE.—M. F. Donohue has secured a franchise to light this city for a period of 25 years. Power will be developed from Badger Creek.

PORTLAND, ORE.—An ordinance is being considered by the City Council, which if passed, will result in the placing of all electric, telephone and telegraph wires under ground.

PORTLAND, ORE.—The council has granted the Cascade Power Company and the Mount Hood Electric Company a 25-year franchise to construct and operate an electric light and power system in this city.

FALLS CITY, ORE.—The City Council is reported to have granted the Luckiamute Valley Water & Electric Manufacturing Company a franchise to operate as an electric light, power and manufacturing company. Z. Henshaw and G. T. Hale are among the directors.

ALBANY, ORE.—The Willamette Valley Company has completed its transmission line to Corvallis, and is now supplying the town with electricity from the Albany plant. The old electric plant in Corvallis, which was recently purchased by the company, has been closed down. It is stated that Albany will soon have a 24-hour service for light and power.

NEWBERG, ORE.—The Newberg Electric Light Company and the Spaulding Logging Company have been consolidated under the name of the Yamhill Electric Company. The company has been incorporated with a capital stock of $25,000, and will build a new plant of 300 horse-power on the Willamette River, which it expects to have completed and in operation by fall.

BAKER CITY, ORE.—Press reports state that Dominicus J. Wilson, of Boise, Idaho, has filed notice for appropriation of 8,000 cubic feet per second of the flow of Snake River for power purposes at Ox Bow Bend in Baker County, Ore. He proposes to construct a dam, tunnels, etc., and develop about 40,000 horse-power to be transmitted to Seven Devils, Sumpter, Greenhorn and Elkhorn mining districts, and also to the cities of Ontario, Weisel, Payette, Huntington and other cities along the line, for light and power purposes.

PORTLAND, ORE.—Every light, power and traction company in the lower Willamette Valley, including Portland, using electrical energy, has been consolidated. The purchasers are E. W. Clark & Company, of Philadelphia, Pa.; J. & W. Seligman and Charles Pratt & Co., of New York, N. Y. The various companies which were absorbed are: The Portland General Electric Company, Portland Railway Company, Oregon Water Power & Railway Company, of Portland, Ore.; Citizens' Light & Traction Company, of Salem, Ore.; Vancouver Light & Power Company, of Vancouver, Wash.; and the Union Light & Power Company, of Silverton, Woodburn and Mount Angel, Ore. The headquarters of the new company will be in Portland. The price paid for the combined plants was $30,000,000.

NEW BEDFORD, PA.—The New Bedford Telephone Company has purchased a site, on which it will erect an exchange building.

PITTSTON, PA.—The Council refused to grant a franchise to the Pittston Light, Heat & Power Company to do business in this city, as the city has been restrained from entering into a municipal contract with the company.

NEW HAVEN, PA.—At a recent meeting of the Town Council the question of erecting an electric light plant was discussed and a committee appointed to investigate and estimate the cost of installing a plant. The members of the light committee are R. F. Sheppard, Resin Moore and Harmon Hay.

STROUDSBURG, PA.—The mayor has vetoed the electric lighting contract as passed by the Council, stating that he thought ten years too long a time to be confined to a certain make of lamp, which may become impracticable in a much shorter time on account of the rapid improvements in electrical appliances.

ANDERSON, S. C.—The plant of the Anderson Water, Light & Power Company, at Portman Shoals, about ten miles distant, was destroyed by fire recently. This was a comparatively new development and represented a considerable outlay of money.

ORANGEBURG, S. C.—W. C. Wolfe, of Orangeburg; E. C. Johnson, of North, and associates, will apply for a charter for an interurban electric railway from North to Orangeburg, and on to the Santee River. The capital named in the application for the charter is $1,100,000 The promoters also plan to develop a water power on the Edisto River, near Orangeburg. The total mileage is 45 and includes an electric street railway system in Orangeburg.

SPARTANBURG, S. C.—The Electric Power & Manufacturing Company, which owns Nesbitt Shoals, Spartanburg County, Palmer Shoals, in Cleveland County, N. C., and Gaffler Shoals in Cherokee County, has sold a controlling interest in the property to E. L. Jennings, R. C. Crawford and Lowndes Kennedy, of Pittsburg, Pa. It is reported that about $800,000 will be expended in developing the water power. W. E. Burnett and T. E. Moore, both of Spartanburg, will be directors of the new company.

STURGIS, S. D.—The Sturgis Power & Light Company is getting estimates for putting in another engine, probably condensing, and a generator, as the present unit is overloaded. U. S. Allison is manager.

NASHVILLE, TENN.—The Board of Aldermen has granted a franchise to the Home Telephone Company to install and operate a telephone system in this city.

SPARTA, TENN.—At the annual meeting of the Gainesboro Telephone Company it was decided to issue bonds to the amount of $100,000, for extensions and improvements to its system. Joel H. Anderson was elected general manager to succeed J. N. Cox, who recently resigned.

FORT WORTH, TEX.—The Northern Texas Traction Company contemplates making extensive improvements in Fort Worth during the next few months.

AMARILLO, TEX.—The Amarillo Gas Company, recently incorporated, with a capital of $50,000, has a 50-year gas and electric franchise. It will expend this year between $35,000 and $50,000. The directors are J. C. and F. J. Storm, of Kirksville, Mo., and L. S. Stowell, of Amarillo.

FT. SAM HOUSTON, TEX.—Bids will be received by L. J. Fleming, Constructing Quartermaster, U. S. A., Ft. Sam Houston, until June 14, for furnishing electric current for illuminating and small motor purposes at Ft. Sam Houston; also for the construction of a complete exterior and interior electric lighting system, with fixtures, etc., at this post.

SALT LAKE CITY, UTAH.—It is stated that arrangements have been made between the Ogden Rapid Transit Company and the Utah Light & Railway Company for the furnishing of power by the latter company to operate the street car lines of the former.

SHELBURNE FALLS, VT.—Dr. W. S. Webb has purchased the power plant and mills at Shelburne Falls. He will utilize the plant to furnish power for electric lights at Shelburne Farms, taking the place of the 100-hp steam power plant.

BURLINGTON, VT.—The contract for the addition to the municipal lighting plant has been awarded by the electric light commissioners for a motor generator to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., for $1,353. It is expected that the addition will be completed August 1. When completed the city lighting plant will have a capacity of 300 kw at its disposal.

ESSEX JUNCTION, VT.—S. A. and C. W. Brownell have resumed work on the hydro-electric installation on the Winooski River at this place. The plans for development were made by Loring N. Farnum & Company, of Boston, and call for three units each consisting of a pair of thirty-inch turbines of 700 hp, operating on a horizontal shaft and directly connected to a 400-kw, three-phase, 60-cycle, revolving field generator delivering current at 6,600 volts. Only one of the units will be installed at present. Step down transformers will be installed to reduce the voltage from 6,600 for use in Essex Junction, while that going a greater distance will be kept at 6,600. The contract to furnish the electrical apparatus was awarded to the Stanley Company, of Pittsfield, Mass., and the water wheels to S. Morgan Smith Company, of York, Pa. Carl B. Brownell, of Burlington, has charge of the construction. It is expected to have the plant in operation in October.

MANASSAS, VA.—The citizens have voted to issue $50,000 bonds for water works, an electric light plant, etc.

NORFOLK, VA.—The new power house of the Norfolk & Portsmouth Traction Company will be built on the old Anderson mill site, at the foot of Lovett Avenue in Brambleton. The plant will be constructed under the supervision of Sargeant & Lundy, of Chicago, Ill., and will cost when completed about $800,000.

PETERSBURG, VA.—An ordinance is now before the City Council to permit the Petersburg Telephone Company to lay conduits and build the necessary manholes for putting wires underground in the center of the city.

PASCO, WASH.—The City Council has granted F. E. Elmendorf, of Spokane, a franchise for water works and an electric light plant.

CHENEY, WASH.—The City Council has granted Mr. Lund and associates a franchise for an electric light and power plant, also for a street railway.

OLYMPIA, WASH.—Seattle capitalists represented by A. L. Kincaid, secretary State Board of Control, and C. W. Schaffer, State Librarian, will petition the City Council for a franchise for an electric lighting and heating plant.

NEENAH, WIS.—Plans are being made for the consolidation of the interests of the Eastern Wisconsin Railway & Light Company, The Winnebago Traction Company, the Wisconsin Traction Light, Heat & Power Company and the Green Bay Traction Company.

MILWAUKEE, WIS.—At a recent meeting of the directors of the Wisconsin Telephone Company it was decided to expend $[illegible] in improvements and extensions, $500,000 to be used in improving the service in Milwaukee, and the balance on the line out in the State. The following officers were elected: President, Alonzo Burt, Milwaukee; treasurer, Thomas Balch, Boston; assistant treasurer, C. J. Lins, Milwaukee; secretary, Charles Grant, Boston; general manager, E. B. Cottrill, Milwaukee.

BATTLEFORD, CAN.—The Council is considering the construction of an electric light plant.

NORTH BATTLEFORD, CAN.—J. A. Gregory & Company are advertising for a company to install a telephone system to connect this town with Battleford. A guarantee of 100 telephones is offered to commence with.

PACHUCA, MEX.—The Compañia Electrica é Irrigadora de Hidalgo, now operating a big plant at Tlaxcoapam, will establish a new plant at Mixquiahuala, which is within a short distance of the old plant. The machinery, electrical supplies and poles have been ordered and the installation will begin as soon as the supplies are on the ground.

CARMAN, MAN.—The Council is preparing a bylaw to authorize the expenditure of $58,000 on an electric lighting plant. Address A. Malcomson, clerk.

WINNIPEG, MAN.—Bids will be received by Alderman J. C. Gibson, chairman fire, water and light commission, until June 4 for two 500-hp electric generators, switchboards, etc., for high pressure fire service water works. Specifications and forms of tenders may be obtained on application to H. N. Ruttan, city engineer.

KINGSTON, ONT.—An election will probably soon be held to vote on issuing $85,000 bonds for extending the municipal electric light plant.

OTTAWA, ONT.—The bill to incorporate the telegraph company, which is to operate the telegraph and telephone lines of the Grand Trunk Pacific, was passed in the Ottawa House of Commons, the capital stock is placed at $10,000,000. The incorporators are Charles M. Hays, Frank W. Morse and others.

TORONTO, ONT.—A franchise has been granted the Independent Long Distance Telephone Company, by the private bills committee. The sum of $200,000 must be spent within one year by the company or the Bell Telephone Company will retain the right to make exclusive contracts, and if this sum is not spent in two years the franchise will be forfeited.

Company Elections.

MANCHESTER, MASS.—At the annual meeting of the stockholders of the Manchester Electric Co., the present board of officers was re-elected as follows: Oliver T. Roberts, president; George C. Lee, Jr., treasurer; Raymond C. Allen, clerk; Philip Dexter, Gordon Abbott, Gardiner M. Lane and Charles E. Cotting, directors.

COLUMBUS, GA.—At the annual meeting of the Columbus Automatic Telephone Company the following officers were elected: Captain T. E. Blanchard was re-elected president; J. L. Norman, vice-president, and J. B. Huff, secretary and treasurer.

New Incorporations.

AUGUSTA, ARK.—The City Power, Light & Water Company has been incorporated with a capital stock of $50,000. The incorporators are J. A. Vinson and others.

LOS ANGELES, CAL.—The Redondo, Hermosa & Belvidere Railway Company has been incorporated with a capital stock of $100,000. The directors are J. G. Palmer, E. A. Smith, R. L. Antudel, M. Giles and C. F. Carlson.

TELLURIDE, COL.—The Institute Electric Company, of Telluride, has been incorporated with a capital of $1,000,000 to manufacture and sell electric power and light, the acquirement of water rights, etc. The officers are Wm. Story, president; Albert L. Woodhouse, general manager; E. C. Lackner, secretary.

GRAFTON, ILL.—Articles of incorporation have been filed by the Grafton Light, Heat & Power Company, with a capital stock of $8,500, by L. T. Westrich and others.

GALESBURG, ILL.—The Home Light & Power Company has been incorporated with a capital of $10,000. The incorporators are W. S. Cameron, Harry Gardt and others.

ELGIN, ILL.—The Elgin Merchants' Light Company has filed articles of incorporation with the Secretary of State with a capital of $2,500. The incorporators are John H. Stickling, John Rienert and Frank H. Stickling.

LITCHFIELD, ILL.—The St. Louis, Champaign & Decatur Railway Company has been chartered to construct an electric interurban line from Litchfield to Champaign. The capital stock is $100,000. The incorporators are Charles Zilly and others.

INDIANAPOLIS, IND.—The Central Railway Company of Indiana has been incorporated with a capital stock of $10,000, by Charles H. Burras, of Chicago; F. F. [illegible], John V. Wagoner, William House and I. B. Moore, of Indianapolis. The company proposes to build an electric railway about 100 miles long, with its principal power house and terminal at Brownsburg.

TOPEKA, KAN.—The Topeka Independent Telephone Company has been incorporated with a capital stock of $1,000,000. The incorporators are D. L. Pankey and others.

SUMRALL, MISS.—The Sumrall Telephone & Telegraph Company has been incorporated with a capital stock of $5,000, by J. B. Anderson and others.

SARCOXIE, MO.—The Sarcoxie Telephone Company has been incorporated with a capital stock of $5,000, by H. B. Boyd and others.

ST LOUIS, MO.—The Century Lighting Company has filed articles of incorporation with a capital stock of $100,000. The incorporators are T. P. Cronin, E. G. Ranken and others.

SPRING GREEN, NEB.—The Spring Green Telephone Company has been chartered with a capital stock of $4,800, by W. T. McKinney and others.

SMITHFIELD, NEB.—The Smithfield Mutual Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are C. A. Powell and others.

NEW YORK, N. Y.—The East Steamship Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are Frank Anable and others.

VAN WERT, OHIO.—The Cleveland, Van Wert & Indiana Traction Company has been chartered with a capital stock of $10,000, by I. R. Tudor, Lee R. Bowewitz and others.

RIVERHEAD, L. I., N. Y.—The Quantuck Electric Company has been incorporated, with a capital of $50,000. Directors: Everett B. Sweezy, of New York, N. Y.; Wm. H. Sweezy, and Robt. P. Griffing, of Riverhead, and others.

CENTREVILLE STATION, N. Y.—The Centreville Lighting Company has filed articles of incorporation with a capital stock of $100,000. The directors are Nathan Lubow, L. W. Lubow and I. D. Wolf, of Centreville Station.

MT. ORAB, OHIO.—The Mt. Orab Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are A. R. Watson and others.

GEORGETOWN, OHIO.—The Brown County Independent Telephone Company, of Georgetown, has been organized by Louis Meischlor, E. H. Kennedy, C. E. Brehm, Harry E. Parker and J. R. Moore. Capital stock is $10,000.

CANTON, OHIO.—The Minerva Telephone Company, of Stark County, has been incorporated with $4,000 capital stock by E. D. Shaw, R. T. Davis, A. A. Bates, C. G. Hursh, B. C. McCauley and W. E. Russell.

HUSTON, OKLA.—The Huston & El Reno Telephone Company has been incorporated with a capital stock of $5,000. The directors are Charles Bradley, W. J. Murray, J. W. Cordray, S. C. Porter, W. F. Foster, of El Reno, and W. D. McRay, of Huston.

GUTHRIE, OKLA.—The Oklahoma City & Shawnee Traction Company has been incorporated with a capital stock of $1,200,000. The principal office will be at Oklahoma City. The proposed line will be about 40 miles in length. The directors are: Sherman Collin, of Ithaca, N. Y.; W. H. Crane, of Adrian, Mich.; Douglas B. Crane, J. B. Kinne, Daniel Ketchum, William P. Young and Oscar B. Hartman, of Oklahoma City.

ENON VALLEY, PA.—The Enon Valley Telephone Company has been incorporated with a capital stock of $10,000.

VETERA, PA.—The Nicktown & Ebensburg Telephone Company has been incorporated with a capital stock of $5,000.

PHILLIPSBURG, PA.—The Decatur Township Electric Light, Heat & Power Company has been incorporated with a capital stock of $5,000.

PHILLIPSBURG, PA.—The Rush Township Electric Light, Heat & Power Company has been incorporated with a capital stock of $5,000.

FAIRCHANCE, PA.—The Fairchance & Smithfield Traction Company has been incorporated with a capital stock of $200,000. The incorporators are Albert Gaddis and others.

ALPENA, S. D.—The Alpena Farmers' Phone Company has filed articles of incorporation with a capital stock of $4,500. The incorporators are J. E. Shull and others.

NASHVILLE, TENN.—The Laurel Valley Railroad, of Carter County, has been chartered with a capital stock of $10,000. The company proposes to construct a railroad to be operated by steam or electricity, from a point near Hampton, Tenn., to Elk River, in North Carolina.

CHATTANOOGA, TENN.—The Chattanooga Railways Company has applied for a charter for the purpose of improving and rebuilding its lines on the top of Lookout Mountain. The capital stock is $100,000. The incorporators are Foster V. Brown, Frank Spurlock, R. W. King, D. J. Duncan and Thomas G. Newman.

BALLINGER, TEX.—The Consumers' Light Company has been incorporated, with a capital of $20,000 by Thomas Ward, J. Wilmeth, W. A. Norman and others, all of Ballinger.

AUSTIN, TEX.—The Mt. Zion & Lost Creek Telephone Company, of Gordon, has filed articles of incorporation, with a capital stock of $1,000. The incorporators are W. H. Rix and others.

BROWNWOOD, TEX.—The Brownwood Gas & Electric Company, of Brownwood, has been incorporated, with a capital of $80,000, by S. P. Coggin, R. B. Rogers and others, all of Brownwood.

WEATHERFORD, TEX.—The Weatherford Telephone Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are J. A. Murray, J. Castler, G. A. Holland, R. S. Lowe, W. D. Carter, C. C. Littleton, J. T. Cotton, E. P. Sawtill and R. A. Armstrong.

LEVEL RUN, VA.—The Renan Telephone Company has been chartered with $5,000 capital. The officers are W. C. Harvey, president, Renan, Va.; E. A. Smith, secretary and treasurer.

NORFOLK, VA.—The Norfolk & Portsmouth Traction Company has been incorporated with a capital stock of $14,000,000. The incorporators are R. Lancaster Williams and others.

HAMPTON, VA.—The Public Service Corporation of Hampton has been incorporated by J. W. Rowe, H. F. Elam and S. C. Rees, all of Hampton, Va., with a capital of $300,000, to produce and distribute light, heat, power and compressed air.

SPOKANE, WASH.—The Spokane Power Development Company has been formed with a capital of $500,000 to construct and operate power plants in Washington, Idaho, Oregon and British Columbia. Directors: Jay P. Graves, F. A. Blackwell, F. Lewis Clark, and others.

PARKERSBURG, W. VA.—The Sun Light Company of this place has been incorporated with a capital stock of $5,000. Robert G., Samuel B., Albert and Meggs Stiles and others are the incorporators.

MILWAUKEE, WIS.—The Milwaukee Telephone Company has been incorporated with $100,000 capital.

HIGHLAND, WIS.—The Individual Telephone Company has been incorporated with a capital stock of $800. The incorporators are John J. Yerke and others.

ATTICA, WIS.—The Attica Mutual Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Oliver S. Jones and others.

MILWAUKEE, WIS.—The Milwaukee, Rockford & Eastern Railway Company has filed articles of incorporation with a capital stock of $100,000. The company proposes to build 75 miles of road in Milwaukee, Waukesha, Walworth and Rock counties. The proposed route will run from Milwaukee to Beloit. H. W. Seaman is the principal stockholder.

LARAMIE, WYO.—The Medicine Bow Telephone Company has been incorporated with a capital of $10,000 by Carl Sieverts, R. N. Cronberg, O. P. Reed, J. H. Bowles and A. C. Cooper, to build a telephone line among the ranches of northern Albany and Carbon Counties. The company will have its principal office at Medicine Bow and will extend its lines to a score or more of ranches near that place.

REGINA, CAN.—The Northern Development Company is applying for incorporation with a capital of $500,000 to develop power on the Red Deer and Etoimomi Rivers. The incorporators are: O. A. Roderbon, A. L. Nanton, John Galt (Toronto), F. J. Fox and John Shough.

WINNIPEG, MAN.—The Siche Western Company has been incorporated to manufacture electricity, etc. The provisional directors are E. C. Colby, G. H. Mauter, Winnipeg, and E. C. Foley, Montreal, Que.

DOUGLAS, ONT.—The Douglas Milling Company has been incorporated with a capital of $40,000 to manufacture electricity for lighting and heating purposes. The directors are T. M. Thrasher, A. McEachern, O. Enright, of Douglas, Ont.

Legal.

PRIVATE BRANCH EXCHANGES.—An injunction restraining the Chicago Telephone Company from discontinuing the service on three trunk lines running into the office of John A. Gauger & Co., Twenty-second and Laflin Streets, has been granted by Judge Walker. The injunction restrains the telephone company from interfering in any way with the private switchboard and seven extension instruments installed in place of the instruments owned and furnished by the telephone company. The bill for an injunction was filed by Beach & Beach, who also secured an injunction against the telephone company which has been pending in the courts since November, 1903. The present fight is to establish the right of subscribers to install private switchboard and extension instruments and attach them to the lines of the telephone company if desired. The Gauger equipment cost outright $350, while the firm had paid $150 a year to the company for the leased apparatus. The dispute involves the right of the company to keep alien apparatus from tapping or connecting with its system.

DAMAGES TO KITE FLYER.—In the superior civil court at Salem, Mass., before Judge Fox, in the case of Melvin A. Deering p. p. a. vs. Gloucester Electric Company, the jury returned a verdict for the defendant. This was an action to recover damage for an electric shock and burning of plaintiff, a 10-year-old lad, received while trying to get a kite off the wire which had fallen on Centennial Avenue in this city. The plaintiff claimed negligent construction and care of the wires, while the theory of the defence was that the wires had been drawn together and burned off by the kite and was not due to any defect or want of care. This contention prevailed.

CUTTING TREES.—In the suit of Osborne against the Auburn Telephone Co., the New York Supreme Court Appellate Division, Fourth Department, has affirmed a dismissal of complaint on its merits, in favor of the defendant. In a suit to restrain a telephone company from erecting its poles and stringing its wires in a street, and for damages occasioned by the destruction of shade trees, it appeared that the company had a franchise to erect its poles and string its wires in the streets, that poles were erected in a street on which plaintiff's property abutted, and that the company had trimmed plaintiff's shade trees. The proof did not show to what extent any particular tree was damaged, or whether the premises were depreciated in value by the cutting of the trees. It was held that the company was lawfully in the streets, and not subject to plaintiff's interference simply because it erected poles contiguous to her premises, and a judgment of dismissal was proper for failure to prove damages. Where an owner of land abutting on a street planted trees along the street, and the city acquiesced in his ownership of them, he had sufficient title to recover damages against a telephone company wrongfully cutting down the trees, though his title did not include any part of the street.

ELECTRICITY A PUBLIC USE.—The New York Supreme Court Appellate Division, Fourth Department, has affirmed an order, in the case of the Niagara, Lockport and Ontario Power Co. against Harke, permitting plaintiff to enter immediately upon certain lands, on the ground that it is a "public use." The plaintiff had already entered into a contract for the construction of a canal, which is in process of building, and which, when completed, will be of sufficient capacity to generate 200,000 electrical horse-power. It had entered into an agreement with a Canadian power company to receive a large quantity of electric power, a considerable portion of which is ready for delivery. "It has also entered into an agreement with a construction company for the delivery of power to be used in the operation of certain street surface railroads, which are named in the moving papers, and the affidavits show that it is important that this power be delivered early during the present year. The contract calls for the delivery of this power at an early date, and the plaintiff is actively prosecuting the building of its line. The transmission of the electricity is at high voltage and along wires nine-tenths of an inch in diameter, which are supported by steel towers 50 feet in height. To transmit the electricity of the extraordinary high voltage of from 10,000 to 60,000 volts in wires along the streets or highways would be dangerous and impracticable. The extent of the business contemplated, including, as it does, the furnishing of electricity for the use of the inhabitants in a thickly settled and extensive territory for illuminating purposes, and for the use of extensive street surface railroad, we think constitutes a public use within the definition of that comprehensive term. The fact also sufficiently appears that 'the public interests will be prejudiced by delay' if the defendant is allowed to block the plaintiff in the fulfillment of the plan for which it was organized and retard the furnishing of electricity or water to the inhabitants along its route, or in supplying electrical power for the operation of railroads and for other necessary purposes which may fairly be for the benefit of the public."

Obituary.

R. J. SHEEHY.

MR. ROBERT J. SHEEHY, whose death was briefly noted in our issue of May 5, was born in Ireland in 1843 and came to this country with his parents when he was four years old. In 1854 he began his business career as a telegraph messenger, and during the period between 1862 and 1868 was a line builder for the old American Telegraph Company, the Franklin and other companies then in existence. He was identified with the introduction of the Stearns duplex, about the practicability of which there was much skepticism at the time. In 1871 Mr. Sheehy went to the newly organized Gold & Stock Telegraph Company in Boston and did some good work in building up the company's business in that city. He left the telegraph service in 1875 and began business for himself in the construction of electrical apparatus; and up to the time of his death he had taken out 50 or more patents on inventions relating to the various branches of electrical engineering. It is stated that in the early days Mr. Edison, in pursuing his own work, frequently ran up against Mr. Sheehy's patents, which led Mr. Edison to remark that Mr. Sheehy was a "prolific inventor." In 1878 Mr. Sheehy installed the first Brush arc lighting plant in Boston, at the Mechanics' Charitable Fair, and afterwards installed a large Brush machine in the Washburn & Moen rolling mills in Worcester, Mass. In 1879, he produced one of the earliest search-lights. He used an ordinary locomotive headlight reflector, and the strong light caused much speculation at Nantasket Beach, where the experiments were conducted. Mr. Sheehy was instrumental in developing the Brush interests in the East and was one of the founders of many of the Brush Companies organized in that section of the country. In 1885 he resumed experimental work and invented and patented printing telegraph instruments, a multiplex system and an autographic instrument, using an alternating-current motor of his own invention for driving the various devices. In 1890 he organized a company to introduce a printing telegraph system designed for the interchange of communications between business houses on the exchange principle. His latest inventions consisted of the "Telotype," said to be a simple, rapid and reliable printing telegraph system, and an electric train controlling system for steam and electrically operated railways. A couple of years ago he went to England to introduce the two latter inventions, and organized an English company to exploit his train control system. He returned to this country a few weeks ago in ill health. Deceased was of a genial nature and had a large circle of friends, who feel deep regret over his death.

MR. C. F. THOMPSON.—We note with regret the death of Mr. C. F. Thompson, for many years secretary and treasurer of the Brattleboro (Vt.) Gas Light Company, controlling the gas and electric light interests of Brattleboro. He was born at Seymour, Conn., in 1831.

MR. CHRIST HOLSCHER, general manager of the Holscher Electrical Manufacturing Company, of Warren, O., died suddenly last week at the age of 55. He invented a number of electrical devices, and the company bearing his name makes refilled incandescent lamps.

Educational.

WINONA (IND.) TECHNICAL INSTITUTE.—A series of interesting lectures will be given at the electrical building at the Winona Technical Institute in Indianapolis, Ind. The first will be by J. G. Van Winkle of the Varney Electric Company, on "An Engineer's Views of Light and Power Wiring."

Personal.

G. R. NEWCOMER.

MR. G. R. NEWCOMER, who was for years connected with the Columbia Incandescent Lamp Co., in charge of its Memphis office, has accepted the position of district manager of the Brilliant Electric Co., Cleveland, O., to take effect May 1, 1906, in which capacity he will take charge of the selling organization in the Middle West and South, with temporary headquarters at Kansas City. Mr. Newcomer has been in the electrical business since 1893, during which time he has covered the greater part of the United States in the interests of several of the largest electrical concerns in the country. For several years he was directly in charge of the selling organization of the United States Carbon Co., severing his connection with that company to accept a position in charge of the Southern territory of the Columbia Incandescent Lamp Co. Mr. Newcomer remained in charge of the Memphis office of this company until July, 1905, at which time ill health made it necessary to retire from active business until now.

MR. J. G. SIGLER, local manager for the Kinloch Telephone Company, of St. Charles, Mo., has resigned that position to accept a more lucrative one in New York.

MR. C. F. HEINKEL, who has been general designer for the Elwell-Parker Electric Company of America, of Cleveland, O., for the past seven years, has been promoted to be chief draftsman of that company.

MR. R. McF. DOBLE.—As a result of the great earthquake and fire, Mr. Robert McF. Doble, consulting and supervising engineer, announces the removal of his office from San Francisco to Colorado Springs.

MR. J. A. BENDURE, for the past five years general manager of the Lima Railway & Light Company and the Lima & Toledo Traction Company, has resigned to become associated with Mr. Joseph B. Mayer, of Buffalo.

MR. SIDNEY E. JUNKENS and Mr. Henry R. Kent have been elected vice-presidents of Westinghouse, Church, Kerr & Company. For many years past Mr. Junkens has been secretary of this engineering company.

MR. FRANK N. WATERMAN, mechanical and electrical engineer, has removed his offices from 150 Nassau Street to 100 Broadway, New York, instead of the reverse, as erroneously announced in these columns last week.

MR. W. M. ZURFLUH, superintendent of the Home Lighting, Power & Heating Company, of Springfield, Ohio, has resigned to become superintendent of the Arcade Building electric light, heat and refrigeration plant at Dayton, O.

MR. W. J. WARDER, JR., of the engineering staff of the Western Electric Company, located recently in New York, on May 1, took the position of designing engineer for Roth Bros. & Company, of Chicago, dynamo and motor builders.

MR. C. F. BAKER, superintendent of power of the Brooklyn Rapid Transit Company, has resigned and Mr. C. E. Roehl, electrical engineer, will, in addition to his other duties, have charge of the operation of all power and sub-stations of the various companies comprising Brooklyn Rapid Transit system.

MR. GEORGE WESTINGHOUSE is the theme of an interesting article by Mr. Arthur Warren in the May *Success*. It deals with the career of this unique but typical American in all his various aspects of inventor, mechanic, promoter, capitalist, etc., and brings out the events with broad philosophical treatment.

DR. G. VAN DAVIS writes us from the Emergency Camp, Presidio, San Francisco, that he has lost his library, equipment, etc., and being thrown out of professional work would like to secure some immediate means of livelihood in handling electrical goods or specialties of any kind, or anything useful in the rebuilding of the city.

MR. F. S. HICKOK, formerly on the engineering staff of the Western Electric Company, of Chicago, and recently connected with Mr. Edward Yeoman in the sale of electric cranes and hoists, has opened an office for himself at 824 Marquette Building, Chicago, as representative of the Case Manufacturing Company, Columbus, O., manufacturers of electric cranes and hoists.

MR. HENRY DOCKER JACKSON, Boston, Mass., has opened offices at 4 State Street, as consulting electrical engineer. Mr. Jackson will make a specialty of electrolysis and power station economy. He has for several years lectured at the Massachusetts Institute of Technology on the subject of electrolysis, having had extensive practical experience in the investigation of electrolytic action.

MR. JAMES R. CRAVATH lectured on illuminating engineering at the University of Minnesota the evening of April 27. In addition to the students a large number of men from the commercial and new business departments of the St. Paul and Minneapolis central station companies were present. Mr. Cravath lectured on the same subject before the Chicago Architects' Business Association, April 24.

MR WM. CLEGG, JR., who has been special agent of the Westinghouse Electric & Mfg. Company in its St. Louis territory, has just received the appointment of acting manager of the St. Louis office. Mr. D. E. Webster, formerly manager of the office, has been transferred to a position in the Chicago sales office of the company. Mr. J. S. Tritle has been appointed acting manager of the new district office opened by the Westinghouse Electric & Mfg. Company, New England Building, Kansas City, Mo. Mr. Tritle was formerly connected with the St. Louis office of the company.

MR A. BALSLEY has resigned as electrical engineer for the Georgia Railway & Electric Company, of Atlanta, Ga., to accept a similar position with the Sao Paulo Tramway Light & Power Company, of Sao Paulo, Brazil, South America. Mr. Balsley after graduating from the Rose Polytechnic Institute, Terra Haute, Ind., and finishing a course in the Lynn factory of the General Electric Company, at Lynn, Mass., became superintendent of the Terre Haute Electric Company, which position he held for several years and later became connected in a similar capacity with one of the Montreal transmission companies, from which place he went to Atlanta. He sailed April 5 for Sao Paulo.

MR. THOMAS E. MURRAY, vice-president of the New York Edison Company, and an officer of the Chattanooga & Tennessee River Power Company, performed a very useful service to the American Society of Mechanical Engineers of which he is a member, by compiling for that body and presenting to those in attendance at the recent convention a handsome souvenir volume of data as to Chattanooga and its environs, enterprises, power plants, history, etc. The text and the numerous illustrations are alike admirable, particularly all relating to the battlefields of Chickamauga, Lookout Mountain and Missionary Ridge, where the greatest American generals and men from thirty-three States struggled for supremacy in the Civil War. Mr. Murray's book contains also an excellent map and account of the Tennessee River power transmission.

Trade Publications.

THE TRUMBULL ELECTRIC MFG. COMPANY, Plainville, Conn., has just issued a 100-page catalogue of electric wiring material.

LOCOMOTIVE CRANES.—The Browning Engineering Company, Cleveland, Ohio, has issued bulletin No. 23, dealing with locomotive cranes. The bulletin is profusely illustrated.

MOTORS FOR DRIVING MACHINE TOOLS.—Bulletin No. 64, of the Crocker-Wheeler Company, Ampere, N. J., is devoted to a complete line of motors, especially adapted to the driving of machine tools.

IGNITION APPARATUS.—The Uncas Specialty Company, 21 Shipping Street, Norwich, Conn., has issued an illustrated booklet dealing with electrical ignition apparatus for gas engines, including Leavitt secondary distributor and primary spark timers.

NERNST GLOWER.—The April issue of the Nernst Glower contains many items of interest to central station men including descriptions of illuminating installations, methods for meeting gas competition and helpful hints to hustling advertisers.

EXHAUST HEADS.—The B. F. Sturtevant Company, Boston, Mass., has issued a folder to which is attached a return postal calling attention to its exhaust head which is designed to entrap the water and yet to produce no back pressure on the engine.

THE DE LA VERGNE MACHINE COMPANY, of New York, has issued a set of handsome postal cards showing the different types of machines built by it, namely the Koerting Gas Engine, the Hornsby-Akroyd oil engine and the De La Vergne ice machine.

ELECTRICAL AND STEAM MACHINERY.—Joseph H. Thompson, Jr., 11 Broadway, New York, has issued bargain list No. 5 giving the capacity ratings of numerous electrical and steam machines which have been renovated and are in condition for immediate delivery.

MACHINE TOOLS.—The Niles-Bement-Pond Company, of New York, in the *Progress Reporter* for May, publishes illustrated descriptions of numerous machine tools, among which may be noted milling machine, checking lathes, slotters, radial drills, boring and drilling machine, rail benders, etc.

SWITCHES FOR LIGHTING CIRCUITS.—Booklet No. 10 of the Hart Manufacturing Company, Hartford, Conn., contains a digest of the types and salient features of "diamond H" switches. Descriptions are given of push-button and rotary switches, plug receptacles and automatic door switches.

BELT CONVEYORS.—The Robins Conveying Belt Company, Park Row Building, New York, has issued a neatly illustrated bulletin, designated as No. 14, which is devoted to conveying and elevating machinery for handling sand, stone, cement, concrete, concrete materials and excavated earth and rock.

AIR BRAKE EQUIPMENTS.—Bulletin No. 4437 of the General Electric Company, Schenectady, N. Y., gives a thorough description of straight air brake equipments for electric cars. Each part of the equipment is treated separately and in detail. A well-arranged diagram serves for showing the connections of the different parts of the system.

MOORE ELECTRICAL CO., 52 Lawrence Street, Newark, N. J., has issued a neat little pamphlet as to its Moore vacuum tube lighting. The frontispiece is the 162-foot tube in the main corridor lobby of Madison Square Garden, New York City. Other views are given, and there are several pages of data, testimonials, etc.

ENGINE STOPS.—The Consolidated Engine Stop Company, 130 East 12th St., New York, has issued a pamphlet containing letters from a large number of well-known industrial plants using the Monarch engine stop and speed limit system. The letters relate to cases of accident where the Monarch system proved beyond a doubt its protective properties.

STEEL BELT LACING.—The Bristol Company, of Waterbury, Conn., announces the publication of bulletin No. 39, a new circular and price-list of Bristol patent steel belt lacing, including several new sizes which the company has recently commenced to make. This circular gives the list in a condensed and tabular form, enabling one to see at a glance the relation which exists between the different sizes and styles.

LIGHTNING ARRESTERS.—The General Electric Company, Schenectady, N. Y., has issued flyer No. 2177, describing a new type of lightning arrester. The arrester consists of a series of spark gaps with cylinder electrodes, so combined with shunt resistances as to provide a highly efficient discharge path for disturbances of low, moderate and high frequency, not only from line to ground, but also from line to line, by means of the multiplex connection.

HORIZONTAL ENGINES.—The B. F. Sturtevant Company, Hyde Park, Mass., has issued as bulletin No. 131 a well-prepared description of its horizontal center-crank engines, which possess all of the features desirable for the driving of direct-connected generators, for which purpose they were particularly designed. Neat half-tones serve for illustrating the main constructional features, while an outline diagram shows the principal dimensions of the engines.

TELEPHONES.—Bulletin No. 19 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is a well-executed, loose-leaf catalogue dealing with generator-call telephones, and showing numerous views of both series and bridging instruments of various styles. Special attention is paid to a new type of transmitter, four-party line selective telephones, "sure-ring" telephones, "non-interfering" telephones, a new type of portable desk telephone and two types of receivers.

ALTERNATING-CURRENT GENERATORS.—Bulletin No. 1050 of the Allis-Chalmers Company, Milwaukee, Wis., deals with alternating-current generators of the water-wheel type. Each of the machines is constructed with a stationary armature and a revolving field. Illustrations are shown of alternators mounted on vertical and on horizontal shafts, and much information is given concerning the performance of the machines, and the details of design which have contributed to its operating characteristics.

ANALYSIS OF COAL.—A descriptive booklet entitled "Little Economics," has been issued by Milton E. Hughes & Company, 324 Dearborn Street, Chicago. After discussing the wastes which exist in the average boiler room, the booklet shows what may be accomplished when proper account is taken of each heat unit obtained from the coal dealer. It is suggested that fuel should be purchased on the basis of the heat units, and mention is made of the fact that the company named is prepared to conduct tests on fuel, boilers, engines, or other machinery.

THE CENTRAL ELECTRIC COMPANY, Chicago, has recently sent out to its trade, a new price list and discount sheet dated April. This price list applies to the company's 1906 general catalogue No. 24 and contains the very latest prices in force on all electrical material. Special attention is called to the fact that new prices are quoted on D. & W. enclosed fuses and safety devices, for which the Central Electric Company is general western agent. This price list should be in the hands of every purchaser of electrical material and any buyer who has not received a copy can secure one on application.

FAN MOTORS.—Special publication No. 7043 of the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., is an attractive bulletin dealing with electric fans and small-power motors. Among the numerous halftone illustrations are shown interior views of homes, offices, stores and banks where electric fans have proved almost indispensable. The motors and the fans, which are also separately illustrated, are either the direct-current or the alternating-current type. The motors are of the constant speed variety and are designed for .05, .08 or .125 horsepower. The alternating-current motors operate on the induction principle and are provided with split-phase windings, the starting coils of which are automatically cut out as the motors reach full speed.

News of the Trade.

THE BUCKEYE ELECTRIC COMPANY and the Jandus Electric Company give 23 Lake Street as their new address in Chicago.

TRIUMPH ELECTRIC COMPANY, of Cincinnati, O., has moved its New York office to the Townsend Building, corner Broadway and Twenty-fifth Street.

KEYSTONE LUBRICATING COMPANY, Allegheny Avenue, Philadelphia, reports Mr. W. A. Campbell as the manager of its Western branch, at 1102 Tacoma Building, Chicago, Ill.

THE NATIONAL BATTERY COMPANY has recently changed its offices from suite 415 to suite 450 in the Old Colony Building, Chicago. The office is under the management of Bertram Smith, who has been doing efficient work for the company during the past year in the western territory.

FAIRBANKS, MORSE & CO., Chicago, have recently sold a large number of their standard mine cars to the Republic Iron & Steel Company, Nassau Ore Company, La Rue Mining Company and the Rhodes Mining Company, for use in these companies' large iron mines in Minnesota.

ELECTRIC WELDING.—A novel arrangement is in use by the Philadelphia Rapid Transit Company, Philadelphia, Pa., for the local welding of track joints. This consists of a small foundry cupola carried on a trolley car and supplied with blast from an electric pressure blower, furnished by the B. F. Sturtevant Co., of Boston, Mass.

THE B. F. STURTEVANT COMPANY, of Boston, Mass., is furnishing direct-connected generating sets, consisting of its own engines and generators, to the Windsor Machine Co., of Windsor, Vt.; Lawton Mills Corporation, Plainfield, Conn.; Simmons Mfg. Co., Kenosha, Wis.; Sanborn Map Co., Pelham, N. Y.; Eagle Brewing Co., Newark, N. J.

AITON MACHINE CO.—On account of the continuel expansion of its business the Aiton Machine Company, of New York, has found it necessary to install a number of new machine tools in its factory at Harrison, N. J. These new tools are all especially adapted to the Aiton work, which is the manufacture of wire, cabling, stranding, insulating and rubber machinery.

FAIRBANKS, MORSE & CO., San Francisco, Cal., now occupy temporary headquarters at 969 Broadway, Oakland, Cal., until they are able to return to their permanent location in San Francisco, where they were recently burnt out. Meanwhile, their many customers are receiving the customary prompt attention and they have never ceased the sale of their well-known specialties, scales, gasoline engines, steam pumps, motors, generators, windmills, etc.

THE GREGORY ELECTRIC COMPANY has just moved into new works at 16th and Lincoln Streets, Chicago. The works occupy practically half a block, and are well equipped with electric traveling cranes, etc., and supplied with excellent railroad facilities, a switch track running into the building. All machine tools are electrically driven, and the endeavor has been to make a model plant throughout perfectly adapted for handling and repairing second-hand electrical apparatus.

THE WM. ROCHE DRY BATTERY CO., of New York, has found its present factory entirely inadequate for the rapidly increasing business and has moved the works to Jersey City where it has a modern plant of sufficient size to fill all orders promptly, a thing which this concern has always endeavored to do. The location of the works is 286, 288 and 290 Clerk Street, Jersey City. The offices and show-rooms are located at 40 West Broadway, corner Park Place, New York City, where a full line in all sizes will be carried.

NORTH ELECTRIC CO., of Cleveland, O., has opened a branch office and warehouse at Kansas City, Mo., where it will carry a large stock of telephones of all kinds, switchboards, construction material and miscellaneous supplies. This branch is in addition to the Dallas branch office and warehouse at Dallas, Tex., and is made necessary in order to take care of the rapidly increasing business in the states adjacent to Kansas City. The company will be prepared to make shipments from Kansas City after May 20. The Chicago office of the North Electric Company has been discontinued. Business west of the Mississippi River will be handled from the Dallas and Kansas City branch offices and warehouses and that east of the Mississippi River will be handled as heretofore from Cleveland.

THE CONNECTICUT TELEPHONE & ELECTRIC CO., of Meriden, Conn., has placed the Pacific Coast agency for its high-grade spark coils with the Geo. P. Moore Co., Inc., of Oakland and Los Angeles, Cal. The establishment of the Moore Company at San Francisco was entirely destroyed by the recent fire, but it has promptly opened up a branch at Oakland and is already carrying a large stock ready for business. The Moore Company carries on hand at all times a complete stock of the well-known "Connecticut" coil. About a year and a half ago, the Connecticut Company realized that there was a chance to improve the electrical sparking equipment of gasoline engines, and with this object in view, began a series of experiments for the purpose of improving this all-important apparatus, with the result that it has produced a coil of very high quality. The Connecticut Company has had 12 years' experience in the manufacture of high-grade electrical apparatus. Nothing but the finest materials enter into its construction.

PELTON WATER WHEEL COMPANY.—Notwithstanding the complete destruction of its San Francisco works in the great fire, the Pelton Water Wheel Company was particularly fortunate. All drawings, books and cost records, so essential to a manufacturing concern, were saved, together with several years' correspondence. In addition, this company has had under construction for several months past new works in San Francisco. These were outside of the fire zone and are being rushed to completion, so that they will be running as usual within a couple of months. In the meanwhile, the well-equipped shops of the company at New York will be utilized for the fulfillment of current orders, so the business will continue practically without interruption. Temporary offices have been established at 1259 Alice Street, Oakland, Cal., to which communications should be addressed. The Atlantic Department is as formerly, 143 Liberty Street, New York. Correspondence is solicited and estimates promptly furnished upon receipt of data.

THE UNDERWRITERS' LABORATORIES of Chicago have started their factory inspection service of flexible tubing at the following factories: The Alphaduct Manufacturing Company, of New York; the American Circular Loom Co., of Chelsea, Mass.; The Osburn Flexible Conduit Co., of Hoboken, N. J. Similar service on unlined conduit is now being made at the factories of the American Circular Loom Co., of Kenilworth, N. J.; Enamel Metal Co., Pittsburg, Pa.; Mark Manufacturing Company, Zanesville, O.; National Metal Moulding Co., Pittsburg, Pa., and Safety Armorite Co., Pittsburg, Pa. Factory inspection services in other lines will be started in the near future. In order to handle the various factory inspections to advantage, as well as their other laboratory work, the Underwriters' Laboratories have established branch offices in various cities and now have representatives in the following places: Chicago, main office and laboratory; New York, Boston and Buffalo, and expect to start branch offices in the near future in Pittsburg and Schenectady. The Wire Inspection Bureau, affiliated with the Underwriters' Laboratories, is now conducting factory inspection service at the establishments of twenty manufacturers of rubber covered wire.

NATIONAL BRAKE & ELECTRIC COMPANY, of Milwaukee, Wis., has issued an announcement to the trade as follows: "The plant and other assets of the National Electric Company were this day formally transferred to the National Brake & Electric Company, a corporation of Wisconsin with a paid-up capital of $1,000,000. The new company, as successor of the Christensen Engineering Company and the National Electric Company, will continue to manufacture air brakes and electrical machinery with extended facilities and abundant working capital. In soliciting a continuance of the patronage with which its predecessors in the business were favored, it takes pleasure in assuring prompt attention to orders, superior workmanship and reasonable prices. As the pioneers in the manufacture of motor driven air compressors and in the adaption of air brakes for electric traction service, it proposes to maintain its leadership by the development of improved devices to meet the new conditions due to the more exacting demands of the present day trade. To facilitate prompt attention to all inquiries referring to prices and sales of its product, the general sales office has been located at No. 519 First National Bank Building, Chicago, Ill., where all correspondence referring to same should be addressed."

THE STANDARD ELECTRICAL WORKS, formerly located at 120-130 New Montgomery Street, San Francisco, have opened a permanent office in the Atlas Building, a 10-story fireproof building at 604 Mission Street, where they have leased office room comprising one-half the ground floor and all the basement for store rooms and are now in a position to fill any and all orders for electrical supplies with their usual promptness. Mr. H. C. Thaxter has assumed the management of this concern and with his usual promtness has chosen one of the best locations in the city for the new headquarters of the firm, whose many friends will be pleased to learn that they have a large stock of supplies on hand ready for immediate delivery. The company still remains one of the leading electrical supply houses on the Pacific Coast as Western agents for the following Eastern manufacturers: Simplex Electrical Co., Simplex Electric Heating Co., Electric Machinery Co., Mechanical Appliance Co., Century Electric Co., American Vibrator Co., Triumph Electric Co., Warren Elec. Mfg. Co., Commercial Electric Co., Jandus Electric Co., Lafayette Elec. Mfg. Co., Duncan Elec. Mfg. Co., Jewell Elec. Instrument Co., DeVeau Telephone Mfg. Co. The Atlas building suffered comparatively little damage from the earthquake or fire. The windows were broken and the woodwork in the upper stories was scorched.

ABNER DOBLE COMPANY.—We have received the following copy of a letter sent out by that company: "During the recent San Francisco fire we suffered some loss, our offices and shops being burned, but we are already resuming business on a larger scale than ever before. We have opened temporary offices at 2611 Broadway, San Francisco, where the business of the company is being conducted for the present. We also have a branch office in Oakland at 668 Broadway. We have now under construction large and new permanent shops and warehouses at Seventh and South Streets, in the Potrero District, where we will have the most completely equipped works on the Pacific Coast. By May 15th part of our manufacturing stablishment will be running full force, and within a very few weeks our entire plant will be in complete operation. We lost in the fire some of our correspondence and drawings. In order to check up our files and make our records complete, we should like to have you send us as soon as possible, copies of all recent correspondence with you that refers to work which has not been closed up. We should also like to have copies of all drawings and blue prints sent you and sent by you to us before the fire. Our organization is intact and we are now ready to take orders and to carry on our business as before. Your efforts in helping us to complete our files will assist us materially and will be very greatly appreciated."

NEW YORK LUNKENHEIMER STORE.—The Lunkenheimer Company of Cincinnati, O., the well-known manufacturer of high-grade engineering specialties, has opened a well-equipped branch store, at 66-68 Fulton Street, New York City. Heretofore the Lunkenheimer Company maintained a suite of offices at 26 Cortlandt Street, through which the export trade of the concern was transacted. While the trade in New York City and Eastern States were able to a great extent to procure Lunkenheimer engineering appliances from the various supply houses, the increased demand necessitated the opening of a branch from which the supply houses and trade in the New York territory could be instantly accommodated. The same courteous attention characteristic of the company will be found to prevail in its new establishment. Being grateful for the patronage of the Eastern trade, it is its endeavor to accommodate the trade by prompt attention to all orders, to do which it has gone to large expense by opening its New York branch store and equipping it with a large and complete line of its many specialties.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 8, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

819,706. ELECTRICAL MEASURING INSTRUMENT; Theodore Abtmeyer, Wilkinsburg, Pa. App. filed Sept. 10, 1904. A form of electric meter having a stationary and a movable coil which are displaced relatively to one another by the current. The motion is counteracted by a tensile spring, the force of which is adjusted and indicated by a pointer and dial.

819,707. AUTOMATIC SPEED INCREASING DEVICE; George Baehr, McKeesport, Pa. App. filed Sept. 17, 1904. A self regulating system for electric motors whose armatures are constantly under load, comprising a motor, a source of current therefor, and automatic means controlled by the load on the motor and arranged to decrease the strength of the motor-field when the load on the motor armature is increased, and to increase the strength of said field when the load on the motor armature is decreased.

819,738. ELECTRIC MOTOR CONTROL SYSTEM; Adolph H. Daus, Chicago, Ill. App. filed Mar. 17, 1905. A motor control system for operating a cut-out in case the motor armature becomes accidentally grounded. The apparatus is arranged to be sensitive to the flow of a small grounded current but independent of any normal motor current.

819,770. SYSTEM OF ELECTRICAL DISTRIBUTION; Benjamin G. Lamme, Pittsburg, Pa. App. filed June 30, 1904. The combination with a dynamo-electric machine having a shunt field-magnet winding, of an auxiliary machine having its armature in the field-magnet circuit of the main machine and its field-magnet winding in series relation to the main distributing-circuit, and a motor for driving said auxiliary machine having its armature connected across the main distributing-circuit and having a shunt field-magnet winding and an opposing series winding, the magnetic circuit of the motor being saturated under no-load conditions.

819,779. OSCILLAPHONE; Walter W. Massie, Providence, R. I. App. filed Aug. 18, 1905. A conducting pencil bridges across a pair of carbon plates or terminals, and in a magnetic field produced by a permanent magnet in the base plate.

819,787. CONTROLLER FOR SYNCHRONIZING SWITCHES; Hugh J. McMahan, Monessen, Pa. App. filed Apr. 10, 1905. A two-armed lever has spring connected cores for a pair of solenoid magnets in the branches of the different generator circuits. Said lever controls a switch lever which connects the generators into circuit at the proper instant.

819,793. ELECTRIC INCANDESCENT LAMP; William J. Phelps, Detroit, Mich. App. filed June 1, 1903. Detail construction of electric lamp having a normal candle power and a dim candle power filament. A spring plate is disposed over the usual central stud of the lamp so as to cut out the low candle power filament when the lamp is screwed tightly in place.

819,804. COMBINED SASH-LOCK AND BURGLAR ALARM; James B. Ridge, Brooklyn, N. Y. App. filed May 20, 1905. An attachment for an ordinary window sash having a spring detent roller, the displacement of which when the window is opened causes an alarm bell to ring. The attachment also has a locking bolt to prevent the window being open when desired.

819,806. ELECTRIC BLOCK SIGNAL FOR RAILWAYS; Walter E. Sands, Brooklyn, N. Y. App. filed Mar. 18, 1905. A block signal system specially adapted for pleasure railroads. Includes a special conductor or trolley divided into sections and a brush or shoe depending from the cars which makes contact therewith to close certain signal circuits within the car.

819,814. INITIATION APPARATUS; John M. Siebert, Pekin, Ill. App. filed July 24, 1905. An initiation apparatus having specially constructed shoes with conducting soles, and conducting strips for completing a circuit from the induction coil to the shoes.

819,815. ELECTRIC REGENERATOR; Joel C. Slaughter, Dallas, Tex. App. filed July 28, 1902. An electric generator comprising two or more induction coils, and a condenser; the delivery ends of the primary wires of said induction coils being connected to the ends of the secondary coils, and the other ends of the primary coils adapted to be electrically connected to an alternating-current generator, and the other ends of the wire forming the secondary coils, being in electrical connection with the condensing-plates of the condenser, substantially as described.

819,816. SYSTEM OF MOTOR CONTROL; Harve R. Stuart, Wilkinsburg, Pa. App. filed Jan. 20, 1904. A rheostat arm moves over circularly arranged contacts so as to cut in and out controlling resistance for the motor. The rheostat arm is moved by worm upon the shaft of the controlling or pilot motor.

819,820. VENTILATING MEANS FOR INCLOSED MACHINES; Egbert M. Tingley, Pittsburg, Pa. App. filed Mar. 17, 1905. A system for ventilating enclosed generators and motors to prevent access of moisture laden air from the engine room, etc. Has chambers in which the air circulates before its passage into the motor.

819,821. ELECTRIC SWITCH; Allen A. Tirrill, Schenectady, N. Y. App. filed Dec. 11, 1902. A form of snap switch adapted to be secured to the ceiling and having means for indicating the condition of the switch relative to the respective circuits. For this purpose the switch has an indicator projecting through the cover so as to show the position of the switch.

819,822. SNAP ELECTRIC SWITCH; Allen A. Tirrill, Schenectady, N. Y. App. filed Sept. 26, 1904. Another form of snap switch designed to be placed on a ceiling and operated by a depending cord or chain. Relates to details of the operating spring and detents.

819,832. SYSTEM OF ELECTRICAL DISTRIBUTION; Joseph L. Woodbridge, Philadelphia, Pa. App. filed Apr. 19, 1905. The combination of alternating and direct-current circuits having an appropriate converter operatively connected between them, a battery and booster, operatively arranged in respect to the direct-current circuit, a booster-regulator, and solenoids interposed in the generator circuits of the direct and alternating system and operative arranged in respect to the booster regulator, substantially as described.

819,873. BURGLAR ALARM; William N. Fawcett, New York, N. Y. App. filed May 19, 1905. Details of a burglar alarm system including contacts on the various doors of a building so as to give an alarm when any door is moved. Special circuits are provided for indicating which door of the series is the one moved.

819,933. REGULATION OR CONTROL OF DYNAMO ELECTRIC MACHINES OR ELECTRIC MOTORS; Charles P. E. Schneider, Le Creusot, France. App. filed Oct. 22, 1904. In a dynamo or motor regulator, the combination of an armature, a plurality of field-magnet poles, a plurality of pole extension pieces in rows intermediate said magnet poles and armature, guide means for said extension pieces, and a revoluble supporting frame for each row of said pieces.

819,935. ELECTRIC INCANDESCENT LAMP; Carl Schubel, Vienna, Austria-Hungary. App. filed Sept. 25, 1905. The combination with an incandescent electric lamp having a bulb and leading-in wires; of a bridge at the bottom of the lamp to support the outer wires forming a free space between the end of the lamp and bridge, the joint between the outer wires and the leading-in wires being contained in said free space.

819,971. ELECTRIC MOTOR AND GENERATOR; John F. Beck, Chicago, Ill. App. filed Mar. 2, 1903. The combination with an armature-body provided with a circular series of notches or winding recesses, of a lap-winding arranged upon said armature body and engaging said recesses, said winding consisting of circumferentially-extending relatively short and long coils, each recess being engaged by a plurality of coils, of which the short coils extend therefrom each way to the next circumferentially adjacent recesses while the longer coils extend therefrom each way to other more remote recesses.

820,025. ELECTRIC DENTAL FURNACE; Daniel G. Steinecke, New York, N. Y. App. filed May 23, 1905. In a furnace, a base having electric contacts forming terminals of an electric circuit, standards secured to the base, a casing open at its top between said standards, a metal cylinder resting in the open end of said casing, said cylinder being filled with refractory material, and said refractory material being provided with a central opening, a muffle in said central opening and an electric heating circuit in the walls of said muffle and terminating in electric contacts to complete the circuit with the source of electricity of making electrical connection with the said electric contacts of the base, substantially as described.

820,031. PROCESS OF REDUCING CALCIUM OXID; Thomas L. Wilson, New York, N. Y. App. filed Jan. 28, 1896. The herein-described process of reducing calcium oxid by the action of carbon commingled therewith and the heat generated by an electric arc, which consists in establishing an electric arc between suitable poles, embedding the arc within a charge of calcium oxid and carbon, reducing portions of the charge, accumulating the product into a mass, thereafter employing said mass as one pole of the arc and maintaining the arc as the the mass accumulates by gradually moving one of the poles of the arc, keeping unreduced portions of the charge around the arc, thereby retaining the heat of the arc and concentrating it upon the work to be done, and substantially excluding the air from the zone of reduction and permitting the escape of the gases produced by the reduction.

820,040. BATTERY PLATE; Owen H. Fay, Chicago, Ill. App. filed Aug. 19, 1904. A battery plate comprising end bars, a series of longitudinal bars provided with a series of rearwardly-flaring grooves, and a series of strips extending across the opposite faces of the plate, and in staggered relation to each other.

820,041. MEANS FOR ACTUATING SIGNALS; Anthony B. Ferdinand, Milwaukee, Wis. App. filed Sept. 8, 1903. An alarm for indicating when a pneumatic tire is deflated. The tire has a push rod incorporated therein which is moved to close an alarm circuit by contact with the ground when the tire is not fully blown up.

820,047. DRY BATTERY; Charles J. Hirlimann, Fort Lee, N. J. App. filed May 25, 1905. A form of dry battery which can be recharged or renewed as often as desired. The carbon element is hollow with longitudinal slots therein and contains a predetermined quantity of liquid excitant suitable to the needs of the cell. In order to recharge the battery it is merely necessary to remove a stopper and fill the carbon element with reagent and then replace the stopper. The reagent gradually soaks into the absorbent material of the cell.

820,063. SELECTIVE TELEPHONE SYSTEM; Noble S. McKinsey and Anton R. Nelson, Susanville, Cal. App. filed June 15, 1904. A selective telephone system comprising a series of telephones, two line wires, one connected to the ground, a resistance therein to kill the ground when the metallic talking circuit is closed, bridges between the line-wires at the respective telephones of the system, means in each bridge for controlling its telephone, and means at each telephone for connecting the other line-wire with the ground, whereby all the bridges are placed in multiple on a circuit through the line wires and ground, substantially as described.

820,064. SELECTIVE TELEPHONE; Noble S. McKinsey and Anton R. Nelson, Susanville, Cal. App. filed Dec. 27, 1904. In a selective telephone system, a party line of which one wire grounds at central, a resistance therein at central greater than that of any talking circuit in the system, means for connecting at central the other wire of said line with the corresponding wire of any other party-line of the system, selector-magnets at each station bridging the wire of the party-line, and means at each station for grounding said other wire, substantially as described.

820,076. PANEL SWITCH AND CUT-OUT; John H. Trumbull, Plainville, Conn. App. filed May 25, 1904. Details of a cut-out having a manually operated circuit breaker and an automatic circuit breaker included on the same panel. Relates particularly to the details of construction.

820,090. MINE GATE; Newton K. Bowman, North Lawrence, O. App. filed Mar. 10, 1905. A gate is provided across the track at the entrance to a mine which gate is normally closed by spring connections. As the car approaches it depresses certain mechanical connections which displace the gate and provide a continuous trolley conductor for the car.

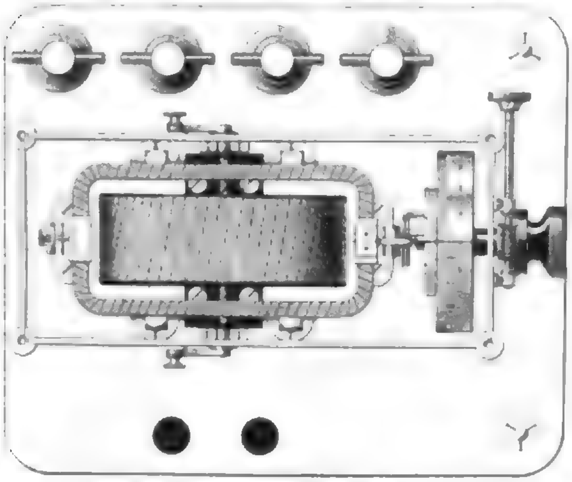
820,113. WATER PURIFIER; Frank B. Hinkson, New Castle, Pa. App. filed May 31, 1905. The water is made to pass through a restricted space between electrically charged plates concentrically arranged, by which the water is purified and sterilized.

820,119. AUTOMATIC ELECTRIC CIRCUIT CHANGER OR SWITCH; Frederick T. Kitt, Denver, Col. App. filed Feb. 15, 1904. A solenoid has a vertically movable core carrying a switch blade and having cam means by which the switch blade turns through 90 deg. at each actuation and thereby completes one of two separate circuits alternately.

820,143. RAILWAY SIGNALING AND SAFETY SYSTEM AND APPARATUS; Georges M. Schreiber, Roubaix, France. App. filed Nov. 15, 1904. A complete railroad signal system having contact connections along the track for automatically blowing the whistle of the locomotive in case it passes a danger signal.

820,169. RESONANCE CIRCUIT; Georg von Arco, Berlin, Germany. App. filed Oct. 4, 1905. A resonance circuit containing a conductor consisting of a stranded wire composed of a plurality of insulated strands the conductive material of each strand being .2 millimeter or less in diameter, substantially as described.

820,176. TELEPHONE SYSTEM; Charles L. Boyce, Detroit, Mich. App. filed Mar. 7, 1902. The combination in a telephone central-station switchboard apparatus, of a line-relay in a main telephone-circuit; a supervisory signal associated with a switch-cord; a local supervisory circuit containing said signal; an auxiliary relay with a winding of high resistance also included in said local supervisory circuit to reduce the strength of current therein and prevent the operation of said signal; and a shunt or short circuit round a portion of said high resistance winding leading through contacts of said line-relay, and controlled by said line relay, to cut out said portion, and prevent the display of said supervisory signal when said relay is unexcited, and to leave said portion in said circuit, when the same is excited; substantially as described.



819,706.—Electrical Measuring Instrument.

820,186. DEVICE FOR COVERING AND PROTECTING CHARGED RAILS; Gustave Egenolf, New York, N. Y. App filed Nov. 25, 1904. A form of housing for third rail contacts having a V-shaped roof which is hinged so as to move over the rail and in protecting relation therewith under normal conditions, but which can be folded back to inspect or repair the rail when desired.

820,187. AUTOMATIC EXCHANGE SELECTOR; Claude D. Enoches, La Crosse, Wis. App. filed Oct. 16, 1905. In a selector for an automatic telephone-exchange, the combination with a rotatably-mounted ratchet wheel, of a stepping pawl, and a retaining-pawl for controlling the rotation of said wheel, and an electromagnet having a quick-acting armature and an armature possessing considerable inertia for controlling the operation of said pawls.

820,211. ELECTRICAL CONNECTION FOR SWITCHBOARDS; Hubert Krantz, Brooklyn, N. Y. App. filed July 21, 1903. The terminal is made with a conical stud and the connection has a correspondingly coned recess which is engaged upon the stud by a machine screw so as to be forced into firm engagement therewith.

820,238. EXPLOSION TURBINE; Augustus L. Moss, Sandusky, O. App. filed Mar. 17, 1905. A diagram of circuits for causing break spark ignition in a plurality of cylinders which form pressure reservoirs for driving the turbine wheel.

820,258. DETECTOR FOR ELECTROMAGNETIC WAVES OR THE LIKE; Ragnar H. Rendahl, Berlin, Germany. App. filed Apr. 18, 1905. In apparatus of the character described, the combination with an electrolytic detector, of means for varying the non-energy-consuming property or factor of said detector independently of the energy consuming properties thereof.

820,260. ELECTRICAL SWITCH INDICATOR; William A. Rideout, Sr., Oshkosh, Wis. App. filed Dec. 11, 1905. The movements of the switch point are effective to close separate circuits through a pair of magnets. The magnets are effective to move a semaphore arm or exhibit signal lamps at a station in the path of the train.

820,280. TROLLEY STAND; Warren W. Annable, Grand Rapids, Mich. App. filed Jan. 31, 1905. A trolley pole retrieving device which is only operative in case the trolley pole is about to strike a guy wire. A wire is stretched in front of the pole when the latter leaves the trolley conductor, and if this wire encounters an obstruction it moves a trip which lowers the pole.

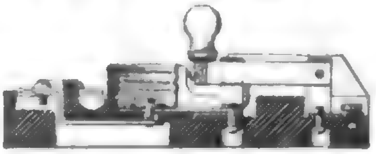
820,282. ELECTRICAL WATER HEATER; William A Brown, Oakland, Cal. App. filed Apr 6, 1905. The resistance element is supported within a perforated casing through which the water circulates. The resistance element is ribbed or corrugated for the purpose of having its heat more efficiently conducted to the water.

820,321. OUTLET OR JUNCTION BOX; Clarence C. Sibley, Perth Amboy, N. J. App. filed Dec. 21, 1903. A form of junction box adapted to receive mouldings which are specially formed of sheet metal. The parts are arranged to be fastened together by metallic ears on the sheet metal mouldings.

820,322. ELBOW FOR CONDUITS FOR ELECTRIC WIRES; Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. App. filed Oct. 23, 1905. Relates to sheet metal mouldings and particularly to an elbow or corner connection therefor which can be bent to varying angles.

820,327. SEWING MACHINE MOTOR; Harold R. Wellman, Riverside, Ill. App. filed Aug. 17, 1905. The entire motor is swiveled on trunnions and has a pulley or driving disc with a curved face concentric with said trunnions. By this arrangement the motor is effective at various angular positions upon its trunnion supports. The transmission speed varying according to the angle.

820,331. REVERSING SWITCH; John N. Anderson, New York, N. Y. App. filed June 23, 1905. A reversing switch for elevators including a single controller shaft having blades secured thereto by special insulated fastenings, and cooperating with stationary contacts.



820,076.—Panel Switch and Cut-out.

820,333. ELECTRICITY METER FOR ALTERNATING CURRENTS; Hermann Aron, Charlottenburg, Germany. App. filed May 27, 1904. Has the ordinary disc element and an electromagnet with shunt coils thereon. A small series coil is arranged between the poles of the electromagnet. The momentum imparted by this rotative field to the disc is proportional to the energy.

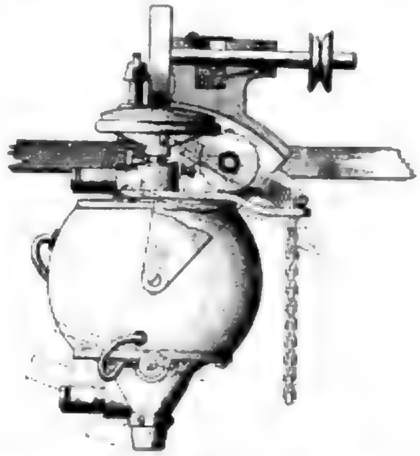
820,348. VAPOR ELECTRIC APPARATUS; William R. Burrows, Newark, N. J. App. filed Mar. 10, 1905. A frangible vessel having a leading-in conductor, said conductor consisting in part of platinum embedded in the wall of said vessel, said conductor having another part consisting of non-amalgamating metal, and a body of mercury surrounding said last-named part and contacting therewith.

820,350 SIGNALING SYSTEM FOR TELEPHONE TRUNK LINES; Merritt S. Conner, Chicago, Ill. App. filed Apr. 9, 1900. The combination with telephone-lines and a trunk-line for uniting them, of a signal in the trunk-line and a source of current in a bridge thereof at one terminal station; a repeating coil at the other terminal, said trunk line being severed and having its severed terminals united through the windings of the repeating coil to form two conductively separated but inductively-continuous circuits, and a high-resistance signal-controlling magnet in the portion of the trunk-line leading to the first-named office, the said resistance being sufficient to prevent the operation of the signal in the circuit therewith; a source of current and a relay magnet in the other portion of the trunk line adapted for connection with the called line, and a shunt of the high-resistance signaling-controlling magnet controlled by said relay, as described.

820,360. MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES; Milo G. Kellogg, Chicago, Ill. App. filed Feb. 13, 1892. In a telephone exchange system, two metallic circuit lines, each permanently closed at the central office through the helices of a polarized call-annunciator and the two lines temporarily switched together for conversion into a single metallic circuit with the annunciators connected so as to respond to the same polarity of current, in combination with a clearing-out annunciator in a bridge or cross connection to said metallic circuit and responding to a current of the other polarity, calling and commutator apparatus at each subscribers' station to send at will calling currents of either polarity, and an operator's cord system including plugs and a calling generator adapted to send to line a current of such polarity only as not to operate the line-annunciators, substantially as set forth.

820,363. CONDENSER; Walter W. Massie, Providence, R. I. App. filed Mar. 2, 1905. A form of condenser having plates with tin foil coatings and slidable rods by which any desired number of the plates may be cut into or out of the condenser.

820,364. VACUUM TUBE REGULATOR; Daniel McF. Moore, Newark, N. J. App. filed Aug. 21, 1905. A device for maintaining the vacuum constant in vacuum tube illumination systems. An air inlet through a porous plug of carbon is normally sealed by mercury, but the mercury is displaced by the armature of a magnet when the circuit conditions require a less vacuum.



820,327.- Sewing Machine Motor.

820,365. VACUUM TUBE REGULATOR; Daniel McF. Moore, Newark, N. J. App. filed Feb. 7, 1906. Covers the method of the above described apparatus.

12,480. PUSH BUTTON ELECTRIC SWITCH; William C. Tregoning, Hackensack, N. J. App. filed Apr. 16, 1906. A snap switch having two switch elements and a pair of push buttons which tension a spring, to move the switch elements abruptly to open the circuit.

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The Atlantic City Meeting.

It seems almost unnecessary to urge our central station readers this year to attend the annual meeting of the National Electric Light Association. The reports as to the preparations indicate a very large attendance at Atlantic City, and the natural attractions of the place appeal this year to a membership that has grown very rapidly of late. It is true that in itself Atlantic City has no great electrical engineering features that might appeal to the curiosity or professional interest of central station managers; but it was long ago discovered that some of the most successful meetings of such bodies are those held in places entirely without attractions of that character. A desirable rendezvous is essential, but the main thing is to offer a programme of useful papers and inviting topics of discussion.

In regard to its programmes the National Electric Light Association has made sharp and distinct improvement in recent years, and moreover has not found it necessary to subdivide itself on a trinitarian basis, like the street railway association. While not losing the strong grasp it has always had on the technical side of the art, it has done more and more to bring within its survey questions of economy, management, rates, securing business, cultivation of new fields and all the problems that belong to the central station commercially considered. And while all the points worthy of discussion may not be raised on the floor of the convention, the larger basis of membership insures that the most casual conversation, with other managers, along the breezy boardwalk, can be made to yield its quota of experience and data. The association is, indeed, to be congratulated upon the manner in which it has enlisted and retains the active support of all that is representative and influential in the art for which it stands, and sees these men at its annual conventions.

The Pike's Peak Plant.

Our Western friends never hesitate to play the limit when it seems good policy so to do, and the remarkable hydro-electric plant which we describe this week is an excellent example of this strenuous logic. It employs the highest head yet attempted—2,200 feet after all deductions for friction of pipes, producing a pressure of close upon 1,000 lbs. per square inch. The mere head would give the plant a claim to most respectful consideration; but in addition it possesses features of exceptional structural interest and typifies two important tendencies of modern hydro-electric work, in that it utilizes otherwise wasted head from a city water system and employs the artificial storage usually incident to water works. The general hydraulic arrangements are those usually followed in high-head plants. The pipe line is carried on moderate gradients over as much of the route as is practicable, and terminates in a nearly straight pressure pipe plunging down a steep slope to the power house and graduated in thickness to meet the increasing pressure. In this instance the lower part of the 21-inch pressure pipe is of ¾-inch steel riveted with external and internal straps to strengthen the joint. The installation of this pipe involved some unusual engineering features, such as the use of a narrow gauge cable railway for its transportation and the anchorage of the line by bedding it in solid concrete in the rather numerous rock cuts along its course. In this way the line was made secure under conditions that were exceptionally difficult.

The power house, for the site of which it was necessary to cut extensively into the side of the mountain, is of unusual design. As usual, the length is parallel to the pipe line but the tail race runs obligingly under the power house and takes the form of a wide tank into which the service pipes, extending at an angle of 45° from the tapered receiver, can discharge through the nozzles. The shafts of the generators are therefore at the same angle with the axis of the power house, and the machinery is so compactly placed that the generator room, which includes the wheels, has an area of only about 1¼ square feet per kilowatt of capacity. As the water is all utilized so that the capacity is determinate, the station is built without reference to extension. The switchboard is on a slightly raised platform midway the longer side of the building opposite the generators, and from it the whole situation can be taken in at a glance. The most interesting part of the power station is the tail race. At the head used the jets cannot be controlled by valves, and deflecting nozzles must therefore be used. This involves the serious question of defence against the tremendous jets from the deflected nozzles, issuing in this case at the enormous velocity of nearly 380 feet per second. No solid material could long endure under such an impact, hence the extremely neat device of catching the jets in a combined tail race and settling tank, defended on its outer wall by cast-iron baffle plates to take care of the remaining velocity. This method has proved effective in disposing of the velocity matter, and the nozzles can be deflected without any fear as to the results.

One of the curious questions raised in this plant is that of wheel efficiency at such enormous heads. Under test the three wheels now installed showed an average of a trifle less than 65 per cent efficiency, as against 80 per cent or a little better for impulse wheels under ordinary heads. The change is obviously due in the main to the increased frictional losses arising from the extreme jet velocity at impact. The loss is a serious one, for the discrepancy amounts to nearly 25 per cent of the plant capacity, say 750 kilowatt for the whole plant. Whether this loss could be materially reduced by extreme care in shaping and polishing the wheel buckets, and whether the surface could be maintained if produced, are questions of doubt. The condition inevitably raises the question whether it would not be worth while in such extreme cases to utilize the water in two or more stages, in spite of the extra cost of building and operating separate stations. An addition of 700 kilowatt to the salable output by getting back to normal wheel efficiency would cover no inconsiderable extra cost, and besides would probably lower the maintenance of the hydraulic machinery. There are few data on wheel performance under very high heads, but what exist all point to increased losses. Inasmuch as high-head plants are in most respects very advantageous, and in them economy of water is extremely important, it would seem that a somewhat critical examination of impulse wheel efficiency would be in order for the purpose of determining the loss of efficiency with increase of head, and the means if any by which it may be averted. It may turn out that all things considered it would pay best to split up extreme heads into several stages, operating the resulting stations in parallel. In cases like that in hand, the loss of efficiency is so great as to demand critical examination.

Lightning and Lightning Protection.

One of the most interesting sociological facts elicited by the Weather Bureau in its recent report on lightning conductors is that the lightning-rod and the lightning-rod man are not so much in evidence as they were thirty years ago. According to the data afforded by the decennial census reports, the annual value of lightning-rod products fell from $1,374,631 in 1870 to $483,296 in 1900. This decline in the lightning-rod business, in spite of the rapid increase in the number of buildings, is an economic feature of modern history for which various explanations have been offered. Perhaps the policy of those corporations which insure buildings against damage due either to fire or to lightning has been one of the main causes. At all events, it is doubtful whether the average owner of a building has changed his views concerning the efficacy of lightning rods during the past thirty years. Tall chimneys and spires continue to have lightning rods erected upon them. The widespread introduction of the steel building has, of course, rendered the lightning rod unnecessary for the protection of the modern skyscraper. Unless, however, all new buildings were constructed of structural steel, we may be assured of a continued and fairly definite average annual damage to property by lightning.

Not only may we continue to expect loss of building property, but we must also be prepared for loss of life. A person staying within a modern steel office building, is as completely protected from lightning shock as science can indicate, and we have yet to hear of injury by lightning to such buildings, or to those within them. But to persons out of doors during thunderstorms or within ordinary buildings incompletely protected, there must always be a certain risk of injury from lightning, although it is usually a very small risk. The number of persons killed by lightning during the year 1899 in the United States, is stated to have been 563, and the injured 820. The deaths through lightning were, therefore, only about one-twentieth of one per cent of the total number of deaths. Electrical circuits must likewise continue to be exposed to injury from lightning unless they are placed underground. No pole line can claim absolute immunity from lightning injury, however complete its protection may be. At the same time we may reasonably expect to reduce the damage and the risk of damage to a minimum by judicious protection of lines across country, and of apparatus in buildings. Great improvements have already been made in these directions.

It is strange how little precise information is yet in our possession on the subject of the lightning discharges. We have only a very imperfect notion as to the magnitude of the electromotive forces involved. Air, at ordinary temperatures and pressures, has strength to resist about three kilovolts per millimetre between flat parallel electrodes well separated. Consequently, at the same rate, a stratum of air one kilometre thick would call for a total breaking stress of three million kilovolts. This may be an upper limit to the voltage of a vertical lightning flash one kilometre long. At a height of a kilometre, the barometric pressure would be about twelve per cent less than at the earth's surface, and the dielectric strength of the air would be less in like proportion; so that even allowing the strength of the uppermost layers, we would require at the same rate 2.64 million kilovolts. But air stressed to 2.64 kilovolts per millimetre contains 300 ergs of electric energy per cubic centimetre, and if the kilometre lightning flash discharged a surface area of one square kilometre or released the energy in a cubic kilometre of air at such stress, it would liberate three million metre-tonnes, or about nine million foot-tons of energy. This energy would suffice to bring to an incandescent temperature a flashing cylindrical column one kilometre long and 120 metres in diameter—probably far in excess of the size of ordinary lightning flashes. We are therefore compelled to assume either that a lightning flash a kilometre long does not release the electric stress very far in a radial direction, or that the average breaking stress of the air is less than 2.6 kilovolt per millimetre. If the area of the released column were reduced to a square hektometre, which seems a very moderate discharging area, and the dielectric strength averaged a kilovolt per millimetre, the lowest experimental value between needle point electrodes, the flashing voltage would be 500,000 kilovolts and the incandescent flashing column might still be about two metres in diameter, a more reasonable diameter for a lightning flash.

It is also very doubtful whether lightning flashes are oscillatory in character. There seems to be no experimental evidence as to oscillation, such as a moving camera might produce in photographing a flash. On the other hand, the electric resistance of the flaming discharge path may well be so large relative to the capacity and inductance of the discharging system as to make oscillation impossible, and a single subsiding discharge the necessary condition. In any case, however, the suddenness of a lightning discharge must be as great as would correspond to a relatively high frequency if the discharge were oscillatory; and secondary induced disturbances in local conductors must often be oscillatory. Observers of lightning might do well if they could mount a camera on a suitable axis, and revolve it, with exposed plate, at a reasonably definite rate at night on the approach of a thunderstorm, so as to gain evidence of the duration or oscillation of lightning discharge.

Surges in Underground Distributing System.

The last number of the *Journal* of the Institution of Electrical Engineers contains a paper on the City of London Works distributing system. The distributing system is three-phase, at 50 cycles per second, and 10 kilovolts. The high-tension feeders are paper-insulated, three-conductor, lead-sheathed cables. Motor-generators in sub-stations distribute direct currents to the consumption mains, with the aid of storage batteries. The coal consumption is shown to average slightly less than 4 lb. per kw-hour delivered to the high-tension feeders. A research was instituted upon the magnitude of the voltage surges capable of being set up in a distributing cable during the operations of switching. The observations were made with the Duddell oscillograph. A number of the oscillograms accompany the paper. It was found that when a three-conductor feeder several miles in length had its conductors connected successively to the high-tension bus-bars, the maximum induced e.m.f. between a given pair was sometimes about double that of the bus-bars. No appreciable surge occurred at disconnecting. In order to avoid the possibility of resonance it is considered preferable to switch a cable in at normal frequency but low voltage, and gradually to raise the voltage to that of the bus-bars, rather than to vary the frequency during the process. Spark-gaps in the central station are permanently provided between opposed plates or strips of carbon and copper. The sparking distance between them is 4.5 mm. for 10 kilovolts, and it is stated that they will discharge at 12 kilovolts, or on a rise of 20 per cent above working voltage. A non-inductive liquid resistance is inserted in the path of each discharger. There is also a small transformer in the ground circuit which operates an electric bell or other indicating device when a spark discharge occurs, so that the time of the discharge may be noted by the station attendant.

The oscillographic results thus obtained are in conformity with those which have been obtained elsewhere. It is found that there is no liability to dangerous surging when a feeder is disconnected from high-tension bus-bars by an oil switch. That is, the operation of disconnecting a feeder, either under normal load, or under light load, gives rise to but little oscillatory disturbance, either in the feeder that is removed or in the rest of the system. On the contrary, when a feeder is thrown on to the high-tension bus-bars of a station, there is likely to be a surge produced in the feeder, the magnitude depending upon the way in which the contact is made, and also upon the particular phase of the e.m.f. wave at the bus-bars when contact is established. The maximum value of the surge e.m.f. is limited to twice the impressed e.m.f., except in special cases of resonance. Moreover, since the surge is of extremely brief duration, a cable that is capable of sustaining for, say, one minute, a voltage 100 per cent in excess of the normal, should readily be able to withstand a momentary surge voltage of this magnitude. Abnormal conditions, such as spark discharges through faults or defective switches, may, of course, produce surges of much greater amplitude than 100 per cent overvoltage.

A number of interesting diagrams are appended to the paper, showing the oscillographic records obtained over certain telephone circuits, when the letters of the alphabet were spoken into the transmitter. Although these are very interesting and instructive they are very hard to harness to arithmetic, not only because the vocal pitch of the fundamental spoken sounds is not appended, but also because our existing theories of telephone transmission require us to consider one frequency at a time, and practically the mean frequency as a general representative of all. In the records, however, all of the frequencies, fundamentals and harmonics, are engaged simultaneously in a free-for-all scramble, so that the individual behavior of each alone is lost in the crowd. It would seem, however, that the broad vowel sounds won in the race for amplitude, while some of the consonant sounds appear thin and poor by comparison.

The author fairly and squarely discredits the "*CR* law" of telephonic limit. Since the British Post Office was the last stronghold of that law, in telephonic circuits, these official and final obsequies of the so-called law are matter for general felicitation. Of course, no one disputes the empire of the "law" over telegraph circuits, in which the inductance is very small and the capacity very large. In fact, it is admitted to apply fairly well to paper-and-air insulated telephone cables. The discrepancy is in overhead wires. The modern theory of telephonic limiting range, based upon all of the four constants per mile, i. e., resistance, reactance, leakage and capacity, is duly considered and compared with a series of experimentally determined limiting ranges on different types of telephone circuit. These experimental results are both valuable and timely. They offer to the engineer for the first time the data which have been so eagerly sought by practical telephonists for a number of years.

A. I. E. E. Meeting at Milwaukee.

The twenty-third annual convention of the American Institute of Electrical Engineers will be held at Milwaukee May 28 to June 1, with headquarters at the Hotel Pfister and sessions in the Public Service building on Sycamore Street. The programme is as follows:

Monday, May 28.—Address of welcome. Address, President Schuyler Skaats Wheeler. "Repulsion Induction Motor," by Maurice Milch. "Comparison of Two and Three-Phase Motors," by Bradley McCormick. "Direct-Current Motor Design as Influenced by the Interpole," by Charles H. Bedell.

Tuesday, May 29.—"Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems," by Farley Osgood. "Cell-Type Lightning Arrester," by Prof. E. E. F. Creighton. "Protective Apparatus for Lightning and Static Strains," by H. C. Wirt. Standardization Rules. The proposed revision of the existing standardization rules will be reported for discussion by the Committee on Standardization. "Short-Circuit and Ground Currents in Alternating-Current Systems," by Chas. P. Steinmetz. "The Self-Synchronizing of Alternators," by Prof. Morgan Brooks.

Wednesday, May 30.—"Magnetic Properties of Electrolytic Iron," by Prof. Chas F. Burgess and A. Hoyt Taylor. "Measurement of Temperature by Electrical Means," by Edwin F. Northrup. "The Educational Value of an Electric Test Car," by Prof. Thomas M. Gardner. "The Art of Inventing," by Edwin J. Prindle. "Shunt and Compound-Wound Converters for Railway Work," by W. L. Waters.

Thursday, May 31.—"Electrical Connections for Power Houses," by David B. Rushmore. "Economies Derivable from the Use of Relatively Small Water Powers of Low Head in the Middle West," by Prof. Dugald C. Jackson. "Oscillations and Surges Against Ground in Alternating-Current Systems," by Chas. P. Steinmetz. "Some Fundamental Characteristics of Mercury Vapor Apparatus," by Percy H. Thomas. "Safety Devices for Steam Engines, Turbines and Motors," by Charles M. Heminway. "Some Notes on the Lighting of Churches," by Edwin R. Weeks.

The local committee is Messrs. John I. Beggs, chairman; W. E. Dodds, W. F. Johnson, H. H. Cutler and C. W. Burkett, who have arranged a programme of entertainment, etc.

Programme of the N. E. L. A. Convention.

A partial programme has now been issued for the twenty-ninth annual convention of the National Electric Light Association to be held at Atlantic City, N. J., June 5-8. It is as follows:

"Report of Committee on Rates and Costs," discussion by Charles L. Edgar, chairman, A. S. Knight, Alexander Dow, Robert Lindsay, E. M. Lloyd, R. W. Royce; "Business-Getting Methods," Frank Frueauff; "Report on Theft of Current," C. F. Mordock; "Laws Governing Theft of Current," E. H. Davis; "Fuel Economies," J. H. Hallberg; "Alternating-Current Systems of Distribution and Their Automatic Regulation," Charles W. Stone; "Some Methods Used in Securing and Retaining Business," Norman T. Wilcox, George N. Tidd, George B. Tripp, M. E. Turner, Leon H. Schorck, R. S. Wallace; "Line Construction for Overhead Light and Power Service," Paul Spencer; "Alternating-Current Elevators," W. H. Dickenson, Jr.; "Mechanical Refrigeration," John Meyer; "How to Make a Small Plant Pay," D. F. McGee; "Design and Manufacture of Hydro-Electric Installations as a Whole," F. F. Cassel; "The Edison System of Southern California," R. H. Ballard; "Modern Switchboard Practice with Particular Reference to Automatic Devices," E. M. Newlett; "Report on Protection from Lightning During 1906," Alex. Dow, chairman, C. A. Hoenold, Robert S. Steward; "The London Sliding Scale as a Method for the Government Regulation of Public Service Corporation," W. H. Gardiner, Jr.; "Report of Committee on Fire Hazards of Electricity," H. C. Wirt, chairman, C. C. Sumner, A. A. Pope; "Report of Committee on Progress," T. C. Martin; "Higher Efficiency Incandescent Electric Lamps in Central Station Service," Francis W. Willcox; "Mercury Arc Rectifier with Magnetite Lamps for Street Illumination," W. E. Barstow; "The Maintenance and Calibration of Service Meters," William Bradshaw; "Report of Committee to Coöperate with Manufacturers' Advertising Committee," Paul Spencer; "Control of Motors on Electric Light and Power Circuits," H. D. James.

Annual Meeting of the Indiana Independent Telephone Association.

The annual meeting of the Indiana Independent Telephone Association was held in the Claypool Hotel, Indianapolis, May 17 and 18. The attendance was large and the meeting was highly successful in every way. The first, or opening session, was presided over by Vice-President Theadore Thorwood, of South Bend. C. S. Norton, secretary-treasurer, read the minutes of the Winona meeting, where the present association was organized and concluded with a very satisfactory report of the financial condition of the association. Mr. Norton next read the report of the executive committee. All of these reports were so full and replete with the accomplishments of the year that the convention was put in an enthusiastic condition on the start, which condition lasted through all the sessions. President Beers' annual address, read by Mr. A. C. Lindemuth, congratulated the association upon the progress and success of the year. Mr. Beers urged the necessity of all independent companies becoming members of the district branch of the association for the common good, a closer relation and a thorough understanding as to the territory each is to develop to its fullest capacity, and to unite their exchanges into one compact system, under standard rules, uniform system of accounts and the furnishing of a service of standard excellence.

Reports were read from the eleven district vice-presidents giving data as to the growth of the business in their territory.

A vote was taken petitioning the authorities of Indianapolis to allow the local independent system to raise its rates as a modification of the franchise and a precautionary measure against financial embarrassment. A similar petition asked for a franchise in Evansville for the Citizens' Telephone Company.

The Southwestern Electric and Gas Association Convention.

The Southwestern Electric and Gas Association held its convention this year at Galveston, Texas, May 16, 17 and 18, at the Tremont Hotel. Galveston, surrounded by water and continually fanned by soft Gulf breezes, is an ideal convention place at this season and brought out a good attendance. Arrangements for the entertainment of the convention were well looked after by Mr. H. S. Cooper, general manager of the Galveston Electric Company, and chairman of the local committee. The first session was called to order Wednesday morning at 10.30 by President M. M. Phinney, of Dallas, the general representative for Texas, of Stone & Webster. He introduced Mayor H. C. Landes, of Galveston, who read a short address of welcome. This address was responded to by W. T. Edgar, of Waco. Secretary Frank J. Duffy, of Beaumont, then read the list of applicants for membership, of which there were 16 for active and 7 for associate membership, making 23 in all. The active membership of the association (that is, operating companies) is now 83.

President Phinney, in his address, spoke of the enterprise of Galveston manifested on every side in the reconstruction and grade raising that had followed the great storm and disaster of 1900. He hoped the convention might absorb and be inspired with some of this same energy and progressive spirit. During the past year the attempt of the association to establish permanent headquarters in charge of an assistant secretary at Dallas had been defeated by the removal in turn from Dallas of both of the men appointed, so that the office was now vacant. Nevertheless, if they could get an assistant secretary who would not move away he thought it well to maintain the office.

He expressed his belief that the regulation of public service corporations is a good thing if intelligently done, and plain, simple laws are made. A large number of regulating bills were introduced in each legislature. The legislature naturally looked to the members of the association for information on how the proposed measures would affect their business. He advised for this purpose the formation of a legislative committee to be made up of the best posted and most experienced men in the business. The committee should be prepared to furnish absolutely accurate information on technical and business questions raised by the legislation proposed. Finally they should never lose sight of the fact that they were public service corporations and should impress this on all employes.

Restrictive legislation was frequently started by some local controversy and relief was sought through the State legislature for the real or supposed wrongs in some one town. Each member should, therefore, see to it that local difficulties in their respective cities did not remain unadjusted so as to be made a dangerous State issue.

A nominating committee was elected consisting of Messrs. H. S. Cooper, of Galveston; Frank J. Duffy, of Beaumont; R. B. Stichter, of Sherman, and Samuel Kahn, of San Antonio. Mr. G. C. Gum read a paper entitled "Up-to-Date Methods of Increasing the Business of Public Service Corporations," an abstract of which will be printed next week.

Wednesday afternoon the gas men had the floor for a time with a letter on "Retort House Practice," by Mr. Frederick Egner. After this a discussion of some of the question box queries was taken up. Mr. H. S. Cooper invited all who wished to spend the evening at Garden Verein, an invitation which was taken advantage of later by a large number.

Thursday morning at the opening of the session invitations from San Antonio and Dallas were extended to the next convention. No action was taken, as the matter is in the hands of the executive committee. Invitations were read from Mr. H. M. Littell, general manager of the traction and lighting companies of San Antonio, and from the mayor and Business Men's Club, of that city. Dallas' invitation was given by Mr. Sam Hobson, of the Hobson Electric Company, of Dallas.

A paper on "What is Electricity?" was presented by Mr. S. J. H. White, in which the author took up some theories he had worked out to explain electrical phenomena.

Mr. Frank J. Duffy, manager of the Beaumont Traction Company, read a paper on the "Relations of Public Service Employes to the Public." This brought out a good discussion, which occupied the balance of the morning.

Immediately after the noon meal cars were in waiting to take the whole convention party to visit the grade raising operations and enjoy the interesting spectacle of one of the largest dredge boats in the world pumping its cargo of sand into a long pipe line and discharging it several blocks inland. The grade of the entire southern part of the city is being raised several feet to prevent a recurrence of the tidal disaster of 1900. All this filling is being done by sand dredged by hydraulic process from the bottom of the ocean and discharged in a similar manner.

At 4 p.m. the party having returned to the hotel the convention was called to order and a paper on "Care, Maintenance and Inspection of Street Railway Rolling Stock" was read by Mr. H. S. Cooper. A discussion on care of car bodies in the Texas climate and types of cars followed this paper, and occupied all the time until adjournment.

In the evening the Sons of Jove, which order originated at one of these Southwestern conventions several years ago, held a grand rejuvenation and after parading the streets in costume with the candidates for admission tied to a long rope, as is the custom of the order, initiated a number of new candidates.

Friday morning a paper was read by Mr. F. W. Yensen on "Telephone Engineering Problems." Mr. A. W. Q. Birtwell presented a paper on "Organization and Operation of Purchasing and Supply Departments," which stirred up an animated discussion on the question of employing a regular storekeeper or stock clerk in a small company. An abstract of this paper and of the discussion will be printed next week.

A letter was read from a member asking that some action be taken toward securing better insurance rates for electrically-lighted properties than on those lighted with gasoline vapor or acetylene plants. The matter was referred to the executive committee.

Mr. F. M. Lege, of the finance committee, reported, auditing the accounts of A. E. Judge, treasurer, which showed receipts of $1,211.93 and $713.32 paid out, leaving a balance of $498.61. Secretary Frank J. Duffy made his report, which showed that the active membership had increased from 65 to 83 during the past year. The nominating committee reported the following ticket of officers, who were elected:

President, H. S. Cooper, of Galveston; first vice-president, J. W. McLendon, of Fayetteville, Ark.; second vice-president, J. P. Crerar, of Denison, Tex.; third vice-president, Samuel Kahn, of San Antonio; secretary, E. B. Meginnis, of Dallas; treasurer, A. E. Judge, of Tyler. Executive Committee—H. S. Cooper, J. W. McLendon, J. P. Crerar, Samuel Kahn, M. M. Phinney, H. T. Edgar, J. F. Strickland, R. B. Stichter, F. J. Duffy, E. B. Meginnis. Finance Committee—F. M. Lege, J. J. King, W. H. Young. Advisory Committee—J. E. Farnsworth, H. M. Littell, C. W. Ford, C. H. Dunbar, E. D. Kelley, E. M. Cooper, David Daly, C. W. Kellogg, W. Burns Head.

Friday afternoon a special boat was placed at the disposal of the party by which was taken a trip of about four miles to the entrance to the harbor to see the work done on the jetties.

Mr. H. S. Cooper, the new president, is well known in the street railway field. He was born in Isle of Wight, England, in 1856. In 1876 he became a manufacturer of agricultural machinery in the South and this connection brought him in touch with electrical enterprises, giving him an experience that later made it possible for him to reorganize and place many unstable properties on a profitable basis. His record in this line secured for him in 1893 the position of general manager of the Schenectady Railway Company, including the entire electric and gas lighting and railway service of the city. The system was in bad shape, for the business depression of 1893 had necessitated placing of them in the hands of a receiver. Under Mr. Cooper's management these properties were placed in excellent physical condition and brought up to a paying basis. His next important work was with the Ithaca Railway Company, of Ithaca, N. Y., which was rehabilitated under his management and placed on a paying basis. Mr. Cooper then organized the Electrical Engineering and Development Company of New York and made critical reports on all kinds of electrical propositions for clients, and so added to his already wide experience. In 1904 he accepted the position of general manager of the Galveston City Railway, where he was confronted by some difficult problems. One of these has been the rearrangement of the lines so as to meet the raise in the level of the city from two to twelve feet.

Figures on the Telephone Census.

Some time ago the preliminary figures were given out of the census taken of the telephone industry in 1902 by the Bureau of the Census, Department of Commerce and Labor. The final report is now ready and the Bureau has issued a compilation of the data. The telephonic art has grown so rapidly in the intervening three years, the figures now possess value chiefly for purposes of comparison; but it is the intention to secure such returns every five years instead of once in a decade, as now. The report prepared by Mr. T. C. Martin, under the direction of Mr. W. M. Steuart, chief statistician of manufactures in the Census Office, contains also the figures of the telegraph industry, electric fire alarm systems and police patrol systems.

The statistics of the telegraph and telephone industries of the United States were first shown in the census of 1880. At that time telegraphy had been growing steadily for nearly 40 years and telephony was in the formative stages of development. Since then, however, telephony has progressed to such an extent that it has surpassed telegraphy in physical and financial magnitude. In 1902 the telephone systems operated more than three-fourths of the wire mileage reported for both telephones and telegraphs, gave employment to seven-tenths of the wage-earners, paid more than two-thirds of the wages, received more than two-thirds of the total revenue, and paid more than two-thirds of the total expenses.

In 1902 there were 3,157 commercial systems, 994 mutual systems and 4,985 independent rural lines. For the commercial systems the mileage was 4,779,571, and the number of telephones, 2,225,981; for the mutual systems the mileage was 70,915, and the number of telephones, 89,316; and for the independent lines the mileage was 49,965, and the number of telephones, 55,747. In connection with the commercial and rural systems there were 10,361 public exchanges. The pay stations numbered 80,870, of which 32,477 were automatic.

The number of salaried employes engaged in the telephone service was 14,124, and the average number of wage-earners, 64,628. The amount paid in salaries was $9,885,886 and in wages, $26,369,735. Although there were only 44 Bell systems in 1902, they reported about seven-tenths of the wire mileage for all telephone systems, more than one-half of all the telephones, and three-fifths of the messages or talks during the year. They employed over seven-tenths of the wage-earners and paid almost four-fifths of the wages.

The number of messages or talks reported for the year was 5,070,554,553; of these 4,949,849,709 were local exchange calls and 120,704,844 were long-distance and toll calls.

Ohio led in the total number of messages, with 558,707,801; and Illinois was next with 541,161,932. In long-distance and toll traffic Pennsylvania was first, with 20,409,621 messages, and New York was a close second, with 20,367,024. The greatest number of local messages, 547,238,743, was reported for Ohio, and the next largest, 535,744,349, for Illinois.

The report shows that on the average there was one telephone to every 34 persons, that each person talked 65 times a year, and that each telephone was used 2,190 times. In 1900 there were 1,157 incorporated urban centers with 4,000 or more inhabitants. Of these 1,002 were provided in 1902 with telephone systems of some description. San Francisco, with one telephone to 9 persons, was the best telephoned city in the United States in 1902, while Cleveland ranked second, with one telephone for every 16 persons; and Boston was third, with one telephone for every 19 inhabitants.

The average revenue per telephone amounted to $37.50 and the average per message, to 1.7 cents, while the average operating expense was $24.56 per telephone and 1.1 cent per message. Reports were received for one system in Alaska, one in the Philippines, and 7 in Hawaii. For these 9 systems there was an aggregate of 5,518 miles of wire, 2,891 telephones and 3,887,925 messages.

In the report a table is given showing the telephone statistics as of January 1, 1905, for the United States and Europe. The number of telephones for the United States was 3,400,000 and the number of Europe, 1,485,784.

The commercial telegraph systems of the country owned and operated 1,318,350 miles of wire in 1902. In addition there were 16,677 nautical miles of submarine cable. The 25 systems had an investment, or capitalization of stocks and bonds, of $162,946,525; a total revenue of $40,930,038; and total assets of $195,503,775. A sum amounting to $15,039,673 was paid in salaries and wages to 829 salaried employes and 26,798 wage-earners.

The railway telegraph systems were reported by 684 companies. They employed 30,336 operators and dispatchers, to whom $20,040,730 were paid in wages. The number of messages sent during the year for railroad business only was 201,743,756 and the number of commercial messages was 4,474,593.

The report contains an interesting chapter on the employment of the telegraph and telephone by the Government. It shows the statistics for the telegraph and telephone service of the Signal Corps in the United States, in the Philippines, and in Alaska, and discusses the use of telegraphy and telephony in the work of the Weather Bureau and the Life Saving Service.

Electric fire alarm systems were installed as early as 1852 and by 1902 there were 764 such systems in operation. The fire alarm systems were distributed through 48 States and Territories, although they were found chiefly in the older and more densely populated sections. The largest number, 106, was reported for Massachusetts and the next largest, 70, for New York.

The practice of putting the fire alarm wires underground has increased rapidly during late years, and more than one-fourth of the 39,635 miles of such wire was underground in 1902. There were 37,832 signaling and annunciating boxes and 1,900 special telephones for use in connection with the fire alarm service. During the year 1902, 85,070 fire alarms were turned in through these boxes and telephones. Of these alarms 12,794 were credited to New York 9,491 to Massachusetts and 9,027 to Illinois.

The combination of the telegraph and telephone as an auxiliary to the police force was first introduced in 1880. In 1902 the police patrol systems were distributed in 32 States and the District of Columbia, most of the systems located in the States with the greatest number of large cities. Massachusetts is credited with the largest number, 28; and New York ranked second, with 14.

There were, in 1902, 148 police patrol systems, with 26,350 miles of wire. The signaling boxes numbered 9,476 and the telephoning boxes 1,170. Over these instruments 40,626,505 police calls were received or sent. This gives an average, per box or station, of 3,816 messages during the year, or a daily average of more than 10 calls. The use of the telephone predominated, the number of telephonic messages being 23,393,812, as compared with 17,232,693 of all other kinds.

Kings River Power Enterprise in California.

The Kings River Power Company is planning to expend upwards of $8,000,000 in developing the large water power possibilities on the Kings River, near Fresno, Cal. The company is composed of capitalists interested in the Edison Electric Company, of Los Angeles, and the Pacific Light & Power Company (one of H. E. Huntington's companies), also of Los Angeles. It is said to be backed by E. H. Rollins, of Boston, and N. W. Harris & Co. and Ladenburg, Thalman & Co., of New York.

The Kings River Valley is the second place the Edison people have looked to in central California as a profitable opportunity of investment. They are now completing the erection of a large power plant on the Kern River, from which power will be taken 116 miles to Los Angeles. Five other plants have been planned in the Kern Valley.

The power developed in the Kings River Valley will be entirely used in central California. Four power plants, each to cost $2,000,000, are to be located on the Kings River. The first will be on the river between Trimmers and Maxon's, to which point the country road already reaches. The second will be at the junction of Mill Creek with the river; the third will be at the junction of the middle and south forks of the river, and the fourth at the junction of Boulder Creek with the south fork of the river. The latter point is the final point of the Ellery survey for the State highway.

These power plants are to be constructed in the order named, during several years to come. Work will begin this summer on the one above Trimmer. About four miles above Maxon's the company is to build a $20,000 bridge to cross over to the south and east side. From this bridge to the fork of the river is a distance of 30 miles, and the company expects to have a roadway for the entire distance within the next year. Already the first 12 miles are done, and a force of 40 men will be put on immediately to push the work on the rest of the way at a cost of $2,000 a mile. Work on the bridge will begin as soon as the supervisors let the contract for the county's share of the improvements.

The total capacity of the company's four power plants will be close to 150,000 hp, of which the first one will furnish 40,000 hp. Chief Engineer F. C. Finkle, of the Edison Electric Company, states that all the power will be used in the San Joaquin Valley development, probably a large portion being used for electric railways that will eventually traverse the valley.

Brooklyn Applied Science Reference Library.

The Applied Science Reference Room of the Pratt Institute Free Library (Ryerson Street near DeKalb Avenue, Brooklyn) has for its object the aiding of those engaged in any trade or industry, irrespective of any connection with Pratt Institute. Hundreds of questions arise every day, in the factories and shops of a city, which could be answered from some printed page. It is the intention of the Reference Room to supply this need as far as possible, sometimes with books, very often with periodicals or transactions, and again with trade catalogues.

In the room set aside for this work in the Free Library of Pratt Institute are taken nearly a hundred trade and scientific papers, giving the latest news of the industrial world. There are besides over fifty of the labor union papers, of which a file is preserved. The most important of the periodicals are bound, and these bound files contain much material that can be found nowhere else. The publications of the U. S. Patent Office are kept here also and are used daily. The collection of books includes up-to-date publications in various industries, such as electrical engineering in all its branches, plumbing, manufacture of textiles, industrial chemistry, gas engines, the making of cement, and so forth and so forth. The books in this room are not allowed to go out, so that anyone coming is sure to find the book he wishes to refer to, if it is a part of the collection. The Library has, however, a good collection of books in these subjects for circulation, often duplicates of the books in the Applied Science Reference Room. The room is in charge of Mr. Edwin M. Jenks, whose work is to help those who are looking up any question that lies within the province of this room.

A large collection of trade catalogues furnishes the very latest information in many lines, and is being enlarged constantly. The Library will get any trade catalogue in print, at the request of any user of the Library, if it is obtainable. One new feature of the room is a collection of mounted cuts of machines and mechanical devices. These may be used in the room or taken away to work with, if desired. A man looking up a new form of chuck, for example, will find a score of cuts showing different chucks, and among these may well find some that will be of service to him.

Men studying in the evening schools, those preparing for civil service or other examinations, lawyers, and men of various interests will find this department of use. The Room is open every day except Sunday, from 12:30 p. m. to 9:30 p. m., and can be used between 9 a. m. and 12:30 through the Library office.

Electricity in Market Gardening.

Experiments of much interest in relation to the electrical stimulation of vegetable growth are now being carried on by Hon. Warren H. Rawson, of Boston, at his large market gardening establishment in the suburban town of Arlington, Mass. Mr. Rawson is one of the best known market gardeners in the vicinity of Boston, and for a long time he has been greatly interested in the problem of accelerating vegetable production by electrical means. He has employed the arc light with success in expediting the growth of vegetables, and the latest development in Mr. Rawson's study of how best to promote thoroughly scientific market gardening, consists in the introduction of electric currents into the vegetable beds themselves, and thus far the results obtained have been sufficiently successful to render them full of significant interest.

In November, 1905, Mr. Rawson, acting in connection with Mr. Reuben Le Baron, supervisor of wires, and a practicing electrician in the town of Arlington, began to experiment with currents of exceedingly small magnitude in the lettuce beds of one of the largest greenhouses on his Arlington estate. The soil had been previously sterilized by heating. It was found that if a copper plate was sunk in the loam and fertilizer of the bed at one end of the house, and connected by an overhead wire to a zinc plate sunk in the bed at the other end, a current measurable on a milli-ammeter flowed constantly through the wire, and a potential difference of about 0.5 volt was found to exist between the terminals. No current was supplied from any outside source; the entire flow occurred as a result of the chemical action of the ammonia and other salts in the bed upon the zinc plate. The bed acted simply like a large battery cell and the current measured varied in value from about 0.4 milli-ampere to almost 15 milli-amperes.

One of the beds in the house was separated from the bed in which the plates were sunk, in order to compare the growth of the electrically-stimulated plants with the growth of plants subjected merely to the usual gardening care. It was found that the electrically-treated lettuce grew enough faster to be ready for market a week ahead of that in the ordinary bed, and the heads were also larger in size. The saving of a week's time in this way means a considerable financial gain to a large market garden, where a single greenhouse may contain from 30,000 to 40,000 heads and have an operating value of $40 or $50 a day. The earlier completion of a crop also releases the bed just that much sooner for further production.

The same general treatment is being applied to the production of cucumbers, and while the experiments are still in a rather early stage, it has been found that the yield of the bed has been considerably increased, and the foliage of the vines has been much augmented.

Care has been taken to treat the compared beds alike, with the single exception of electrical application. The experiments have been tried in three different sized greenhouses, the largest being 400 ft. long and the smallest about 100 ft. The width of the beds is about 13 ft. each, and the depth approximately 2 ft. Of this depth, about 1 ft. consists of manure, which is strongly ammoniacal. The size of the plates used has been varied more or less, and the composition of the soil has been found to have considerable influence upon the results. At the time of the writer's visit the 400-ft. house was equipped with a ½-in. zinc strip at the end of one bed, connected to a No. 16 wire running through the house to a copper terminal which consisted simply of a single bare wire of No. 16 size sunk in the bed at the opposite end from the zinc terminal. An ammeter gave a reading of 4 milli-amperes. Cucumbers are being raised in this bed. In some cases it has become necessary to cut down the current by decreasing the plate area, in order to avoid stimulating the crop to a rank growth. In other cases plates 12 in. by 10 in. in area have been used. It is certainly interesting to observe the current flow under the conditions prevailing.

Prof. George E. Stone, of the Amherst Agricultural College, has become greatly interested in the experiments at Arlington, and a thoroughly scientific study of all the conditions and phenomena is now in progress. Readings are being taken of the current flow, the size of the crop is being recorded, and all the important facts which might have a bearing upon the production rate and comparative results are being recorded with care. The whole subject is, in this country, in its infancy, and there is room for an exhaustive study of the different factors which influence the vegetable growth. In many quarters the idea prevails that current is applied externally from the mains of the local electric light and power circuits, but such is not the case. A great deal remains to be found out as to the proper size of plates for various soils and kinds of product, the best current to use, the effect of temperature, moisture, etc.

At first blush it seems almost impossible that a current of a few milli-amperes spread out in sheets over a cross-sectional area of about 26 sq. ft. and a bed 400 ft. in length could produce enough chemical action or stimulation of the roots of the plants to make any perceptible difference in the results. The experiments have gone far enough to satisfy the investigators that there is a stimulus to the growth, however, and it is highly probable that in the not distant future a notable gain in the knowledge of forced market garden production will be enjoyed by the agricultural world. The only expense seems to be the cost of installation, which is a very small matter as thus far practiced.

Douglass Burnett.

Douglass Burnett was born April 6, 1872, in Brooklyn, N. Y., and received his primary education at the Juvenile High School of that city. After four years in the preparatory department of the Brooklyn Polytechnic Institute, he passed four years in the scientific course of that school, specializing in chemistry, and in 1890 was graduated with the degree of B. S. The following year he took a post-graduate course in electricity. During an illness of Prof. Frost, Mr. Burnett had charge of the chemistry classes of the Brooklyn Polytechnic, and at another time had charge of the physics classes during an illness of Prof Sheldon.

At the formation of the Manual Training High School in Brooklyn, Mr. Burnett was appointed instructor in science and latterly had charge of the classes in physics and chemistry. After occupying for a time the position of assistant instructor in chemistry at Pratt Institute, Mr. Burnett for five years was instructor in charge of the evening classes in physics at that Institute. In November, 1904, he entered the employ of the Edison Electric Illuminating Company of New York, and after serving a short time as a clerk in the inspection department, became inspector of isolated plants in New York City and later was made superintendent of the "Annual Survey," which embraced making tests of customers' installations and testing the feeder and main systems. In 1897 he became assistant general agent in charge of the wholesale department, with charge of the canvass for service to new buildings and of all cases involving isolated plants. The duties incident to this work required an intimate knowledge of existing lighting and power conditions and requirements in all the large buildings of New York, and involved the preparation of detailed estimates as to the service and current cost, together with the direction of tests of meter and power equipments and elevators, as well as an intimate knowledge of steam heating, steam and hydraulic elevators and steam and gas engine performances. Among the duties were the preparation of complete electrical specifications for building equipments, and passing upon specifications for plants, equipments, elevators and motors.

DOUGLASS BURNETT.

On February 1, 1904, Mr. Burnett was appointed manager of the electrical department of the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., which position he now occupies. In this position he has had particular charge of questions of policy of the company in its relations with the public. He assumed his duties less than a week before the great fire of 1904, and thus had to meet a number of new conditions imposed by the stress of the emergency. From a system with 3,000 customers at that time, the business has increased to one of over 6,000 customers, and there has been an increase in the connected installation from 187,000 to 425,000 16-cp lamp equivalents, the increase in power service being from 2,200 hp in motors connected to 9,000 hp. This substantial increase has been secured in spite of very active competition with the gas company, and a very much more active competition with another electric light company established about the time of the fire.

Mr. Burnett is the inventor of an apparatus known as the Burnett luminometer for the measurement of illumination. He has delivered many lectures on scientific and engineering subjects before the Brooklyn Institute of Science and Arts and other bodies, and has presented papers before the American Institute of Electrical Engineers (of which he is a member in full standing) and the Association of Edison Illuminating Companies, and contributed articles to the technical press. At the time of assuming his present position, he was vice-president of the New York Electrical Society.

CURRENT NEWS AND NOTES.

PROTECTING NIAGARA.—Governor Higgins, of New York, has vetoed the Foelker bill, for the "protection" of Niagara, and in his memorandum says: "The legislative intent doubtless was to help save Niagara, but the expression of such intent by this bill is not felicitous. Approval thereof on my part would under no conditions place the slightest restriction upon the power companies or upon future legislatures, and it might have a diametrically opposite result from that intended."

STREET RAILWAY ASSOCIATION.—Secretary Swenson has issued a circular calling attention to the existing conditions of individual membership in the American Railway Mechanical and Electrical Association, as sketched in a further letter from Mr. S. W. Mower, the secretary and treasurer of that body, which has become a constituent of the larger American Street and Interurban Railway Association in its engineering branch. It all looks very cumbrous and complicated, but doubtless works out easily as a plan for confederating the various interests brought together for co-operation. The change made is that all old members of the Mechanical Association become eligible for associate membership in the engineering branch of the larger, comprehensive body, with dues of $5 each.

CIVIL SERVICE POSITION.—A competitive examination, under the auspices of the Civil Service Commission, for the position of mechanical engineer in the Bureau of Filtration of the City of Philadelphia will be held at room 875, City Hall, Philadelphia, on Saturday, June 2, 1906, at 10 a.m. Applicants must be citizens of the United States, under 35 years of age, and must be graduates of Lehigh University, University of Pennsylvania, Massachusetts Institute of Technology, Troy Polytechnic Institute, Stevens Institute, or other schools of equal grade. They must have had at least two years' experience with steam plants and pumping machinery, preferably pumping stations. The salary is $250 per month. Blank forms of application may be had at the office of the Civil Service Commission, 875 City Hall, Philadelphia, upon personal application by residents of Philadelphia and upon application by mail by non-residents. These must be filed, properly executed, on or before May 28, 1906.

DINNER TO COMMISSION.—The National Civic Federation gave a dinner on May 21 at the Park Avenue Hotel, New York City, to the members of its commission sailing this week to investigate municipal ownership in England. Justice Gaynor, of Brooklyn, gave an unexpected turn to affairs by assailing the recent merger of traction systems in New York City as "dishonest enough to shock the moral sense of the people of the entire country." President August Belmont, of the Federation, responded warmly to this assault and said: "I want to repudiate right here, in the most unqualified language, this insinuation that I or my associates manage these corporations in any other spirit than that of honesty or of correct purpose and with any other view than that of complying with every letter of the law. But I do think that every corporation and every corporate manager is entitled to be heard in court first and then his action shall be tested after the verdict of the court and not before. You know to what I refer and therefore it will not be necessary for me to add anything and I am sorry that I have had to make this statement."

TYPHOON IN LUZON.—A severe typhoon struck the Island of Luzon last week and advices from Manila state that telegraphic communication was interrupted in all parts of the island.

USE OF NATURAL GAS.—The Shreveport, La., Traction Company informs us that it is now operating its system with natural gas under its five horizontal return tubular boilers of 150 hp each. It is estimated that the monthly consumption of gas will approximate 7,000,000 cu. ft. The company uses a boiler gas regulator which keeps the steam at about 120 lb. pressure, allowing a variation of less than 2 per cent, regardless of load. Forty burners to each boiler were installed.

THE FRANKLIN MEDAL.—A cable dispatch from Paris of May 19 says: "At to-day's meeting of the Council of Ministers M. Bourgeois, Minister of Foreign Affairs, presented the medal given by the United States to France in commemoration of the Franklin anniversary. The council decided to send a message of thanks to President Roosevelt and the American nation and also to establish a special section in the Mint, where the medals commemorative of Washington, Lafayette, Paul Jones, Franklin and others connected with the early ties between France and the United States will be deposited."

WESTERN SOCIETY OF ENGINEERS.—The electrical section of the Western Society of Engineers held its last meeting of the season in its rooms in the Monadnock Block, Chicago, Friday evening, May 18. The programme consisted of an interesting paper by Mr. H. R. King, of the Western Electric Company, in which he described in detail the huge new shops of the company at Hawthorne, near Chicago. These shops have been in the process of construction for the last two years, and provide for the employment of about three thousand people. The lecture was well illustrated by lantern slides showing the construction of the buildings, special machinery employed and other features of technical interest.

OPENING OF SIMPLON TUNNEL.—At Domodossola, Italy, on May 19, the new Simplon tunnel, whose trains are to be operated electrically, was opened by the King of Italy. The Simplon tunnel is 12¼ miles long, and is the longest in the world, the next being the St. Gothard tunnel of about 9½ miles. It consists of two parallel tunnels, each for a single line of rails placed about 52 ft. apart from center to center. One terminus is at Brieg, in the Rhone Valley. The Italian terminus is at Iselle. Italy and Switzerland ratified the convention providing for the construction of the tunnel at the end of 1896. The cost of the tunnel was estimated at $14,000,000; $10,000,000 was to be borne by the Jura-Simplon Company, of Switzerland, $3,000,000 by the Swiss Government, and $1,000,000 by Italy. Operations were commenced at both ends in the autumn of 1898.

CHIEF ELECTRICIAN CURTIN.—Letters of commendation have been sent by the Secretary of the Navy to officers and men who distinguished themselves during the great disaster at San Francisco. Of the enlisted men commended Chief Electrician Curtin, of the Pike, is especially honored. After doing all he could to assist in fighting the fire, Curtin established an emergency hospital, now called the Curtin Hospital, and for days managed to obtain the medicine and other supplies required to care for as many at 300 patients daily. After recounting this remarkable achievement, Acting Secretary Newberry's letter says: "The department cannot too highly recommend you for your extraordinary display of energy and resource. It must be a pleasure to the public, as well as to the department, to know that the personnel of the United States Navy is composed of men of your character, who only need an opportunity to show their true worth."

HOTEL TELEPHONES.—It is becoming a common thing to find a telephone in every hotel bedroom. There was a total of 25,000 city calls registered at the new Hotel Astor, New York City, for the month of April, 1906, and for the same month 2,500 suburban and long-distance calls appear upon the record. If the other months show similar totals, the aggregate number of calls of all kinds, exclusive of those coming in, for the year, would be 330,000. The total revenue from telephone use is something like $50,000 annually. In February there were 75 Philadelphia calls, 50 Boston and 503 Jersey City. The hotel does a large telephone business with itself. There are 5,000 interior calls a day, for practically every need or desire of a guest is attended to by telephone. Guests are talked to by telephone as much as they talk. There is an average of 1,000 incoming calls a day, or 365,000 a year. Hundreds of reservations of rooms are made daily by telephone, and thousands of inquiries on every conceivable subject, from the sailing of ocean liners to the price of corned beef hash, are expeditiously answered over the wires. The cashier's desk in every dining room is provided with an instrument, by which guests can retain a table for any meal. Every baggage room is similarly equipped.

INVESTIGATING OPERATION.—A special correspondent of the New York *Tribune* writes from London as follows: "The American experts now occupied in investigating the practical operation of public and private ownership in British towns have the virtue of reticence. There are no premature disclosures of opinion. They are making a close study of the plants and accounts of twenty-four street railway, electric light and gas undertakings, twelve under public and twelve under private management, and they are awaiting the arrival of the main committee of the National Civic Federation this month before tabulating the results or instituting a comparison between the two systems of ownership. Their own work is to be scrutinized by their American associates and a series of visits paid to various towns where local authorities and company officials can be consulted. It may be a month or six weeks before the labors of the engineers and accountants can be revised and completed; and when the facts are summarized there will be various interpretations of them, for the committee includes hearty supporters and strenuous opponents of what is known as municipal socialism. Meanwhile, the experts on the ground are cautious in discussing any branch of the subject, since they know that their own processes are to be investigated and revised before any conclusions are based upon them. If the commission does nothing else, it will establish a new American record for silence, self-restraint and moderation in controversial matters."

COOLING THE SUBWAY.—Keeping the New York Subway road cool in summer has been a great problem. A plan has now been worked out, not for cooling the air, but changing it. To exhaust air between stations two devices will be used, automatic valves and electric fans. The valves will be operated by the trains themselves. These valves open outward only under the increased pressure of air caused by passing trains. An outrush of the heated air between stations is thus produced, which of course induces an inflow of surface air at the stations. The greater the number of trains passing the greater becomes the volume of air removed. For the stretch between Brooklyn Bridge and Columbus Circle there are to be fourteen of these outlet chambers. The engineers recommend that the chambers be constructed as valve and fan chambers combined, the valves to be always in operation, but the fans to be used only for the twelve night hours, or for excessive heat or emergencies. The discharge of air from these chambers will be through gratings in the sidewalk after the air has been passed through cycloidal tubes to diminish its velocity. If these sidewalk gratings prove unpopular, however, ornamental chimneys 10 ft. high can be provided to discharge the air high above the street. The valves and fans together will be able to effect a complete removal of air throughout the Subway once every thirty minutes, it is said. If the fans and louvres are to work at their highest efficiency more openings for inflowing air will have to be provided at the stations. To increase these openings it is proposed to cut out 6,000 square feet of vaulting at various stations and substitute gratings, with copper pans underneath for drainage.

CHICAGO CABLE LINES are among the last of their kind in the United States. Plans have now been completed for their immediate change to electricity.

ATLANTIC CITY EXHIBITS.—The American Diesel Engine Company is an addition to the long list printed last week of exhibitors at the National Electric Light Convention in June.

A HALL OF INVENTIONS is proposed for the Jamestown Exposition, where undeveloped inventions can be exhibited, the belief being that possibly some new arts and appliances may thus be brought to light.

A. I. E. E. IN TORONTO.—At the annual meeting of the Toronto branch of the American Institute of Electrical Engineers, the following were elected: Chairman, Mr. R. G. Black; vice-chairman, Mr. K. L. Atkin; secretary, Mr. R. T. MacKeen. Executive committee, Messrs. W. A. Bucke, H. W. Price, W. G. Chace.

LIGHTING IN COSTA RICA.—An electric lighting contract has been awarded by the municipality of Punta Arenas, Costa Rica, to William F. Teller, an American connected with the San José Electric Company, who will transfer it to the newly organized Punta Arenas Electric Light Company (capital, $27,900 gold), which will install the plant.

CLEVELAND ELECTRICAL CONTRACTORS are looking forward with much anticipation to the sixth annual convention of the National Electrical Contractors' Association, to be held there July 18, 19 and 20, and a local committee is already working out a programme of entertainment for the visitors. At the Boston convention last year the statement was made that they would have a hearty welcome when they went to Cleveland in 1906, and those in charge of the arrangements will use their best endeavor to see that the promise made in Boston is fulfilled. The social feature will be emphasized.

GOVERNMENT CABLE—At Washington, on March 16:—Secretary Taft to-day urged before the House Committee on Interstate and Foreign Commerce the military necessity of a Government cable to Guantanamo, Cuba, Porto Rico, and the Isthmus of Panama. "We are proceeding upon the theory that we are to fortify the Panama Canal," he said. "We have already had a report from the artillery and engineering board as to the fortifications to be made there. It is said the canal ought to be neutral, but it will be necessary to have forifications to protect it against those who may not observe that neutrality. With the conditions there as they are and the United States under the responsibility of suppressing insurrections, and in a country where they have insurrections once a year it makes communication a necessity." The total cost of a cable to touch at Cuba, Porto Rico, and Panama, he said, was estimated at $1,300,000. It could be laid by converting the army transport Sumner into a cable ship at nominal cost. Opposition to the proposition was made on behalf of the company now operating the American system, represented by S. C. Neale.

LEADING-IN WIRES FOR MERCURY VAPOR LAMP.—In the usual form of mercury vapor lamp the current is conducted to and from the mercury electrode by means of a platinum wire hermetically sealed through the glass wall of the evacuated chamber. On account of its coefficient of expansion, platinum is used for this purpose. It has been found, however, that such seals are subject to deterioration because of the amalgamation of the platinum wire, and, unless the platinum wire projects a considerable distance into the mercury, there is liability of heating at the surface of contact of mercury and platinum. A patent issued to Mr. W. R. Burrows on May 8 relates to means for overcoming the difficulty by forming the leading-in conductor of three parts welded together end to end. The center part is of platinum, and is completely embedded in the glass wall of the tube, and is thereby protected from amalgamation. The upper part of the leading-in conductor is of iron, and is of considerable length and cross-section to increase the area of contact between the solid conductor and the mercury electrode. The lower part, to which the terminal of the lamp is connected, is of copper.

POWER FOR THE RAND.—Advices from the Cape of Good Hope state that the plan to supply the Witwatersrand goldfields with electricity generated on the Vereeniging goldfields, near the Vaal River, is taking tangible shape, a powerful German syndicate, composed of the Allgemeine Electricitäts Gesellschaft, four German banks and Messrs. Lewis and Marks, having subscribed the necessary $10,000,000 for its realization, and two engineering experts being now in South Africa to make the final surveys. The scheme contemplates the generation of electricity in quantity by a powerful steam plant on the coalfields, which offer an inexhaustible supply of cheap fuel, and its transmission over the 35 miles which separates the Rand from Vereeniging. The plant laid down will be an extensive one, the estimates providing for $3,900,000 being spent on the power station, $1,700,000 on transformers, electric lines and sub-station, $1,500,000 on a water storage tank, and other items, $1,900,000. The output is estimated at 300,000000 units, which can be produced at a cost of ¼ d. per unit, and will yield a revenue of about $425,000 a year. The realization of this scheme will, it is said, practically shelve that of the Victoria Falls indefinitely.

COLOMBIAN CABLE CONCESSION.—United States Consul Pierre P. Demers sends from Barranquilla, Colombia, a copy of a cable concession recently granted by the Government of Colombia to Francisco J. Fernandez, a native of that country, which concession has been accepted and ratified by the Colombian legislature. The merchant of the coast must now send his messages overland on the national telegraph lines to Buenaventura on the Pacific side via Bogota, a distance of nearly 1,500 miles, or almost that from Savanilla to New York. This is not only very expensive, but extremely uncertain, and frequently involves delays of from three to five days. It is the intention of the present owner to sell his privilege or develop it with foreign capital. The French Cable Company operating in Venezuela is considering a proposition made by the grantee of the concession. The concession includes also the exclusive privilege of erecting wireless telegraph stations within the jurisdiction of Colombia. In that respect Savanilla, the seaport of Barranquilla, offers unusual advantages for the erection and successful operation of a wireless station. Stations are already established in Colon, a little over 300 miles from Barranquilla, Bocas del Toro, Port Limon, Bluefields and many other ports of the West Indies. The governmert guarantees, it is said, an interest of 7 per cent on practically all the capital invested.

A REPORT ON OWNERSHIP.—A very interesting and elaborate report on municipal ownership in Great Britain, made by Everett W. Burdett, a Boston lawyer, is published in the *Journal of Political Economy* for May. Mr. Burdett went abroad to make the investigation of public operation of utilities on behalf of conservative American interests. Their reports heretofore have been held as confidential. Briefly stated, Mr. Burdett's conclusions are that municipal ownership and operation of public utilities in Great Britain has been only partially successful at the best, and has failed in many of the very respects for which its supporters claim most; and that, so far as the present status in Great Britain is desirable, it is owing to the conditions which do not exist and cannot be duplicated in America. Perhaps the most serious of the ill consequences is the hampering and restriction of industry. The backwardness of the development of electrical enterprise in England led to such a state of things that in 1902 the Council of the Institution of Electrical Engineers appointed a committee to investigate conditions and suggest action that would assist the industry. The committee's tabulated conclusions showed that the United States, with less than double the population of Great Britain, has six times the amount of apparatus installed for furnishing electricity to lamps and motors, sixteen times as much for traction, twenty-three times as many miles of electric railway, twenty-six times as many motor cars, and over five times as much invested in such enterprises.

Plant of the Pike's Peak Hydro-Electric Company.

THE Pike's Peak Hydro-Electric Company has a plant located at Manitou near Colorado Springs, Colorado, which enjoys the distinction of operating with the highest head of water of any power-plant in the world, the static head being 2,417 ft. It further occupies a unique position among water-power plants in that its water wheels are operated with water belonging to a city water works. The plant utilizes a head of water which was before wasted.

The city of Colorado Springs gets its water supply from reservoirs located high up among the mountains, which are filled with the drainage from the snows on Pike's Peak. The water is taken from these mountain reservoirs along creek beds to pipe lines, which pipe lines take it down to what is called the Mesa reservoir located a short distance from Colorado Springs. This reservoir acts as a reserve storage reservoir connected directly with the Colorado Springs city pipes. The water, in falling from the pipe intakes up in the mountains to the Mesa reservoir previous to the erection of the plant under discussion, had this head entirely wasted in pipe friction. The present plant utilizes about 2,200 ft. effective head of the total fall between the mountain intakes and the reservoir, the balance being lost in pipe friction.

The Pike's Peak Hydro Electric Company operates under a franchise granted to George W. Jackson, September 8, 1808. Under this franchise, in consideration of finishing the Strickler tunnel, which was a part of the Colorado Springs water supply system, the city of Colorado Springs granted to Mr. Jackson the right for twenty-five years to exclusive use of any water powers that could be developed in connection with the Colorado Springs water-supply system. The franchise, of course, was granted on condition that the utilization of the water power should in no way interfere with the Colorado Springs water supply. Under this franchise, right was also given to store water on the city's water reserves, thus making it possible for the company to build whatever reservoirs seemed necessary to make possible the development of a maximum amount of power without interfering with the continuity of the Colorado Springs water supply. The franchise also gave the right to string wires for any purpose on the streets of Colorado Springs. On January 1, 1903, the Pike's Peak Hydro-Electric Company formally acquired the rights under the Jackson franchise. Mr. G. A. Taff, president and general manager of the company, had secured an option of these rights six months previo. s to this, and had done much preliminary work investigating the possibilities of the scheme. He found that the minimum discharge through the pipe line connecting the mountain intakes with the Mesa reservoir was 486 cu. ft. per minute, and the maximum discharge 1,111 cu. ft. The storage capacity of the mountain reservoirs, when completed, he found would amount to 335,900 000 cu. ft.

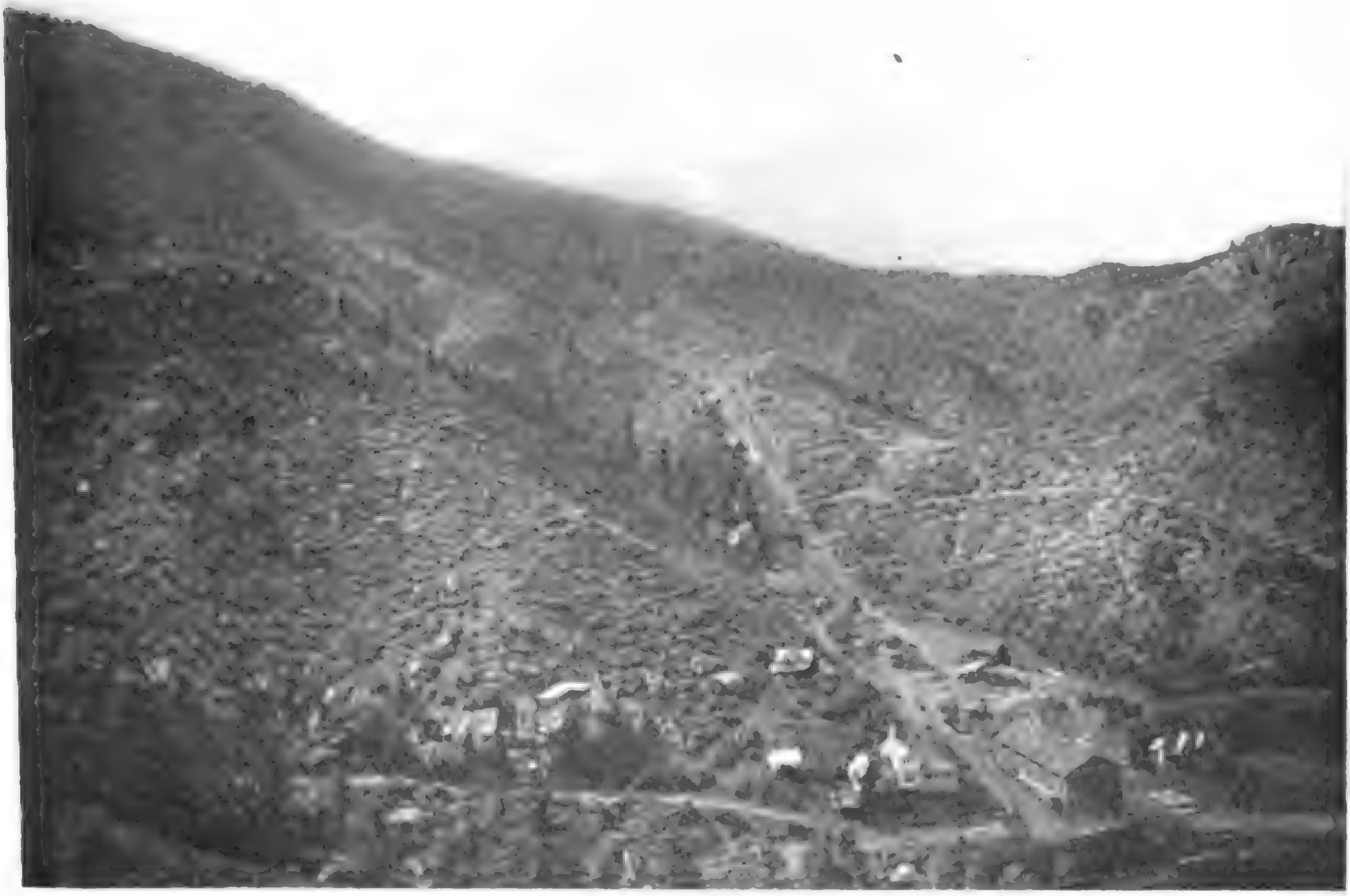


FIG. 1.—BIRD'S-EYE VIEW OF POWER HOUSE AND PIPE LINE.

From the mountain intakes to Manitou a 14-in. pipe line was in existence, this pipe line being most of the way laid in a cañon occupied also by the Pike's Peak Cog Railroad. This 14-in. pipe line was not sufficiently strong for the head under which it was proposed to operate. It was therefore necessary for the company to build a new pipe line of its own, the lower end of which should be able to withstand the pressure due to a 2,400-ft. head. The plan adopted was to lay a line of light piping from a point near the mountain intakes, along high ridges, with only sufficient fall to give head enough to overcome pipe friction, and then drop to the power house through a short length of pressure pipe.

Fig. 1 gives a bird's-eye view of the power house in the valley and the surrounding mountains. The pressure pipe begins its sharp descent to the power house at the point marked "*A*" near the upper left-hand corner of the engraving. The location of this pressure pipe can be seen by the scratch down the side of the mountains, which marks the excavation for this pipe. This pipe line is one of the most notable features in hydraulic engineering at the present day and involves work of a much heavier character than before attempted in pipe line construction.

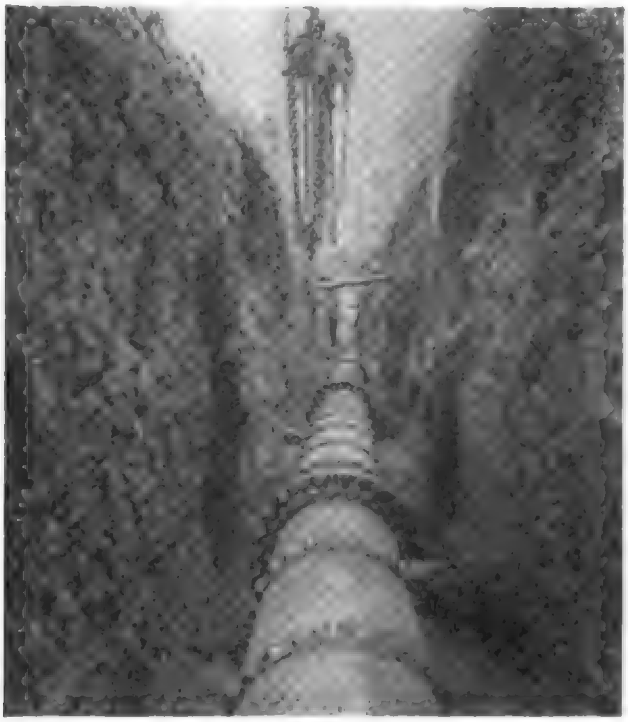


FIG. 2.—PRESSURE PIPE IN TRENCH.

The work began at once after the Pike's Peak Hydro-Electric Company purchased franchise rights on January 1, 1903, as surveys had been carried on during the six months previous. All contracts for material were let within three months, and all of these contracts called for a completion of the work November 1, 1903. The heavy pressure pipe was not completed, however, until fifteen months later. The plant began operation February 15, 1905.

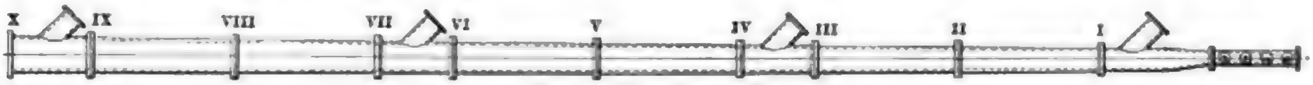


Fig. 3.—Cast Steel Header.

The water supply at Colorado Springs, as before mentioned, comes mainly from the slopes of Pike's Peak. On account of the west slope yielding a much better supply than the east slope, the Strickler tunnel was constructed by the city in order to bring the water from reservoirs on the west slope to the east slope and thence down a creek bottom to the pipe intake. Besides the water supplied through the tunnel, there are two other creeks from which water is taken. The city intakes are at present small pools of water made by damming the creek with low dams. The company expects to enlarge these intakes considerably so as to give a small storage capacity and also form settling basins which will not fill as rapidly as the smaller basins now in existence. It will be understood that the pipe line acts as a bypass around the city's 14-in. pipe, which latter follows down the cañon from the intakes to Manitou, where the power house is located. From the intakes to the point where the pressure pipe begins, the pipe is 20 and 21 in. in diameter. The pressure pipe, which is 4,775 ft. long, is 21 in. inside on account of the extra number of rivets and the inside butt strap, which cause additional friction. Great precautions were taken to anchor this pipe thoroughly. For that reason a trench was dug and blasted for the whole length of the pipe (Fig. 2), and wherever it passed through solid rock, the trench was filled with concrete after the pipe was laid. This concrete was mixed on the spot with decomposed granite, which was found everywhere on the mountain side and which makes an ideal material for concrete, as it is sharp and cubical. There are no convex curves in the pressure pipe except near the top, so that there is no chance for the pipe to bulge out away from the mountain side. There is only one horizontal curve on the pressure pipe, and at that point there is a shoe. The pressure pipe itself is of ¾-in. sheet steel rolled into tubular form and the seam riveted to double-butt straps, one inside and one outside the pipe. The pipe was made up in 32-ft. lengths between flanges, each length being composed of 5-ft. lengths riveted to each other.

The manufacture of this pipe proved quite a problem. The contract was taken by the Holthoff Machine Company, later consolidated into the Power & Mining Machinery Company, of Milwaukee. Five-foot lengths of ¾-in. sheet steel were rolled into tubes of 21-in. inside diameter. The riveting was done on a 100-ton hydraulic press, having a special oil-tempered nickel-steel stake 18 in. in diameter, over which a length of pipe would be slipped for riveting. This stake would spring only slightly under the pressure brought against it while being riveted near its top. Of course, an enormous foundation was required for this stake. After the pipe seams and joints had been riveted, it was necessary to caulk the joints under pressure in order to be sure that they were tight. It was found that in no other way could it be determined whether the joints were tight. A factory test pressure of 2,000 lb. was applied on all the lower section of the pressure pipe. The rule on all the pipe work was to apply double the working pressure as a test. The pipe was calculated by Mr. Taff to have a factor of safety of three throughout.

From a ¾-in. thickness at the bottom, the pressure pipe gradually diminishes in thickness until the top of the steep incline is reached. One flange is counter-bored to receive the ring tunnel on the opposite flange. This counter-bored groove has a gasket of an alloy composed of one-half tin and one-half lead. This was the only kind of gasket that was found that would withstand the pressure. Pure lead was at first tried and probably would have been all right had the counter-bore been turned to fit very accurately over the ring. With the counter-bored groove a loose, sliding fit, as it was made in this case, it was found that the lead would be squeezed out in a thin film when the water pressure was applied. The credit for the successful solution of the gasket problem is due to Mr. F. M. Davis, superintendent of the Holthoff factory.

FIG. 4.—VIEW OF POWER HOUSE FROM ABOVE.

The low-pressure pipe has single-riveted lap seams and also riveted lap joints. The riveting of joints was, of course, done as the pipe was laid in this case. On this pipe there are no bends of less than 20-ft. radius.

The laying of the pipe lines was an interesting piece of work, not only on account of the extremely high pressures which part of the line had to withstand, but also because of the long, steep incline of the high-pressure pipe. To carry the pipe and the workmen up this incline, a cable tramway of 30-in. gauge was built. Alongside of this tramway was made the cut into which the pipe was laid. The cable was driven by an electric motor located at the bottom of the incline. The pipe was unloaded from a siding of the Colorado Midland Railway. It was then loaded on cable tram cars, taken up a tram road to the bottom of the incline and hoisted to whatever point it was to be laid. The low-pressure pipe was also taken to the top of the incline in this way when it was rolled off and hauled by means of one-horse wagons along the grade which had been made for the pipe.

The mountain is so steep in some places along the pressure pipe that workmen could not stand alone without something to hold to. Fig. 2 shows one of the deep cuts made for the pipe line with the block and tackle used for lowering the pipe into the cut. This view also gives a good idea of the exterior appearance of the double-butt riveted seams on this pipe.

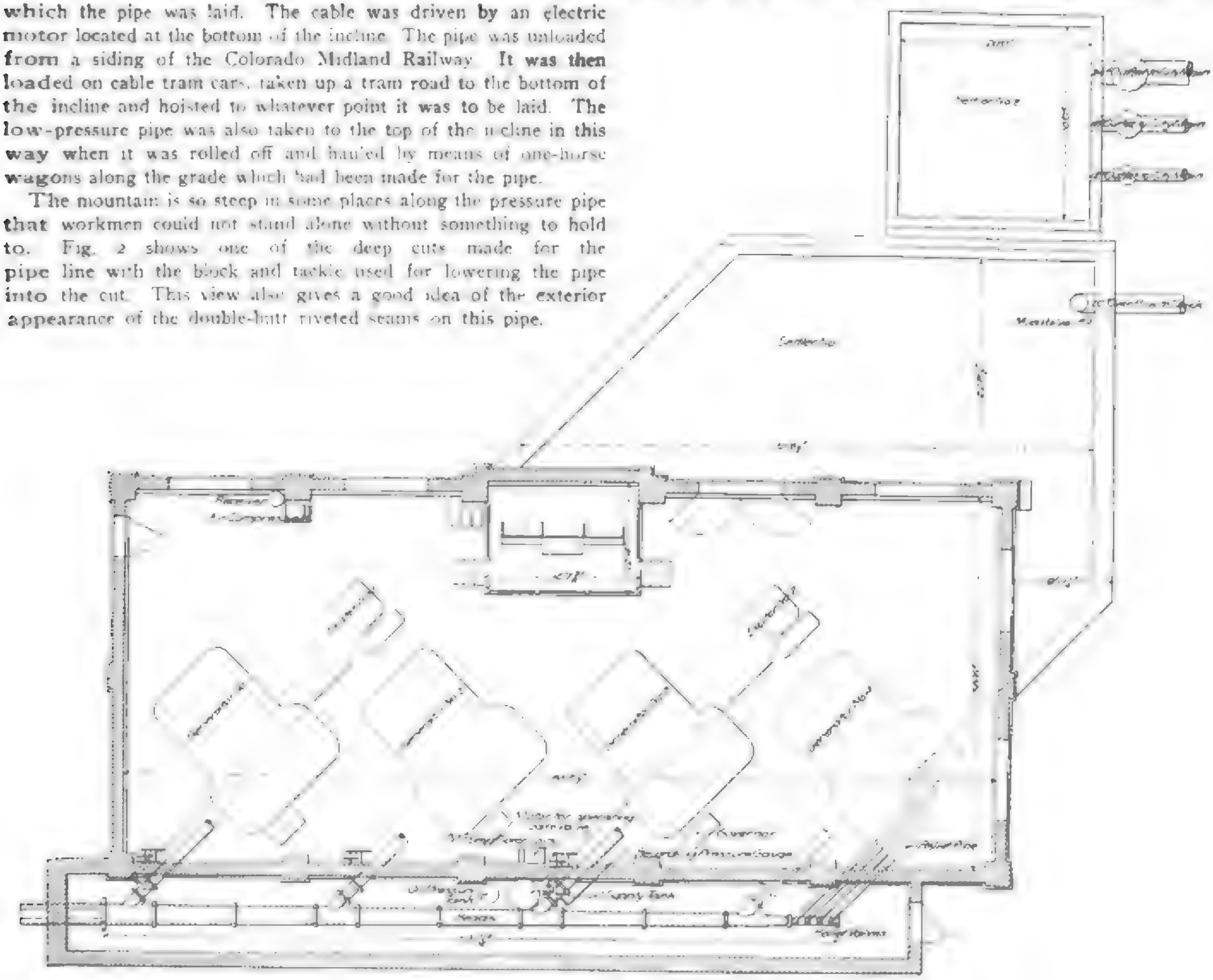


FIG. 5.—GENERAL PLAN OF POWER HOUSE.

The car on the incline railway carried 1,000 lbs. counterweight as ballast, as there are points where a change in grade causes considerable lifting on the front end of the car. The tailrope of the idler of the hoisting mechanism carried 3,000 lbs. weight. This mechanism will hoist, without slipping, a load of 15,000 lbs. up a 62½ per cent grade. The heaviest load ever taken up was 12,000 lbs., including the car.

At the power house, the high-pressure pipe line terminates in a header shown in Fig. 3. From this header provisions are made for four branches leading to the water wheels in the power house. At the end of this cast steel header are four Crosby 2-in. relief valves. These are adjusted so as to open at 1,100, 1,200, 1,300 and 1,400 lbs. pressure respectively.

Although it may not be evident from the photographs, the location of the power house is such that it was necessary to make a large excavation in the side of the mountain to accommodate it. Fig. 4, which is a view taken from just above the power house, gives some idea of this, although the ground is so steep in that vicinity that it is almost impossible to secure photographs showing the true situation. There is no level ground in the vicinity. The general plan of the power house is shown in Fig. 5. Provision has been made for four generators, three of which have been installed. These generators were placed at an angle on account of greater convenience in the disposal of the waste water from the water wheel nozzles. As can well be imagined, the problem of successfully cushioning the force of the stream from a nozzle from which water is issuing at over 940 lbs. pressure calls for considerable skill in design. If such a stream were allowed to strike masonry or iron work, it would soon destroy whatever it impinged against. The speed of the water wheels is governed

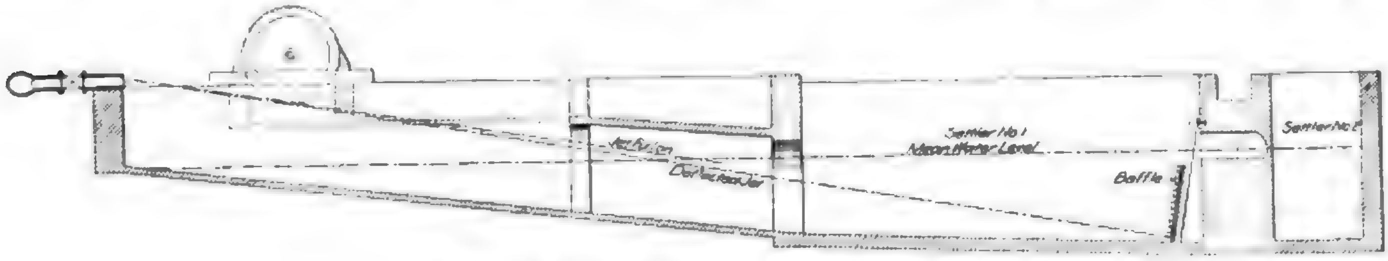


FIG. 6.—SECTION THROUGH POWER HOUSE.

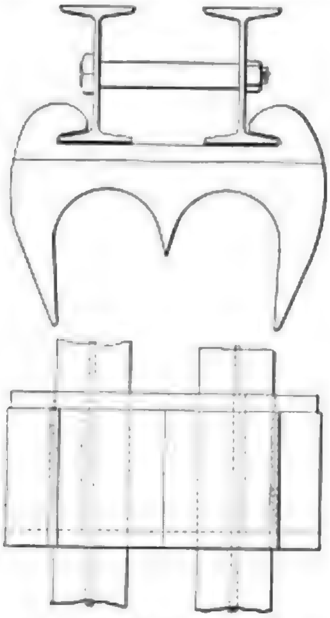


FIG. 7.—BAFFLE PLATE FOR TAIL RACE.

by deflecting the nozzle away from the buckets when the load is light, thus allowing part of the water to go past the wheel with full force into the tail race. On very fluctuating load, almost the whole jet may occasionally have to be taken care of in the tail race. Fig. 6 shows a section through the power house and the settling tanks which adjoins the power house one of which really acts as a part of the tail race. It will be seen from this that when the jet is fully deflected from the water wheel, it strikes the water in the tail race at such an angle that it has about 40 ft. of water cushion before reaching the cast-iron baffles on the far side of the settling tank. Tests made to determine the effect of the unthrottled jet have shown that the jet will under no circumstances reach the baffle. It ploughs deep furrows in the water, which, when they reach a certain depth, collapse. This cycle of cutting and filling in the tail water goes on continuously. The baffle plates in the tail race, details of which are shown in Fig. 7, are made up of sections of cast iron, which slip over vertical I-beams. They are made in sections, partly on account of convenience in handling, and partly so that it will not be necessary to renew the whole baffle in case part of it is worn out. From settler No. 1 the water flows into settler No. 2 and back into the Colorado Springs water works supply from which it was taken up in the mountains.

Near the power house a small machine shop was built in the early stages of construction. This is equipped with first-class machine tools including a lathe, drill press and shaper. The structural steel for the power house was bought in standard lengths and cut and drilled here, thus effecting a considerable saving. The interior of the power house is shown in Fig. 8. It is spanned by a Whiting hand power traveling crane. Each of the three large units is driven by a Pelton water wheel running at 450 r.p.m.

Tests on the efficiencies of the water wheels made during the latter part of June, 1905, by Mr. G. A. Taff, president and manager of the Pike's Peak Hydro-Electric Company, and Mr. George M. Peck, of the Pelton Water Wheel Company, gave the following results:

Wheel on generator No. 1, 68.85 per cent efficiency.
Wheel on generator No. 2, 61.50 per cent efficiency.
Wheel on generator No. 3, 64.51 per cent efficiency.

The average for the three machines is a little less than 65 per cent efficiency at normal full load. Facilities for accurately measuring the tail water were provided a short distance below the power house. Two large wooden tanks were sunk in the side of the mountain and arranged so that one could be discharged while the other was filling, thus actually measuring the water instead of depending on a weir measurement.

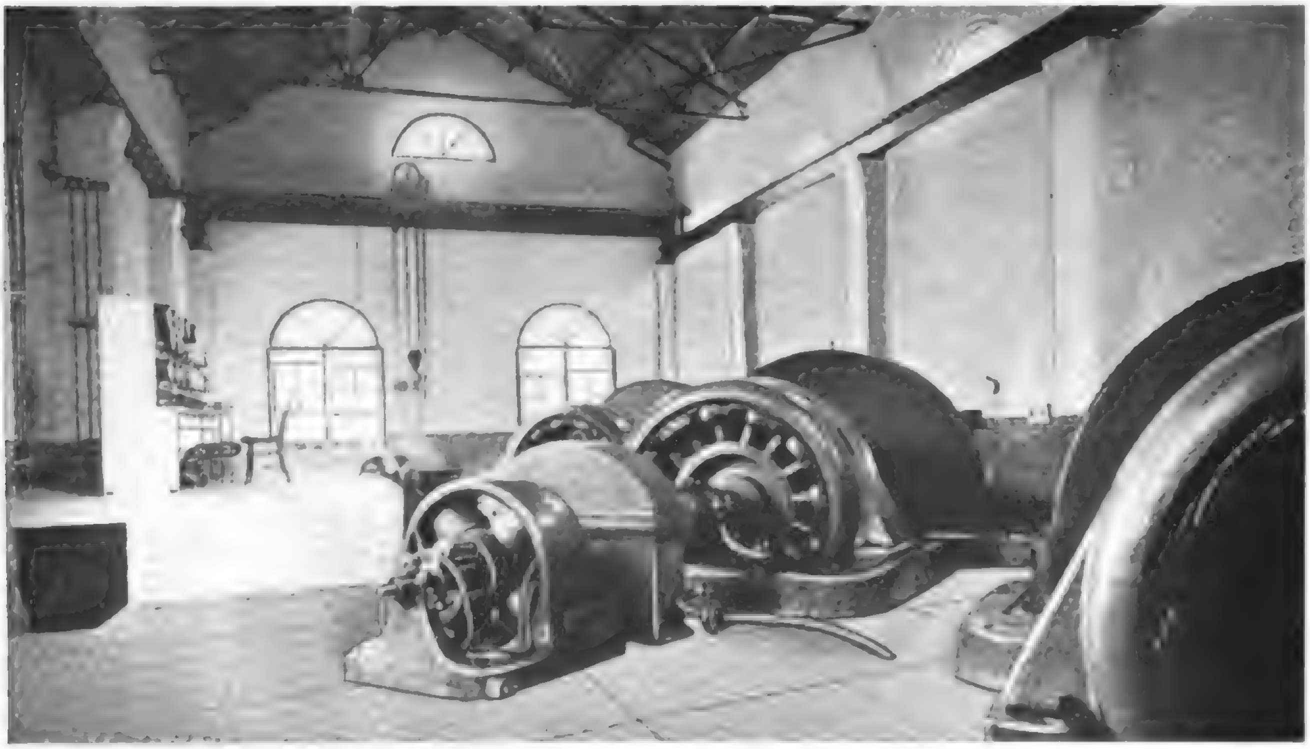


Fig. 8—View of Interior of Power House.

The wheels are provided with Lombard water wheel governors and are governed entirely by deflecting the nozzle away from the wheel, as it would be out of the question to govern by throttling under such a high pressure. The wheels are provided with needle nozzles, by which the size of the stream can be varied by hand. It is the practice to adjust the needle valve so that the governor on one of the generators will be inactive. This generator will work along on a constant load, allowing the other to do the governing and take the fluctuations. This is found more satisfactory than letting both governors do the regulating. In dealing with a long, high-pressure pipe line it is of great importance to make it impossible for an excited attendant to close a valve suddenly, as such closing would wreck the pipe. The gate valve controlling the flow of water to each of these wheels is operated by an electric motor. One of these valves is shown in Fig. 9. The motor is geared by a worm to the valve stem. The gear can be thrown in and out by means of the handle seen on the hub of the large hand wheel. This motor is operated at 125 volts direct current from the exciter circuit. When operating at full speed, it requires twenty-five minutes to close the valve when it is completely opened. The needle nozzles are also equipped with hand wheels, by which it is impossible for the attendant to close the needle valve rapidly. The pipe line is therefore well insured against shocks due to sudden stoppage of the column of water.

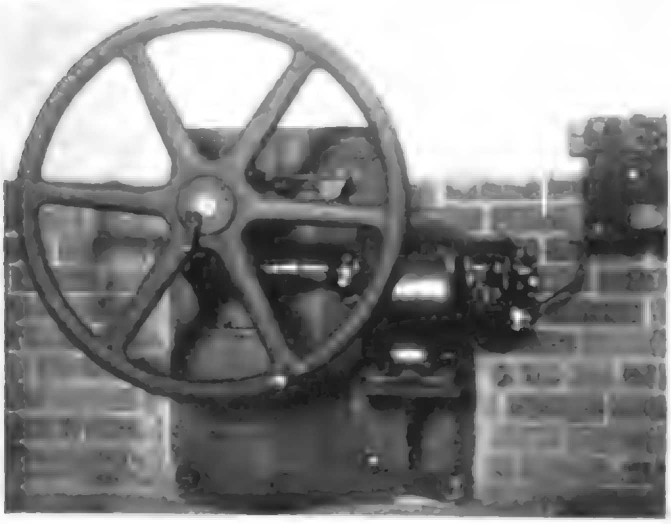


FIG. 9.—MOTOR-OPERATED GATE VALVE.

The three General Electric generators which are connected to these water wheels are rated at 750 kw each. They give 6,600-volt, three-phase, 60-cycle currents. They will carry full load for twenty-four hours without attaining a temperature in any part of more than 35° C. above the surrounding air, and an overload of 25 per cent for ten hours, and 50 per cent for two hours within the temperature limits. Their efficiencies are 94.5 per cent at full load, 93.5 per cent at three-quarter load, and 91 per cent at one-half load. The drop in voltage between no-load and full-load on non-inductive load, without change in field excitation, or speed, is 5 per cent. Working at rated current capacity with 80 per cent power factor, this drop in voltage between full current and no load is 20 per cent. There are two 45-kw, 125-volt exciters, direct-connected to small Doble water wheels running at 975 r.p.m. The piping for these wheels is so small, because of the high pressure, that they seem almost like toys.

The foundations, settling tanks, floors and switchboard platform, as well as the cover to the large settling tank, are all of reinforced concrete, which was mixed from the decomposed granite dug out of the side of the mountain just above the power house. A more convenient supply of material could not be imagined. A Drake concrete mixer was set up just beyond the power house site and driven by a 5-hp induction motor. Two men were employed to shovel the decomposed granite out of the mountain side into the machine and were given extra wages with the understanding that they keep it fully supplied. The mixed concrete was taken away from below by the workmen as fast as made and put into the building.

The switchboard and switching apparatus, including the oil switches, is of a design original with Mr. Taff, the oil switches with which the board is equipped being made by the company. A general view of the switchboard which is on a raised concrete platform, is shown in Figs. 8 and 10. The switches are all located under the board and are operated with compressed air by means of the small handles seen on the switchboard table. No high-tension wires come to the upper part of the board. Along the bottom of the board are disconnecting plugs, by which the oil switches can be disconnected from the high-tension circuits when the switches are to be cleaned or repaired. The cross-section through one of these oil switches is shown in Fig. 11. The compressed air cylinder and piston for operating these switches are mounted at the bottom of the switch. In fact, the same casting serves both for the switch casing and the compressed air cylinder. Compressed air for operating these switches is supplied by a storage air tank kept filled by a Christensen motor-driven compressor with motor operated off the exciter circuit. The air valves used in operating the switches are the ordinary Christensen straight air-brake motorman's valves. The only difference is in the handles, which are as indicated on the board. The upper part of the switch casing is filled with oil and has a wood fibre lining. The switches have main contacts to carry the current and auxiliary contacts upon which the arc is broken. These auxiliary contacts have an open circuit clearance of 3⅝ in. The insulating material used in these switches is kiln-dried maple wood treated by boiling in paraffine from eight to nine hours until the wood sinks and no more effervescence appears on surface of the liquid.

As the conditions were such as to make it certain that the power house would never be extended to include more than the four generators for which it is laid out, the switchboard was built with a fixed number of generator and feeder panels. The middle of the switchboard is given over to feeders, each switch handle representing one feeder. Just above the switch handle is a set of pilot lamps, one pair showing red, and the other blue, according to whether the switch is closed or open. Contacts carried on the rod which extends out at the top of the switch, complete the circuit through the red lamps when the switch is closed, and through the blue lamps when the switch is open. The generator and exciter switches are at the right and left of the board. The generator and feeder switches have double indicating pilot lamps. Next to each main generator switch is the switch controlling its field circuit. The direct-current switches are of a similar design to the high-tension alternating-current switches. Only a single pair of pilot lamps is provided for on the direct-current switch, however. At the right-hand end of each of the side panels is a switch for one exciter whereby it can be connected to the exciter bus-bars.

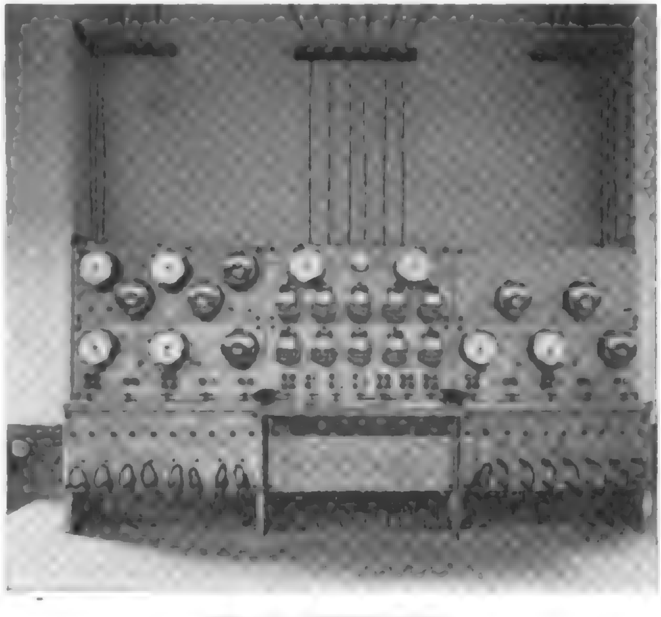


FIG. 10.—SWITCHBOARD.

At present two three-phase circuits, each of solid No. 000 wire, leave the power house to feed into the transmission system of the Colorado Springs Electric Company, which buys at wholesale all of the Pike's Peak Hydro-Electric Company's electricity, save the small amount used in lighting Manitou and the streets and public buildings of Colorado Springs. The Manitou lighting is accomplished with a 3,900-volt distribution, which is supplied by connecting the Manitou load between one of the outer wires and the neutral of the star-connected generators. This neutral is led out to the socket which appears midway between the other sockets at the right-hand lower corner of the switchboard. This, of course, unbalances the circuit, but the lighting of Manitou is a very small per cent of the total load.

The two main feeders leaving the power station run direct to a switching sub-station of the Colorado Springs Electric Company at Colorado City, where it is connected to the triangular network of 6,600-volt transmission lines belonging to the Colorado Springs Electric Company, which distributes electricity for lamps and motors in Colorado Springs and vicinity. This company's plant was fully described in this journal in the issue of June 3, 1905.

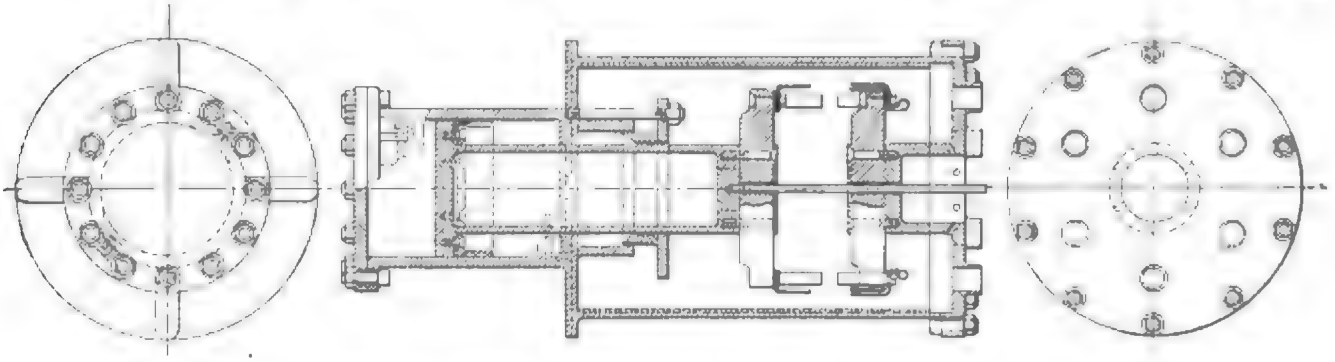


Fig. 11.—General Arrangement of Pneumatic Oil Switch.

The position of the Pike's Peak Hydro-Electric Company is purely that of the manufacturer of electricity for motors, if we leave out of account the street lighting in Colorado Springs and the small distribution system in Manitou. That a very low rate must be made on this wholesale electricity is evident from the fact that the Colorado Springs Electric Company buys the electricity in preference to operating its steam plant which is located directly at the coal mines near Colorado Springs. The apparatus at the steam plant is sufficiently economical in its performance to be able to turn out a kw-hour with a consumption of from seven to eight pounds of cheap, lignite coal. The Pike's Peak Hydro-Electric plant, while an expensive one to build in some respects, is a very cheap one to operate. The regular force consists of six men to operate the power house, make small repairs, and patrol the pipe lines.

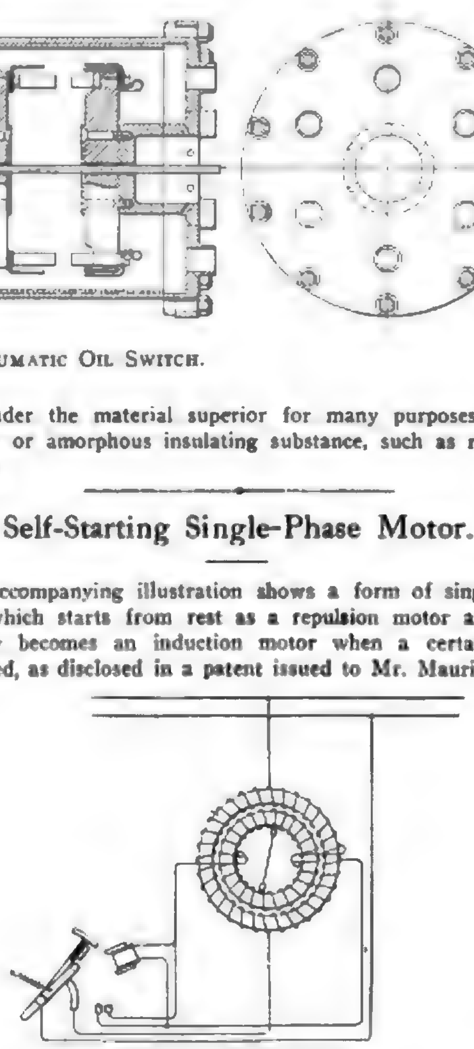
At the time the franchise under which this company operates was granted, a contract was also secured from the city to supply all the electricity needed for street lighting with 6.6-ampere, 72-volt alternating-current lamps, at a price of $66 per lamp per year, for a period of 25 years. The Pike's Peak Hydro-Electric Company has confined itself to generation, leaving the Colorado Springs Electric Company to do the work of distribution. The entire engineering of the company is in the hands of Mr. G. A. Taff, of Colorado Springs. When a market opens up for power the company will build another power station higher up in the mountains utilizing a fall of about 1,500 ft. of this same water.

Refractory Material for Electric Insulation.

Two patents issued March 27 to Mr. D. M. Steward, deal with a refractory material of high electrical resistance, which is stated to possess practically perfect homogeneity, to be absolutely fireproof and to be unaffected by cold or moisture. As the basic material, use is made of hydrous magnesium silicate, commonly known as "talc," "steatite" or "soapstone," which is mixed with a suitable proportion of water-glass sodium silicate, or potassium silicate. The effect of varying the proportionate quantity of water-glass is to change the degree of hardness obtained. For general purposes 100 parts by weight of magnesium silicate or aluminum silicate in finely commuted form are combined with 20 parts of water-glass, sodium silicate or potassium silicate in fluid form, to obtain a plastic mass having a consistency about equal to workable putty. The mixture is subjected to great pressure, which imparts to it the shape ultimately desired, and is then dried in a steam-heated kiln. The final step in the process consists in subjecting the article in the kiln-dried state to a temperature of from 1,500° to 2,000° C. for from five to eight hours. It is stated that by aid of the process outlined above minute tubes may be produced practically without limitations as to length, and that the hardness, stress-resisting qualities and the resistance to moisture and to the effects of heat and cold render the material superior for many purposes to any vitreous, or amorphous insulating substance, such as rubber or the like.

Self-Starting Single-Phase Motor.

The accompanying illustration shows a form of single-phase motor which starts from rest as a repulsion motor and automatically becomes an induction motor when a certain speed is reached, as disclosed in a patent issued to Mr. Maurice Milch on May 1, 1906. The commutator on the rotor is provided with four brushes (two-pole model). Under starting conditions two of the brushes are joined in short circuit, so that the machine starts as a repulsion motor. The other two brushes are connected in circuit with the energizing coil of an electromagnet which receives an appreciable current under the transformer e.m.f. existing between the brushes when the rotor is at rest or is revolving at a very slow speed. As the speed of the rotor increases the quadrature field produced by the repulsion motor increases also, and at a definite speed the current through the electromagnet, which is due to the difference between the transformer e.m.f. and the speed e.m.f., decreases to a value sufficient to allow the switch lever connected with its armature to be closed and the second pair of brushes to be connected together through a small portion of the primary winding. This small portion of the primary winding is included in circuit so as to impress upon the brushes a compensating e.m.f. which supplies the exciting current to the machine, and thereby improves its power factor.



Self-Starting Motor.

Simple Circular Current Locus of the Induction Motor.

By A. S. M'Allister.

In an article which appeared in the issue of the Electrical World for April 21, it was shown that by introducing certain assumptions concerning the circuits of an induction motor, which assumptions involved well-defined but practically negligible errors, the complete performance of the machine could be determined from a current locus whose most prominent feature is its simplicity. Mention was also made of the fact that it is possible to represent the various quantities necessary for ascertaining the characteristics of an induction motor graphically by means of simple circular arcs and straight lines. The present article deals specifically with the use of the simple circular locus of the primary and secondary currents of the motor for determining the complete performance of the machine.

Figs. 1 and 2, which are reproduced from the article referred to above, show, respectively, the exact representation of the circuits of an induction motor, on which a true diagram should be based, and the modified representation, in accordance with which the simple diagram is constructed. A comparison of these two illustrations will serve for ascertaining the magnitude of the errors involved in the use of the simple circular locus, a view of which is given in Fig. 3. At any point P on this locus, the line MP represents the primary current, while the angle, EMP is the angle of lag of the current behind the primary e.m.f., EM. The line OP shows the secondary current, both in value and phase position. When the secondary current has zero value, that is, at synchronous speed, the primary current becomes equal to MO, ON being its "wattless" component and NM its power component to supply all of the no-load losses. When the rotor is stationary, the secondary current assumes some value such as OF, and the primary current is the vector sum of OF and OM (not drawn). The curve, OPF, is the arc of a circle having its center on the line ON prolonged.

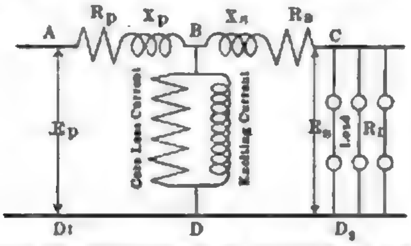


FIG. 1.—EXACT REPRESENTATION OF CIRCUITS OF AN INDUCTION MOTOR.

Under starting conditions, all of the power received by the motor is used in supplying the copper and core losses of the machine. The line FI is the power component of the primary current at starting, and hence, by the use of the proper scale, it may represent the total losses of the machine when the rotor is stationary. If it be assumed that the circuits of the machine are faithfully represented by Fig. 2, then the line $HF = (FI - MN)$ of Fig. 3, shows the secondary copper loss and the increase of the primary copper loss over its (synchronous) no-load value. The line HF being properly divided at G, GH represents the increase of the primary copper loss, and GF the secondary copper loss for the current OF. By drawing from the point O a straight line, OGJ, passing through the point G, the complete performance of the machine may be determined directly from inspection.

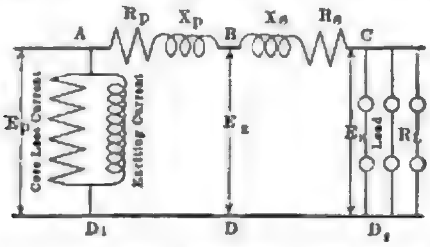


FIG. 2.—PRACTICALLY EXACT REPRESENTATION OF THE CIRCUITS OF AN INDUCTION MOTOR.

If from any point P on the circular locus a line be drawn perpendicular to the diameter, OK, the following quantities may be observed at once:

MP is the primary current,
EMP is the primary angle of lag,
$\cos EMP$ is the power factor,
OP is the secondary current,
PT is the total primary input,
TS is the "constant" losses of the machine,
RS is the added primary copper loss,
RT is the total primary losses,
PR is the total secondary input, in watts;
PR is the torque, in synchronous watts,
QR is the secondary copper loss,
$QR \div PR$ is the slip, with synchronism as unity;
$QP \div PR$ is the speed,
QP is the output,
$QP \div PT$ is the efficiency.

The maximum power factor occurs when the point P is at A, where the line MP becomes tangent to the circle.

The maximum output occurs when P is at B, the point of tangency of a line drawn parallel to OF.

The maximum torque occurs when P is at C, the point of tangency of a line drawn parallel to OG. The current which is required to give maximum torque varies somewhat with the primary resistance, but it is independent of the secondary resistance, although the speed at which the maximum torque is obtained depends largely on the value of the secondary resistance. The secondary resistance required to give maximum torque at starting bears to the assumed constant primary resistance the ratio of $G'C$ to $G'H'$ of Fig. 3.

The proof of the accuracy of the diagram in representing the value and phase positions of the primary and secondary currents for the circuits as shown in Fig. 2 was given in the article mentioned above, and it need not here be repeated. That the various other quantities are accurately represented as indicated may be shown as follows:

Denoting as α the angle POK of Fig. 3, it will be seen that $OS = OP \cos \alpha$, and that $OP = OK \cos \alpha$. Hence, $OS = OK \cos^2 \alpha$, or $OS = \overline{OP}^2 \div OK$. The interpretation of the last equation is that, as the point P moves around the circle, the line OS is at all times proportional to the square of the line OP. That is to say, the line OS is proportional to the secondary copper loss or to the increase in the primary copper loss over its no-load value. Under starting conditions, the secondary and the added primary copper losses are represented by FG and GH; and at any point P, the corresponding losses must bear to FG and to GH the ratio of OS to OH. Therefore, the secondary and the added primary copper losses are accurately shown by the lines QR and RS, respectively.

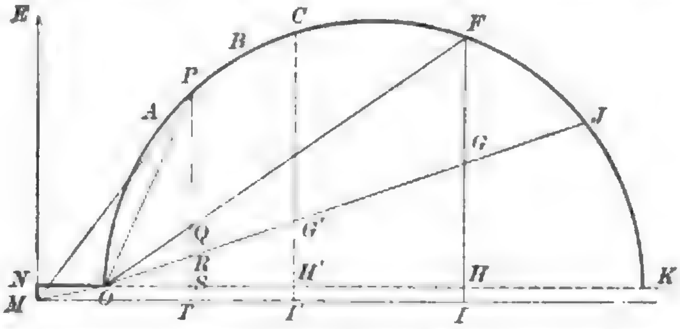


FIG. 3.—SIMPLE CIRCULAR CURRENT LOCUS OF AN INDUCTION MOTOR.

That the ratio of the secondary copper loss to the total secondary input is equal to the slip is too well known to need proof. It seems desirable, however, in this connection to call attention to the fact that this ratio is a true measure of the slip whether the magnetism of the machine remains constant or not, and that the accuracy of the determination of the slip by this method is in no wise affected by the substitution of the modified circuits of Fig. 2, for the exact circuits of Fig. 1. Thus, if the secondary copper loss is determined without error, and the secondary input is known, both the speed and the torque may be ascertained with precision. It is seen, therefore, that any errors introduced must relate to either the currents or the losses.

If the points O and F of Fig. 3 are obtained from an actual test on a machine, it is evident that the circle diagram as constructed must be at least approximately correct for the primary current locus. Under starting conditions the power received by the machine is accurately represented by the line FI. If the distance FG be drawn equal to the easily determined "added" primary copper loss, the distance GH must represent the secondary copper loss with a fair degree of accuracy.

It is especially worthy of note that under starting conditions and at synchronous speed the errors are eliminated, and throughout the operating range of the motor the various errors tend to cancel each other. Even in extreme cases, where the (synchronous) no-load triangle, OMN, is large in comparison with the circle diagram, the errors are relatively small and for most practical purposes may well be neglected.

It is not possible to obtain absolute accuracy in a simple diagram of an induction motor. Moreover, it is unnecessary to construct a diagram with a degree of accuracy greater than that which can be employed with it in scaling off the various values. The principal advantage to be found in the graphical method of treating induction motor phenomena resides in the fact that by the use of a simple diagram one is able to follow optically, and thus mentally, the changes which take place throughout the operation of the machine, while in the manipulation of algebraic formulas, which can be used for absolute accuracy, one is apt to find himself more or less in the dark concerning these changes

Synchronous Converters Versus Motor Generators.

By Clarence P. Fowler

ALTHOUGH synchronous converters have in the past been largely employed as the connecting link between alternating current and direct current networks, yet doubt seems to exist in the minds of some engineers as to whether or not this class of apparatus is as suitable (under some conditions) for the conversion of current as the motor-generator—a double machine unit, consisting of an alternating-current motor direct connected to a direct-current generator—the two machines being mounted on a common bed plate.

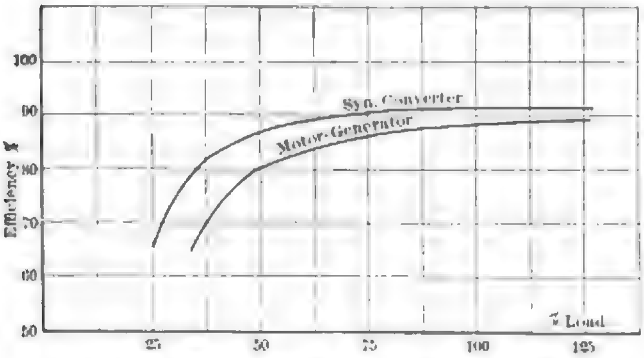


FIG. 1.—EFFICIENCY CURVES OF 60-CYCLE MACHINES.

In what follows, it has been endeavored to institute a comparison between these two well-known types of dynamo electric machinery, covering the following characteristics in the order named: 1, efficiency; 2, floor space and cost; 3, inherent regulation and voltage control; 4, overload capacity; 5, methods of starting; 6, hunting; 7, power factor; 8, frequency; 9, reversibility.

In order that comparison may be made on what seems to be a common plane, the induction motor-generator set will be excluded from consideration, and the motor used will be assumed to be of the synchronous type. This machine, like the synchronous converter, has the advantage of phase control by variation of field excitation, and this generally tends to improve the power factor of the system to which it may be connected.

The synchronous motor armature will be assumed to be wound for the direct application of the working voltage of the system, namely 6,600 volts, and will therefore be of the revolving-field type.

Efficiency.—In comparing the efficiencies, combined efficiencies will be considered. These will depend upon the total losses of conversion from high-tension alternating current to direct current, which would include the losses in transformers plus losses in converter in one case and total losses in the motor and the generator in the other. Under these conditions the synchronous converter shows quite a percentage gain in efficiency at full load over the motor-generator, the efficiency in favor of the converter becoming more marked at lighter loads, due to the relatively lower copper and iron losses of the latter machine. It might be noted here that this better efficiency on the part of the rotary converter at fractional loads has quite a marked effect in improving the "all day" efficiency of the plant using this type of machine

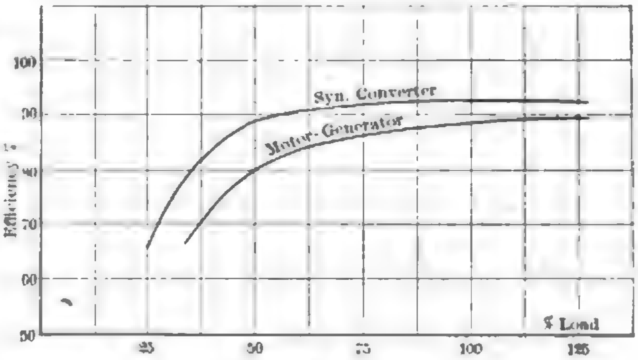


FIG. 2.—EFFICIENCY CURVES OF 25-CYCLE MACHINES.

This poor showing in efficiency is one of the most serious drawbacks that the motor-generator possesses, and has been a great barrier to its adoption in substations fed from steam-driven stations where fuel forms a large portion of the operating expenses. The comparative efficiencies are clearly demonstrated by references to Figs. 1 and 2—Fig. 1 showing the combined efficiency curves for a 500-kw, 575-volt, 60-cycle synchronous converter and the equivalent motor-generator, and Fig. 2 giving a similar set of curves for a 500-kw, 575-volt, 25-cycle synchronous converter and the corresponding motor-generator set.

It is notable in comparing the curves of Fig. 1 with those of Fig. 2, that in the case of the converter designed for the lower frequency the efficiency is somewhat higher than that of the 60-cycle machine, while the motor-generators for the two frequencies are practically equally efficient.

Floor Space and Cost.—Again taking the two machines of Figs. 1 and 2 as a basis for comparison, the cost per kilowatt of the 500-kw, 60-cycle, 575-volt converter and lowering transformers would be $15.50, while that of the motor-generator for the same output, frequency and direct voltage would be $19. For 25 cycles the relative costs would be $16 for rotary and lowering transformers, while for motor-generator the cost would be $20. These facts serve to show not only the relatively higher cost of motor-generators—being a double unit instead of one—but also the greater inherent output which the converter possesses per pound of active material as will be discussed later under full load conditions on the direct-current side of the machine.

As regards the floor space occupied, the motor-generator has the advantage over the synchronous converter with its lowering transformers, although this objection vanishes and actually turns in favor of the rotary if the transformers be mounted on a superstructure such as a gallery, as is found in some of the more modern installations. Assuming, however, that the lowering transformers for the converter are placed on the floor, the relative number of kilowatts capacity per square foot of floor space in the case of the two sets of 500-kw outfits before considered would be as follows: For 60-cycle converter, 4 kw per square foot floor space; for 60-cycle motor-generator, 5.62 kw per square foot floor space, for 25-cycle converter, 4.35 kw per square foot floor space; for 25-cycle motor-generator, 5.55 kw per square foot floor space.

Inherent Regulation and Voltage Control.—With the synchronous converter, any voltage disturbances which occur on the alternating-current system are obviously reproduced on the direct-current side, which could not occur with the motor-generator set provided the impressed alternating voltage does not drop to the point at which the motor falls out of step, and, it might be added, that some engineers' specifications are now calling for synchronous motors which shall not fall out of step when the impressed voltage falls as much as 15 per cent under full load conditions on the direct-current side of the machine.

For railway service where voltage regulation is not as exacting as with lighting, it is usual with converters to depend upon automatic compounding by the aid of a series field winding in conjunction with a judicial amount of reactance* inserted between the rotary and its source of supply.

With the closer regulation necessary in the operation of rotaries for lighting purposes, it is usual to have some device such as the induction regulator, which can be controlled by hand and which permits of variations of the applied alternating voltage over a wide range in a gradual manner.

With the motor-generator, however, the direct voltage bears no fixed ratio to the alternating voltage, and the former can, therefore, be gradually varied over a wide range by simple shunt field control of the direct current generator. This method of control presents considerable advantages in simplicity over the one just cited for synchronous converters.

Overload Capacity.—Owing to the neutralizing effect of the alternating and direct currents in the converter armatures, there results a low copper loss for this type of machine, and, since the heating is reduced, the output may be increased as compared with the same armature forming part of a straight direct-current generator. This low copper loss on the part of the converter becomes more marked as the number of the phases increases, as might be expected, owing to the greater distribution of the leading in taps on the alternating-current side of the armature, as well as to the increase of the average length of time when an alternating-current tap to armature winding will have the same angular position as the brushes resting on the commutator, thereby reducing the effective length of the path through which current must flow before finding an outlet on the direct-current side.

TABLE I.

RELATIVE ARMATURE HEATINGS FOR SAME LOAD.

	D. C. Gen.	Three-phase Converter	Two-phase Converter	Six-phase Converter
(H)	1.00	.555	.37	.26

Table I gives the relative heating of the same armature used as an ordinary direct current generator, and also when the same machine is used respectively as two, three and six-phase converters at unit power factor, the heating of the direct-current generator being taken as unity.

TABLE II.

RELATIVE RATINGS FOR SAME HEATING.

D. C. Gen.	Three-phase Converter	Two-phase Converter	Six-phase Converter
1.00	1.34	1.64	1.96

The heating being proportional to the square of the current and as the output is proportional directly to the current, for the same heating the relative rating by armature heating can be obtained by multiplying the rating of the direct-current generator by $\frac{1}{\sqrt{H}}$ from which is derived Table II in which the rating of the direct-current generator is taken again as unity.

It is seen, therefore, that for a given amount of copper and iron the converter is quite superior in output to the generator and especially to the motor-generator.

Further, the amount of load that may be carried by the converter is not dependent upon the mechanical torque, as there is no transference of mechanical power from the alternating current to the direct current side as would be the case with the motor-generator set, the maximum load on the former type of machine being limited by the heating of the armature conductors.

Methods of Starting.—The synchronous converter and the motor generator set are about on a par as far as starting characteristics go, neither being self-starting without considerable disturbance to the system, and in order that they may be started, each requires some form of auxiliary starting device such as a motor, or provision must be made for starting from the direct-current end which requires some initial source of direct current when the sub-station is to be started up after having been completely shut down.

Hunting.—The tendency on the part of the rotating members of synchronous apparatus to alternately speed up and slow down is found to some extent in both synchronous converters and motor-generators. Inasmuch as this phenomenon is accompanied by the shifting of the magnetic lines of force across the polar arc, anti-hunting devices in the shape of heavy copper grids (surrounding and embedded in the pole face) have been quite effectively applied in the case of the synchronous converters without undue eddy current losses in these damping devices.

With synchronous motors wound for the direct reception of high voltages, which consequently have a fewer number of slots, the employment of such expedients for the prevention of hunting becomes more or less prohibitive owing to the excessive eddy current losses in the damping devices. The tendency toward hunting increases with the frequency, the higher-frequency converters being more sensitive in this respect than motor-generators, owing to the fact that high-frequency converters cannot be satisfactorily designed with sufficient armature reaction to produce the desired stability.

Power Factor.—The synchronous converter has no appreciable torque upon its shaft, and with constant field strength, the power factor is practically independent of the load on the direct-current end. This is a condition that prevails with converters used for lighting service which are usually shunt wound, and is clearly exemplified by a test on some converters of which the writer had charge, the results of which are given below. The machines upon which the tests were made are ordinarily used for serving a large urban railway system and were of 1,500 kw capacity, 3-phase, 25-cycle, 600 direct volts, the machines were equipped with series field coils, but these were never used, even in regular service, to obviate the possibility of a runaway upon the reversal at the direct-current end.

The readings which were taken when the field current was held constant and the load varied on the direct-current end are as follows:

Direct Current Load, Kilowatts.	Direct Current, Field Amperes.	Alternating-Current Power Factor.
0	8.5	99
375	8.5	99
630	8.5	99
935	8.5	99
1240	8.5	99
1420	8.5	99
1520	8.5	99

The above readings correspond approximately with similar observations made upon another unit which was designed as an exact duplicate of the first.

As before stated, it is usual in railway practice with converters to use series coils with reactance inserted in the alternating-current leads. When the amount of the reactance is properly chosen, and care is exercised in adjusting the current in the series field coils by the use of a shunt resistance, the power factor may be held quite high over a wide range of loading at constant potential. Thus it is possible to obtain the results shown by the curves of Fig. 3, which give the relation between the power factor and the load with the same reactance inserted, but the series field coils in curve *A* are shunted to give 100 per cent. power factor at full load, whereas with curve *B* the series field coils are shunted to give 100 per cent. at three-quarter load. Keeping the power factor constantly high at partial load as in curve *B* means decreased heating of converter at light load and is an important factor where loads are fluctuating as in railway service.

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* See writer's paper on "External Reactance for Synchronous Converters," ELECTRICAL WORLD AND ENGINEER, June 17, 1905.

In the case of the synchronous motor-generator set the state of affairs is different because of the mechanical transference of power from the motor side to the generator side. This is the well-known case of the simple synchronous motor working against a resisting torque, and under such conditions there is a critical load for each field strength which brings the current into phase with the impressed e. m. f. so that for stability of power factor under varying loads on the direct-current generator, it would mean considerable adjustment of the motor field to eliminate the wattless component of the current at all times.

Furthermore, if the synchronous motor is excited from the direct-current generator which it drives (which is usually the case) and if this latter machine is over compounded, then under fluctuating loads, an added complication will exist of varying the field on the motor, which will have the effect of producing a rather unstable power factor.

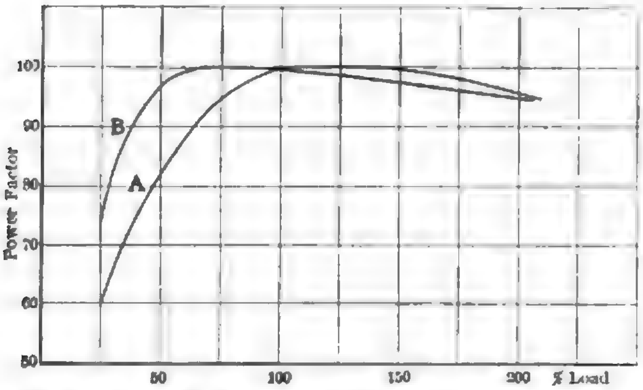


FIG. 3.—EFFECT ON POWER FACTOR OF ADJUSTMENT OF SERIES FIELD CIRCUIT OF SYNCHRONOUS CONVERTER.

Frequency.—With the motor-generator set composed, as it is, of two machines electrically independent of each other, each may be designed for its intended purpose, the only condition common to both being the speed, and this is determined by the number of the motor poles, which is not, however, hampered by any consideration of the direct-current generator to which it is conected, and the motor may be designed for operation without any difficulty on circuits of frequencies now largely in commercial use, namely, 25 cycles and 60 cycles per second.

As regards the converter, however, quite different conditions exist, since the electrical independence of the alternating current and direct current sides is lost and the best design naturally resolves itself into a compromise of the features of the component types. At the lower frequency, 25 cycles per second, the converter shows an excellent performance, and it is at this frequency that all the modern large systems, employing converters, are operated.

There are, however, certain lesser systems with which it is considered advisable to combine a lighting and railway load, operating at a frequency suitable for lighting. It is on such systems that the high frequency converter has its widest field of application.

The aggregate output of railway converters designed to operate on 60 cycles per second is now quite large although manufacturers formerly hesitated to build them. Generally speaking, their behavior is rather unsatisfactory for the following reasons:

They have a tendency to hunt, owing to the limited distance between poles, which renders it difficult to design a machine, having high armature reaction, which property is conducive to stability of operation.

Direct-current generators as ordinarily constructed do not commutate well, when operating at speeds which produce frequencies higher than 25 cycles per second, owing to the large number of current reversals per second, and the attendant difficulties in commutating.

With the high commutator speed necessary with 60-cycle converters there is found to be considerable difficulty in keeping the brushes in intimate contact with the commutator surface—resulting in the necessity for increased brush tension with the somewhat abnormal resultant wear of both the brushes and the commutator.

Due to the relatively short commutator arc between positive and negative brush holders, the arc of commutation is very limited, so that the machine becomes very sensitive to slight changes in the position of the neutral point, and frequently this condition becomes so aggravated as to cause the machine "to flash over," as might result from the shifting of the magnetic lines of force across the polar arc as a result of hunting troubles.

With the crowded brush holders it becomes much more difficult to replace brushes under operating conditions (should this be found necessary) than would be the case were more space available such as is the case with the low-frequency type of converters.

Several improvements in details of design have been applied to 60-cycle, 575-volt converters to alleviate some of the above troubles, with varying degrees of success, such as specially designed brush holders with moving parts of small inertia, which will readily accommodate the brush surface to the swiftly moving commutator.

Also with multiple wound armatures a large number of balancing rings have been found necessary to equalize the potential generated in the individual armature circuits.

These and other artifices have been used to render the 60-cycle, 575-volt converter operative, but the same is inherently faulty, and no amount of finesse in design can render its performance equal to that of a 25-cycle machine, constructed for the same voltage.

Reversibility.—Although synchronous converters, primarily designed to convert alternating current to direct current, are not best suited to operate as "inverted converters," or for converting direct current to alternating current, owing to their relatively high armature reaction, yet they may be sometimes called upon to temporarily handle this class of service, and when so operating the speed of the machine as a direct-current motor is no longer fixed by the frequency of the supply circuit, but depends upon the field strength.

When supplying alternating current of low power factor the field may become so demagnetized as to cause the armature to reach a destructive speed if it is not equipped with a speed-limiting device. A separate direct-connected exciter with undersaturated field, whose voltage is very sensitive to changes of speed, may be employed for maintaining the speed at its normal value.

With the motor-generator set, which has two separate fields, obviously any reactions on the alternating end do not in any way affect the strength of field on the direct-current end. It is due to this fact that when converting from direct current to alternating current the motor-generator speed is considerably more stable than that of the converter.

Summing up the situation, it would seem that each type of converting apparatus has a field of its own where it can be most advantageously employed.

From what has been set forth above it is apparent that, all things considered, the converter is decidedly advantageous for use in an urban system for supplying power to lamps and motors from a large central station at a moderate frequency, the motor generator showing its superiority when operating from a system having a relatively poor regulation, as in the case of lighting circuits from a long transmission line, and also for furnishing a desirable method of obtaining a direct current for railway service from 60-cycle systems.

Rubber Insulated Cables Without Lead.

By JAMES S. MCLEAN.

In one of the papers on rubber-insulated underground cable, read before the American Institute of Electrical Engineers, extracts of which were published in the ELECTRICAL WORLD of May 5, 1906, the writer notes that the suggestion was made that the proper cure for electrolysis is to omit the lead sheath. This would be true under certain conditions, but in the writer's opinion these conditions do not obtain in any present conduit system where there are ever present acids and gases of various kinds that have a deteriorating effect upon rubber insulation.

This brings up the question of a suitable substitute for lead. The principal requirements of such a compound are that it should have a neutral reaction, should be acid, alkali, and moisture-proof, should be a non-conductor, should have great flexibility under temperatures ranging from —18° C. to at least 65° C., and should be of such mechanical strength as to withstand all mechanical injury during installation. It is to be regretted that a material with the above qualifications has not yet been discovered.

In this connection the result of the writer's observations on an installation of non-leaded rubber-insulated cable on which his opinion had been asked might be or interest.

In this particular system, which was a 220-volt direct-current commercial one, the main cables were leaded and the tap or service cables were without lead and comparatively short, run through glazed clay conduits. The cables themselves were regular 600-volt white core rubber, finished with two cotton braids saturated with a weather-proofing compound. The insulating compound probably contained 15 per cent to 20 per cent of pure Para rubber mixed with zinc white or Paris white, or both, and various other mineral ingredients.

The manholes were small and comparatively dry, and the cables were stretched straight across the center, the splices being made by clamping the bared ends of the conductor into brass lugs which were left uninsulated. This, of course, was extremely bad engineering.

The trouble which developed on these unleaded cables after a few months of service was as follows: A white crystalline deposit formed upon the cable at the edge of the duct; soon after the deposit appeared the rubber insulation began to swell until it was separated from the conductor and was several times its original dimensions. This swelling, of course, broke through the cotton braiding, and longitudinal cracks appeared in the insulation, which lost its original black color and took on a flesh color, the exposed surface being covered with clots of a glistening yellowish-white substance. Altogether the cracks had the appearance of ulcerating flesh wounds. The surfaces being moist, were fairly good conductors and so grounded the cables.

Upon submitting the white crystalline deposit to a chemical analysis it was found to contain a large percentage of free sodium and some common salt, as well as dirt and other impurities one would necessarily expect. This was perfectly natural under the conditions.

As is generally known, clay conduits are glazed by sprinkling the interior with an excess of common salt while hot. Now when these ducts are laid and condensation is formed in the ducts, some of the excess salt passed into the solution which eventually collected upon the cable at the edge of the ducts.

With the above conditions there was a leakage current which passed through the solution, and by electrolytic action the sodium chloride was separated into sodium and chlorine, the sodium forming a deposit, and the chlorine dissolving in the water. At the same time that this action is going on, some of the water is broken up into hydrogen and oxygen. The free hydrogen and chlorine will not unite by being mixed in the dark, but needs diffused sunlight to form combination. As these two gases are formed in the dark they will in all probability simply remain a mechanical mixture in water, but to all intents and purposes as far as chemical reactions go, they form hydrochloric acid. This attacks the weather proofing compound and eventually the acid chlorine gas reaches the insulating compound, where it preceded the presence of hydrogen, to attack the zinc oxide in the compound, forming zinc chloride and water. As soon as the zinc chloride had been formed it in turn atacked the rubber in the insulating compound with a rapidly deteriorating chemical action. The chemical equation of such action is as yet merely a conjecture by such men as Carl Otto Weber, Ph.D.

While the above action is going on the free sodium attacks the rubber, by softening the surfaces, after which the rubber rapidly decays. The above combined actions soon destroy the insulation.

In the writer's opinion the above are the principal chemical and electrical actions which destroyed the insulation in this particular case. What other actions take place in this or any other conduit system at any time can only be conjectured.

The above instance is, of course, an extreme case, but is an indication as to what unprotected rubber insulation in a conduit system is exposed to. Even if the insulation had been continuous, the possibility of the above action would be an ever-present one, as leakage currents would at some time traverse the duct system and the cables therein. This, as well as the deteriorating action on the rubber by the gases in the duct system, would of necessity shorten the life of the cable.

Electrolysis is, of course, a bad thing, but with a reasonable amount of care the life of a cable system can be greatly lengthened. The majority of operating companies seem to fail to realize the importance of systematic tests, and the change of bonds to meet the requirements of these tests, the general practice seeming to be that of having the cable manufacturer bond the cables, and let it go at that, making no tests or changes in the bonding until the cable begins to show trouble; then the cable manufacturer is notified and his experts make tests to locate the trouble, and submit their reports. In almost every case the operating company is at fault, all due to the fact that it does not realize the importance of giving the cable system the benefit of expert care.

It seems, therefore, that until the discovery of a cheap compound which is acid, alkali and moisture-proof, of great flexibility and mechanical strength, as well as a non-conductor, as a substitute for lead sheath, we must pay attention to the bonding of the cable and try to impress upon the operating companies the necessity of giving the cable system the benefit of expert care. In the writer's opinion this will remedy a large number of complaints of trouble caused by electrolysis. Of course it will not entirely remedy it as long as lead sheath is used, so we must try and control the conditions as far as possible until such time as a substitute has been discovered.

New Telephone Patents.

SUB-STATION CIRCUIT.

For common battery systems there has been a gradual evolution of the subscriber's instrument circuit. At first it was considered sufficient to use a low-resistance receiver included directly in series with the transmitter and line. The necessary low resistance of the receiver and the inclusion of the receiver cords in the battery circuit proved serious defects and an induction coil primary was then substituted for the receiver, which latter was connected to the secondary. From this there have been various deviations, using both induction and reactive coils in various combination with condensers. As an improvement over all these,

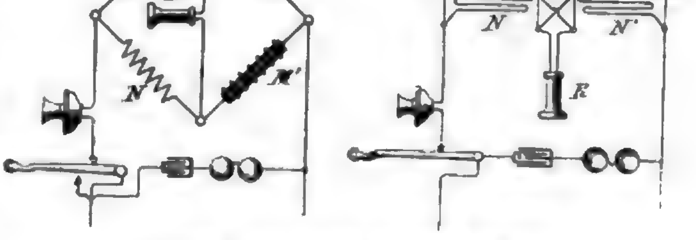


FIG. 1.—MANSON TELEPHONE SYSTEM.

R. D. Manson has brought out a bridge arrangement of receiving circuit shown in Fig. 1. In this the coils M, M', N and N are all of equal ohmic resistance, and thus for direct currents there is an equal drop of potential in each part, and there is no direct current flowing in the receiver. For alternating telephone current there is an entirely different effect, for two of the coils are wound inductively and two non-inductively. The inductance of the two reactance coils is of so great effect as to render their impedance to the telephone practically infinite, so that all telephone current must go through the receiver. Mr. Manson has patented his invention and has assigned his patent to the Dean Electric Company.

STATION APPLIANCES.

A. V. R. Fechtenburg, of New York City, has patented an auxiliary receiver support for use when one has temporarily left the instrument. This support is in the form of the usual hook, and is to be mounted in a convenient position. The hook lever is pivoted, the weight of the receiver overcoming the normal upward tension of a spring. A toothed sector is opposed to a wiper attached to the hook, and thus as the hook descends or ascends as the case may be, a series of momentary contacts occurs between these parts. By suitably arranging the wiring these contacts are made to shunt the transmitter to cause a clicking signal to notify the waiting party at the other end of the connection of both the departure and approach of his correspondent. It is unlikely that telephone companies will hail this invention with satisfaction, as the only way to induce subscribers not to leave a telephone off the hook, is by making it impossible to leave a receiver in circuit without its abnormal position being very noticeable.

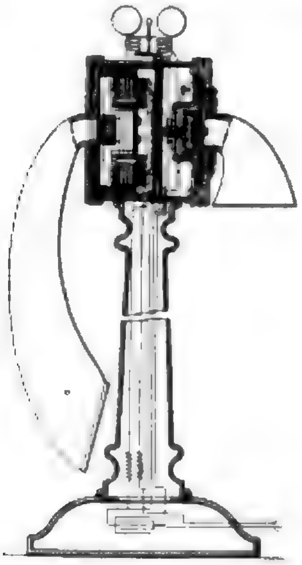


FIG. 2.—LEVENBERG TELEPHONE.

Fig. 2 shows an attempt to improve the desk stand set by a complete change in its various parts. Both receiver and transmitter are in cylindrical cases with rotating mouthpieces. The receiver part carries trailers traveling over a commutator to effect the circuit changes. This set is the invention of S. P. Levenberg, of New York.

C. E. Egan, of Columbus, O., has obtained a patent for a polarized bell, combined with a condenser. The bell has the usual frame and two-legged magnet; one leg, however, is provided with a coil, the other carrying a cylindrical rolled type condenser of similar appearance. Mr. Egan has assigned his patent to the Egan Electric and Telephone Manufacturing Company.

A revolving adjustable desk arm has been patented by T. J. Skelley, of Collinwood, Ohio, which is built upon a somewhat different plan from the usual one. The arm is composed of three rigid bars pivoted upon vertical pins and arranged to swing over each other in horizontal planes. The telephone set, arranged as for a desk set, is secured to a vertical pivot on the end of the outermost bar.

PARTY LINE.

L. A. Schmidt, of Chicago, has invented a party-line system with a lock-out feature. Each station has two double-wound relays, the contacts of one opening the line beyond its own station, and those of the other opening its own station circuit. The middle of each relay winding is connected to one of its contact joints. Current drawn through the relay and contact is differential in effect on one relay, and cumulative on the other, and vice versa. By this means a station having right of way holds its own circuit, cuts off the line beyond and cuts off the telephones of stations between it and the exchange.

SWITCHBOARDS.

A switchboard providing for a plug ejecting jack has been patented by S. Kitsee, of Philadelphia. It is doubtful, however, if there is anything of practical value in the invention.

Mr. E. Land has invented a semi-automatic switchboard, in which the operator receives all signals automatically, even the number desired, and then in response completes the connection. In this instance she manipulates keys to do this, but the complexity of her duties is much too great.

A patent, assigned to the Kellogg Company has been granted to W. W. Dean for an improved circuit for one-way trunks for use with certain two-wire switchboards. The present improvement provides a guard signal.

LETTERS TO THE EDITORS.

Life of Incandescent Lamps in Frosted Globes.

To the Editors of Electrical World:

Sirs:—Referring to the article by Messrs. Cravath and Lansingh in your issue of March 17, 1906, page 917, on the effects of frosting incandescent lamps, the results apparently show considerable superiority in point of life for lamps in enclosing globes as compared to frosted lamps.

If, however, the loss of light due to enclosing globes is taken into consideration, and the lamps be brought to the same mean spherical watts per candle (read through the globe) as the frosted lamps in the same report, the lamps enclosed in globes would give but 53½ per cent of the life values shown for these lamps. That is, the life of lamps in enclosed globes would be only 226 hours, which is about the same life the frosted lamps give according to the tests described.

It seems to me in justice to frosted lamps that this point of view should be taken into consideration. Frosting a lamp reduces the light but a small percentage—6 to 8 per cent—where the use of a frosted enclosing globe reduces the light from 20 to 25 per cent.

Harrison, N. J. F. W. Willcox.

Rolling Mill Electric Motors.

To the Editors of Electrical World

Sirs:—Referring to the interesting article on "Motors in Rolling Mills" in your issue of April 21 it may interest your readers to learn of the development of electrically-driven rolling mills which has taken place in Sweden. As early as 1894 the Boxholm iron works installed two three-phase induction motors of 100 and 70 hp respectively, furnished by the Allmanna Svenska Elektriska Aktiebolaget, of Vesteras, which firm has been the leading one in Northern Europe in the alternating-current branch of electrical engineering. Shortly thereafter the Hofors iron works installed 750 hp in motors for driving some of its rolling mills. In the last 10 years a great many other iron works have adopted the electrical system to a smaller or larger extent, such as Domnarfvet (600 hp, a large number of smaller motors not included); Horndal (750 hp); Nordiska Metallaktiebolaget (about 1,100 hp); Fagersta (2,200 hp); Sandviken (2,700 hp).

The system used in Sweden almost without exception for driving rolling mills is the three-phase. There are several reasons for adopting this system, one of the most important being the simplicity in construction and service of the three-phase induction motor, which is least likely to be damaged from the presence of iron or coal dust. An objection to the use of induction motors is the difficulty of economical speed variation. The Allmanna Svenska Elektriska Aktiebogalet has, however, by using certain inventions of Lindstrom and Danielson, solved this problem in a satisfactory manner. The motors are built either with windings that can be connected for either of two sets of poles, the one being the double of the other, or are built as concatenated (tandem) motors, thus running either at a speed corresponding to the number of poles of the primary motor or at a speed corresponding to the total number of poles of the primary and secondary motors. Motors have also been built with a combination of these two methods such that either the primary or the secondary of the concatenated motors is provided with a two-speed winding. Some motors of this type are used at Sandviken, one of them consisting of a primary motor with 32 or 64 poles and a secondary motor with 4 poles. The secondary motor is used only in connection with the 32-pole winding of the primary motor, and the machine will thus run at 182, 165 or 91 r.p.m., with a normal output of 600, 535 or 300 hp. respectively. Another motor of the concatenated type, but with a two-speed secondary motor winding, runs at 428, 375, or 333 r.p.m.

At the Fagersta iron works there are 7 motors for driving the rolling mills, one of which is a 400-hp tandem motor, with a speed of 180 and 120 r.p.m. Of special interest are the arrangements for driving the large blooming mill at these works. The main motor is a 600-hp, three-phase induction motor running at 214 r.p.m. The power is transmitted by ropes from the motor to a large grooved pulley built as a heavy fly-wheel (70 tons) and connected to a Lindsay coupling for reversing the rolls. In order to maintain a good power factor and at the same time get more energy out of the fly-wheel at light loads, the winding of that motor, which at normal load is delta-connected, can be star-connected when the rolling mill is running at half load or less. In addition to the main motor there are several other motors in use, serving different purposes, and all operated by one man from a platform.

The three-phase system has proved very satisfactory, not only on account of the good features of the induction motor with respect to safety and low cost of operation, but also with respect to energy economy. An induction motor, when running above synchronism will act as a generator and give energy back to the line. Now, when several rolling mill motors, connected to their fly-wheels, are running on the same electrical system, the energy of the fly-wheels will be electrically transmitted to the point of heaviest load. When using direct-current machinery such heavy fluctuations in load, causing sometimes the machines to run as generators, would probably lead to commutation troubles.

Schenectady, N. Y. Julius Korner.

Campaigning in the Institute Election.

To the Editors of Electrical World:

Sirs:—The undersigned, having been responsible for the circular which you criticise in your issue of May 12, wish to make the following statements in regard to it:

1st. The substitution of one ballot for another previously sent in is an established Institute usage, having been resorted to many times in the past by individual members. Further, a circular requesting that this be done was issued during at least one previous campaign, namely, that of 1900.

2nd. No date or place of issue was given on our circular in view of the fact that it was issued as representing the wishes of a widely distributed number of members. Furthermore, the question of date and place of issue is in no way pertinent.

3rd. We believe that at least one of you was aware of the fact that we were the authors of the circular. Further, so far as we have been able to inform ourselves, you are the only persons of our acquaintance claiming any knowledge of the authorship of the so-called "bogus circular" issued from Philadelphia. In consequence, your connection of the two was unjustifiably misleading. We have had no connection of any kind with the said "bogus circular," and are at the present time in ignorance of both its author and its source.

4th. We have obtained in the case of every name used an authorization for its use in connection with circulars to be sent out. The authorization was such that we understood that we were warranted in applying it to all circulars issued. In view of the wide geographical distribution of the names it was obviously impracticable to submit each circular to each person involved, for criticism. If any signature has been used in a way not intended it has been due to a mutual misunderstanding.

C. O. Mailloux.
Ralph D. Mershon.
F. A. C. Perrine.
H. G. Stott.

[No one in the editorial rooms knew anything as to the authorship of the circular, or as to the responsibility for the campaign methods now admitted by our correspondents.—Eds.]

To the Editors of Electrical World:

Sirs:—In connection with the letter which I sent you last week, you mentioned the fact editorially that I informed you that I had not seen the last circular to which my name was appended in support of Dr. Sheldon's candidacy, before it was issued, and this fact is stated in conjunction with your editorial comment in such a way as to imply, apparently, that the gentlemen who used my name did so without authorization.

It is due to the gentleman who obtained my signature to the first circular, and who authorized its use as signer of the second circular, which was not submitted for my approval before it was issued, to say that his action to which I objected was due simply to a misunderstanding as to the scope of the authorization which I gave him to use my name at the time the first circular was issued. There can be no possible question of good faith involved so far as I am concerned.

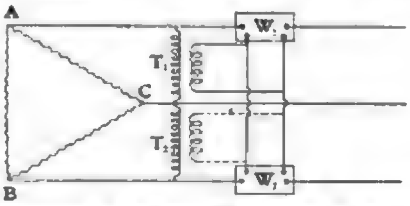
New York City. L. B. Stillwell.

Measurement of Power in Three-Phase Systems.

To the Editors of Electrical World:

Sirs:—In your issue of March 17, 1906, there appeared an article on the measurement of power in a balanced three-phase system by two wattmeters having their potential coils connected across between the same two leads through a transformer. A general statement was made of this article that the power is twice the reading of the normal wattmeter minus the reading of the other. This statement is only partially true, and the interpretation of it may lead to error in some cases.

The accompanying diagram shows the connections of transformers and wattmeters, as indicated in the article referred to above.



Connections of Transformers and Wattmeters.

With the well-known two-wattmeter method of measuring power in a three-phase system, the reading of one wattmeter will be $E\ I\ cos\ (30^\circ + \Theta)$ and that of the other will be $E\ I\ cos\ (30^\circ - \Theta)$. When Θ is a positive angle, that is, when the current lags behind the e.m.f., the former reading is always smaller than the latter. When the leads of one wattmeter are changed from normal to the connections shown in the diagram then this wattmeter reads $E\ I\ cos\ (90^\circ - \Theta)$. Now, it is evident that if this latter reading be subtracted from twice the reading of the other wattmeter which has normal connections in the circuit, the result obtained will depend upon which of the meters has retained its normal connections.

$$\text{Since } \cos(30^\circ + \theta) = (\cos 30^\circ \cos\theta - \sin 30^\circ \sin\theta)$$
$$= \left(\frac{\sqrt{3}}{2} \cos\theta - \tfrac{1}{2} \sin\theta\right)$$
$$\text{and } \cos(30^\circ - \theta) = \left(\frac{\sqrt{3}}{2} \cos\theta + \tfrac{1}{2} \sin\theta\right),$$

while $\cos(90^\circ - \theta) = \sin\theta$,
it follows that $2\,I\,E \cos(30^\circ - \theta) - I\,E \cos(90^\circ - \theta)$
$= 2\,I\,E \cos(30^\circ + \theta) + I\,E \cos(90^\circ - \theta) = \sqrt{3}\,I\,E \cos\theta$

The interpretation of these equations is that care must be taken in determining whether the reading of the changed wattmeter must be added to or subtracted from double the reading of the wattmeter which is maintained with its normal connections. With proper care, this method of measuring power, although an inconvenient one, is applicable to the balanced three-phase system with either a leading or a lagging current.

Ithaca, N. Y. Lester A. Magraw.

[The object of the method of connection suggested in the article referred to above was to permit of the use of only one step-down transformer in a high-potential three-phase system. The author of the article called attention to the disadvantage of the method which resides in the fact that it requires a certain amount of calculation and is not applicable to a commercial polyphase watt-hour meter. The present letter emphasizes the necessity for care in making the calculations for determining the true watts. It would seem that all of these objections could be overcome if wattmeter W_2, in the illustration, be connected with its series coil in lead, C, and its shunt coil in parallel with that of wattmeter W_1. Each of these methods gives erroneous results when the system is unbalanced, either as to voltage or as to load.—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Testing of Transformers.—Morris and Lister.—A paper read before the Birmingham section of the (Brit.) Inst. Elec. Eng. on a method of testing transformers and transformer iron. The method necessitates the use of two similar transformers and is essentially an application of the Kapp-Hopkinson differential method of testing direct-current machines. The authors first give a characteristic diagram of a transformer which they call the characteristic triangle. They then describe the connections used in their test. They are shown in Fig.1 where $T_1 T_2$ are two similar transformers under test; T_3 an auxiliary testing transformer; W_1 a wattmeter reading the iron losses of the transformers, T_1 and T_2; W_2 a wattmeter reading the copper losses of the transformers, T_1 and T_2 (which is also used to determine current and phase angle by the three-point wattmeter method); V is a low-reading voltmeter for measuring the secondary voltage of the auxiliary transformer; R is the main-current regulator for varying the phase angle of the current; r is the resistance for the volt circuit of the wattmeter, W_2; S_1 is a two-way, double-pole volt switch, and S_2 a three-phase volt switch. One of the supply points is joined through the wattmeter, W_1, to the middle point of the secondary winding of the auxiliary transformer. The terminal pressure of one transformer is raised, and the other lowered, the average flux density of the two transformers thus remaining normal. The primary winding of the auxiliary transformer is connected to the supply, as shown through the main-current regulator. By moving the adjustable contact of the regulator, the phase of the impressed short-circuit voltage can be varied through 60 deg. Detailed descriptions are given of the various tests which may be made with transformers.—Lond. *Elec.*, April 27.—The discussion which followed the paper is abstracted in Lond. *Elec.*, May 4.

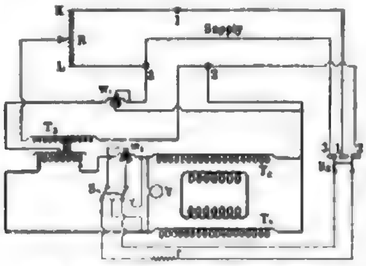


FIG. 1.—CONNECTIONS FOR TEST.

Ventilation of Turbo-Generators.—Niethammer.—The production of a thorough and noiseless ventilation with high-speed electric machines for direct and polyphase currents is difficult on account of the small radiating surface per kw capacity. The best arrangement of the passages of the cooling air or cooling medium, therefore, requires a special study for turbo-generators. In the present article the author gives a review of the different solutions of this problem which have been proposed by different firms or inventors.—*Elek. und Masch.*, April 22.

Interpole Construction.—Hipple.—An illustrated article discussing the construction and action of the interpole type of direct-current motor.—*Elec. Jour.*, May.

Three-Wire Generators.—McIntire.—An illustrated article for direct-current generators for supplying three-wire networks.—*Elec. Jour.*, May.

Lamps and Lighting.

Zirconium Lamp.—In an article on various new incandescent lamps mention is made of the zirconium lamp of Hollefreund which is stated to consume one watt per hefner candle, the voltage being 37 to 40. The life is stated to be comparable with that of the osmium lamp. The same company also makes a "zirconium-carbon lamp" which has a greater mechanical strength than the zirconium lamp, and can be made for voltages up to 250, but its useful life is not more than 300 hours, while it consumes 2.4 to 2.5 watts per hefner candle. On the other hand the price is low, being 19 cents for ordinary lamps.—*Jour. f. Gas Beleucht.*, April 28.

Traction.

Electrolysis from Return Currents of Tramways.—Larsen.—Some notes on the work done by a special committee of the German Society of Gas and Hydraulic Engineers. Electrolytic corrosion of gas or water pipes by the stray currents from tramways has occurred in 15 out of 130 German cities. Forty-eight different cases having been observed. Special investigations have been made in Elberfeld, Strassburg, Dresden and Hamburg. In Strassburg the rail joints were very bad, the increase of resistance due to the joint being sometimes 100 per cent; on the other hand, joints welded by thermit were very good. The regulations of the German Society of Gas and Hydraulic Engineers require first as good and safe a rail joint as possible, second, a suitable arrangement of return feeders, and third, the maintenance of the potential differences in the rails within certain minimum limits. On the other hand the Association of German Electrical Engineers emphasizes that it is the potential differences in earth which are dangerous to the gas and water pipes and which should be held within certain limits. Another difference between the two societies is that the Society of Gas and Hydraulic Engineers assumes that pipe joints of high resistance may cause corrosion, while the Association of German Electrical Engineers considers them a means for protection of the pipes.—*Elek. Zeit.*, May 3.

Petrol-Electric Omnibus.—A note stating that the Pieper petrol-electric omnibus is to be introduced in London. The petrol engine drives a machine which acts either as a dynamo or a motor according to circumstances, and is used in conjunction with a small battery of accumulators. On the particular omnibus to be run on the London streets the battery consists of 25 cells of 60 amp.-hr. capacity at one-hour rate, but capable of giving about 400 amperes for short periods without undue strain. Each cell will contain 9 plates, each 5½ in. by 8 in., and the weight of the complete battery will be about 400 pounds. The conditions under which the battery works are favorable in so far as it will very frequently receive short charges, but, especially in careless hands, the discharge rate when starting on hills may be excessive. Experience will also show whether the very small battery proposed will be equal to the work without greatly exceeding the estimated figure of cost of maintenance, which is 0.2 cents per mile. The weight of the complete vehicle will not greatly exceed that of a petrol omnibus, as the added weight of the electrical equipment is to some extent compensated by the absence of the gear-box and the reduced size of the engine. It is claimed that a saving will be effected on the maintenance of tires as the starting is smoother than on the ordinary petrol system.—Lond. *Elec.*, May 4.

Steel Rolling Stock.—SHEFFIELD.—A paper read before the Tramways and Light Railways Association on European practice in the use of steel for the rolling stock. Lond. *Elec.*, April 27.

Electric Railway Engineering.—WYNNE.—The fourth of the series of articles on electric railway engineering deals with the calculation of speed-time and power curves.—*Elec. Jour.*, May.

Installations, Systems and Appliances.

Switches.—The first part of a fully illustrated description of the Hollinwood Works of the Ferranti Company, which manufacture switchgear, meters and other electrical instruments. The latest design of a high-tension remote-control switch designed for the Glasgow Electricity Works is shown in Fig. 2. *A* is the trip coil, *B*, off-position of links; *C*, a solid rod (insulated); *D*, insulation cap, to be placed over the terminal; *E*, insulation sleeve; *F*, attachment for hand operation, only in case of emergency; it is ordinarily removed; *G* is a removable cover. The cables are brought in at the side instead of at the top, which facilitates considerably the leading in, and there is a cast-iron box enclosing the terminals, with a door at the side. The tank is now supported from a slate base, instead of being held up by insulated bolts. Twenty of these switches, each capable of dealing with 6,000 kw at 6,500 volts are made for Glasgow. A new type of three-phase motor switch with no-voltage and overload relay is also described.—Lond. *Elec.*, April 27.

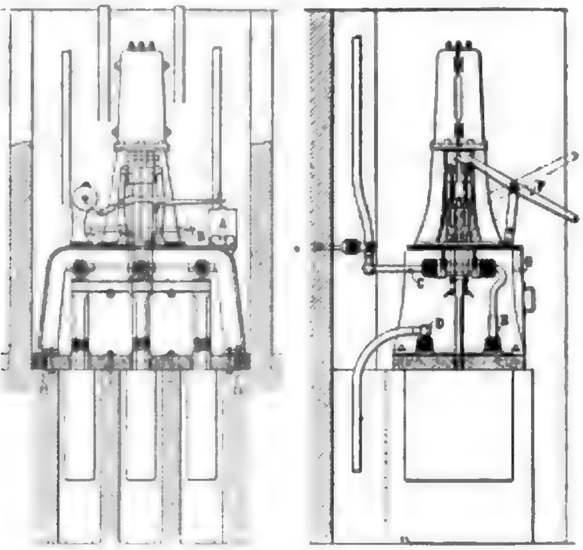


FIG. 2.—SECTIONAL VIEWS OF REMOTE-CONTROL SWITCH.

Central Station Business.—KIMBALL.—An article of a general nature discussing how to solicit and get new business for electric central stations.—*Cassier's Mag.*, May.

Wires, Wiring and Conduits.

Calculation of Three-Wire Networks.—FINZI.—A three-wire distributing network must have a certain elasticity; that is, when some lamps or consuming devices are disconnected or inserted, the operation of the others should not be disturbed. For the calculation of the network the difference between the maximum possible voltage and the minimum possible voltage at the terminals of the consuming device is of prime importance. With a two-wire system this voltage varies between the voltage of the central station and the same voltage minus the loss in the line. The difference between the maximum and minimum limits equals therefore the loss of voltage in the line. In a three-wire system this is no longer the case when the two halves of the network are not equally loaded. The basis of the calculation of the cross-section should, therefore, be not the maximum permissible loss of voltage but the maximum permissible variation of voltage and this depends on the difference of the load in the two halves of the network. The cross-section of the neutral conductor should be chosen on the basis of this consideration. The author gives the formulas for the three-wire direct-current system and also for three-phase lines with the phases in star connection.—*Elek. Zeit.*, March 22.

Standardizing Conductors.—The reprint of the revised rules for standardization of conductors and cables of the German Association of Electrical Engineers. They refer specially to the standardization of rubber insulated cables, of flexible conductors, etc. For copper conductors the rules are as follows: "Conductor, copper" (Leitungs kupfer) shall have a resistance not greater than 17.5 ohms for one km. length and one square millimeter cross-section at 15° C. The resistance, R_t, measured at t degrees C is to be changed to 15 degrees by the following formula:

$$R_t \div R_{15} = 1 + 0.004\ (t - 15)$$

"Copper conductors" (Kupferles tungen) must be made from "conductor copper." The effective cross-section of copper conductors is to be determined by resistance measurements, whereby the resistance of one km. length per one square millimeter is to be assumed as 17.5 ohms, as mentioned above. In cables, the length of the cable is to be taken into consideration without considering bendings of the copper. In determining whether a copper conductor is made of conductor copper, as defined above, the cross-section is to be determined by measuring the length and weight of a uniform straight piece of conductor; if there is no special determination of the specific weight the value of the same is to be assumed as 8.91.—*Elek. Zeit.*, April 19.

Fuses.—KLEMENT.—An article stating that enclosed fuses in stations are occasionally found to be too sensitive, to prevent their fusing too often, thicker fuses are sometimes employed than is proper. But experiments have shown that with this practice the line conductors may be heated to such an extent that the insulation is destroyed in a comparatively short time. The remedy recommended by the author is that the enclosed fuses should be dimensioned so that they do not fuse at double the normal current, but at three times the normal current in about one minute. The article is illustrated by numerous diagrams and tables. *Elek. Zeit.*, April 5.

Electrophysics and Magnetism.

Watt Component and Magnetising Component of Potential Difference.—NOUGUIER.—In alternating-current calculations it is usual to consider the positive (or negative) reactance as causing the current to lag behind (or lead in advance of) the potential difference. The author endeavors to show that it is often preferable to consider the potential difference as being in advance of (or lag behind) the current and to introduce into the calculation the terms of watt component and magnetizing component of the potential difference, instead of the analogous components of the current. The consideration of the watt component and of the magnetizing component of the potential difference tends to give very simple analytical expressions for the instantaneous "watt power" and "magnetizing power"; i. e., to separate in each instance the real instantaneous power into its two parts, one furnishing the "watt energy (mechanical, termic, chemical, etc.)"

and the other the energy which is periodically accumulated in the apparatus of self-induction and capacity and periodically restored. The first part performs work outside of the apparatus under consideration, while the second part does not furnish external work and does not even increase the value of the "mean intrinsic power" which is always zero for a period comprising a complete cycle. If one employs the usual conceptions of watt component and magnetizing component of the current, it is not so easy to make this separation. The present installments deal in detail with the following problems: First, mechanism of the instantaneous exchange of power between the different apparatus of an alternating-current network; second, decomposition of the real instantaneous power into instantaneous watt power and instantaneous magnetizing power; third, calculation of the instantaneous watt power and of the instantaneous magnetizing power and of their mean values in the case of sinusoidal wave forms.—*L'Eclairage Elec.*, April 21 and 28.

Measuring Sparking Voltages.—Watson.—A paper read before the Birmingham section of the (British) Inst. Elec. Eng. The principle of the method used by the author is as follows: If a condenser be connected to a direct-current source of supply, and a spark-gap is so arranged that as soon as the condenser is charged to a certain voltage it shall spark across the gap, the condenser will automatically continue to charge and discharge so long as it is thus connected. Let the number of sparks occurring per second be noted, and also the current flowing into the condenser. If this current is divided by the number of sparks per second we have the quantity per spark expressed in coulombs. Dividing this by the capacity of the condenser, we have the potential difference at which that spark occurred, and the air broke down. In the method as used by the author a galvanometer is placed between two condensers, and the spark-gap to be tested is connected across their outer coatings; the spark-gap being connected to a Wimshurst influence machine. Across the galvanometer is placed a small auxiliary spark-gap of about 0.01 in. opening, and between this and the galvanometer are placed two small choking coils, which do not contain iron. The object of the auxiliary spark-gap is as follows: When the condensers are charging, a certain quantity of electricity passes through the galvanometer, being simply the charging current of the condensers. When these discharge, there is, of course, an exactly equal flow of electricity, which, if it passed through the galvanometer, would give it an equal deflection in the opposite direction, so that the net reading would be zero. But the discharge from two condensers is very sudden, and generally of an oscillatory nature. It cannot, therefore, pass back through the galvanometer and choking coils, but passes entirely across the auxiliary spark-gap. Thus the galvanometer measures only the charging current, and not the discharge of the condensers, and gives a steady deflection. The sparking distance is not proportional to the pressure, since the rate of increase of voltage with increase of sparking distance decreases gradually. Within moderate limits the sparking voltage of any gap is determined by the size of the smallest electrode, and the other one may be varied within reasonable limits without appreciably affecting the result. If unequal-sized electrodes are used it is advisable that the largest one should be placed on the negative pole, otherwise any advantage accruing from its use is lost. In fact, placing it on the positive pole is worse than having no large electrode at all, and causes brush discharges to commence much sooner.—Lond. *Elec.*, April 27.—An account of the discussion which followed the paper is given in Lond. *Elec.*, May 4.

Radioactivity.—Boltwood.—An abstract of an American Physical Society paper on the relative proportion of the total alpha-ray activity of radioactive minerals due to the separate radioactive constituents. The general conclusions reached in the paper are: That actinium is a disintegration product of uranium; polonium is a disintegration product of radium through the emanation; radiothorium is a disintegration product of ordinary chemical thorium, which is elementary in character, and the alpha-ray activity of minerals in radioactive equilibrium is equal to the sum of two factors, one of which depends only on the amount of uranium present and the other only on the amount of thorium contained in the mineral.—*Phys. Rev.*, May.

Canal Rays.—Austin.—An account of an experimental investigation of the emission of negatively charged particles produced by canal rays. The chief results are as follows: When canal rays strike an earthed metal surface there is a weak diffuse reflection of these rays. There is also a diffuse emission of negative particles having widely varying velocities. This negative emission increases as the angle of incidence of the canal rays increases, and is probably similar in character to the secondary negative emission produced by cathode rays.—*Phys. Rev.*, May.

Self-Induction.—Zipp.—With reference to a recent article of Peukert on determining the coefficient of self-induction by weighing, the author gives some general theoretical notes on self-induction and armature reaction, the purpose being to get a greater "uniformity of theories on secondary direct-current and alternating-current circuits."—*Elek. Zeit.*, May 3.

Constitution of Electron.—Kaufmann.—A full French translation of the German paper which was previously noticed in the Digest.—*L'Eclairage Elec.*, April 21 and 28.

Electrochemistry and Batteries.

Lead-Zinc Accumulator.—Lacau.—An account of experimental researches on the lead-zinc accumulator. While its efficiency is very satisfactory, yet the author does not think the accumulator to be practical since it is too cumbersome, needs too much attendance and is as heavy as a lead accumulator of equal solidity.—*L'Eclairage Elec.*, March 10.

Electrochemistry.—Kershaw.—An illustrated article giving a summary of the developments of electrochemical and metallurgical industries in 1906.—*Cassier's Mag.*, May.

Units, Measurements and Instruments.

Calculating Springs for Electric Devices.—Edler.—Spiral springs are often used in switches, circuit-breakers and other electrical apparatus as well as in electrical instruments. The author refers to a former paper of Dijzhoorn which gives valuable data on springs for comparatively greater stresses. In the present article the author discusses the calculation of springs for such apparatus in which relatively small forces (often below one kg. per square mm., but mostly not much more than 3 or 5 kg.) occur. The discussion is restricted to springs made of round steel or brass wire. The article is to be concluded.—*Elek. und Masch.*, April 29 and May 6.

Battery for Electrostatic Measurements.—Krueger.—For charging needles of electrometers and for calibrating electroscopes a battery giving a thoroughly constant and well-defined voltage is desirable. It is best to construct such a battery of standard cells. The author describes a battery comprising 100 cadmium dry standard cells of special construction so as to take up little space. The total voltage of the 100 cells in series is 102. The battery is divided into 5 groups each of 20 cells, the ends of each group being connected to binding posts. The internal resistance is 100,000 ohms. A current of 0.00001 ampere would, therefore, produce a drop of one volt, due to the internal resistance. It is, therefore, important to take as little current as possible from the battery. However, even if the battery is short-circuited for not too long a time, the cells recuperate their initial e.m.f. rather quickly.—*Phys. Zeit.*, March 15.

Units and Dimensions.—Juppont.—A reply to a criticism of Brylinski with respect to their controversy on a proposed new system of units and dimensions.—*L'Eclairage Elec.*, May 5.

Telegraphy, Telephony and Signals.

Microphones for Long-Distance Telephony.—Longo.—An article on two new microphones designed by Italian engineers for use on long-distance lines. The first is due to Angelini, the object being to double the microphonic circuit. The construction is shown in Fig. 3. A hard rubber disc, *a a'*, has a circular cavity in the centre which is divided into two equal parts by two small pieces of fibre or mica. The space, *b*, between these pieces is filled with a certain amount of wadding. In the two compartments of the circular cavity are disposed two metallic semi-circular sectors, *c c'*, the upper surfaces of which have a section as indicated in the illustration. This surface is in contact with the granular carbon. Two screws permit adjustment of *c c'*. Above the granular carbon the vibrating carbon plate is provided.

With this arrangement it is possible to insert between each of the sectors, *c c'*, and the vibrating plate a cell and the primary of an induction coil, the two secondaries being connected in parallel, as indicated in Fig. 4. With a cell of negligible resistance like a storage cell it is possible to use the same battery for the two circuits, as indicated in Fig. 5. It is said that good results have been obtained with this microphone for telephonic transmission from Rome to Palermo, a distance of 1,000 km. over a line formed almost entirely of 3-mm. bronze wire and containing an underground rubber-insulated cable of a length of more than 10 km. The construction of this microphone offers no difficulties. The second new microphone mentioned is due to Majorana, but is not yet described. It is only stated that it is based on capillary attractions which produce variations of resistance in an electrical circuit permitting telephonic currents to be obtained by means of an induction coil. It is stated that a current of more than 100 milliamperes may be used with this transmitter for a wave of 500 periods. Some general considerations are added in which the author expresses his belief that with higher voltages the mutual inductance of the lines might prove more troublesome and that the real solution of the problem of long-distance telephony is to be found rather in proper construction of the transmission line than in the design of special microphones. —*Jour. Télegraphique*, April 25.

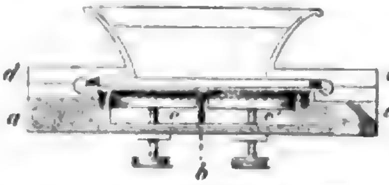
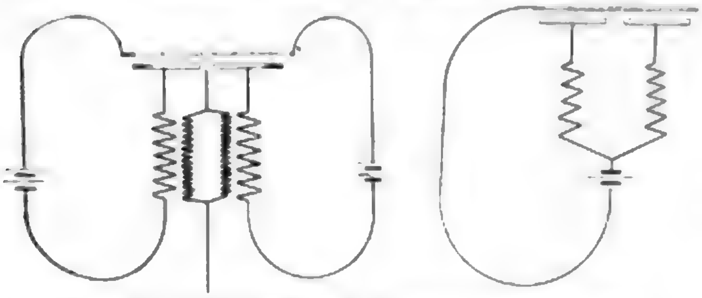


FIG. 3.—CROSS-SECTION OF MICROPHONE.



FIGS. 4 AND 5.—DIAGRAMS OF MICROPHONE CONNECTIONS.

Standardization in Telephony.—McBerty.—A paper read before the Western Soc. of Engineers on standardization of methods and appliances in telephony. The engineer should determine for each locality, in view of the electrical losses which will be encountered in varying proportions of the probable connections, the minimum grade of transmission permissible in view of the cost of conductors. The acceptance of a single standard applied uniformly to all cases would not seem to be in the direction of adequate planning. The standard of transmission should, therefore, provide a sliding scale, variable within wide limits and adjustable to actual conditions. The engineer fails to exercise his function when he accepts unreservedly, standards of performance which are established under unknown conditions in other places. Proposals to standardize appliances now being generally agitated, are rather to reduce telephonic appliances to a few types for uniform application. The important considerations tending toward so-called standardizing of appliances are, reduced cost of manufacture, reduced quantity of stocks, increased promptness of supply and universal knowledge of uses and maintenances. The most important disadvantage is that standardizing prevents the natural selections which operate where a variety of forms are present to bring the fittest to the fore. Standardizing of appliances is safe and even necessary for an operating company with an established business, but undesirable for a newcomer compelled to make his way on a showing of good reason for his existence. A related disadvantage of standardizing appliances appears in the inertia of ideas and of plant, which result from limiting the types of appliances. In so far as it is possible, the selection of standard appliances should be based upon costs rather than prices. An account of the long discussion which followed is also given.—*Jour. Western Soc. Engineers*, April.

Wireless Telegraphy in a Certain Direction.—Marconi.—A reprint of the Royal Society paper on methods whereby the radiation of electric waves may be mainly confined to certain directions, which was noted in our issue for April 21. At the transmitting station the method consists simply in stretching the great part of an ordinary direct excited air wire horizontally in the direction in which the waves are to be transmitted. From the numerous curves given in the paper it is seen that the strength of signals received by stations on lines at an angle with the horizontal air wire is approximately proportional to the square of the cosine of the half angle. It is noteworthy that over long distances where unfortunately no precise measurements could be made, experiments point to a higher degree of concentration forward than is shown in the short range experiments, the results of which are quantitatively given. The converse problem of receiving signals only from selected direction is solved in exactly the same way. Two advantages follow from the complete power of discriminating in azimuth. First, the source of the waves received can be located, and, second, undesired or obnoxious signals or disturbances, if not on the line of communication, can be shut out from the receiver. The first advantage would be extremely advantageous for the mariner, and the second would be welcome in every application of wave telegraphy. A peculiar fact is that the signals were received best when the horizontal air wire was directed away from the sending station. Fig. 6 shows the insulated horizontal air wire, *A B*, while Fig. 7 gives the quantitative results of measuring the current in microamperes at the earthed end of the receiving conductor under the conditions of direction of the transmitting air wire indicated in the small left-hand diagram.

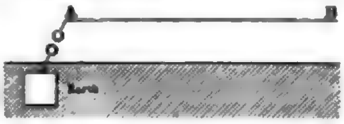


FIG. 6.—DIAGRAM OF AIR WIRE.

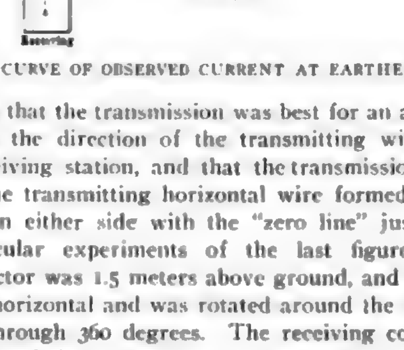


FIG. 7.—CURVE OF OBSERVED CURRENT AT EARTHED END.

It will be seen that the transmission was best for an angle of zero, that is, when the direction of the transmitting wire was away from the receiving station, and that the transmission was a minimum when the transmitting horizontal wire formed an angle of 110 degrees on either side with the "zero line" just mentioned. In the particular experiments of the last figure the transmitting conductor was 1.5 meters above ground, and had a length of 60 meters horizontal and was rotated around the earthed point all the way through 360 degrees. The receiving conductor was vertical and fixed, its height being 18 meters. The distance of transmission was 260 meters.—Lond. *Elec.*, May 4.

Automatic Printing Telegraph.—An article on commercial applications of the Murray automatic page-printing telegraph system, which has now been working for about two years between Edinburgh and London, and a complete duplex installation is being constructed for London-Dublin. The system has also been working for more than a year between Hamburg and Berlin, and it is now working between St. Petersburg and Moscow. The Indian Telegraph Department has ordered a complete duplex equipment for use between Calcutta and Bombay, a distance of 1,200 miles, and the Austrian administration is having an experimental set constructed for trial between Vienna and Prague. Some information is given on experiments made in Russia. Among others, a telegraphic loop line was made up from St. Petersburg to Waroslavl to Kazan to Moscow and back to St. Petersburg, a distance of 1,926 miles, of 5-mm. iron wire (600 pounds per mile), with repeating station at Waroslavl, Kazan and Moscow. The speeds obtained were indefinite, as one of the sections was not in good condition. The Wheatstone system got about 35 to 40 words a minute, and at times a little higher. The Murray system got 56 words per minute, and 10 messages were transmitted and printed. They were found to contain two wrong letters—a remarkably good result considering the condition of part of the line. This is the first time on record that a printing telegraph has worked over such a distance as 1,900 miles, even of copper wire, and in this case the wire was iron. The highly favorable results obtained with the Murray system during these trials are explained by the inventor as being due chiefly to the employment of the Baudot alphabet, which is shorter than the Morse in the ratio of 5 to 8. The inductive interference from neighboring wires was very severe on the long lines and was an important factor in limiting the speeds obtained. Some notes are given on the telegraph service in Russia, which is said to be efficiently managed.—Lond. *Elec.*, *Elec. Rev.*, May 4.

Capillary Telephone.—Boruttau.—An article on the history, construction and operation of the capillary telephone, which is based on the change of the capillary constant between mercury and electrolyte with variation of the electrical potential (i. e., the same principle on which the capillary electrometer is based). A number of different constructions are described.—*Phys. Zeit.*, April 1.

BOOK REVIEWS.

The Universal Electrical Directory. London, 1906: H. Alabaster, Gatehouse & Co. Cloth, 1,520 pages.

This standard and useful publication once more makes its welcome appearance, growing in value with bulk. It contains the names and addresses of members of the electrical and allied trades and professions throughout the universe. For facility of reference it is divided into four sections; i. e., British, containing 14,227 names; Colonial and general, containing 4,385 names; Continental, containing 7,938 names; U. S. A., containing 7,029 names, making a total of 33,529 names. Each of these sections is again divided into alphabetical and classified sections and in the case of the British a Geographical Section is also given, by which a glance at any town shows all firms of any importance therein. The sections are indicated by a thumb index, which renders them perfectly easy of access.

A strikingly useful feature of the book is the information regarding electricity works in Great and Greater Britain. The systems of distribution and of voltage are given, the engineer's name and capacity of plant, and in the case of alternating current, periodicity and phase are included. It would be a boon if this could be done by some one for other colonial and foreign plants.

Telegraphic addresses and telephone numbers will be found in the alphabetical sections, and particulars as to capital, etc., of limited companies are given in the British alphabetical section. To meet a growing want the book is now published in two forms, "A," containing the British and Colonial and General Sections only, and "B" containing the Continental and U. S. A. Sections.

Berechnung und Entwurf Electrische Machinen, Apparate und Aulagen. III Bund. Elektrische Schaltaulagen und Apparate samt Grundlagen zur Projektierung elektrischen Aulagen. By Prof. Dr. F. Niethammer. Stuttgart: Ferdinand Enke. 572 pages, 609 illustrations, 13 tables.

While this present volume of Dr. Niethammer's is made up largely from trade publications, it cannot be denied that it contains much interesting matter, and that it will be frequently referred to, not alone by engineers, but by those who for one reason or another may have occasion to post themselves on the state of the art at the time of its issue.

The subject matter of the various chapters forming Part I and occupying the first 460 pages is the accessories for electric light and power plants, namely, switchboards as a whole, switches, fuses and circuit-breakers, instruments, lightning arresters, rheostats and miscellaneous devices.

With the exception of the instrument chapter, which the author has treated extensively in another work, and has passed over with but brief mention in the present one, the various sections are quite full and, in a colloquial fashion, exhaustive, their value being much enhanced by the co-operation which has evidently been extended by many of the large European and American companies, who have been liberal in their contributions of photographs and detail drawings. A section which, while extending over but eight or nine pages, will prove of undoubted value in many instances, gives the over-all dimensions, net weights and prices of standard sizes of the various apparatus of which the volume treats. These data are conveniently arranged and seem accurate.

Part II of the book gives a mass of greatly condensed information to enable the preliminary calculation of plants for supplying electricity for lamps and motors. The electricity consumed per inhabitant in average towns and how this is distributed for residence, manufacturing and traction work, are the first subjects treated. Next come the total installation costs for plants of various capacities and with different prime-movers. Following are average prices of the various items making up a plant, including buildings, machinery, electrical accessories, sub-station machinery, generating prime-movers, etc., etc. After this, in turn, are further data on the speeds, bulk, weights and costs of machines and their accessories; and like data on boilers, chimneys, generators, transformers, storage batteries, conductors, etc., etc.—in fact, all the elements of a complete plant and distributing system. Finally there are the operating expenses, itemized in much the same fashion.

If all of the information in this Part II is as accurate as checks made by dipping in here and there at random indicate that it may be, an engineer with a slim stock of experience can take up this book and make up about as close an estimate of what a given station proposition under European conditions means as one who has been in harness for many years. Even for American workers, with some slight revision in the light of the different conditions applying, the data will in many cases prove acceptable to a degree. It is an excellent book to have at hand for reference.

Tests of an Interpole Railway Motor.

By G. Herbert Condict.

A number of tests have recently been made by the Electro-Dynamic Company, of Bayonne, N. J., on interpole motors for railway work with very satisfactory results. In one case the motor was overloaded more than 300 per cent and there were no signs of sparking or flashing at the brushes. The value of this characteristic in railway service is of the utmost importance, as the work is intermittent and often motors of great capacity are employed merely to surmount some excessive grade, or for quick acceleration. With the interpole motor the limiting factor is not commutation, as with the ordinary motor, but is the heating. As the extra heating of the motors can be readily taken care of by forced draught, it follows that a motor of much smaller size may be used for a given service, or a far greater power can be furnished by a motor of a given size. This last feature is of the utmost importance. A smaller motor for a given power gives greater clearance from the ground. This is a factor of great importance in suburban and heavy electric railway work, because the limited space underneath the car precludes, with the ordinary design, the use of motors having more than a comparatively small capacity.

With commutator troubles practically eliminated, with the size of the motor per horse-power reduced and with its ability for operating with weak fields and at a wide range in voltages, the

by Google

interpole motor is the most practicable design for trunk line conditions. The ideal method is to equip each car with powerful motors so as to obtain the maximum speed with high voltages (2,000 to 3,000 volts) upon the trunk lines and to divert the same cars on to city or branch tracks when they reach their destination. In the city the same motors and the same controllers can be used. Under these conditions the traveler, instead of leaving the car at the railway station, a mile or more from his hotel or the center of the town, will ride from the city system in one town to the city system in another and thus comfortably and easily be landed at his hotel or doorstep. It was considered a great improvement when baggage could be checked from the traveler's house to its final destination, but it is of much greater importance to be able to pass from one's own home to the final end of the journey, not only without change, but at the highest speed. The combination of the multiple unit system with the interpole motor makes this commercially possible.

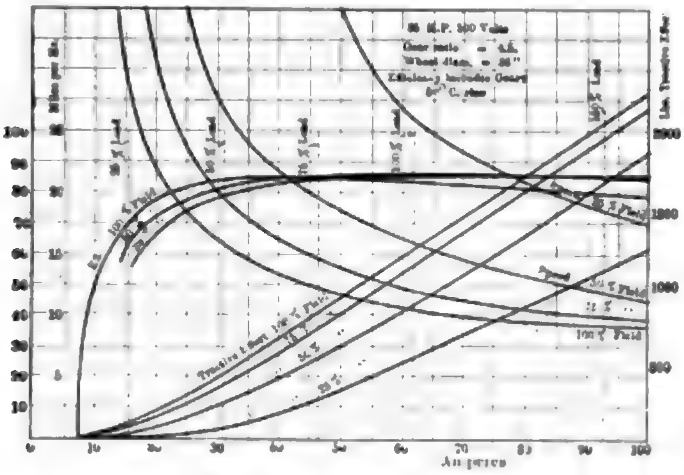


FIG. 1.—PERFORMANCE CURVES.

The accompanying characteristic curves of a 35-hp interpole motor in this connection cannot fail to be of interest, as giving the very remarkable performance of this motor when operated under weak field conditions. On account of the absence of commutator troubles, the field of the interpole motor, as stated, can be weakened to almost any extent, thus delivering high speeds, and at the same time the motor can be run at excessive overloads. Both of these advantages can be secured with a high degree of efficiency, as shown by the curves in Fig. 1. It will be noted that the loss in the gears is included. The motor from which these curves were taken has a weight of less than 1,500 lb.

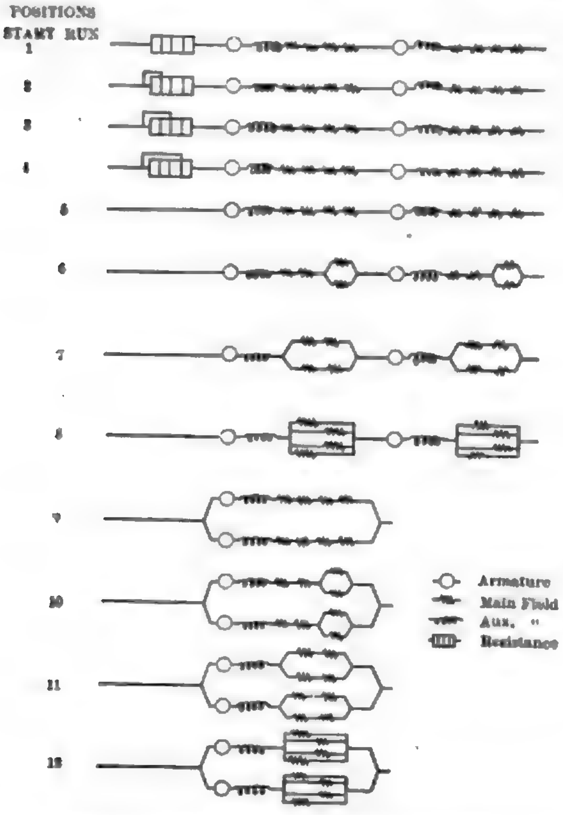


FIG. 2.—SERIES PARALLEL CONNECTIONS OF INTERPOLE MOTORS.

In Fig. 2 is shown one of the various possibilities of control of the interpole railway motor. This is a series parallel system in which full use is made of the increased speeds obtained by weakening the fields of the motors. After starting up in series with resistance, the motors are brought into the running series position (No. 5) and from this point on have an almost indefinite number of efficient running positions, in this case eight, which may be obtained without the use of any resistance. A great improvement in economy of power consumption when compared with the ordinary type of railway motor will thus be secured.

Recent developments have demonstrated that the interpole motor, as used in railway work, has not yet reached its final stage and some surprising results may be anticipated.

Test of a Kitsee Storage Battery.

BY E. W. STEVENSON.

A test of a Kitsee storage battery was recently made by the writer as a demonstration before the board of trade of the city of Wilkes-Barre, for the purpose of showing its advantages. Judging from the curve shown in Fig. 2 its merits are certainly considerable, and it deserve more than a passing notice.

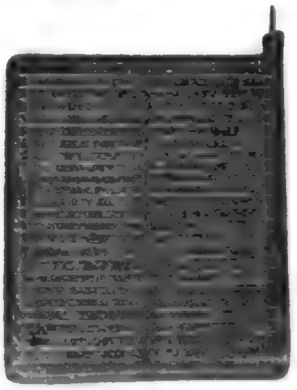


FIG. 1.—PASTED POSITIVE PLATE.

Fig. 1 is a photograph of the positive plate. The reason for the large capacity of the cell will be seen at a glance. The construction is such that most of the plate is made up of active material, and, though apparently this would render the plate weak structurally, it seems to have no such effect. The grid containing the active material is held in a framework of hard rubber, and is therefore very light.

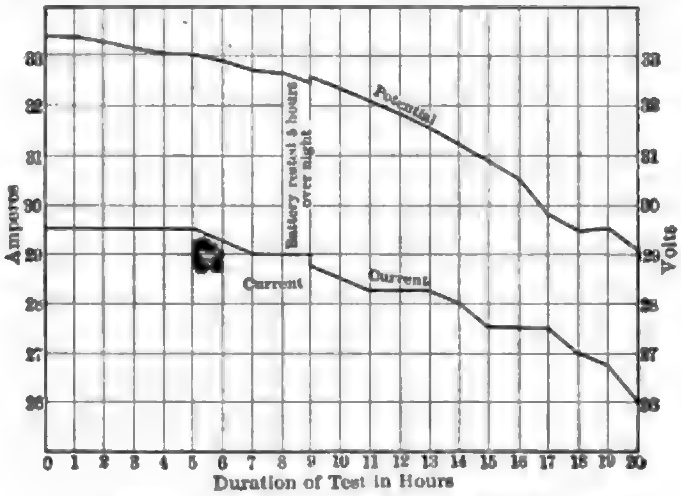


FIG. 2.—TEST OF 16-CELL STORAGE BATTERY.

According to the published figures of all the other companies, this cell, taking the type tested as a standard (17 plates, each 7¾ in. by 9 in.; total weight of cell complete, 125 lbs.) has the large increase in capacity of from 40 to 60 per cent over any other battery of a similar size in the market.

At the conclusion of the twenty-hour test noted in the diagram, the battery was submitted to a very severe strain, double load being drawn off it for 45 minutes. Even with this the average potential per cell did not drop to 1.5 volts.

The cells were hand made, and were therefore not of the best construction. The writer is of the opinion that with proper mechanical devices for manufacture, a much better cell could be produced.

The proper representatives of the Lehigh Valley Railroad, the Del., Lack. & W. R. R., and other railroad men were present at the test and expressed their satisfaction at the behavior of the battery.

The Allis-Chalmers Steam Turbine.

Last week in an account of the first runs of the Allis-Chalmers steam turbine in the Williamsburg station of the Brooklyn Rapid Transit Company, reference was made to the remarkably small injury found to be caused by foreign substances in the cylinder, the presence of which substances might have been thought sufficient to cause grave damage. Below we give details of a later experience of this kind, which illustrates in a remarkable manner the abuse the turbine will successfully withstand.

Shortly after starting up the turbine on the morning of April 25, a peculiar noise was heard in the turbine cylinder, and the machine was stopped and opened up. It was then found that a piece of steel had gotten between the spindle and the shroud of the first row of stationary blades, where, acting like a lathe tool, it had cut into the body of the drum for a width of about 3/8 of an inch, and for a depth of nearly 3/16 inch, this cut being alongside of and opening into the groove which holds the first row of spindle blades, as shown in Fig. 1. This had loosened the calking strip which held the ring of blades in place. For a distance of five or six inches this strip had moved partly out of its groove, thereby loosening the ring of blades, which under the influence of centrifugal force, had bent outward and the channel-shaped shroud ring had rubbed so hard in the bore of the cylinder that the flanges of the shroud ring had worn almost down to the beads of the riveting which holds the ring to the blades. The fact of greatest interest is that under these severe conditions not a single blade had come out or even become loosened or injured in any way.

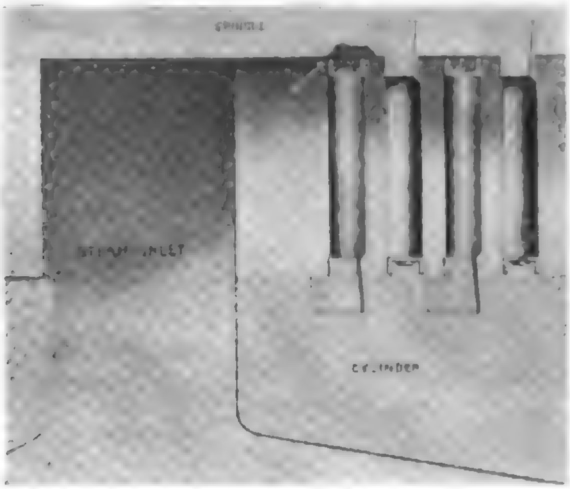


FIG. 1.—SECTION THROUGH FIRST ROW OF BLADES.

As it would have been unsafe to attempt to hold blades in the damaged groove, and it not being convenient to keep the turbine out of service long enough to make permanent repairs, the erecting engineer removed this one ring of blades, closed the cylinder and immediately put the turbine back into service.

An examination of the removed ring of blades (Fig. 2) showed that one-half was as good as when put in, while the other half was damaged only as to the wearing away of the flanges of the shroud ring. With a new half shroud ring this ring of blades would be in perfect condition.

An investigation as to the cause of the mishap showed that the piece of steel which cut the grooves in the shaft was apparently one of the leaves of a pocket knife handle. A further search discovered the remainder of the metal parts of a large jack-knife, but the outer covering of the handle had disappeared. The large blade of the knife showed that it also had been rubbing hard. The turbine had not been opened up since March 30, and the knife must have gotten into the turbine at that time or previously, as it would be impossible for it to get into the interior except when the turbine was opened up.

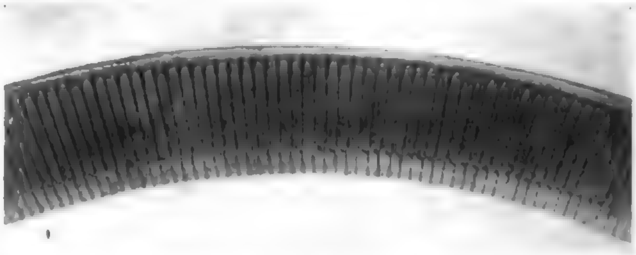
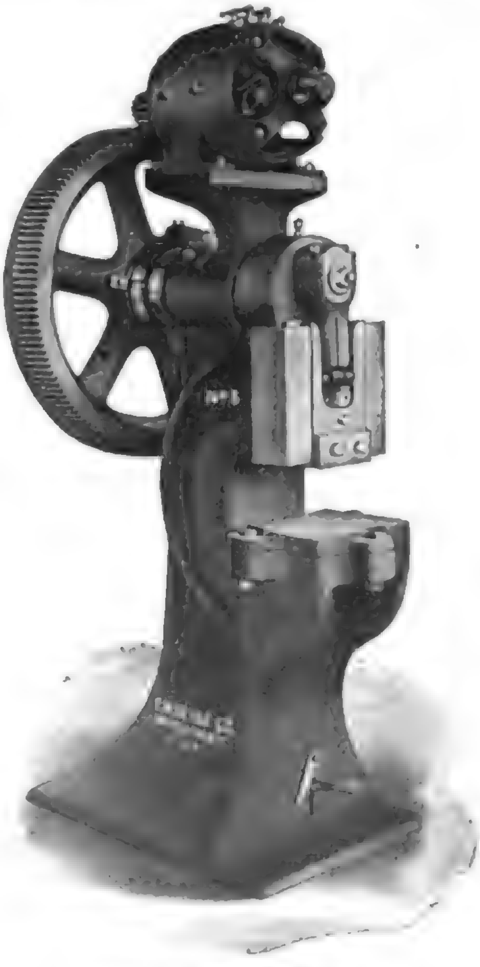


FIG. 2.—PORTION OF RING OF BLADES FROM SPINDLE.

Press with Electric Motor.

The demand for electric motors for driving nearly all classes of machinery is constantly increasing, and this increase is very noticeable in the large number of power presses now being fitted for the electric drive. In this kind of machinery it is often advantageous to have the motor located in such a position



ELECTRICALLY-DRIVEN PRESS.

that it is entirely out of the way of the operator, and also to have the machine occupy no more floor space than is absolutely necessary.

To provide for both of these features the E. W. Bliss Co., of Brooklyn, has recently supplied one of its "Stiles" presses with the motor arranged as shown in the accompanying illustration, which, it will be noted, is a very simple and efficacious way of accomplishing the desired results. The starting box is attached to the far side of the press within easy reach of the operator, who has perfect control of the machine at all times by simply depressing the foot treadle to cause the slide to descend and raising his foot to make the slide stop. In addition to the motor equipment on this press it is interesting to know that the machine itself is very largely used in the manufacture of electrical instruments, fittings, parts, etc.

Blast Furnace Gas Engine Development.

The Carnegie Steel Company has made a long step in the right direction by its recent adoption of gas engines to utilize surplus gas from its furnaces for the generation of power needed in the electric driving of mill machinery. Sometime ago the company contracted with the Westinghouse Machine Company, of Pittsburg, builders of large engines and turbines, for some large blowing engines to be driven by blast furnace gas. For the purpose of conducting preliminary experimental work an engine of 350 hp running at 150 revolutions with 30-in. stroke was installed and has since made a remarkable record for itself under the severest possible tests for efficiency, reliability and durability. The two gas blowing engines are now under construction at East Pittsburg for the work at the Edgar Thompson Furnaces, Bessemer.

These will be twin tandem units with Slick air blowing "tubs" arranged in front or vis-a-vis and with fly-wheel interposed between the two sides of the engine. Each of these blowing units will have a capacity of 25,000 cu. ft. of free air per minute, operating against a normal blast pressure of 18 lb. and running at a speed of 60 to 75 r.p.m. When higher pressure is demanded by the furnaces the valve gear of the engine may be so altered as to deliver air under pressures up to 25 lb. per sq. in. in proportionately less quantity. These engines are of the heavy-duty, double-acting type as standardized by the Westinghouse Machine Company, and will be among the largest ever constructed for use with blast furnace gas.

Very recently the Carnegie Steel Company has contracted with the Westinghouse Machine Company for another blast furnace gas engine unit similar in design to the blowing units above mentioned, except that the engine will drive a direct-connected electrical generator for the purpose of augmenting the present power service at the Bessemer works. The gas engine will have the same stroke as the blowing unit, viz.: 54-in., and operating at a normal speed of 75 r.p.m. will develop approximately 2,500 brake hp on blast furnace gas. The generator will be a 1,500-kw, direct-current machine connected in parallel with the steam-driven dynamos at the present Edgar Thompson power plant.

Portable Electric Hoists.

The electric hoist shown in Fig. 1 has been designed for use where the bottom block is exposed to much heat, being fitted with a chain in place of the more commonly employed wire rope. These hoists are equipped with a controller, which provides for five speeds where the delicate handling of the load is necessary. In places where such refinement is not needed the controller is arranged for only two speeds. In the illustration the controller is operated by means of pendant cords. On account of the presence of the solenoid brake on the hoisting mechanism, the hoists can be controlled from a distance when desired, permitting the controller to be detached and mounted independently of the hoist at any convenient place. The hoisting mechanism will swivel a full turn in either direction around the suspending hook without injurious twisting of the wires. Where it is necessary for the hoist to swivel continuously, however, turntable collector rings are employed. The terminals pass into the top hook, and thence to the insulated rings, contact to the latter being made by two brushes as shown in Fig. 2.

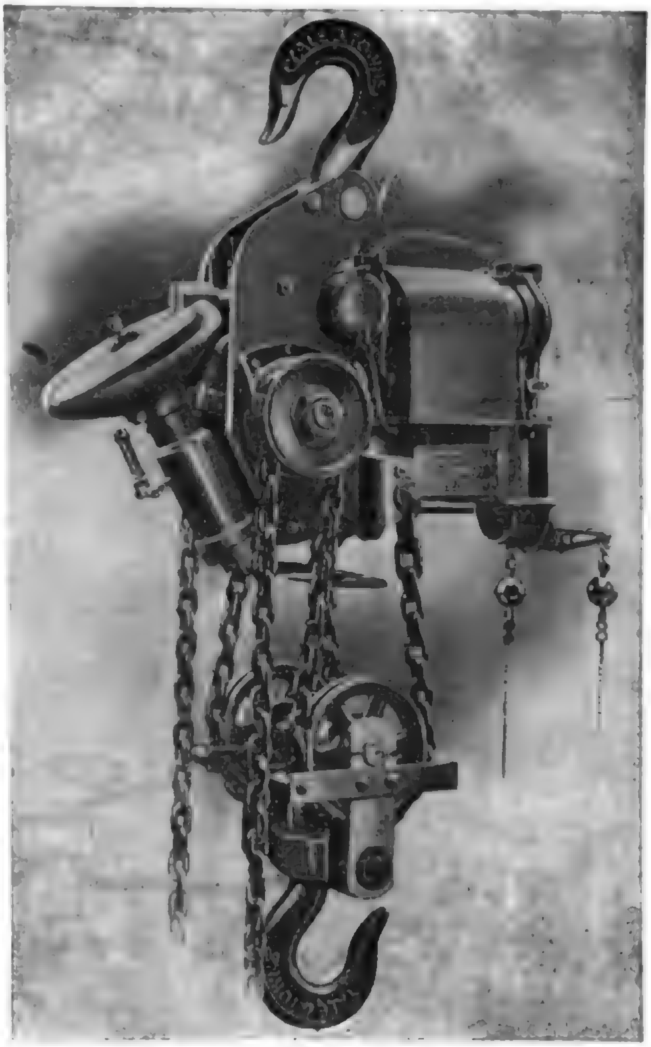


FIG. 1.—PORTABLE ELECTRIC HOIST.

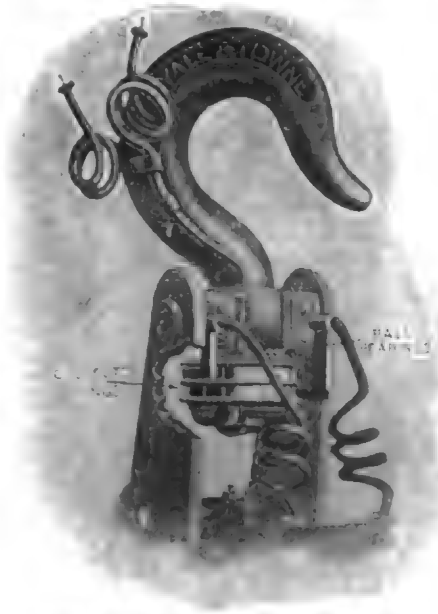


FIG. 2.—TURNTABLE COLLECTOR RINGS.

These hoists are made by the Yale & Towne Manufacturing Company, 9 Murray Street, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Excellent reports of business conditions were the rule last week and the situation is thus summarized: Retail trade has expanded with warmer weather and the settlement of labor troubles; jobbing reorder business is of a full seasonable volume, San Francisco demand being a feature; fall orders are equal to, and in many lines in excess of, last year at this period; industry, except in some sections of the soft-coal field, is as active as ever before, and the return tide of currency from the country is evidenced by increasing Western bank deposits and perceptibly easier money. Demand for speculative purposes has fallen off and collections are better. Lack of moisture in portions of the winter wheat belt is responsible for the first irregularity of the season in crop reports, but spring wheat and corn are doing well. Railway earnings show good gains; building is active, and there were large sales of lumber, hardware, paints, glass and other material, and the iron and steel industry, while showing some irregularity in foundry-pig prices, due probably to the molders' strike, draws great confidence from the large volume of orders booked for steel rails for next year's delivery. Collections tend to improve. The demand for steel rails for 1907 delivery was the feature of the iron and steel markets. Demand for structural material is quieter, but mills are very busy on old contracts. Coal and coke are lower, supplies being ample and demand less active. Copper is higher, and the market reflects steady and large demands for home and foreign account. One large Western producing interest on Friday refused market specifications for 3,000,000 pounds of electrolytic wanted for August shipment. This producing interest closed its books for August copper at the opening of the week. Among the larger producers June and July bookings have been closed, and there is not much August copper to be had in heavy tonnages. Casting copper for nearby delivery is not to be had in large quantities from makers of prime brands. The domestic market quotes Lake, 18⅞ to 19c. for August; electrolytic, 18¾ to 18⅞c. for August and September. Prime casting grades are 18⅝ to 18¾c., nominally at thirty days, but commonly understood to be later as to shipments. The business failures, as reported by *Bradstreet's*, are at a low level. The number last week was 161, against 162 the week previous and 191 in the corresponding week last year.

WESTINGHOUSE LOCOMOTIVES.—In the construction department of electric locomotives at the East Pittsburg factories of the Westinghouse Electric & Manufacturing Company there is a very busy time at present. Within the last week or two orders came into this department for no less than 55 electric locomotives. Some of these are for mining plants and will be used for hauling coal in the pit. Others are for manufacturing plants, where the electric locomotive is now finding extensive use in the transportation of material from the shops to the railroad siding, and a very large number are for railroad companies for hauling freight. These orders for electric locomotives do not come from one part of the country but are shipped everywhere. The Youghiogheny & Ohio Coal Company, of Cleveland, has ordered five; the Ziegler Coal Company, of Ziegler, Ill., three; the Berwind-White Coal Mining Company, of Windber, Pa., four; the Copper Queen Consolidated Mining Company, of Colorado, twelve; the Mammoth Copper Mining Company, of Mayville, Cal., one; the Seattle-Boston Copper Company, of Seattle, Wash., one; the St. Louis, Rocky Mountain & Pacific Railway Company, three; the Pennsylvania Salt Manufacturing Company, of Natrona, Pa., three; the Pittsburg Plate Glass Company, of Charleroi, Pa., four; the Pocahontas Colliery Company, of Pocahontas, Va., three; the Washington Railways & Electric Company, of Washington, D. C., one freight locomotive and the Tennessee Copper Company, of Isabella, Tenn., three.

C. H. BROWN ENGINE COMPANY.—The C. H. Brown Engine Company is the name of a $75,000 Massachusetts corporation in process of organization at Fitchburg, Mass., which will buy the land, buildings, equipment and patent rights of C. H. Brown & Company. The incorporators are: Moses J. Perault, Charles B. Smith, W. E. Putney, Alpha Garth, Edward J. Welch, Frank E. Brown, George P. Grant, Jr., Charles F. Irish, George H. Cutter, William L. Sargent, of Fitchburg, and Walter F. Brown, Boston. At a meeting of the incorporators these temporary officers were elected: President, Walter F. Brown; secretary and treasurer, William L. Sargent. Directors: M. J. Perault, E. J. Welch, W. F. Brown, F. E. Brown and W. L. Sargent. Articles of incorporation will be filed with the commissions of corporations in Boston this week. The company will continue to manufacture the Brown automatic cut-off engine, and expects to employ 100 skilled mechanics.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company's instrument statement for April and four months shows the following output of Bell telephones:

April:	1906.	1905.	1904.	1903.
Gross output...	206,557	174,207	102,907	104,429
Returned	65,357	44,981	42,335	43,491
Net output ..	141,200	129,226	60,572	60,938
Four months—				
Gross output...	733,041	475,775	404,475	410,390
Returned	244,019	153,971	151,325	160,137
Net output. .	489,022	321,804	253,150	250,253
Total output	6,187,280	4,910,962	4,032,667	3,400,573

This is equivalent to 3,093,640 stations.

LARGE WHITE CONTRACT.—A contract has been made whereby J. G. White & Company, of New York, are to build a new high speed interurban line costing $2,000,000, between Rochester and Lockport, for a syndicate represented by Frederic Nichols, E. R. Wood and Sir Henry M. Pellatt, of Toronto. The contract covers the entire construction, inclusive of track, overhead work, distributing system and five sub-stations. The right of way will be graded for two tracks, although the construction of only a single track is provided for in the initial contract. The contract includes also the rolling stock, which will be of the established standard for high speed interurban service. Work will be begun immediately.

WARREN ELECTRIC MANUFACTURING COMPANY.—The receivers of the Warren Electric Manufacturing Company have filed in the Common Pleas Court a summary of receipts and disbursements from the date of their appointment, October 28, 1905, to April 16, 1906. The account shows cash on hand and accounts receivable of $45,550. Receivers' certificates were issued and sold to the amount of $13,000 and there are accounts payable to the amount of $5,286. The surplus under the administration of the receivers is $36,265. The principal items in the accounts receivable are claims of $26,351 against the U. S. Navy Department and $14,250 against the Consolidated Lighting Company, of Sandusky.

FOREIGN TRADE—The Bureau of Statistics, Department of Commerce and Labor, reports imports and exports of merchandise for April and for ten months ending April 30, as follows:

April:	1906.	1905.	1904.
Imports	$107,327,038	$95,636,142	$83,521,882
Exports	144,491,909	129,358,229	109,880,405
Excess of exports.	$37,164,871	$33,722,087	$26,358,523
Ten months ending April 30—			
Imports	$1,020,881,835	935,072,990	829,231,975
Exports	1,488,393,999	1,275,059,368	1,277,715,480
Excess of exp.....	$457,512,164	$339,986,378	$448,483,505

WIRELESS SHIPPING EQUIPMENT.—The Massie Wireless Telegraph Company, of Providence, R. I., has a contract for equipping the Enterprise Transportation Line, plying between New York and Fall River, and the system will be put in operation at once. Land service will be given the boats from the Massie stations at Wilson Point and Point Judith.

THE GENERAL ELECTRIC COMPANY has acquired a large tract of land between the Erie Canal and the Mohawk River. The company has under consideration, it is said, the erection of a large blast furnace. With the opening of the new barge canal, the ore will be brought direct from the mines to the furnace and made into pig iron.

POWER IN WASHINGTON.—The Similkameen Falls Power & Development Company, of Oroville, Wash., Mr. H. W. Johnson, manager, is developing a power transmission plant of 1,000 hp, and is now in the market for motors ranging in size from 5 to 25 hp.

ELECTRIC LOCOMOTIVES.—As to the effect of electric railway work on manufacturing of steel, etc., it is stated that the 35 Westinghouse electric locomotives ordered by the New York, New Haven & Hartford Railroad Company, for service between the Grand Central Station and Stamford, will consume 5,950,000 lb. of American steel.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market toward the close of the week became heavy, being influenced by the weakness of Pennsylvania Railroad shares on the revelations brought out regarding irregularities in the conduct of its coal traffic. Prior to this the general tendency had been toward an advance under the influence of easy conditions in the money market, although the trading throughout was professional and narrow. In industrials there were no special features, apart from the relative steadiness of the United States Steel issues, a reaction in the International Pump shares, and a break in National Lead, caused by the fact that the dividend on the common stock, the first which has been declared thereon since 1901, was only 1 per cent instead of a larger amount. The local traction securities were irregular, but showed some strength on the favorable accounts of earnings which they exhibit. A large trading was done in Brooklyn Rapid Transit at figures ranging between 82¼ and 84⅞, the closing price being 83¼. Metropolitan Street Railway certificates closed at 114, and Interborough-Metropolitan, common and preferred, closed at 51½ and 84½, respectively, the former being a net loss of 2¾ and the latter of 1¾. The electric stocks were generally weak and losses on the week's business were recorded at the close. Allis-Chalmers common declined 1¼ points net, closing at 55¾, and preferred 1¾, the last quotation being 109¾. General Electric made a net gain of 1 point, closing at 168¾, and Westinghouse dropped 4 points, the last quotation being 154. Western Union Telegraph closed at 92¼, which quotation is a fractional decline. Interborough Rapid Transit, on the curb, closed at 232, a net gain of 1 point on the week's business. Mackay Companies advanced 1⅜, closing at 72. The curb market, except for pool operations in two or three stocks, such as Mackay and Chicago Subway, which were bid up sharply, was without special feature. Prices were run up a little early in the week, then sagged off, as efforts were made to liquidate. Liquidation, in fact, was the keynote to the market. Outsiders were not disposed to buy many stocks, and traders, being suspicious, held off. Following are the closing quotations on the Stock Exchange May 22:

NEW YORK

	May 15	May 22		May 15	May 22
Allis-Chalmers Co.	20⅝	20¼	General Electric	167½	167
Allis-Chalmers Co. pfd.	56	55¾	Hudson River Tel.	...	...
American Dist. Tel.	*39	*39	Interborough Rap. Tran.	232	230
American Locomotive	67⅞	68⅝	Mackay Cos.	73	74¼
American Locomotive pfd.	116	114½	Mackay Cos. pfd.	74	73⅝
American Tel. & Cable	90	90	Marconi Tel.	...	...
American Tel & Tel.	138	137	Metropolitan St. Ry.	115	110
Brooklyn Rapid Transit	83¾	83¼	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	92¾	92¼
Electric Boat pfd	65	66	Westinghouse com.	158	154
Electric Vehicle	11	11	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	May 15	May 22		May 15	May 22
American Tel & Tel	139	137½	Mass. Elec. Ry. pfd	65	65½
Cumberland Telephone	117½	..	Mexican Telephone	...	...
Edison Elec. Illum.	246½	246	New England Telephone	136	...
General Electric	168¼	168	Western Tel. & Tel	...	...
Mass. Elec. Ry.	18¾	19¾	Western Tel. & Tel pfd.	90	90

PHILADELPHIA

	May 15	May 22		May 15	May 22
American Railways	51½	52	Phila. Electric	8	7⅝
Elec. Co of America	11¼	11⅜	Phila. Rapid Trans.	26⅛	26¼
Elec. Storage Battery	73	72	Phila. Traction	99	98¾
Elec. Storage Battery pfd.	...	..			

CHICAGO

	May 15	May 22		May 15	May 22
Chicago City Ry.	160	160	National Carbon	88	88
Chicago Edison	...	...	National Carbon pfd	120	120
Chicago Subway	...	58	Union Traction	...	...
Chicago Tel. Co.	...	122	Union Traction pfd	...	...
Metropolitan Elev. com.	27½	26			

* Asked

INDIANA TELEPHONE DEALS.—During the present month considerable progress has been made toward a merger of interests in the independent telephone field in Indiana. At a recent meeting in Fort Wayne the independent plants of Peru, South Bend and the Delaware and Madison County telephone companies, capitalized at $10,000,000, agreed upon plans and terms for an alliance with the St. Louis independent interests. At a similar meeting in Vincennes, the controlling interest of the Knox County Home Telephone Company, owned by W. R. Gardner and others, of Toledo, Ohio, was pooled with the Central Home Telephone Company, of Louisville, Ky., of which the Toledo people have become directors. The Home Company has 1,300 subscribers in Vincennes and gives free service over the whole of Lawrence County in Illinois just across the Wabash River. The local stockholders are greatly pleased with the new alliance. A similar alliance has been effected at Washington, Bloomington, Seymour and Bedford exchanges, which have been operated independently. By entering this pool they obtain long-distance service with the Kinloch, of St. Louis, the Central, of Louisville, and other cities allied with them.

DEVELOPMENT IN UTAH.—It is announced from Salt Lake City that the Utah Light & Railway Company is to be taken over by a $25,000,000 corporation, composed of English and American capitalists. The new company will also acquire the Ogden Street Railway and build an electric line from Juab County, Utah, to Oneda County, Idaho. It will be known as the Intermountain Consolidated Railroad Company, and will be incorporated both in Utah and Idaho. The board of directors will include H. H. Vreeland, New York City; Baron d'Oissel, Paris; Sir Thomas Jackson, London; William G. Rathbone, Manchester, England; Alexander McKenzie, Ottawa, Canada; Henry Dupont, Paris; Beresford Hope, London, and a number of Utah men, among them Governor John C. Cutler. The enterprise will be financed through the Intermountain Trust Company, incorporated in Utah and Idaho. If this policy is completely carried out the sale of the traction interests will be followed by the sale of Mormon Church stocks in banks, sugar factories, the great Z. C. M. I. department store, and many smaller enterprises. It will be a commercial revolution profoundly affecting the political and social life of the State.

CHICAGO EDISON.—Advices from Chicago state that the lighting committee of the city council has recommended for passage, with certain modifications, the ordinance reducing the rates charged by the Chicago Edison and Commonwealth Electric companies. The rates are fifteen cents per long hour the first two years and thirteen cents the next three and ten cents per short hour the first year, nine cents the second, eight cents the third and seven cents the fourth and fifth. A discount of 1 per cent per kilowatt hour is to be deducted from bills paid within ten days. The companies are authorized to consolidate, but when consolidated 3 per cent of the gross receipts of both are to be paid to the city as compensation. To expedite the sale of its bonds the franchise of the Commonwealth Electric is amended so as to run to its successors or assigns. One amendment provides that the rates shall never exceed the schedule fixed in the ordinance as outlined above.

TRI-CITY CONSOLIDATION.—A consolidation is under way of all the street railway, gas and electric lighting properties in Davenport, Ia.; Rock Island, Ill.; Moline, Ill., and East Moline, the new organization to be known as the Tri-City Railway & Light Company, with a proposed capital stock of $12,000,000, of which will be issued $2,600,000 cumulative 6 per cent preferred and $9,000,000 common; with $6,000,000 of 5 per cent bonds issued and $3,000,000 bonds reserved. During 1906-7 it is proposed to expend $1,500,000 in various improvements. Messrs. J. G. White & Company estimate for 1906 gross earnings of $1,485,000; operating expenses, etc., $843,000, and $642,000 net, leaving $289,490 available for dividends after taking $352,510 for bond interest. These figures will show a marked gain for 1908.

CINCINNATI GAS & ELECTRIC.—The Consolidated Gas & Electric Company, recently organized by New York capitalists, has acquired control of the Cincinnati Gas & Electric Company, in accordance with plans already noted. The new company guarantees the Cincinnati company 4½ per cent dividends on its stock for two years, 4¾ per cent the next two years, and 5½ per cent a year thereafter. The authorized capital of the Consolidated Gas & Electric Company consists of $10,000,000 of 6 per cent preferred stock and $6,000,000 of common. The Guaranty Trust Company, the Windsor Trust Company and George W. Young & Company are interested.

DIVIDENDS.—The Syracuse Lighting Company has declared the regular quarterly dividend of ½ of 1 per cent on the common, payable June 1. The directors of the Kansas City Railway & Light have declared the regular preferred quarterly dividend of 1¼ per cent, payable June 1.

CANADIAN CAPITAL FOR U. S. A.—Montreal and Toronto capitalists have purchased $1,300,000 of the preferred stock of the Tri-City Railway & Light Company, of Davenport, Ia., and the stock will be listed on the Montreal Exchange.

GENERAL NEWS.

Construction Notes.

CENTREVILLE, ALA.—This town is now lighted by electricity from the new electric lighting plant.

MONTGOMERY, ALA.—The Montgomery Traction Company has its $40,000 street railway barn and shops well under way, and will soon begin other improvements to its system.

GADSDEN, ALA.—The City Council has entered into a contract with the Alabama City, Attalla & Gadsden Railway for electric lighting franchise for fifteen years. The company is required to build a plant to cost at least $90,000, and it is understood that the plant to be erected will go far beyond that. The franchise is limited to ten years, but it runs five more if satisfaction is given. The company is also building considerable new track.

LOS ANGELES, CAL.—The Sunset Telephone Company is considering the advisability of placing its wires in conduits along Olive Street.

SAN FRANCISCO, CAL.—The California Street Cable Company is preparing to rebuild its power plant on California and Hyde Streets, which was destroyed by the earthquake.

SAN DIEGO, CAL.—The Home Telephone Company will make immediate improvements in the back country system and to that end Manager Woodridge has been authorized to construct an extension to Cuyamaca, which will represent an outlay of $25,000.

SAN FRANCISCO, CAL.—The Bay Counties Railway Company filed notice of change of its principal place of business from Napa to San Francisco. The company was recently incorporated with $1,000,000 capital stock to build a railway forty-five miles in length through Marin, Sonoma and Napa Counties.

PASADENA, CAL.—On May 3 the citizens voted in favor of issuing $125,000 in bonds for the installation of an electric system. It is stated that the city will, in all probability, buy up the Edison Electric Company's holdings in Pasadena, if they can be acquired at a reasonable figure. The Edison Company does not maintain a power house, but merely the system of wires by which the power is distributed. In case the city should buy the local system it would still have to build a plant.

DENVER, COL.—The Northern Colorado Power Company, which recently purchased the Boulder Light & Power Company, has been reorganized and the capital stock increased from $50,000 to $3,000,000. It is stated that the company will take over the electric light, gas and steam plants at Cheyenne and Ft. Russell, and the plant of the Consumers' Electric Company at Lafayette. The company will construct as soon as possible a 10,000-hp plant at Lafayette, and ultimately increase it to 35,000 hp. The plant at Boulder will be discontinued as soon as the plant at Lafayette is completed. It is the intention of the company to consolidate a number of plants in northern Colorado and southern Wyoming towns, and to supply light, power and fuel to the towns and mines in the territory where its lines extend. It will also furnish power to the Denver, Boulder, Fort Collins and Greeley branch of the Colorado & Southern Railroad as soon as it is electrified.

CANAAN, CONN.—The machinery of the Canfield Auto Company is now operated by electricity, power being furnished by the Berkshire Power Company.

HARTFORD, CONN.—The Common Council has voted to accept the proposition of the Consolidated Railway Company to double the track on Sisson Avenue and lay an additional track on New Park Avenue.

HARTFORD, CONN.—The Hartford Electric Light Company will soon be able to supply its patrons with the graphitized filament incandescent lamps to take the place of the 16-cp incandescent lamp now in use.

MOODUS, CONN.—The financial interests back of the Salmon River Power Company have taken preliminary steps toward the construction of an electric railway between Moodus and East Haddam. It is estimated that it will cost $100,000 to construct and equip the road.

MIDDLETOWN, CONN.—The Rhode Island Contract Engineering Company (F. H. Hoadley, vice-president and manager, Providence, R. I.) has secured the contract for complete installation of the plant of the Salmon River Power Company and will purchase contractors' equipments. Cost of work proposed, $500,000.

ROCKVILLE, CONN.—The Rockville Gas & Electric Company has just completed the expenditure of $40,000 in the enlargement of its plant and installing new street lamps. The company is now extending a line to Stafford Springs, where connections will be made with the Stafford Springs Electric Light Company, which is under the same ownership as the local concern.

PENSACOLA, FLA.—Stone & Webster, of Boston, Mass., have acquired the electric railway and lighting systems of this city through the purchase of all securities of the Pensacola Electric Terminal Railway Company and the Escambia County Light & Power Company. A new company, under the management of Stone & Webster, will be organized to operate these systems. The railroad system now includes about 12 miles of track operated by electricity and 7 miles by steam power. It is proposed to convert at once the latter line to electricity. The new company will improve the entire property and extend the system to meet the requirements of the growing population.

SOCIAL CIRCLE, GA.—An election will soon be held to vote on the question of issuing bonds for an electric light plant.

OCILLA, GA.—The new municipal electric lighting plant was put into operation for the first time May 16, and is giving satisfaction.

FITZGERALD, GA.—The capacity of the municipal water and light plant has recently been doubled, and extensive improvements are contemplated in extending the lighting service and water mains.

CULDESAC, IDAHO.—The Culdesac Milling Company will soon install an electric lighting plant. The company is now installing a 55-hp Leffel water wheel, which will increase the power capacity to 100 hp. Bids have been asked for a 500-light dynamo, and work on the construction will soon commence. The plant, exclusive of the water power, will cost about $3,000.

PEORIA, ILL.—The Interstate Telephone Company will spend fully $100,000 in improvements on its plant in this city this year.

ELGIN, ILL.—The Elgin & DuPage Electric Railroad Company has changed its name to the Chicago-Elgin Electric Railroad Company.

MILAN, ILL.—S. S. Davis and associates contemplate constructing a dam on Rock River for developing water power for electrical purposes.

JOLIET, ILL.—Plans are being made by President R. R. McCormick for a water power plant to be constructed by the drainage board south of this place, to cost about $2,000,000.

MAPLE CITY, ILL.—The Mainland syndicate, which holds the contract for lighting the streets, has been asked to submit estimates on three different propositions for lighting the city during the twelve months.

KANKAKEE, ILL.—Plans are being considered for the construction of a large power and lighting plant in this city. H. G. West, of the Consumers' Coal Company, of Chicago, and A. J. Vernier are the promoters.

ATHENS, ILL.—The Athens Electric Light Company during the past six months increased its alternating load to full capacity, and expects to install a 60-kw or larger machine in the near future. J. P. Stutzman is superintendent and electrician.

SPRINGFIELD, ILL.—The Springfield, Clear Lake & Rochester Interurban Railroad Company will issue bonds for $60,000 to secure the aid of local subscribers. Work on the road is progressing rapidly and several miles of grading have been completed out of Rochester. J. E. Melick is president and G. E. Hemenway, treasurer.

GRANITE CITY, ILL.—The Alton, Granite & St. Louis Traction Company, the Alton Gas & Electric Company, the Granite City Railway lines and allied corporations in Granite City, are now controlled by the East St. Louis & Suburban Railway Company, of which L. C. Haynes, of East St. Louis, is general manager. It is said that a new corporation with a capital of $14,000,000 will hold the stock of the various corporations. The names of the operating companies will be retained.

FLORA, IND.—A company has been organized here to construct and install a modern electric light and water works plant. The company will file articles of incorporation under the name of the Flora Light & Water Company.

COLUMBUS, IND.—The Citizens Telephone Company is considering the construction of a new branch exchange at East Columbus. Two plans are being considered, one being to extend the cable to the suburb and the other to build the exchange, on which estimates are being made.

HUNTINGTON, IND.—The management of Riverside Park has found it can secure light from the Huntington Light & Fuel Company at a figure cheaper than it can handle its own plants and has contracted with the company for between 300 and 400 lamps to be erected in Riverside Park and to be put into operation as soon as possible.

INDIANAPOLIS, IND.—The Louisville & Eastern Railway recently bought by Messrs. Elliott, Fuavre & Gates of this city, has filed a mortgage for $2,000,000 at Frankfort, Ky. The mortgage provides that not more than $450,000 shall be spent for the extension of the road, for twenty-two miles. Work on the extension will soon begin.

LAFAYETTE, IND.—The Lafayette Street Railway Company, which is a part of the Fort Wayne & Wabash Valley Traction Company, has been granted a franchise for eighty-six years to operate cars on certain streets by the Board of Public Works. The interurban company has secured a franchise for fifty years to operate its cars in the city. It is said that the latter grant will assure the immediate building of the Logansport-Lafayette branch of the road.

NOBLESVILLE, IND.—The Hamilton County Telephone Company has been organized to operate a rural telephone line in Hamilton County. The plan is to have exchanges in the small towns which have not yet been served by telephone companies, with headquarters in this city and in Sheridan. Six new exchanges will be put in; those at Hortonsville and Eagletown to be the first constructed. Fletcher Jessup, of Hortonsville, is president.

TULSA, I. T.—A street railway company has recently been organized here by local and outside capitalists. It has a capital stock of $200,000, with $10,000 paid in, and has a cash bond to put up with the city guaranteeing to complete ten miles of electric railway in twelve months. L. F. Parker, of St. Louis, Mo., is interested in the company and will probably be its first president.

MUSCATINE, IA.—Frank X. Schaefer has petitioned for a franchise for an electric light and power system.

SHENANDOAH, IA.—John A. Masters is reported to have purchased a controlling interest in the electric light plant here, and will rebuild the same.

BOONE, IA. The power plant of the Newton & Northwestern Railroad Company will be located at Fraser, and work on the construction of the plant will begin without delay. The J. G. White Company will have charge of the work.

WICHITA, KAN.—The Wichita Gas, Electric Light & Power Company has decided to construct a new plant.

DOWNS, KAN. C. S. Dittman is contemplating putting in an electric light plant here for his own use and for the town. A plant of sufficient capacity to light the town would cost from $10,000 to $18,000.

HUTCHISON, KAN. The foundation is being laid for the power house building for the People's Water, Light & Power Company. This plant will also furnish power for the Hutchison Interurban Railway Company.

LAWRENCE, KAN.—Bids are wanted by H. B. Fears, superintendent, Haskall Institute, Lawrence, for furnishing and delivering as required, five electric motors, aggregating about 23 hp, with transformers, etc., set in place ready to run.

INDEPENDENCE, KAN. It is announced that A. C. Stitch, with a company of capitalists, will organize a company for the purpose of erecting an electric light plant. The city is being canvassed for customers and the plant will be erected at once. It is to cost about $10,000.

PARSONS, KAN.—The Parsons Electric Light & Power Company is planning extensive improvements and additions to its plant within a short time which will cost about $35,000. The company will add to its equipment new boilers and dynamos and put in additional switchboards, transformers, steam connections, etc.

LEXINGTON, KY.—The Lexington-Winchester Interurban Electric Railway in Kentucky has secured the necessary rights of way and will probably begin work on the new line this summer.

SHELBYVILLE, KY.—The town of Shelbyville has granted a 99-year right of way to the Louisville & Eastern Electric Railway for an interurban road to be completed within one year. A line to Eminence is also to be constructed.

MORGAN CITY, LA.—The Morgan City Improvement Company will increase the capacity of its plant by adding two 75-kw direct-current machines and will extend its lines. Hugh Young is president.

SOUTH PARIS, ME.—The citizens of this village have decided not to build a municipal electric lighting plant at present.

WESTBROOK, ME. The Westbrook Electric Light & Power Company is installing two 100-hp rotary converters and other necessary equipment to furnish power for the paper mill.

BANGOR, ME.—The power plant of the Bodwell Water Power Company, which is now being constructed at Old Town, is nearly completed, and is expected to be in operation in a few weeks. It is said that the plant will have a capacity of 3,000 hp, and that the current will be transmitted to this city. The charter of the company enables it to build transmission lines and to sell power for all purposes throughout Penobscot County.

AUGUSTA, ME.—The Kennebec Light & Heat Company is making extensive improvements to its plant. It has just installed a 750-hp steam turbine, direct connected to a 500-kw alternating-current dynamo. Three dynamos of 200-kw capacity each are to be installed. The whole system is to be changed from single to three phase, separate wires to be used for street lighting, inside lighting and power. The company uses both water and steam power. It furnishes electricity for Augusta, Togus, Hallowell and Gardiner.

MECHANICS FALLS, ME. The controlling interest of the Mechanics Falls Water & Light Company has been purchased by Libbey & Dingley, of Lewiston, Me. The new management will at once assume control. Power will be supplied from the Deer Rips power station at Auburn, the present power station will be held in reserve in case of accident. Work will begin at once on the installation of the transmission line from Auburn. To accommodate this increased demand on their power, Libbey & Dingley have contracted with the General Electric Company for another unit to be installed at the Deer Rips power house at Auburn. This unit will be of 1,500 hp. This will give a total of 4,000 horse-power, with space for the installation of two additional units when required. In the installation of this new unit larger wheels will be used. At the annual meeting of the Mechanics Falls Water & Electric Light & Power Company, the following officers were elected: President, H. M. Dingley, of Lewiston; treasurer, W. S. Libbey, of Lewiston; clerk, J. E. Parkhurst, of Lewiston; directors, H. M. Dingley, W. S. Libbey, J. E. Parkhurst, Fred G. Gordon and Harry A. Edgecomb.

BOSTON, MASS.—The city of Medford has granted a franchise to the Boston & Lowell Interurban Railway Company.

GLEASONDALE, MASS.—The town of Gleasondale is now lighted by electricity. The current is furnished by the municipal electric light plant of Hudson.

WHITMAN, MASS.—The Edison Company is rapidly extending its service in the town, not only furnishing additional lights for the town, but also to many business houses and residences.

WESTFIELD, MASS.—George Pettibone, manager of the municipal electric light and power plant, has recently installed a 5-hp motor in the machine shop of Moore & Moore, on Crary Avenue.

ARLINGTON, MASS.—At a town meeting May 15 F. A. Bisbee, Harry Hornblower and Franklin Wyman were appointed a committee to investigate the question of municipal lighting.

HOLYOKE, MASS.—J. Louis Perkins will operate his paper mill in South Hadley by electricity. As soon as the new machinery is installed power will be furnished by the Holyoke Water Company as soon as the machinery is placed.

ORANGE, MASS.—The Orange Electric Light Company is planning the construction of a new steam power plant, to be located at Wendall Depot, in connection with the water power station, as the power furnished by the old Grove Street station is inadequate at times of low water.

HOLYOKE, MASS.—The quarterly report compiled by D. W. Kenney, City Auditor, upon the business of the municipal lighting department for the quarter ending February 28, showed an increase of $7,657 over the corresponding quarter in 1905. The increase in receipts for gas was $2,388, while the increase in electric light and power was $5,269.

GREAT BARRINGTON, MASS. At a recent meeting of the fire district it was voted to rescind the vote taken at the annual meeting, to appropriate $3,500 for street lighting, and to appropriate $4,421.50 in its place. The Great Barrington Electric Light Company has agreed to furnish 239 32-cp incandescent lamps at $18.50 per lamp per year, instead of $19.25, the price paid last year.

BOSTON, MASS.—The railroad commissioners have issued an order authorizing the Worcester & Blackstone Valley Street Railway Company to issue additional stock to the amount of $140,000. At present the company has a capital stock of only $60,000. The new stock is to be sold to the present stockholders at $100 a share, the income to be devoted to reducing the floating indebtedness.

TAUNTON, MASS.—The County Commissioners of Bristol County will receive bids at the Court House in Taunton, until 10.30 a. m., May 28, for furnishing and installing the electric lighting fixtures in the building for the registry of deeds for the northern district of Bristol County. Drawings and specifications may be seen at the office of the County Commissioners, County Court House, Taunton, Mass.

TEMPLETON, MASS.—The citizens voted on May 14 to appropriate a sum not to exceed $15,000 to establish an electric light plant. An electric light committee was elected consisting of Eugene Lincoln, of Templeton; C. Aylmer Smith, of Baldwinville, and Charles H. Leathe, of Otter River. The present plan of the committee is to use the money appropriated to erect poles and string wires through the town, and to purchase current from the Gardner Electric Company, of Gardner, Mass.

GRAND RAPIDS, MICH. The Grand Rapids Brass Company has installed a 200-hp gas producer plant and generator, and about 90 electric motors.

MEMPHIS, MICH.—The Village Council has passed an ordinance granting S. D. Lester, of Sandusky, the exclusive privilege of establishing and maintaining an electric light and water works system in this village.

BAY VIEW, MICH.—The electric lighting plant of the Bay View Camp Ground Association will probably be enlarged in the near future. At present it consists of a 45-kw alternator supplying 16 and 32-cp lamps during the summer season.

CONSTANTINE, MICH.—Plans and specifications are nearing completion and bids will soon be asked for the construction of the proposed power plant on St. Joseph River at Constantine, for H. L. Hartensten. H. von Schon, of Detroit, is the engineer.

ANN ARBOR, MICH.—The Michigan State Telephone Company has been awarded a contract by the board of regents for the installation of a complete telephone system for the university buildings and campus for the State University at Ann Arbor.

MUSKEGON, MICH.—The West Michigan Interurban Company has announced that Eastern capitalists have agreed to furnish the money for the construction of the electric railway from this city to Hart. James K. Flood, of Hart, is interested in the project.

TRAVERSE CITY, MICH.—A company has recently been organized in this city for the purpose of furnishing electric power. The company has a capital stock of $50,000 fully subscribed. The officers are Daniel J. Albertson, of Kalamazoo, president; William H. Thirly, vice-president; William H. Umlor, secretary, and Anton W. Bartak, treasurer.

LANSING, MICH.—The Lansing water and electric light plant (municipal) has recently installed a circuit of alternating-current arc lamps. It will put in a sub-pumping station of two million gallons capacity to be run by an electric motor. The plant has also put in the last of a contract of 600 Nernst lamps for stores. C. D. Dodge is superintendent.

PENTWATER, MICH.—The Pere Marquette Power Company is constructing a dam and power house on the Pere Marquette River about 25 miles east of Pentwater. The plant when completed will have a capacity of about 3,000 hp. The company will build about 75 miles of transmission line, and proposes to furnish electricity for lighting and power to the various towns through which its lines extend. The work is well under way and is expected to be completed about October 1. J. N. Cotton, of Hart, Mich., is president.

NEW ULM, MINN.—The Minnesota Central Telephone Company contemplates installing a central energy system.

STAYTON, MINN.—George H. Woodgate has purchased the Enterprise telephone system and will extend it.

HOKAH, MINN.—R. D. Sprague, of Caledonia, is reported to be interested in developing the water power here for electrical purposes.

BOVEY, MINN.—F. McCormack, of Duluth, has submitted a proposition to install water works and an electric light plant at this place.

STILLWATER, MINN.—The Western Gas & Investment Company, of Chicago, Ill., owner of the local electric light plant, is preparing to develop power on the Apple River.

RUSH CITY, MINN.—An election will be held to vote on issuing bonds for developing the water power; probable cost, $15,000. The engineers are Claussen, Burch & Pillsbury, of St. Paul.

DULUTH, MINN.—Work has commenced of putting the wires of the electric, telephone and telegraph companies underground, in accordance with the ordinance recently adopted by the City Council.

MANKATO, MINN.—The Mankato Gas & Electric Light Company is planning extensive alterations and improvements in its lines in the business section of the city. The company is endeavoring to interest the merchants in electric signs, and has secured the services of an expert to solicit business and design signs for prospective patrons.

ST. PAUL, MINN.—The Union Manufacturing Company has petitioned the city to extend its franchise for electric light and power to include the western half of the city. The company is ready to agree to furnish electricity at a maximum rate of 8 cents per kw hour for motors and 14 cents per kw-hour for lamps, with a minimum charge of $1 per month.

VICKSBURG, MISS.—Hon. Oliver C. Catchings has petitioned for a franchise to operate a street railway in this city. A new company is being organized by Harry K. Johnson, Frank Markham and the Helgason Brothers. The company also intend to build a new power plant.

ST. LOUIS, MO.—The Sodeman Heat and Power Company, of St. Louis, has filed a statement with the Secretary of State to show it had increased its capital stock from $50,000 to $100,000, all the increase paid.

ST. LOUIS, MO.—Thomas B. Carter, Supervisor of City Lighting, has been authorized by the Board of Public Improvements to prepare a comprehensive plan for a complete electric plant for lighting the entire city.

GRAFTON, MO.—The Village Council has granted L. T. Westrich a franchise to erect and operate an electric light plant in this place. A company has been organized with a capital stock of $10,000 to build the plant.

BOWLING GREEN, MO.—An ordinance has been passed by the Council granting the Pike County Electric Light & Power Company the right to erect, maintain and operate an electric light and power plant in this city.

LINCOLN, NEB.—The Citizens' Street Railway Company will increase its capital stock to $100,000.

HAVELOCK, NEB.—P. T. McCere has been granted a franchise for the erection of an electric lighting plant in this city.

LINCOLN, NEB.—The contract for the new light and power plant at the university has been let to Olson & Lawrence. Work on the building will begin at once.

WEST POINT, NEB.—The Independent Telephone Company, operating a telephone system around Beemer and Wisner, will petition the City Council for permission to establish an exchange in this city.

TECUMSEH, NEB.—Judge S. P. Davidson and P. H. Hopkins have been appointed by the Commercial Club to propose to the City Council a special election to bond the city for $10,000 for an up-to-date electric light plant.

GRAND ISLAND, NEB.—The Matthews Electric Company, of Kansas City, Mo., has secured the contract for constructing the water works and an electric light plant for Grand Island. Engineer, W. K. Palmer, Kansas City, Mo.

SEARCHLIGHT, NEV.—W. B. Atwell, of the Searchlight Western Telegraph Company, announces that construction will soon commence on the electric power plant in this district.

EXETER, N. H.—A receiver has been appointed for the Exeter, Hampton & Amesbury Street Railway Company on petition of bondholders who wished to foreclose their mortgages. The railway is a part of the New Hampshire Traction Company's system.

NEWARK, N. J.—The Sanitary Ice Company has submitted a propositon to the new city hall commissioners to light the new city hall. The company agree to install a plant at a cost of $35,000 and furnish energy for lamps and motors for the building for a period of ten years at five cents per kw-hour, and at the end of ten years to turn the plant over to the city free of cost.

RATON, N. M.—The Colorado Telephone Company has recently purchased a lot on Park Avenue, and will at once commence the erection of a building to be used for its plant and offices. The plant will not only be enlarged but modernly equipped, involving an expenditure of about $70,000.

WILLETS POINT, N. Y.—Bids will be received until June 12 by Capt. George H. McManus, Constructing Quartermaster, U. S. A., Ft. Totten, for installing electric light fixtures in 13 buildings at this post.

TROY, N. Y.—The United Traction Company purchased the franchise which was recently sold at auction, to construct and operate an electric railway on Hoosick Street from Fifteenth Street to the city line. The price paid was $598.25.

LITTLE FALLS, N. Y.—The Herkimer County Light & Power Company, of Little Falls, has entered into a contract with the Utica Gas & Electric Company, of Utica, to purchase electricity from that company, the minimum charge to be $10,000 yearly.

SAYVILLE, N. Y.—The Sayville Electric Light Company is extending its lines to Great River, and will light a number of the country residences in that section. It is stated that the company will also install electric lamps in and around the Oakdale station.

BINGHAMTON, N. Y.—Alderman Bromley has announced that work will soon begin on the plans for the municipal electric lighting plant. It is planned to have the plant ready for operation when the lighting contract expires with the Binghamton Light, Heat & Power Company.

BUFFALO, N. Y.—It is announced that the control of the Buffalo Southern Railway Company, which operates the Buffalo, Hamburg & Aurora Electric Railway and Buffalo, Gardenville & Ebenezer Electric Railway, has passed into hands of new interests. It is said that the new management will extend the road to East Aurora in the near future, and make other improvements.

ROCHESTER, N. Y.—A contract has been made whereby J. G. White & Company, of New York, N. Y., are to build a new high speed interurban line, costing $2,000,000, between Rochester and Lockport for a syndicate represented by Frederic Nicholls, E. R. Wood and Sir Henry M. Pollatt, of Toronto. The contract covers the entire construction, inclusive of track, overhead work, distribution and five substations; also the rolling stock. The right of way will be graded for two tracks, although the construction of only a single track is provided for in the initial contract. Electricity will be secured from the Ontario Power Company, at Niagara. Work will be commenced immediately.

NEW YORK, N. Y.—After four years of fighting before the Board of Aldermen and the Board of Estimate, the New York & Port Chester Railroad Company has secured a franchise for an electric railroad in the Bronx. The Port Chester Road is to pay the city $8,000 a year for the first five years after the signing of the contract; then $13,000 a year for the next five years, and then $35,000 a year for the next fifteen years. From the date of the commencement of the operation of any part of the railroad until the end of the first five years of the grant the company is to pay an additional sum of five and four-tenths cents per annum per linear foot of single track within the present boundaries of the City of New York, and for the next succeeding five years an additional sum of 7 7-10 cents per annum per linear foot of single track, and for the next succeeding fifteen years an additional sum of 20 cents per linear foot. The term of the franchise is twenty-five years, with a provision, on a readjustment of price, for a renewal of twenty-five years.

MOREHEAD, N. D.—The city is considering the question of installing a 150-kw unit in the municipal electric plant, to furnish electricity for a day power circuit.

STEUBENVILLE, OHIO.—The board of education has decided to install an electric lighting plant in the new high school building. The outfit will include a 40-hp engine and a 25-kw generator.

CINCINNATI, OHIO.—The village of St. Bernard has issued $5,000 bonds for the purpose of installing additional machinery in the municipal electric light plant. Geo. E. Schroder is village clerk.

YOUNGSTOWN, OHIO.—F. A. Kaercher and Christopher Deibel, of this city, have purchased a tract of land on West Boardman Street and propose to erect an independent electric light and power plant.

OBERLIN, OHIO.—The Oberlin Gas & Electric Company has declared a dividend of 6 per cent on preferred stock. The business of the company is growing so rapidly that it has just placed contracts for machinery to double its equipment.

TOLEDO, OHIO.—The Tuscarawas County Telephone Company has been purchased by the syndicate headed by James S. Brailey of Toledo. The company has increased its capital stock and bonded indebtedness to $350,000 and will make improvements.

EATON, OHIO.—The Dayton & Western Traction Company is negotiating for the purchase of the Eaton Electric Light, Power & Ice Manufacturing Company. The company plans to place a substation at Eaton and operate the lighting plant from this.

AKRON, OHIO.—J. Milton Dyer, of Cleveland, is preparing estimates as to the cost of installing an electric lighting and steam heating plant to be placed in the jail building and to furnish light, heat and power for all the county buildings, including the new court house.

PORTSMOUTH, OHIO.—The Portsmouth Home Telephone Company is planning to install a new switchboard, cables, telephone instruments and other improvements at a cost of $80,000; contracts for material are to be placed at once and the improvements are to be completed the latter part of September.

HASKINS, OHIO.—A. Chester, of Bowling Green, is endeavoring to secure a franchise for an independent telephone system in Haskins.

CLEVELAND, OHIO.—The Perry-Payne Company has been granted a permit for the proposed additions to its power plant on Oregon Street, which will cost $50,000.

DELAWARE, OHIO.—The Delaware Electric Light & Power Company has elected A. J. Lyon, president; Adolph Frank, vice-president; J. G. Rosenthal, secretary; and M. Miller, treasurer. The company plans to make some important improvements to its systems.

FREMONT, OHIO.—The Fremont-Yaryan Company, operating an electric light and hot water heating station, has issued a trust deed for $75,000 to secure a bond issue of like amount. The proceeds are to be used in extensions to the power station. It is stated that the plant will supply power to a new interurban road to be built from Fremont to Tiffin.

CINCINNATI, OHIO.—The Cincinnati Gas & Electric Company is negotiating with the city authorities to secure a new lighting contract with the city, and to install new arc lamps having 50 per cent higher candle power than those now in use. The company has arranged to install the new lamps on one circuit and the city will investigate the company's claims for superiority for these lamps.

TIFFIN, OHIO.—The Consolidated Gas & Electric Company and the Tiffin Edison Electric Illuminating Company have submitted identical bids each for illuminating a different portion of the city. They proposed to furnish eighty 2,000 candle-power lamps for ten years at $75 per lamp, with additional lamps at $70 each or under a five year contract at $77.50 and $72.50 respectively. The city has rejected the bids.

CINCINNATI, OHIO.—The stockholders of the Cincinnati Gas & Electric Company will meet June 25 to pass on the proposition of leasing the property to the Consolidated Gas & Electric Company on a guarantee dividend basis. The new company has deposited $3,000,000 guarantee for payment of dividends and $2,000,000, which will be expended in improvements to the property during the next five years.

BRYAN, OHIO.—General Manager E. E. Darrow, of the Toledo & Indiana Railway Company has submitted a proposition to the city to furnish energy for commercial lamps at 2½ cents per unit, and for street lamps at $33 per year, the city to install, own and maintain its lines and lamps. The city is considering a proposition to issue $30,000 worth of bonds for the purpose of installing an electric light plant in the water works plant, but this will not be passed upon until the other one can be investigated.

TOLEDO, OHIO.—J. N. Gardner, president of the Gardner Construction Company, which is now in charge of the financing and construction of the proposed Cincinnati, Toledo & Detroit Short line, has returned from Europe and says he has interested European capitalists in the purchase of $6,000,000 of bonds necessary to build the road. Construction work on the line will be started again this Fall. The proposition contemplates a road across Western Ohio from Toledo to Cincinnati by the way of the western tier of counties. The project has been talked of for some years, and a small amount of work has been done between Napoleon and Defiance.

FREDERICK, OKLA.—The new electric lighting plant has been completed and is now in operation.

COTTAGE CITY, ORE.—The Willamette Valley Company has petitioned City Council for a thirty-year electric light franchise.

DAYTON, ORE.—The citizens of this village are considering the question of constructing an electric lighting plant.

PORTLAND, ORE.—The Council has reported favorably on the ordinance granting the American Investment Company a franchise to construct, maintain and operate steam pipes, cold air pipes, wires and conduits, for the transmission of heat, power and light, and to operate cold storage plants; cost of plant proposed is $500,000.

CONNELLSVILLE, PA.—The City Council has awarded a contract for the installation of an electric fire alarm system.

LOCK HAVEN, PA.—The Lock Haven Electric Light & Power Company is making extensive additions to its plant, and when completed will establish a day power circuit.

WLKESBARRE, PA.—A new electric plant has recently been installed in the plant of the Hazard Rope Works for the purpose of operating the machinery by electricity.

BOONEVILLE, PA.—The Sugar Valley Telephone Company has applied for a charter, and has ordered materials to construct a telephone line from Tylersville to the county seat.

KENNETT, PA.—New York capitalists have secured a controlling interest in the White Clay Creek Supply Company, which operates the electric lamps in Kennett and vicinity, with power houses in this city and at Rosedale, Del.

CONNELLSVILLE, PA.—Two new charters have been approved by the Governor for the West Penn Railways Company. The charters cover Gallatin Avenue and Broadway, Uniontown, and will open the way for more lines for the West Penn system. The company will ask for franchises from Uniontown at once. The Gallatin Avenue line in Uniontown will be used to build a line to Leisenring No. 3 and that vicinity, while the Broadway charter will be used to connect Brownsville and Uniontown by an electric line.

BATESBURG, S. C.—The municipal electric light plant, which has been in operation eighteen months, is giving entire satisfaction, and has proved more than self-sustaining.

WALHALLA, S. C.—Frank Head, representing Head & Company, bankers of Louisville, Ky., has purchased the entire issue of $250,000 bonds of the Oconee Water, Light & Power Company of this city. The company supplies electric power to five towns in South Carolina. The sale was made by Mayor James Thompson and associates.

GREENVILLE, S. C.—Owing to the electric power plant of the Anderson Water, Light & Power Company, located at Portman, 8 miles from Anderson, S. C., being damaged by fire resulting from a bolt of lightning, the cotton mills and other industrial plants which were operated with power from the plant were forced to shut down temporarily, but most of them will be able to resume operations at once, arrangements for power having been made with auxiliary plants in the city. Street and incandescent lamps are being supplied in Anderson from the company's auxiliary station located in the city.

PIERRE, S. D.—The City Council has granted a franchise to Noah Newbanks, of this city, and Frank Fischer, of Fort Pierre, S. D., to operate a street railway in this city.

ATHENS, TENN.—The Athens Electric Light Company is preparing to make an addition to its power house.

SPARTA, TENN.—The Gainesboro Telephone Company will issue bonds to the amount of $100.000 for extensions and improvements to its system. Joel H. Anderson is general manager.

SALT LAKE CITY, UTAH.—The principal holdings of the Mormon Church in the Utah Light & Railway Company are to be taken over by a $25,000,0000 corporation composed of English and American capitalists. It will be known as the Inter-Mountain Consolidated Railroad Company. It is said that the new company will also acquire the Ogden Street Railway. It is also announced that the Salt Lake & Los Angeles Railroad, another church property, has been sold to a local syndicate for $500,000.

BURLINGTON, VT.—The city treasurer has been authorized to sell on June 15, $171,000 bonds, of which $39,000 are for improvements to the electric light plant.

FT. ETHAN ALLEN, VT.—Bids will be received until June 15 by Capt. W. E. Cote, Construction Quartermaster, U. S. A., Burlington, for furnishing and installing electric fixtures and service connections in Administration building at Ft. Ethan Allen.

MANASSAS, VA.—The citizens have voted to issue bonds for $50,000 for electric light, sewer and street improvements, and will soon ask for proposals for the work.

RICHMOND, VA.—The large power plant of the Virginia Passenger & Power Company on the upper Appomattox River is nearly completed, and is expected to be in operation by June 15 at the latest.

SPOKANE, WASH.—A branch line of the Spokane & Inland Railway to connect the line now building to Palouse City with the Colfax line is projected.

SEATTLE, WASH.—H. F. Grant, manager Seattle Electric Company, writes that Stone & Webster, of Boston, Mass., are engineers in charge of the improvements contemplated.

NORTH YAKIMA, WASH.—J. C. Brooker, City Clerk, writes that there is talk of calling a special election this summer to vote on the question of constructing water works and an electric light plant, but nothing definite has yet been done. A. H. Nicol, City Engr.

SUNNYSIDE, WASH.—H. W. Turner, Town Clerk, writes that bids have not yet been asked for the proposed water works and electric light plant, to cost $10,000. The committee consists of W. B. Bridgman, W. B. Cloud and William Hitchcock. Engineer, Prof. O. L. Waller, of Pullman.

WATERFORD, WIS.—The Waterford Milling Company is getting the material and has started the work of installing an electric lighting plant to supply the village of Waterford with electricity for lamps.

HAMILTON, ONT.—The East Incline Railroad was put out of business by the burning of its power plant and shops.

FORT SASKATCHEWAN, CAN.—O. H. Higman has received a 15-year franchise from the town to light the street and supply power. He will shortly commence the erection of a plant.

OTTAWA, ONT.—The Bell Telephone Company has offered to pay the city $5,000 annually for a 5-year extension of its franchise and offers business telephones for $45 and residence telephones for $25 per annum.

EUGENIA, ONT.—Rowan & Elliott, of St. Catherines, Ont., have the contract for the tunnel construction in connection with the proposed power plant of the Georgian Bay Power Company. Other contracts, bids for which will be called for shortly, include 3,500 feet of pressure pipe, dam, embankment and power house construction. Engineer, H. von Schon, of Detroit, Mich.

WINNIPEG, MAN.—The Fire, Water and Light Committee has withdrawn its call for tenders for electric generating apparatus for the high service water works (bids for which were to have been opened on June 4) having made other arrangements for securing electric power.

RIGAUD, QUE. The Town Council is considering a proposition for the erection of an electric light plant.

New Industrial Companies.

THE STANDARD ELECTRIC SUPPLY COMPANY has been organized at Charlotte, N. C., and has bought out the stock of the Standard Electric Co.

THE CHARLOTTETOWN ELECTRIC & TRANSIT POWER COMPANY has applied for incorporation with a capital of $50,000 to carry on a general electrical supply business.

THE ELECTRICAL CONSTRUCTION COMPANY, of London, Ont., has applied for incorporation, with a capital of $100,000. The object of the company is to manufacture electric signs, etc.

THE CUMBERLAND LAND & COLONIZATION COMPANY, of Rome, Ga., has been incorporated by J. R. Deal and others, to engage in various lines of business, including the generating and transmission of electric power.

THE NATIONAL AMERICAN TELEPHONE COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $1,000, for the purpose of manufacturing telephones, etc. The incorporators are W. R. Lea, O. C. Meyer and E. R. Lea

THE IGNITER APPLIANCE COMPANY, of Cleveland, Ohio, has been incorporated by C. W. Hunt, W. C. Hine, R. W. Hine, P. G. Kassulker and W. W. Tremaine, with a capital stock of $10,000. The company will manufacture ignition devices.

ZOBEL & MAKIN ELECTRIC MANUFACTURING COMPANY, of Johnstown, Pa., has been chartered with a capital stock of $10,000. The purpose of the company is to manufacture miniature lamps. The directors are John Zobel, Carl A. Zobel and Alvic O. Makin.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY, of New Brunswick, N. J., has been incorporated with a capital stock of $1,500,000. The incorporators are Edgar T. Barcalow, Frank R. Jones and Edward Morris. The company will manufacture and deal in electric appliances.

THE MULLER POROUS PLATE ACCUMULATOR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000. The company propose to manufacture electric storage batteries. The directors are Frank Assmus, of Mt. Vernon; Albert Muller and J. F. Joyce, of New York.

THE BANNER ELECTRIC COMPANY, of Youngstown, O., has recently elected the following officers: W. B. Carr, president; C. F. Cook, vice-president; N. L. Noris, secretary and manager; O. U. Cassady, treasurer. A dividend of 8 per cent on common and preferred stock was ordered payable quarterly. During the year just ended 750,000 incandescent lamps were manufactured. This year the output will be a 1,000,000 lamps. The company is now using its new plant on Market Street, where it has a much enlarged capacity.

THE ENAMELED PIPE & ENGINEERING COMPANY, of Cleveland, O., have been incorporated with $50,000 capital stock. Incorporators are: R. F. Nailler, D. H. Sell, J. B. Looker, N. O. Mather and Osborne Esgate. The company will manufacture an enamel which it is claimed by its inventors will prevent electrolysis and which is the invention of R. F. Nailler an electrician of this city, and F. P. Summers, of Cleveland, patentees of the system. The plant for the manufacture of the enameled pipe, pumps and fittings which the company will put out will be located in Cleveland. The company will also do a general engineering, designing, consulting and constructing business and now has two large contracts for mining machinery in the West.

Legal.

NEW YORK TELEPHONES.—Commissioner Ellison of the Department of Water Supply, Gas and Electricity in behalf of the New York Electric Lines Company, one of the subsidiary companies of the Great Eastern Telephone Company, has been served with a writ of mandamus to compel him to issue a permit to begin the construction of its conduit system, under a franchise granted to the company in 1883 by the Board of Aldermen. The company is represented by ex-Chief Justice Alton B. Parker, assisted by Charles W. Dayton, J. Aspinwall Hodge, Frank B. Vermilye, Tracey C. Becker, of Buffalo, and the firm of Black, Olcott, Gruber & Bonynge, of this city. The Electric Lines Company alleges that it has never ceased to do business, and that during the time complained of by the telephone interests opposing the grant of the permit the company was active.

Obituary.

MR. W. T. BOUCHELLE.—We regret to note the death of Mr. William T. Bouchelle, assistant to the president of the New York Telephone Company, at his home in Greenwich, Conn., on May 19. He entered the service of the company in 1884 and his connection with it continued steadily for 22 years. For 17 years he was in the executive office as confidential secretary and assistant to President Cutler, in which capacities he won universal esteem by his devotion to duty and his personal characteristics. The funeral took place on the afternoon of May 22 at Greenwich, when the executive offices of the company were closed as a mark of respect to his memory.

Personal.

FRANK B. CHESTER, of Bowling Green, Mo., manager of the Wood Company Telephone Company, has resigned and has been succeeded by W. H. Wallace.

MR. A. M. HUNT is secretary of the San Francisco Citizens' Committee on Light & Power, which has a large amount of important work committed to its care in the devastated city.

MR. W. C. L. EGLIN, of the Philadelphia Electric Company, and secretary of the National Electric Light Association, has sustained a severe bereavement in the death of his mother.

MR. LESTER W. COLLINS, superintendent of the Leominster Electric Light & Power Company has resigned to accept a position with a Boston electric concern. Mr. Charles M. Young, of New York, has been selected to fill the vacancy.

DR. E. F. ROEBER has brought out in pamphlet form his very interesting paper on the themo-dynamics of the electric incandescent lamp, which, with demonstrations, he read before the American Electro-Chemical Society last year. It is accompanied by the discussion.

MR. L. S. GREENLEAF has been appointed general manager of the Hudson River Telephone Company to succeed the late Henry Hawley. Mr. Hiram T. Stevens of Syracuse has been elected vice-president and Mr. B. C. Woolverton, also of Syracuse, chief engineer.

MR. V. C. GILPIN, well known as a manufacturers' agent in the electrical field, has recently taken over the agency for the American Conduit Manufacturing Company, whose sales he will control in the metropolitan district with offices at 120 Liberty Street, New York City.

MR. C. L. EDGAR, president of the Boston Electric Company, accompanied by Mrs. Edgar, has sailed this week for England, to perform his duties as a member of the public ownership commission appointed by the National Civic Federation. He will be gone several weeks.

MR. W. J. CLARK, manager of the foreign department of the General Electric Company, has sailed this week for Europe. While on the other side it is his intention to devote some time to the municipal ownership and operation inquiry now being conducted by the National Civic Federation.

MR. E. H. SMYTHE, for several years in the patent department of the Western Electric Company, and recently in the engineering departments of the Central Union Telephone Company and the Chicago Telephone Company, has opened offices in the Monadnock Block, Chicago, as a patent expert.

MR. GEORGE L. COLGATE, of Batavia, N. Y., as consulting engineer for the Eastern Monroe Electric Light & Gas Company, is making plans for the erection of a power plant with a capacity of 10,000 horsepower. His specifications calls for three turbo-generators of 2,500 kw each, with attendant condensers, boilers, economizers, etc. The plant will be operated at 2,400 volts, 60 cycles, three phase.

MR. F. NICHOLLS, first vice-president of the Electrical Development Company of Niagara Falls, laid a cornerstone of the new power house, on the Canadian side of the river on May 8. Another stone was laid by Sir H. Pellatt, the president of the company, and a third by Sir W. M. Clark, lieutenant-governor of the Province of Ontario. The party then made a trip through the 2,200 ft tunnel discharging under the great cataract.

MR. GEORGE J. WELLINGTON, consulting and contracting electrical engineer of San Francisco, informs us that his offices were completely gutted by fire but that the organization remained intact. Since the first Sunday after the fire his firm has been occupying temporary offices in the same Kohl Building which had not been altogether destroyed. Since that time active work has been done in preparing for the coming reconstruction of the city.

MR. T. A. EDISON.—Advices from Orange, N. J., state that Mr. Thomas A. Edison, accompanied by his brother-in-law, J. N. Miller, Frederick Ott and George Poppe, has started on a long trip in two automobiles. The party carried a complete camping outfit and all will have a spell of outdoor life. Their destination is North Carolina for prospecting. Messrs. Miller and Ott will be the cooks, it not being deemed safe to allow Mr. Edison to turn his inventive faculties loose when it comes to providing meals. The party will forage as it travels.

DR. FRANCES W. MONELL, the electro-therapist, gave an "electrical tea," with the cooperation of the New York Edison Company, on May 19, to some three hundred club women and others, at her apartments in Ivy Court. All the refreshments were cooked electrically, the illuminations and special features of interest were electrical, and the whole affair was a highly successful demonstration of the social and domestic availability of the electric current and its modern appliances. It is by such functions that the utility of electricity can best be made convincing.

MR. E. ROSEWATER.—Mr. Edward Rosewater, veteran editor of the *Omaha Bee*, and the best known Republican politician in the West, has announced in his own newspaper his candidacy for the United States Senate, to succeed Senator Millard. In his announcement Mr. Rosewater calls attention to the fact that he has advocated for many years the principles now held by President Roosevelt. Mr. Rosewater has been in Rome as the representative of the United States at the International Postal Congress. He has long been an antagonist of the railroad in politics and is a national figure. During the war he was a telegraph operator in the

White House and was one of the pioneers in the development of Nebraska.

MR. H. C. BAKER, formerly in charge of the Atlanta territory of the Crocker-Wheeler Company, in which capacity he became well known as an electrical engineer throughout the Southern industrial field, has started for San Francisco, where he will take charge of the Pacific Coast territory of the Crocker-Wheeler Company. The offices at Fremont and Howard Streets, San Francisco, were completely destroyed by the recent fire; temporary offices have been established at 2611 Broadway. Mr. Baker will enter an active field of electrical development in which the company is already conspicuously established by its installation of 4,000 kw alternating-current generators in the plant of the California Gas & Electric Corporation. These machines, the largest gas-engine-driven alternators in the world, escaped damage in the recent disaster.

MR. JOHN I. BEGGS.—In recognition of his services as trustee of the National Electric Company, the department heads of the newly formed National Brake and Electric Company have presented John I. Beggs with a bronze tablet. The tablet bears the following inscription: "Presented to John I. Beggs, trustee of the National Electric Company, Milwaukee, by the officers of the company as a mark of esteem of the manner in which he handled the company and its employees during the twelve months the National Electric Company was under his management, April 1905, March, 1906." The names inscribed upon the tablet are J. H. Denton, general superintendent; R. P. Tell, secretary and treasurer; J. L. Walles, general sales manager; and W. L. Waters, chief engineer. Mr. Beggs has also been presented with a testimonial in the form of a leather-bound album from the employees of the Twelfth Street Station. The album contains the autographs of the employees, together with an appreciation of the fact that their wages were voluntarily raised by the president.

MR. W. S. BARSTOW.—The announcement of the incorporation of the engineering firm of W. S. Barstow & Co., with offices at 56 Pine Street, New York City, and Failing Building, Portland, Ore., is looked upon in electrical circles as a natural outcome of the enormous development in transmission and lighting which has set in on the Pacific Coast. Mr. Barstow, who has in recent years been closely identified with this work, has now secured the co-operation in the new company of Mr. J. B. Taylor, late with Westinghouse Church, Kerr & Co., and Mr. R. L. Donald, late with the Southern Pacific Railroad. This strong combination will undertake the complete designing and construction of electric lighting, railway and power plants and distributing systems; the designing and construction of industrial plants; supervision and management of electrical properties; special reports and examinations on operation, improvement and extension of existing installations. Within the last week it has booked orders for seven important installations running into millions of dollars. Mr. Barstow, who was at one time prominent in the electric lighting field, and manager of the great Edison system in Brooklyn, is at present the president of the New York Electrical Society.

News of the Trade.

DODGE & DAY, engineers, Philadelphia, announce the recent removal of their offices to Drexel Building, Suite 597

THE PENN HARDWARE COMPANY, Reading, Pa., is installing a 150-hp Koerting gas engine to be run on producer gas furnished by a Koerting suction producer. The entire plant is supplied by the De La Vergne Machine Co., New York.

THE STANLEY-G. I. ELECTRIC MFG. COMPANY'S San Francisco office now occupying temporary quarters in the Blake Block, Oakland, announces that it will move next week into Rooms 403, 404 and 405 Atlas Building, 604 Mission Street, San Francisco.

ALLIS-CHALMERS COMPANY.—In addition to the office recently established at 906 Broadway, Oakland, Cal., the company has now opened quarters in the Atlas Building, 602 Mission Street, San Francisco, where its staff is ready also for the transaction of business.

IMPERIAL SOLDERING STICK.—The Standard Chemical Company, Cincinnati, O., is placing on the market a soldering flux under the name "Imperial Soldering Stick." It consists of a ¾-inch cylinder 5 inches long covered with tin-foil and enclosed in a cylindrical wooden receptacle.

THE WAGNER ELECTRIC MFG. COMPANY, of St. Louis, Mo., has purchased a tract of land lying between the River des Peres and the Wabash Railroad Avenue, the consideration named being $24,000. Preparations are being made by the company to build a factory on the tract.

FORT WAYNE ELECTRIC WORKS have established temporary offices for the Pacific Coast at 62 Blake Block, Oakland, Cal., but will later occupy rooms 403-4-5 Atlas Building, San Francisco, as soon as that structure is ready for occupancy. The concern has also replaced its stock, which was destroyed by fire.

THE AMERICAN AXLE WORKS, of Philadelphia, have found that the demand for their product greatly exceeds their present output. They have engaged Dodge & Day, engineers, of Philadelphia, to investigate the condition of their plant, and report on just what changes should be made to their present layout and what additional building should be undertaken to enable them to increase their capacity about fifty per cent.

GENERAL STORAGE BATTERY COMPANY, of 42 Broadway, New York City, will make an exhibit of the Bijur cell at the coming convention of the National Electric Light Association at Atlantic City on Young's Pier and at the immediately succeeding convention of the Master Car Builders and Master Mechanics Association on the Steel Pier. This exhibit will follow the general lines of that made at the recent Chicago Electrical Trades Exposition.

ELECTRIC WIRING COMPANY, 106 East Eighth Street, Kansas City, Mo., wishes to receive catalogues and price lists as to staples and specialties. It has contracts in hand for the new Shubert Theatre, Elks Club, Kansas City Athletic Club, Langdon Hospital, Metropolitan offices, etc. It will carry a stock of lighting and decorative fixtures, and will give special attention to problems of illuminative engineering. It is equipped to supply plans, specifications and estimates for anything in the lines indicated.

YEARSLEY, LEVINE & CO.—Yearsley & Levine have recently sold an interest in their business to Mr. Richard Scheinert, formerly with the Public Service Corporation of Camden, N. J., and Mr. Scheinert has also joined the firm under the name of Yearsley, Levine & Co., in the capacity of superintendent. The firm have taken much larger quarters at 211 North Third Street, Philadelphia, where they will display their very extensive stock of second-hand electrical machinery, and where they will be glad to deal with prospective purchasers.

LATHE IN OPERATION.—During the Master Car Builders' and Master Mechanics' Conventions to be held at Atlantic City, June 13-20, the Niles-Bement-Pond Company will have on exhibition and in full operation one of its extra heavy 90-inch driving wheel chucking lathes. This will afford an exceptional opportunity to observe this machine at work. Owing to its great weight, this machine cannot be shown on the Steel Pier. The company has therefore built a special booth, two minutes' walk south from Pennsylvania Station on New York Avenue, near Atlantic Avenue, where all are cordially invited to witness a demonstration of this machine.

NORTHERN MOTORS.—The installation of electric power equipment in certain classes of service necessitates that the machines be totally enclosed so as to be dust proof or be protected to exclude flying pieces. In cases where electric machines are to be installed for such service the Northern Electrical Mfg. Co., Madison, Wis., applies dust proof or protecting covers which not only afford the requisite protection against dust or other materials, but are readily removed, thus making it easy to inspect the running parts. This insures the satisfactory operation of Northern protected and dust proof machines in all classes of service. The Northern Company frequently employs direct-current motors for operation in wet locations where provision has to be made not only for the exclusion of moisture, but water. This is successfully accomplished by the Northern design.

THE PELTON WATER WHEEL COMPANY.—This company deems itself particularly fortunate, notwithstanding the complete destruction of its works in the recent disaster at San Francisco. In the three hours prior to the burning of its works, it succeeded in saving all commercial books, complete cost memoranda and the greater part of the original tracings, together with several years' correspondence. The new San Francisco plant of the company which had been under construction for a couple of months prior to the fire, is outside the fire zone. A large force is now at work and the company expects to be installed in its new location by the middle of July of this year. A complete equipment of modern machine tools is already on the way, and machine shop facilities will be even better than before the disaster. The Pelton Water Wheel Company has temporary offices at 1259 Alice St., Oakland, Cal., but will be permanently located in the Monadnock Building, San Francisco, after June 15.

MEAD-MORRISON MFG. COMPANY is the successor to the firm of that name and the Rawson & Morrison Mfg. Company with which it has consolidated. The staff of the latter concern will be retained and the business will be continued along the old lines of product in hoisting engines, derrick swingers, electric hoists, belt hoists, suspension cableways, cable roads, etc., inclusive of all kinds of machinery for handling coal and other bulky materials. The capital is $1,000,000 and the headquarters are at Cambridge, Mass. The officers are: Eugene N. Foss, president; William J. Selleck, vice-president; John G. Morrison, treasurer; Willard S. Martin, general manager; Orton G. Dale, New York manager; Gust. Pers. Wern, manager of engine department; Almon E. Norris, chief engineer; Frederick W. Scott, superintendent. Directors: Eugene N. Foss, Boston, Mass.; John G. Morrison, Cambridge, Mass.; Willard S. Martin, Cambridge, Mass.; Arthur P. French, Boston, Mass.; Benjamin D. Brown, New York; William J. Hoyt, Manchester, N. H.

125-TON ENGINE BED PLATE.—The progress of the huge 125-ton engine slide and bed plate casting which was poured over two weeks ago at West Allis Works of the Allis-Chalmers Company, is attracting universal interest from the fact that it is the largest single casting ever poured in the company's works during an engine building career of more than a quarter of a century. The casting, which was taken from its mould on April 24, weighs, roughly, 133 tons. Three heavy traveling cranes, whose aggregate capacity is 145 tons, will be used in conjunction to lift the casting from the pit in the floor of the foundry and place it ready for the process of cleaning, which will require the work of ten men in two shifts. So heavy is this single piece, that instead of attempting anything but a straight lift with the cranes, specially laid railroad tracks will be provided to bring directly to the side of the casting, a special flat car built for the purpose of handling this piece. This car has 16 wheels and is the largest of its kind ever built. The same car used to transport the casting from the foundry to the machine shop No. 1, where it will be subjected to machining processes necessary to finish it, will afterwards carry the finished piece to its destination. At the present time, it is the intention to convey the casting directly to Machine Shop No. 1, where the heaviest machine tools are located. The casting will be bolted to the floor and machine tools used in the finishing will be brought to it.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 15, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Atty's, 140 Nassau St., N.Y.]

820,407. ELECTRIC RAILWAY; John A. Gafey, Tarkio, Mo. App. filed May 23, 1905. A form of collector shoe for electric railways having a frame guided in the usual conduit slot, and which carries spring-pressed rollers for engaging the usual conductors. An air blast is provided for cleaning the conduit in advance of the shoe.

820,411. RAILWAY SIGNALING SYSTEM; Henry W. Griffin, New York, N. Y. App. filed Jan. 18, 1905. A complete block signal system of the overlap type adapted to display danger and caution signals. The track rails are divided into insulated sections charged with direct-current potential, and polarized relays are included for securing the overlap feature.

820,412. RAILWAY SIGNAL SYSTEM; Henry W. Griffin, New York, N. Y. App. filed Jan. 31, 1905. Relates to modifications of the above.

820,413. RAILWAY SIGNALING SYSTEM; Henry W. Griffin, New York, N. Y. App. filed Feb. 28, 1905. Another form of block signal having substantially all of the above mentioned features.

820,421. ELECTRICAL CIRCUIT BREAKER; Charles F. Hutchings, Bay City, Mich. App. filed Oct. 14, 1903. A circuit breaker having a knife blade switch which is spring impelled into circuit opening relation, but which is normally restrained against such movement by a solenoid. The solenoid is differently wound so as to open the cut-out whenever the magnetic field thereof is shifted due to a short circuit on the line or in the motor.

820,423. TROLLEY FOR OVERHEAD TROLLEY SYSTEMS; Ezra F. Landis, La Salle, N. Y. App. filed Feb. 20, 1905. The usual trolley wheel is completely covered by protecting housing except for a slot where the wheel engages the wire. At this point a pair of spring shoes are arranged to normally close over the wire.

820,432. TELEPHONE-SWITCH; William E. McCormick, Chicago, Ill. App. filed Aug. 26, 1901.

820,440. TROLLEY POLE; Robert P. Rever, Newark, N. J. App. filed Feb. 18, 1905. In order to impart greater flexibility to a trolley pole, the pole is made with a pivot joint and has spring wires or blades incorporated in it so as to hold the two sections in alignment.

820,463. ATTACHMENT FOR TELEPHONE RECEIVERS; Casper Zimmerman, Aberdeen, S. D. App. filed Nov. 4, 1905.

820,464. SELF-ACTING ELECTRICAL ROPE-STRAINING DEVICE; Otto Adam, Dresden, Germany. App. filed Feb. 16, 1905. An apparatus for coaling ships at sea, comprising a cable which is stretched over pulleys on the respective ships and may be tightened by a small motor-driven windlass. The latter is set in operation by a centrifugal device moved by the cable to be tightened.

820,481. TROLLEY; Jacob R. Deily, Philadelphia, Pa. App. filed Sept 5, 1905. The usual harp has a yoke swiveled therein on which are journaled two trolley wheels so as to give a better contact with the trolley wire, and to lessen the liability of the pole leaving the wire.

820,482. APPARATUS FOR TREATING LIQUIDS; Leon Dion, N. Y. App. filed May 24, 1904.

820,489. BALLAST DEVICE FOR NERNST LAMPS; Ludwig Glaser, Berlin, Germany. App. filed June 8, 1905. In order to overcome the defect of iron ballast when used with second-class conductors of large cross-section, due to the fact that the iron does not glow soon enough, the patentee makes use of a supplemental iron filament which initially takes all the current, and becomes heated, and when the main filament or ballast is sufficiently heated thereby, this is automatically cut into circuit.

820,491. ELECTRIC SWITCH; David E. Gray, New York, N. Y. App. filed Feb. 21, 1905. Has means for electrically connecting two of the contact members of the switch when the third contact is engaged by the switch arm.

820,496. AUTOMATIC CIRCUIT BREAKER; Dag Hoyem, Brooklyn, N. Y. App. filed Oct. 24, 1904. Details of construction of a magnetic circuit breaker which is designed to be sensitive to the tripping action, which is opened positively by a spring, and which is closed by a toggle action.

820,498. ELEVATOR CONTROL SYSTEM; John D. Ihlder, New York, N. Y. App. filed Feb. 16, 1905. A complete diagram of circuits for an electric elevator of the push button type, in other words, in which the movements are controlled from different floors by push buttons thereon.

820,499. ELECTRIC ELEVATOR CONTROL SYSTEM; John D. Ihlder, New York, N. Y. App. filed Mar. 13, 1905. Relates to additional features of the above and particularly to means by which the elevator is brought to rest at exactly the same point regardless of variations of load, speed, or direction of travel.

820,504. CONTROLLER FOR ELECTRIC MOTORS; Alvaro S. Krotz, Springfield, O. App. filed Nov. 4, 1904. Details for a controller especially adapted for use with electric vehicles. The patent includes the mechanical features and also the arrangement of circuits of a controller adopted for a storage battery and two motors.

820,521. ELECTRICAL PROTECTIVE DEVICE; Charles A. Rolfe, Adrian, Mich. App. filed June 22, 1903. A graphite pencil is included in the electric circuit to be protected and a mercury thermometer has its bulb embedded in the graphite. The rise of temperature due to excessive current expands the mercury until the latter closes a ground circuit.

820,529. AUTOMATIC TRAIN REPORTING SYSTEM; Elmer E. Steiner, Knightstown, Ind. App. filed July 10, 1905. Depressible tappets are provided at points along the track so as to be engaged by specially constructed shoes carried by the train. The latter have a plurality of projecting lugs spaced in a special and predetermined way for each train so as to give a distinctive signal when passing over the tappets.

820,530. RAILWAY; Alpheus H. Wood, Ann Arbor, Mich. App. filed Sept. 11, 1905. An inclined bearer fixed at a point along the roadway operates to raise a shoe or tappet depending from the train, and which serves to operate an electric switch on the car. The purpose is not stated.

820,555. RECOVERY OF COPPER FROM SOLUTIONS CONTAINING IT; Benvenuto Comba, Turin, Italy. App. filed Sept. 14, 1903.

820,574. ELECTRIC FURNACE; James E. Hewes, Plattsburg, N. Y. App. filed July 18, 1905.

820,584. TROLLEY POLE CONTROLLER; Joseph F. Mackin, Columbus, O. App. filed Aug. 21, 1905. A pneumatic means for retrieving a trolley pole. A sleeve and rod are so arranged that when their motion is slow they do not bind with respect to one another, but in case of a quick relative movement, the sleeve binds and a valve is opened which admits air to retrieve the pole.

820,604. ELECTRIC COUPLING; Otto Schaller, Steglitz, near Berlin, Germany. App. filed June 1, 1905. In order to avoid danger to employees when making the electrical connections in a train, the conductors are enclosed in tubes similar to the usual air brake tubes and having clasps also generally similar. The electric circuit cannot be completed with the power terminals until the tubes are properly clasped together.

820,641. PROTECTOR FOR INSULATORS; John L. Gleason, Boston, Mass. App. filed Feb. 17, 1904. A form of molding, and particularly the corner connection therefor to be used with electric wiring. The corner boxes are shaped in quarter cylindrical form and have notches for the reception of the molding along their edges.

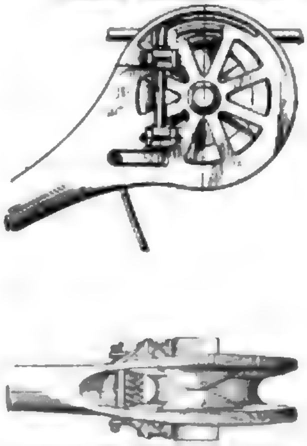
820,649. ELECTRIC MACHINE AND SYSTEM; Frederick W. Knopfe, St. Louis, Mo. App. filed Aug. 25, 1904.

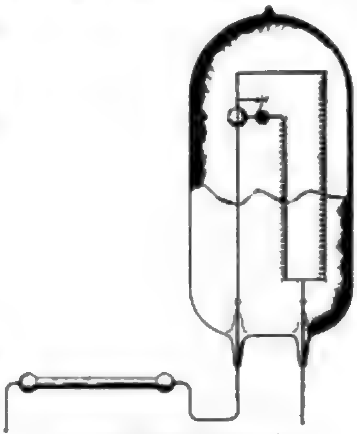
820,652. TELEGRAPHIC SYSTEM; Jacob W. Lattig, West Bethlehem, Charles L. Goodrum, Philadelphia, Pa., and Edward E. Clement, Washington, D. C. App. filed June 9, 1903. A wireless telegraph system particularly adapted for trains. A plurality of stations are located along the track each capable of emanating or receiving wireless waves. The stations may be automatically actuated by an ordinary telegraph line from the central or train despatcher's office.

820,656. OZONE-VENTILATOR; Frederic De Mare, Brussels, Belgium. App. filed Sept. 23, 1904.

820,700. FIRE-ALARM BOX; Loudoun Campbell and Frank G. Campbell, Washington, D. C. App. filed Apr. 4, 1905. In order to prevent the possibility of a fire alarm not being given by ignorant persons who mistake the usual local bell for the alarm, the patentee proposes to have the usual local bell in an electric circuit so arranged that the local bell is rung simultaneously with the fire alarm proper.

830,753. ELECTRICAL VIBRATORY MOTOR; James L. Adams, Jr., Springfield, Ill. App. filed Mar. 24, 1905. Mechanical details of a massaging implement having an armature which moves to and fro between electro-magnets of special form having angular pole faces. The armature is supported by conducting springs through which the current is supplied thereto.


820,423.—Trolley for Overhead Trolley Systems.


820,489.—Ballast Device for Nernst Lamps.

820,755. ENERGY METER FOR THREE-PHASE PLANTS UNSYMMETRICALLY LOADED; Riccardo Arno, Milan, Italy. App. filed Sept. 20, 1902. A device for measuring the energy in a three-phase system which is unsymmetrically loaded. Has two series coils, two shunt coils, and a compensating coil in series with each shunt coil, and means for impressing each shunt coil with an electro-motive force which is displaced in phase with relation to normal electro-motive force between the corresponding leads of the three-phase system.

820,756. ALTERNATING CURRENT METER; Riccardo Arno, Milan, Italy. App. filed Feb. 10, 1904. Relates to modifications of the above particularly adapted to single-phase alternating-current circuits.

820,781. SUSPENDED ELECTRICAL DENTAL MOTOR; John F. Hammond, Brewster, N. Y. App. filed Apr. 27, 1905. The motor is flexibly suspended from a horizontal arm or crane, and is carried on trunnions so as to be capable of assuming any position. The motor has the usual flexible shaft connection with the dental tool.

820,803. TWO-DIVISION TELEPHONE SYSTEM; John H. Lendi, Chicago, Ill. App. filed Oct. 27, 1902.

820,823. ELECTRICAL FIRE ALARM APPARATUS; James P. Robertson, North Sydney, Near Sydney, New South Wales, Australia. App. filed July 17, 1903. A thermostat operated fire alarm adapted to operate in conjunction with a central alarm system. Has various indicators for showing the location of the fire and also for showing whether the automatic sprinklers are in operative condition.

820,877. CONTROLLER FOR ELECTRIC CIRCUITS; Sam H. Kanmacher, Schenectady, N. Y. App. filed June 22, 1904. Has a single spring connected directly to the switch to hold it normally in off position and a lost motion connection between the switch and the distant controlled device to permit the desired movement to the switch without disturbing said device.

820,890. ALTERNATING CURRENT MOTOR; Adolph W. Schramm, Philadelphia, Pa. App. filed May 20, 1905.

820,924. INSULATOR FOR HIGH-TENSION LINES; Emil Giraud, Paris, France. App. filed Oct. 1, 1904. The usual hangers are fixed to tubes swiveled upon the guy or cross wires and the tube has arms which ground the conductor in case the wire breaks and causes the tube to be angularly displaced.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

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NEW YORK, SATURDAY, JUNE 2, 1906.

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ATLANTIC CITY.

The complete programme of the meeting of the National Electric Light Association, to be held next week at Atlantic City, will be found on another page. As will be seen, it is very comprehensive in its range and scope, so that few topics of interest to the central station manager escape attention, while the presidential address may be expected to bring out the general "politics" of the situation. Evidently the week at the seashore will be very well spent regarded from the intellectual standpoint, and the secretary is deserving of credit for the well-directed work that is thus brought to bear upon the problems of the art and industry. Those problems were assuredly never greater than they are to-day. Amid much standardization, and in spite of the universal aim to secure uniformity in material, methods and practice, electric light and power to-day is, as an engineering, public service business, confronted by a whole legion of new and perplexing questions. The resources of the art are larger, but the demands upon them are simply insatiable. From the ground up, the structure of the industry is in full process of renovation. This is in itself a hopeful feature, and there can be no decline or retrogression where such willingness prevails to try the new thing; but it is obvious that the central station manager is subjected to severe strain while adopting the unavoidable policy of "settle as you go."

The very type of current to employ is not by any means a finality. Both direct and alternating are in widest use. The type of generator and of prime-mover is by no means settled. Of new lamps there is a bewildering variety. In power distribution, notable differences in practice present themselves. As to circuits, whether overhead or underground, constant improvements challenge attention; while as to meters with all the refinement going on, much is yet promised in the future. The programme at Atlantic City reveals a good deal of this "state of the art," and the discussions will show how diversified is the practice and experiment possible with some 4,000 central station plants scattered over so widespread a country as this.

THE A. I. E. E. CONVENTION.

It is to be regretted that the conventions of the American Institute of Electrical Engineers and of the National Electric Light Association should have been scheduled to occur within four days of each other at places thirteen hundred miles apart—namely, the Institute convention at Milwaukee, May 28 to 31, and the National Electric Light Association convention at Atlantic City, June 4 to 9. Both gatherings are likely to lose attendance to some extent by the inevitable selection involved, for although it is physically possible for one and the same individual to attend both, the probability of doing so is minute. In view of the large number of scientific and technical conventions that take place about this season of the year, it would seem as though a new society should be organized with the avowed object of correlating and collecting conventions for the reduction of time and expense in rushing about the continent of North America. If societies whose aims and objects are connected would consult each other and arrange conventions suitably near to each other in time and place, the unfortunate joint membership would be benefited by an enlarged freedom of choice and by an opportunity to take part in more than one gathering. It would be very desirable for the American Institute of Electrical Engineers, the American Electrochemical Society and the National Electric Light Association to come to mutual annual agreement on this question. The present chaos is excellent for the railroads of the country, however, and it is a comfort that some one is content. Another unfortunate effect of the choice of the A. I. E. E. date is that it precludes the general attendance of members connected with electrical engineering instruction in technical schools, who usually add greatly to the value of the discussion of convention papers.

ALTERNATING-CURRENT ELECTROLYSIS.

The laws controlling electrolysis by direct current are very extensive in detail, even in so simple a case as that of a pair of platinum plates immersed in dilute sulphuric acid. The laws controlling electrolysis by alternating currents are rendered yet more complex by the introduction of a number of actions peculiar to alternating currents, such as polarization capacity, for example. A large and varied literature has, therefore, arisen upon the subject. Many attempts have been made to employ electrolytes practically, in connection with alternating-current circuits, for a variety of purposes, such as electrolytic condensers, electrolytic rectifiers and the like. Some of these applications of alternating-current electrolysis are already in actual service. The subject of alternating-current electrolysis is thus important, both in its theoretical and in its practicable aspects. A recent number of the *Transactions* of the Faraday Society contains a paper on "Alternate-Current Electrolysis," by Mr. W. R. Cooper. The paper is of special interest in that it is accompanied by a number of oscillograms, showing the curves of current and voltage for a particular simple type of electrolytic cell. The cell consisted of a pair of platinum wires, each offering about 1 mm.² of surface, immersed in dilute sulphuric acid. The oscillograph voltmeter recorded the voltage at cell terminals, including a certain manganin wire resistance, while the oscillograph ammeter was in shunt to a part of this resistance. The source of voltage was a small transformer, of adjustable transformation ratio, connected to alternating-current mains of 83 cycles per second.

When the impressed effective e.m.f. was 0.3 volt the effective current was about 60° in phase ahead of the voltage, and both were approximately sinusoidal. The electrolytic cell behaved like a leaky condenser. When the impressed voltage was gradually raised the current approached to it in phase. At an impressed e.m.f. of 0.65 volt the current wave was still roughly sinusoidal, about 8 milliamperes in strength, and 20° ahead of the voltage. A very marked change set in as the impressed e.m.f. reached 1 volt. The current departed from the sinusoidal type and the resistance of the cell increased considerably during parts of the cycle. This was probably due to occlusion of portions of the electrode surfaces by gas. A still further slight increase of impressed e.m.f. to 1.15 volt, effected another great change in the type of current wave. The current became oscillatory. That is, rapid vibrations were superposed upon the fundamental current wave. These current vibrations occurred at a rate of about 500 cycles per second, and were probably due to Wehnelt interrupter action, i. e., to cyclical formation and release of bubbles of gas at the electrode surfaces. The resistance of the cell was also greater on the average than prior to the appearance of oscillations. The oscillations somewhat increased in frequency as the current strength and voltage increased. Gas is stated to have been visible on the electrodes when the impressed e.m.f. reached 2.2 volts, and gassing, or liberation of gas bubbles, was recorded at 30.85 volts. It seems likely that the microscope would have made gassing visible as soon as vibrations appeared in the current wave oscillogram at 1.15 volt. At relatively high e.m.fs, such as 5 volts, the current was again nearly sinusoidal, with rapid superposed vibrations, and its phase was about 10° ahead of the voltage. It is clear that there are at least three different phenomena present in such a case, tending to influence the current wave, namely, the diffusion of ions through the electrolyte, the polarization capacity of the electrode surfaces and the occlusion of parts of the electrode surfaces by decomposition products.

IRON LOSSES IN SINGLE-PHASE COMMUTATOR MOTORS.

Among the minor problems connected with the determination of the performance of single-phase motors of the commutator type, one of considerable theoretical interest is found in the variation of the iron losses with the change in speed. In the compensated series motor the magnetic field has a constant direction in space, and is alternating in value. This condition exists whether the armature (rotor) is stationary or in motion, so that the determination of the losses in the stator core is relatively simple when the density of magnetism is known. When the rotor is at rest, the losses in the core may be ascertained with a high degree of accuracy, but simplicity of treatment ceases to exist when it is in motion. In this latter case the individual sections of the rotor are subjected to entirely different cyclic changes, and the law of the variation is exceedingly complex. The losses due to these changes have never been accurately expressed mathematically, although approximate formulas which give results sufficiently exact for all practical requirements have been developed.

When the rotor revolves at synchronous speed, that section of the rotor core which at the instant of maximum flux occupies the mechanical position in the center of field, is subjected to a unidirectional flux, which varies in value from the maximum to zero; while that section of the rotor which at the instant chosen occupies a position midway between the field poles is subjected to a flux which alternates at double the circuit frequency. At intermediate sections of the rotor, the flux is more or less unidirectional, but in any case it varies considerably in value. At speeds between synchronism and zero the conditions change gradually from those just described to such as exist in a stationary transformer. As the speed increases above synchronism, the conditions approach more nearly to what would exist if the armature were revolved at the particular speed chosen in a field which varied extremely slowly from the zero to the maximum value. That is to say, the losses in the armature at a very high speed approach in value the mean of the losses which would exist if the same armature were rotated at this speed in a field produced by a direct current, and hence it is possible to determine their value with a fair degree of accuracy.

In a recent article in these columns, Prof. Dr. F. Niethammer reported some tests in which the iron losses in an alternating-current series motor were directly measured. In these tests precautions were taken to insure that the true value of the iron losses was obtained, so that the curves shown may be taken as representing the facts as they exist. The author found that the curves could be expressed in the form of equations, and has determined the constants of the equations involved as applied to the particular motor tested. The statement that the stator iron losses of repulsion motors will be the same as for the compensated series motor, must be considerably modified if actual conditions are to be represented. When the rotor of the repulsion motor is stationary the stator field occupies a constant mechanical position and alternates in value; but when the rotor revolves at synchronous speed the stator field is constant in value and travels synchronously around the core. It follows, therefore, that the losses in the stator of a repulsion motor under speed condition are much larger than those in the stator of a similar compensated series motor, and the equations for representing the stator losses in the two machines must be essentially different in form.

Capacity Effect in Electric Shock.

It is well known that when a primary high-tension system, such, for example, as a 40,000-volt, three-phase system, is thoroughly well insulated throughout, it is possible for a person standing on the ground to receive a severe shock on coming into contact with any wire of the system, owing to the fact that he makes an imperfect ground on the system at the place where he comes into contact therewith. This brings the potential of that point nearly to zero, and alters the entire distribution of potential in the system. Accompanying the change in potential will be a temporary discharge or flow of current, part of which is likely to pass through the person to ground. Provided that the insulation of the system remains excellent at all other points, no such strong current can be maintained through the leak so applied, and the shock will be but momentary, although it has been observed to be severe in some cases. It is similarly possible to receive a lesser momentary discharge, or shock, through a condenser coming into contact with the high-tension system. Thus, if a condenser be connected with the system and be left insulated at the other terminal, the connection of that terminal to ground through a person would be able to pass a momentary discharge through his body. Considering the primary and secondary windings of a transformer as a condenser, it is within possibility to receive a shock on touching a well-insulated secondary circuit by grounding that circuit through the body. We believe, however, that in all cases where severe shock have been received through a secondary circuit, they have been due to actual contact between primary and secondary wires, and not to mere electrostatic induction. Nevertheless, the only complete safeguard against shock when accidentally touching a secondary circuit is a permanent ground properly made on the secondary circuit, preferably at its electric neutral point.

Metallic Filament Lamps.

We are steadily getting more reports from abroad of the evolution of metallic filament lamps of various kinds. First came the osmium and tantalum lamps, now we have zirconium and tungsten lamps. Of the efficiency of these types there is no doubt whatever, while regarding their commercial importance much yet remains to be seen. Several of them seem rather difficult to produce for the voltages ordinarily used, but we believe that even the osmium lamp, probably the most troublesome of them all from a mechanical standpoint, has now been made for 110 volts instead of the 50 or 55 volts of the earlier forms. What the life of the very slender high-voltage filaments will be remains to be seen, but there is little doubt that a reasonable life can be reached by a small sacrifice of efficiency. Starting with an "efficiency" of 1 to 1.5 volts per candle, one could well afford to cut these figures a bit to increase the life, still remaining in a region far beyond the capabilities of carbon. And, by the way, why should not one refer to volts per candle as the "duty" of a lamp instead of persisting in the illogical though customary use of efficiency when its reciprocal is really meant—as absurd in reason as to speak of a speed of so many hours a mile. There is no doubt that for easy construction and long life the metallic filament lamps should be made for rather small voltage or rather large candle-power, yet by some sacrifice of efficiency one may come within the range of usual practice.

Why, however, should we lay so much stress on custom in these matters? Of course, from the standpoint of illumination extreme subdivision of units is a good thing, yet as a matter of fact the great mass of interior lighting is done with 16-cp lamps in spite of the convenience of lamps of 8 cp and below. It has evidently been found that the net gain in illuminating efficiency by the use of smaller units may be quite offset by the lessened actual efficiency and the increased cost of the renewals. The economic considerations are simple. At 10 cents per unit and 20 cents for renewal, 1,000 hours of a 50-volt, 16-cp lamp would cost $5.20, while 1,000 hours of two 8-cp, 32-volt lamps would cost $6.80, leaving a margin of about 25 per cent to cover the less effective distribution of the larger unit. On the same principle, a 32-cp, 50-volt metallic filament lamp for 1,000 hours would cost $5 for current and possibly $1 for renewal, leaving a very large margin to cover the loss in distribution. Taking into account the very high intrinsic brilliancy of the metallic filament lamps, it would look as if they should be employed in practical illumination somewhat differently from the lamps now commonly in use. In particular they would seem to be well suited to indirect and diffused illumination, which should be used even with carbon lamps far more than it is. Even the last-named are too brilliant to be used unshaded, so that in this respect all incandescent lamps must stand together. For ceiling and cornice installation, the very high-efficiency lamps can be used with admirable effect and great economy, and for such use increased size of units is unobjectionable. A lamp with a duty of 1.5 volts per candle, even if of 32 cp or thereabouts, can be used to very great advantage, and it is therefore an open question as to how much it is worth while to struggle toward a reduction of candle-power. High voltage is practically very much more important since this bears directly upon the economy of distribution.

Park Lighting Peaks.

The majority of central station men are so accustomed to considering the maximum peak load as coming at about the hour of 6 p. m. in the month of December each year, that the idea of a maximum peak load in midsummer will strike them as a novelty. Nevertheless, there are a number of central stations of which this is true. In some cities in Ohio this is due to the fact that natural gas is used extensively in winter on account of its value in heating the room which it also lights, while electric light is used in summer because gas would be unbearable. In other cases the existence of the maximum peak in the summer may be due to a large park or pleasure resort lighting load. The latter is a very desirable class of business, and which can be taken at a low rate provided it comes well under the peak load capacity of the station. When, however, there is so much of park lighting that it forms the maximum peak of the year, a company should go very slow about making the low rate. We have heard of such business being taken on to an extent that new apparatus was needed to take care of it and at rates which should only be given to non-peak users. A summer resort or park which lights up only a few months every year in midsummer is all very well where there is a station and line capacity which can find no other use during the summer; but when it comes to putting in additional station transformer and line capacity to take care of this class of business, there should be a fixed charge included in the rate to take care of interest and depreciation on the apparatus necessitated by this load. That part of the station capacity which is required both for the summer and winter peaks may have its fixed charges divided between the customers coming on these two peaks. Transformer capacity can be utilized for both peaks in some cases by moving certain transformers from the parks to the business district in the winter.

The Lighting of Public Halls.

There is an inertia in the world of mental operations just as marked as there is in the physical world, although it does not at present permit of precise quantitative statement or measurement. Instinct is but the name given to the inertia of habit. It is not only necessary that this inertia should exist in all the processes of organic activity, including memory, but it is also in many ways most fortunate. The dexterity of hand and the deftness of thought which come by long practice in a given line of industry are the great benefits of the tendency of mind, as well as of matter, to persist in a direction which previous activity has selected. If it were not for this property of nerve ganglia, inherent to some extent in every protoplasmic cell, we should have to employ our attentive effort constantly upon the simple physical and chemical actions, such as breathing, whereby life is maintained. On the other hand, mental inertia has also its detriments and disadvantages, which, while far outweighed by benefits, need yet to be watched for and minimized. Prior to the general introduction of illuminating gas, about the middle of the last century, men were accustomed to expose to full view the torches, candles or lamps with which they lit up the interiors of buildings. The brilliancy of these luminous sources was relatively so low that they did not distress the eye, and their number was generally so small that there was but little danger of overstimulating the eye by glare. Thus the altars of cathedrals, in full view of the assembled audience, glittered with multitudinous tapers; but the retinal stimulus was agreeable rather than excessive. When, however, gas jets became available for illuminating public halls, and particularly when high-efficiency arc or incandescent lamps came into use, the habit, many centuries old, of hanging the illuminating sources in full view of the audience became a pernicious custom. Although the plan is decried by the experts, yet it persists even to-day and we all too frequently sit in a public hall trying both to see and not to see simultaneously.

It is not yet recognized as it should be that the retinal stimulus depends upon the intrinsic brightness of a luminous source, or its intensity per square centimeter of surface as well as upon its total intensity. A uniform spherical intensity of 100 candles emitted by a translucent globe a foot in diameter, has a brightness or intrinsic brilliancy of less than one-quarter of a candle per square inch, or one-thirtieth of a candle per square centimeter. If the filament of the 100-cp lamp be viewed directly, the brilliancy of the filament will be about 50 candles per square centimeter, producing a much greater retinal stimulus. In the case of the globe-enclosed lamp of 100 candles total external intensity, the eye would be able to rest upon it without fatigue, while the same total candle-power in a naked filament might at short range be even painful and even dangerous to observe. A hall to be perfectly lighted should provide sufficient illumination in all parts for the easy reading of print and at the same time should have every luminous source concealed from direct vision, like the footlights of a theatre. Where this condition may not be fulfilled, the luminous sources should be enclosed in, or covered by, diffusing globes or reflectors, so as to scatter their light and reduce the intrinsic brilliancy as viewed by the observer, especially when they are at a low elevation, and are likely to come within the direct line of the observer's vision. The articles by Messrs. Tay, Cravath and Lansingh, on pages 1127 and 1130, emphasize these considerations and give illustrations of halls that are well and ill-lighted.

Soliciting by Employes.

We print elsewhere in this issue the plan adopted at Sheboygan, Wis., to secure new business through the regular employes of the company, rather than through special paid solicitors. At the Northwestern convention last February, Mr. Geo. D. Westover, of Cadillac, Mich., described a scheme he had successfully tried whereby a commission to employes was given for new business secured. These cases naturally bring to mind the question of how far such schemes are applicable. It will probably be agreed at the outset that in cities of 40,000 inhabitants and over the conditions are such that regular solicitors are necessary to get the best results. In cities of over 40,000 the operating employes of the company are not naturally personally acquainted with any large percentage of possible customers, and they have little time to devote to soliciting if they are properly attending to their regular duties. They are furthermore usually specialists in certain operating work and apt to prove poor solicitors. In the smaller towns of 3,000 population and under, on the other hand, it will be generally conceded that men to do nothing but solicit cannot be employed.

As to the size of town that will justify the employment of a special solicitor there is considerable difference of opinion. A town of 10,000 population certainly will in the majority of cases. Below this it is questionable. The manager himself will usually do better than any special solicitor a small company can afford to hire, or soliciting may be done by some one man in combination with other duties. In a small town the manager, together with the various employes, will have an acquaintance that covers the community fairly well. If an inducement can be made to all employes to bring in new business, it ought to produce results—better results, at least, than if there is no interest taken in the matter by employes. As to whether a central station in a town large enough to support a solicitor should adopt a plan allowing a commission on new business to all employes, is a matter worth some thought. With a solicitor and several other employes working the same field on a commission basis, there is an excellent opportunity for hard feeling which should be guarded against in whatever plan is adopted. By getting operating and accounting employes interested as solicitors, they are naturally more than ever anxious to make the service perfect and relations with customers agreeable. In these days when good central station solicitors are scarce, latent talent in members of the operating force should be ferreted out.

At the recent meeting of the Southwestern convention the paper of most immediate and practical interest to central station men was that relating to methods of increasing business, read by Mr. G. C. Gum, and of which an abstract appears on page 1144. The statement made by him that a large factory does not, like the average central station, depend on the personnel of the production department to market its product, is worth thinking about, even if not entirely new. We are further glad to note the emphasis he puts on increasing the general standard of illumination among the stores in a town as a means of increasing gross revenue. Illumination is more than something to see by in a store.—it is advertising. Upon this basis it must be urged both in large and small towns, and first effort should be concentrated on the most progressive merchants. There is an immense difference in the standards of illumination among the merchants of different towns, and usually there is much more chance for development in the small towns than in the large, though there are notable exceptions

Combined Gas and Electric Companies.

The number of cities in which the gas and electric lighting interests are under the same control is constantly on the increase. Whenever such consolidations of gas and electric companies take place, questions of great and immediate importance to the management always come up in fixing on a general policy. The first question is usually as to whether gas lighting shall be pushed and encouraged, or whether the lighting business shall so far as the company can influence it, be confined to electricity. In passing upon these matters the example set by some of the consolidated gas and electric companies that are making the best earnings should be considered, as well as the relative inherent merits of the two methods of illumination and the probable trend of future development. It is notable that consolidated gas and electric companies whose earnings per capita of population are highest are, as a rule, pushing gas for cooking, heating and industrial purposes, but electricity for lighting purposes. There are two good reasons for this. In the first place, the public demand is sure to be more and more for electric light as against gas as time goes on, because it is convenient, clean and up-to-date. In the second place, the public is willing to pay more for electric lighting than for gas lighting and consequently the revenue per capita of population can reasonably be expected to be larger with electricity as the common illuminant than with gas.

An argument sometimes used by consolidated gas and electric company managers against the pushing of electric lighting in the residence districts is that the gas mains must be placed all through these districts to take care of gas ranges, and it is consequently better to encourage residence customers to use gas for lighting than to cover the territory also with electric lighting service. It may be true that the company's investment could be kept down to a lower point by giving only one class of service to a residence, provided a large proportion of the residences in a district were gas range users and there was no electric service in the district. As a matter of fact, we seldom find such conditions. Electric lighting mains must be run on most of the residence streets to serve the many wide-awake customers who demand the most modern and convenient light and will not put up with gas. It may also be true that in order to serve the scattered gas ange customers, gas mains must be placed on nearly all the esidence streets. In other words, both gas and electric distribu n systems have to be maintained in residence streets any- ay. There appears to be no doubt that more income can be tained from a residence territory by giving both classes of vice and pushing only electricity for lighting. Further than , the public will be much better satisfied than if any at- pt is made to force gas lighting on builders of new houses ailure to give electric service in the residence districts. A any which pursues such a policy is sure to be listed by the P where it belongs, namely, among the back numbers.

Gasoline Lighting.

We still continue to hear of the competition of gasoline vapor lamps with electric lighting, especially in the smaller towns. We have always believed (and have no reason to change that belief) that this class of gasoline lighting is to be considered as a dangerous and temporary makeshift not likely to last long in any community where it is introduced. Nevertheless, there seem always to be a few in every community who are willing to try things when they are new. The progress made in their introduction depends much on the management of the central station company. With good service, reasonable rates and attention by the company to a customer's installation so that he may get good results for his money, gasoline lighting plants will not make much headway. We are inclined to believe with one of the speakers at the Iowa convention that it is well for central station men not to make too much ado about or oppose too actively the introduction of gasoline lighting installations in a town. In other words, let the thing hang itself rather than advertise it by opposition. Unfortunately it usually takes one or two gasoline accidents fairly near home to bring the users of these appliances to a realizing sense of their danger. Indeed, we believe that it is the duty of every central-station manager as a citizen, aside from anything he owes his company, to call attention to the dangers of this class of lighting and to the frequent accidents which result from it. As shown by a recent Underwriters' *Bulletin*, part of which was quoted in our issue of March 3, 1906, page 442, the Underwriters' engineers state plainly that the use of gasoline lighting appliances introduces an extra fire hazard which should always be recognized by increased insurance rates. In spite of this extra hazard and the undeniable fact that electricity is safer, we find frequently that no higher insurance rates are charged for a gasoline-lighted store than for one lighted by electricity. This is manifestly unjust, since users of electricity should be entitled to a better rate than those using a dangerous illuminant like gasoline. Central station companies certainly can, without violating the public idea of fair play, ask that the safer illuminant be given the better insurance rate. It is certainly not too much to ask that insurance companies live up to the recommendations of their own experts.

Of course, the fundamental reason why gasoline lighting appliances are put in is that the customers believe they are going to get more light for their money. It is therefore clearly up to the central station men to meet these conditions, in advance, if possible, by securing to their dissatisfied customers the best illuminating results. The sellers of gasoline vapor lamps are very likely to select for their field of action a town where the lighting rates are high, the service indifferent and where the only things to be found in the way of electric illuminants are incandescent lamps improperly equipped with reflectors and alternating-current arc lamps, which are notoriously weak in the amount of useful light thrown downward. The most effective way of meeting this competition appears to be, first, to make rates that are right; second, to give good, reliable service, and third, to use incandescent lamps equipped with good reflectors or Nernst lamps well distributed over a store. By placing the sources of light above the area to be lighted and with the downward distribution of light afforded by either incandescent lamps with reflectors or Nernst lamps, the best results can be obtained in store lighting.

N. E. L. A. Daily Programme.

The following is the daily programme for the convention of the National Electric Light Association at Atlantic City next week:

Tuesday, June 5, first session, 10 o'clock a.m.—Address of Welcome by the Governor of New Jersey or the Mayor of Atlantic City. President's Address, Mr. W. H. Blood, Jr. Announcements. Report of Committee on Progress, Mr. T. Commerford Martin. "Magnetite Arcs and Mercury Rectifiers," Mr. W. S. Barstow; "Flaming Arcs," Mr. Louis B. Marks. Tuesday, second session, 2 o'clock p.m.—Report of Steam Turbine Committee, Mr. W. C. L. Eglin, chairman. "Fuel Economy," Mr. J. H. Hallberg; "Mechanical Refrigeration," Mr. John Myer; "Electric Heating," Mr. James I. Ayer; "Line Construction for Overhead Light and Power Service," Mr. Paul Spencer.

Wednesday, June 6, third session, 10 o'clock a.m.—"Business-Getting Methods," Mr. F. W. Frueauff; "How to Make a Small Electric Plant Pay," Mr. D. F. McGee; "Some Methods Used in Securing and Retaining Business," Mathias Turner, N. T. Wilcox, Geo. N. Tidd, R. S. Wallace, Geo. B. Tripp, Leon H. Scherck; "Free Installation of Electric Signs," Mr. John F. Gilchrist. Wednesday, fourth session, 2 o'clock p.m.—"Profitable Co-operation," Mr. J. Robert Crouse, Jr. Report of Committee to Co-operate with Lamp Manufacturers on Advertising, Mr. Paul Spencer, chairman. "Grounding Secondary Alternating-Current Services," Mr. Sidney Hosmer. Report on Protection from Lightning During 1905, Mr. Alex. Dow, chairman. Report of Committee on the Fire Hazard of Electricity, Mr. H. C. Wirt, chairman.

Thursday, June 7, fifth session, 10 o'clock a.m.—"Maintenance and Calibration of Service Meters," Mr. William Bradshaw; "Comparison of Direct-Current and Induction-Motor Load," Mr. I. E. Bogen; "Alternating-Current Systems of Distribution and Their Automatic Regulation," Mr. C. W. Stone; "Alternating-Current Elevators," Mr. W. Noble Dickinson, Jr.; "Modern Switchboard Practice with Particular Reference to Automatic Devices," Mr. E. M. Hewlett; "Control of Motors on Electric Light and Power Circuits," Mr. H. D. James. Thursday, sixth session, 8.30 o'clock p.m.—"The Meaning and Proper Treatment of the Agitation for Municipal Ownership of Public Utilities," Mr. Everett W. Burdett.

Friday, June 8, seventh session, 10 o'clock a.m.—"New Illuminants," Prof. H. E. Clifford; "Higher Efficiency Incandescent Lamps in Central Station Service: Their Value and Effect and the Policy Therefor," Mr. F. W. Willcox; "The Edison System of Southern California," Mr. R. H. Ballard; "Design and Manufacture of Hydro-Electric Installations as a Whole," Mr. E. F. Cassel. Question Box and Wrinkles, Mr. Paul Lupke. Friday, executive session for Class A and B members only, 2 o'clock p.m.—Report of Executive Committee. Report of secretary and treasurer. Laws of the different States governing theft of current, Mr. E. H. Davis. "Methods of Current Theft," Mr. C. T. Mordock; "Sliding Scale Methods of Public Regulation," Mr. W. H. Gardiner, Jr. Report of Committee on Rates and Costs, Mr. C. L. Edgar. Report of Committee on Standard Rules for Electrical Construction and Operation, Mr. E. H. Davis. Report of Committee on Public Policy, Mr. Arthur Williams. Report of Committee on Relations Between Manufacturers and Central Station Companies, Mr. Henry L. Doherty. Election of officers.

Note has already been made in these pages of the special features of entertainment in connection with the meeting and the special cars or trains arranged for by Mr. G. F. Porter, master of transportation. In addition to the receptions, trips, etc., already announced, there will be a baseball game and a golf tournament, for the latter of which President Blood is offering two prizes.

For the three prizes offered by the Co-operative Electrical Development Association, Mr. Blood has appointed the following committee to report on the papers presented: Douglass Burnett, of Baltimore; G. E. Montague, of Niagara Falls, and E. H. Mather, of Portland, Me.

Mr. Arthur Williams, chairman of the convention committee, announces that the arrangements for the golf grounds and club house are very satisfactory. The two prizes are a large loving cup and a stein, both of leather with silver trimmings, of the latest design. The regular badge of the association, silver-plated, has been mounted on each prize.

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The Electrical Industries of Germany.

By W. C. Dreher.

The Society for Protecting the Interests of the German Electrical Industry has issued a report on the progress of that industry in 1905. The year was, according to this report, one of uncommon activity, excelling the boom year, 1900. This great activity had only one feature to mar it—the prices of finished goods could not be raised sufficiently to make up for the advance in raw material cost. One striking difference between the present boom and that which ended six years ago is pointed out. In the earlier period the electrical industry played the role of a leader, a creator of prosperity. Through the establishment of electrical plants of all kinds upon their own account the electrical companies made much new business for the iron and some other leading industries; and all this had a stimulating effect upon the general prosperity of the country. At present conditions are completely reversed. The electrical industry takes the orders that are brought to it and executes them; but it is doing no artificial pushing in order to create business. It is borne along upon a wave of prosperity which it did nothing to call into being; and thus its condition is far sounder than during the hot-house development that was seen in the closing years of the nineties.

The chief impulse to the activity in 1905, says the report, was given by the German coal and iron industries. Here electric power was introduced on a large scale for driving hoisting machinery, pumps, ventilating fans, transporting men and commodities above and under ground, illuminating mines and shops. The ultimate source of power in nearly all such cases was found in the gases from blast furnaces, which were formerly allowed to escape and go to waste. These are now saved, purified and burned in gas engines for driving electrical generators. Many of the large rolling mills of the country are already operating their rolls in this way, and others that are without this improvement are hastening their plans to put in such machinery. German companies which have introduced this system say it has a marked effect in cheapening production.

Even in remoter branches of the iron industry, like hardware shops, electrical power made rapid progress last year. The textile branches, too, made larger demands than ever upon the electrical industry, and many other branches of manufacture did the same. The increase of electrical plants was accelerated by improvements for economizing steam, by the suction gas motor, and by the larger application of water turbines. It is noted that many signs indicate that a period for the utilization of Germany's water powers in a higher degree than hitherto has set in. Natural water powers are being developed and streams in mountains and hills are being dammed for the creation of electrical energy.

Considerable progress is noted in the application of electricity in transportation. Electric towing machines, running on a track on shore, are coming into use for propelling canal barges; electric cranes for loading and unloading ships are rapidly supplanting steam machinery for this purpose, and electrical signaling apparatus is being put on all ships. Of course there steady growth in street and suburban railways, and the use electricity on standard-gauge road is extending. Trackle roads are also coming into use, and the electrical automobile making rapid progress. The year also saw considerable progr in the use of electricity on the farm. This was mainly in tra portation and in driving agricultural machinery. This deve ment necessitated the establishment of many central station country districts. New inventions in telegraphing and phoning instruments opened up wider fields for both, and the trical industry felt the effects of this increased demand.

Besides the active home demand for electrical good he foreign market took larger quantities than ever before. far as electrical goods can be traced in the Government's stats, Germany's exports last year reached 73,000,000 marks, pared with 65,000,000 marks in 1904. As much electrical goods is classified in groups where it cannot be detected, it is assumed that the total exports amounted to not less than 100,000,000 marks, or about $24,000,000. In 1898 the Government made a careful inquiry into the amount of electrical exports and found that they had a total value of 57,000,000 marks. The chief field for these exports last year was in other European countries, which are also enjoying a period of unusual prosperity; also in South and Central America, and in South Africa. This report, however, admits that the export movement was accelerated by the fact that the new commercial treaties were to go into effect on March 1, 1906. This event caused foreign customers to make larger orders than usual and to have the delivery of the goods hurried as much as possible. Some of Germany's neighbors, notably Russia and Austria, have largely increased their duties on electrical machinery; and it is known that one, at least, of the great manufacturing trusts of Berlin is contemplating the establishment of branch factories in both countries.

The intenser activity in the electrical industry necessitated a large increase in the number of people employed in it. The society places the total number of employes at the end of the year at 82,000, as compared with 72,500 at the end of 1904. The increase in the number of workmen was greatest with manufacturers of special articles, their increase having been about 20 per cent, while the number of the working force with the great manufacturing trusts, covering the entire field of electrical machinery, gained only 10 or 11 per cent. The number of such special establishments, too, underwent a notable increase during the year. They now number 250, as against 225 in 1904. The official statistics taken in 1899 of the number of employes in the electrical industry showed a total of only 26,321 for 1895, and 54,417 for 1898.

The report concludes with expressing regret that the electrical industry is practically without any firm general organization for regulating production and prices. Only the manufacturers of electric lamps have a common selling agency, and a more or less loose combination of manufacturers of dynamos and motors was able to effect a slight advance in the prices of such machinery. Still, prices are far too low in proportion to the prices of raw materials. This is now the struggle of the day in the German electrical industry—to raise prices to a point where profits will be more secure.

Telephone Statistics of Germany.

According to recent statistical returns published by the German Telegraph Department, no less than 322,000,000 marks has so far been expended for German telephone plants. More than 12,800 officials are employed in the telephone service, which comprises 510,831 subscriber stations situated in 4,062 localities with exchanges of their own. The number of conversations exchanged has for the first time reached one thousand millions. The most extensive of all local telephone systems is that of Berlin, comprising 74,836 subscribers' stations, and 196,098 km. of circuit on which an average of 578,422 conversations are exchanged every day. Hamburg, with 31,707 subscribers' stations and 271,518 daily conversations, and Frankfort on Main (14,104 and 108,170 respectively) come next in order. The longest telephone line is the Berlin-Paris (1,092 km.) on which a daily average of 53 conversations at the rate of five marks each is maintained. Of other lines more than 900 km. in length, the double lines to Memel, Budapest and Bâle should be mentioned, the former of which has been most frequently used (229 times per diem).

Wiring With Flexible Conduit.

In the article by Louis J. Auerbacher on "Wiring with Flexible Conduit and Armored Cable," which appeared in our issue of April 7, it was stated that fibrous conduit having an internal diameter less than ⅝ in. would not pass inspection. In the changes to the Code adopted at the annual meeting of the National Board of Fire Underwriters and published in the April supplement just issued, the use of fibrous conduit having an internal diameter of ½ in. is permitted.

Milwaukee Convention of A. I. E. E.

The opening session of the twenty-third annual convention of the American Institute of Electrical Engineers was held in the auditorium of the public service building of the Milwaukee Electric Railway & Lighting Company, said to be the largest and finest railway terminal building in the world. In addition to the auditorium, it contains offices of all the departments of the company, dining rooms, small halls, committee rooms, billiard rooms and bowling alleys. The railway station part of the building is provided with waiting rooms, check rooms, news stands, reading rooms and a lunch counter.

The attendance up to Wednesday evening was meagre, the total registry of members and guests, including ladies, up to that time being only 230. Several of the important papers on the printed programme will not be presented, the advancement of date of the meeting being given as the cause for their non-readiness.

When President Wheeler called the convention to order he took occasion to remark that much interest was added to the event on account of the fact that it marked the dedication of the new public service building of a company which is intimately connected with the work of the Institute. He introduced Mr. C. W. Burkett, of the local committee, who announced the inability of the Mayor of Milwaukee to be present, and explained that city attorney John T. Kelley was present to represent the Mayor. Mr. Kelley, in welcoming the members, stated that the building in which the convention was being held stood as a monument to the energy and courage of electrical engineers and especially of Mr. John I. Beggs, as president of the Milwaukee Electric Railway & Lighting Company.

The Entertainment Committee, of which Mr. H. H. Cutler is chairman, arranged an informal reception to the visiting members, which was given in the red room of the Hotel Pfister on Monday night. A large number of ladies were present and ices and refreshments were served. The Local Committee had arranged for a banquet on Thursday evening at the Hotel Pfister, but after conferring with the officers of the Institute this was called off. The business of the convention will be concluded Thursday noon, and owing to the rather small attendance and the fact that a large number of delegates had arranged to leave for home immediately after the session of that day, it was considered that the attendance would not be sufficiently large to justify a banquet. The Local Committee will give an informal supper and smoker to the members and guests at Whitefish Bay on Wednesday evening.

MONDAY'S SESSION.

The address of President Wheeler consisted of a discussion of the topic "Engineering Ethics." He stated that electrical engineers are frequently referred to as professional men, which they are indeed, and they should so regard themselves. They are under moral obligations to the public, and they should appreciate their relations to the public and to one another. He read numerous extracts from publications of laws and transactions of professional bodies to show that much has been accomplished by other professional men in the line of defining their moral obligations, and to point out the course which should be pursued by electrical engineers.

The electrical engineer should recognize his duty to his client, to the public and to the engineering society. The most important of these is his duty to his client. He should not possess any connection with a manufacturing company unless his client is informed of this fact. He should hold in confidence all data, drawings, etc., which rightly belong to the client. He should recognize the rights of a corporation, just as of the individual. It is his duty to educate the public to an appreciation of certain engineering questions, and he should cease to surround the business with an air of mystery and uncertainty. In regard to an engineer's duty to his societies it may be stated that when meetings of the society are uninteresting, the individual members themselves are at fault. The societies offer the best opportunity for the engineers to become thoroughly acquainted; and it must always be remembered that the most reliable estimate of an engineer is that held by the members of his own profession. Following the custom inaugurated by his predecessor, President Wheeler introduced President-elect Dr. Samuel Sheldon, who expressed his appreciation of the great honor bestowed upon him, and stated that the responsibility of the office is becoming heavier each year as the Institute continues to grow and to broaden its field of activity.

The first paper of the convention was one by Mr. Maurice Milch dealing with the repulsion-induction motor, which, in the absence of the author, was read by Dr. C. P. Steinmetz. As noted in our abstract elsewhere in this issue (p. 1132), the repulsion-induction motor is a combination of the two machines, from which it takes its name. It possesses a large starting torque, a limited maximum speed and operates with a large slip at full load. It is intended for elevator or similar work. Its disadvantage resides in the fact that it is equipped with a commutator. In its performance it closely resembles the compound-wound, direct-current elevator motor.

The discussion was opened by Prof. D. C. Jackson, who stated that for general distribution, especially for the small plants in the West, single-phase circuits are much preferable to polyphase circuits. He expressed the opinion that the self-starting, single-phase motors are destined to replace the polyphase motors for such distribution. The speed range of the repulsion-induction motor can be adjusted by the design, and the motors can be constructed for any required work.

Mr. G. Percy-Cole believed that the large slip of the motor would prove disadvantageous for certain classes of work. Although the starting torque is large, the starting current is also large. In this respect the motor does not seem to be equal to the Wagner motor, which gives from 2.5 to 3 per cent slip as compared to 5 per cent for polyphase motors, or 15 per cent for repulsion-induction motors. For elevator service the Schueler type of repulsion motor is excellent, and the speed is under perfect control. In this machine 50 per cent excess torque can be obtained with 50 per cent excess of current.

Dr. Steinmetz remarked that for constant speed service the best machine is the polyphase induction motor, but for services requiring frequent starting the repulsion-induction motor is far preferable. He thought that automatic control of the speed as obtained in the Milch motor is much better than control by mechanical means, which latter may, in fact, be considered as a mechanical speed-limiting device, which is liable to fail at any time.

The second paper, which was devoted to a comparison of two-phase and three-phase induction motors, was read by the author, Mr. Bradley McCormick. It was shown that the two-phase motor is in all respects slightly inferior to the three-phase machine. By taking into account the distribution of the primary coils, the variation of the primary magnetomotive force and the flux produced thereby, the author showed that the magnetizing current in a three-phase machine is about 15 per cent more than that in the two-phase, but that when expressed in per cent of full load current the exciting currents of the two machines are equal. An abstract of this paper will appear in our next issue.

Dr. A. S. McAllister stated that without considering in any way whatsoever the various factors discussed in the paper other than the assumption that the frames of the two machines are equal and are subjected to the same iron losses, it can be shown that the quadrature exciting watts of the two motors must be equal. The quadrature watts, W_q, are properly expressed by the formula:

$$W_q = q\ f\ B_m^2 \left(\frac{V_1}{\mu} + V_2 \right)$$

where V_1 = volume of the iron,

V_2 = volume of the air-gap,

μ = permeability of the iron,

B_m = maximum magnetic density,

f = frequency,

q = a constant = $\frac{2.5}{10^8}$ for c.g.s. units

Therefore, two motors having equal values of core and of air-gap operated at the same magnetic density and frequency must require the same value of quadrature exciting watts, quite independent of the phases, the number and the distribution of the primary coils.

Dr. C. P. Steinmetz said that tests had shown that when a certain motor was connected up for twelve phases, six phases, three phases or two phases, the volt-amperes for excitation were the same in each case, but that when the connections were changed to single-phase the exciting volt-amperes were slightly less, and in this case the output was somewhat less than one-half of that when the machine was operated polyphase.

Mr. C. F. Scott traced the evolution of the phase induction from the time when projecting poles were used until the present time when distributed windings are universally employed, and explained the advantages derived from the use of the distributed coils.

Mr. R. E. Hellmund stated that tests prove conclusively that the leakage of a two-phase motor is more than that of a three-phase machine, due, doubtless, to the larger free-end leakage flux of the former machine.

Mr. Sebastian Sentius read a paper describing numerous heat tests on alternators which can be applied in those cases where it is inconvenient to test the machines under normal conditions of operation. The principle of the tests consists in bringing current into the armature winding at such points that no induced e.m.f. has to be overcome. The author assumes that the short-circuit test affords the data for predetermining in a sufficiently accurate way the regulation of an alternator, and also to normal field current and flux.

Dr. Steinmetz expressed the opinion that the investigation of the various methods of making heat tests on alternators will soon become of sufficient importance to justify attention by the standardization committee. The importance of specifications for such tests are due to the manufacture in increasing numbers of 5,000-kw and 8,000-kw machines which require from 20 to 24 hours at full load to reach their final temperature rise. The amount of power involved is too great to make the tests under operating conditions. Moreover, it is practically impossible to control the temperature of the air surrounding the machine for such a period. Hence, the losses must be caused to take place without load. No single method yet proposed is perfectly satisfactory for this purpose, but the no-load short-circuit and open-circuit tests serve admirably as checks on the predetermined performance of the machine.

A paper on "Direct-Current Motor Design, as Influenced by the Interpole" was presented by Mr. C. H. Bedell. This paper gave an outline of the advantages derived from using commutating poles on direct-current motors, as noted in an abstract in this issue (p. 1134).

Mr. H. F. T. Erben discussed the delay in the application of the commutation poles which have been known for a long time. Interpoles were tried about 15 years ago, but with indifferent success, due to lack of sufficient m.m.f. in the auxiliary pole windings. During the past two years many machines varying in size, from 1/2 hp to 2,000 kw have been built, and from these much valuable data have been obtained. Most thorough investigations have been made of commutation phenomena. Machines are now being built which commutate perfectly. Machines can be made to overcompound 10 per cent merely by shifting the brushes, and yet they operate without sparks.

Mr. W. L. Waters remarked that ten years ago the trade did not wish to use interpole motors, and there was no demand for them or for any type of variable-speed motor. The demand originated and grew with the introduction of the multiple-voltage system. The advent of the steam turbine has caused a great demand for high speed, direct-current generators, which can advantageously be equipped with interpoles. They have an important place to fill as high-speed generators, reversible boosters and variable-speed motors.

In reply to a question of Mr. Sentius as to the effect of using a compensating field winding, Mr Erben said that such a winding had been tried, but the protecting interpoles had proved preferable. He stated that an efficiency of 96.2 per cent had obtained with a 500-kw turbo-generator ventilated by induced draught. In reply to a question by Mr N. J. Neall, he said that a railway motor equipped with commutating poles did not spark at any load. Such motors permit of the use of four or more economical speed points and thus give a wide range of speed.

President Wheeler thought that for variable-speed work the multiple-voltage system is most excellent, and he doubted if the interpole motor will prove advantageous when cost and complications are properly considered.

Mr. David Hall stated that where the design is not limited by the commutation the interpoles are disadvantageous, but by the use of interpoles the structure can be redesigned more economically.

Dr. Steinmetz said that interpoles are especially advantageous for high-peripheral speeds due to the high frequency of commutation. By use of such poles a motor on single voltage gives a speed range of 4 to 1, and a range of 8 to 1 on a three-wire, direct-current system.

TUESDAY'S SESSION.

The meeting on Tuesday was devoted to the presentation and discussion of three papers on lightning arresters and to the discussion of the report of the Committee on Standardization.

The proposed revision of the existing standardization rules drew forth a lively discussion as to the advisability of framing rules which were characterized by some as being too exacting and tending to limit the manufacturer unnecessarily. The sections criticised related to rheostats, lightning arresters, lighting units, the testing of lamps and of direct-connected generators. The discussion was entered into by Messrs. N. J. Neall, D. C. Jackson, F. A. C. Perrine, P. H. Thomas, H. C. Wirt, C. W. Rice, P. M. Lincoln, C. F. Scott, C. P. Steinmetz and S. S. Wheeler. Prof. Jackson stated that the first report of the Standardization Committee was excellent, the second, which was broader, was poor and the last one, which is much extended, is bad. He thought that the committee has gone too far. The rules are in an unfortunate form; they should be reconsidered and considerably shortened. Dr. Steinmetz explained that the object of standardization is to determine what is the best practice and to prevent the unnecessary accumulation of machines and apparatus of odd sizes and ratings. If, however, the rules will prevent manufacturers from producing inferior devices, such as rheostats, they will prove of benefit not only to the customer, but to the better class of manufacturers who must build devices to compete in price with inferior makes. It is not expected that the rules as they now stand are correct in every detail, but it is hoped that each member interested will suggest alterations in those rules in which he is particularly concerned. The prime requisite is to have the rules in a properly amended form to become operative at the earliest possible date and for their adoption not to be delayed until the next annual convention. He endorsed the suggestion of Mr. C. F. Scott that the rules be referred back to the committee, in order that copies might be sent out to all members and interested parties for comment, the committee being authorized to make the necessary alterations and to submit the rules to the Board of Directors for publication in their final form. The suggestions of Messrs. Scott and Steinmetz were placed in the form of a motion which was carried against a small dissenting vote.

The three papers by Mr. Farley Osgood, Mr. E. E. F. Creighton and Mr. H. C. Wirt dealing with lightning arresters were read in succession and discussed together. Mr. Osgood's paper related some experiences with lightning and static strains on a 33,000-volt transmission system at New Milford, Conn., in which excellent results were obtained from multi-gap arresters without series resistances. The paper by Prof. E. E. F. Creighton described numerous methods of testing lightning arresters, while Mr. H. C. Wirts' paper dealt with the features embodied in the construction of various arresters, particularly those using non-arcing metals. Abstracts of these papers will be found on following pages.

Mr. Percy H. Thomas explained that in the low-equivalent type of arrester the series resistance is employed to limit the current from the dynamo, and to assist in extinguishing the arc, and it has been found to operate quite satisfactorily. This resistance need not be high, but it does not seem desirable that it be omitted entirely. He stated that the number of series gaps required to break an arc at a certain current depends largely upon the amount of inductance in circuit.

In reply to a criticism by Mr. Thomas as to the necessity of conducting tests on arresters with extremely high frequencies, Prof. Creighton stated that a transmission line may divide itself into sections in which currents may oscillate at frequencies of several hundred kilovolts, especially after a lightning stroke, and a lightning arrester should be able to remove these surges successfully.

Mr. J. B. Taylor said that the mere fact that arresters connected from line to line may discharge in series does not prove that a high potential exists between the wires; the effect may be due to the condenser action of the gaps at some extremely high frequency oscillation. The discrepancies in determining the voltage by means of the needle gap may be largely attributed to the conductors in the neighborhood of the gap. Consistent results may be obtained by shielding the gap at all times.

Mr. N. J. Neall said that only when the various types of arresters are tested under exactly similar conditions can conclusions be drawn as to the effectiveness of each type. The high-voltage propositions are the most severe ones, and laboratory tests are entirely inadequate for these conditions. Tell-tale papers placed in the spark-gaps of arresters in actual service are excellent for obtaining the desired information.

Mr. P. M. Lincoln explained that the designer of lightning arresters is confronted with three problems: To prevent the high-frequency surges from getting into the power house; to provide a path for the escape of the surges, and to prevent the dynamo current from following the arc. The last problem is the most difficult, and it has not yet been successfully solved. Dr. F. A. C. Perrine thought that the overhead grounded line is of great importance, in that it reduces the amount of work for the arresters to perform; it spreads out the disturbance and lessens its severity. Mr. C. F. Scott referred to the pioneer work of Mr. A. J. Wurts with lightning arresters, and said that even down to the present time very little improvement has been made over the arrangement of non-arcing cylinders used by Mr. Wirts. The shunting of the gaps was accidentally discovered by Mr. Henry Noel Potter during a test with a voltmeter in shunt with some arrester gaps.

Mr. Farley Osgood expressed the opinion that it would be to the mutual benefit of all parties concerned if the designers of apparatus would consult with the operating engineers, and not attempt to force upon the engineers certain equipments which their experience teaches them are not best suited for the work. Dr. Steinmetz remarked that arresters are unable to protect absolutely against lightning, but they can check the overflow of static electricity and remove it from the system. A transmission line should be considered an electrical problem and not merely as a mechanical one. The line should be erected so as to avoid localities in which lightning most frequently occurs. A transmission system in a real lightning district is never free from disturbances. Care should be taken to select valleys and not hills for the route of the line. The most effective protection is found in the overhead wire grounded at frequent intervals. It is good to use a steel wire strung along the top of the poles, and best to have three wires, two being placed at the ends of the cross arms. A locally closed short-circuit placed parallel to the transmission line is of great service in damping out the surges. After commenting upon the fact that for small gaps the striking voltage depends upon the frequency as shown in Prof. Creighton's paper, Dr. Steinmetz gave an extremely interesting explanation of the fact that the total striking voltage of several series-connected gaps is much less than the sum of the voltages necessary to break down the individual gaps. This phenomenon, which is especially marked at high frequencies, was attributed to the fact that the total potential is not equally divided between the gaps, but the law of the distribution of the potential is roughly parabolic, with the greater potential gradient across the gaps near the line wire. The potential gradient depends upon the condenser charging current which passes from cylinder to cylinder, and this current, which is greatest at the line wire decreases to a very small value at the ground end of the series of gaps. Both the condenser charging current and the steepness of the potential gradient depend upon the frequency. At a certain high frequency, depending upon the voltage of the surge the potential gradient becomes great enough to cause an arc to form across the gap nearest to the line wire, and then the other gaps arc across in quick succession. The multigap arresters will not protect against low-frequency high-power surges. When such surges occur, the safest plan is to shut down the system.

WEDNESDAY'S SESSIONS.

By Telegraph.

Both morning and afternoon sessions were held on Wednesday. The first paper read at the morning session was that by Mr. W. L. Waters entitled "Shunt and Compound Converters for Railway Work." In the discussion of the paper Mr. John B. Taylor said that the general tendency is toward compounded converters, the series winding of which assists in controlling the polarity, and the efficiency of such converters is quite high. Mr. Paul M. Lincoln said that compounded converters must be used if the rising voltage characteristic is desired. Mr. Waters contended that the cost of compound converters is about 6 per cent more than for simple shunt-wound machines. Prof. Morgan Brooks, of the University of Illinois, then presented his paper on the "Self Synchronizing of Alternators," which was not discussed. The next paper was that by Prof. C. F. Burgess, of the University of Wisconsin, on "Magnetic Properties of Electrolytic Iron." In the discussion Mr. E. F. Northrup said that the needle galvanometer is best adapted for measurements with iron. Prof. D. C. Jackson believed that electrolytic iron will become of much importance in electrical engineering. Dr. Steinmetz made the interesting preliminary announcement that observations had shown that manganese is magnetic when combined with other non-magnetic substances, such as copper and aluminum; and that it is not improbable that an alloy will be found having a higher permeability than that of iron. Mr. Edwin F. Northrup then presented his paper on "Measurement of Temperature by Electrical Means." Replying to a question by Mr. W. L. R. Emmet, Mr. Northrup said that it is possible to measure the temperature of steam by a spiral of wire.

Dr. Steinmetz made a motion that the Institute, through its President and Board of Directors, shall formulate a code of ethics to be submitted to the membership for approval. Prof. Jackson, Mr. C. F. Scott and President Wheeler supported the motion, which was adopted. Mr. M. K. Akers, of Urbana, Ill., then read a paper by Prof. Thomas M. Gardner, of the University of Illinois, entitled "Educational Value of an Electric Test Car." Prof. Jackson said that such a test car was also valuable in bringing the college in contact with operating railway engineers. In reply to a question by Mr. Paul M. Lincoln, Mr Akers said that the accelerometer used with the car is quite accurate. The next paper was that by Mr. Edwin J. Prindle, entitled "The Art of Inventing." In the discussion Dr. Steinmetz said that invention is an engineering incident, a process of development; the professional inventor he considered to be only one step above the professional promoter.

On discussion on the organization of local branches, Mr. C. F. Scott said that the local branches should be integral parts of the Institute, but each should stand on its merits. The headquarters should continue in New York Each of the branches organized should discuss topics of local interest and affiliate with local societies. The branches should assist in increasing the membership. Major George F. Squier reported that a branch is in process of organization in San Francisco. Mr. Kempster B. Miller said that the Chicago branch is a success. Dr. Steinmetz said there are two kinds of branches; educational and originative. The former are feeders to the Institute and the latter supply papers He suggested that representatives of branches should attend the meetings of the Board of Directors, but without vote. Prof. Sheldon said that closer cooperation with local branches was needed and that the interest should be considered of both the home and local branches. The paper by Prof. D. C. Jackson on "Economies Derivable from the Use of Relatively Small Water Powers of Low Head in the Middle West," was presented by the author, but not discussed. The next paper was that by Mr. Percy H. Thomas entitled "Some Fundamental Characteristics of Mercury Vapor Apparatus." Dr. Steinmetz questioned some of the statements in the paper. Some of the phenomena of arcs can be simply explained with reference to the law of the conservation of energy. The heat effect is predominant and the ionization theory is only a fashion. He said that 6,000 volts could be obtained from a single converter and that he had obtained 25,000 volts without short-circuiting. The paper by Mr. Charles M. Heminway, an abstract of which appears on page 1132, was read by title. Mr. W. L. R. Emmet in the discussion said that without a safety device a turbine may race, and that on a Curtis turbine a centrifugal device is employed which controls the admission of steam. Dr. A. S. McAllister read the paper by Mr. Edwin R. Weeks entitled "Some Notes on the Lighting of Churches." There was no discussion.

Lightning Arresters.

Three papers dealing on the general subject of lightning arresters were read at the Milwaukee convention of the American Institute of Electrical Engineers, as follows: "Experiences with Lightning and Static Strains on 33,000-Volt Transmission Systems," by Mr. Farley Osgood; "Methods of Testing Protective Apparatus," by Prof. E. E. F. Creighton; "Protective Apparatus for Lightning and Static Strains," by Mr. H. C. Wirt.

The paper by Mr. Osgood related to the actions of the multigap series-resistance type of arrester unit, and the multi-gap type of arrester unit without the series resistance, as observed during the summers of 1904 and 1905, at New Milford, Conn. These experiences would seem to indicate that it is the resistance in series with the gap which causes the greater obstruction to the lightning discharges, rather than an increase in the number of the gaps themselves. It is expected that much trouble will be eliminated by placing a resistance in shunt with a portion of the gaps. It seems advisable, also, to change the arrangement of the high-potential coils of the transformers from the present delta connection to a star formation, and to ground the neutral points.

The paper by Mr. Wirt gave an outline of the features which were considered in developing the shunt resistance type of arrester. In the New Milford installation 672 gaps were placed in series from line to line and from line to ground, as it was thought that this number would be required to prevent a short-circuit on the system. The theory of the operation of this arrester is that the cylinders are charged up electrostatically, with sufficient voltage so that the gaps are broken down in succession, passing the charge along from cylinder to cylinder and discharging the whole series practically instantaneously. At first the arresters were installed without any resistance, and, even in this condition, they gave a remarkable improvement in operation over the arresters of older type having distributed series resistance. No arrester in any sub-station held the dynamic arc, and the arresters at the generating station held the dynamic arc only three times. It was due to this experience that the shunt resistances were added. Laboratory tests have shown that the low-voltage, moderate-current discharges go through the series gaps and resistance, and the large-current, high-voltage discharges go through all of the gaps The proper adjustment of series and shunt gaps must be determined by actual service tests.

The character of the metal used has much to do with the amount of dynamic current that will pass through the arrester after the static discharge. Cylinders of uniform size were constructed of many different metals and alloys, including the so-called non-arcing metal now on the market. With the best alloy a reduction of 10 per cent to the number of gaps could be made compared to the number required when ordinary brass rods were used for the cylinders with the same dynamic current. This new alloy was also found to be about 5 per cent better than non-arcing metals previously used in arresters. The grounded star system of transformer connection presents an advantage in the arrangement of gaps as the arrester can be designed for 58 per cent of the voltage between line and ground.

Until recently the common idea as regards the effects that are taking place in a transmission system during lightning storms has been that a high-potential wave has come from the outside circuit, usually a considerable distance, to the station and discharged to ground either through the apparatus or through the lightning arresters, and that by the interposition of a reactive coil between the lightning arresters and apparatus the lightning discharge has been repelled to ground through the arrester. According to recent experience this idea of the effects in a system is incomplete and primitive. There is good proof to support the view that considerable effect is exerted by the electrostatic capacity of the entire transmission system—not only from lines to ground, but also from line to line, as shown by the discharges through multiplex arresters from line to line without any discharge to earth. At all times during the operation of a system there is a condenser effect, and the line voltages resulting therefrom are apt to be greatly above the voltage of the generator. The lightning disturbance charges up the system electrostatically and the excessive aggregate voltage causes a discharge to pass. This discharge may occur on the lines outside a station—from line to line over cross arms for example, making a short-circuit and causing a surge of dynamic current which in turn breaks down apparatus at the station; so that, although there would appear to be only a remote connection between the high voltage manifestation in the apparatus and the short-circuit on the line, one is really a consequence of the other; or the discharge may take place from line to ground, thereby setting up high static stresses between line and line in the station, or anywhere else in the system, and giving rise to high-voltage oscillations.

From the above considerations it is apparent that an arrester must be able to take disturbances of both high and low frequency and of considerable current capacity as well. It is believed that the shunt resistance type of arrester is an advance in the art, inasmuch as it affords effective protection against the disturbances of widely varying character.

The paper by Prof. E. E. F. Creighton treated of the methods of testing arresters and dielectrics, including direct-current potential test by alternating potential obtained from a generator, disruptive stroke test, inductorium test, half wave test and arc-extinguishing quality test. In discussing the arc-extinguishing quality test the author stated that any one can design an arrester that will in general protect against lightning stroke. The difficulty lies in combining the protective quality with that of the quiet suppression of the arc which usually follows a lightning stroke over an arrester. In either case the transmission system is usually shut down. The usual method of suppressing the dynamic arc is by means of a number of series gaps between brass cylinders. In the light of recent work the name non-arcing metal applied to the brass is inappropriate. Dr. C. P. Steinmetz has pointed out that it is a rectifying effect. The rectifying power depends upon the difficulty met in reversing the arc stream. Once established in either direction the current flows without any appreciable difficulty. The three principal materials in the order of their rectifying power, are zinc, magnetite and mercury. Zinc, however, is not the best material to use in an arrester. This is due principally to its low-melting temperature. In a lightning arrester the rectifying quality is obliterated by the splashing of the molten metal across the air-gap. There is a very definite amount of energy that can be expended in each gap during a half cycle of the generator before the metal will splash across the gap and short-circuit the cylinders. This energy is easily measured with a ballistic wattmeter.

In testing arc-extinguishing quality the first requisite is sufficient power to sustain an arc over the simple multigaps used. The second is a ballistic wattmeter to measure the energy lost per stroke. The third requisite is a suitable set of resistances to use in parallel or series with the multigaps. The fourth requisite is a synchronous switch. This synchronous switch consists of a rotating insulating arm carrying a conductor which sets off the static spark at any desired point of the e.m.f. wave. This arm is carried by either the generator shaft or an auxiliary synchronous motor. By this means the discharge which follows the static spark has been studied. Starting with the zero value of the e.m.f. no current follows the spark. With twelve gaps in series on a 2,400-volt circuit it is possible to increase the e.m.f. wave to a considerable percentage of the maximum value before the line current begins to follow the spark.

As shown in oscillograms, the current is extinguished before the e.m.f. reaches its zero value. Since the current at this point is extinguished as soon as established, the energy lost will be so slight that the cylinders will be able to conduct the heat away and radiate it between strokes.

If, however, the synchronous switch is carried still farther back on the e.m.f. wave, the current will be of correspondingly greater intensity and duration. The maximum expenditure of energy will take place when the point on the rising part of the e.m.f. wave is reached where the spark just causes an arc. The current then is on the longest time possible in the half wave. Any point lower on the e.m.f. wave allows a spark to pass without an arc following. These tests indicate why some arresters have been satisfactory for long periods and yet they finally burn up. It is a case of the law of chance.

There is another piece of apparatus that is desirable to have, viz.: an oscillograph, to indicate whether the arc is extinguished at the end of the first half cycle or not. Since taking an oscillogram for each stroke occupies a considerable time and involves an expense, a substitute can be made of some form of apparatus utilizing the difference in the electrochemical effect of a direct current and an alternating current. If the ballistic wattmeter deflection has once been noted when the duration of current was known to be only a half cycle, neither of the devices above are really necessary to show whether the current carries over more than a half cycle.

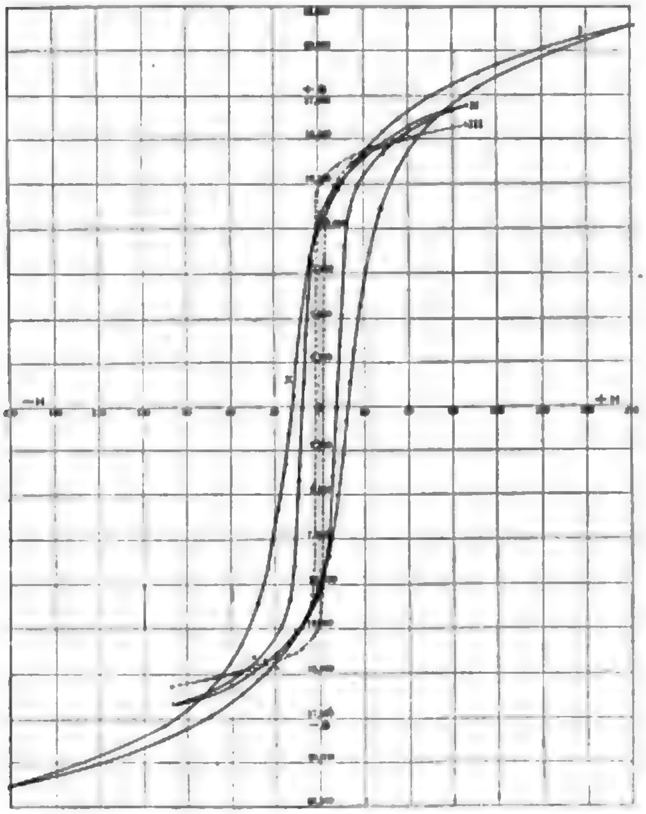
Another factor affecting the arc-extinguishing quality is the frequency of stroke. Two rapidly succeeding strokes will do more damage and constitute a greater risk of permanently establishing an arc than a dozen or more strokes at intervals of several seconds. The required severity of the test is a matter of judgment. It would seem to be sufficiently severe to demand that the multigap arrester extinguish a double-stroke at least once without excessive damage to the arrester, and that the arrester should have an endurance of perhaps a thousand strokes taken with such an interval between strokes as to allow the cylinders to radiate the heat energy from the arc.

Magnetic Properties of Electrolytic Iron.

A preliminary report on an investigation to establish the relation between coercive force, permeability hysteresis constants, etc., of electrolytic iron as affected by heat treatment was made by Dr. Chas. F. Burgess and Mr. A. H. Taylor, at the Milwaukee convention of the American Institute of Electrical Engineers. Although the values of B in curve 1 of the accompanying illustration are probably several per cent too low, on account of magnetic viscosity, the curve shows several rather remarkable properties. The iron is evidently very hard; the coercive force is 18 dynes and the retentivity 10,000. It seems that the field of 210 dynes does not saturate the iron, although it carries the induction to the high value of 21,250. At the same time there is relatively little area added to the hysteresis loop by running the field so high. The test ring was heated for several hours at a temperature of 200° C., and magnetic tests again made. These gave a curve almost identical with the first.

The ring was then unwound, embedded in magnesium oxide, and heated for eight hours at about 1,200° C. In this process a small portion was corroded on one side, necessitating the turning down of the ring, and hence a different choice of windings. The ring was found to be much softer than at first, and on being tested with the step-by-step method, gave values for the magnetic induction 17 per cent lower than those obtained by the method of reversals. This difference was traced to magnetic viscosity, and a modified ballistic method was devised to eliminate the error. The dotted curve was obtained by this method, and a comparison with the large curve shows that a tremendous change had taken place with the heating at 1,200° C. The iron is now in the condition of a rather soft steel, with a coercive force of about 2.5 dynes, a retentivity of 12,500 and a large amount of magnetic viscosity in the steep parts of the curve. A second heating of the ring to over 1,200° C. produced no appreciable change in the magnetic properties.

Another ring was prepared of electrolytic iron deposited from a solution maintained more nearly neutral than in the former case, the deposit being somewhat less hard and brittle and the fracture showing a finer crystalline structure. Magnetic viscosity is usually found in rather soft steels, of low coercive force, or even in many samples of soft iron. It was therefore a matter of surprise to find that the step-by-step method gave values of the maximum induction for this ring 6 per cent lower than those obtained by the method of reversals, and by the modified ballistic method. This indicates a considerable amount of magnetic viscosity.



MAGNETIZATION CURVES OF ELECTROLYTIC IRON.

Dr. Clayton H. Sharp.

Clayton Halsey Sharp was born December 5, 1869, at Seneca Falls, N. Y., where his primary education was received in the Mynderse Academy. In 1890 he was graduated from Hamilton College with the degree of A.B., during his course having taken special observatory work in astronomy. From 1890 to 1892 he was teacher of sciences in the Lyons Union School, of Lyons, N. Y. In 1892 he entered Cornell University as a graduate student, and was graduated in 1895 with the degree of Ph.D., the subject of his graduating thesis being "A Bolometric Study of Light Standards."

Dr. Sharp was engaged for some years in research work and in work of instruction in physics and applied electricity at Cornell. His work related chiefly to questions of photometry, improved standards of light, the combustion of mixed gases, etc., some of the results of which were communicated to the *Transactions* of the American Institute of Electrical Engineers in a "Note on an Acetylene in Oxygen Flame," in 1902. An interval of fourteen months in 1899-1900 he spent in European travel and in research work in the Physical Institute of the University of Leipzig. This consisted chiefly in a study of the optical properties of films containing colloidal solution of silver (Lippmann's photographic film) and of methods of measuring the thickness of such films by optical means.

In 1901 Dr. Sharp resigned his position at Cornell to become test officer of the Electrical Testing Laboratories in New York, then known as the Lamp Testing Bureau. Since the time that he has been in charge of the technical affairs of that company it has expanded its activities from the narrower field of testing incandescent lamps to the broad field of electrical and photometrical testing of all kinds, its laboratory being now one of the best equipped electrical laboratories in the world. In 1903 he made a tour of inspection of European laboratories and electrical instrument factories, in connection with the work of laboratory equipment and of development of methods of testing for the New York Laboratory.

DR. C. H. SHARP.

Dr. Sharp has been called in on various consulting and expert work and is the author of numerous papers on electrical, photometrical and other physical measurements, laboratory equipment and practice, etc., contributed to the *Transactions* of various societies and associations and to the technical and scientific press. He is member of the Phi Beta Kappa and Sigma Xi honorary societies; associate member of the American Institute of Electrical Engineers; fellow of the American Association for the Advancement of Science; member of the American Physical Society, the Société Internationale des Électriciens, and member and vice-president of the Illuminating Engineering Society.

CURRENT NEWS AND NOTES.

ILLUMINATING ENGINEERING SOCIETY.—The New England section of the Illuminating Engineering Society held its fourth regular meeting on May 22. The subject for the evening was "Street Lighting," and the following papers were presented: "A Method of Street Lighting by Incandescent Lamps" and "Lighting of Streets by the Incandescent Mantle Burner System." A general discussion followed the reading of the papers, and was taken part in by a large number of those present. Mr. Cowles, of the Boston Edison Company, stated that he was especially interested in the subject, as his company was at present operating about 6,000 series incandescent lamps for street lighting. He also discussed the relative advantages of 25 to 32-cp units for general use. Mr. Sargent, of Haverhill, advocated a higher candle-power and thought that 40 cp was better adapted for ordinary service. The question of reflectors and the æsthetic side of street lighting was taken up by Mr. Barnes, of Providence, and others, and the need for a more efficient and better appearing street reflector was generally admitted. The color of incandescent and Welsbach lamps and its effect on general illumination was also discussed. The society will hold its next regular meeting on June 26.

THE A. I. E. E. METRIC VOTE.—The final returns of the vote by the membership of the American Institute of Electrical Engineers on the metric system, show 1,654 votes in favor of the adoption of the system and only 186 votes in the negative.

CODE ELECTRICAL FITTINGS.—The Underwriters' National Electric Association has issued a supplement to the National Electrical Code, containing the changes and additions adopted at the annual meeting last December, as already noted in abstract in these pages.

ILLUMINATING ENGINEERING SOCIETY.—This society will hold a meeting at the Edison Auditorium, New York City, on Friday, June 8, at 8.15 p.m., when Dr. Louis Bell will read a paper on "Some Physiological Effects in Illumination and Photometry." This is an interesting subject to which Dr. Bell has given special attention, and his discussion of it will doubtless attract a large audience, including some of the delegates from Atlantic City.

THE ELECTRIFIED ERIE.—The directors of the Erie Railroad have authorized the immediate electrification of that portion of the line between Rochester and Mount Morris, N. Y., a distance of 35 miles. It is probable, before this work is completed, that a connection of eight miles will be built to Conesus Lake. This will be the initial installation, which will be gradually extended until the entire Rochester division will be so equipped. The power will be obtained from one of the companies now operating at Niagara Falls. It is proposed to use the latest design of standard suburban coaches, which will hold 65 persons and will have 200-hp motors. An hourly service will be maintained between Mount Morris and Rochester.

SUBMARINE SIGNALS.—The United States Government has issued a notice to shipmasters navigating the coasts of Massachusetts, New York and New Jersey that, beginning June 1, and operating continuously, day and night, excepting in case of accident, until noon on August 1, a submarine bell will be sounded from five lightships. They will be attached to the Boston lightship and those at Pollock Rip Shoals, Nantucket Shoals, Fire Island and Sandy Hook. Masters of craft fitted with apparatus for hearing submarine signals, or those in charge of vessels not so fitted, are asked to note carefully while approaching any of these lightships the distance and direction in which the signal is first heard, and how far it is carried after passing the vessel. They are also asked to note the direction and force of the wind, the condition of the sea, or any other fact that may, in their judgment, assist in determining the value of the signal as an aid to navigation. Postal cards will be furnished on application to the Lighthouse Inspectors at Boston or Tompkinsville, S. I., for the convenience of those making the reports. The cards have printed on them a series of questions, with spaces for the answers. This should afford a good test as to the efficacy of the apparatus.

MUNICIPAL NIAGARA POWER.—U. S. Consul Seyfert, of Stratford, makes a digest of the findings of the commission appointed by seven Canadian municipalities to estimate on the cost of developing 30,000 to 100,000 horse-power at Niagara Falls for transmission to various cities in the Dominion. The power plant and electrical transmission to the seven cities is estimated at $6,684,629 for 30,000 hp, $9,354,611 for 60,000 hp, or $11,909,100 for 100,000 hp. Additional cost would be involved in delivering power to other cities. The annual cost of maintenance is estimated at $859,610, $1,138,551, and $1,413,634, respectively. This includes interest at 4½ per cent and sinking fund for payment of entire plant in forty years. The cost of electricity at Toronto for twenty-four hour service would be $14.60 per hp per year if 100,000 hp were developed, $15.73 if 60,000 were developed, and $21.97 if only 30,000 were provided for. The rates at more distant cities would be higher, reaching $34.48 at Woodstock on the 30,000-hp development. It is figured that if 11 other cities join the 7 taking the initiative, the full 100,000-hp plant could be used.

GROSSCUP ON CORPORATIONS.—Judge Peter S. Grosscup, of the United States Circuit Court of Appeals, who recently put forth a plan for dealing with the problem of corporate encroachment by compelling corporations to incorporate under the Federal Government, simplify their financiering, and admit to a share in their management the many instead of the few, has an article in the June number of the *American Illustrated Magazine* on the subject. Judge Grosscup is against Government ownership except in the case of some municipalities and their public utilities. He declares that the remedy for the trust problem lies rather in public control through individual ownership, and in this article, which he calls "The Rebirth of the Corporation," he endeavors to show how with a foundation of national incorporation the problem would begin to solve itself. "The corporation," he says, "is no sin in itself. Ownership incorporated is no sin in itself. The corporation as the legal method of wielding large masses of individual resources to a common end has been one of the most helpful agencies of modern life. But the corporation left to do as it pleases—emancipated from all care as to its character and birth and all watchfulness of its conduct afterward—is the cause of the great sin that has grown up within the vast property domain covered by corporate ownership."

SPOKANE WATER POWERS.—In some recent special correspondence Mr. Frank E. Carpenter says of the water powers of Spokane: "The city lies in a valley on both sides of the rushing Spokane. This river here plows its way through a mighty gorge, over fall after fall, having a descent of 132 ft. in a quarter of a mile. The river, in fact, does the greater part of the work of the city. The falls have a minimum capacity of 32,000 hp, and of this 15,000 has already been developed. The river lights the city, turns its mills and factories, operates its street railways and travels over 100 miles of wire to the Cœur d'Alene mines, and carries there the electricity by which they produce about one-fifth of all the lead of the world. The energy of the Spokane River is enormous. In addition to the 32,000 hp which lies in the heart of Spokane, there are several million available hp in the river above and below the city. The Spokane has a big volume and it flows for a distance of 90 miles above and below here, through a gorge of such a nature, that factories can be built all along it. In this 90 miles the river falls 1,200 ft., or more than twice the height of the Washington monument; and the fall is such that it is estimated a horse-power greater than that of Niagara can be generated from it. The power is so situated, that turbines can be put in every three or four miles along the whole 90-mile gorge and each set of turbines will have a fall of 40 ft."

ENGLISH MUNICIPAL CONDITIONS.—Mr. Frank Jay Gould in a recent interview on his trip to England, where he looked into the question of municipal ownership, said: "In Great Britain this policy of municipal ownership has been so much encouraged that it has become a menace to the commercial enterprise of the nation. In the last ten years the national debt of Great Britain has doubled, but the municipal debt has been quadrupled. Over half of this increase in municipal debt has been expended on what are called 'reproductive undertakings,' such as tramways, electric plants, gas works, and slaughter houses. It would seem fair to assume that this large amount invested in enterprises which, we are told, bring revenue to the municipalities, would have an effect in reducing the rates of taxation, but this is not the case, as taxes have more than doubled. Probably between 50 and 60 per cent. of the community pay taxes directly; the balance, the laboring classes, who live in tenements or rent rooms in houses, pay taxes indirectly. The Socialist politician would lose much weight in his argument for municipal ownership if the laboring classes could be made to realize what a large proportion of their rents are taxes—that is, any increase in taxation effects a corresponding increase in the rents this laboring class must pay. One effect of municipal ownership in England has been that it is now impossible to get the same class of men in the City Councils as formerly, this expression of municipal enterprise makes it necessary to meet oftener and give much more time to city affairs, which they are unable to do, having their own business to attend to, and another and undesirable class is filling their places."

CLOSING MUNICIPAL PLANT.—The municipal gas plant at Hamilton, O., has been closed, as a source of loss to the city.

THE NAVAL BUDGET.—The naval appropriation bill to be reported this week includes $65,000 for the extension of the wireless telegraph system on the Pacific Coast.

TELEPHONE REGULATION.—The bill placing the telephone and telegraph companies under the supervision of the Massachusetts highway commission was enacted in both the Senate and the House of that State last week, and sent to the Governor for his approval.

FRANCHISES IN DENVER.—The complete returns of the recent municipal election at Denver, Colo., show that the Municipal Ownership city ticket was defeated. The Denver City Tramway and the Denver Gas & Electric Company twenty-year franchises were carried. The Denver Municipal Traction, Denver Terminal Railway and Union Pacific Railroad franchises were defeated.

TELEPHONY IN CHICAGO.—The Manufacturers' Telephone Company has applied for a charter through a committee of the Illinois Manufacturers' Association. Since 1901 the Manufacturers' Association has been carrying on a contest in the courts against the Chicago Telephone Company for reduced rates and improved service. It is proposed that the city shall be represented in the management of the new company and that the prices to be charged for telephone service shall be fixed upon consultation and co-operation with city officials. The city also is to participate in the profits.

LIGHTING IN NICARAGUA.—Vice-Consul A. O. Wallace, of Managua, reports that the city of Leon, Nicaragua, has given an electric light and power contract to Rene John La Villebouvre, an American residing at Managua. The city takes 100 arc lights of 1,200 cp each, and absolves the contractor from all taxes, gives him the free use of any municipal lands and all the building material for construction; also guarantees free of duty the importation of all needed machinery and tools for thirty years—the life of the contract. The plant is to be installed within eighteen months, and to be sold to the highest bidder at the end of the thirty-years' term.

ELECTRICITY IN COLOMBIA.—United States Consul F. P. Demers, of Barranquilla, notes a Colombian concession given Francisco E. Baena, president of the Barranquilla tramway, prolonging for thirty-nine years a previous concession. It includes the obligation to put into service modern cars, substitute electric traction and to extend the lines. Barranquilla has about 50,000 inhabitants. Soledad and Sabanalarga are respectively 6 and 36 miles distant. The company has also been granted an electric light franchise. The concession is of interest, it being the intention of Mr. Baena to develop the enterprise with American capital and equip the whole service with American machinery.

WATER POWER IN JAPAN.—United States Consul Hunter Sharp, of Kobe, writes that water power in Japan has hitherto been little developed. However, a notable development in the Kobe district for the generation of electricity appears to be at hand. Since the Russo-Japanese war the great increase in the cost of coal, more than 60 per cent, has caused various companies using steam to seek a more economical motive power, and with this object in view a number of undertakings are now in course of formation, the promoters being among the most prominent and influential business men in Japan. The most prominent of the proposed companies is the Ujikawa Electric Power Company, with a capital of $10,000,000 and a development of 40,000 hp. This company will furnish the city of Kyoto and vicinity with electric motor power. Among others is one for supplying Nagoya, where the power will be used by the Miye Cotton Spinning Company, Nagoya Electric Light Company, Nagoya Electric Tramway Company and the Atsuta Arsenal. It is also the intention of the Hanshin Electric Railway Company, of Osaka, which connects that city with Kobe, to use water power for generating the electrical energy required by its lines.

LIGHTING DATA.—The National Electric Light Association has issued to its members new editions of the bulletins dealing with rates for city lighting and for commercial lighting and power. These are extremely useful publications and in their latest form are greatly extended. The book on commercial rates now reaches a size of 127 quarto pages and is replete with information, although in compiling the data it has frequently been found necessary to condense considerably, more particularly where the discounts are on a long sliding scale. In such cases the complete scale is on file at the office of the association for the use of members. Revised editions are hereafter to be issued yearly.

POWER FOR CALCUTTA.—It is reported from British India that a scheme is being developed for the supply of electric power to the mills and factories along the Hooghly, the area served extending 25 miles to the northward of the town of Hooghly and 17 miles southward to Budge Budge, a total distance of 42 miles, embracing practically the whole of the works of the Calcutta district, which at present use over 100,000 hp. Besides power for industrial enterprises, electricity will be supplied in bulk to distributors and for electric traction and for lighting the premises of those using the power supply. It is not proposed to sell energy within the limits of Calcutta and Howrah, which are covered by the Calcutta Electric Supply Corporation; but trunk mains will be laid through these areas. The draft license asks for the adoption of two systems of supply—a two or three-wire direct-current supply at a pressure not exceeding 600 volts between the outer wires, and a single-phase or polyphase alternating-current supply at a pressure not exceeding 10,000 volts. The capital of the company which it is proposed to form has been provisionally fixed at $1,500,000, and will be issued in London; but the prospectus is not likely to be ready for some months at least.

WIRELESS IN SAN FRANCISCO.—In noting the San Francisco disaster, we referred recently to the general lack of any resort to the wireless telegraph system. Mr. L. M. Wright, first-class electrician on board the man of war "Chicago," sends us the subjoined interesting data: "In reviewing the published accounts of the San Francisco disaster in the April 28 number of the Electrical World, I take notice with pleasure the 'hearty word of praise' given to telegraph operators, but not knowing whether or no this includes the wireless telegraph operators I will take this opportunity to let the readers know the part the U. S. S. *Chicago* and operators played in alleviating the grave situation: At 8.05 a. m., April 18, when about twenty-five miles from San Diego, Cal., we received word from the De Forest wireless station at that place that an "Earthquake had about demolished San Francisco and fires breaking out," followed by another message confirming the report. These facts were given to the officers, and shortly we were proceeding to the scene with all possible haste. We were in constant touch with shore by wireless during this entire trip and kept bulletins posted of existing conditions in San Francisco. Long before our arrival every preparation was made for landing parties. On account of the chaotic condition that existed, the wireless seemed the only system whose wires were not down. The military and municipal authorities, and the general public realizing this, we were flooded with messages many of which were of considerable importance, as they were bulletins keeping the government authorities in Washington, D. C., informed as to the situation. This busy time lasted about two weeks, during which time the *Chicago* alone sent and received over 1,000 messages, while the other stations at Mare Island Navy Yard, Yerba Buena training station and the Farrallone Island were also kept very busy."

West Brighton, Coney Island, from the Ocean.

Electric Lighting at Summer Resorts on the Atlantic Coast.

THE extended use of electricity in summer resorts presents so many possibilities and is so manifestly advantageous to large central stations during the season when the normal demands on electric systems are lowest, that it would seem that more energy might be devoted by electric light companies towards creating a field and a demand for their surplus capacity during the summer months. Whatever efforts have been made in this direction have brought good returns, and although governing conditions are so different as to forbid the adoption in toto in any locality of methods or policies that have made for success in one instance, still these policies are worthy of careful attention and study, being pregnant with suggestions that might be of service. It is only within recent years that electricity has been used to any great extent in summer resorts, and even now the possibilities that lie dormant are greater than one would imagine.

When, ten years ago, the Brooklyn Edison Company began to further the use of electricity on Coney Island and kept promoting its use with increased zeal each successive year until Coney Island became the brightest spot in the world, other companies, being quick to perceive the possibilities open to them, followed in its steps and diminutive Coney Islands sprang up in various parts of the country. The amusement park idea also became very popular with the electric railway companies, and at the present time almost every railway company of importance either operates an amusement park of its own or runs to one maintained by other interests. All of these undertakings depend for their success on the use of electricity on a large scale.

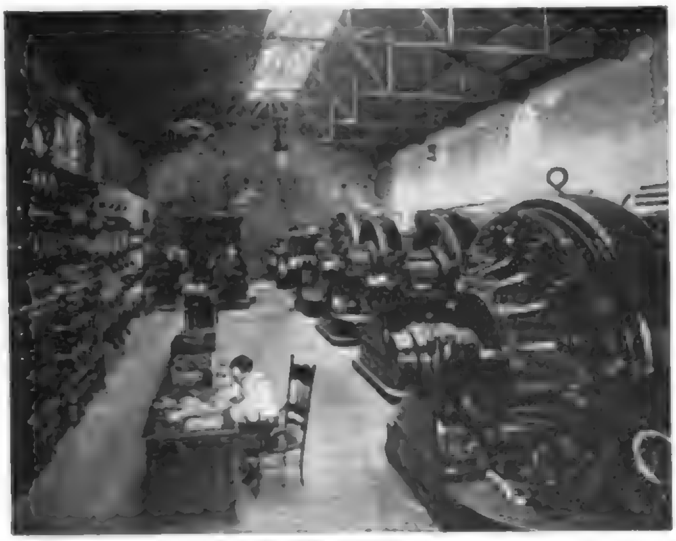


FIG. 1.—WEST TWELFTH STREET SUB-STATION, CONEY ISLAND.

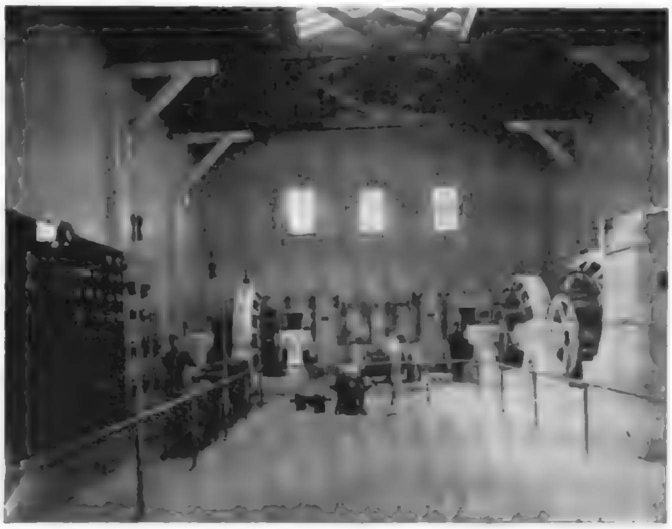


FIG. 2.—INTERIOR OF DREAMLAND SUB-STATION.

Many cities, to be sure, are not so fortunate as to have such summer resorts as Coney Island so near their doors; but there are many resorts within transmitting distance of most large cities which would furnish an outlet for the surplus energy of large central stations. While it is the purpose of the present article to describe the lighting of some of the best-known resorts along the Atlantic coast, it would probably not be amiss to point out how these might possibly be fed with energy from a distant station with profit. At Long Branch and Asbury Park, for instance, there are small companies doing well in spite of uneconomical power stations, the greater part of whose equipment is idle most of the year. Coal costs considerably more in these towns than at points on trunk lines, and the maximum demand in summer is such that a fair-sized station favorably situated could supply it, with energy to spare, for the intervening towns. The distance from Jersey City to Asbury Park, for example, is about 40 miles. There would in most cases be little doubt but that from a plant of good design, a number of small towns could be lighted with more profit than with a small steam plant in each town. It would probably also be possible to do electric lighting in towns too small to support an independent lighting station. The business would require good management to make it pay, but large companies with their economical plants and with the talent at their command should be able to do this work at considerable profit.

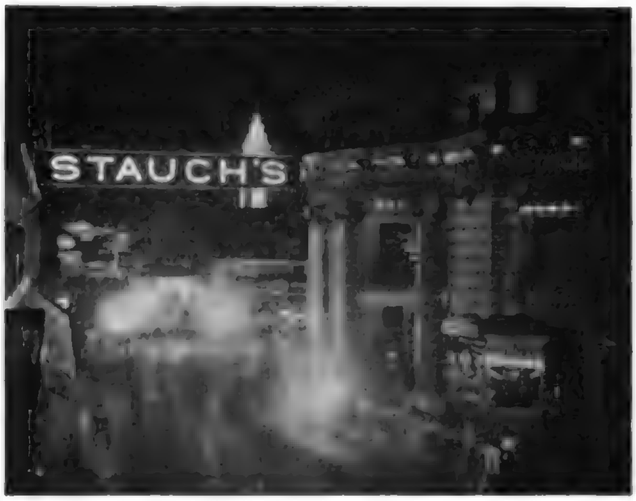


FIG. 3.—CONEY ISLAND'S ONCE-FAMOUS BOWERY.

A station at Camden could feed Atlantic City and all the intervening towns during the summer with energy, the same equipment being used to supply Philadelphia during the other months of the year. Metropolitan stations may find more profitable outlets nearer at hand, and there may be conditions which might render the transmission of energy to such places unadvisable; but these cases are cited merely as possibilities, the difference in the price of fuel alone making them attractive.

CONEY ISLAND.

Ten years ago there was practically no source of illumination on Coney Island other than gas and kerosene oil. Early in 1897 the Brooklyn Edison Company extended its lines to Coney Island, the first contract being made on March 31 of that year for 75 incandescent lamps. The company did a big business from the start and with the advent of the electric light Coney Island was completely transformed. It began to grow in public favor. The little beer sheds, flimsy music halls and museums with their "barkers" soon dwindled away in the glare of the electric light, and the brilliant and artistic Coney Island of to-day is the result.

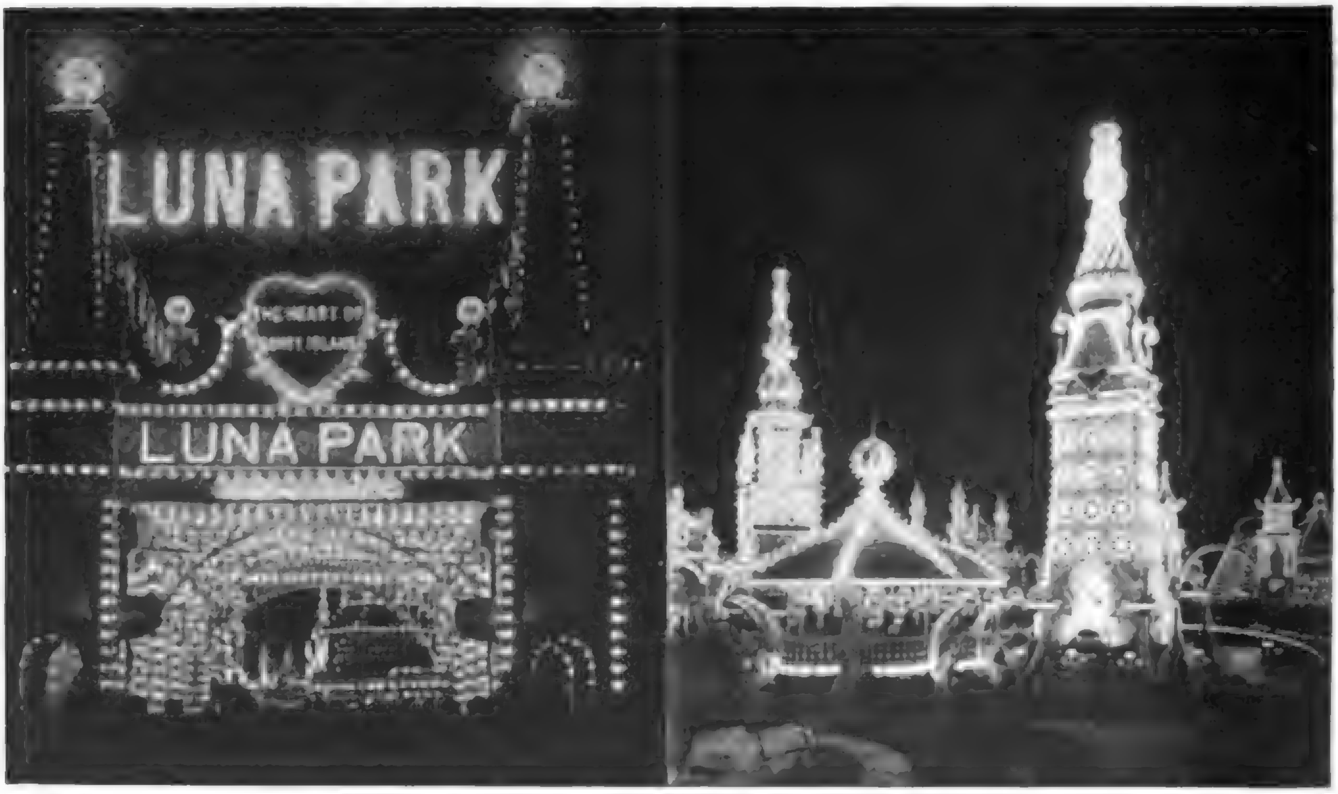


Fig. 5.—Entrance to Luna Park and Towers Near the Lagoon.

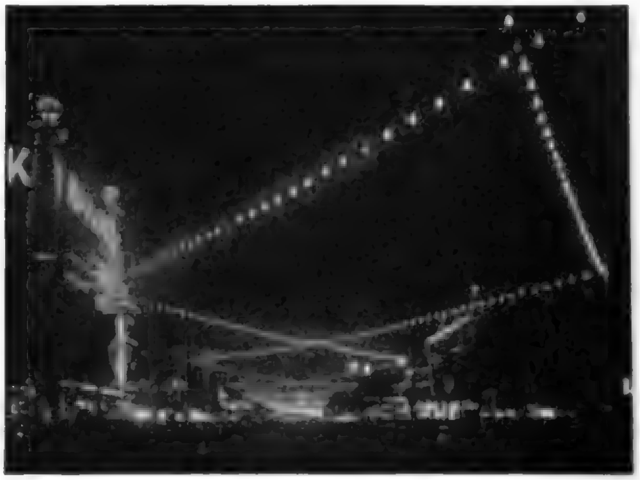


FIG. 4.—SURF AVENUE DURING THE MARDI GRAS.

In point of popularity Coney Island probably surpasses every other resort in the world. Every means of transportation is taxed to the uttermost in carrying passengers. From dusk until long after midnight the place is ablaze with light and surging crowds move from one attraction to the next. The summer season at Coney Island begins more than a month earlier and extends long after that of other resorts along the coast. It is a matter of record that shortly after the inauguration of a reliable electric service, electric lighting became an important and necessary factor in the development of the gigantic places of amusement, and their most attractive feature.

With the exception of a few small isolated plants here and there, all of the electricity used on Coney Island is supplied from the Bay Ridge station of the Brooklyn Edison Company, six miles distant. Twenty-five-cycle, three-phase current at a potential of 6,600 volts is transmitted to sub-stations at Coney Island by four underground three-phase feeder lines, two of which go direct to a sub-station in Dreamland and two to the Edison sub-station on West Twelfth Street. In addition there are also two overhead three-phase transmission lines from the Bay Ridge station to West Twelfth Street. The Dreamland sub-station of the Edison company contains three 1,000-kw rotaries and two 100-kw, 125-volt rotaries used for balancing the three-wire system. The rotary converters in the West Twelfth Street station have an aggregate capacity of 4,400 kw, and there is in addition 60-cycle alternating-current apparatus having a capacity of 400 kw, and six 125-light Brush arc machines for city lighting in outlying districts. All the apparatus in the sub-stations is capable of a 50 per cent overload for four hours, and in addition there is a "pilot" circuit connecting the Dreamland sub-station with the station on West Twelfth Street. This circuit feeds pilot lamps for emergency lighting in Dreamland in case of mishap, and also carries the early day load in the latter place. The Bay Ridge station is tied to the Gold Street station of the Edison Company, the latter station having been recently entirely overhauled. All of the reciprocating engines have been taken out and steam turbines installed in their place. There is at present installed one 5,500-kw unit and one 7,500-kw unit. The equipment in the Gold Street station will eventually consist of eight 7,500-kw turbo-generators and one 5,500-kw unit.

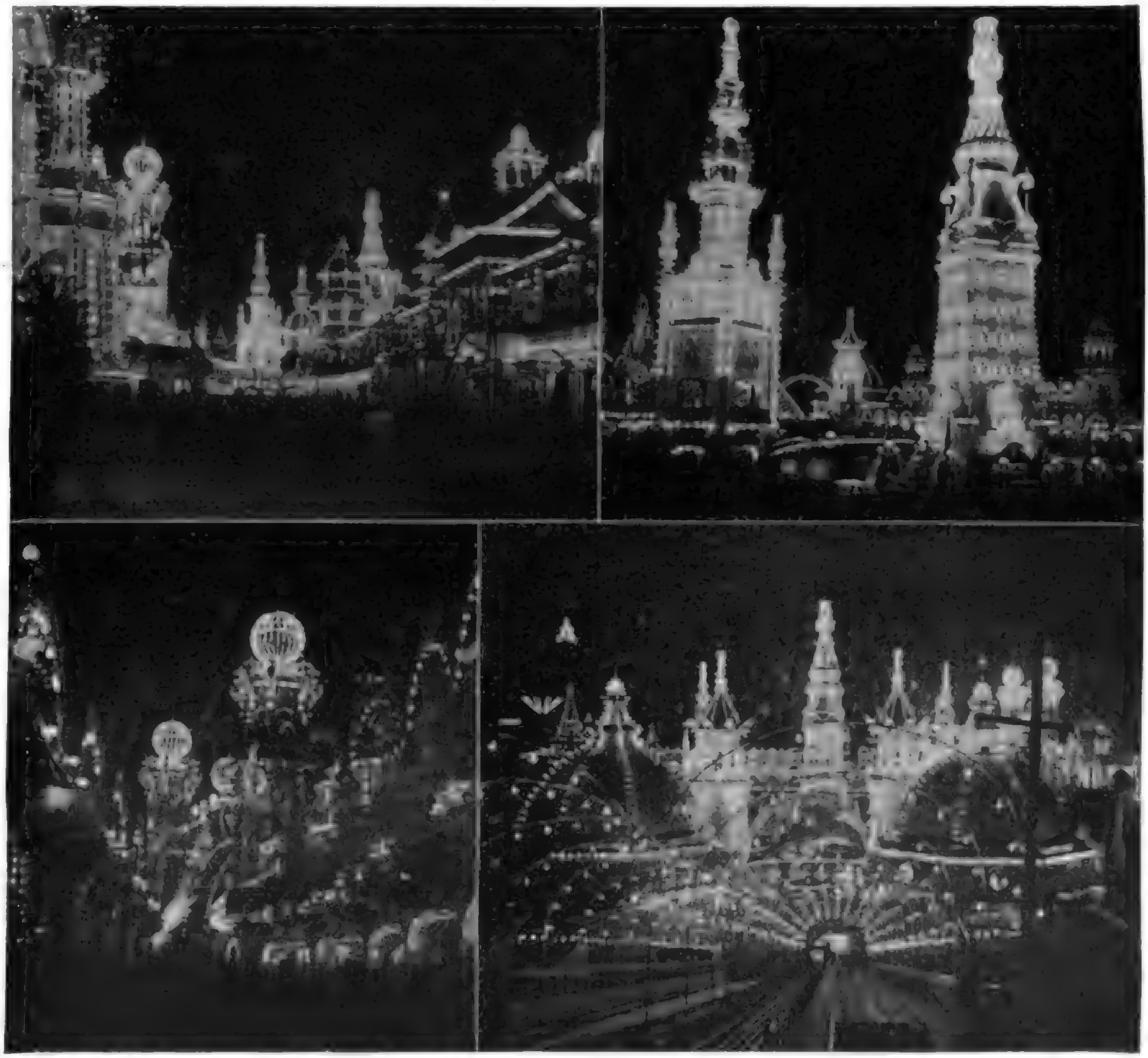


Fig. 6.—Night Views of Luna Park, Showing Lavish Use of Electricity.

Electricity is used for all sorts of purposes at Coney Island; but the major portion is used for purely decorative lighting. The Dreamland station supplies Dreamland exclusively, while Luna Park and all the other attractions are supplied from the West Twelfth Street station. There is also a small sub-station maintained at Brighton Beach for supplying "Pawnee Bill's" show at that place. The capacity of this latter station is 400 kw, fed by high-tension feeders from the West Twelfth Street station at West Brighton.

The winter load at Coney Island is about 125 kw. The load is increased on Saturdays and Sundays during April and from May 1 to the middle of May, when the large attractions open, the load assumes large proportions. Last May this was 2,875 kw on the West Twelfth Street station and 3,100 kw on the Dreamland station. The maximum load comes on about July 4, when the load on the West Twelfth Street station reached last year 3,625 kw, and that at Dreamland 3,500 kw. This was for purely decorative lighting on the three-wire system at West Brighton and does not include the electricity consumed in the outlying districts. The day load at Coney Island during the summer is about 500 kw.

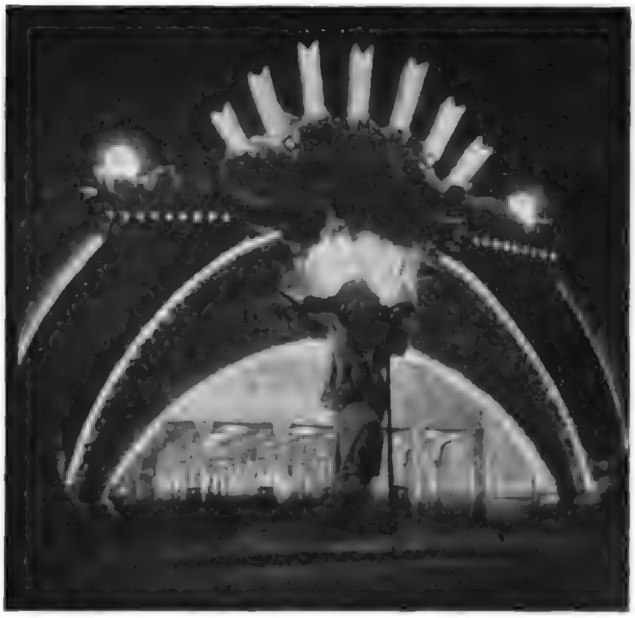


FIG. 7.—ENTRANCE TO DREAMLAND.

It is curious to note what changes have been brought about by the use of the electric light in Coney Island and also how the well-known fact that people will travel where there is light is here corroborated. The famous Bowery always mentioned in the same breath with Coney Island, has dwindled into insignificance, and the previously-deserted Surf Avenue has suddenly jumped into prominence, and only because of the electric light. The Coney Island season winds up in a blaze of glory late in September in the so-called Mardi Gras Carnival, now an annual and notable feature at this resort. The carnival usually extends for a week and during that time the largest crowds visit Coney Island. Surf Avenue is then a solidly packed mass of humanity. In addition to the usual brilliancy of the electric illumination at the Island, thousands of incandescent lamps are strung across Surf Avenue, where the carnival procession takes place.

The tremendous success of every really high-class amusement enterprise established at this picturesque resort has attracted the eye of the capitalist to a formerly undreamed-of extent, and competition for the patronage of the public has resulted in the establishment of amusement parks that vie with one another in the lavish use of the incandescent lamp. The pioneers in this line were Messrs. Thompson and Dundy, who established Luna Park in 1903. The photographs reproduced herewith give but a faint idea of the rare beauty of this great enterprise with its towered and turreted structures illuminated by over 110,000 incandescent lamps. These illustrations show Luna Park as it is to-day, the photographs being taken a few days after the place was opened for the season. It is impossible to picture the radiant splendor of this park when its hundred thousand lamps are lighted, and shed their rays upon attractive buildings, decorative devices, the waters of the lagoon, the winding walks, etc. It is a great demonstration of the combined beauty and utility, and above all, of the advertising value of the electric light.

As may be gathered from the various engravings, the buildings are all outlined in light against the background of the sky after nightfall. The eaves, ridges, turrets, spires, domes, etc., are all outlined by 8-cp incandescent lamps, studded usually two feet apart where this is possible and much closer nearer the ground, so that the outlines are perfect. There is not a single hiatus to be filled by the imagination nor is there any blinding glare to mar the effect or to create discomfort. Electric motors are used to drive all moving machinery. A new attraction to be called the "White Horse Rapids" will utilize 700 hp in motors to drive the centrifugal pumps. These motors will be fed direct with 6,000-volt current. The proprietors had already purchased a complete steam equipment to drive these pumps, and while this was yet on the cars the Edison company made an arrangement with Messrs. Thompson and Dundy whereby they took the equipment off the latter's hands and installed three-phase induction motors instead. The steam equipment heretofore used to drive the pumps feeding the chutes was also supplanted by electric motors.

The lamps are in circuit for about five hours every night. Fourteen concentric lead-covered feeders of 1,000,000 circular mils encompass the entire park. These feeders are tapped at intervals, switches being arranged so that any feeder or any section may be cut out. The feeders are all underground, and each building is controlled separately, a separate board being provided for the decorative lights. The wiring for the most part is exposed knob and tube work, the lamps being removed in winter and the sockets plugged. The electricity delivered to every building is metered, readings being taken weekly. The Edison company maintains about 70 meters in the park. Bills are rendered weekly and payments are made weekly. As an addition to the decorative lighting there are 2,500 miniature alternating-current lamps distributed in the foliage of the flower garden around the bandstand. These lamps are fed through a transformer. Mr. H. S. Thomas is the electrical engineer for the proprietors and it is he who planned the entire decorative lighting features.

Dreamland was opened by a syndicate in 1904, and surpasses Luna Park in the number of electric incandescent lamps connected in circuit. The lamps here are spaced not more than 12 in. apart and are 8-cp in size. The lighting scheme culminates in a tower which rises into the air a height of 260 ft. This is doubtless the most brilliant and striking example of spectacular

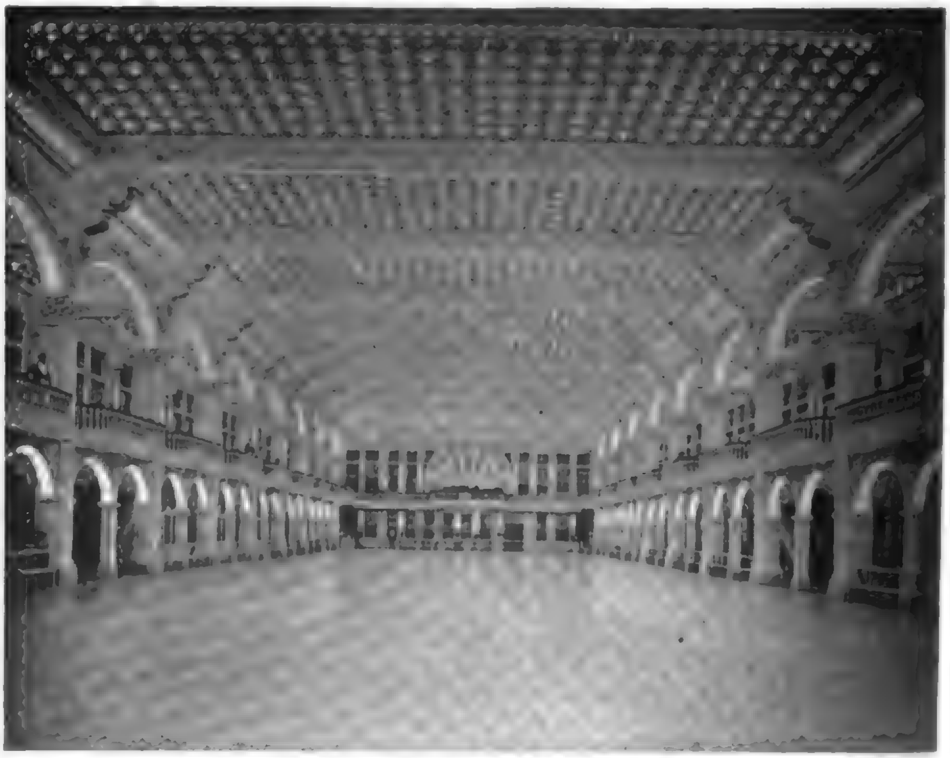


FIG. 8.—THE BALL ROOM ON THE OLD IRON PIER IN DREAMLAND.

illumination ever produced. The nearest approach to it was the electric tower at the Pan-American Exposition in Buffalo, which in its time called for much praise. The Dreamland tower contains considerably more electric lamps than did the tower at Buffalo, and it is distinctly visible from the Jersey coast. A near view is given of this tower, and some of the illustrations also show it as seen from a distance. These pictures portray better than words the splendor of this illuminated tower. There are, of course, other attractive features of Dreamland as the engravings show. The entrance with its supporting figure of heroic proportions and its many lamps, the various show buildings, many of which are open for the first time this season, and the immense ballroom on what was formerly the old iron pier, are all worth mention. The ballroom lighting is very brilliant and the light distribution has been the subject of much favorable comment. There is also about 750 hp in motors which are used for many and varied purposes.

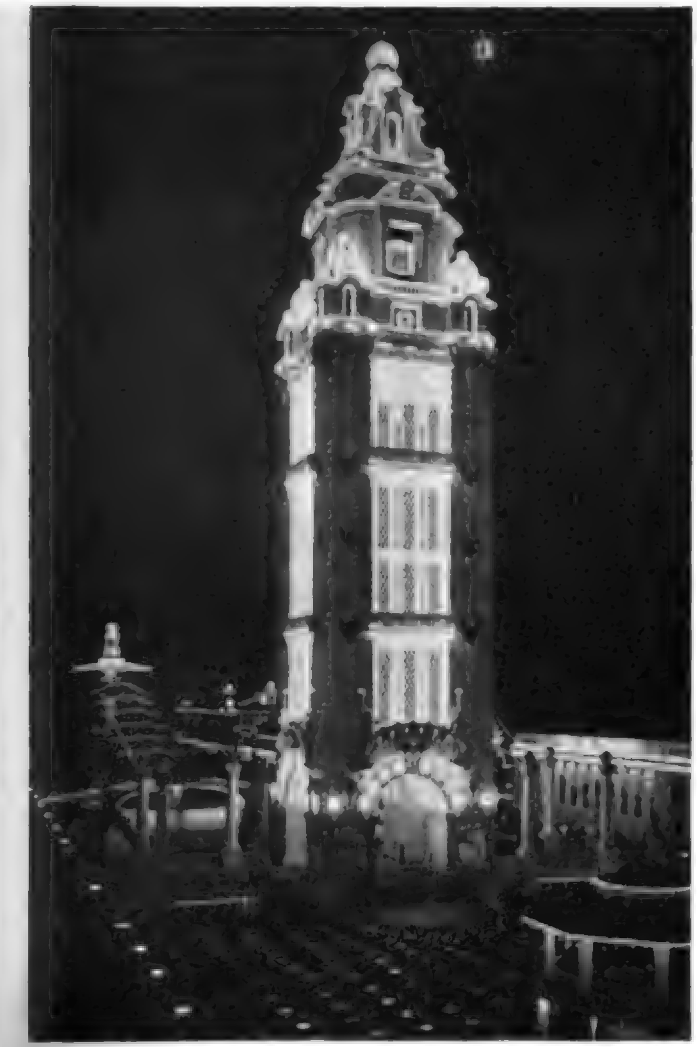


FIG. 9.—DREAMLAND'S MAGNIFICENT TOWER.

FIG. 10.—SURF AVENUE FROM BRIGHTON BEACH, SHOWING DREAMLAND ON THE LEFT AND LUNA PARK ON THE EXTREME RIGHT.

The Dreamland sub-station, which is owned and operated by the Brooklyn Edison Company, is housed in Electricity Building to the right of the tower. The front of the building is made to imitate the appearance of a rotary converter and the transformers and rotaries are painted white so as to give the station an ornamental finish. The machinery is all visible from the walk, but to those unacquainted with electrical apparatus the technical merit of the installation is lost. Separate feeders are run from the sub-station switchboard to each building interior and wherever it is possible to do so, the decorative lighting on the buildings is similarly connected. The feeder circuits are all run underground.

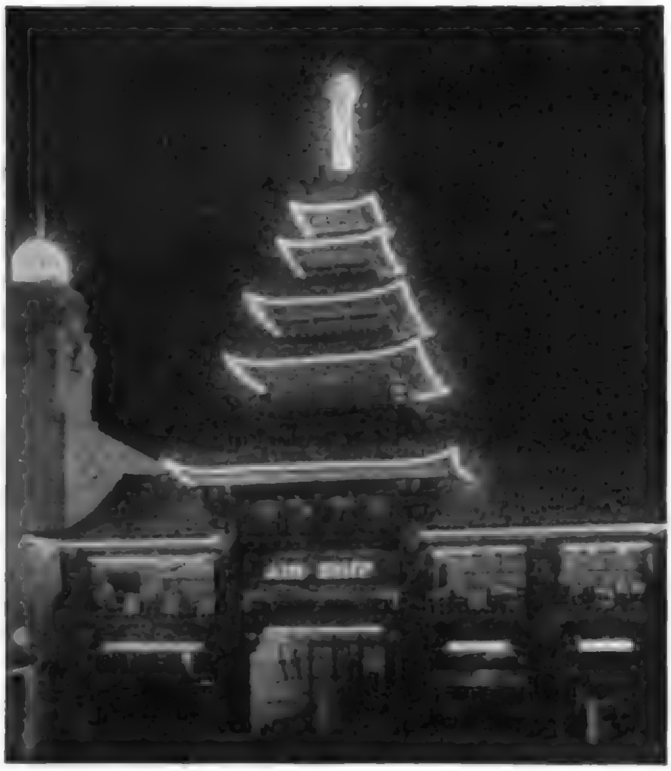


FIG. 11.—NOVEL ATTRACTION IN DREAMLAND.

The once famous Bowery still draws its crowd, and this thoroughfare has been considerably improved since the fire a few winters ago, which wiped out most of the resorts between Surf Avenue and the sea. In nothing is the improved character, the artistic development and the greater stability of the new Coney

Island more manifest than in the buildings which have been erected to replace those destroyed. Electricity is largely used along this walk, and though there is little hope of its ever regaining its former popularity, the tone has been considerably elevated.

There are many amusement enterprises on Surf Avenue requiring a large amount of electricity, such as the Galveston Flood, Trip to the North Pole, The Deluge, The Rocky Road to Dublin, not to mention the many caroussels, restaurants, signs, etc., which likewise use electricity. The use of large electric signs on the Island is increasing rapidly, advertisers appreciating the value of this form of display in so popular a resort. Last year Brighton Beach Park was laid out and improved, and naturally many thousand electric lamps were used. The attraction at this place this season will be "Pawnee Bill's" show, a performance of the Wild West variety, and arrangements are being made for the lavish use of electricity at the entrance and also in the enclosure where the performance is given. Another interesting development brought out at Manhattan Beach are the picturesque Japanese tea gardens and theatre. These are prettily laid out in Oriental fashion with little islands and artificial waterways, Japanese pagodas, tea booths and houses. The whole is adequately lighted at night by incandescent lamps. The boardwalk leading from Ocean Parkway to Brighton Beach is effectively lighted at night by festoons of incandescent lamps strung from pole to pole along the outer edge of the walk.

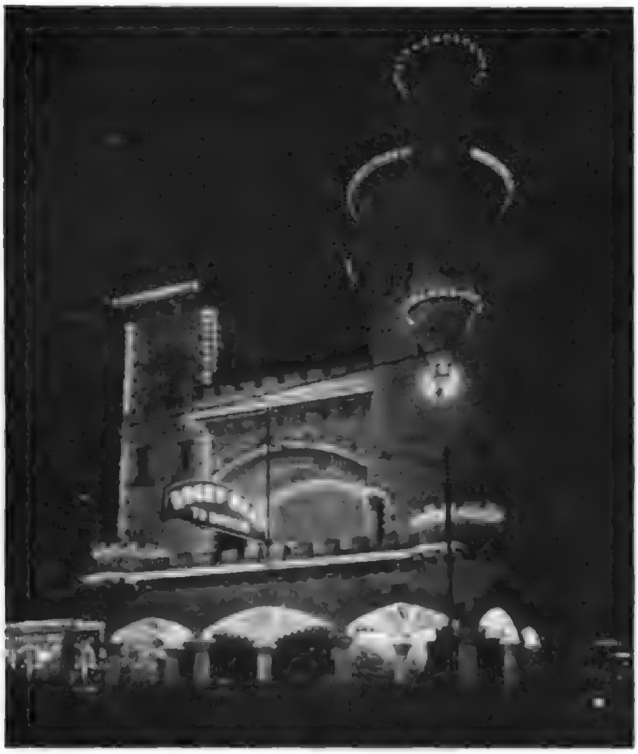


FIG. 12.—ROCKY ROAD TO DUBLIN.

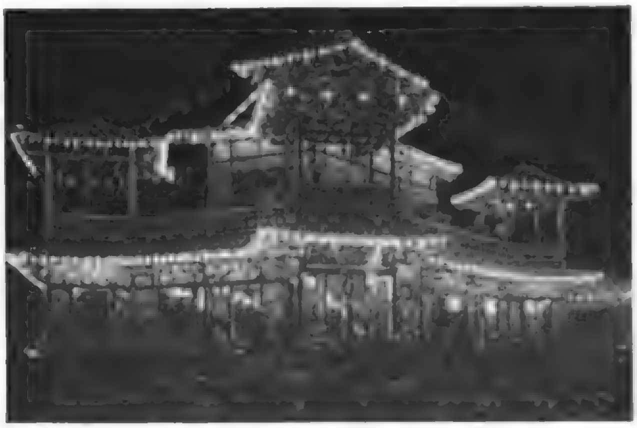


FIG. 13.—JAPANESE TEA GARDENS AT MANHATTAN BEACH.

The effect of the Coney Island lighting upon the load curve of the Brooklyn Edison Company is graphically indicated in the curves presented herewith. These will probably be of more interest to central station men than the mere recital of how and where the electricity is used. The curves are those of maximum winter load and of maximum summer load, in 1905. The most striking and significant feature of the curves is the illustration of the fact that more machinery was required to handle the summer load than was required to handle the maximum winter load six months later, which is a rather unusual feature in central station operation in large cities. While the peak load in December is naturally broader owing to the shorter day, the peak load in summer has a breadth which is not at all insignificant, lasting as it does for four hours.

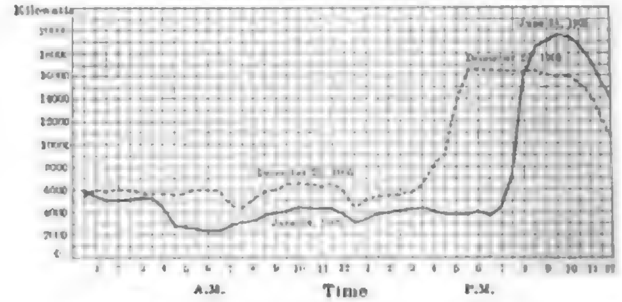


FIG. 14.—CURVES SHOWING MAXIMUM SUMMER AND WINTER LOADS.

A number of minor but still important amusement resorts are located almost as closely to New York City as Coney Island, and in each of these electricity is used to a very great extent. These miniature Coney Islands are known as North Beach, South Beach, Bergen Beach, Rockaway Beach, etc. The first is situated on Long Island Sound and the last on the Atlantic. The other two are situated on the bays close to the ocean.

ATLANTIC CITY.

Atlantic City, N. J., is one of the famous watering places on the Atlantic coast. A thousand hotels are located on this stretch of beach swept by ocean breezes, and these open wide their hospitable doors to over 200,000 sun-scorched dwellers of the cities during the summer season. Nowhere are the comforts greater, apartments more palatial or cuisine better. Its hostelries command the admiration of tourists who have traveled over the world and tested the hospitality of the greatest hotels on the continent of Europe.

Atlantic City is first and foremost a pleasure resort, and in order to retain its position among the leading resorts it has striven by every legitimate means to provide its patrons with everything conducive to their entertainment and pleasure. The chief attraction of the city is its famous boardwalk, extending for miles along the silvery shore of the Atlantic Ocean. This walk is the objective point of every man, woman and child visiting Atlantic City, and fully 80 per cent of its visitors spend practically all of their time on this esplanade.

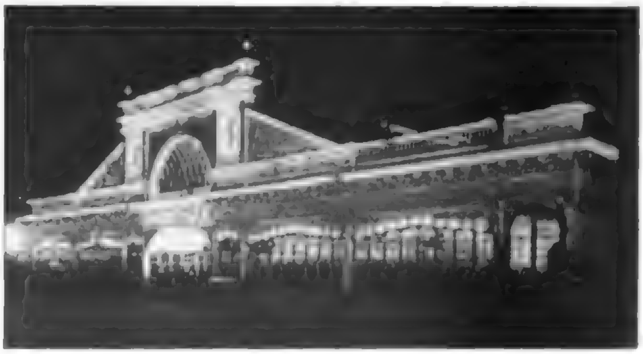


FIG. 15.—YOUNG'S PIER, ATLANTIC CITY.

Extensions and improvements have been made to this walk from time to time, for the authorities realized that if Atlantic

City was to retain the good wishes of the visiting public the attractiveness of this walk must be maintained. This had been done very fully and satisfactorily so far as its condition by day was concerned; but the boardwalk was as popular by night as by day, and very little was done to make it bright and attractive by night. Last summer, however, after considerable discussion, and with scarcely enough funds available for the purpose, the city made a contract with the Atlantic City Light & Power Company "for 8,432 incandescent lamps of 4 and 25 cp to be strung lengthwise and crosswise and at angles over the boardwalk in a fashion to make the ocean front on a summer's evening like unto a scene from the fairy land." The contract price was $5,583 and covered the cost of erecting wires and lamps, the latter to be frosted, supplying the electricity and maintaining the illumination for two months, the lamps burning four hours each night.

We are informed that this illumination attracted more attention and actual money-producing income than any other improvement made in the resort for years. Besides, the immense popularity of the boardwalk illumination stirred the hotel and business men of the cross streets to an imitation of this addition of beauty. In many cases these interests extended the scheme of lighting on the cross streets so as to attract the thousands to these streets and consequently away from the dark and dismal thoroughfares, for they appreciated the fact that people would travel wherever there was light.

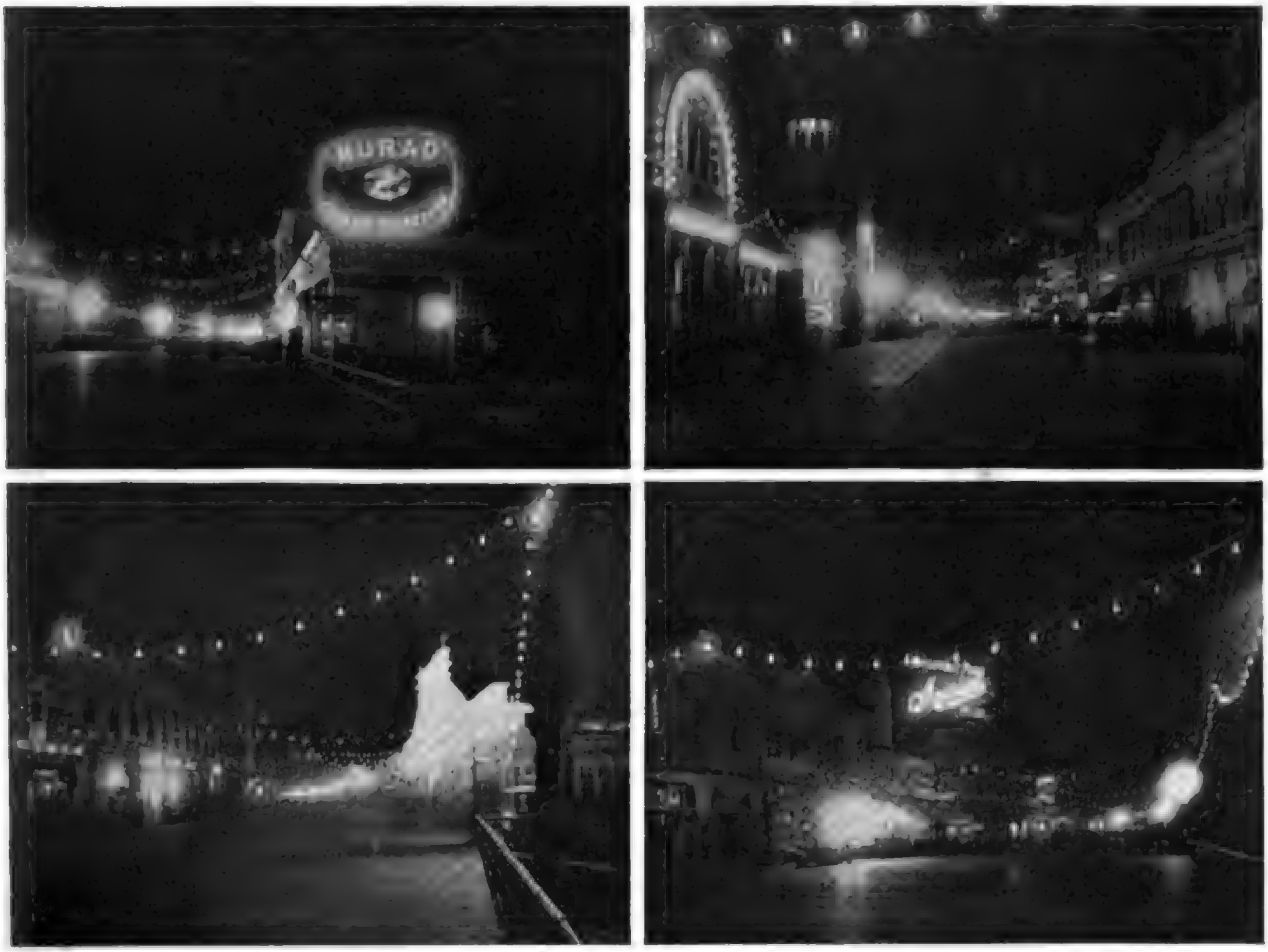


FIG. 16.—NIGHT VIEWS OF ATLANTIC CITY'S FAMOUS BOARDWALK.

The boardwalk is 4⅛ miles long and varies in width from 20 to 40 ft., while between Illinois and Maryland Avenues the walk is 60 ft. wide. The accompanying illustrations show sections of the boardwalk lighted at night. These pictures were taken late in May, the lamps being lighted specially for the purpose. The city contract only calls for the lighting of the lamps during the months of July and August, but they are also lighted on special occasions, when large conventions are being held. The photographs hardly do justice to the lighting of this walk at night, since the season had not yet begun, and many of the store windows along the walk were in total darkness. The illustrations, however, show the arrangement of the lamps well. On the outside of the walk at the foot of each street is an enclosed arc lamp. A steel wire is drawn taut between the poles for the purpose of supporting the festoons of lamps arranged along the outer edge of the walk. There are about five loops between each pair of poles, and where these are caught up and fastened to the steel wire is a 25-cp lamp. Spaced every two feet on either side of the 25-cp lamp are 4-cp lamps, there being 30 lamps to a streamer. The festoons which are arranged at right angles to the walk are spaced 70 ft. apart. These are likewise supported from a steel wire, a 25-cp lamp being placed in the center of the streamer, where it is caught up and fastened to the supporting wire.

The lamps are fed from alternating-current mains running on the pole line along the outer edge of the walk. Within reach on each pole is a switch controlling these decorative light circuits. Extending from the boardwalk out into the Atlantic are a number of steel piers almost as famous as the boardwalk itself. These are known as Young's Ocean Pier, Steeplechase Pier, Atlantic City Steel Pier and Heinz Pier. The piers with their numerous buildings are outlined with electric lamps, which when lighted at night make a very attractive picture. Young's Pier has about 4,000 incandescent lamps connected in circuit; the Steel Pier has a like number and the Steeplechase Pier has about 2,300 lamps. The Heinz Pier is lighted with arc lamps and has a monogram sign over the building at the end of the pier containing 3,000 lamps. On this sign is spelled out the name of every one of the "57 varieties." There is at present building beyond Young's Ocean Pier, and below the Marlborough-Blenheim a new pier of steel and reinforced concrete to be known as the New Young's Pier. Work on this is being rushed so as to have it ready for the summer season, and it is estimated that over 10,000 incandescent lamps will be used on this pier. Nearly all of these piers are supplied with their own lighting plants; the Steel Pier has a 220-volt, direct-current outfit, and Young's Pier, where the Electric Light Convention is to be held, is lighted from an isolated plant supplying alternating current.

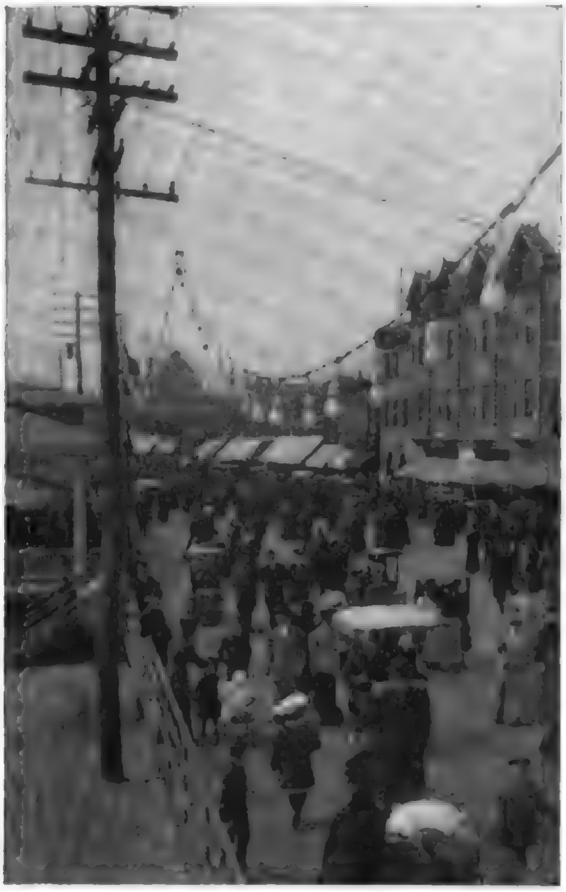


FIG. 17.—ATLANTIC CITY'S BOARDWALK, SHOWING ARRANGEMENT OF LAMPS.

The largest and best hotels in Atlantic City front on the boardwalk and face the ocean. Most of these are open all the year, Atlantic City having mild winter weather, thus making it also a fair winter resort. Thirty of the large hotels are equipped with their own lighting plants, the exhaust steam from the engines being used for various heating purposes. An information bureau is being established at Atlantic City this year and every effort is being made by the association of hotel men to make it a convention city, which it is undoubtedly fast becoming. The main drawback heretofore has been the absence of a suitable convention hall. This year there is being erected in front of the New Young's Pier a $1,000,000 Hippodrome. This is to be equipped with an isolated plant, and will require a considerable amount of electricity. It is also expected that this building will serve as a convention hall, sufficient seating capacity being provided for the largest conventions ever held. This building will be built of reinforced concrete, and it is expected will be ready sometime this summer.

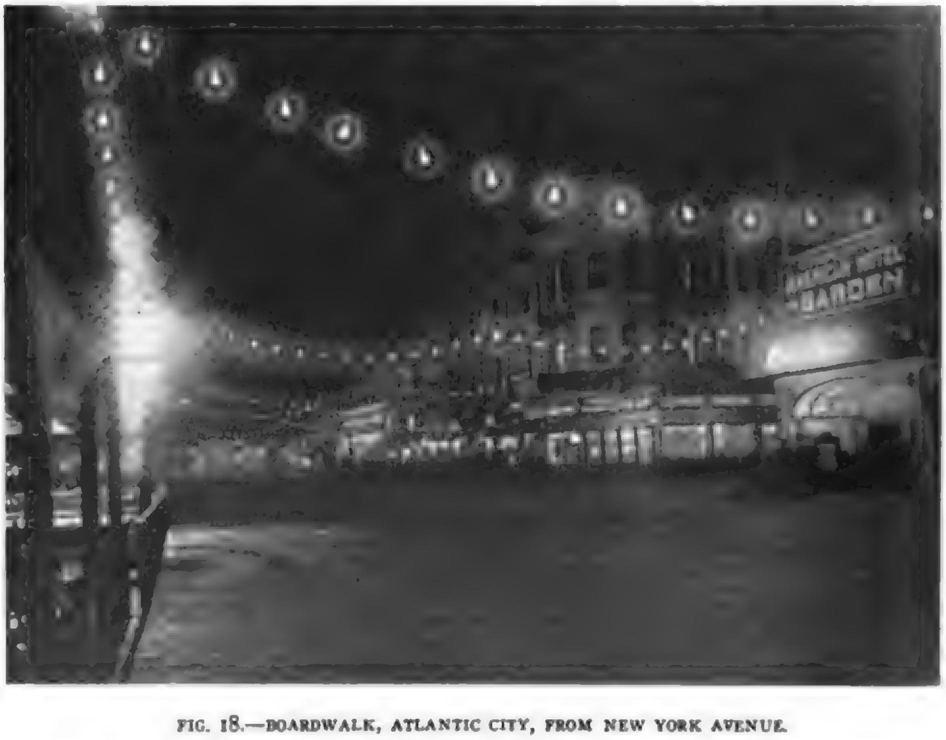


FIG. 18.—BOARDWALK, ATLANTIC CITY, FROM NEW YORK AVENUE.

Nearly all of the smaller hotels are supplied with electricity by the Atlantic City Light & Power Company, and the amount of temporary lighting done by this company is considerable. The company supplies electricity for over 500 electric signs, the largest of which are rated at 30 kw. Every hotel dignified by a name has an electric sign of some sort, and on the boardwalk a number of large signs are placed on the roofs of buildings wherever this privilege can be obtained. The boardwalk signs have no local significance, being rented by large general advertisers. A city ordinance prohibiting the placing of signs of any description over the walks is rigidly enforced, so that signs must be placed on the roofs of low buildings or within the building lines.

All of the electric light circuits in Atlantic City are overhead. Alternating current at a frequency of 125 cycles and direct current on the three-wire system are available, the latter being used principally for motor circuits. Transformers are placed on poles for stepping down the 2,000-volt, single-phase current to 220 volts for commercial lighting circuits. The company supplies 900 9.6-amp. direct-current series arc lamps and 100 6-amp. enclosed alternating-current series arc lamps, in addition to about 40,000 alternating-current incandescent lamps. The motors connected to the company's circuits are used chiefly to drive elevators in the hotels. The street lighting is done by 450 arc lamps on an all-night basis at $75 per year. The rate for commercial lighting ranges from 16 cents to 8 cents per kw-hour, depending on the quantity used. Two years ago gas sold at $1.50 per thousand cubic feet, when a franchise was granted to a new gas company. Competition between the gas companies has resulted in a rate of 90 cents per thousand cubic feet, which price is now fixed by ordinance. There is little or no competition, between the gas and electric light companies, the former devoting all their energies to fighting between themselves. A franchise was, however, recently granted to a new electric light company, known as the Atlantic City Suburban Electric Light Company. No effort has been made thus far to utilize this franchise.

A determined effort has recently been made by the authorities and hotel men to beautify the city, and one of the first improvements recommended is the removal of all the electric light poles and wires from the boardwalk, the city granting the electric light company permission to fasten these to the beams supporting the boardwalk where the telephone and signal wires are now placed. The Underwriters also recently compelled the appointment of a city electrician, who has supervision of all electric wiring installed in Atlantic City. The city now makes the inspection and collects the fees instead of the Underwriters. These latter found that while they could compel wiring according to the code in buildings insured, they had absolutely nothing to say in the wiring of a building adjoining, if it happened to carry no insurance, though this nevertheless constituted a risk. Applications must now be filed with Mr. A. C. Farrand, the city electrician, who grants a permit for the work, which must be installed according to the latest edition of the National Electric Code. When the work is complete it is inspected and if found satisfactory a certificate to that effect is granted. This bureau has now been in operation about two years.

The lighting load at Atlantic City is peculiar, being large in summer and very small in winter. For about two months of the year the company has a demand for all the electricity it can generate and more, while the winter peak is about one-fifth of the summer peak. The city, however, is rapidly building up and becoming popular as a winter resort.

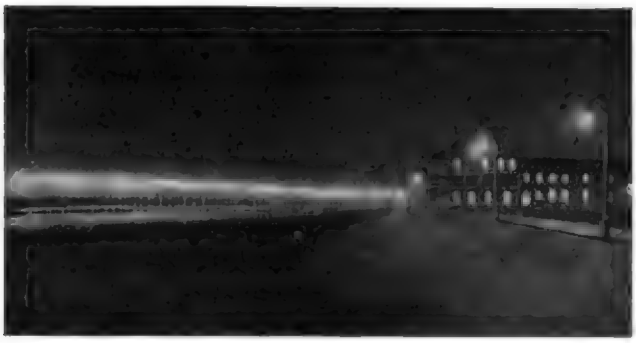


FIG. 19.—PROPOSED LIGHTING OF OCEAN AVENUE AND BOARDWALK, LONG BRANCH.

The Pennsylvania Railroad Company has recently decided to change over the motive power of its West Jersey & Seashore branch from steam to electricity. This road is 64 miles long and runs between Camden and Atlantic City. Over this roadbed an express service will be established, the initial installation providing for a three-car train every 15 minutes between Camden and Atlantic City, making the 64 miles in 80 minutes without stops. Each car will be equipped with two 200-hp direct-current motors. Electricity will be supplied for the most part through a third rail, with here and there short stretches of overhead conductors. The power house will be located at Camden, and the electricity will be generated by three 2,000-kw, 25-cycle, three-phase turbo-generator sets. Six sub-stations located between Atlantic City and Camden will be supplied with electricity at a potential of 33,000 volts, which will be stepped down and converted into 650-volt direct current. The contract calls for the completion of this road by July 1, 1906, in order to take care of the heavy summer traffic. If, as has been rumored, this increase in train service between Philadelphia and Atlantic City will also be accompanied with a decrease in the rate of fare, the possibilities for an increased use of electricity at Atlantic City are very promising. The normal population of Atlantic City is at present about 28,000, and this is swelled to about 200,000 during July and August. Sooner or later some sort of attraction like Dreamland and Luna Park of Coney Island will find its way to Atlantic City, for it is not reasonable to suppose that almost one-quarter of a million people will be forever content with a boardwalk and an excellent surf; and the attraction which uses the most electricity is the one that will pay best. The only places of amusement are located on the piers and these will be supplemented this summer by regular attractions in the new Hippodrome, which has a seating capacity of over 4,000, and which will be managed by Nixon and Zimmerman, of Philadelphia.

LONG BRANCH.

Long Branch, N. J., has a population of about 9,000, which is increased many hundred per cent by the influx of visitors during the summer season. The town is lighted by the Consolidated Gas Company of New Jersey, which company also lights from this station Seabright, Monmouth Beach and West Long Branch. As in other summer resorts along the Atlantic coast, the electric light load begins to come on about June 1, increasing daily thereafter until by July 1 every machine in the station is heavily loaded. The period of heavy load extends to the beginning of October, when the demand gradually falls off until about November 1, by which time the transient population has departed, and Long Branch once more becomes a quiet New Jersey town.

The electric light station is equipped with 2,300-volt, single-phase machinery, the frequency of which has recently been changed from 125 cycles to 60 cycles, and with 500-volt, direct-current apparatus for feeding motor circuits. The output of the station in single-phase current is 1,800 kw, and the direct-current dynamos have a maximum capacity of 300 kw. Coal costs about $3.50 per ton, and gas sells at $1.50 per thousand cubic feet, subject to a discount of 15 cents. Electricity is sold at 20 cents per kw-hour, a charge also being made for readiness to serve, the Doherty system of accounting being in vogue.

Two years ago there was not an electric sign or a window display in all the territory covered by the company; to-day there are in Long Branch alone 5,000 4-cp incandescent lamps burning on a flat rate of 45 cents per lamp per month from dusk until midnight. These lamps are burned on a yearly contract. In addition there are over 2,000 4-cp incandescent lamps used in branch stores maintained by prominent New York concerns. These stores are open only six months of the year. The company also has contracts for eleven new signs requiring a total of 512 lamps, which were switched into service on the first of June.

From November 19, 1904, to May 1, 1906, the lighting load has increased a trifle over 119 per cent, due to the energy of a new commercial and advertising department headed by Mr. A. W. Houston, Jr. New business is sought by personal letters and by personal solicitation, no printed literature being distributed. Mr. Houston was formerly connected with the Denver Gas & Electric Company, where he was well schooled in new business-getting methods. He is of the opinion that the reason many so-called commercial departments do not obtain better results is because they are composed almost entirely of solicitors—men who are without doubt good salesmen and who are able to sell a great many electrical appliances, but who are totally unfit to represent an electric light company. One high-class representative is worth a half dozen solicitors, he claims, and nothing will lose the public support quicker than for a company to send out men not capable of representing it upon all questions which may arise while they are canvassing the public for additional business. It is an electric light company's business to sell electricity, and to sell as much of it to as few customers as possible—that is, making the sale per meter service and per mile of circuit as large as possible. Every commercial manager and general manager, he says, should

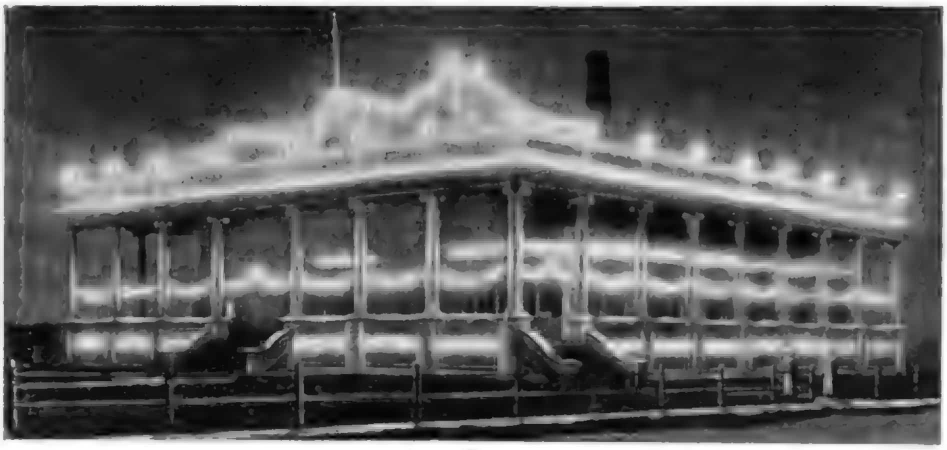


FIG. 20.—THE CASINO AT LONG BRANCH.

remember that when he sends out a man to represent the company in every detail to the public, that the public through that man judges of the commercial manager, the general manager, the president and the stockholders. It is through him that the public forms an opinion of the electric light company, and it is up to him to make this opinion one of the highest. To do this the solicitor must be in every sense a representative. Only by a strict adherence to the foregoing does the company account for this rapid increase in business in a rural district.

The company's electric light lines do not extend into the older residential section to any very great extent. The streets are lighted by 6.6-amp. enclosed arc lamps, with opalescent inner and clear open-bottom outer globes. There are about 300 of these in circuit burning on an all-night basis at the rate of $82 per year. Although the company also operates the gas plant, neither gas nor electricity is pushed to the detriment of the other. Gas is pushed for industrial purposes and for fuel. The electric light company only furnishes renewals free; service connections, signs and wiring are all charged for.

Fig. 20 is a view of the Casino recently purchased by the town of Long Branch and opened for the first time this year. This building is outlined by 5,000 4-cp incandescent lamps, electricity for lighting which is supplied by the electric light company on contract with the town for four months of the year. This building faces the ocean, and adjoining it is a bandstand also outlined with electric lamps where concerts are to be given during the summer. The lamps are spaced seven inches apart so that from a distance the building seems to be outlined in lines of solid light. Ocean Avenue, the road in front of the Casino, is to have a concrete sidewalk eight feet wide skirting the right side of the roadway, which is 60 ft. wide; and skirting the left side along the beach a boardwalk 20 ft. wide is being constructed for a distance of one mile. Iron arches 35 ft. high at the center and extending the width of the boardwalk are being erected along this walk and each arch will be lighted by 20 16-cp incandescent lamps. Three arches are spaced 35 ft. apart, followed by three spaced each 50 ft. apart; then three 35 ft. apart and so on the entire length of the walk. On the sidewalk parallel to the boardwalk and on the opposite side of the roadway are enclosed arc lamps suspended from ornamental iron electric lamp posts spaced every 75 ft. and extending the whole length of Ocean Avenue. Work is now under way on these improvements, which are expected to be completed this summer.

The electric light company has been instrumental in pushing this work, and the town has taken it up in the hope of restoring this section of Long Branch to its former popularity. A few years ago the steamboat pier to the left of the Casino was washed away and never rebuilt, so that this section has suffered in consequence. The popularity of electric-lighted boardwalks elsewhere along the coast has led the authorities of Long Branch to believe that a similar walk along the ocean front at Long Branch would rehabilitate the town to its former rank among summer resorts. Property has already increased considerably in value in this section even before the improvements are completed.

There will be no unsightly electric light poles and wires along Ocean Avenue and the ocean front as is the case with many other boardwalks along the coast. The incandescent lamps on the boardwalk and the arc lamps along Ocean Avenue will all be fed from underground cables. All poles along the avenue have already been removed and the beach will likewise be cleared of encumbrances. There is also a move on foot fostered by the electric light company to put Nernst lamps on both sides of Broadway. This is the principal street in Long Branch and runs past the Casino to the beach. The plan is to use four-glower Nernst lamps and to space them every 50 ft. These are to be installed at the expense of the merchants along the street, who will also pay for the electricity to light them, the town already supplying arc lamps on this thoroughfare.

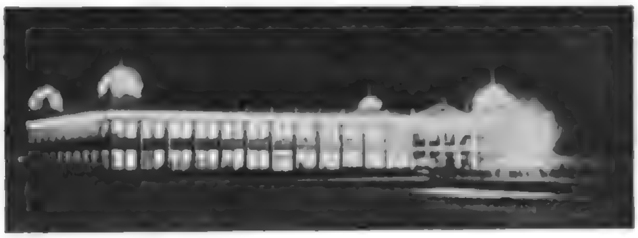


FIG. 21.—CASINO AT ASBURY PARK.

FIG. 22.—JUDGES' STAND, ASBURY PARK, DURING CARNIVAL.

All the summer residences are supplied with electricity through underground cable. West End, where these summer colonies congregate, is brilliantly lighted by 4 and 8-cp incandescent lamps, which are used to outline many of the buildings. A number of electric signs are also lighted in this section. The maximum summer load at Long Branch is three times the maximum winter load at present, and when all the proposed improvements are completed the summer load will be considerably increased.

ASBURY PARK.

A little over 30 years ago, what is now Asbury Park and Ocean Grove was nothing but a trackless waste of sand dunes and brier growth. The resorts which to-day occupy this charming spot on the Atlantic are known throughout the length and breadth of the land. The population of Asbury Park with its great hotels, business blocks and residences is increasing yearly. The city enjoys the unique distinction of being the only coast resort in the United States owning its water frontage, and it is fast becoming the greatest social center on the Jersey shore. Ocean Grove is so bound up with stringent "thou shalt nots" that little or nothing in the way of secular amusement is tolerated. It is the campmeeting ground of the Methodist Church, and is the largest of its kind in the world.

The Atlantic Coast Electric Light Company which lights Asbury Park also supplies, Deal, Allenhurst, Loch Arbour, Bradley Beach, Avon, Belmar, Spring Lake, Sea Girt, Villa Park, West Deal, South Elberon, Edgemere, Interlaken, West Avon and West Asbury Park. The station on Railroad Avenue has an output of 1200 kw in single-phase current, and this is sold on yearly contract at 20 cents per kw-hour, while from May to October the rate is 30 cents per kw-hour. There is a sliding discount of 10 per cent up on all bills, the discount varying with the amount of the bill. Enclosed arc lamps are used to light the city, there being 210 of these connected in circuit during the

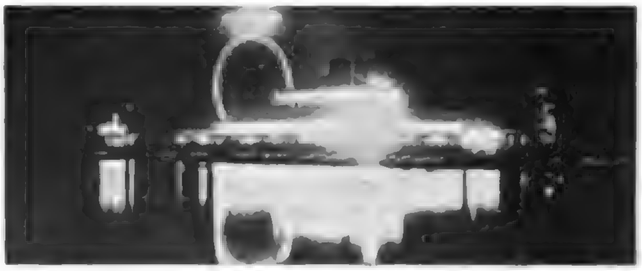


FIG. 23.—SCHNITZLER'S AMUSEMENT RESORT, ASBURY PARK.

winter and 330 in summer. The extra lamps in summer are used principally in Asbury Park and are charged for at the rate of 50 cents per night. Gas sells for $1.50 net in Asbury Park and environs and is used considerably for fuel purposes, although there is much of it used for illumination and not a little for gas arcs. The trouble is that the electric light company is carrying all the load that its antiquated station will stand, but within a year or two an entirely new and modern station with turbines for prime-movers will probably be built, when the additional demand can be supplied. There are about 2,000 residences supplied with electricity during the months of July and August, while for the rest of the year there are hardly more than 300 residences connected in the entire territory served. These are so scattered, and the circuits are so arranged, that all of the latter must be kept alive the year round to supply yearly patrons. The summer load is over four times as large as the winter load, and even at 30 cents per kw-hour the station is overloaded. The city has an isolated plant to supply the boardwalk, Casino and Arcade buildings, and when special carnivals are held the street railway company helps to light up the lakes and bridges. The distribution circuits are all overhead, the pole lines being for the most part on the alleys back of the houses in the choice residential sections and on the public highways in most of Asbury Park.

The city plant contains two 50-kw, 220-volt direct-current machines, the output of which is used to light the Casino and Arcade buildings, as previously stated, the buildings being owned by the city. An additional unit will be installed shortly to feed festooned incandescent lamps strung from pole to pole along the boardwalk. The 3,000 lamps used for this purpose last year were supplied with electricity by the electric light company. The Casino at the foot of Asbury Avenue is a building of the Exposition type. It is the place of recreation for the thousands who promenade the boardwalk at all seasons of the year and is also a concert hall, being provided with a stage of ample dimensions for dramatic and operatic entertainment. It is outlined with lighted electric lamps at night numbering over 2,000. The Fifth Avenue Arcade is a companion building to the Casino and is Venetian in type. The numerous archways are lighted by myriads of electric lamps which give the beautiful structure at night the appearance of a blazing square. The Arcade is an open auditorium for band concerts, which form the principal attraction of the boardwalk. Like the Casino, this building has seating capacity for 5,000 people.

Asbury Park is also the scene of many carnival events during the last week in August. These are known as Coronation, Queen's Court Ball, Masque Fete, Baby Parade and Deal Lake Carnival. All of these take place on successive days in the order named, and with the exception of the Baby Parade, which is held in the afternoon, all are evening events in which decorative electric lighting plays an important part. Wesley Lake, a coast tributary dividing Asbury Park from Ocean Grove, is the scene of a beautiful annual boat carnival. The lake is a mile long and at night when illuminated is one of the beauty spots of the coast. This carnival takes place before the Camp Meeting in Ocean Grove, and large Corinthian columns are arranged along the banks of the lake and these are festooned with electric lamps. In the center of the lake a ship is placed and this is outlined with 500 incandescent lamps. Deal Lake is a placid and beautiful stream on the northern boundary of Asbury Park, dividing the city from Allenhurst and the fashionable resort of Deal. This is the scene of a grand water fete inaugurated with great success by the Asbury Park Carnival Association. This is also illuminated at night by incandescent lamps entwined around Corinthian columns, and the bridges across the lake over which the trolley cars pass are also studded with incandescent lamps fed with current furnished by the railway company.

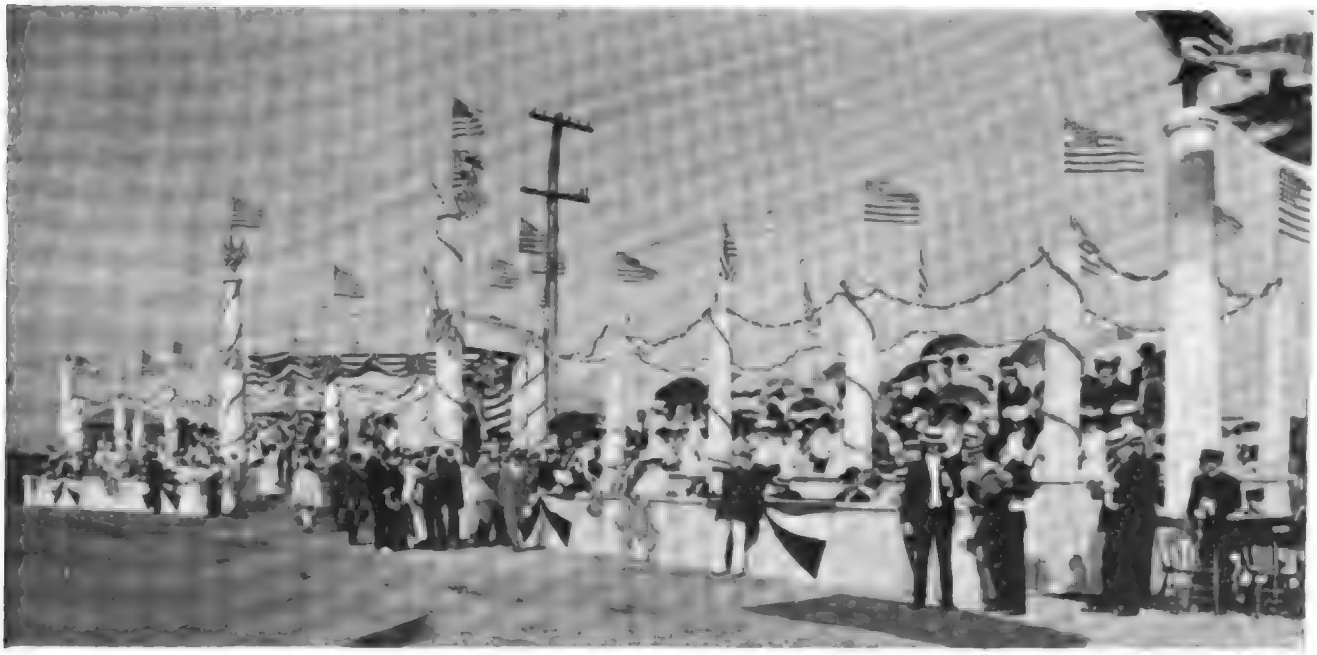


FIG. 24.—DECORATIVE LIGHTING ON OCEAN AVENUE DURING CARNIVAL WEEK.

Ocean Avenue, on which the land carnivals are held, is lighted on such occasions by over 5,000 incandescent lamps in addition to the arc lamps. The judges' stand and grand stands are all decorated and entwined with garlands, hidden behind which are numerous incandescent lamps. During the Masque Fete, masked marches are held on Ocean Avenue and on the boardwalk, both of which are transformed into promenades of great brilliancy and beauty by the lavish use of electricity. Masked balls are held in the Arcade and in all the leading hotels, and in all these places electricity is depended on for the decorative effects. A well-lighted place of amusement on Wesley Lake is Schnitzler's flying horses, Ferris wheel and tower, electricity for which is supplied by an isolated plant. The use of electric signs in Asbury Park is increasing rapidly; but it is a curious fact that despite the superiority of electricity for this class of lighting, the largest sign in Asbury Park now being erected on the roof of the principal department store will be lighted by Humphrey gas arcs in box letters of galvanized iron and opalescent glass. This sign will be 150 ft. long and the letters five feet high.

The Springfield, Ohio, Central Station.

The People's Light, Heat & Power Company, of Springfield, Ohio, has recently completed a new generating plant with the intention of abandoning entirely its old equipment. The old plant contained one 28x48-in. Hamilton simple Corliss engine of 500 hp and one 18x30-in. Buckeye engine of 200 hp. These were belted to a line shaft 86 ft. long. This line shaft carried nine clutch pulleys and had 24 bearings. From it were belted two 150-kw, 1,300-volt, 133-cycle, monocyclic generators, three 125-light Brush arc dynamos, two 50-light T. H. arc dynamos, and one 30-light T. H. arc dynamo. There was also one 500-volt power generator. It is of interest to note that with all these generators revolving on open circuit, one of the engines indicated 78 hp after the engine friction losses had been deducted. The boiler room contained three 300-hp Berry boilers.

THE NEW POWER STATION.

Land for the new power station was obtained adjoining the old station, but more favorably situated as regards coal, as the new station has a spur track from the Pennsylvania Railroad. The general arrangement of the new station is somewhat peculiar owing to the fact that it was necessary to run this spur track diagonally across the engine room in order to reach the boiler room. The plant is near the down-town district of Springfield, and next winter hot-water heating service will be begun under the Yaryan system.

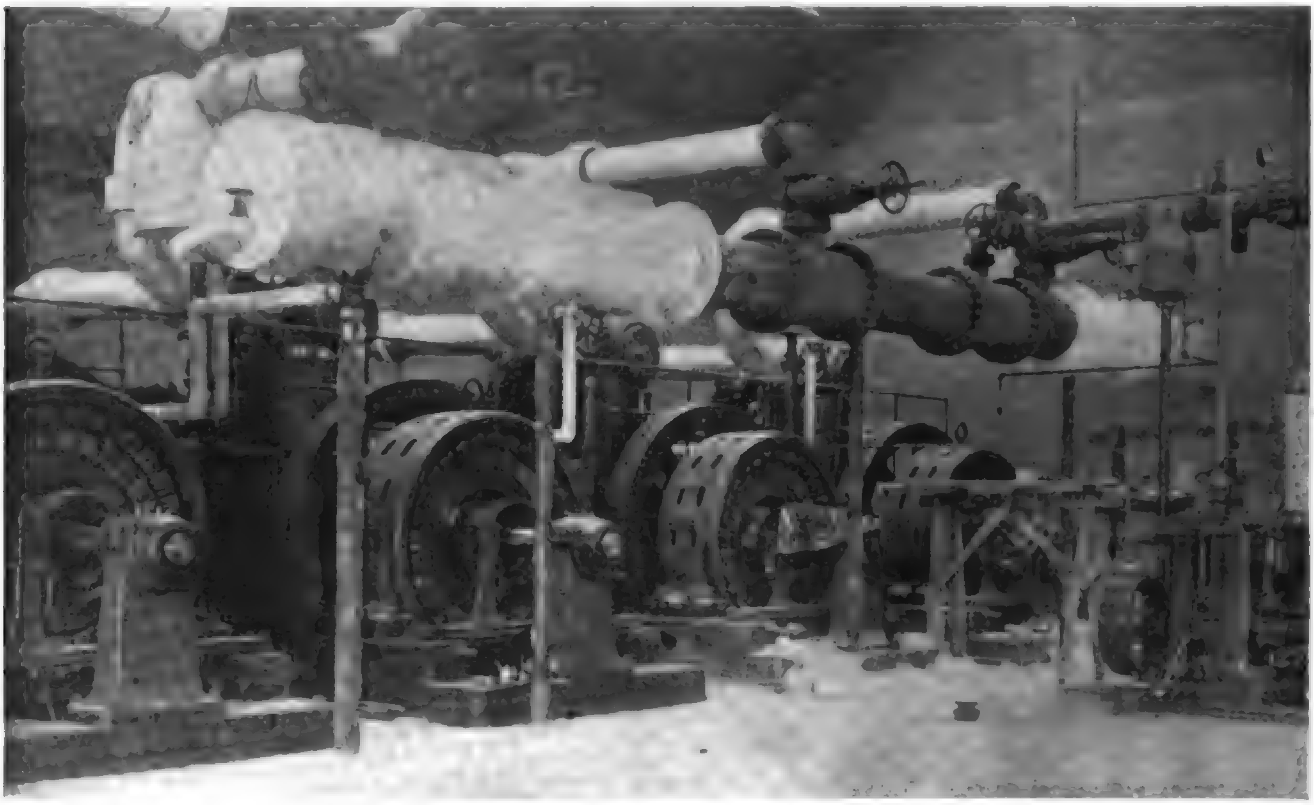


Fig. 1.—General View of Engine Room.

The plant contains four 250-kw units shown in Fig. 1. Each consists of a Westinghouse compound engine 16 and 27 in. with 16-in. stroke operating at 150-lb. boiler pressure and direct connected to a Westinghouse two-phase, 60-cycle, 2,300-volt generator. The exciters are 25-kw Westinghouse generators driven by 8x7-in. simple Westinghouse engines.

Fig. 1 was taken during the process of covering the exhaust steam main with double standard thickness of magnesia sectional covering. It will be noted that the flanges as well as the pipe lengths are being so covered. The object of covering the exhaust main is, of course, to secure as much exhaust steam as possible in the hot-water heater for the heating system. There are two Smith Vaile compound duplex pumps for circulating the water in the heating system. The company expects to have about 20,000 ft. of radiation at the beginning of the next heating season.

Fig. 2 shows the boiler room and coaling arrangement. The engine room floor is considerably higher than the boiler room floor. The coal cars come in through the engine room at its floor level and dump their loads of coal from the elevated tracks in front of the boilers, as shown. This track is not permanent and will be changed when the old plant, which is in the rear of the new one, can be torn down. Then the siding will come in through the old property and only enter the boiler room.

At the time this photograph was taken the coal storage room in front of the boilers was being kept filled because of the prospects for a coal strike. It is intended ordinarily not to fill this space so completely and to put in coal scales and a small flat-wheeled coal truck so that coal used each day can be weighed as it is used. The four boilers are of the Heine type rated at 450-hp each. The chimney of the plant is 150 ft. high with a 10-ft. flue built of Kellogg radial brick. For heating feed water there is a Hoppes exhaust heater, and live steam purifiers. The feed water leaves the exhaust steam heater at 208 degrees and enters the live steam purifier.

Over the engine room there is a Case 20-ton hand crane with 62½-ft. span. This crane paid for itself in the reduced price given by manufacturers on machinery erected with the crane facilities as against the price without crane facilities.

The plant is to be operated condensing with the circulating water of the hot water heating system to do part of the cooling during the heating season. Cooling towers are to be placed on the roof to furnish condenser cooling water during the summer.

SYSTEM OF DISTRIBUTION.

The lighting feeders are all single-phase and equipped with double-throw oil circuit-breaker switches by which the feeder can be thrown on to either of the two phases. The motor feeders are independent of the lighting feeders, two-phase circuits being run for motors. The old 500-volt motor service, which is limited in capacity, is to be abandoned and two-phase service is to be given instead. The company owned several motors used by customers under the old régime, and it was consequently easy to make the change by purchasing new motors. Before so doing, however, it secured five-year contracts in nearly every case. New customers bought their own motors, as is customary in other cities. Motors of 5 hp and under are of Wagner, Westinghouse and General Electric single-phase type and are operated from the lighting circuits.

The street lighting of the city has just been changed from open direct-current series to the series alternating system. Westinghouse lamps are used, hung on arc cut-outs made by the Philadelphia Electric & Manufacturing Company. There are 355 street lights and 45 other outside arc lamps on these circuits, making a total of 400 outside arc lamps. The change both from direct to alternating arcs and from 133-cycle, 1,300-volt general distribution to 2,300-volt, 60-cycle distribution, required careful planning to carry out without serious interruption to service. Commercial circuits were changed over at the rate of about one per day so that the service was not off at night.

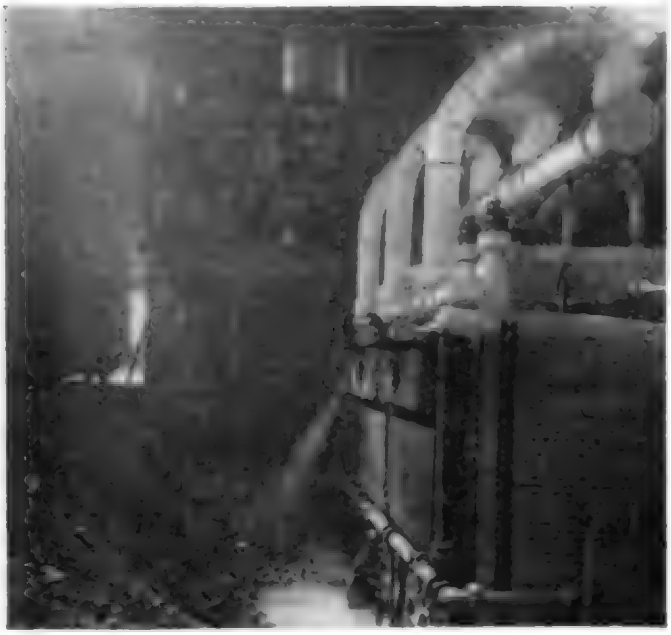


FIG. 2.—BOILER ROOM.

The peak load last December was 500-kw, including all business, the load factor being high. The peak load will run much higher during the summer as the company lights two large summer parks.

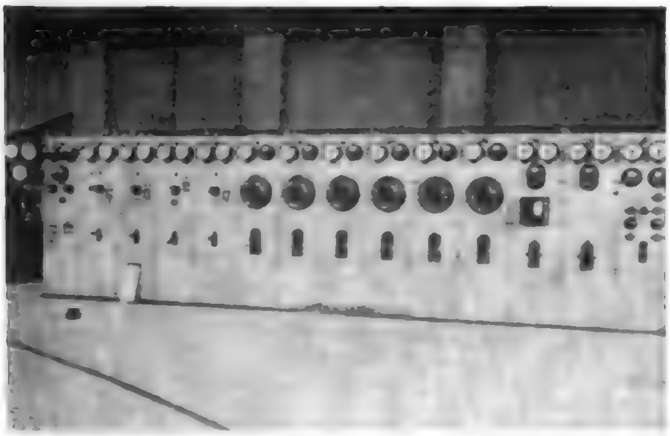
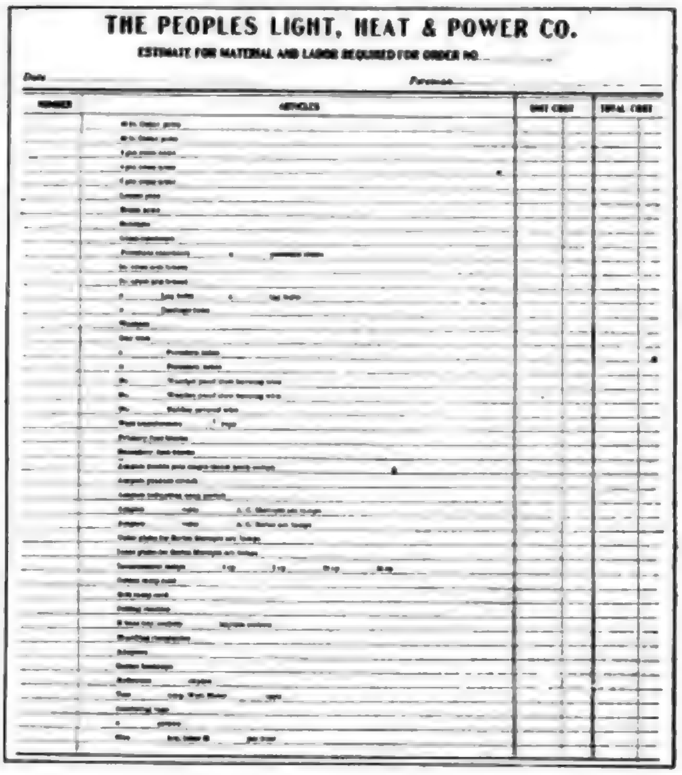


FIG. 3.—SWITCHBOARD.

NERNST LAMPS AND GAS COMPETITION.

Natural gas is sold in Springfield at 25 cents per 1,000 cu. ft., which, of course, makes it exceedingly low in cost when used in mantle burners. To meet this competition, the Nernst lamp has been utilized. There are now about 1,300 Nernst glowers connected in service, of which 300 were recently connected on a contract calling for 50 six-glower lamps. Three and four-glower sizes are most used. Nernst lamps are maintained by the company, their maintenance requiring one-half of one man's time. The cost of glower maintenance compares very favorably with incandescent lamp renewal cost. Nernst lamps during December, January and February last replaced 53 gas arcs, and over one hundred gas burners. Three solicitors were on this work. Spring Grove Park is lighted with 50 six-glower lamps and several hundred incandescent lamps.


THE PEOPLES LIGHT, HEAT & POWER CO.

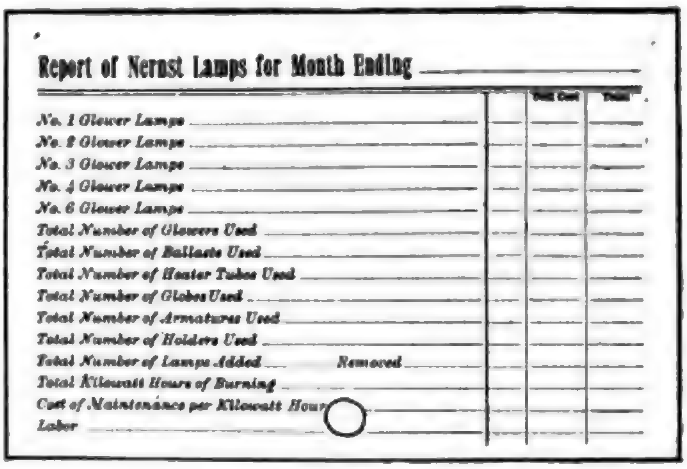
ESTIMATE FOR MATERIAL AND LABOR REQUIRED FOR ORDER NO. ______

Date ______ Foreman ______

FIG. 4.—MATERIAL CARD.

VOLTAGE REGULATION.

The voltage regulation is ordinarily excellent, as is shown by the low cost of Nernst lamp renewals, and is maintained by a General Electric voltage regulator connected in the exciter field circuits. The regulator can be connected to work with both of the exciters. For individual feeder regulation there is a Westinghouse-Stillwell type hand regulator on each lighting feeder. A curve drawing recording voltmeter is on the switchboard, the records of which show that with the regulator in operation the voltage is maintained within 2 per cent of that for which it is adjusted.


Report of Nernst Lamps for Month Ending ______

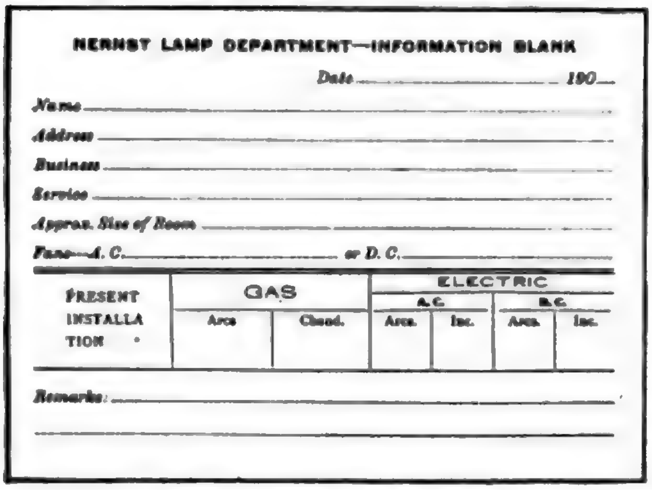
Unit Cost | Total

No. 1 Glower Lamps ______
No. 2 Glower Lamps ______
No. 3 Glower Lamps ______
No. 4 Glower Lamps ______
No. 6 Glower Lamps ______
Total Number of Glowers Used ______
Total Number of Ballasts Used ______
Total Number of Heater Tubes Used ______
Total Number of Globes Used ______
Total Number of Armatures Used ______
Total Number of Holders Used ______
Total Number of Lamps Added ______ *Removed* ______
Total Kilowatt Hours of Burning ______
Cost of Maintenance per Kilowatt Hour ______
Labor ______

FIG. 5.—NERNST LAMP REPORT.

CUSTOMER'S METERS.

Meters are principally Ft. Wayne and Westinghouse types. The company aims to test these once a year, the test being made with the meter in place on the customer's premises, by using a portable watt-hour meter and a bank of lamps of known voltage. The company's methods of handling meter complaints are interesting. A customer's meter is tested at once upon complaint. If the customer is not satisfied he may have the meter tested by a disinterested expert. If the meter is not correct, the company bears the expense of the test, and if the meter is correct, the customer pays for the test. The company finds the calibration card furnished by the manufacturer with each meter of great value in settling customer's complaints, these cards certifying that the meter was tested and found correct within a certain per cent at the factory.



NERNST LAMP DEPARTMENT—INFORMATION BLANK

Date ______ 190__

Name ______

Address ______

Business ______

Service ______

Approx. Size of Room ______

Fuse—A. C. ______ *or D. C.* ______

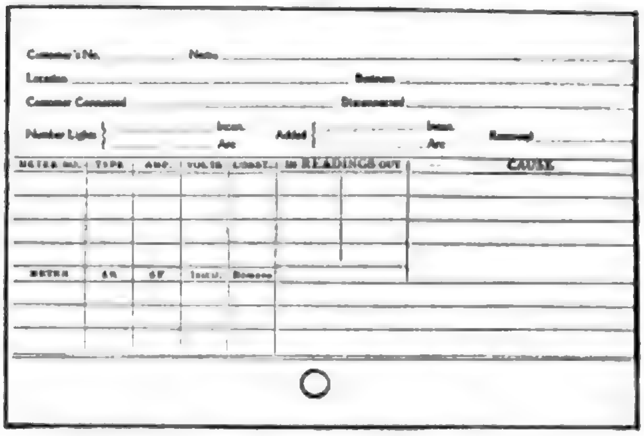
PRESENT INSTALLATION	GAS		ELECTRIC			
			A.C.		D.C.	
	Arcs	Chand.	Arcs.	Inc.	Arcs.	Inc.

Remarks: ______

FIG. 6.—INFORMATION BLANK.

BUSINESS POLICY AND NEW BUSINESS.

In the past year there has been an increase of nearly 50 per cent in the number of customers, 226 being added. Springfield had a population in 1900 of 38,253. The latter part of June, 1905, five solicitors were started. The growth was so rapid that in September the soliciting force was cut down to one, owing to the limited capacity of the old plant.



Customer's No. ______ Name ______

Location ______ Business ______

Customer Connected ______ Disconnected ______

Number Lights { ______ Incan. ______ Arc } Added { ______ Incan. ______ Arc } Removed ______

METER NO.	TYPE	AMP.	VOLTS	CONST.	IN READINGS OUT		CAUSE

METER	IN	OUT	Install.	Removed

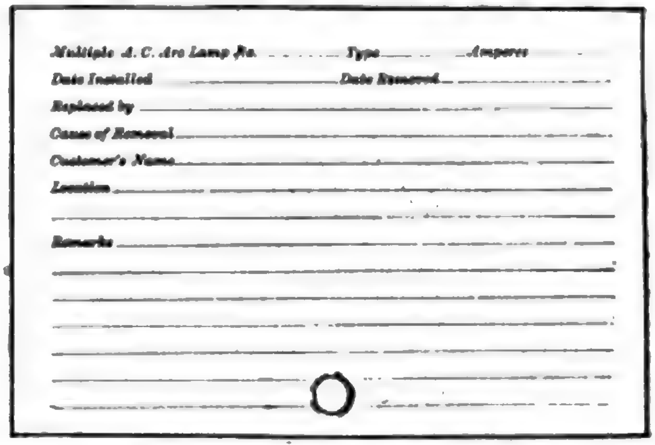
FIG. 7.—CUSTOMER'S CARD.

As Springfield is a good manufacturing town, having 185 factories, and as the company is now prepared to take care of scattered power business, a special effort is being made to get this class of business, since it will give the steady day load, which is so essential where hot-water heating is to be done. The company has had its offices on the third floor of a business block, but will move to a good location on one of the principal streets where it can have a display room in connection with its office. It does not strive to do wiring for customers, leaving local contractors to get what they can of this business. When necessary it will do wiring at cost plus 10 per cent.

The company hopes to get into the electric sign business on a large scale; but little has been done so far, about thirty signs now being connected. The idea is to run separate sign circuits from the secondaries of the transformers in the down-town district, these sign circuits to be operated for four hours after sun-down. As the distance from the power station to the business district is not great, it is figured that it will be cheaper to put in a few solenoid-operated switches and a special switch circuit from the power house, than to have a patrolman open and close these switches.

RECORD BLANKS.

In making up estimates for material for a job, it is difficult even for the experienced man to think of all the items, and the result is that some are usually omitted and have to be added subsequently or are left out of the original estimates. For this reason the form shown in Fig. 4 is used. This contains a list of the items likely to be used on any ordinary job of connecting up a service or installing arc lamps.



Multiple A. C. Arc Lamp No. ______ *Type* ______ *Amperes* ______

Date Installed ______ *Date Removed* ______

Replaced by ______

Cause of Removal ______

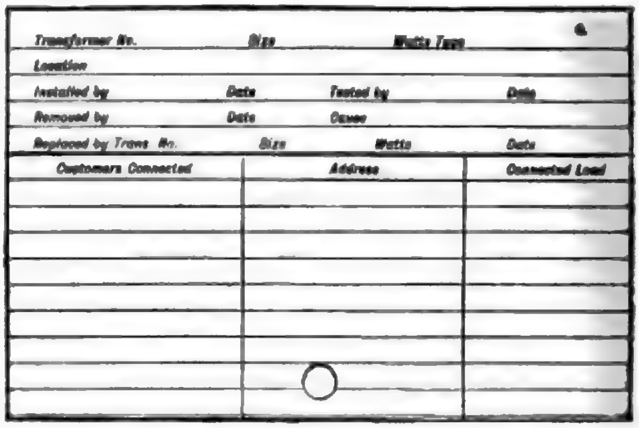
Customer's Name ______

Location ______

Remarks ______

FIG. 9.—ALTERNATING-CURRENT ARC LAMP RECORD.

Fig. 5 shows a 4x6-in. standard card used to sum up the cost of Nernst lamp maintenance each month. Fig. 6 is a card used simply as an information blank in regard to possible Nernst lamp customers. Fig. 7 is a customer's card kept in a standard 4x6-in. card index. Fig. 9 is a card used as a record of multiple alternating-current arc lamps. Fig. 10 is a card used to keep a record of the transformers connected, giving their location, date of installation, customers connected and connected load.



Transformer No. *Size* *Watts Type*

Location

Installed by *Date* *Tested by* *Date*

Removed by *Date* *Cause*

Replaced by Trans. No. *Size* *Watts* *Date*

Customers Connected	*Address*	*Connected Load*

FIG. 10.—TRANSFORMER RECORD.

At a special meeting of the Board of Directors of the company the following method for handling the contract department was adopted. As the unsold peak capacity was 400 kw, it was thought best to push the contract business extensively and rapidly and especially to displace gas arcs and gas engines. The company for a nominal consideration placed the contract department directly under the Nernst Lamp Company, which in turn has secured competent lighting, power and sign experts, and devised a good advertising campaign. The result has proven satisfactory, and from present indications it will only be a short time until the present capacity is sold.

The company is under the general management of Mr. Charles S. Kay with Mr. Charles S. Johann as general superintendent and chief engineer. The design of the new plant and of all the recent changes have been in charge of Mr. Johann.

Oil-Engine Driven Electric Lighting Plant at Camden, N. Y.

By H. B. SWEET.

A MUNICIPAL electric lighting plant which was recently put in operation at Camden, N. Y., is of considerable interest on account of the motive power there employed.

Camden is a village of 2,500 population, in the central part of the State, and owing to numerous manufacturing establishments is a prosperous and growing municipality.

When the vote was taken which authorized the establishment of a municipal lighting system, public sentiment was in favor of water as a motive power, provided a proper site could be obtained. When surveys and measurements were taken along the available streams in the vicinity, only one site was found which was worthy of consideration, and this site was far from ideal, on account of the low possible head and the indications of high flood water.

While the question of motive power was under consideration, the attention of the commissioners having the matter in charge was called to an internal combustion engine, using a low-grade distillate of petroleum, as fuel, for which remarkable economies were claimed. Several plants in which this engine had been in use for a considerable time, were examined, and a test made on one of them confirmed the claims of the makers, and this type of engine was finally adopted.

The design of the plant provided for the installation of two units, each unit consisting of one 170-hp engine running at 200 r.p.m. direct-connected to a 130-kw, two-phase alternating-current generator. Two single-phase, 2,200-volt circuits supply the primary of the incandescent lighting transformers, while the street arc lamps are supplied by a 6.6-amp., constant-current obtained by means of a constant-current transformer. The switchboard carries feeder regulators and watt-hour meters, in each of the incandescent lighting circuits and a watt-hour meter in the primary circuit of the arc transformer registers the energy consumed in the street lighting system. The electrical equipment does not differ from that usually employed in modern practice in plants providing a general service for arc and incandescent lamps and motors, the chief interest in the plant, centering in the prime-mover.

The engine is a three-cylinder, internal combustion machine, operating upon the four-cycle principle, the cylinders being water-cooled by water supplied from the village water mains. An air compressor run in connection with the engine is used to deliver the fuel in the form of a spray into the engine cylinders, and to store air under pressure in several steel air bottles for starting the engine. The air for fuel injection is carried to mingling chambers located on the sides of the cylinders, to which chambers the fuel oil is also led previous to its injection into the cylinders.

An oil storage tank of 7,500 gal. capacity is buried outside of the power house walls, and oil is fed from this tank through a rotary hand pump to a 25-gal. auxiliary tank carried on a bracket on the power house wall. From the small tank the fuel oil flows by gravity to each of three small plunger pumps on the engine, each pump delivering to a single cylinder through the mingling chamber, and all pumps being controlled by the governor mechanism. The operation of a single piston through one complete cycle, four strokes, is briefly as follows:

First (inspiration stroke). The piston being in the upper end of the cylinder, moves to the bottom, drawing in a full cylinder of air through the admission air valve, this air being under atmospheric pressure.

Second (compression stroke). The admission air valve is closed and the piston moves from the bottom of the cylinder to the top, compressing the air drawn in at the previous stroke to a pressure of about 500 lb. per sq. in. The heat due to compression to this amount is sufficient to ignite any of the petroleum products, and just before the piston reaches the end of its upward stroke the needle valve controlling the admission of fuel is opened, allowing all of the fuel in the mingling chamber to be injected into the cylinder. Upon the opening of the needle valve the fuel is delivered into the cylinder by reason of the excess of the compressor pressure over that due to compression in the cylinder

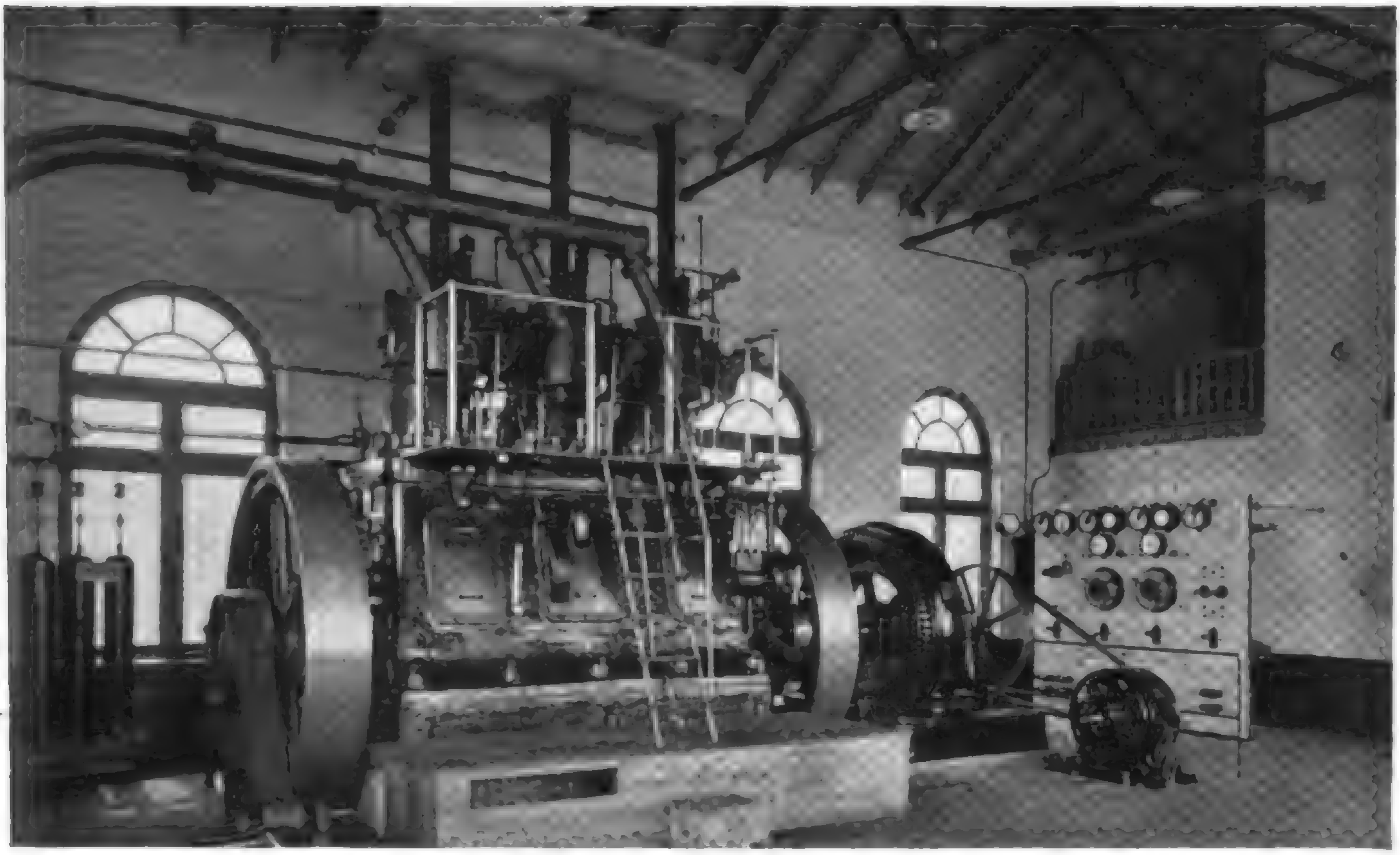
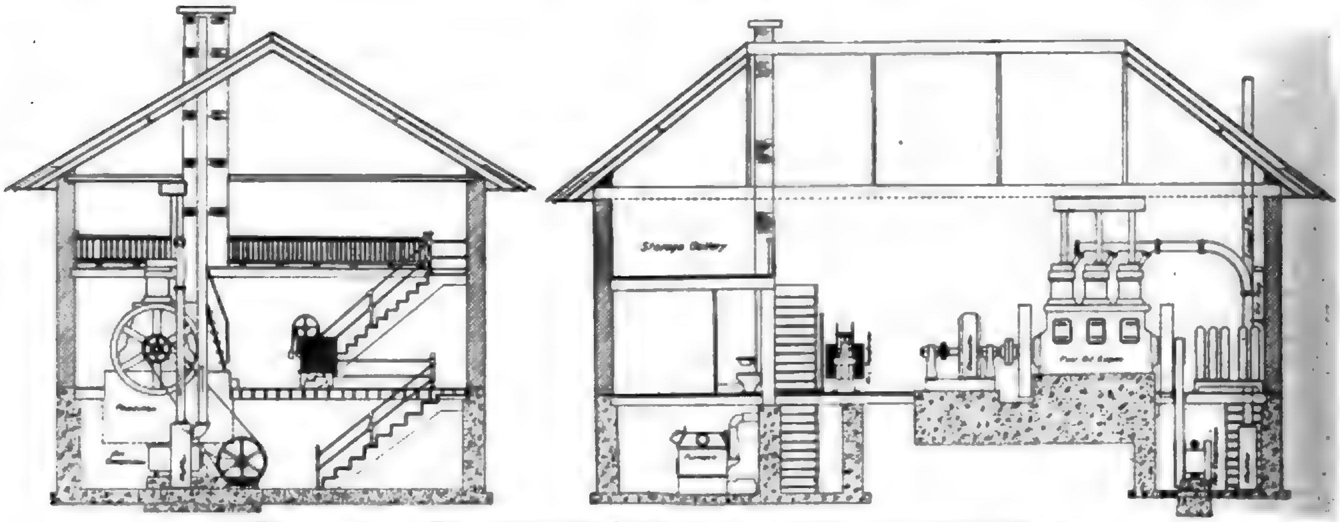


FIG. 1.—OIL ENGINE GENERATING PLANT.

of the engine. The combustion of fuel takes place during a period equal to about 10 per cent of the downward stroke of the piston, and the shock of the power stroke is, therefore, much less severe than that which obtains in any form of explosion engine.

power house while Figs. 2 and 3 show the general arrangement of the machinery.

The engine in this plant was furnished by the American Diesel Engine Company, of 11 Broadway, New York City, and the electrical apparatus was furnished by the Westinghouse Electric & Manufacturing Company.



Figs. 2 and 3.—Transverse and Longitudinal Sections of Power House.

Third (power stroke). The piston descends from the upper end of the cylinder for a distance equal to 10 per cent of its stroke; the fuel supply is then shut off and the power for the remaining portion of the stroke comes from the expansion of the hot gases.

Fourth (exhaust stroke). The piston being at the bottom of the stroke, the exhaust valve is opened and in the return of the piston to the upper end of the cylinder the gases of combustion are ejected. The exhaust valve is then closed and the cycle has been completed.

Governing is effected by a small fly-ball governor, which regulates the length of time during which by-passes on the fuel feed pumps remain closed. During the closed period of these by-passes each pump forces fuel into its respective mingling chamber, from which it is injected into the engine cylinder. Starting is effected simply and quickly and the speed regulation is fully up to that of high-speed engines of other types. The fuel combustion is very complete, as is shown by the exhaust gases which are absolutely colorless within the full-load rating of the engine. A piece of damp white blotting paper held over the exhaust pipe for fifteen minutes shows only slight traces of discoloration.

The acceptance tests conducted upon the engine after one month of service showed the following results in fuel consumption per kw-hour at the switchboard, the corresponding costs being based upon the delivered price of the fuel oil now in use.

¼ load,	.164 gal. per kw-hour,	cost............	$.0058 per kw-hour.
½ "	.112 " "	"	.0040 " "
¾ "	.101 " "	"	.0036 " "
Full "	.101 " "	"	.0036 " "

The above fuel consumption and costs include all losses up to the point of delivery of the energy to the outside lines. Allowing the conservative figure of 10 per cent for electrical losses and changing to a hp-hour basis, the engine should be charged with the following fuel consumption and costs per hp-hour:

¼ load,	.11 gal. per hp-hour,	cost............	$.0039 per hp-hour.
½ "	.076 " "	"	.0027 " "
¾ "	.068 " "	"	.0024 " "
Full "	.068 " "	"	.0024 " "

The daily operation of the plant confirms the figures of fuel consumption, given above, the average fuel cost for a 10-hour run with 75 arc lamps for a connected load of 2,000 incandescent lamps, being less than $2.50.

The neatness and compactness of a plant of this character is a striking feature to one familiar with the conditions prevailing in the average small plant. It has been said that the fuel is carried upon the "mantle piece," and the remark applies to the cleanly conditions prevailing. Fig. 1 shows the interior of the

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Gas-Engine Central Station at Winchester, Ind.

The central station at Winchester, Ind., owned by the Citizens' Water & Light Company, is operated entirely by Westinghouse gas engines supplied with natural gas. These gas engines have now been in service about 5½ years, so that their behavior as prime-movers in a central station can be fairly judged. There are two of these engines, each of 125 hp, and of the three-cylinder upright type. One is direct-connected to two direct-current, 220-volt generators of 40 kw each. The other is belted to a 120-kw, 60-cycle, 1,100-volt, single-phase alternator.

The maintenance of the gas engine has been considered one of the bugbears in connection with its use, so that the results in Winchester are interesting. Mr. Carl R. Semans, manager of the company, says that the repairs on these engines have not exceeded an average of $100 per year for two engines during their life. This, however, does not include one accident, namely, the breaking of a crank shaft, which of course was a large item of expense. It is hardly to be considered as chargeable especially to the gas engines, as it is something that might occur on any engine, although of course more likely to occur on a gas engine than on a steam engine. The charge is ignited in these engines by means of a touch spark. Most of the trouble experienced with them is in connection with the ignition. The points become blackened and the coating which forms in the igniter causes short-circuits in the stem. The gas engines have given sufficient satisfaction so that Mr. Semans would put in gas engines and a producer outfit rather than steam engines if building a plant out of the natural gas district. Although the present electric lighting service is only during the hours of darkness he thinks that the company could probably give 22 or 23-hour service with the present engine, although a shut-down of an hour or two would be necessary each day to permit the cleaning and inspection of certain parts of the gas engines. The most expensive part of gas engine maintenance is renewing the exhaust valves, which cost $15 each. A lathe is kept in the plant for dressing down these valves.

220-VOLT LAMP EXPERIENCE.

The direct-current three-wire system of distribution used in the down-town district has 220 volts between the neutral and outer wires and 440 volts between the outers. The company's experience with 220-volt lamps has not been satisfactory. No make of lamp has yet been found entirely free of the fault of short-circuiting in the lamp itself near the leading-in wires. Such short circuits are extremely annoying because whenever they occur they blow the fuse on the circuit supplying the lamp. All the principal makes of lamps have been tried with the hope of finding one which did not have this peculiarity. Another drawback to the use of 220 volts is illustrated by the fact that there are no arc lamps in the down-town district because of the unsatisfactory light given by arc lamps for 220-volt circuits, with their long, unsteady violet arc.

Gas Engine Station at Winchester, Ind.

The company operates both the electric light and water works system. A view of the station is shown in Fig. 1. The water works pumps in the background are driven by Nash gas engines. The plant is located at the edge of town and some heavy direct-current feeders run from the station to the business square.

Gasoline vapor lamps have made some inroads in the commercial business, about half a dozen of customers having been lost to gasoline plants around the business square. This is probably due in part to the unsatisfactory results obtained with 220-volt arc lamps. No attempt has been made to introduce 110-volt arc lamps, two in series.

The company has both flat-rate and meter customers. The flat rate is 75 cents per month for one 16-cp lamp, $1 per month for two 16-cp lamps, $1.40 for three and $1.80 for four. For each additional lamp over four, the rate is 30 cents. Lamps under 16 cp are supplied at proportionate rates, except that 20 per cent is added to compensate for the lower efficiency of the lower candle-power lamps.

The meter rate is 10 cents per kw-hour. For bills of from $5 to $10 per month there is 5 per cent discount; from $10 to $20, 10 per cent discount. For every $10 increase in bill up to $90 there is an increase of 5 per cent in discount, which makes the discount 50 per cent for bills over $90 per month.

Reducing Operating Expenses at Washington, Iowa.

The Iowa Gas & Electric Company, of which Mr. George S. Carson, of Iowa City is president, recently purchased the electric light plant at Washington, Iowa, and some important operating economies have been made under Mr. Carson's direction. The station was giving day and night service and about 21 hours per day was operated with a 14x36-in. Corliss engine which was much underloaded and had leaky valves and pistons. A smaller new Corliss engine, 11x24-in., was installed, and the old large engine was overhauled and put in good shape. The small Corliss engine is now run 20 hours out of the 24, leaving the peak load for the larger engine. By making these changes and by cleaning boiler flues and looking after some other details, a reduction of 40 per cent in the coal bill was made.

Some Points in Illumination.

By Cole Tay.

Many wiring contractors and architects have very little idea of the proper proportioning and placing of lamps. As a rule in lighting by electricity a certain number of watts per square foot is used to determine the number of lamps required for brilliant, ordinary and general lighting respectively, while with gas one or several chandeliers and wall brackets are placed architecturally without due regard for the results to be obtained. In order satisfactorily to study the subject the effect of light on the human eye should first be considered. Daylight is the natural condition for the eye's use. In this it is noted that on cloudy days the eye is fatigued less and the details of objects are more distinct than on bright days. It it is also noted that objects in the opposite direction from the sun are most clearly seen, while as the range of vision approaches the sun this distinctness is gradually lost until when looking directly toward it the object only appears in outline. It is further noted that the eye is less satisfied in a place where there are bright lights and shadows than when the view is uniformly illumined, whether the light be intense or otherwise. It is seen, therefore, that the characteristics of daylight are perfect diffusion, absence of strong shadows and reflections and the location of the source of light without the ordinary range of vision.

Applying these observations to the indoor lighting problem the following points will be gathered: First, that the lamps should be small units uniformly distributed, for the eye adjusts itself to the strongest light in the range of vision, and objects reflecting a smaller amount appear to be less illuminated than if the entire light were less intense, but uniformly distributed. Therefore, gas arcs and electric arcs are not suitable where detail is required. Put the arcs in the market, warehouse or large high-studded room having few obstructions to cast shadows and use the small units for drug stores, book stores, rooms having show cases, libraries, etc. Again, the multiplicity of small units makes the shadows less sharp, both because the sources are less intense and because the shadow of one lamp is lighted by the other.

The lamp should be placed high, for the intensity on a lighted surface is inversely proportional to the square of the distance of the source from that surface, and the difference between the vertical and slant rays is less as this distance is increased, which adds to the uniformity. Thus, considering a light of uniform spherical candle-power 6 ft. above a surface, the slant distance at a point 6 ft. from the first is about 8½ ft. and the intensity directly beneath the light is to that at the second point as 72 is to 36, or nearly double; while if the light be raised to a height of 10 ft. the intensities at the points in question are as 136 to 100, or only 1⅓. The intensity curves at different distances from the lamp as shown in Figs. 1 and 2 illustrate this point. Again, the lamps being above the range of vision, the eye receiving the reflected rays from its work is not pierced from the side by direct rays. When this condition is not obtained the eye suffers extremely from the unnatural strain. The church and public halls are very common instances where this rule is violated. The eye in looking at the speaker is obliged to receive the rays of intervening lamps. The lids swell to protect the eye and the result is a drowsiness too often attributed to the dullness of the speaker or to lack of ventilation. The discerning theatre manager takes advantage of this fact by concealing the lights or by turning down those which are visible when the attention is desired on the stage.

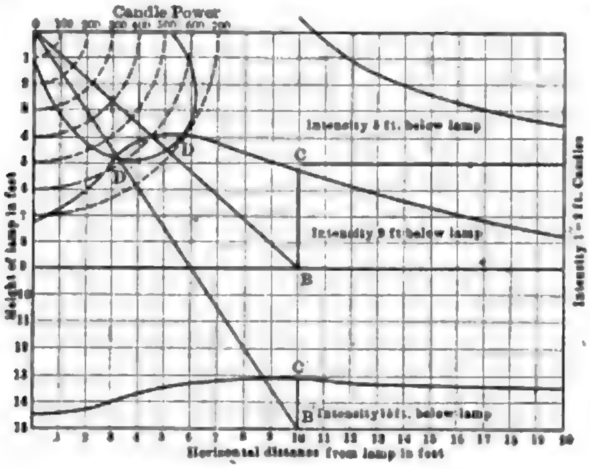


FIG. 1.—ILLUMINATION CURVES OF CONTINUOUS-CURRENT, SERIES-ENCLOSED ARC.

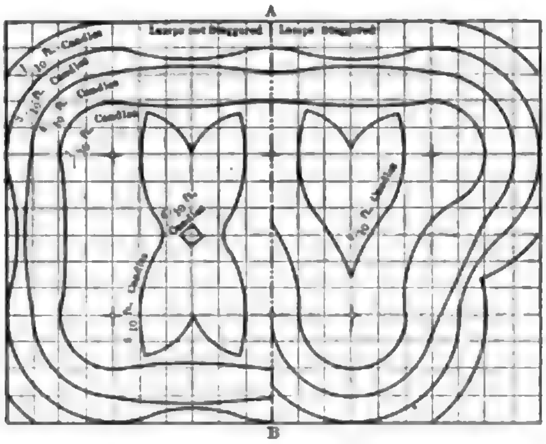


FIG. 3.—CURVES SHOWING DISTRIBUTION OF LIGHT WITH HOLOPHANE REFLECTORS.

When it is impossible to place the lights high the source in either electricity or gas should be diffused by some means such as a ground-glass globe. The loss in candle-power in transmitting the light may not be so much as might at first be imagined, since the total candle-power of the lamp is its intensity multiplied by the superficial area of the incandescent surface. Thus, the great intensity of the arc of a naked arc lamp is multiplied by a very small superficial area, while when enclosed in a globe sufficiently translucent just to hide the arc, the less intensity is multiplied by the external surface of the globe. In considering the entrance of intense rays into the eye it should be noted that rays reflected by a bright surface have this same effect. As an extreme case it has happened that the reflected rays from the pencil writing of a clerk whose work was placed directly between himself and an arc lamp caused such irritation of the eye that the services of an optician were necessary; the whole trouble could have been obviated by simply moving the work to one side of the direct line between the clerk and the lamps when, of course, the reflected rays passed in a different direction.

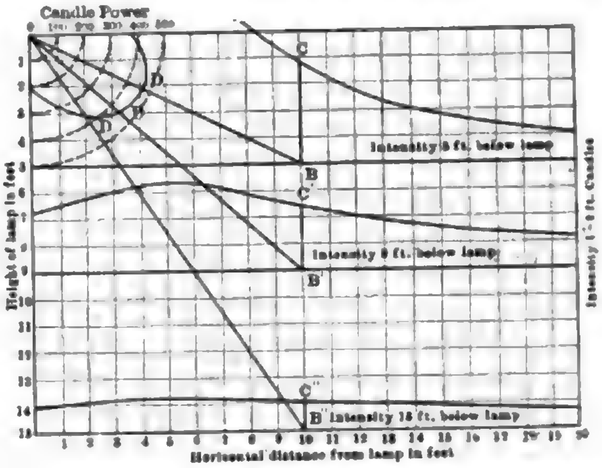


FIG. 2.—ILLUMINATION CURVES OF ALTERNATING-CURRENT, SERIES-ENCLOSED ARC.

A uniform, well-distributed light of a given amount gives clearer detail and consequently appears to give more light than a greater amount supplied by large concentrated units. This is due to the tendency of the eye, above referred to, to adjust itself to the strongest light offered.

Having considered these three fundamental characteristics, the problem is simply to adapt them to the conditions of the room in question and then choose the amount of light that will give the intensity required. The measure of intensity is the foot-candle or candle-foot, which is the intensity of light given by a standard candle at the distance of one foot. Thus, a 16-cp incandescent lamp gives 16 foot-candles at a distance of one foot; or since this intensity varies inversely as the square of the distance, it gives 4 candle-feet at a distance of 2 feet, or one candle-foot at a distance of 4 ft. The selection of the required foot-candles is determined by the proposed use of the room and the color and condition of the walls and ceilings as well as the height of the ceiling. The intensity necessary for good illumina-

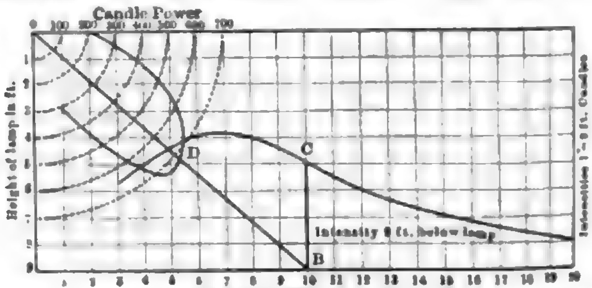


FIG. 4.—ILLUMINATION CURVES OF CONTINUOUS-CURRENT, 6.6-AMP., SERIES-OPEN ARC.

tion varies from ½ foot-candle for general lighting of public halls, etc., ¾ for stores displaying goods in detail, 1 to 1½ for bright illumination of ballrooms, etc., and 2 to 2½ for reading and desk lamps.

The selection of the proper unit is also governed by the color and character of the walls and ceilings and the amount of interruption caused by furniture and other objects. The value of the light used can be greatly increased by introducing good reflecting surfaces. Dark colors in wall and ceiling tints and finish of woodwork, draperies and broken surfaces like bookcases and shelves, reflect but little, while a glossy white paint increases the available light, 85 per cent being reflected. Thus, in a room devoid of furniture with fresh white enamel paint on walls and ceilings, the available light is five times that of the source. This does not mean, of course, that the total amount of light emitted is increased, but that the part which would otherwise be absorbed by the non-reflecting surfaces is turned back by the white paint and is available for use in conjunction with the direct rays. On the other hand, if the walls are hung with black velvet only 1.003 times the original light can be utilized. As an extreme case if the walls and ceilings were covered with French plate mirrors 20 times the light obtained by the original conditions would be available. Between these limits there is a wide range for the exercise of judgment.

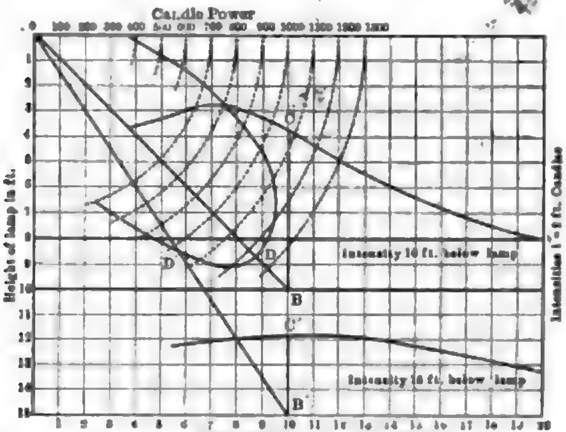


FIG. 5.—ILLUMINATION CURVES OF CONTINUOUS-CURRENT, 9.6-AMP., SERIES-OPEN ARC.

Having chosen the intensity, the height of the lamp is determined by dividing the candle-power of the lamp by the foot-candles required and taking the square root of the result. This gives us the height above the surfaces to be lighted, which are the counters, tables, goods displayed, etc. If this brings the lamps too low, a larger unit must be used, the number of lamps increased, or better, the light of the next lamp may be made to reinforce the first by regulating its distance. Although this distance cannot be well calculated accurately, the following estimate will aid the judgment: Suppose 0.8 foot-candle the intensity to be furnished by the first lamp, which is taken as an end one in one row, and 0.4 to be furnished by the next adjacent lamp. If there is but one row, then the height will be found by using the 0.8 foot-candle from one lamp as above. The distance to the next lamp will be the square root of the difference of the candle-power of the lamp divided by 0.4 foot-candle and the square of the height first found. Taking convenient figures for illustration, if the desired intensity be 1.2 foot-candles, the height of a lamp giving 16 spherical cp will be $\sqrt{16 \div 0.8} = \sqrt{20}$ = about 4⅘ ft., and the distance apart of the lamps will be $\sqrt{16 \div 0.4 - 20} = \sqrt{40 - 20}$ = about 4½ ft. again. Then the two lamps together will give an intensity of 1.2 foot-candles. If this were not an end lamp there would be two aiding lamps, each giving ⅙ of 1.2 foot-candles and the distance apart would be $\sqrt{16 \div 0.2 - 20} = \sqrt{80 - 20}$ = about 7¾. If there were three rows placed opposite each other—that is, not staggered—there would be four aiding lamps giving 1/12 of 1.2 foot-candles, and the distance would be $\sqrt{16 \div 0.1 - 20} = \sqrt{160 - 20}$, say 12 ft. This is assuming that the lamps have a uniform intensity at the angles covered. This is not true of any particular kind of lamp or in different makes of the same kind of lamp.

A graphical illustration of reinforcement of lamps is shown in Fig. 6, where by placing two lights 12 ft. apart almost uniform intensity is obtained. The rated candle-power of any lamp is the spherical or hemispherical candle-power, the first being the average of about 38 readings of the photometer taken at different angles through a complete circle, the second the same readings taken through a semi-circle. Where the intensity varies greatly as in an arc lamp, a curve of the candle-power of the lamp at different angles should first be made in which the vertical and horizontal scales should be in feet, as in the illustrations. Having drawn this for one lamp, it is, of course, good for any number of future cases. Then in the above illustration the candle-power in the particular direction is used and the calculations made as before. As it is evidently impossible to obtain absolute uniformity of distribution, the above calculations may be made roughly and are not tedious.

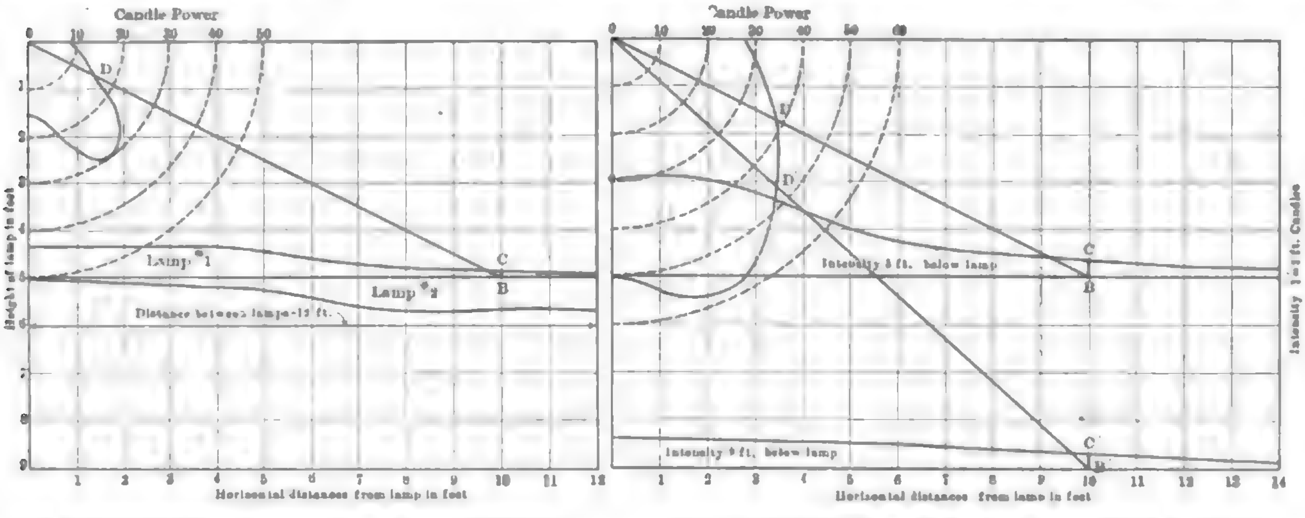


FIG. 6.—ILLUMINATION CURVES OF 16-CP INCANDESCENT LAMP WITH HOLOPHANE REFLECTOR.

FIG. 7.—ILLUMINATION CURVES OF 50-CP MERIDIAN LAMP WITH FROSTED GLOBE.

When the walls are practically non-reflecting, the distance of the first lamp from them will be given by the first example above. Where the reflection is good, the total amount may be taken equal to that of a lamp and the distance will be equal to that between two lamps when there is but one row. Of course, in practice the lamps sometimes cannot be placed symmetrically and the distance apart will not often fit the dimensions of the room. In that case, having determined the theoretical distance apart as above, the watts per square foot can be determined by dividing the candle-power of the lamp used by the area lighted. Take the above case where there are three rows 12 ft. apart, the area allotted to one lamp would be approximately 12 ft. square, or 144 sq. ft.; and allowing 50 watts per lamp there would be ⅓ watt per sq. ft. In the case of a single row, the area allotted each lamp would be 7¾ ft. square, say 58 sq. ft., and the watts per sq. ft. would be 50 ÷ 58, or 9/10. Now dividing the area of the room in question by the watts per square foot gives us the number of lamps required for the room. It will be seen by Fig. 3 that the staggered lamps produce more uniform illumination than those placed opposite. It is often impossible to stagger the rows without destroying the symmetry, but when there are three or more rows they may always be staggered.

In window lighting two objects are desired. First, to attract customers from a distance by the blaze of light in the windows as a whole and second to display goods in detail to a person near the window. The first condition is obtained by exposing the lamps in such a way as to light the whole glass area, the second by concealing them as much as possible and depending on the light reflected from the goods only. The character of the goods displayed determines whether the first effect would be obtained at the expense of the second. If the detail is great, as with jewelry or toys, or when soft effects are desired, as in draperies, the reflected light only should be used and the blaze should be obtained by outside light. When the articles are large as in a furniture store, the reflected light may be made secondary. In either case but one-half the window light may be considered available, for the interior lighting displacing that amount of the light calculated for the store. The light should be placed as near the pane of the glass as is consistent with good mechanical construction, thereby lighting the glass itself better and also showing the goods by rays that are reflected more directly from them to the outside. As stated above, the conditions encountered make the matter of lighting one of judgment, but by studying the problem as outlined a layman can secure the results effectively.

The above rules hold good for rooms not over 15 ft. high. For heights above this the installation should be increased in a direct proportion to the increased height of the room. Thus, in a room 18 ft. high, the installation as above calculated would be increased by 3/15, or ⅕. The lamps should be placed high if the top of the room is to be lighted, and the necessary intensity could be gained by combining the lights of several adjacent lamps in a manner similar to the case above referred to.

The curves above mentioned are easily plotted on common cross-section paper, by using the candle-power as given by the photometer for each angle of 10°. It will be found convenient to plot the candle-power by drawing quadrants of circles in which the radii represent the candle-power, with the center at the upper left-hand corner of the sheet, using a scale such that all the units shall be multiples of ten. Thus, in Fig. 7, the candle-powers are 20 ft. to the inch, the distances are 2 ft to the inch, and the foot-candles are 2 foot-candles to the inch.

Having the curve of the lamp plotted, and wishing to know the intensity on a plane, say, 5 ft. below the lamp, as in Fig. 7, place the zero of the scale (20 ft. to the inch in this case) at o, and swing it to the point *B*, where the intensity is required. Note the candle-power where the scale crosses the curve at *D*, and the distance where it crosses the plane at *B*. Divide the candle-power, *O D*, by the square of the distance *O B*, and the result is foot-candles, to be laid off on the vertical ordinate, *B C*. The intensities may be found at other points similarly, taking the points near together where the desired curve changes direction rapidly. Having drawn two intensity curves for a given plane, the distance apart may be determined by folding one sheet along the line of the plane and placing the inverted curve on the line of the plane of the other curve. By sliding the lower curves from right to left, the distance between the two curves will give the total foot-candles due to reinforcement of one lamp by its neighbor, and the proper distance apart of the lamps easily determined. (See Fig. 6.) Fig. 3 shows the lines of equal intensity as plotted from the curve in Fig. 6, that part to the left of *A B* showing the lamps opposite; that to the right staggered. This curve shows remarkably uniform intensity.

Lighting of Public Halls and Lodge Rooms.

By J. R. Cravath and V. R. Lansingh.

In the lighting of public halls, lodge rooms and the like, the object to be attained is an even, general illumination of the whole room with as little eye-trying glare in the eyes of the audience as possible. In audience rooms of all kinds, it is desirable either to conceal the sources of light, or, if this is not practicable, to place them high, and so far out of the ordinary line of vision that the effect on the eye will be least detrimental. The rays from a source of artificial light, if that source is not very intense, may not be sufficient to cause noticeable discomfort to a person with strong eyes. When one sits for a long time with the rays falling in the eye, however, there usually follows a slight unpleasant burning sensation, the cause of which the owner is frequently not aware of. The only way to obviate entirely this is to keep the sources of light where direct rays from them cannot fall in the eye. As this is frequently not practicable, the use of diffusing globes is the next best thing, always keeping the light as far out of the ordinary line of vision as possible.

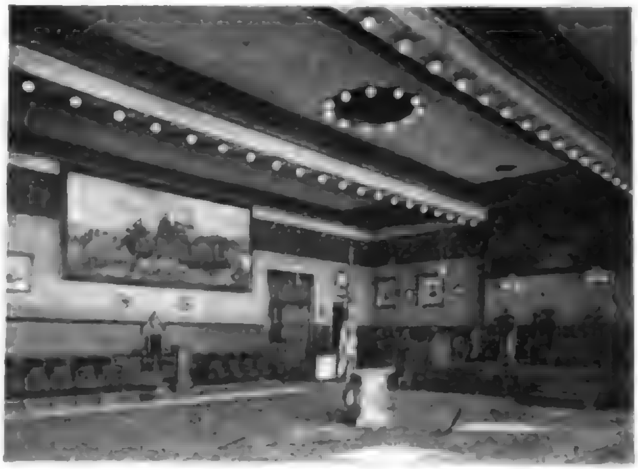


FIG. 1.—A WELL-LIGHTED LODGE HALL.

The following engravings are from photographs taken by daylight to show the arrangement and equipment of lights. Fig. 1 is an example of a well-lighted lodge hall. The lamps are placed high on the ceiling and are enclosed in globes which diffuse the light, and at the same time give the maximum amount of light downward. The same effect could be produced by a diffusing globe, if it were of a large enough diameter to permit the introduction of a small reflector through the neck of the globe, which reflector could be placed over the lamp. A ball with prismatic reflector for the top half and ground glass bottom

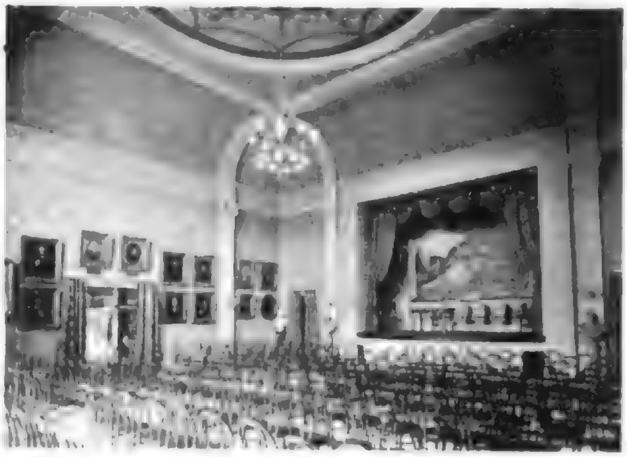


FIG. 2.—A BAD METHOD OF HALL LIGHTING.

would produce similar results to the globes used. It would have been possible to have lighted this hall well by using instead of these globes, a prismatic reflector with frosted bulb lamps. The latter arrangement would probably have resulted in a higher intensity of light on the floor, since reflectors give a stronger downward candle-power than the globes mentioned. The general effect would have been more trying on the eyes on account of the less perfect diffusion of the light, and the cost of lamp renewals would have been greater since frosted bulb lamps have only approximately half the life of clear bulb lamps enclosed in globes. The hall shown in Fig. 1, which is a lodge room known as Washington Hall in Chicago, is 44 ft. wide by 50 ft. long. There are 48 lamps of 16 cp on the two ceiling beams and 11 lamps in the circle at the center. The six lamps back of the platform should hardly be counted as aiding in the useful illumination of the room, as they detract from rather than add to the general effect, and should never be turned on. Counting the ceiling lamps only, therefore, there are 59 16-cp lamps to illuminate this hall of 2,200 sq. ft. floor space. With lamps taking 56 watts each the energy consumption would be 1.5 watts per square foot of floor space in this room. The illumination is good.

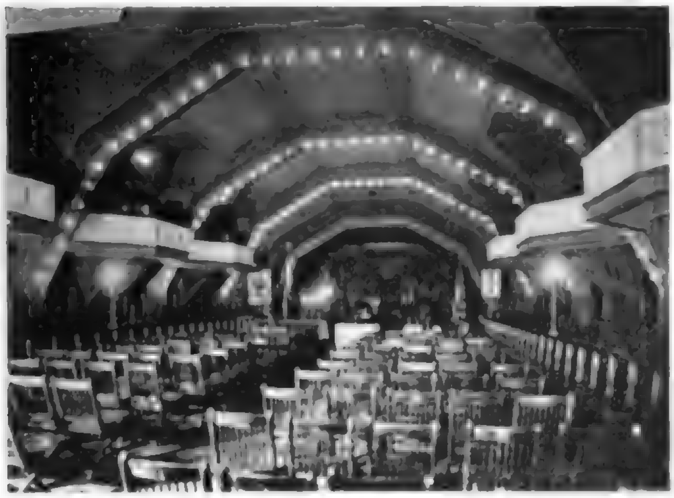


FIG. 3.—SYSTEM OF LIGHTING RUINOUS TO EYES.

Fig. 2 shows an assembly room lighted mainly from a central chandelier. This chandelier is equipped with opal bell reflectors. The light falls in the eyes of persons seated in the back row. Although a central chandelier is the common method of lighting such a room, it is hard on the eyes of that part of the audience which must face it. It would have been better to place the lamps at the rear and sides of the room so that the rays would not fall in the eyes of persons in the audience. Somewhat higher efficiency could be secured with the present chandelier and reflectors by pointing the lamps straight down, because with this reflector, which gives a wide distribution of light, an unnecessary amount of light is thrown toward the ceiling when the light is placed at an angle as in this case. A better way if the chandelier is retained would be to raise the chandelier to mar the ceiling and use powerful prismatic concentrating reflectors to throw the light down, leaving the lamps at about the same angle as shown, thus getting the lamps more out of the line of vision. The bracket lamps on either side of the stage are very trying since they must be faced by the audience.

Fig. 3, the Masonic Temple lodge room in Chicago, is a glaring example of how not to light such a room. The large number of bare lamps placed on the arches make it impossible for persons in the audience not to receive a large amount of light from these lamps directly in the eyes. Furthermore, since there are no reflectors on the lamps, a large amount of light is wasted which could be directed downward were reflectors used. The lighting of this hall could be considerably improved by simply putting on deep reflectors with frosted bulb lamps, which would increase the amount of illumination on the floor and decrease the glare. If enclosing globes are used for diffusing purposes, the choice, if maximum efficiency were desired, would lie between the ordinary diffusing globe and the diffusing ball, either of which would direct the light downward. Otherwise ground glass balls could be used. In planning the lighting of a new room of this kind the lamps should be placed behind rather than upon the arches and thus be hidden from the view of the audience when the room is used for general entertainment purposes. If this were done, the lamps should be placed at an angle of about 45 deg. to the ceiling, pointing forward toward the platform, and equipped with efficient reflectors to direct the light forward and downward.

Combination Lighting and Traction Plants.

A number of interurban roads in the Central West have reached the stage in their development where they are seeking loads for their power stations. The purchase of small lighting stations in towns along their line not only furnishes an additional source of income, but it provides consumption of current during the night when the railroad load is light. Where high-tension transmission from the central station is used, the lighting station in a small town can frequently be transformed into a sub-station to good advantage, and the expenses of operation are reduced considerably as the attendants can take care of both systems. An interesting combination plant of this kind is now in operation at Norwalk, O., the plant and system of the Norwalk Gas & Electric Company having been acquired by the Cleveland & Southwestern Traction Company. The old power plant has recently been thoroughly overhauled and now contains a rotary converter for operating the west end of the Norwalk division of the road feeding eastward about 12 miles. The old boilers and engines were retained for use in case of emergency and they have proved very convenient for operating not only the local lighting system, but a portion of the railway end as well in cases of trouble with the transmission line. The two engines are 125-hp Hamilton-Corliss condensing engines placed on either side of the engine room. Adjoining one of these engines is a 250-kw rotary converter, while adjoining the other is a motor-generator set consisting of a 300-hp, 387-volt, alternating-current, motor direct-connected to a 200-kw, 2,000-volt arc machine. Belted to the extended shaft of the rotary is a 75-kw alternator for incandescent lighting. The primary current enters the station at 22,000 volts and passes through a step-down transformer, where it is reduced to 387 volts. The current passes through an alternating-current switchboard controlling the circuits to the rotary and to the motor-generator set. The 650-volt, direct-current generated by the rotary, supplies a small power circuit in the city as well as the railway. The 75-kw machine belted to the rotary supplies the daylight incandescent load. This machine is connected to a common bus-bar with the larger generator, and the motor-generator set is started in the evening when the lighting load becomes heavier. The rotary and the 75-kw alternator have separate exciters and the voltage variation caused by the inequality of the railway load is compensated for in the lighting circuits by a voltage regulator for the exciter voltage.

The energy for the street lighting is taken off in four circuits through Westinghouse current regulators, two circuits on each. The motor-generator set may be connected by means of a lever-operated clutch to the belt and pulley from the engine adjoining it, while the other engine is belted to a jack shaft from which either the rotary or the 75-kw generator may be belted in very short order.

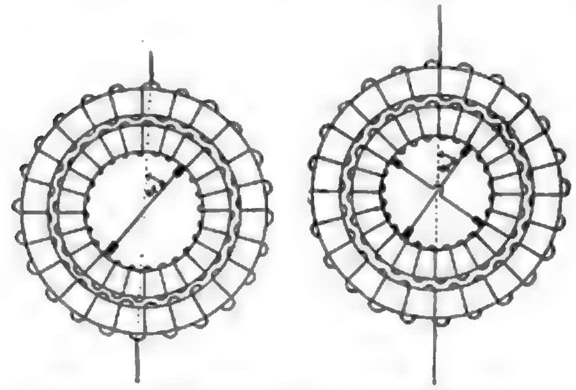
The whole is an extremely flexible arrangement. In several instances where the transmission lines have been interrupted, direct current for that end of the railway has been supplied from this station; while on other occasions the machines have been operated inverted, and alternating current has been generated for the next sub-station, so that the entire division has been operated from this station.

The company has recently greatly improved its line work and has put up 22 miles of arc circuit of No. 6 and No. 8 wire; 18 miles of commercial circuit of Nos. 4, 6 and 8 wire, and five miles of motor circuit of No. 8 wire. The town has a population of about 8,000. Natural gas is sold at a very low rate and the company has entirely abandoned its artificial gas business. It operates about 3,000 incandescent lamps and makes a rate of 10 cents net for residences with a minimum charge of $1 per month, and 6 to 8 cents per kw-hour for stores and business places. Formerly it had a great many flat-rate customers, but these are being taken off as rapidly as possible. The city contract calls for 110 arc lamps at $70 per year, midnight schedule.

The local manager is now starting on an aggressive campaign after additional residence business, the installation of fans, electric signs, small motors, electric flat-irons and other heating specialties. He is fitting up a room with these articles for demonstration.

New Type of Alternating-Current Motor for Elevator and Tool Work.

In a paper read at the recent Milwaukee meeting of the American Institute of Electrical Engineers Mr. Maurice Milch described a type of motor in which starting characteristics similar to those of a repulsion motor are associated with the synchronous-load characteristics of an induction motor. The motor consists of a repulsion motor and a commutator induction motor combined in one structure. The two component motors are shown diagrammatically in Figs. 1 and 2. It is stated that the commutator motor indicated in Fig. 2 does not possess any starting torque whatsoever, for any sine-shaped field component perpendicular upon one brush circuit is completely damped out and annihilated by the other brush circuit which is short-circuited upon itself and does not contain counter electromotive forces when the rotor is at rest. As soon, however, as the rotor is set into motion a torque appears which just gradually increases and then decreases as the rotor approaches synchronism; thus it possesses the speed-torque characteristics of the single-phase induction motor. The author shows that by simply choosing a particular distribution of ampere-turns along the gap of the machine, the two elementary motors indicated in Figs. 1 and 2 may be combined in one apparatus, and that by winding the primary member with any full-pitch distributed winding and the secondary member with any full-pitch drum winding the required conditions will be obtained. When the motor is provided with two sets of brushes, each set being placed nearly perpendicularly to the other, the resultant machine will be similar in principle to a combination of a two-pole induction motor with a four-pole repulsion motor, which possesses a good starting torque and a limiting speed somewhat above synchronism.



FIGS. 1 AND 2.—DIAGRAM OF COMPONENT MOTORS.

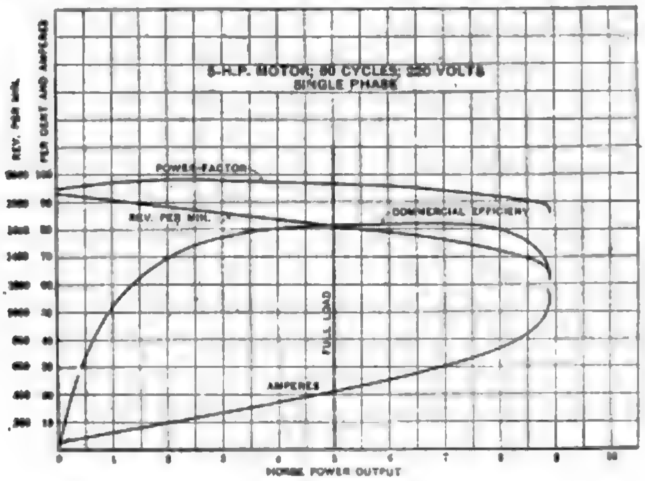


FIG. 3.—CHARACTERISTICS OF 5-HP MOTOR.

Fig. 3 shows the results of a brake test of a 5-hp, 60-cycle, 220-volt motor. The performance of the motor, according to these curves, compares very favorably with any other single-phase motor of this size, and at the same time points out the commercial possibilities of the motor. Considering the application of this motor, that is, for tool, elevator and similar work, it would appear that the large slip at full load is of very little importance in most cases. Should closer speed regulation be required in a particular case, a portion of the primary winding may be cut out at full speed so as to make the axis of the primary member practically coincide with that of the "power" circuit of the secondary; the slip will then be reduced to about three or four per cent. The high power factor is due to the introduction of an auxiliary electromotive force into the "compensating" circuit, which serves to supply the exciting magnetomotive force to the rotor, which is almost non-inductive at synchronous speed. The commutation of all motors of this type built so far compares quite well with that of corresponding direct-current motors, and endurance tests have also shown that the commutator does not require more care.

Automatic Engine Stops.

At the Milwaukee convention of the American Institute of Electrical Engineers, Mr. Charles M. Heminway presented a paper describing automatic safety devices for steam engines and turbines. The author stated that automatic stops bear the same relation to steam engines and turbines that safety valves do to boilers or circuit-breakers to dynamos. It is probable that the universal adoption of circuit-breakers closely followed an unusually large number of accidents; similarly, the alarming increase in the number of runaway engines and resultant fly-wheel wrecks will doubtless hasten the general use of safety devices for engines and turbines.

Engine stops are of varied design and are applied in many different ways. Most of them are designed merely to stop the engine mechanically in case of over-speed. There is a growing tendency toward the use of electric current to trip the engine stops, thus allowing them to be operated from any number of points. When an employe is caught in the machinery, when the belting breaks, when the shafting or the machinery is out of order, when a cylinder head blows out—in all cases when it would be impossible to reach the throttle promptly, the automatic stop is invaluable.

One stop is designed to be attached to the governor column, and upon being tripped electrically, opens a steam valve, allowing steam to enter a small cylinder against a piston which raises the governor balls to their maximum position thereby cutting off the supply of steam to the cylinder. This is a reliable stop and in connection with a speed limit device is very effective.

Other forms are applied to special valves which must be placed in the steam line and operated as an auxiliary to the main throttle valve. The valve in these forms is usually closed by steam pressure, the steam being admitted to some small cylinder and moving a piston in closing. These forms have many points in their favor, but care must be taken to keep them in order, and the expense of inserting a special valve in a steam line already erected is rather great.

Another type of engine stop operates directly upon the throttle valve and can be easily applied to any engine without interfering with its regular work. This stop is bolted to the engine frame at any convenient place, and is attached to the valve stem by means of a sprocket wheel and chain. As the valve is opened, a cable, to one end of which is attached a weight, is wound on a drum on the stop and is held by a pawl which engages in a ratchet wheel. When the stop is tripped electrically the weight is released, revolving the sprocket wheel and thus closing the valve, a dash-pot in the stop forming a cushion to prevent jamming the valve. This, in connection with the speed limit, forms a very satisfactory device; and as gravity is depended upon for doing the work there is nothing that is likely to fail in operating.

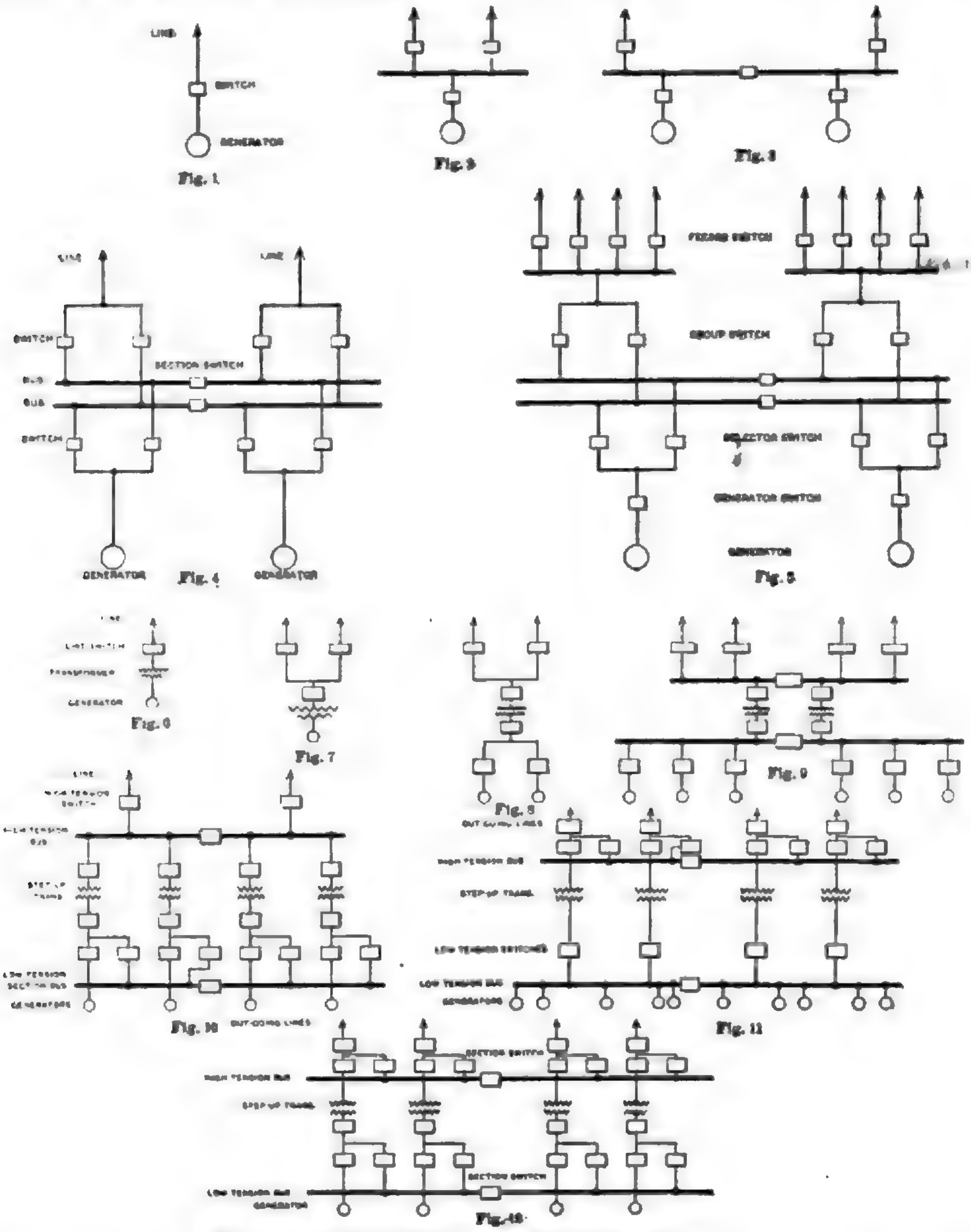
Another engine stop also operating on the throttle and connected to it with a sprocket wheel and chain, similar to the one just described, is operated by a small electric motor. This is more expensive on account of the motor and the necessary generating apparatus. The current can be taken from bus-bars, but in order to insure reliability it is advisable to have the engine furnish its own current. This kind of stop is particularly desirable on units having 12-in. valves, or larger.

In order to insure protection for all contingencies, an automatic vacuum breaker is wired in the circuit with each of the engine stops where condensing engines are equipped with this safety device, so that if the engine should be shut down automatically, the automatic vacuum breaker will operate simultaneously with the engine stop opening the exhaust to the atmosphere.

Another provision for safety has been provided in an automatic circuit-breaker trip which also is wired in the circuit with the engine stop. In plants where engines operate generators in multiple, the closing of the circuit, either automatically by the speed limit or from any of the push switches in the system, operates not only the engine stop, but also the circuit-breaker trip, thereby cutting out the generator to prevent it from running as a motor.

Electrical Connections for Power Stations.

A discussion of the general principles relating to the interconnection of generators, transformers, lines, bus-bars and switches with their relays was given by Mr. D. B. Rushmore in a paper read at the Convention of the American Institute of Electrical Engineers, held in Milwaukee during this week.



Electrical Connections for Power Stations.

The simplest system is one in which a single generator feeds directly into the line without transformers or bus-bars, and with a single switch, as shown in Fig. 1. Next comes the use of a single bus and a multiplicity of lines or feeders, necessitating a switch for each line, a single bus and a generator switch, as indicated in Fig. 2. A second generator necessitates the addition of a bus sectionalizing switch, as represented in Fig. 3. The addition of another bus-bar necessitates selector switches for both lines and generators (Fig. 4), to allow any group of lines to be run from any group of generators. If there are a large number of feeders, a group switch is added to the lines and a generator switch to the machine, and there is obtained what might be called a standard system of connections for an urban railway system, as illustrated in Fig. 5. This arrangement is subject to discussion, but possesses many valuable features. It will be noticed that both the generators and line have two oil switches in series—a point open to discussion.

Fig. 6 represents the simplest layout with transformers of a single generator transformer bank, switch and line. This is used where a number of plants feed into the same system. With more than one line, as in Fig. 7, a bus-bar and transformer switch are used on the high-tension side. In Fig. 8 we have the next step, where several generators connected to a low-tension bus-bar through generator switches, and a low-tension transformer switch is employed. It will be noticed that there are here two oil switches in series. The arrangement shown in Fig. 9, while more complicated, is better, in that the plant is divided, and the two parts may be run independently, and all of the transformer "eggs are not in one basket." This arrangement is typical of an installation with many feeders and with a number of small generators.

Fig. 10 represents another step where the generator capacity is sufficiently large to allow of a generator-transformer unit combination with a duplicate outgoing line. This, with slight modifications, represents the layout of one of the most modern plants at present being installed. By running in parallel on the high-tension side only, any generator can be run with any transformer. The whole station can be run in parallel or the two parts run separately. It will be noted here also that two switches are in series.

Fig. 11 represents a modification where the generator capacity is relatively small, and a transformer line unit is used.

Fig. 12 illustrates a generator, transformer and line unit which is very desirable and is possible in some plants. Here each unit may be run as an independent station or any single combination may be made.

The station connections which are shown represent the latest practice in plants recently installed, and are self-explanatory. The conditions necessitating these arrangements are, however, not evident. In most of them, however, a low first cost has been an important factor.

Commutation Poles in Direct-Current Motors.

In a paper read at the annual convention of the American Institute of Electrical Engineers at Milwaukee, Mr. C. H. Bedell discussed the design of direct-current motors as influenced by the use of the inter-pole. After outlining the limitations in output which are soon reached when no special means are employed to control the field distribution, descriptions were given of the advantages attending the use of small auxiliary poles placed midway between the main poles with pole faces covering the region of commutation.

In order that the proper commutating field may be obtained that would vary with the load, the inter-poles are wound with the necessary number of turns and connected in series with the armature. Thus when the load on the armature is heavy, the ampere-turns on the inter-poles are large, resulting in a powerful commutating field; and when the armature load is light, the excitation of the inter-poles is light, resulting in a weak commutating field. That is, by this construction a heavy commutating field is provided when required, independent of the main field strength, and this commutating field varies with the load.

The question may be asked whether the same excitation is required on the inter-poles for a given load, for both high and low speeds. Experiment has proved conclusively that if the excitation of the inter-poles is correct for high speeds, it is also correct for all lower speeds. Although the same number of lines of force are sent into the armature from an inter-pole for a given load, irrespective of the rate of rotation, yet the electromotive force generated in the short circuited coil is proportional to the rate of rotation. Thus a high electromotive force is provided for the very quick reversal of the current at high speed, and a much lower electromotive force is provided for the slower reversal at the low speed.

In the designing of machines along the old lines, some of the dimensions are limited by the sparking condition. For example, it will not do to put more than a certain number of ampere-turns per inch of periphery on the armature, as a larger number produced too great armature reaction. Similarly it will not answer to have too small an air-gap for the same reason. With the interpole construction these conditions do not obtain, for no matter what the armature reaction may be over the face of the main pole, the inter-pole always gives the proper field for commutation. It follows, therefore, that radical changes in proportions may be made, materially reducing the size of the machine.

The change in the relative amount of iron and copper in the armature makes quite a change in the form of the efficiency curve. As the amount of iron is less, the hysteresis and eddy-current losses are less. The increased amount of copper makes I^2R armature loss greater. The full load efficiency is practically the same as in the standard motor, but on light loads the efficiency is increased. The motors, therefore, show a much better efficiency under varying loads approaching the condition of the all-day efficiency of the transformer.

The author stated that by the use of the interpole the following advantages are obtained: A powerful commutating field is provided to assist the carbon brushes in resisting the sparking tendency, and this field is independent of the main field. The intensity of the commutating field is proportional to the load on the armature. The brushes are placed on the neutral line, and in consequence the machine is perfectly reversible, and may operate either as a motor or dynamo without shifting the brushes or changing any of the connections. A large number of ampere turns per inch of periphery is permissible, also small air-gaps, resulting in a large output for the material used. The form of the efficiency curve is better suited to the average load.

The Inspection of Motors and Motor Bearings.

By Wm. Kavanagh.

The tendency of motor manufacturers to lessen the clearance between the armature and pole pieces of motors increases the liability of accident to the binding bands on armatures, and requires extra precaution on the part of the motor attendant or electrician, if this is to be forestalled. The object of lessening this air-gap is to effect economy in the operation of the motor; but this economy is not realized by reason of the frequent renewal of bearing sleeves and the extra attention necessary to forestall accidents. When motors are attached to ceilings and boxed in the expense incurred in their maintenance is increased because the boxes employed are usually so small that proper inspection is almost impossible. When motors not fitted with break-down bearings are fixed to ceilings and boxed in much trouble is experienced in changing armatures or renewing the bearing sleeves. When an armature is too close to the pole pieces a small spark will be seen between it and the pole pieces or the binding wires will appear bright and polished.

The clearance may be determined as follows: The person in charge of the motors should carry a number of clearance strips of different thicknesses. These are generally made of thin sheet brass and when the motor is stopped one of those strips can be passed between each pole piece and the armature; the thickest strip being used first. If this strip cannot pass, then the next thickest strip should be tried and in this way the amount of clearance can easily be determined. By using such precaution many accidents to armatures may be obviated and unnecessary breakdowns prevented. Usually the greatest number of accidents to armatures occurs from permitting the bearings to wear down. In plants where no regular "belt man" is employed each employee repairs his own belt, and in almost every case these are made too tight. The extra tension on belt increases the wear on the bearing sleeve, thus lowering the armature and increasing the liability of accident.

The tension on a belt may cause an armature to run in an oblique direction between the pole pieces, as illustrated in Fig. 1. It is very important to note the direction of belt strain when testing for clearance. When the tension on the belt is either up, down or horizontal, the bearing will wear in that direction and the resultant strain on the commutator bearing will cause this bearing to wear in the opposite direction, as shown by Fig. 2. Referring to Fig. 2 it will be noted that the strain caused by the belt being too tight has worn the sleeve, *A* in a downward direction, as indicated at *B*, while the resultant strain on the armature bearing, *A'*, has worn the sleeve in an upward direction, as shown at *B'*. In like manner if the belt strain is horizontal the wear on the bearings will be in that plane, as shown diagrammatically by Fig. 3.

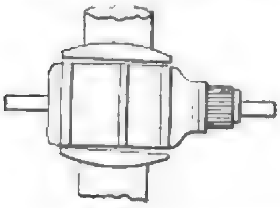


FIG. 1.

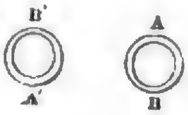


FIG. 2.

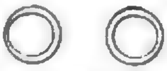


FIG. 3.

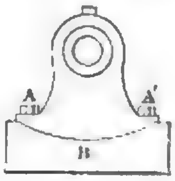


FIG. 4.

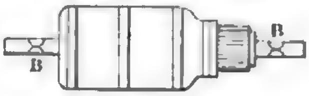


FIG. 5.

If the sleeves are worn down and there are none at hand which can be used the armature may be raised sufficiently to permit the insertion of some thin strips of sheet metal beneath the sleeves, care being taken that the strips so inserted do not interfere with the rotation of the oiling rings. In this way much wear can be obtained out of the sleeves before they are finally discarded.

Where motors are provided with breakdown bearings, the insertion of strips to maintain the concentricity of the armature, with reference to the pole pieces, can be readily made by loosening the bolts, *A* and *A'*, Fig. 4, and inserting the strips at *B*. The life of the sleeves may thus be greatly prolonged. The heating of motor bearings may be due to any of the following causes: Belt excessively tight; oil old and gummy; non-rotation of oiling rings; leakage of oil from the bearings either through the glass connections, or through some hole in the bearing casting; high peripheral velocity of the oiling rings, thus discharging the oil out of the well and eventually lowering the amount of oil. In order to prevent hot bearings the old oil should be removed from the oil well at least once every two weeks, and the well washed out with kerosene oil. After this has been done the well may be filled with fresh oil, and when the motor is running, the attendant should make certain that the oil rings rotate.

Where bearings are under excessive strain, the lubrication may be assisted and the liability to heat lessened by filing some shallow grooves in the journal, as shown in Fig. 5. The grooves should intersect each other, as shown at *B*, and should not extend quite the length of the journal. If properly filed these grooves will be found a great improvement and will materially assist to prevent heating.

If sleeves are to be renewed, and it is found necessary to file or scrape them in order to have them fit, matters may be greatly facilitated by heating the sleeves, which will thus be expanded and slip on the journal without driving. If driving is resorted to the sleeve is liable to be injured, especially if it is made of babbitt metal. Sometimes it may be difficult to insert the sleeve in the bearing, in which case if the bearing is heated and the sleeve placed in a pail of cold water considerable labor may be saved. The sleeve must be a fairly loose fit for the journal. The plan just mentioned is followed in several large motor-driven plants, and it is surprising how much time and labor is saved by such a simple process.

Where motors are blown out by means of compressed air it is poor policy to hold the nozzle of the blower close to the armature or field coils, as this affects the insulation, and in some cases strips the insulation from the coils. The air should be dry and the nozzle kept far enough away so as not to injure the insulation.

If motors are operating in an atmosphere laden with iron or emery dust the pole pieces will be found covered with a fine deposit of this dust which must be wiped or blown off; otherwise it will find its way into the armature coils eventually, causing a burn out.

If motors must be attached to ceilings they should not be boxed in. The boxes are usually not large enough to permit men to repair the motor advantageously, and the boxes act as a dust trap, retaining most of the dust carried in by the belt. The following practical hints on the inspection of motors may be helpful to the motor attendant or electrician: Motors should be kept clean; the bearings should be supplied with a sufficient quantity of clean oil; particular attention should be given to the oiling rings, it is very important that they rotate. The brushes should be in the best non-sparking position and have sufficient pressure on commutator and should also be free to move under the spring tension; there should be equal clearance between the poles and armature; in oiling motors the bearings should not be entirely filled.

Oiling Systems for Electric Engines.

By W. H. Wakeman.

WHEN electric plants for supplying light for our streets and other purposes first made their appearance, the short-stroke, high-speed engine which they often employed was in great contrast to the long-stroke, low-speed machine with which we had been familiar for a long time, and the oiling devices that they called for were as different from what we had been using as any other part of the new system. As time has passed away, improvements and changes have been made along these lines until a remarkable state of perfection in them is the result, and the object of these articles is to give some account of these.

The first electric lighting engine that the writer had charge of made 275 turns per minute, and drove a pair of Thomson-Houston dynamos fitted with electric governors. No grease was used on these engines, but every bearing was intended for oil, and it had to be used in large quantities. Each bearing was supplied with oil by an independent sight feed oiler with a glass body, and as they were not of large size it required much time to keep them all feeding oil.

The only objection to this system is that it takes too much time to care for it, and largely on this account something different was devised, although I sometimes think that if the first oiling system that ever was used proved to be perfect, others would appear just to be different from the invention of somebody else.

The first change along this line to be noted is shown in Fig. 1. It is used on the Sturtevant engine and others. A comparatively large reservoir is located on a higher level than the highest bearing to be oiled, and a separate pipe leads from this to each bearing. In the illustration there are eight, each of which is fitted with a sight-feed regulated independently of all others. This enables the engineer or oiler practically to fill all of his cups at once, not through the nozzle of a small can, but by pouring it in with a gallon measure. Each feed is set to supply the quantity that is required by the bearing it feeds, thus making it possible to regulate the whole perfectly. Some of these feeds are for bearings inside of the crank case, which cannot be reached easily.

Fig. 2 illustrates the oiling system adopted for Westinghouse engines. The crank case is partially filled with water, then one gallon of black West Virginia oil is added. This kind is recom-

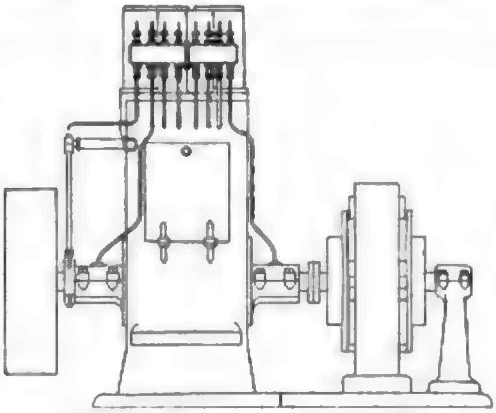


FIG. 1.—OILING SYSTEM OF STURTEVANT ENGINE.

mended in preference to more expensive kinds because the churning action of two cranks in rapid motion does not cause it to saponify or turn to soapsuds. Of course, every internal part is covered by this mixture of water and oil, which lubricates all of the bearings. This engine has no cross-heads, as the connecting rods are attached to cranks at one end and wrist pins set directly in the piston at the other. These pistons are made very deep, exceeding the diameter of the cylinder in order to prevent cutting and rapid wear from the peculiar strain brought to bear on them.

This is a single-acting engine taking steam on the upper end of each cylinder only. If water leaks past the pistons it goes into the crank case, and this would raise the water level too high, carrying the oil with it, if provision was not made for preventing it. This is done by connecting a pipe into the base of the crank case, as shown, and carrying it up to the desired oil level. Nothing but water comes into this pipe, because oil keeps as near the surface as possible. It cannot rise higher than the outlet of this pipe, and this keeps the oil from overflowing through spaces around the crank shaft, etc. Of course the engineer cannot tell whether these bearings are heating or not; therefore, so long as oil in the crank case is maintained at a proper level he cannot be held responsible for undue wear and tear.

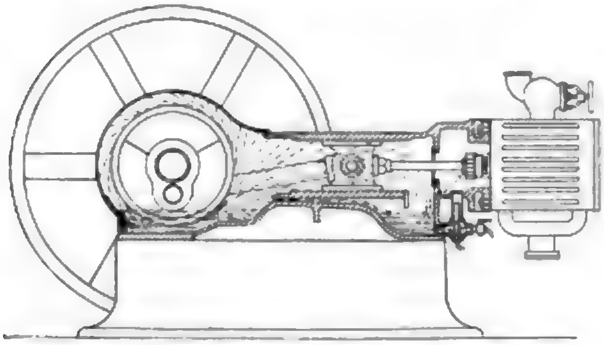


FIG. 3.—OILING SYSTEM OF "IDEAL" ENGINE.

Fig. 3 shows an oiling system similar to the above, applied to a horizontal engine. It is used on the "Ideal" engine and others. Oil is put into the crank case and the crank dips into it at every revolution, splashing it on the guides, also the wrist pin bearing, thus keeping them all well oiled. As this is a double-acting engine, water will sometimes come out around the piston rod, and this must be kept out of oil to be used for lubrication. This is accomplished by providing an opening for it to escape into the bottom of the frame. Oil is also thrown into this space by the crank, but water always goes to the bottom, letting oil rise to the top. There is a water gauge under the piston rod near the stuffing box that is ingeniously contrived. When the annular space around the central tube is filled it then falls into the tube and escapes through the ell as shown. Of course this can be piped away to any suitable place.

The objections to this kind of oiling system, whether applied to a vertical or a horizontal engine, are that it does not give the engineer a chance to know whether the bearings are running cool or not, and when it becomes necessary to repair these engines the parts are in a dirty condition. As many of them are run for long periods without shutting down, it shows that the plan is feasible, but it does not prove that lubrication is perfect. As it is not a difficult matter to clean them, the second objection is not very serious.

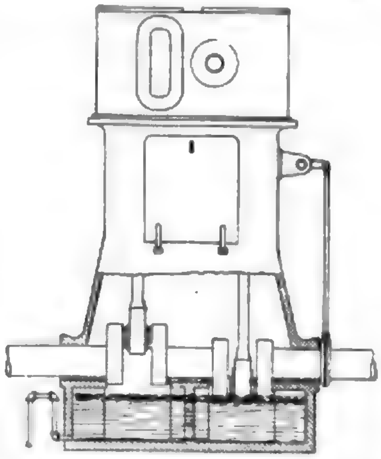


FIG. 2.—OILING SYSTEM OF WESTINGHOUSE ENGINE.

Fig. 4 illustrates an oiling system that is used on Payne engines. When one of these engines is to be started, the central tank shown is filled with oil which is delivered through brass pipes and sight feeds to the bearings. (See also Fig. 5.) After this oil has lubricated these bearings it goes to a receiving tank on the lower part of the frame. (See Fig. 4.) From this it is taken by a pump operated from the rock shaft and forced into the upper tank again. It flows from the free end of a curved pipe into a funnel, as shown in Fig. 5, and as this is in plain sight it gives the engineer a chance to see whether this oil pump is working or not. As it is filtered before leaving this tank, or it may be better to say that it is well strained as there is not time enough given to filter it, there is no danger of small pieces of waste or other objectionable matter getting into the sight feeds and clogging them.

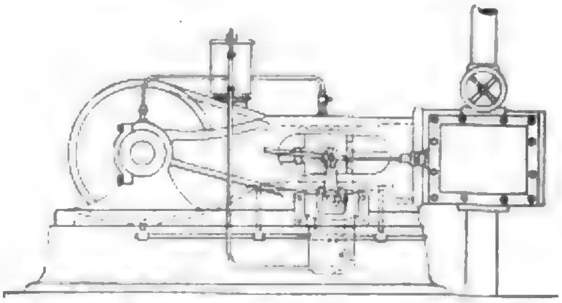


FIG. 4.—OILING SYSTEM OF PAYNE ENGINE.

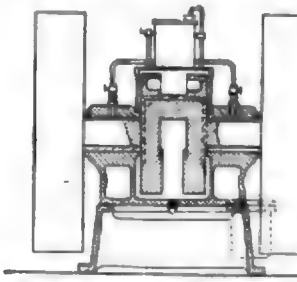


FIG. 5.—OILING SYSTEM OF PAYNE ENGINE.

There is no good reason why a system of this kind should not work well under fair conditions, but some engineers do not favor it. Some time ago I saw one in operation, but the oil was in such poor condition that it could barely be used, and was in danger of failure at any time.

LETTERS ON PRACTICAL SUBJECTS.

PECULIAR DESTRUCTION OF INCANDESCENT LAMPS BY DEFLECTED FILAMENTS.

I should like to bring to the attention of your readers a curious condition which I have found to exist in the prescription room of one of our local druggists whom we supply with electricity, the current being alternating and the potential 110 volts. In the center of the prescription room hangs a 16-cp incandescent lamp. The walls of the room are lined with the usual array of drugs, chemicals, etc., in glass bottles. The pharmacist states that every three weeks he has to renew the lamp in the center of the prescription room, owing to its burning out, and he showed me six or seven of these burned-out bulbs. In each case the filament was deflected until it touched the glass, puncturing it and of course ruining the lamp at once. The direction of this deflection was always the same; but a careful inspection revealed no chemicals for which I should judge the filament would have either an affinity or antipathy. There are no magnets or electrical devices in the vicinity which could affect the lamp, which I might add is of standard G. E. make. I should like to receive the opinions of interested parties as to the cause of this, through the columns of the ELECTRICAL WORLD.

DALLAS, TEXAS. H. B. CHAMBERLAIN.

PARALLEL OPERATION OF ALTERNATORS.

With reference to Mr. Reynold's question in the parallel operation of alternators as noted in the May 5 issue, I am of the opinion that the machines were not in step until the field excitation of the alternators was strong enough to hold them together. I have frequently had trouble with the phasing apparatus not working when starting up, and not having time to locate the trouble and not wishing to delay taking on the load I have started the machines with the switches closed, and noticed that the alternators pumped until the exciting current was strong enough to hold the alternators together after which they remained in phase.

SOUTH WINDHAM, MAINE. B. H. ELKINS.

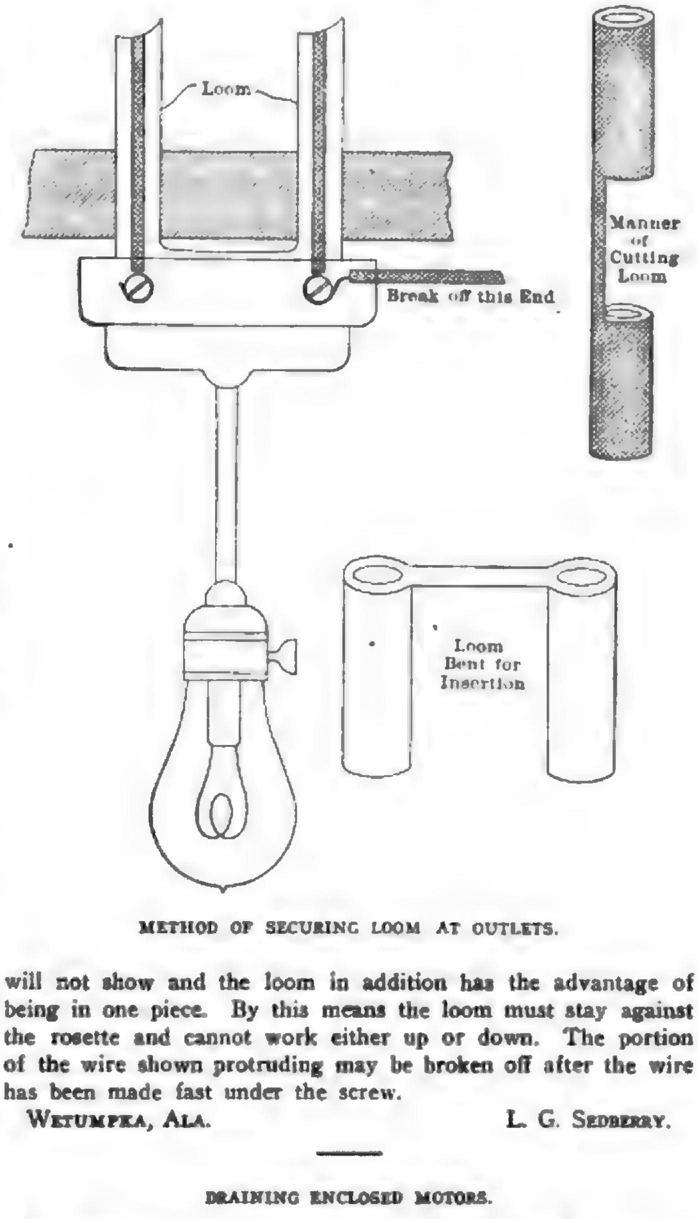
LOSS IN ECONOMY DUE TO IMPROPER EXHAUST PIPES.

It is somewhat strange to find at this late date, when so much has been done to improve the efficiency of engines and in every way possible to reduce the consumption of fuel, that so little attention has been paid to the proper design of the exhaust pipe lines especially in connection with condensing engines. So much depends on the proper design of the high pressure steam piping that the design so far as general arrangement is concerned has become almost standard. The exhaust piping, however, is subject to little pressure so that the element of danger is not present. Water hammer hardly exists except where an engine is so piped that a pocket of water lodges between it and the condenser which may become a menace if the vacuum is suddenly lost. The calamities are, however, never as great as in the case of high pressure steam pipes, the faulty design only affecting the coal pile. The usual fault is that the exhaust pipes are too small or else have so many bends and elbows that they increase the friction of the flow of steam and raise the back pressure on the engine. In condensing plants increase of back pressure is quite costly since the mean effective pressure is reduced, yet this does not seem to have entered the minds of many engineers. Everything is done to enable the full boiler pressure to be available at the engine cylinder while at the exhaust end whatever economy may be effected at the steam end is more than trebly lost by the use of long pipes too small in diameter and containing numerous elbows. In modern turbine installations this is not true, since the condensers are very close to the turbines and the economy effected thereby is placed to the credit of the turbine. It is not uncommon to find feed-water heaters placed between the condenser and the engine and the engineers operating these imagine that they are effecting an economy by heating the water, whereas they are merely straining at a gnat and swallowing a camel.

BROOKLYN, N. Y. M. LEONARD.

METHOD OF SECURING LOOM AT OUTLETS.

I submit herewith a method of securing loom at outlets which will doubtless be of interest to your readers. A portion of the loom equal to the distance between contacts is cut away, as indicated in the sketch. The loom may then be bent back and inserted. The 1/16 in. of loom between the rosette and the wall will not show and the loom in addition has the advantage of being in one piece. By this means the loom must stay against the rosette and cannot work either up or down. The portion of the wire shown protruding may be broken off after the wire has been made fast under the screw.



METHOD OF SECURING LOOM AT OUTLETS.

WETUMPKA, ALA. L. G. SEDBERRY.

DRAINING ENCLOSED MOTORS.

In most factories the inspection of motors usually means a hurried glance at the commutator and brushes and refilling the bearings with oil. This had been the practice at any rate in our factory and a recent experience shows how futile such examinations are. We have a number of completely enclosed motors fastened to the ceiling. Owing to the character of the work it is necessary to use fully enclosed motors or else to use unsightly boxes for partially enclosed motors. A boy climbed a ladder daily to look after the bearings and see that they were well supplied with oil, while an electrician would make weekly inspections of the motor interiors. One day one of the motors broke down and not being able to determine the cause of the breakdown the motor was unbolted from the ceiling and removed to the workshop. When it was taken apart the lower field coil was found burned out and that part of the casing was thick with oil. This had leaked from the bearings and the casings not being provided with a drain of any kind the oil simply accumulated until trouble resulted. Similar trouble from the other motors was forestalled by drilling a hole in the bottom of the casing of each so as to form an outlet for any oil that might find its way to the bottom of the casing.

Indianapolis, Ind. J. A. McFey.

USE OF SLIDE RULE FOR COPPER WIRE CALCULATIONS.

I submit some formulae for slide rule calculation of copper wire, which I hope will be of use to some of the readers of the Electrical World. I do not claim these to be new to all, but owing to the fact that I have never seen them in print or heard of anyone using them, I think they are original. They are, moreover, approximately correct. It is a well-known fact that if the logarithm scale on the back of the slide rule be set on the gauge number (B. & S.), the resistance per 1,000 ft. may be found on scale D under 1 on scale C. The decimal point is set by remembering the resistance of a No. 9 and a No. 10 wire. Sizes 00, 000, and 0000 are treated as Nos. 9, 8, 7 and sizes 10 to 20 are treated as Nos. 1 to 10. The following will be new to many, I think: To find the area or diameter in circular mils or mils, set the rider to 10,350 on the right index of scale A. Then set the resistance per thousand feet on scale B to rider, and over 1 on scale B find the circular mils on scale A; and under 1 on scale C find the diameter in mils on scale D. To find the safe current for rubber or weatherproof wire, set 1 of scale C to the diameter in inches on scale D. Then set the rider to the diameter on the left-hand scale B. Next set 1 of the right hand scale B to rider and under 5 of the right hand scale B find the current on scale D for rubber-covered wire. For weatherproof wire, under 10 of right hand scale B find the current on scale D.

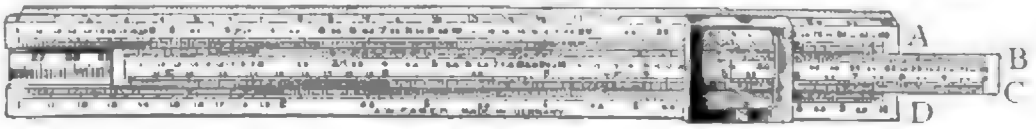


Fig. 1.—Front of Slide Rule.

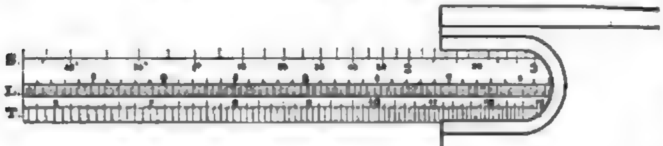


FIG. 2.—REVERSE OF SLIDE RULE.

Salt Lake City, Utah. G. M. Milner.

CONVENIENT RULE FOR CALCULATING THE SIZE OF WIRE FOR THREE-PHASE CIRCUITS.

The three-phase three-wire system is the most used for transmission work, and the calculation of the size of wire for such a system has often puzzled persons acquainted only with direct-current calculations. The square root of three, which is introduced, acts to befog them, and they are also likely to calculate the three drops, and then wonder whether to add them, average them or neglect one of them. A simple and satisfactory rule and one easy to remember is as follows: The ratio of the amounts of copper used for equal drop, power and voltage is 100 for direct-current circuits and 75 for three-phase circuits. It follows then that if one calculates the size of wire by ordinary direct-current rules, and then divides the circular mils by two, the proper size of wire for a three-phase circuit is obtained. The reason for this is that three-fourths of the volume of two wires of a given size is equal to the volume of three wires of half that size, lengths being equal. This simple rule has helped me very much, and while I do not claim it to be original or new, many readers I feel would be glad to know it.

Albany, N. Y. A. C. McMahon.

CALCULATION OF PULLEY AND BELT SIZES BY MEANS OF THE SLIDE RULE.

All manner of pulley calculations, the speed of gears and of belts are very quickly and easily made with the slide rule. Indeed, it is the writer's belief that the slide rule saves him at least one month's time in a year's work, to say nothing of the assurance of accuracy which accompanies its use. It is to be regretted that every mechanic does not possess and use one of these little instruments. Although a special slide rule is procurable for shaft and pulley computations which is very convenient, the ordinary slide rule will serve the same purpose and at the same time be useful for other calculations.

In a certain belt problem, for instance, it is desired to find what pulleys will enable a belt to connect two shafts with speeds of 225 and 200 r.p.m. By placing the point marked 2 on the slide opposite the point 225 on the rule and looking along the right hand side of the rule, it will be found that there are a number of different diameters of pulleys which will satisfy the conditions of the problem. The points 16 and 18 coincide, showing that pulleys of that diameter will do the work. Other numbers which coincide are 24 and 27; 32 and 36; 40 and 45; 48 and 54, and several other diameter of greater magnitude than desirable.

It is very easy to determine the speed with which any given pulleys will drive a shaft from another shaft running at stated speed. It is only necessary to bring opposite each other the points indicating the diameters of the pulleys at hand, look along the rule until the point is found which indicates the speed of one of the shafts and opposite that point on the slide will be found the number indicating the speed at which the other shaft will run. Take the case of a shaft running at 200 r.p.m. with a 54-in. pulley on it, and let it be required to find the velocity of the belt which runs upon that pulley. To do this ordinarily would mean to solve the following by ordinary arithmetical calculation: $200 \times 54 \times 3.141 \div 12 = 2825$. To do this readily by means of the slide rule the constants, 3.141 and 12 are gotten rid of by dividing the former by the latter, on the rule, the result being .262, which multiplied by the shaft speed and diameter of the pulley gives the linear belt velocity at once. To avoid the use of a decimal quantity and to use one division instead of three multiplications, the reciprocal of .262 is found and used instead. This constant 3.83 as well as the reciprocal of 3.1416 which is .7854 should be committed to memory.

Roughly speaking, the belt speed is one-fourth the product of the pulley diameter and the shaft speed taken in inches and feet respectively. To make the calculation with the slide rule it is only necessary to select one of the numbers, say 200, locate it on the rule and make the constant 3.82 coincide with it; then look along the slide until the point is found which indicates the pulley diameter, 54, and under that on the rule will be found the point indicating the belt speed in feet per minute, which in this case would be 2,820. The slide rule is a great time saver and should be in the hands of every one having much calculation to do.

Plant City, Fla. J. F. Hobart.

REVERSING OF ROTARY CONVERTERS.

It is a common experience to sub-stations containing rotary converters supplied from high-voltage lines to have the polarity of the rotary converters reversed by a short on the high-tension lines, so that when the rotaries are started again after an occurrence of this kind they give current in the reverse direction from what they did before. The possibility that this may occur should be remembered by all installing or in charge of rotary converter sub-stations. The converters usually flash over or the breakers come out, making it necessary to reflash the fields if the converter is to generate its current in the proper direction. This can be done by opening the field circuit at a convenient point and with the resistance all cut in circuit exciting the field for a moment with current from another source so that the rotary will build up in the right direction. The field circuit may then be closed and the voltage brought up as usual.

BUFFALO, N. Y. K. L. SMITH.

THE ELECTRIC SIREN.

In the modern motor car harsh sounding horns are used as a long-distance warning. These sounds are not intended to delight the musical ear, although in the expensive cars some effort is made to mitigate the harsh sounds by employing musical horns operated by the exhaust from the engine. In this connection it has seemed strange that no use has ever been made of the electrical siren. It is well known that any magnet excited by alternating current emits a humming noise. If a thin sheet of iron be placed over it for immediate contact, the volume of sound resulting will be a revelation, and if the sheet is mounted with a frame so as to form a diaphragm and the magnet be made sufficiently powerful and operated at a suitable frequency, a most piercing, penetrating sound is emitted which can be heard for miles, especially if collected and transmitted by a megaphone. A small rotary transformer is sufficient to supply the current to operate the instrument. The control is accurate and easy and the pitch of the sound could be modulated if necessary. The sound, of course, would be weird and uncouth, but not more so than the groans of the horns now in use. An ordinary telephone receiver attached across a 52-volt alternating-current circuit will convince anyone of the noise-making possibilities of such apparatus. I remember such a device being used on a Fourth of July celebration and it eclipsed any sound I ever heard.

NEW YORK. C. JONES.

CONVENIENT METHOD OF TESTING ARMATURES AND OF REMOVING INSULATION FROM WIRES.

I recently heard of a few kinks in use in one of the large railway shops in Chicago, which may be of interest to your readers. Unfortunately I can remember but two of these at this time, a method of testing armatures and a convenient means of stripping the insulation from old coils. The armatures to be tested are placed in a rack and brushes are made to bear on the commutator just as in actual practice. The brush holders are bolted to the rack and these are supplied with alternating current at a potential of about 80 volts and at a frequency of 37½ cycles. The armatures which are, of course, without fields, are rotated by hand and any open circuit makes itself manifest by severe flashing. Defects in the armature such as burrs of copper or pieces of solder short-circuiting adjacent bars are instantly burned out at the same time without injury to the commutator. As is well known it is not always an easy matter to remove insulation from wires, much scraping being necessary. In the armature department of these shops a low voltage transformer is used with success to expedite the removal of insulation. Current at a potential of about 7 volts is passed through the armature coil which heats up sufficiently to loosen the insulation, thus making its removal an easy matter.

CHICAGO, ILL. F. G. BRANDT.

CALIBRATING STEAM GAUGES.

It is interesting to note that the mercury gauge which was long ago discarded for practical use still remains the fundamental standard in calibrating new gauges or correcting old ones. The gauge to be calibrated is connected on the same pipe which opens from the pump into the short leg of the mercury column, and the positions of the pointer are observed and marked on the dial when the mercury stands at heights corresponding to certain definite pressures. The heights to which mercury is raised for each definite pressure are based on the fact that 2.038 in. of mercury at 60° F. in the column corresponds to one pound per square inch. If a steam gauge becomes incorrect it is well to bear in mind before starting to repair it that it is impossible to adjust it without a standard test gauge. Merely putting the gauge pointer back to zero will not make a gauge correct. When a gauge is suspected or known to be incorrect it should be sent at once to the maker or to some responsible firm having suitable facilities for repairing, testing and calibrating it.

PORTLAND, ORE. OWEN NEWMASTIE.

STAMP MILL CAMS AND CAM SHAFTS.

In a recent conversation with a machinery salesman on a subject of cams and cam shafts for stamp mills, the fact was brought out that the strain on the cam fastening is very severe, owing to the jar due to the cam striking at the beginning of the lifting stroke, and also on account of the cam being struck on a rebound. The question then came up of the possibility of a more efficient application of power by means of electrical devices and elimination of the self-destroying features of the present mechanical ones. I do not know if this has been tried but it seems to me worthy of consideration.

The application of a large solenoid to each stamp would eliminate all wearing and moving parts except the stamp head and stem with a spring counterbalance, and would secure a mechanism as desirable in its action as the well known cushioned steam hammer. The application of current to each solenoid from a distance could by some suitable device be made of such frequency and duration as to take advantage of the vibration period of the stamp in order to economize the power of its rebound. In addition to the possible greater durability and efficiency could be added the efficiency of electrical transmission of power direct to the stamp.

LAUREL SPRINGS, N. J. HERBERT W. STODDARD.

WINDOW BURGLAR ALARMS.

One of the most unsatisfactory devices the electrician has to install is the window burglar alarm as now made. Even when a carpenter is employed to do the mortising, the work is apt to be unsatisfactory, and the difficulty of making good connections which in time will not develop "shorts" and breaks is very great. Part of the trouble is due to the flimsy nature of the devices usually obtainable from the electrical supply dealer, but I have never seen a window burglar alarm device that I consider satisfactory either electrically or mechanically, and door burglar alarm devices are but little more satisfactory. I have been told that many patents have been issued on window burglar alarms, some of which are claimed to obviate the objections to the old forms, but apparently none of these has entered into general use. The reason may be that the devices involved too much complication in installation, or that owing to limited sale of house burglar alarms, manufacturers of house electrical supplies have not considered it worth while to place them on the market.

Without doubt many electricians have thought of improvements over the old types, and some have probably devised and applied satisfactory forms. I think a real service would be done if work in this line were published, and I hope that this letter may bring out some experiences. As a starter I should like to submit the following suggestion for criticism:

First, use two separate contacts of the very simplest form, installed some inches apart and connected respectively to the two circuit wires. Second, inset a narrow strip of brass in the side of the sash. When the window is closed one or both of the contacts will seat on the wood of the sash; when the window is raised, both will come into contact with the brass strip and complete the electrical circuit. An obvious objection to this method is the cost of the brass strip and cost of labor of setting it, but this would not apply in many cases where security is desired at any reasonable cost. I hope that others will give their ideas on the subject.

CHICAGO, ILL. JAS. L. WHITE.

REPAIRING CORLISS VALVES.

The valve stems on a 14 by 30 Corliss engine became badly worn where they passed through the bonnets into the valve chambers and the bearing surfaces were also found to be in very bad condition. This was corrected by chucking the bonnets in a lathe and taking a thin boring cut through them. A reamer was then passed through the cut and the bearings were left in fine condition, although somewhat larger than originally made. The stems were worn along the portion which projected through the bonnets, so that they were put in a lathe and a cut taken to reduce the diameter about one-half inch less than the enlarged diameter of the bonnets. The stems were then taken to a brass foundry and a coating of brass moulded around them sufficiently thick to permit the stems to be machined to fit the bonnets. The repaired stems worked fully as well as entirely new ones, and cost considerably less. In putting them in the sand, a wooden sleeve of the required diameter for the brass was slipped over the stem along the portion to be covered with brass. The mold was then rammed in the usual manner, and when opened the stem was taken out and the sleeve removed. The stem was then replaced as if it were a core and the brass poured around it.

Chicago, Ill. **Frederic James.**

HOME-MADE FORCED DRAFT APPARATUS.

In a small Texas town the load on the station had become so large that when the peak came on the boiler pressure dropped appreciably making it difficult to carry the load. This peak, however, was only of short duration and since it would not pay to install another boiler, we used a small fan to force the draft and thus keep up the boiler pressure. The fan, however, was always giving trouble and refused to work when we most desired it. We then got an old wind mill wheel and drove this from the shaft to which the feed pumps were connected. We housed in the wheel and used a wooden box to direct the breeze under the grate. The wheel was of the light steel construction and it was not necessary to drive it very fast to obtain a good draft. We used a wooden slider in the box somewhat similar to the slider in the air box of a hot air furnace, to regulate the draft. The old wheel worked well for about a year, and although somewhat unsightly, did good service. When a modern engine was put in place of three small ones we found that the steam consumption was not so great and that it would not be necessary to force the boilers even with the heaviest peak. The old wheel was then removed.

New Orleans, La. J. Browlus.

RE-BABBITTING A WRIST PIN.

Not many years ago brasses were made adjustable for rods by means of a wedge and a set screw. The brasses were made of some supposedly good bronze or similar metal and it was the duty of the engineer to drive the key or wedge until the brasses fitted the pin with the required degree of closeness. The set screw was then tightened and the job was complete. While this arrangement worked well in the hands of a competent engineer, it soon became the prey of the monkey-wrench fiend and in order to prevent this the brass was made a solid fit around the pin and the only means of adjustment was to file away some of the metal between the halves of the brass. It was found that when a pin became hot through lack of sufficient oil, or through the presence of dirt, it would be damaged if the engine were kept running. Indeed the writer has seen brasses so hot that they actually brazed themselves to the rod and had to be chipped off. To prevent injury to the pins, brasses are now usually lined with babbitt metal and set up solid, brass to brass, with a wedge and a screw. With this arrangement should the wrist pin become hot the babbitt metal simply melts out, thus warning the engineer of trouble before the pin is damaged. A case of this kind recently took place in the backwoods where there was not a piece of metal of any kind to be had which could be used as a mandrel upon which to babbit the pin brasses. The engine had to be gotten in shape, however, and the only object of approximately the right size was a tin can about three inches in diameter and ten inches long which had contained some cement used in connection with the roofing material with which the factory was covered. The can, however, was not exactly cylindrical. A hole was therefore punched in one end of the can and a nipple soldered in and steam connections made between the can and the boiler. A drip connection was also made so as to throttle the steam pressure to a point which would not rupture the tin can. The scheme worked perfectly and under a pressure of about 20 lbs. the can rounded out nicely, the flats disappearing and the can calipering with little variation in diameter. Steam was kept on for a short while after the mandrel was in place and before the babbitt metal was poured, thereby heating the box to a degree which insured a perfect flow of metal. A sheet of writing paper was wrapped around the tin can before it was set to receive the babbitt metal.

Jersey City, N. J. F. J. Hammond.

METHODS OF SETTING POLES IN UNSUITABLE SOIL.

There are a number of places where the life of wooden poles is so short that the means taken to prolong it may be of interest. In Salt Lake City, for instance, where salt is plentiful and cheap, it has been found that the liberal use of the substance around the pole while the dirt is being filled in and tamped, is very effectual in preventing rot under ground. Where pole lines run through low ground and swamps and where the climatic conditions are such that timber rots quickly, a concrete setting for the pole often proves effective in staying this. In New Orleans the plan is to put a box of slightly larger dimensions than the pole in a concrete setting as shown herewith. The pole is then slipped into the box and clean, sharp sand poured around it. A sufficient space is left between the pole and the box so that a

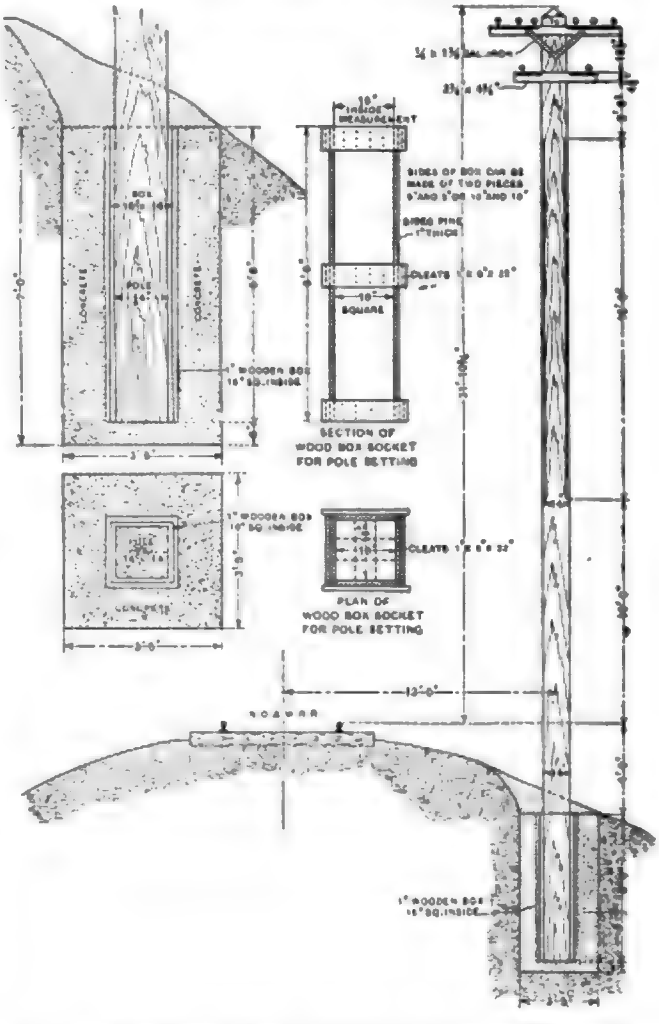

BOX
POLE
CONCRETE
1" WOODEN BOX 16" SQ. INSIDE
3' 0"
INSIDE MEASUREMENT
SIDES OF BOX CAN BE MADE OF TWO PIECES
SIDES PINE 1" THICK
CLEATS
10" SQUARE
SECTION OF WOOD BOX SOCKET FOR POLE SETTING
PLAN OF WOOD BOX SOCKET FOR POLE SETTING
12'-0"
ROADWAY

FIG. 1.—POLE SETTING ALONG RAILROAD TRACKS IN NEW ORLEANS.

narrow scoop can be put in to take out the sand without disturbing the concrete setting when it becomes necessary to put a new pole in the place of the old one. Square poles are used for this work. The concrete setting is about 7 ft. deep by 3½ ft. square. The box is made of inch pine and is 16 in. square inside and about 6½ ft. deep. The base of the poles is 14 in. square. In very soft ground it is sometimes necessary to drive piles deep into the earth and fasten the pole to the pile, as shown by the sketch herewith. In some parts of Canada poles of reinforced concrete are being employed. These are made on the ground with their butts immediately over the hole in which they are to be erected. A 35-ft. pole for ordinary line work weighs about 2½ tons and a 50-ft. pole about 5 tons. All poles are made square on account of the ease of making and also because of the saving in steel possible thereby. The poles are molded in wooden forms, in a horizontal position, the top side being left open and finished with a trowel. The concrete is composed of one part Portland cement, two parts clean, sharp sand and four parts broken stone. Some of these poles are erected on the Welland Canal transmission line.

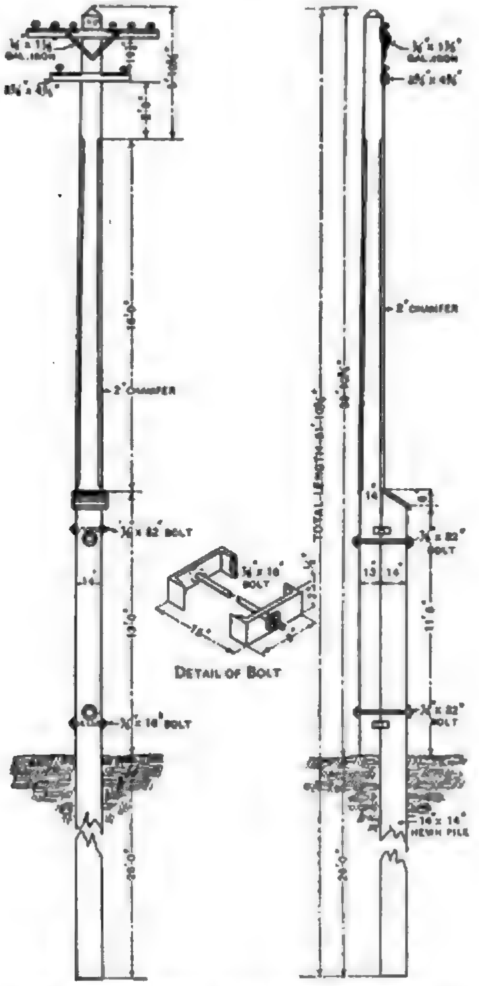


FIG. 2.—POLE SETTING IN VERY SOFT EARTH.

QUEBEC, CANADA. LLEWELLYN DRAKE.

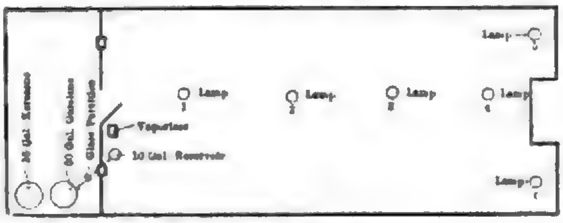
TROUBLE DUE TO IMPROPER WATER COLUMN CONNECTION.

A small horizontal tubular boiler had been running steadily night and day in a lighting plant for a month, and it was customary to blow off the boiler late in the afternoon and again very early in the morning on account of the sediment contained in the water. One morning while the boiler was being blown off, as usual, it was noticed that the water did not drop in the gauge glass, although the boiler had been blowing off for some time. The middle gauge cock on the water column was then tried and water flowed from it freely, so it was thought that the boiler had been pumped very full previously. Fearing, however, that something might be wrong, the engineer ordered the blow-off closed; but as the water had dropped somewhat he ordered it opened again. Just as soon as the blow-off was again opened the water in the gauge glass began to drop rapidly and finally disappeared from view. The engineer then perceived what had happened. The gauge had been indicating wrongly and the boiler had undoubtedly been blown very low. The damper was immediately closed and wet ashes thrown on the fire. Steam was shut off the engine and the boiler allowed to cool. After the pressure had dropped an examination was made and it was found that the front sheet of the boiler had bulged out considerably at the sides over the fire and that both heads had also bulged out, and this of course condemned the boiler for further use. It was found that about 6 in. of water was left in the boiler and that the cause of the false registration in the gauge glass was due to the lower water column connection being filled with sediment. The casting was tapped for 1¼-in. pipe, but when connecting it a bushing and a much smaller pipe was used. The connection was rather long and the bottom connection was tapped into the boiler head among the flues near a hand hole. An entirely new sheet had to be put in the boiler over the grates and about 35 tubes had to be safe-ended. The water column was repiped with 1¼-in. pipe, as was intended, and the bottom connection was tapped into the front head just below the top row of tubes. This incident should serve as a warning to engineers to make sure that their water columns are properly connected.

COLUMBUS, OHIO. R. Z. BISHOP.

EXPLOSION OF A GASOLINE LIGHTING PLANT.

That the Underwriters are very particular as to the installation of electrical wiring, is well known, and to this there can be no reasonable objection. But what seems strange to the average small central station manager is that these same Underwriters will permit the installation of hazardous gasoline lighting plants in the smaller towns and cities, without any apparent regard for their own interests. The accompanying sketch gives the floor plan of a gasoline plant which recently blew up in Petersburg, Ill., showing the location of the reservoir, vaporizer and lamps, and of the gasoline and kerosene tanks. The explosion occurred about closing time when a clerk was in the act of shutting off the supply of gasoline, and it was only through the grit of the clerk that the store was not burned, he having stayed with the machine until he could turn off the supply of gasoline and shut off the vaporizer. As it was, a quantity of gasoline was scattered around on the floor, but fortunately did not take fire. The entire plant was completely wrecked. The conducting pipe (which is a 2-in. tin soldered pipe) was so hot that the joints became unsoldered. The globes on the lamps, which are of clear glass similar to those used with open arcs, were melted, and some of the brass tubes were also fused. There are two other plants in the same city which have generators even more dangerous than the machine that exploded, as they contain from three to six gallons of gasoline at the boiling point all the time the plant is in operation.



PLAN OF GASOLINE-LIGHTING PLANT.

It seems only common justice that the Underwriters should apply rules to gasoline lighting equally as stringent as those they impose upon electric lighting. As you have pointed out in your columns, Underwriters' engineers have reported in strong terms on the great hazard of gasoline lighting, but their opinions thus far appear to have been entirely ignored by the Tariff Associations.

PETERSBURG, ILL. R. H. ABBOTT.

QUESTIONS AND ANSWERS.

Does it make any difference on which lead of a generator the circuit-breaker and ammeter are connected? F. B. W.

While it makes no difference to which terminal the series winding is connected provided it is connected properly with respect to its magnetizing effect, as a rule machines have the series winding in the positive side, so that circuit breakers and ammeters should be connected on the negative side. Unless this obtains, the ammeter will not register the entire output of the machine and the circuit-breaker will not open the equalizer circuit where compound-wound machines are operating in parallel.

How may automobile engines be tested? The builders' claims seem to be so very excessive that a convenient means for testing automobile engines would be appreciated. T. R. S.

The most convenient method for testing automobile engines and one which we believe is used by many of the manufacturers of high class automobiles consists in coupling the engine by means of the cone clutch to a direct-current dynamo or motor. The ammeter and voltmeter readings are taken and the product multiplied by a certain constant representing the efficiency of the dynamo. This result in watts is converted into its equivalent in horse-power by dividing the product by 746.

Is it possible to generate more than 50 horse-power economically in a single cylinder of a gas engine?

Yes. The largest gas engine now running of which we have knowledge develops about 1,000 hp in a single cylinder. The gas engines being built by the Snow Steam Pump Works for the California Gas & Electric Corporation are expected to develop 1,350 brake horse-power in each cylinder, and the company is offering gas engines, a single-cylinder of which will develop at maximum rating 2,500 brake horse-power. The Oechelhauser gas engines are built in sizes developing 250, 300, 400, 500, 750, 1,000, and 1,500 horse-power in a single cylinder.

We have a 15-hp. shunt-wound motor on a light load. About 18 months ago it burnt out on the edge and under the commutator, leaving the face of the commutator intact. I cleaned out the cavity and filled it with plaster and wound new cord with shellac around the edge and had no trouble until a few days ago, when the same trouble appeared. I applied the same remedy and have it running again. Can you tell me the cause of the trouble? F. J. M.

From the sketch which you enclose it is evident that your trouble is due to oil finding its way from the bearing or other source onto the commutator. If you will file a groove around the circumference of the shaft, making the side near the commutator almost perpendicular to the axis of the shaft, you may stop oil from creeping along the shaft to the commutator.

I have a 50-hp. induction motor direct connected to a direct-current dynamo. The motor receives three-phase 60-cycle current at a potential of 2,200 volts from a hydro-electric plant. The speed of the motor is not sufficiently high to maintain the voltage of the dynamo for the lamps to burn brightly and when cutting in a direct-connected steam generator set the voltage is raised sufficiently to take the entire load from the motor-generator set which then reverses and drives the induction motor as a generator. This lasts for a space of about five minutes. What dangerous effect does this have on the hydro-electric alternator at the distant end of the line? A. R.

The induction motor which is driven as a generator merely pumps back current into the line, and instead of being detrimental to the alternator at the other end, assists it to supply the current, the energy being taken from the steam-driven generator.

What should cause an enclosed arc lamp to explode? While switching in a lamp the other day an explosion took place which smashed both the inner and outer globes; yet no electrical defect was found in the lamp. B. M. P.

The arc is enclosed to lengthen the life of the carbon by excluding oxygen. The supply of air being imperfect, the burning of a carbon results in the formation of carbon monoxide, a poisonous gas. The cooling of the lamp permits air to leak in and combine with the carbon monoxide to form an explosive mixture. The ignition of this mixture is accomplished when the lamp is placed in circuit again and an explosion takes place just as when a lighted match is brought into a room filled with escaping gas. The phenomenon being purely chemical is not due to any electrical defect in the lamp.

We are running our central station on the 220-volt three-wire system and are giving an all-night service. We wish to install a direct-connected three-wire set to take the load after the large belted set is shut down for the night. Could we throw the smaller set in multiple with the large set during the peak, and would it be all right to start the smaller set and when it is built up to full voltage throw the load over to it simply taking a flash in the lamps which were lighted at the time? Would this damage the large set? T. E. Co.

As is the case with all other generators, running in multiple, it will be necessary for your three-wire generators to have the same general characteristics if they are to run in multiple or otherwise each will not take its just portion of the load. The proper way to cut in your smaller machine and relieve the large set is to bring the smaller set up to full speed and adjust its voltage as near that of the larger machine as possible, when it may be thrown in multiple with it. The large machine may then be cut out by throwing resistance in until the load as indicated on the ammeter is very small. The circuit-breaker may then be opened and then the main switch, after which the engine may be stopped. The practice of throwing the load from one machine to another in the way you suggest is barbarous and is detrimental to both machines. By following the method outlined above there will be no flash in the lamps and the service will be infinitely better.

I have a direct-current dynamo giving 130 amperes at 120 volts. The device which consumes the current requires regulation both of volts and amperes, and I wish to be able to adjust the same at will or keep one of them constant, as may be necessary at the moment. Would a resistance in series and other resistances in parallel be the most practical arrangement? I want to have at my disposal anything from 2 to 15 volts and from 5 to 100 amperes. What is the best arrangement? I do not care how much electrical energy is wasted or changed into heat in resistances. H. P.

The best way to utilize the dynamo you have is to excite the field from some outside source with a rheostat in circuit, using preferably full voltage for the purpose, and then reduce the speed of the dynamo until at full field it gives 15 volts. The regular rheostat which comes with the machine will then probably enable you to reduce this voltage as low as two volts. For your current control you will require a resistance in series with your dynamo, which should have a value of three ohms and should be capable of carrying 100 amp. without distress. The resistance should be graduated over 30 to 40 points. By using a water rheostat you can probably obtain the desired gradations. It will probably be necessary for you to reduce the speed of your dynamo to about one-eighth of its present speed. If no outside source of energy is available, you can obtain results by exciting the field coils with batteries; but this will not be satisfactory since the field will be very weak and the armature reaction at maximum currents will be so great that it will upset the field and cause trouble with the adjustment of the current and voltage values and also some trouble from sparking. If your dynamo has several field bobbins in series you can reduce the voltage of the machine by coupling the field bobbins in parallel and reducing the speed accordingly. Thus, if your dynamo has a two-bobbin field, by placing the bobbins in parallel and reducing the speed one-half you may obtain half voltage. If it is a four-bobbin field and these are placed in parallel and the speed reduced one-fourth the voltage will also be reduced to one-fourth of its former value. This will bring the voltage of the machine down to a value that you perhaps can control with your field rheostat to obtain the values you desire. Still another method would be to use a long water resistance, about a foot square and six feet long. Put the full voltage of the machine on the trough and sprinkle salt in the water until a satisfactory current value is reached. By means of two plates inserted midway in the trough you can take off current at any voltage you desire by adjusting the plates at different distances apart and the current can be controlled with a resistance in the local circuit thus taken off. The first method is the most satisfactory, for it will enable you to hold your voltage at any value you desire while the current is then under the adjustment of the external resistance. Any adjustment in the other arrangement disturbs both the current and voltage values.

CENTRAL STATION SALE OF CURRENT

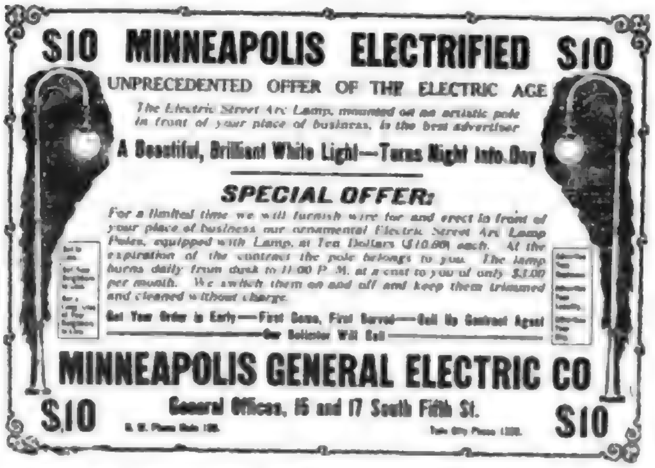
Business-Getting Organization of Minneapolis General Electric Company.

The Minneapolis General Electric Company, which is the only central station company in that city, will soon have available about 12,000-hp from a water power at Taylor's Falls 40.67 miles from Minneapolis. The ultimate capacity of this water power when further developed will be 24,000-hp. The transmission to Minneapolis will be at 55,000 volts. At the city limits this will be stepped down to 13,500 volts for underground transmission to rotary converter sub-stations and static transformer sub-stations. The development of this water power has led to a great activity in pushing for business to give the new water power plant a load.

BUSINESS-GETTING ORGANIZATION.

Mr. W. Randolph Sweany, contract agent of the company, came to Minneapolis from Atlanta in September, 1905, to organize the contract department on progressive lines and to build up the company's business. The city has been divided into six districts. There is one solicitor and one assistant to each district. At present writing it is expected to add a third man for each district. The contract department employs altogether about 20 people. The solicitors are paid a straight salary. Mr. Sweany does not believe in the principle of paying solicitors a commission on business secured because conditions may be such that one solicitor will secure more business than another, though he has not done more work but has had a better territory. He believes it desirable for the contract agent to be in a position where he can shift solicitors from one territory to another that they may have the territories to which they are best adapted. A little later he expects to add some demonstrators to the contract force for the purpose of demonstrating the use of electric cooking and heating devices.

Besides the solicitors the contract agent has under his charge an advertising department and a demonstration department. In addition to the district solicitors there is one man whose specialty is prospective buildings and whose work is to keep in touch with architects, contractors, city building permits and everything which pertains to the extension of service to new buildings. There are five men who are experts on power engaged in testing and technical engineering work pertaining to possible new power contracts. One of these men is also an expert in illumination, who looks after changes in customers' installations which are not giving satisfactory lighting results. Mr. Sweany, the contract agent himself, is also an engineer and power expert who is able to figure accurately on power contracts, and to teach his men how to do it.



$10 MINNEAPOLIS ELECTRIFIED $10

UNPRECEDENTED OFFER OF THE ELECTRIC AGE

The Electric Street Arc Lamp, mounted on an artistic pole in front of your place of business, is the best advertiser

A Beautiful, Brilliant White Light—Turns Night Into Day

SPECIAL OFFER:

For a limited time we will furnish wire for and erect in front of your place of business our ornamental Electric Street Arc Lamp Poles, equipped with Lamp, at Ten Dollars ($10.00) each. At the expiration of the contract the pole belongs to you. The lamp burns daily from dusk to 11:00 P. M. at a cost to you of only $3.00 per month. We switch them on and off and keep them trimmed and cleaned without charge.

Get Your Order in Early—First Come, First Served—Call Up Contract Agent—Our Solicitor Will Call

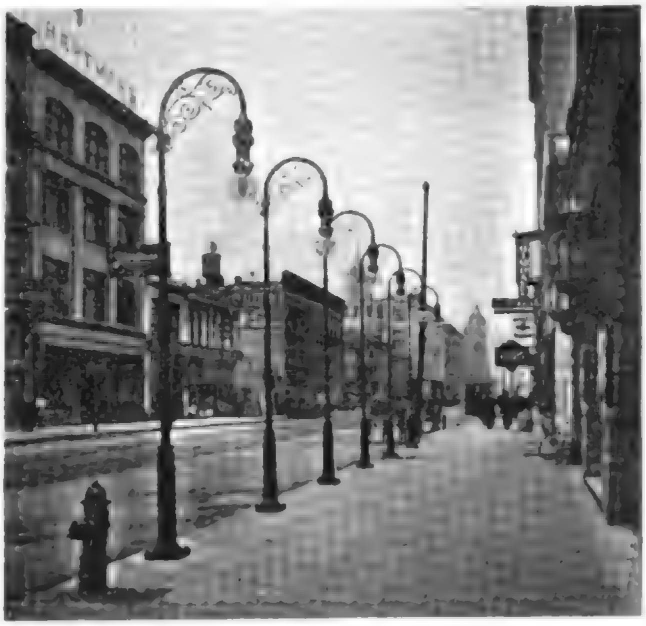
MINNEAPOLIS GENERAL ELECTRIC CO

$10 General Offices, 15 and 17 South Fifth St. $10

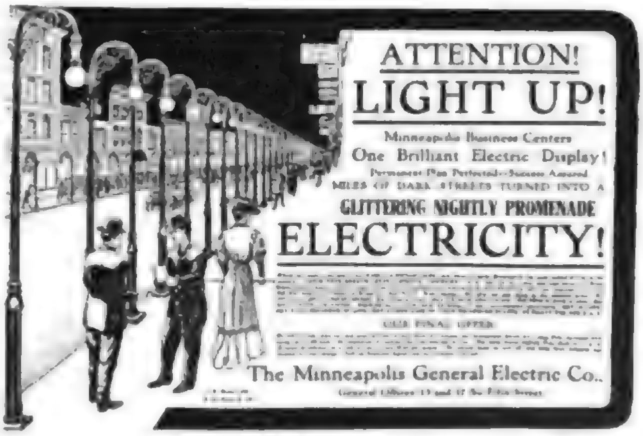
Sign business is solicited by a special man who is also a rapid sketch artist. This man can go to a prospective sign customer and sketch out before him various ideas and suggestions as to an electric sign. He is sufficiently expert in this work to give as he talks and draws the probable cost of the kind of sign he is sketching, and the number of lamps it will contain, and the cost per year to operate.

SPECIAL STREET LIGHTING.

The district solicitors concentrate their efforts on different special branches, one at a time. Recently effort has been directed toward the securing of special private street-lighting contracts from merchants and property owners. The proposition is to erect ornamental arc-lamp posts on the sidewalk in front of a merchant's place of business, as shown in the accompanying illustration. The aim is to place these posts as short a distance apart as the city ordinance will permit, namely, 20 ft., avoiding all fire hydrants by 4 ft. The company will furnish, wire and erect, in front of a place of business these ornamental arc lamp poles with lamps at $10 each. This is on a 5-year contract. The lamps are 3¼-ampere, direct-current arcs operated off of a 110-volt circuit. The cost to the customer for operation is $3 per month. The company turns them on and off, trims and cleans them. They are switched on at dusk and off at 11 p. m. Contracts for 400 of these lamps have already been taken. The company fully



SPECIAL STREET LAMPS.



ATTENTION!

LIGHT UP!

Minneapolis Business Centers

One Brilliant Electric Display!

Permanent Plan Perfected—Success Assured

MILES OF DARK STREETS TURNED INTO A

GLITTERING NIGHTLY PROMENADE

ELECTRICITY!

OUR FINAL OFFER

The Minneapolis General Electric Co.

General Offices 15 and 17 So. Fifth Street expects to have orders for 1,000 within a short time, as the start was made in the edges of the business district and it is unlikely that the merchants in the more important streets will allow the outlying business streets to outshine them. The gas company has also been putting up competition for this special street lighting and has erected a few posts equipped with gas "arc" lamps.

Two of the company's half-page newspaper advertisements of this special street lighting are reproduced herewith. Before starting to push this scheme the endorsement of the Minneapolis Commercial Club and the Retail Dealers' Association was secured. The idea at first was to promote a united movement to light entire streets in this way as has been done in some other cities. The gas company, however, did not wait for this movement to develop, but began to take contracts for gas-lighting posts on certain streets from individual merchants here and there, thus forcing the electric light company to begin to push for this business without waiting for the general movement.

DISPLAY ROOMS.

The demonstration department, which consists of the company's show-room, is at present housed in a very neat little store-room several doors from the company's general offices, since there was not room for such a display in the offices. It is intended to move this display room to better quarters as soon as they can be secured. The display room is, nevertheless, very attractively fitted up. The mistake has not been made of trying to crowd too much into the room so that persons are confused by the great amount of apparatus shown. There is a sample of all the common heating and cooking utensils and of the principal small motor applications, such as sewing machine motors, drill press motors, press drills, etc. The ceiling is studded with various kinds of incandescent lamps and reflectors. The whole room is finished in white, and when lighted at night looks very decidedly like lighting headquarters.

FLAT IRON CAMPAIGN.

The company placed 200 electric flat irons in use in two months of effort. It expects soon to place 1,000 irons at a time. The first start was made by writing about 1,000 letters to the residence customers offering electric flat irons on 30 days' free trial. This resulted in about 200 being placed. The next move will be to send out 1,000 flat irons, by wagon, taking them to customers and seeing that they are properly fixed for the customer's use. These irons will be left for 30 days' trial and it is confidently believed that a large per cent of them will not come back to the company. Six-pound flat irons are sold at $3 each.

The company does not do wiring contracting, but prefers to keep the good will and encourage the efforts of private contractors to get business. It does, however, endeavor to see that its customers get proper treatment and equipment from the contractors. Especially in the case of electric signs, the contract department is particular to specify designs which will give good results and to require all bidders to conform to the company's specifications rather than to allow bidders to confuse the issue by offering less satisfactory substitutes.

ADVERTISING POLICY.

Advertising, like soliciting, is concentrated on certain specialties, but one thing being taken up at a time. No general advertisements appear. Mr. Sweany does not consider general advertising of electric light and power a good way to invest money. One of the Minneapolis papers runs a "Home Builders' Sheet" in its Sunday edition, which is found to be a good place to advertise.

Business Getting at Avoca, Pa.

By Frank Howard.

I have been much interested in the communications from Janesville, Wis., and Lewiston, Pa., printed in your issue of May 5, as to the volume of business connected in those places within a space of a few months, particularly in view of what has been accomplished in the same line by a central station with which the writer is connected. The population of the chain of six small mining towns supplied from the station at Avoca, Pa., of which I am manager and superintendent, is about 12,000. The new business connected from March 31, 1905 to April 1, 1906, was 2,750 16-cp equivalent incandescent lamps, 21 arc lamps, 52 fans and 37-hp in motors. The average service connected was 25 or less lamps. The larger portion of this increase is the result of systematic soliciting and the satisfaction given by the illuminating service rendered. The rate is 10 cents per kw-hour, less from 5 to 25 per cent discount for cash.

Up-to-Date Methods of Increasing Business.

Under the above title Mr. G. C. Gum, of Fort Worth, Texas, read a paper at the Southwestern Electric and Gas Association at Galveston, May 16, making some good suggestions as to methods of increasing the demand for commercial lighting in a town. He likened the central station business to a factory.

A trunk factory or a giant packing industry, unlike the average central station, does not depend upon nor expect its various superintendents, foremen and workmen employed in the manufacturing or producing end of the industry to market its goods.

It is plain that in central station operation as commonly conducted, that the trend of practice is essentially one of production rather than one of marketing. Pains and care have been taken in selecting men who are proficient in the technical or at least practical art of production and little or no thought has been given to the commercial end of the undertaking.

It is highly essential that the forces be subdivided into at least two departments in the smaller plants and into three or more departments in the larger ones, each of which should be supreme in its particular aim and vocation.

The producing or manufacturing end, the selling or marketing end and the collecting end in the larger plants are essential in promoting the welfare of the organization and it is imperative that a harmonious interweaving of these three branches be in evidence to insure the highest attainments.

After speaking in a general way about the organization and tactics of a new business campaign he makes the following specific suggestions:

To start a modern business campaign, as applied to the lighting industries, one of the most essential features in securing increased revenue in districts already covered is to produce dissatisfaction with the present low intensity of illumination.

"Raise the Standard" is the motto you must adopt and the hobby you must possess.

This can be easily accomplished by lighting up one of your best merchants—as he should be lit up. Don't guess at it, but figure out his illumination—show him the figures. It demonstrates to him that you are taking an interest in his betterment and are putting some gray matter back of your effort. It also gives him the impression that you are not trying to unload on him, as you can substantiate your statements by known facts. If he cannot be induced to accept the installation as designed, offer him a thirty days' trial based upon his acceptance of the installation if the results are satisfactory to him. Even go so far as to stand part of the expense of wiring and current, if necessary. This is advertising—advertising your goods solely by their merits. This method is far more productive than newspaper advertising, although the latter is not to be belittled.

The laying out of the lighting, as ordinarily practiced, cannot even be considered a mental undertaking. The usual procedure has been one of "I guess" all along the line from start to finish.

Past practice has left the matter of laying out the illumination of all classes of work to wiremen, contractors and architects, very few of whom have the least idea of illuminating engineering.

This condition of affairs must cease with the advent of the New Business Department. A free bureau of information covering the entire range of central station utilities should be established and its services extended to architects, wiring contractors and the general public.

Anticipate business immediately upon learning that a new building is being planned by taking the matter up with the owner as well as the architect and offering your services to them.

To assist in a revenue procuring campaign a two-rate system of charging is of great advantage in securing long-hour consumers as well as in cultivating them. It is one of the most easily adjusted and equitable rates imaginable and a proper use of it, together with the many applications of current now at hand, is advisable.

One of the most valuable revenue producers we have at hand is the flat rate method of window, sign and outside lighting. This flat rate is based upon the metered consumption of the installation computed on a two-rate system of charging, so that in reality the flat rate given is to all intents and purposes a meter rate under disguise. By establishing this system we are enabled to do away with meter investment, as the installations are placed entirely under the control of the central station, which makes it a point to light these lamps at dusk each day, turning them off at an hour previously agreed upon, which should not be earlier than 11 p.m.

Sign lighting is another valuable field which should be under the control of the central station. Many an opportunity is usurped by cheap transparency signs where had proper business tact been displayed the income could have been at least doubled. In this field do not forget your motto, "Raise the Standard." Argue for the best and accept the cheapest under protest.

In the decorative or outlining lighting, the use of small candlepower units tastefully arranged has a marked effect on the monthly receipts as well as upon the general prosperous air of your city.

Flattering reference was made at the close of the paper to the work of the new business department of the San Antonio Gas & Electric Company.

Mr. Samuel Kahn, of San Antonio, was called upon to tell more of the work there He explained that the San Antonio Gas & Electric Company started its new business department a little over a year ago. It was patterned after that at Denver, which had been in existence several years and where the men were trained for new business work in other plants controlled by the American Light & Traction Company.

In San Antonio there was one manager of the department and four solicitors. They now had 140 electric signs in the city, the largest of which had about 500 lamps and took 10 kw.

Mr. R. B. Stichter, of Sherman, thought the agreement by the company to bear part of the cost of an installation if it did not prove satisfactory to the customer gave a customer confidence that the company had faith in the proposition. It was a good plan.

Mr. Gum stated in answer to a question that the San Antonio company had an installment payment plan in connection with residence wiring.

President Phinney told of the Chicago Edison Company's plan of furnishing signs free on a long enough term contract so that they would be paid for by the regular monthly bills. In Dallas he had put out some signs on a two-year contract, under which the price of the sign was put in the regular bills and the customer owned the sign at the expiration of the contract. In Dallas they had now approximately 300 signs. Property owners had to secure city council permission for all signs projecting over the walk and were required by ordinance to light the sign every night until about 11 p.m. He questioned whether this ordinance was a good thing for the company.

Development of Current Supply in Baltimore.

The growth of electrical business in Baltimore since the great fire has been remarkably rapid, and we are indebted to Mr. Douglass Burnett, general manager of the Consolidated Gas, Electric Light & Power Company, for some details of the work done in various ways to secure new customers and larger revenue in that city. The broad policy adopted in connection with vigorous pushing and liberal advertising has just doubled the number of customers since the fire of February, 1904, has increased the horse-power of connected motor load over four times, and has increased the equivalent of 16-cp lamps nearly threefold. It is believed that this is an unsurpassed record for the two years under consideration.

The company advertises twice a week in each daily newspaper, and aims never to repeat the same advertisement in the same paper. The "ads." occupy generally a 30-line space on the first page, and are not illustrated. In the two years, the company has thus run about 400 separate pieces of copy, distributed among the different papers. Some extra advertising is also done in certain programmes and in special editions of the newspapers, as occasion may demand.

A good deal of work is done with bulletins and flyers. The company has an electrical directory that is perhaps the completest local thing of the kind in the country. It enumerates virtually all who do construction wiring or sell apparatus in the territory, and being vest pocket size is extremely handy. In two years it has been put through five editions, which is a good indication of its utility.

Having now between six and seven thousand customers, the management issues usually from 5,000 to 10,000 bulletins; the excess over the actual list of patrons being sent to a mailing list of several thousand names, nearly all of which are those of "prospects." The printed matter is also distributed from the show rooms and by the solicitors. The bulletins are sent with the customers' bills, and thus the editions are pretty well exhausted. Contrary to the usual practice the bulletins do not have a regular "fancy" cover page. The aim is to have each bulletin give a clear, full, yet concise, talk on one particular subject, and the successive numbers are illustrated by cuts made from photographs taken in Baltimore on the premises of various customers.

As a matter of fact, the company counts very largely on personal solicitation for the development of its business; hence the publicity campaign is made secondary to actual canvassing.

Follow the Wires.

The Denver Gas & Electric Company has issued an attractive booklet under the above title. It contains an illustrated account of the daily routine of a man who finds electricity ready to serve him at almost every moment of the day. The last page of the pamphlet which can be taken as a kind of summary of what has gone before is a suggestive advertisement and is reproduced herewith.

Let

Electricity

TALK FOR YOU
The Electric Sign

CLIMB FOR YOU
The Electric Elevator

CARRY YOU
The Electric Automobile

COOK FOR YOU
All kinds Cooking Appliances

DO YOUR LAUNDRY WORK
The Electric Iron

COOL AND WARM YOU
Electric Fan and Grate

LIGHT YOUR WAY
In the House
On the Porch

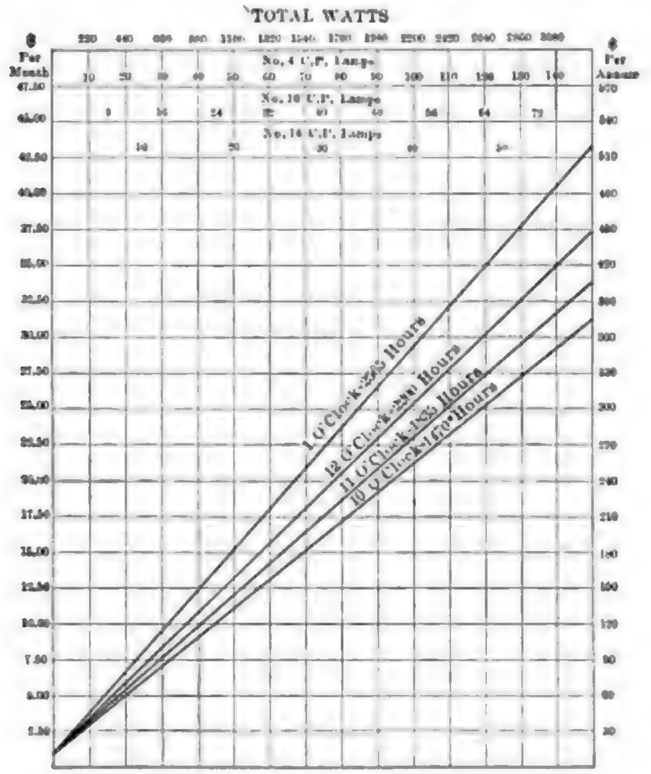
¶ We have the electricity
that will do all of these.
It is at your disposal at
any time you ask for it.

The
Denver Gas & Electric Co.

Phone Main 4000

A Diagram for Sign Rates.

Mr. H. J. Gille, superintendent of the commercial department of the St. Paul Gas Light Company, has worked out a very convenient diagram for the use of the solicitors of that company in determining sign rates. This shows at a glance any rate a solicitor is likely to need. The rate in dollars per month is shown at the left, and the rate per annum at the right. The total watt consumption is given at the top, but to obviate the necessity of figuring the wattage, the equivalent in standard 4, 10 and 16-cp lamps is given also. By the use of the diagonal lines drawn on the diagram the rate can be obtained on a sign under any one of four conditions, from dusk until 1 o'clock, 12 o'clock, 11 o'clock or 10 o'clock.



SIGN RATE CHART.

Business Getting Methods at Sheboygan.

The Sheboygan Light, Power & Railway Company, under the management of Ernest Gonzenbach, has been experimenting with methods of pushing for business the past three months, and has had some rather remarkable experiences, both successful and unsuccessful.

ELECTRICAL SHOW PAYS.

An electrical show was held the week beginning March 26, in a small store building which the company rented for the purpose. The latter part of the week this room was literally packed every evening so that the door had to be closed against newcomers. One direct result of this show was the placing of 76 household, 6-lb. flat-irons, orders for which, on free 30-day trials, having been taken at the show. At the end of 30 days only one iron out of the 76 was returned. They were sold at $3.75 each.

SOLICITING.

The success of the electrical show is surprising in view of the company's experience with solicitaion. Sheboygan has the reputation of being a conservative place, and the difficulties of central station solicitors there would seem to bear this out. Two experienced central-station solicitors who had made good progress elsewhere, threw up their hands in despair after trying it awhile in Sheboygan. The employment of solicitors has, therefore, been abandoned for the present, and the following plan to get business through the regular employees of the company has been adopted:

Nine principal employees of the company from a "New Business Board," consisting of the superintendents of lighting, railway and freight departments, the accountant, two cashiers, two meter readers and one inside arc-lamp trimmer. This board elects its own president, secretary and treasurer, and appoints committees. Meetings are held every Monday evening. The object of the organization is, of course, to get new business both in the light and railway departments.

PROFIT-SHARING.

The members of the Board get each month 10 per cent of the increase in gross receipts over the corresponding month of the previous year. The division among the members is made according to the relative amount of business that each turns in in proportion to the total business. This division is made by the general manager according to his judgment.

The lighting department gross revenue is showing an increase each month of 15 to 20 per cent over the year previous, which while not as good as in some places, is considered satisfactory for a conservative town with very active gas competition.

The company publishes a little paper called the Sheboygan *Electrical News* each month.

Two Immense Electric Signs.

In no branch of the electric industry has the advance been more rapid than in the manufacture of electric signs. Enormous signs of great beauty and effectiveness have multiplied at such a rate that the public is now prepared to greet almost any achievement in this direction without surprise. Fig. 1 herewith shows the greatest electric sign in the world, which has just been completed for the New York Edison Company at its coal storage plant at Shadyside, N. J. This enormous sign may be seen clear across the Hudson River and up and down Riverside Drive for a great distance, and spells through the night the name and fame of the institution that it advertises. In order to insure against the slightest interruption to its service due to a coal famine or similar trouble, the New York Edison Company keeps an enormous supply of coal constantly on hand in its storage yards at Shadyside. The confidence thus established in the permanence and reliability of its service fully repays the expense. More adequate or striking means of advertising incidentally this enormous coal supply than the magnificent electric sign above mentioned, could not have been devised.

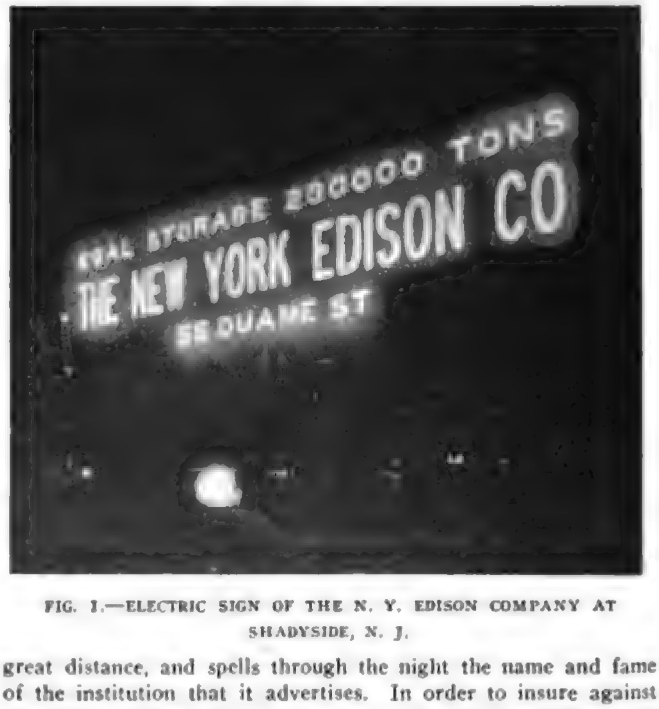


FIG. 1.—ELECTRIC SIGN OF THE N. Y. EDISON COMPANY AT SHADYSIDE, N. J.

It is interesting to note some of the data in connection with its construction. The steel work is anchored in concrete piers containing about 125 cubic yards of cement. Although built in the lightest possible manner consistent with strength, the structure contains upwards of 70,000 lb. of steel. The lower row of letters in the sign is elevated 55 ft. above the ground; the height of the sign over all is 91 ft., and the length is 160 ft. The top and the bottom rows of letters are 5 ft. tall and the letters in the center row are 14 ft. tall. The sign contains 1,800 8-cp incandescent lamps and a special engine and generator of 75 kw capacity is installed to supply the electricity. In cost this sign represents an outlay far greater than anything previously attempted, and it marks the most signal advance in the art of electrical sign building yet recorded.

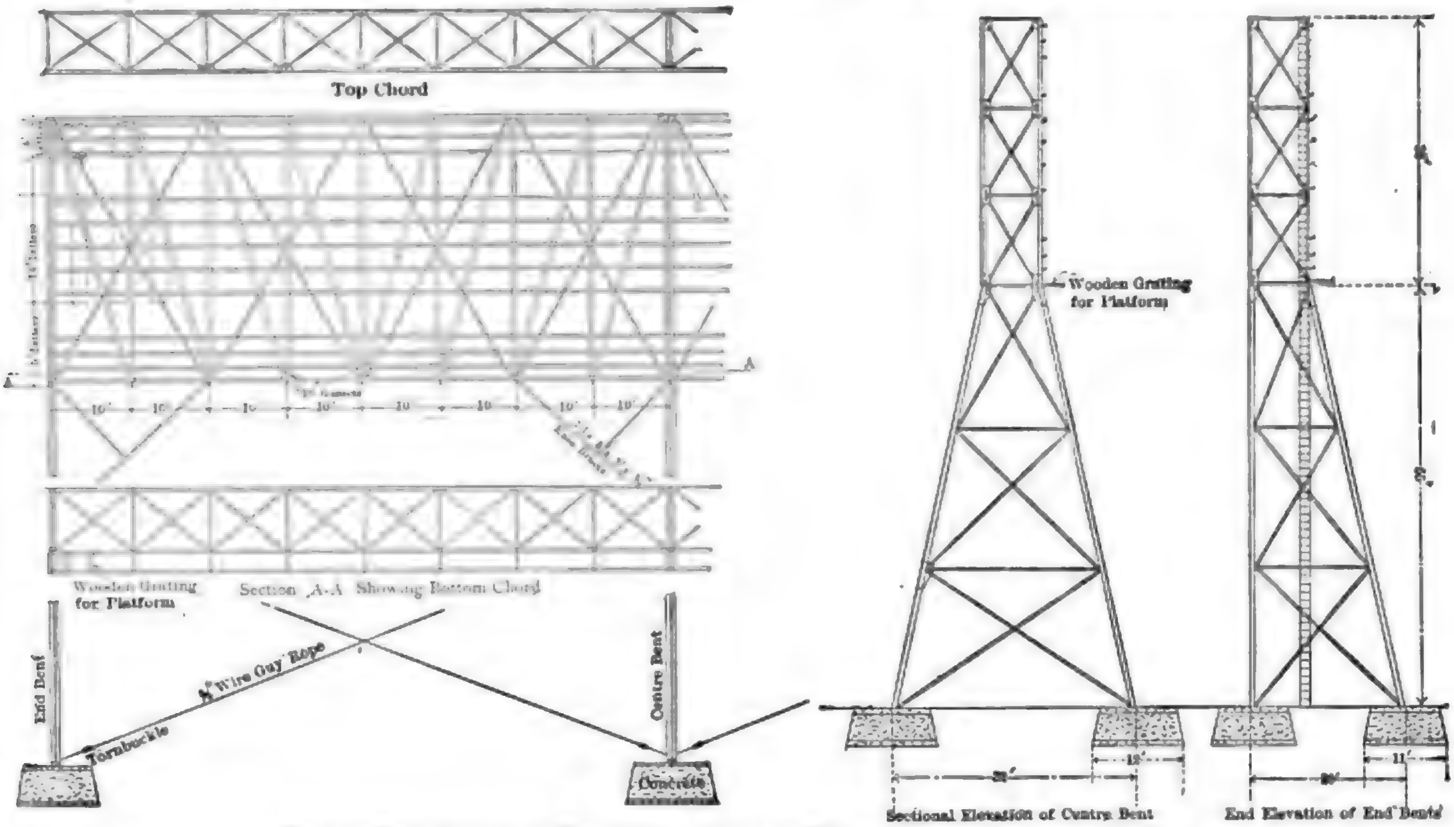

Top Chord
Wooden Grating for Platform
Section A-A Showing Bottom Chord
End Bent
Wire Guy Rope
Turnbuckle
Centre Bent
Concrete
Wooden Grating for Platform
Sectional Elevation of Centre Bent
End Elevation of End Bents

FIG. 2.—DETAILS OF IRON WORK SUPPORTING THE EDISON SIGN AT SHADYSIDE, N. J.

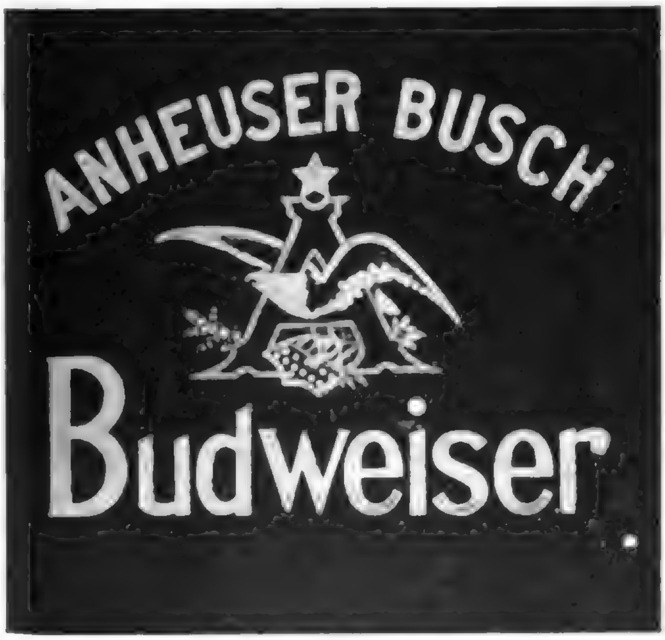


FIG. 3.—ANHEUSER BUSCH SIGN ON BROADWAY.

Another interesting sign is located on Broadway. Broadway's wonderful display of electric signs presents a spectacle never to be forgotten. Its hotels, its cafés, its theatres and its other places of amusement along the "Great White Way" vie with each other in their displays of the most striking electrical effects. One of the most conspicuous signs is that recently erected for the Anheuser-Busch Company on the top of the roof of the Old Guard Armory at Forty-ninth Street. At this particular point Broadway makes a turn, and from a distance the sign seems to set squarely across the street. The height of the sign over all is 50 ft. and the width is 55 ft. The trade mark is 28 ft. high by 32 ft. wide. The sign is studded with various colored lamps, producing a beautiful and graceful effect. Both of these immense signs were erected by the Metropolitan Engineering Company, of Brooklyn, N. Y.

The Southwestern Question Box.

The question box of the Southwestern Electric and Gas Association drew out some central station discussion of interest.

A question as to the efficacy of boiler compounds in preventing scale with central Texas surface water brought out the fact that deep well water in central and northern Texas does not cause scale. Two compounds (Dixon and Parsons) has given satisfactory results with scaling water, but strange to say no mention was made of treating water to precipitate the solids before they enter the boiler.

What methods of protection against loss in collecting meter bills have been successfully introduced other than the meter deposit plan?

The prepayment meter and the weekly payment plan were suggested. President Phinney showed there should be a parallel between lighting and other lines of business, in which credit was given according to a customer's reputation and acquaintance.

Mr. A. E. Judge, of Tyler, required deposits only from transients or known poor payers.

Mr. T. B. Whitted said that new persons in a town usually rented from some property owner who had looked them up enough to be willing to guarantee payment of the light bill.

Mr. E. D. Kelly, of Hillsboro, said that he treated all customers alike and required a deposit equal to the cost of the meter.

Mr. F. M. Lege, of Beaumont, said he had so many transients he had to require a deposit. He had a few prepayment meters.

Mr. E. B. McGinnis advocated the plan of giving each customer a certain credit rating indicating the treatment to be given in case of delinquency. With very poor credit rating immediate shut-off would follow delinquency. By bunching each class of credits together the matter was easily handled. Over 100,000 prepayment gas meters were in use in New York.

What success has been attained with the 3¼ or 3½-amp., 110-volt, multiple, enclosed, direct-current, ⅜-in. carbon lamp? If not successful, why?

Mr. J. R. Cox, of Galveston, had tried them and found them entirely satisfactory. At Waxahachie they had been found a great success. The smaller lighting units were more desirable than the large.

Mr. W. B. Head, of Grandview, had used them with much success, as had also Mr. Kelly, of Hillsboro, and Mr. R. B. Stichter, of Sherman. The latter had 90 out of 100 arcs placed within the past year of this kind.

Mr. J. R. Cravath, of the Electrical World, was asked to give information on this subject and said that the Chicago Edison Company had probably gone into the small carbon arc business more systematically and thoroughly than any other company in the country. It now had in service 1,500 direct-current arcs with 5/16-in. American carbons. These gave much more light, steadier light and whiter light than ½-in. carbons.

A Remarkable Wreck and Quick Repairs at Cedar Falls, Iowa.

At 10.40 a.m., March 20, 1906, the Cedar Falls sub-station of the Citizens' Gas & Electric Company, of Waterloo and Cedar Falls, Iowa, was completely wrecked by a gas explosion. This sub-station supplied by step-down transformers all of the lighting and power of Cedar Falls, a city of over 5,000 inhabitants. It is supplied by a high-tension transmission line from Waterloo, 7½ miles distant. This line is of three No. 6 semi-hard-drawn copper wires, and is operated normally at a pressure of 10,000 volts, three-phase.

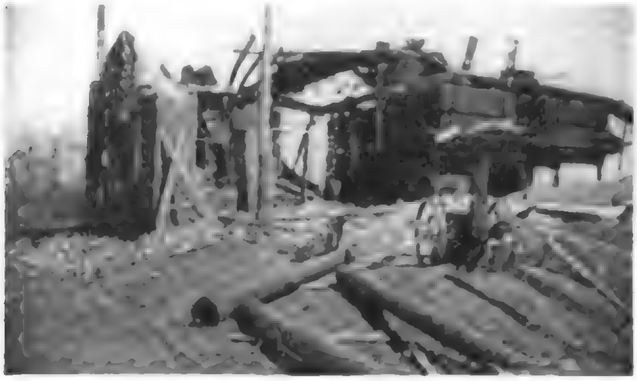


FIG. 1.—WRECKED STATION AT CEDAR FALLS.

The explosion which wrecked the station was caused by the accidental escape of gas from a large gas main which was being tapped. The wreck of the sub-station was complete, as can be seen by the accompanying engraving, Fig. 1. After the explosion the gas issuing from the main took fire and burned up what little was left of value in the sub-basement after the explosion did its work. In spite of the complete destruction of the sub-station and the fact that no step-down transformers were available in the vicinity, service was resumed in Cedar Falls about 24 hours after the accident. This was done by transmitting at 2,300 volts over the 10,000-volt transmission line from Waterloo. A load of 150 kw was carried this way. In order to compensate for the drop in the transmission line, a boost of about 800 volts was arranged. At the power station at Waterloo two transformers with a ratio of 2,300 to 255 volts were connected with their primaries across two legs of the three-phase circuit and with their secondaries in series with two legs of the circuit. In other words, there was one 255-volt transformer secondary in series boosting on each of two legs of the three-phase circuit, giving a total of 510 volts boost at the Waterloo end. At the Cedar Falls end the voltage was raised 300 volts by means of two regulators. This gave a total of 810 volts boost at full load. During light load the boosting transformers at Waterloo have to be disconnected to avoid too much of a raised voltage. Later another pair of regulators were added at the Waterloo end making 1,110 volts total boost. By means of these combinations the voltage was maintained within a few volts of normal at Cedar Falls. The temporary switchboard consisting of transformer primary plug fuses mounted on an ordinary board. The temporary sub-station housing these switches is shown in Fig. 2.

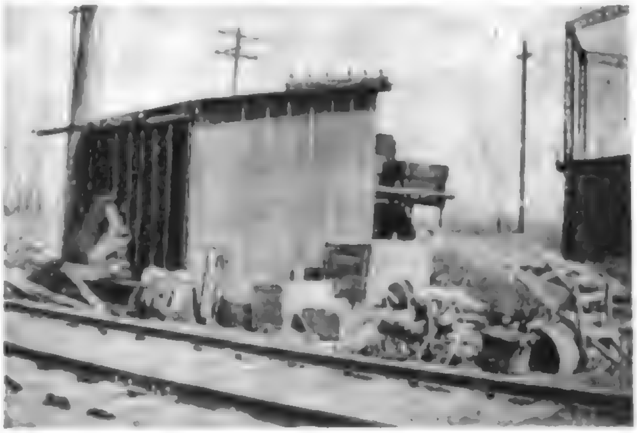


FIG. 2.—SWITCH HOUSE REPLACING DESTROYED SUB-STATION.

To add to the company's troubles, after the sub-station had been blown up, high water in the river caused the washing away of a railroad embankment which carried away the company's transmission line for some distance. The wires were then strung over tree tops. For the above particulars we are indebted to Mr. Austin Burt, superintendent of the electrical department of the Citizens' Gas & Electric Company. Fig. 3 shows the general scheme of connections for this makeshift transmission. The Cedar Falls load is connected between two legs of the three-phase circuit. The current carried in three legs of the circuit at maximum load is indicated on the drawing.

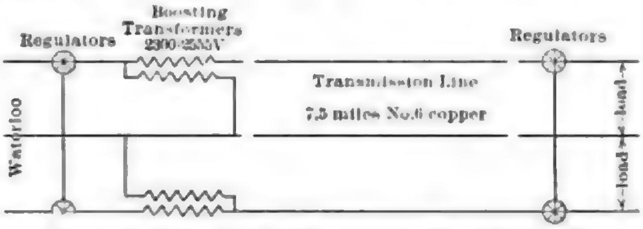


FIG. 3.—CONNECTIONS FOR TEMPORARY TRANSMISSION.

Cost of Maintaining Arc Lamps.

In view of the present interest in cost of maintenance of various electric illuminants the following figures on the cost of maintaining arc lamps will be of interest as giving specific data from commercial practice. These figures are furnished by the courtesy of R. E. Richardson, general manager of the Kansas City Electric Light Company.

COST PER MONTH PER LAMP.

Trimming	$0.1110
Carbons	.0693
Repairs	.0569
Inspection	.0924
Outer Globes	.0118
Inner Globes	.0259

The costs given are the averages for about 3,500 enclosed arc lamps in Kansas City.

New Telephone Patents.

TRANSMITTERS AND TRANSMITTER PARTS.

Many attempts have been made to improve upon the granular "solid back" type of transmitter by increasing the length of granular carbon circuit, with a view to increasing the possible resistance change. These attempts have included not only an actual deepening of the granular button, but also the connecting of two or more buttons in series. For one or another reason none of these have proved of practical advantage. W. W. Dean has now patented a transmitter embodying another scheme, involving the use of concentric carbon chambers. Fig. 1 shows a section of the transmitter assembled and also its working parts. The carbon chamber is pressed in the diaphragm and carries the intermediate electrode in disc form. The chamber is closed by a new electrode and mica washer as usual. The rear electrode is, however, composed of two parts, one an armless and the other a small central disc. Separating these is a cup-shaped piece of paraffined paper, which is clamped in place by the small central electrode, and whose front edge approaches closely the face of the intermediate or front electrode. It clears this face just enough to permit a movement of granules from and to the central enclosure. The electric circuit of the transmitter is from one to the other back electrode through the carbon. Mr. Dean has assigned his patent to the Kellogg Switchboard & Supply Company.

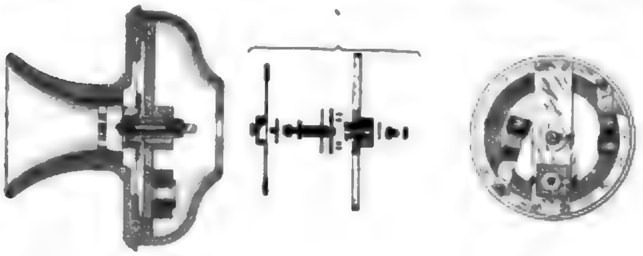


FIG. 1.—DEAN TRANSMITTER.

A transmitter of the inverted solid back type has been patented by M. Setter, of Chicago, the patent being assigned to the Automatic Electric Company. In this transmitter the rear electrode is backed by a thick felt washer which fits the walls of the carbon chamber and keeps the mica supporting washer free from contact with and damping by the carbon. Another feature of novelty is the provision of an aperture in the bridge through which the assembled microphone button may be inserted or removed.

A third new transmitter, the joint invention of E. R. Corwin and F. H. Parker, of Lafayette, Ind., approaches the old granular Blake in principle. The contact between the parts moving with the diaphragm and the stationary parts and through which the action of the transmitter is brought about, is maintained by the normal tension of the parts. For the usual arrangement of parts the front electrode carries a stud which bears upon the middle of the diaphragm. For the inverted type the rear electrode carries a stud which bears upon the bridge.

H. J. Guttman, of Chicago, has invented a sheet steel-pressed mouthpiece for transmitters. This is of the usual form even to the perforated protecting wall, which in this case is held in place by burs forced down from the body. The Automatic Electric Company has obtained the patent by assignment.

A different form of mouthpiece is that patented jointly by Messrs. F. C. Fisher, of Cheltenham, Pa., and W. C. Culin, of Camden, N. J. This is a composite affair, the body of which is of metal, with the ordinary screw stud for engaging the transmitter front. The outer edge is provided with a rounded double flange projecting equally inward and outward from the thin metal shell. Both within and without the metal shell retained by the flanges, are insulating protecting coatings which give the mouthpiece the appearance of a rubber mouthpiece, while obtaining the strength of the metal.

TERMINAL STRIP.

Another invention of Mr. Guttman's is a terminal strip formed by the ending metal strips through a thin strip, exactly as a common pin is inserted. The strip has two rows of holes, and the punchings in U-form are inserted, the legs passing through the holes. After this the legs are bent outward and project beyond the strip, the punchings becoming locked by the bending.

SWITCH-HOOK LEVER.

In Fig. 2 is shown an ingenious method of working up a hook-switch lever from a stamped metal blank. The figure is practically self-explanatory, the hook being formed by folding the blank longitudinally and shaping the prongs. H. J. Guttman is the inventor of this device the Automatic Electric Company being assigned the patent.

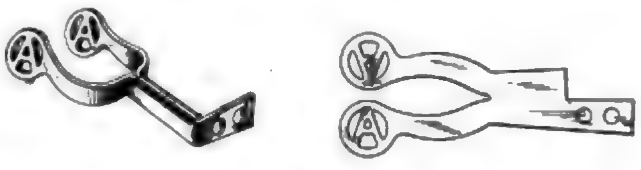


FIG. 2.—GUTTMAN SWITCH-HOOK.

LETTER TO THE EDITORS.

Present Day Central Station Enterprise.

To the Editors of Electrical World:

Sirs:—I was much interested in the editorial in your issue of May 5, entitled "A Recent Lighting Rival," and particularly the enumeration of new sources of electrical illumination which promise to bring electricity to a parity with the Welsbach as to cost of a given amount of illumination. Of these cheaper sources, two—the glower and mercury vapor lamps—have been on the market for some time; the graphitized filament and the flaming arc lamp have been exploited for some months, and it seems to be only a matter of a short time when the metallic filament lamp will be commercially in the field.

The above presentation brings up the pertinent question, What is the average central station man doing to take advantage of the recent improvements in electric light sources, and what thought is he giving to the revolution in his business which will accompany the introduction of the metallic filament lamp? The observation of the writer is that, compared with the attitude towards improvements in the early days of electric lighting, the average central station man of to-day is far from being alive to the important questions of the hour that affect the future of his business. In the case of the Nernst lamp he appears to have been driven to give it recognition, only under the stress of competition from gas "arcs." The mercury vapor lamp with its splendid adaptability for the economic lighting of warehouses and other large interiors where æsthetic quality of light is not a factor, would fifteen or twenty years ago have been eagerly investigated by every central station manager with a view to immediate adoption, but it now appears to arouse not even an apathetic interest; and the same appears to be true of the flaming arc with its efficiency five-fold greater than that of the enclosed arc.

Of very serious import to the central station industry is the work now being done in developing the metallic filament lamp. The direct-current tantalum lamp, with the efficiency of 1.9 watt per candle, appears to be now ready to enter the commercial stage. The osmium lamp, with its efficiency of 1.5 watt per candle, has in Germany reached the era of exploitation, and recently we have been given promise of a one-watt tungsten lamp. The results thus far achieved in the development of the metallic filament indicate strongly that the day is not far distant when the carbon filament lamp, even in its latest improved state, will be a thing of the past; and the progressive central station man cannot too soon begin to lay plans for the adjustment of his business to the basis of a cut of 40 per cent or greater in current consumption from his present incandescent lighting service. The situation that will be presented in this connection cannot be met by increase in meter rates, and now is the time to consider the question of higher candle units—replacing the 16-cp unit by the 25-hefner, or 22-cp, for instance—and the matter of a low system of rates under which a final and successful assault may be made on gas as an illuminant, thereby vastly increasing current consumption, instead of standing by and seeing it reduced by the introduction of the high-efficiency metallic filament lamp.

BOSTON, MASS. CHAS. R. FIELD.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Commutator Motor.—BRESLAUER.—An article, illustrated by diagrams, discussing the behavior of single-phase commutator motors and taking into consideration the short-circuit current in the coil under the brush. Graphical methods are made use of. The chief results are as follows: The currents which are produced by the main field on account of short-circuiting of armature windings in the neutral zone behave like the secondary windings of a transformer with a stray field. The secondary e.m.f. produces in all cases an increase of the short-circuit current when at rest, and there is an improvement in the power factor. The author gives rules for finding the characteristic diagram from two simple short-circuit measurements.—*Elek. Zeit.*, April 26.

Lamps and Lighting.

Arc Lamp.—STADELMANN.—An illustrated article on a new type of electric arc lamp of high candle-power with the use of conductors of the second class (electrolytic conductors). The arrangement is shown in Fig. 1, where *a* represents one or more pieces of a material of a conductor of the second class, while *b* is one or more pairs of carbons. The lamp is started by bringing the carbons together as in ordinary arc lamps. When the circuit is closed the carbons are separated from each other. The arc heats the conductor of the second class, *a*, until it becomes incandescent and then conducts the current itself. Part of the current is then shunted off through *a*. The distance between the carbon, *a*, may then be still further increased. The distance of *a* from *b* must be chosen so that the resistance of the part of the arc between *a* and *b* is not too large; on the other hand, *b* and *a* should not be baked together. The conductor, *a*, of the second class serves in this case both for emitting light and for reflecting light. The light given out by such a lamp is very steady since the conductor, *a*, of the second class serves as a "light accumulator." For this reason the lamp is not sensitive to variations of the current. No figures as to efficiency are given.—*Elek. Zeit.*, May 3.

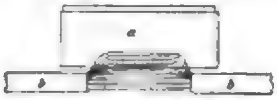


FIG. 1.—DIAGRAM OF ELECTROLYTIC ARC LAMP.

Long Flame Arc Lamps.—ANDREWS.—The first part of an illustrated paper read before the British Institute Electrical Engineers on the improvements obtained by using a long arc with flame arc lamps with special reference to the construction of the Carbone arc lamp, in which inclined carbons are used with 80 to 90 volts across the arc.—Lond. *Elec.*, April 27. The second part of the paper gives photographs of the two ends of the carbons when lighted, and includes certain candle-power curves. In discussing the impregnation of carbon by metallic salts the author says that considerable improvement has been effected during the last year or two in the composition of the carbons used for chemical carbon flame arc lamps. The large amount of calcium salts first proposed by Bremer and the non-conductive scoria caused a great irregularity in burning. The carbons are now usually of the composite type, consisting of three zones. The outer zone or envelope is composed of pure carbon, giving mechanical strength. The next contains carbon mixed with various salts, such as those of calcium and magnesium, and the inner soft centering core is made of the same material less strongly compressed. He then takes up the color effects of flame arcs. The paper is to be concluded.—Lond. *Elec.*, May 4.

High-Voltage Arc Lamps.—LUX.—The tendency to increase the voltage of supply in electricity works has resulted in the construction of arc lamps operated at higher voltages than heretofore, in order to avoid the loss of considerable power in the series resistances. The first successful experiments with arc lamps with higher voltages were made with entirely enclosed arcs operated at 120 volts between the electrodes. The light of these lamps, however, is too rich in blue violet and ultra-violet rays. More recently several firms have produced lamps of such a kind that two of them may be connected in series across a 220-volt circuit. The most favorable voltage was found to be about 80, when using an arc with very restricted supply of air. The author gives results of tests of two types of "bi-volta" lamps of the Siemens-Schuckert Company, one type having the carbons one above the other, the other type having the carbons side by side in an inclined position. The first type was tested with a supply voltage of 75 and with a current of 8 amp., so that it consumed 600 watts at the terminals. The mean hemispherical candle-power was 629. The distribution of light was very uniform. The consumption of power was 0.986 watt per candle. The type with inclined carbons was operated with 83 volts and 8 amp. and therefore consumed 664 watts at the terminals. The mean hemispherical candle-power was 817, hence the power consumption was 0.812 watt per candle. With this type of lamp the distribution is not symmetrical around the axle. This was taken into consideration when making the tests.—*Zeit. f. Beleucht.*, April 20.

Arc Lighting.—HENDERSON.—An illustrated discussion on the design, operation and maintenance of enclosed arc lamps, dealing especially with details of arc enclosure, the construction of bushings for the carbons, clutches, dash-pots, short-circuiting switches, binding posts and the alignment of parts. The author then deals specifically with direct-current multiple and series lamps and with alternating-current multiple and series lamps.—*Elec. Jour.*, May.

Photometry of Incandescent Lamps.—LUX.—The conclusion of his article on the use of a device of his own for determining the mean spherical candle-power of an incandescent lamp which is being revolved during the test. The author strongly urges to read incandescent lamps by their mean spherical candle-power, not by horizontal candle-power.—*Zeit. f. Beleucht.*, April 30.

Photometric Lamp.—ELLIOTT.—A description of a new standard photometric oil lamp for special use in gas works.—*Progressive Age*, May 5.

Electric Lighting and Great Fires.—HERZOG AND FELDMANN.—An article discussing two instances in which electric lighting installations were made responsible without justification for great fires by the public press, and dealing with the unfair ideas of the general public concerning short-circuits and the possibility of sparks. Good installation, thorough control and proper maintenance are, however, important in all electric lighting installations.—*Elek. und Masch.*, April 29.

Public Lighting Corporations.—GARDINER.—A paper read before the Ohio Gas Light Association on some economic relations between public lighting corporations and the public. The subject is discussed under the following headings: Economic forces causing the inauguration and conduct of the public lighting business, non-monopolistic character of the public lighting business, economic laws governing prices, main items of specific interest to the public in the public lighting business, adjustment of price on the basis of saving and profit sharing.—*Progressive Age*, May 15.

Power.

Surface Condensing.—WEIGHTON.—A long paper illustrated by diagrams on the efficiency of surface condensing. The chief conclusions are as follows: It is conducive to efficiency in a surface condenser that the water resulting from condensation should be intercepted and removed from the condenser as soon as possible after it is formed. It is conducive to efficiency that the condenser capacity should be a minimum consistent with the accommodation of the necessary surface, and that the design should be such as to secure a pervading and uniform flow of vapor throughout the condenser section, thus utilizing the whole of the condensing surface provided, as well as obviating stagnant recesses in which air might be retained. It is conducive to efficiency that the condensing water should travel at a fairly high speed through the tubes, and that it should enter at the bottom and leave at the top of the condenser. With suitable condenser design and proportions, the temperature of the condensing water at the discharge point may be equal to, or slightly higher than, the temperature due to the vacuum. This holds true for vacua up to slightly over 29 in. With suitable condenser design and proportions, the temperature of the hot well may be from 3° to 5° higher than the temperature due to the vacuum. This holds true for vacua up to slightly over 29 in. With suitable condenser arrangements and a reasonably air-tight system, there is nothing gained in efficiency by the use of air pumps exceeding in capacity 0.7 of a cubic foot per pound of steam condensed, up to a limit of close upon 29-in. vacuum. For vacua exceeding this limit, or for cases in which air leakage is considerable, the air pump capacity must be increased, or else the vacuum efficiency will fall. With suitable condenser design and proportions, and in conjunction with "dry" air pumps, a condensation rate of at least 20 lb. of steam per square foot of surface per hour will be maintained in association with a vacuum of 28½ in. and a quantity of condensing water equal to 24 times the feed water, at an inlet temperature of 50°. With suitable condenser design and proportions, and in conjunction with "dry" air pumps, a condensation rate of at least 36 lb. of steam per square foot of surface per hour will be maintained in association with a vacuum of 28½ in. and a quantity of condensing water equal to 28 times the feed water, at an inlet temperature of 50°. The most economical vacuum, in its widest sense, will obviously be that vacuum with which is associated the minimum steam consumption per horse-power developed. Whatever may be the value of this particular vacuum in any given case, it is clear that it cannot possibly exceed that degree of vacuum beyond which the pump power absorbed in increasing the vacuum exceeds the power return in the main engines due to that increase. This much, at any rate, is clear, without any reference whatever to the consumption of steam in the engines utilizing the vacuum. When the condenser is used in connection with a steam turbine, the limit in economical vacuum production is practically identical with the highest attainable vacuum; and when used in conjunction with reciprocating quadruple-expansion engines, the limit is slightly less than the maximum vacuum; but the difference between the two cases is not very striking.—Lond. *Eng'ing*, April 13 and 20.

Surface Condensation.—SMITH.—An experimental study of condenser problems, especially of the effect of air in relation to the surface condensation of low-pressure steam. The chief deduction is that air, even in minute traces hitherto considered innocuous, should be, by initial design and subsequent management, rigorously excluded from high-grade surface-condensing installations. With high vacua climatic conditions are potent limiting factors and must be specially considered.—Lond. *Eng'ing*, March 23.

Separation of Oil from Feed Water.—HARWOOD.—The author discusses the following two methods: In the first the separation of the oil from the feed water is effected by a discharge of electricity between plates immersed in the water while in the second method a chemical coagulant is mixed with the water. The cost of the chemical treatment is considerably less than that of the electrical treatment, though the amount of attention required is slightly greater. The success of either of the two methods depends ultimately on the method of final separation and purification by some forms of filter. The only filtering medium which has given any real satisfaction is fine quartz sand used in a filter of the open or gravity type.—Lond. *Elec. Rev.*, April 13.

Boiler Room Losses.—ORR.—An article discussing the possibilities of savings in the boiler rooms of central stations. The necessity of skilled firemen is pointed out, together with a discussion of the advantages of mechanical stoking. A great many other details of boiler room economics are also discussed.—Lond. *Elec. Eng.*, May 4.

Nomenclature.—HOBART.—An article on the advantages of employing electrical engineering nomenclature in steam engineering calculations.—Lond. *Elec. Rev.*, April 27.

Installations, Systems and Appliances.

Electromagnetic Control of Governors.—SPEYER.—Central stations supplying energy for light, power and traction and running their alternating and direct-current machines coupled to the same engines must necessarily have some means for steadying the bus-bar pressure. If no battery and booster are used it is possible to employ an electromagnetic coil fixed on to one end of the engine governor as shown in Fig. 2. The operation is as follows: The current in flowing back from the traction load to the negative brush carrier of the dynamo passes round the electromagnet, *B*, with the result that the core, *M*, is pulled down to a greater or less extent according to the strength of current flowing through its coils, or, in other words, the amount the core, *M*, will be pulled down is directly proportional to the load. As will be seen from the illustration, this core, *M*, is attached to the governor, *N*, in such a way as to help it in its working, with the result that the opening and closing of the inlet and outlet valves, corresponding to the varying load, is performed in a far shorter time than is possible when the mechanical governor is used alone. It is not really necessary for the whole amount of current passing in a return cable to be sent through the electromagnet; a certain percentage of it will do the work just as well. Though this method of keeping the bus-bar pressure constant possesses the distinct advantage of doing away with a battery, it does not allow one to run the engine and work the boilers with their most economical and constant load, with the result that there may, perhaps, be a greater coal consumption than when one is working with a battery, for with this latter it is possible to have a steady load on the engine, and to arrange for the extra load to be taken up by the battery. This point must, therefore, always be taken into consideration. The above method has been used with full success in the central station of Wiesbaden, Germany. The variation in the traction load may be anything from 100 kw to 700 kw, but with this system of control there is never more than a 3 per cent pressure drop on the 600-volt tramway system. On the low-voltage side of the alternating-current plant for lighting purposes, etc., the voltage drop never exceeds more than 2 per cent, and as the engines are supplied with large and heavy fly-wheels, this drop occurs so gradually that it is impossible to detect any flickering of the lamps. The Breslau and Charlottenburg central stations, which have heretofore employed a battery for keeping the bus-bar pressure constant, are now contemplating superseding this older method by adopting electromagnetic regulation.—Lond. *Elec. Eng.*, April 20.

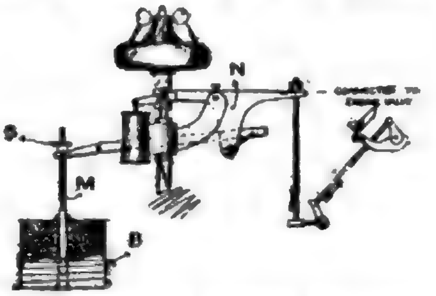


FIG. 2.—DIAGRAM OF GOVERNOR CONTROLLER.

Traction Current from Lighting Stations.—HOPPE.—In an investigation of the financial results of municipal electricity works, the author found that among the plants which gave satisfactory financial results there were a great many which supplied electricity not only for lamps and stationary motors, but also for traction, and that some of these plants were successful, although they sold the kw-hour for traction at a lower price than the direct cost of operation. The author gives numerical data on this subject and emphasizes the economy of lighting plants selling electricity to traction companies. He claims that an independent traction plant cannot produce the electricity as cheaply as a plant which also supplied energy for lamps and stationary motors. —*Elek. Bahnen*, March 14.

No-Load Losses of Transformers.—Schmidt.—The first part of an article illustrated by diagrams, discussing various arrangements for the prevention or diminution of the no-load loss of single-phase and polyphase transformers.—*Elek. und Masch.*, May 6.

Wires, Wiring and Conduits.

Deflections Due to Break of Overhead Wires.—Hawthorne and Morton.—A mathematical note on the deflections caused by a break in an overhead wire carried on poles. In the modern conditions of electrical power transmission along overhead wires, it is a matter of practical importance to know what will happen in case a wire breaks. The relaxing of tension at one point will throw a one-sided pull on the range of poles on either side of the break; and it is essential for safety that the maximum deflection thus produced should be below a definite limit. The authors present an analytical study of the problem and apply it to a special numerical case. They suppose the wire to be fastened at its ends to massive "anchor poles" whose yielding is negligible, and to be supported by equally-spaced flexible poles. One of the results of their analysis is that at a distance from an anchor pole the successive deflections approach a geometric progression. The maximum deflection, which of course occurs in the pole next to the break, and which becomes greater as this pole is further removed from the anchor pole, approaches a limiting value. When this limit is below the allowable safe deflection, it does not matter how widely the anchor poles are distributed. In the numerical case that the authors have studied the number of wires are six, the tension of each wire 1,000 lb., the weight of each wire 0.42 lb. per foot, the distance between consecutive poles 100 yards. A test of the stiffness of a pole showed that a deflection of 3 in. was caused by a force of 800 lb. applied to the top in a horizontal direction. The following table gives the calculated deflections in feet when the break occurs after the first, second, …… 7th pole, counting from an anchor pole:

Deflection of	1st	2nd	3rd	4th	5th	6th	7th Pole
When n = 1	.33						
2	.24	.53					
3	.16	.36	.62				
4	.11	.23	.41	.67			
5	.07	.15	.26	.43	.68		
6	.04	.09	.17	.27	.44	.69	
7	.03	.06	.11	.17	.28	.44	.694

The limit of the ratio of successive deflection is 1.58, and the limiting value approached by the maximum deflection is .696 foot. It will be seen that this is almost reached at seven poles' distance from the fixed end. These results are shown graphically in Fig. 3. The points corresponding to each position of the break are strung together on a curve, although, of course, the intermediate points on the curves have no physical meaning. The asymptotic approach of the extreme points of the curves to the limiting value is very obvious. The maximum deflections liable to be caused by breakage of 1, 2, …… 6 wires, the point of break being distant from both fixed ends, are as follows:

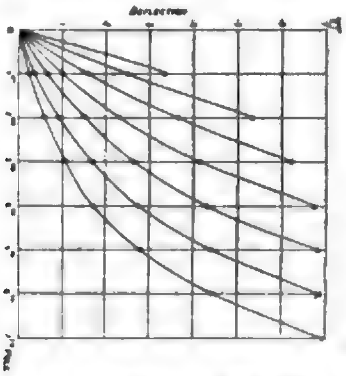


FIG. 3.—CURVES OF DEFLECTION.

Number of wires broken	1	2	3	4	5	6
Deflection ……………	0.03	.07	.127	.213	.307	.696 ft.

—*Phil. Mag.*, May.

Faults of Direct-Current Three-Wire Networks.—Fernie.—An article on faults occurring on direct-current three-wire networks with a neutral wire earthed at one place and 460 volts between the outer wires. In the writer's experience 90 per cent. of all faults occur on the negative main. A negative fault in popular language "always draws water"; this effect is commonly described as electric endosmosis, and is easily illustrated by sticking a bare negative wire into the ground, in apparently dry soil, when moisture at once appears around it. This fact seems to the writer to be largely instrumental in causing faults on buried cables (although he agrees that decomposition of the insulation due to the abnormal osmotic pressure of some of its constituents would also very likely take place, especially in the case of India rubber and high pressures). When the insulation of a cable becomes damaged from any cause, if it be a positive main the probability is that no "earth" occurs, as the endosmotic effect acts in a helpful direction and drives away moisture, the great enemy to all insulation; thus, so long as the cable is "alive" it will remain to all intents and purposes quite sound. With a negative cable the reverse is the case, the earth being at a 230 volts higher potential; there is a constant strain on the insulation, tending to drive moisture through the insulation to the copper. Thus the slightest weak place breaks down, and water getting in, a bad fault is soon caused by the accompanying electrolytic action of the current. As an argument in favor of his considerations the author points to the almost entire immunity that alternating-current networks enjoy from faults. The remedy which he advocates on the basis of his theory is to use a triple-concentric cable with the inner core the negative, the middle one the neutral wire, and the outer the positive. It seems logical to make the outer positive in preference to neutral, as the positive is the strongest and best able to protect itself; the negative is always trying to surrender, and should, therefore, be in the safest place. The neutral wire is normally passive while the positive actively defends itself, and in doing so protects the other two. The cable should be paper-insulated and lead-covered, and over this, again, there should be a braiding suitably impregnated. A draw-in system appears preferable to a solid system.—Lond. *Elec.*, May 11.

Wood Troughing.—If in the case of mains laid on the "solid" system, wood troughing is employed, care should be taken to prevent the wood from rotting in the ground. The Haskin system of treating wood consists in placing the raw timber in a large steel cylinder or treating chamber; superheated air is then applied under great pressure. The high temperature, ranging from 300° F. to 400° F., destroys the tendency to germinate, and kills all fungi, germs and insect life in the wood. Before removing the wood from the cylinder it is allowed to cool down under the same pressure, with the result that the "new compound" arising from the heating of the natural fluids in the wood is consolidated with its fibre.—Lond. *Elec.*, April 27.

Wood as Insulation Material.—Wernicke.—An article pointing out that wood is still sometimes used as insulating material, for instance for the brush holders of street railway motors or for insulating sections of the overhead trolley construction. It is pointed out that wood is not at all satisfactory, and that there are certain artificial insulating materials which should be used instead, like ambroin and others.—*Elek. Bahnen*, April 4.

Wiring with Lead-Covered, Rubber-Insulated Wire.—A "communicated" article on the system of wiring with twin lead-covered wire. This is compared with wiring in screwed barrel, wiring in split tubing with socketed joints, and wiring in wooden casing, especially with regard to first cost and permanence of work. The comparison is in favor of the twin lead wiring.—Lond. *Elec. Rev.*, April 20.

Extra High-Pressure Regulations.—A reprint of the new extra high-pressure regulations of the British Board of Trade with an editorial discussion of the same.—Lond. *Elec.*, April 27.

Electrophysics and Magnetism.

Rectifying High-Frequency Electric Currents.—FLEMING.—A (Brit.) Phys. Soc. paper on the construction and use of oscillation valves for rectifying high-frequency electric currents. If a metal plate is sealed into an incandescent lamp, the space between the metal plate and the incandescent carbon filament possesses a unilateral conductivity, negative electricity being able to pass freely from the hot carbon to the plate, but not in the opposite direction. This fact may be used for the construction of an oscillation valve, as shown in Fig. 4. A carbon filament lamp is constructed, the carbon loop of which is upheld in the center of a highly exhausted glass bulb. T_1 and T_2 are the terminals of the carbon filament. Around the loop is fixed a smaller cylinder of nickel, *CB*, which is connected to a platinum wire sealed through the side of the bulb. The valve is used as follows: The carbon loop is made incandescent by a suitable battery of secondary cells, a sliding rheostat being added to adjust the voltage on the terminals of the lamp. The circuit in which oscillations are to be detected is joined in series with a dead-beat mirror-galvanometer, and the valve connected with the circuit by wires joined respectively to the terminal of the nickel cylinder and the negative terminal of the carbon loop. In using the valve the carbon filament must be brought to bright incandescence, about equal to that which in a carbon filament lamp would consume 3 watts per candle. So used, the valve enables one to employ a sensitive mirror-galvanometer of the ordinary type to detect the presence of electric oscillations in a circuit and to institute comparative measurements. Several applications are described and it is pointed out that these oscillation valves have quite a different range of use from the mercury-vapor rectifier and the electrolytic rectifier. The electrolytic valves produce no rectifying effects with high-frequency alternating currents, because the time element enters into the formation of the aluminic hydroxide film on which their action depends. On the other hand, the mercury-vapor tubes which have been proposed for use with high-tension alternating currents will not operate below a certain minimum potential-difference between the electrodes. The vacuum-valve, however, will pass current unilaterally with a fraction of a volt difference of potential between the incandescent and the cold electrode, and there is no minimum potential difference below which they will not act; hence their use is conditioned solely by the sensitiveness of the galvanometer employed with them. By its simplicity and ease of use the carbon-filament vacuum recommends itself as a useful addition to our resources for experimental work in connection with electric oscillations and electric-wave telegraphy.—*Phil. Mag.*, May.

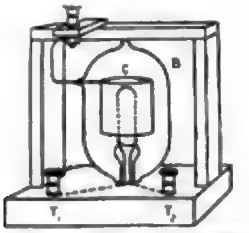


FIG. 4.—OSCILLATION VALVE.

Ionization of Gases.—BRAGG.—An account of an experimental investigation of the ionization of various gases of the alpha particles of radium with some references to the magnetic deflection of the alpha particle and its acquirement of a positive charge. *Phil. Mag.*, May.

Units, Measurements and Instruments.

Integrating Photometer.—BLONDEL.—A German translation of his French paper on integrating photometers, the mesophotometer and lumenmeter.—*Zeit. f. Beleucht.*, April 30.

Uniform Notation.—STRECKER.—A preliminary report to the Berlin Elec. Socy. on uniform notation of physical and electrical quantities in formulas.—*Elek. Zeit.*, April 19.

Testing Refractory Materials.—HARKER.—At a recent soiree of the Royal Society in London, Harker exhibited his apparatus for testing refractory materials at very high temperatures, up to 2,500° C. Discs about 20 millimetres in diameter and 3 millimetres in thickness, made of the material, are placed in a little tubular furnace, open below and above, consisting of two tubes of Acheson graphite fitted into one another. An electric arc is formed, and the disc is observed from below with the aid of mirrors, the image of the disc appearing in the plane of a small electric lamp, whose current is varied until both the object and the lamp shine with the same brilliancy. The principle is thus the same as in the optical pyrometer. While this heating is going on, pressure may be applied to the disc by means of a lever and a little graphite rod resting on the center of the disc; a pointer shows when the sample gives way.—Lond. *Eng'ing*, May 11.

Permeameter.—A note on the Picon permeameter which Campbell is investigating and which was exhibited at the recent soiree of the Royal Society in London. The test bar is clamped so as to form the middle bar of a rectangular yoke (or, rather, pair of yokes), the three iron cores being parallel to one another. By means of a small switch the lines of force may be made either to go all round the yoke, or down the test-bar and in two paths round the yoke; and with the help of independent magnetizing coils wound on the yokes, exact compensation is obtained for the reluctance of the yokes, and the four joints, which are always in circuit. When the compensation has been effected, the magnetic induction, *B*, is deduced from the throw of a ballistic galvanometer, the magnetizing force, *H*, being applied by a third coil round the test-bar. The readiness with which the instrument works was demonstrated with the help of Campbell's bifilar galvanometer. When a galvanometer is deflected for many hours at a time, its suspension wire is apt to take a set, which prevents its returning readily to zero; when the mirror is suspended by two wires, about a centimetre apart, the zero creep is avoided.—Lond. *Eng'ing*, May 11.

Telegraphy, Telephony and Signals.

Localization of Faults in Telephone Lines.—FREIMARK.—A summary, illustrated by diagrams, of the usual methods employed in the United States for localizing faults in telephone lines.—*Elek. Zeit.*, April 19.

Testing Telegraph and Telephone Cables.—COHNREICH.—An article, illustrated by diagrams, on the determination of the insulation, the resistance and the capacity of telegraph and telephone wires.—*Elek. Anz.*, April 29.

Cable.—The first part of an illustrated description of the telephonic and telegraphic cable of the Simplon tunnel.—*Jour Telegraphique.*—April 25.

BOOK REVIEWS.

TELEPHONY. Part VI, Switchboards and the Central Office. By Arthur Vaughan Abbott. New York: McGraw Publishing Company. 275 pages, 169 illustrations. Price, $1.50.

This volume completes the series of six volumes by Mr. A. V. Abbott on telephone engineering. The previous volumes covered, respectively, The Location of Central Offices, The Construction of Underground Conduits, The Cable Plant, Construction of Aerial Lines, The Sub-Station. The final volume naturally takes up the central office, cleverly designated by the author as "The brain of the telephone exchange, from which the wire plant, a complicated ganglion of nerves, radiates in all directions." The chapter heads are as follows: Introduction, Distributing Boards, Circuits and Apparatus for Small Switchboards, Transfer Systems and the Multiple Boards, Common Battery Circuits, Toll Line Circuits, The Power Plant, Traffic. The last-mentioned chapter is of particular interest, the subject of traffic being treated both broadly and exhaustively with respect to detail. A number of curves are given of the traffic record of different classes of exchanges from that of a large city to farming towns and small villages. Other curves give the "A" operator's load of similar exchanges. Curves are also included on trunk line loads, relative position loads, hourly and minute variations; finally, there is an interesting curve on the probable use of the telephone. As these curves are plotted from the results of analyzed data taken from actual practice in a great many exchanges, they should be of much value to central office men in studying their own traffic and in fixing rates.

Electric Railway Accounting. The Monthly Report, The Accounting Department and The Accountant. By W. B. Brockway. New York: McGraw Publishing Company. 84 pages, 5 charts. Price, $1.25.

The author states that while many works have treated the accounting of electric railways, none has handled the subject from the standpoint of the actual street railway accountant, which is the subject of the present work. The subjects of the chapters of the book are as follows: What a Report Should Be, A Suggested Form of Report, Relation of Operating Expenses to Earnings, Some Other Units of Comparison, Curves as a Means of Expression, Statistical Information, What Standardization of Accounts Means, The Balance Sheet, Accrued and Suspended Accounts, Expert Examinations, Accounting Department Not a Revenue-Producing Department, Some Qualifications of a Railway Accountant, The Accounting Office, Taking Things for Granted. Each of these subjects is treated in a specific manner and in such a way that the information given can be immediately applied by the street railway accountant. In this respect the book is an agreeable contrast to other works on the subject of accounting, which, while excellent in laying down general principles and discussing their bearings, are of little service to the busy accountant who looks for information of direct applicability in his everyday work.

American Newspaper Annual. Philadelphia: N. W. Ayer & Sons. 1,300 pages. Price, $5.00.

The extent of what may be called the modern newspaper industry in the United States is well illustrated by this valuable annual publication, more than 1,100 pages being required to list the periodical publications of the United States, its possessions and Canada. The total number of newspapers and periodicals enumerated is no less than 23,595, which includes 2,357 daily papers. It is somewhat surprising to find that at the beginning of 1906 there were 21 less dailies printed than in the previous year, and that there was a loss of 115 in the total number of newspapers and periodicals notwithstanding a gain of 116 in monthlies. Even in the Western States there were five less daily newspapers printed and 27 less weekly newspapers. The small gain in weekly newspapers is to be accredited to the Territories and Canada, as otherwise there would also have been a loss in this class.

The publication also serves as an up-to-date Gazetteer and as such is valuable to those not particularly interested in the statistics of newspapers. Preceding the entry of the newspapers printed in a town, are concise local statistics and information, including population, railroad location, distance from the nearest considerable city or railroad center of importance, the principal local industries, and the agricultural and other products of which the town is the shipping point. Preceding the statistics for each State is a well-executed double-page railroad map and a description of the State, with county divisions, giving the character of surface and soil, chief products and manufactures, etc. The newspaper statistics given consist of the date of establishment, the name of the publishers, the number and size of pages, subscription price, circulation and the politics, industry, religion, etc., represented by the Journal. One section of the annual comprises a separate classification by name and place of publication of daily, weekly and monthly newspapers, religious, agricultural, class and secret society publications, and publications in foreign languages. There is also a list of press and editorial associations.

Synchronous and Other Multiple Telegraphs. By Albert Cushing Crehore. New York: McGraw Publishing Company. 124 pages, 42 illustrations. Price, $2.00.

This book describes the more important systems which have been developed for obtaining independent telegraph circuits on a single wire, both with and without synchronism. The first part of the book is devoted to the general subject of methods of obtaining independent telegraph circuits by the use of direct and alternating currents on the same wire, and comprises the first technical description of these methods which has been attempted. The second part of the book deals with the means of obtaining the synchronous rotation of two bodies at distant points, and the third part with the means by which such rotation may be utilized for obtaining independent telegraph circuits. The third part concludes with an account of some practical methods of operating Morse systems by the synchronous method, showing how circuits operated over the same trunk lines may be distributed to different points. In view of the great development in rapid telegraphy systems in recent years, this treatise on the fundamental principles employed, and their application in certain systems, forms a much-needed contribution to the literature of telegraphy.

Experimental Researches Upon the Construction of Hydraulic Mortars. By Henri Le Chatelier. Translated by J. L. Mack. New York: McGraw Publishing Company. 132 pages, illustrated. Price, $2.00.

This work is based upon a degree thesis by M. Le Chatelier, but the author for this translation indicates in notes the more important advances made since the thesis was written, in the theoretical knowledge of cements, and gives references to publications in which these appear. The book is divided into three parts under the heads of Plaster, The Silicates of Barium and Cements and Hydraulic Limes. The chief object of the work is the study of the chemical reactions which are produced in the limes and hydraulic cements, either during their calcination or during their hardening. First the more simple analogous bodies, such as plaster and the silicates of barium are taken up, the phenomena found in these bodies being used to throw light upon the theory of calcareous cements. The final pages of the book deal with the practical side of hydraulic cements under the heads of causes of destruction and of testing.

Electric Power Transmission. A Practical Treatise for Practical Men. By Dr. Louis Bell. Fourth Edition, Revised and Enlarged. New York: McGraw Publishing Company. 700 pages, 350 illustrations. Price, $4.00.

This new edition of Dr. Bell's standard treatise on "Electric Power Transmission" has been entirely rewritten in some of its parts, and new matter to the extent of 90 pages added. The author in his preface states that the changes which have taken place in the art during the past few years have made a new edition of the work imperative, that important accessory apparatus, of which modern stations are full, needed special attention, as well as considerable new material of a more general sort, and that descriptive matter which had to do with things which are obsolete and without historical importance required elimination. The work has become so well established as an authoritative treatise that it would be superfluous to attempt any general review of its contents. In rewriting the chapter on Present Tendencies in High-Voltage Transmission, Dr. Bell points out that in five years the average working voltage of transmission lines has nearly doubled. A most interesting table in this section gives data of American high-tension transmission plants worked at 20,000 volts or more. In each case the kilowatt capacity, the voltage, the distance transmitted and the frequency are given. From this table it appears that there are at present no less than 13 60,000-volt plants, 34 plants operating between 30,000 and 57,000 volts, and 14 plants operating between 22,500 and 26,400 volts. More than 40 plants are listed which operate at from 20,000 to 22,000 volts, and the author in a note to the table states that so many transmission plants at 20,000 volts and thereabouts are now being installed that it is almost impossible to make the list inclusive.

BOOKS RECEIVED.

Berechnung und Ausfuhrung der Hochspannungs-Fernleitungen. By Carl Fred Holmboe. Berlin: Julius Springer. 88 pages, 61 illustrations. Price, 3 marks.

Report of the Electric Railway Test Commission, Louisiana Purchase Exposition. New York: McGraw Publishing Company. 621 pages, 209 illustrations. Price, $6.00.

Analyse des Metaux par Electrolyse. By A. Hollard and L. Bertiaux. Paris: H. Dunod and E. Pinat. 180 pages, illustrated. Price, 6 francs.

The Art of Generating Gear Teeth. By Howard A. Coombs. New York: D. Van Nostrand Company. 129 pages, 37 illustrations. Price, 50 cents.

Electrical Engineering in Theory and Practice. By G. D. Aspinall Parr. London: Macmillan and Company. 447 pages, 282 illustrations. Price, $3.25.

Elektrische und Magnetische Messungen und Messinstrumente. By H. S. Hallo and H. W. Land. Berlin: Julius Springer. 517 pages, 343 illustrations. Price, 15 marks.

Electrical Nature of Matter and Radioactivity. By Harry C. Jones. New York: D. Van Nostrand Company. 212 pages. Price, $2.00.

Physical Chemistry for Electrical Engineers. By L. Livingston R. Morgan. New York: John Wiley & Sons. 230 pages, illustrated. Price, cloth, $1.50.

Uber Elektronen. By Dr. W. Wien. Leipzig: B. G. Teubner. 28 pages. Price, 1 mark.

Fortschritte in der Anwendung der Röntgenstrahlen. By Dr. Joseph Rosenthal. Munchen: J. F. Lehmann. 31 pages, 20 illustrations. Price, 1.20 mark.

Theorie und Berechnung Elektrischer Leitungen. By Gallusser and Hausmann. Berlin: Julius Springer. 162 pages, 145 illustrations. Price, 5 marks.

Elektrischer Energie. Die Preisstellung bein Verkaufe. By Gustav Siegel. Berlin: Julius Springer. 192 pages, illustrated. Price, 4 marks.

Berlin-Zossen Electric Railway Tests. Translated by Franz Welz. New York: McGraw Publishing Company. 58 pages, 18 illustrations, 38 plates. Price, $3.00.

Commande À Distance. Au Moyen de L'Electricite. By Regis Frilley. Paris: Gauthier-Villars. 190 pages, 94 illustrations. Price, 3.50 francs.

Westinghouse Auxiliary-Pole Direct-Current Motors.

To meet the demands for power imposed by modern machine tool work, involving wide and efficient speed control, the Westinghouse Electric & Manufacturing Company has developed a new line of direct-current motors, with a speed range of four to one on a single voltage. The control of this exceedingly wide speed is obtained by introducing resistance in series with the shunt field coils, and by the use of auxiliary poles and coils. This latter feature has been introduced to control the field form during the variation of field strength necessary to secure so wide a range of speed.

The auxiliary poles are bolted to the frame midway between adjacent main poles. The winding of the auxiliary poles is connected in series with the armature and produces a magnetizing effect which is proportional to the armature current. This introduces a factor which compensates for the distortion caused by armature reaction and field weakening. In ordinary motors the effect of armature reaction is to shift the path of the magnetic flux, weakening the leading pole tips and, consequently, shifting the neutral point, necessitating a backward lead of the brushes to obtain a field for sparkless commutation. By introducing the auxiliary poles a commutating field is maintained in a fixed position regardless of load or direction of rotation.

The application of this type of motor to machine-tool drive not only obviates the use of mechanical speed changing devices, thereby increasing efficiency, but places each machine under perfect control of the operator with a much wider range of speeds than can be obtained by mechanical methods.

The practical application of these motors is illustrated by a typical installation in the new projectile shop of the Firth-Sterling Steel Company at Demmler, Pa. This company had, previous to adopting the Westinghouse equipment, made an investigation of various methods of machine tool drive, both mechanical and electrical. Following out one line, five-step cone pulleys were reduced to two steps and a much wider belt was used to drive the machines, owing to the increased power requirements. This method did not give satisfaction in practice and was soon abandoned. The multi-voltage system of motor drive was next investigated but did not meet with favor, and the Westinghouse auxiliary field motors were then adopted and have given entire satisfaction in every respect.

The equipment consists of eight 10-hp motors driving eight 26-in. swing Bullard lathes, two 15-hp motors, each driving a Bullard horizontal boring machine; and one 7½-hp motor direct-connected to a Bullard turret lathe. The speed of the motors is varied by controllers with twenty-one notches, giving twenty-one motor speeds. In addition to the above there is a 35-hp constant-speed motor belted to a line shaft which furnishes power to a group of small machines including a planer, cutting-off machine, centering machine and two drill presses.

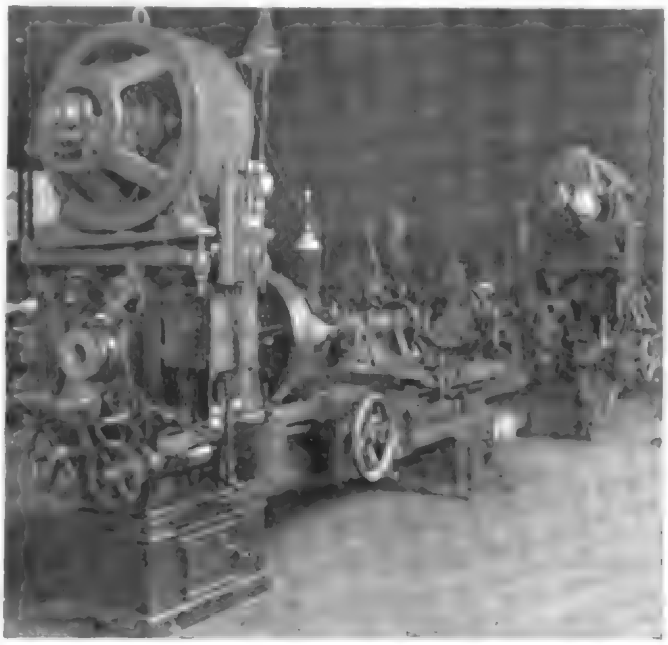


FIG. 1.—AUXILIARY-POLE MOTORS IN PROJECTILE WORKS.

A novel method of checking the efficiency of employees has been introduced by the Firth-Sterling Company, which is made possible by the use of electrically-driven machinery. It consists of placing, in a convenient location for observation, a recording ammeter arranged to be connected in circuit with any machine whenever desired. Previous tests have determined approximately the current required for a given class of work, so that the record of the ammeter indicates whether or not the machine is working up to its capacity and the time it stands idle.

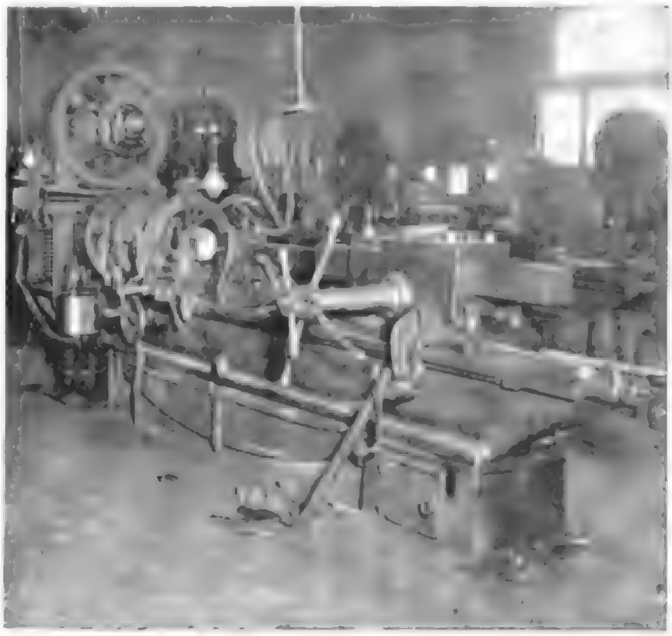


FIG. 2.—AUXILIARY-POLE MOTORS IN PROJECTILE WORKS.

The opportunity of comparing the relative outputs of similar machines performing the same class of work in the same manufacturing plant rarely presents itself in as forcible a manner as in the Firth-Sterling plant. The old projectile shop still uses belt-driven lathes, some with wide belts. These belt-driven lathes are the same type of machines as the motor-driven lathes, and the result of some very interesting tests of the number of projectiles finished in ten hours show conclusively the greatly increased efficiency of motor-driven machines.

Diameter of projectile	6 in.	7 in.	8 in.
Projectiles finished in 10 hours, motor-driven lathe	38	32	25
Projectiles finished in 10 hours, belt-driven lathe	27	27	17
Per cent increase	40.7	52.3	47

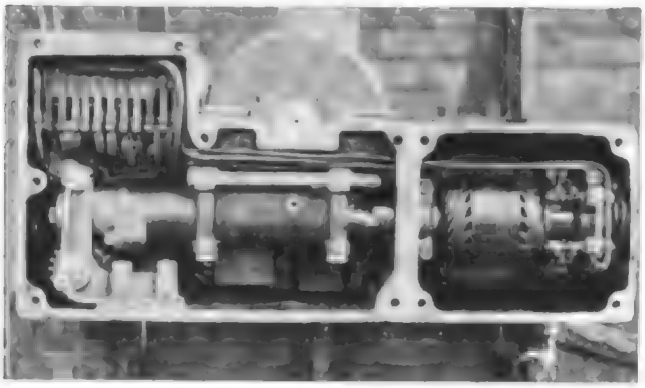
Average increase in output, 46.6 per cent.

The belt-driven lathes will eventually be changed to motor drive, which is accomplished by adding an inexpensive mounting for the motor. The shop with the motor-driven machines presents a clean and light appearance; the absence of belting, with the exception of that driving the group of small machines, is a noticeable feature, which naturally aids in cleanliness and gives unobstructed light, both natural and artificial.

Power-Door Mechanism.

Electrical mechanism of an interesting kind has been developed in the evolution of the system of electrical power doors now installed upon most of the new cruisers and battleships of the United States Navy. The accompanying illustration shows the power box of the latest model of these "long-arm" power doors, with the protective cover removed in order that the motor, controller and operating gear may be clearly seen.

The motor itself is of special construction, designed to stand the abrupt starting and stopping of the power doors in time of emergency. This motor is directly connected to a worm engaging a worm wheel, which in turn transmits the load through its shaft and a pinion to a pin rack upon the bulkhead door plate. In performing its work the worm exerts a thrust in the direction of its axis and this thrust is borne by a specially constructed bearing supported by a heavy helical spring. This spring has upon it an initial load equal to the greatest thrust which it is desired that the motor should deliver. As soon as the thrust actually exerted by the worm exceeds the initial compression upon the spring, it gives way slightly, allowing the worm shaft to move axially. This motion of the worm shaft is multiplied and used to cut off the current, and the same motion in the reverse direction, when the load is removed, will complete the circuit which it has previously broken.



POWER BOX OF ELECTRICALLY-OPERATED BULKHEAD DOOR.

In this way the automatic cut-out protects the motor by opening the circuit as soon as the load upon the motor becomes too great for it to safely handle, and when the load decreases to a safe amount the circuit is automatically closed by the same device. The usual means of protecting motors by fuses on incoming circuits would not be suitable for a power door for the reason that if the door plate should strike an insuperable obstruction in closing, and the fuse should be blown, the door would be absolutely inoperative until some one could replace the fuse.

This cut-out gives to the door an almost human intelligence in its action when operated from the emergency station. In the official tests of this door it was closed into a mass of coal, sometimes striking lumps so large that it could not entirely cut through. The circuit to the motor was opened, but nevertheless the door was not inoperative, for when water was allowed to rush into the bunker back of the coal it at once loosened the masses of coal beneath the door plate, relieving the mechanical resistance, and the motor immediately started again to close the door as if its work has not been interrupted.

An important feature of the power mechanism is the "liberty action," which gives men in the vicinity of the doors a means of interrupting their closure from the central station above deck. By operating a handle placed on each side of the bulkhead, the door may be opened while the emergency is "on." After the handle is released the door again closes without further manipulation. In other words, the "liberty action" provides a means of escape or passage from one compartment to another, and makes it impossible at the same time for any door to be left open in the excitement of a disaster.

All the bulkhead doors equipped with this power mechanism are connected with the central emergency station on the bridge of the vessel. A turn of a hand wheel throws the station into action, and by a step-by-step switching mechanism the doors are automatically started at three-second intervals, thus avoiding a sudden and large demand on the ship's dynamos.

Meter Sealing.

The H. C. K. Company, 45 Broadway, New York City, manufactures a new lead seal press, and lead seals with wires, for electric and gas meters, service boxes, fare registers, freight and baggage cars, etc. One important feature of the press (Fig. 1) is that it fastens the lead seal to the wire in such a way that it is absolutely impossible to open the seal without cutting the wire. The zigzag shaped dies in the press form the lead seal, as shown in the accompanying illustrations, Fig. 2. The initials of the owner of the press can be sunk in the lower die. When several presses are required by one company, they are usually numbered consecutively, and the number or figure is sunk in the upper die of the press. The initials and numbers will appear raised on each lead seal which has been closed by this press.

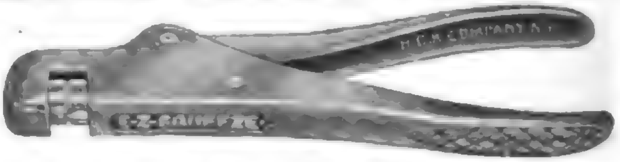


FIG. 1.—LEAD SEAL PRESS.

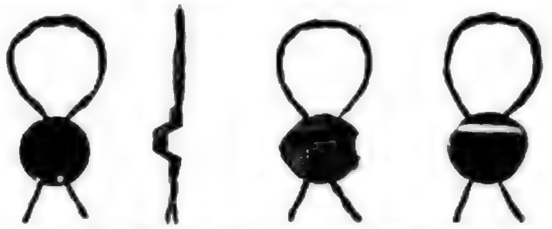


FIG. 2.—SEAL IN DIFFERENT STAGES OF FORMATION.

Central stations and railway companies have found it advantageous to number each press, which is for use by one employee only, who is held responsible for his press and for all seals bearing his identification number. The utility of this system of meter, fare register and car sealing is appreciated by superintendents and managers who may otherwise have difficulty in locating the employee last applying the seal. The press is constructed of malleable iron, and the dies are made of tempered steel. A number of central stations, railway companies and exporters are now using the presses, seals and wires with satisfactory results. The subject of meter sealing was discussed at some length in May, 1905, in these pages by Mr. J. H. Hallberg, now a member of the H. C. K. Company.

Electric Repair Automobile.

The Toledo Railways & Light Company has recently purchased an electric line automobile for its illuminating department, and has placed a contract for five others, two for the lighting department and three for the street railway department. They were built by the Pope-Waverly Company, of Indianapolis, and have a speed of 15 miles an hour and a capacity of 1½ tons with a battery radius of action of 40 miles with one charge. The outfit now in service is proving very satisfactory, being used on connecting up and line work. It covers about twice as much ground as a horse-drawn vehicle of the same size, and from present indications it costs considerably less to operate and maintain. An illustration of the vehicle is given below.

Pignolet Switchboard Instruments.

REPAIR AUTOMOBILE.

SWITCHBOARD INSTRUMENT.

The accompanying illustration represents a new type of switchboard voltmeters and ammeters manufactured by Louis M. Pignolet, 78 Cortlandt Street, New York, small electrical measuring instruments. These instruments are 5 in. in diameter and 1.5 in. deep and are thus very compact and specially adapted to installations where space is limited. They are furnished in various readings up to 150 volts and 50 amp. Two bolts provided on the back of each meter convey the current and also serve to fasten the instrument to the switchboard so that but two holes are required in the board.

The instruments are of the permanent magnet type, thus securing the high accuracy and even scale divisions of this class. The magnets are of imported special steel carefully treated to insure permanency. The principle of operation is as follows: An iron armature is pivoted between the poles of each magnet and is provided with an aluminum pointer which is kept at zero on the scale when no current is flowing through the instrument, by the attraction of the magnet upon the armature. The current to be measured passes through a coil of wire located between the poles of the magnet and produces a magnetic field at right angles to that of the magnet. This field causes the armature to turn and produces a greater or less deflection of the pointer according to the strength of the current passing through the coils.

Dinkey Ventilated Controller.

The dinkey controller illustrated herewith (Fig. 1) was designed for the control of motors under severe and exacting conditions, such as are met with in steel mill service. Besides being of substantial mechanical construction, it is simple in operation, one lever being used for both the forward and reverse motion, thus dispensing with the use of a separate reversing switch. The operating resistance being mounted within the frame makes each unit compact and self-contained. The form of the resistance is such that a large amount of heat is dissipated, thus fitting the controller to withstand severe overloads. The contact face is of heavy slate and the contact segments are of pure copper screwed to brass lugs, all wiring connections being made on the brass lugs. By this construction any of the segments can be removed and replaced without disturbing the wire connections. The contact arm carries powerful blow-out magnets which, traveling with the contact fingers, are always in position for effectively disrupting any arc which may be formed. The drop-forged copper contact fingers are provided with renewable tips which may readily be replaced with a minimum waste of material.

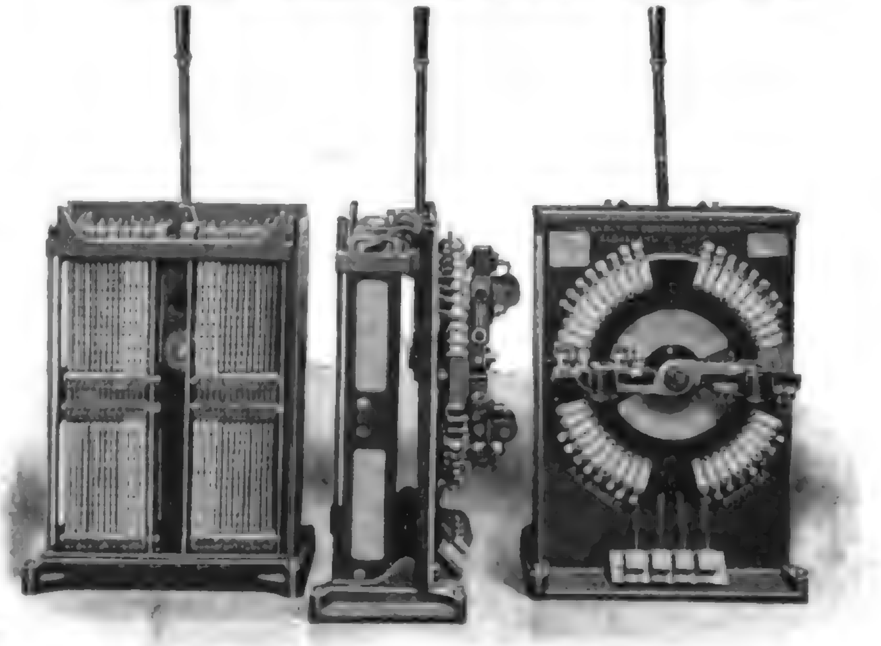


FIG. 1.—DINKEY CONTROLLER.

For coil resistance, one end of the controller casing is made in the form of a door, removing which gives access to all of the connections in the bank of resistance and renders it possible to remove or replace any of the units without removing the controller from its place and without disturbing other parts or connections.

The type of resistance shown in Fig. 2 consists of a heavy 1½-in. asbestos tube, stiffened by a central brass rod, which also serves to bring the rear terminal forward, thus facilitating the making of connections. This form of resistance is especially adapted for 500-volt controllers.

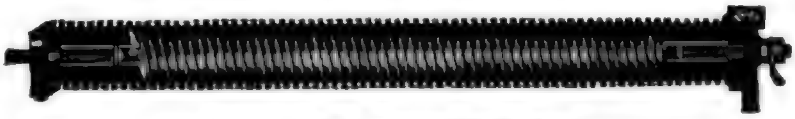


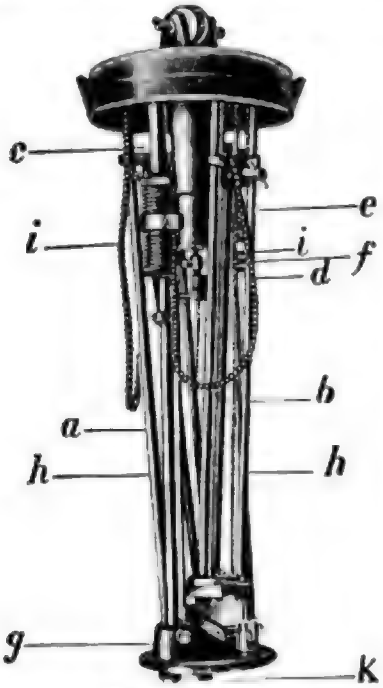
FIG. 2.—RESISTANCE UNIT.

This controller is made by the Electric Controller & Supply Company, Cleveland, Ohio.

Beck Flaming Arc Lamp.

The Beck Flaming Lamp Company, New York, was recently incorporated to manufacture Beck flaming arc lamps under the patents of Heinrich Beck, of Meininger, Germany, the American rights for which the company purchased. The accompanying illustration shows the mechanism of the Beck lamp, with the case removed. The carbon, *a*, is rigid, and the carbon, *b*, swings. The current passing through the magnet, *c*, swings the carbon, *b*, to the right, and at the same time, the arc is formed. The length of the arc can be regulated by the check nut, *d*. The magnet, *c*, in direct-current lamps is entirely encased in iron, so that damage is impossible. Under the magnet is a dash-pot, *e*, which prevents the too rapid pulling apart of the carbons. The dash-pot is easily removed by screwing it to the left, and consists of a tube with a graphite plunger. While burning, an asbestos ring, *f*, excludes fumes or ashes. In alternating-current lamps the iron housing of the magnet is dispensed with, but the magnet is thoroughly protected. In both the direct and alternating-current lamps the magnet is wound with heavy wire, and is in series with the carbons, no finely wound magnets subject to burning out being necessary in this lamp.

The reflector is made of enameled iron and is supported by two iron rods, *h, h*. On these rods are the two blow-out magnets, *i, i*, which are wound with bare wire and have a movable contact. Through these movable contacts it is possible so to adjust the blow-out magnets that the flame will be projected downward to give the greatest illumination. The alternating-current lamp has no blow-out magnets, but is otherwise practically the same as the direct-current lamp. The carbon feed is the main feature of the Beck lamp, but notwithstanding its great simplicity, it was only perfected after years of experimenting. One of the carbons—in direct-current lamps, the positive one—has a rib running its entire length, and rests on an insulated metallic support, *K*. The rib, through the action of the current, burns to a fine point, which point gradually disintegrates, allowing the carbon slowly to sink downward. Through a compensating chain, both carbons feed down at the same rate of speed, and so gradually that the lamp burns quietly and without flickering. Should a jar or a defect in the carbons break the point suddenly, it takes only a few moments for a new point to form. The arc is formed on the side opposite the rib and does not get near its point, so that it is impossible for the support to be melted or damaged. The rib is comparatively cool, and the heat of the carbon is not communicated to any extent to the support, as the carbon only rests on a point thereof. The other carbon is round and feeds simultaneously with the ribbed carbon, as above described.



BECK FLAMING ARC LAMP.

The lamps are made to burn singly on 55 to 65 volts, and two in series on 110 to 120, and four in series at 220 to 240 volts, on either direct or alternating current. The carbons burn from 8 to 15 hours, depending on their length, and consume only 0.163 watt per hemispherical candle-power.

Diesel Engines in Texas.

The Diesel engine seems to be making good progress in central stations and isolated plants in Texas as evidenced by information given out at the recent Galveston convention. Their popularity in Texas is, of course, partially due to the cheap crude oil which is a common fuel there. The central station at Sherman, Texas, has been operated entirely by these engines for some time with a very great saving in fuel bills over steam engines. At Beaumont and at Brownwood the central stations are being supplied with these engines, while orders have been received from those at Amarillo and at Denison. These engines consume .065 to .07 gal. of crude oil per brake hp-hour. Oil prices in Texas run from 1 to 1.5 cents per gal.

Time-Controlled Phonograph.

The accompanying illustration shows a time-controlling mechanism for use with phonographs which has recently been patented by Dr. J. E. Hett, of Berlin, Ont. The mechanism is very simple, consisting of a spring which trips a lever attached at one end to an ordinary alarm clock at the other end to a cord which passes over a pulley and is connected to the starting lever of a phonograph. The case contains three ordinary dry-cell batteries, when the alarm is sent from the phonograph will deliver its message, and at the same time the miniature 4½-volt lamp is turned on. The light, however, may be turned off and on at will and three ordinary dry cells will give a good light for a considerable time before they are exhausted.

TIME-CONTROLLED PHONOGRAPH.

It is generally supposed that the first thoughts which are impressed upon the brain in the morning cling to a person more or less throughout the whole day. The Doctor experimented on himself with the phonograph to test this point, and found the results so gratifying that it led him to devise the arrangement described.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Ample rains throughout the farming regions provided the most important commercial factor of the past week. Retail trade responded to the stimulus of warm weather, and there is an unusually liberal volume of wholesale business for this time of the year. Mercantile collections are still somewhat irregular, but at most cities payments are improving, and the financial situation is more encouraging now that the San Francisco banks have resumed business without any disturbance. Manufacturing plants are well occupied, and building operations are heavy, but there are indications of a lower level for commodity quotations for the month of May. Customary summer quiet is noted in some departments, although there is less than the usual interruption, and preparations are already in progress for a very active fall season. Labor conditions have improved. Railway earnings thus far reported for May exceed last year's by 11 per cent, and foreign commerce at the port of New York for the last week showed gains of $1,934,259 in exports and $1,134,601 in imports over the movement of 1905. Activity in outdoor work, such as building, with consequent heavy demand for lumber, hardware and other materials, is still a feature, though some large centers report less prospective work in view and some abatement in real estate speculation. An active steel-rail trade, good business in structural materials, an inactive foundry pig-iron market, with prices probably easier. and further cleaning up of the available supplies of steel-making irons, the paucity of which is still marked, are the principal features of iron and steel. Upward of 1,000,000 tons of steel rails have been ordered for delivery in 1907, and the tonnage carried over from this year will reach 300,000 tons. Copper is in good demand at home and abroad. All producers are heavily engaged for deliveries of Lake, electrolytic and casting copper in June, July and August. Prices are firm at 18⅞ to 19c. for Lake to be shipped in August. Electrolytic is mostly sold up for August at 18⅝ to 18¾c. There is no visible supply at any electrolytic works. Casting copper is in larger demand for the best brands than makers can care for under promise of prompt deliveries. Prices are 18⅝ to 18¾c. *Bradstreet's* reports 170 business failures during the week ending May 24, as compared with 161 in the week previous and 179 in the corresponding week last year.

APRIL FOREIGN TRADE.—The reports of the United States Bureau of Statistics show that the foreign commerce of the United States in April, 1906, was larger than that of the corresponding month of any earlier year, consisting of $107,000,000 imports and $144,000,000 exports; total, $251,000,000, or more than a quarter of a billion dollars in a single month. In only one previous April has the total of imports and exports reached as much as $200,000,000. For the ten months ending with April the record is equally striking, being: Imports, $1,021,000; exports, $1,488,000, or a total of $2,509,000. No similar period of any earlier year ever touched the one billion dollar line in imports or reached the $1,300,000 line in exports. The total commerce of the United States for the ten months ending with April is thus over $2,500,000,000, and should the monthly average for May and June be as great as that for the ten months for which the record is made the total of the fiscal year 1906 will exceed $3,000,000,000. The increase in imports occurs in manufacturers' materials and finished manufactures, and the increase in exports occurs in agricultural products and manufactures. The increase in imports for the ten months ending with April amounts to about $86,000,000, and is about equally divided between manufacturers' materials and manufactures, the total figures for the nine months of which the Department of Commerce and Labor through its Bureau of Statistics has completed the analysis, indicating a gain of about $44,000,000 in manufacturers' materials, and $51,000,000 in the two classes, manufactures and luxuries, while there is a decrease of about $20,000,000 in foodstuffs. In exports there is for the ten months an increase of $215,000,000, and the nine months' figures, now completed, show a gain of about $136,000,000 in agricultural products and about $50,000,000 in manufactures.

ELECTRICAL DEVELOPMENT IN JAPAN.—According to a representative of a large wire manufacturing company, Japan has under consideration several new plans for development of electrical power. One of the largest concerns projected is the $10,000,000 Ujikawa Power Company, which will construct a plant with a capacity of 40,000 hp and furnish electric power to the city of Kioto and its environs. The Hanshim Electric Railway Company is planning to use water power in generating the electricity required by its lines between the cities of Osaka and Kobe. A new company will similarly supply electricity to Nagoya, the Miye Cotton Spinning Company, Nagoya Electric Light Company, Nagoya Electric Tramway Company and the Atsuta Arsenal.

APPARATUS FOR MEXICO.—Emile Pinson, chief engineer of the Companies Electrica e Irrigadore of Pachuca, Mexico, and I. Sternfeld, general manager of Braniff & Company, the Mexican representatives of the Westinghouse Electric Company, have been in Pittsburg for several days in connection with a very large and important order for electrical machinery, being constructed at the East Pittsburg works. The company which Mr. Pinson represents operates one of the largest water power transmission plants in Mexico, having a capacity of 40,000 hp for the operation of several mines in the vicinity of Mexico.

MACHINERY FOR LOS ANGELES.—The Pacific Light & Power Company, of Los Angeles, Cal., has contracted with Charles C. Moore & Company, of San Francisco, for a complete power plant to be installed at Redondo, a suburb of Los Angeles, for supplying power to the street railway system. The nominal capacity of the new generating station is 15,000 kw, consisting of three 5,000 kilowatt units. Each unit will consist of a 5,000 kw fly-wheel type General Electric, 50 cycle, 18,000 volt alternator direct-connected to a combined double horizontal and vertical compound condensing engine.

PLANT FOR CANADA.—The Canadian Westinghouse Co. is installing a large water power plant near Montreal, Canada. The initial order calls for three 5,000-hp alternating-current generators, and twelve 3,000-hp transformers. The plant is erected by the Provincial Light, Heat & Power Company, and the power will be furnished to the Montreal Light, Heat & Power Company for use in the city of Montreal, a distance of forty miles.

GOLD MILL PLANT.—A large cyanide gold mill is reported sold by Fairbanks, Morse & Company, Chicago. The entire plant will be operated by Fairbanks-Morse direct-current dynamos and motors, driven by water power—a 240 foot head of water being available at this point. The mill will be near Boulder, Colo., and will contain many features of novelty and interest. It will be a very modern and complete plant in every way.

CROCKER-WHEELER GENERATORS.—The Crocker-Wheeler Company, of Ampere, N. J., has recently placed on the market a size 83D engine type generator with an output of 75 kw, 275 r.p.m., 125 or 250 volt, and has in the past few days received from four power users orders for six of these new generators. Negotiations are now under way for a number of these machines for plants in different parts of the country.

NEW YORK CENTRAL SIGNALING.—The Westinghouse Electric & Manufacturing Company has an order for a large amount of electrical apparatus to be used by the New York Central & Hudson River Railroad Co. in connection with the operation of its signal system. The contract calls for four motor-generator sets, three alternating-current generators, and a large number of transformers.

APPARATUS WANTED.—The corporation of Barrie, Ont., Canada, is about to purchase water tube boilers, cross-compound engine, a 300-kw alternating-current, two-phase, 2,200-volt, revolving field generator, switchboard, street lighting apparatus, etc. Specifications will be ready this week and contracts closed in about twenty days. Mr. K. L. Aitken, 164 Bay Street, Toronto, is the consulting engineer.

OIL ENGINE ORDER.—The Massachusetts Talc Company, Boston, Mass., has decided to install two 125-hp "Hornsby-Akroyd" oil engines to drive general machinery by belt. The De La Vergne Machine Company, of New York City, has the contract.

TROLLEYS FOR TEXAS.—It is stated that great activity is being displayed in the development of interurban trolleys in Texas. Several interurban electric lines are to be built out of Dallas to neighboring towns. McKinney, Sherman and other prosperous towns are to be connected by electric lines. It is stated that the Northern Texas Traction Company, which owns and operates the electric line between Fort Worth and Dallas, has in view a number of important extensions to embrace several suburban towns in its system. The building of an electric line between Fort Worth and Mineral Wells is being promoted. Projects are also on foot to give Maxahachie, Greenville, Cleburne and other towns electric railway connection with Dallas. The construction of an interurban electric railway between Temple and Marlin is proposed by a syndicate of Pennsylvania men who are interested in similar enterprises. It is estimated that the cost of building the road, including its equipment, will be $1,000,000. The promoters are asking that a bonus of $300,000 in money and stock be subscribed by the people of the two terminal towns and by land owners along the right of way. R. A. Reese, of San Antonio, is acting as the representative of a syndicate of Eastern men who contemplate building an interurban electric railway between Austin and San Antonio, a distance of 80 miles. A New York firm has been investigating the situation with the view of financing the building of an interurban electric line between Austin and Lockhart, a distance of about 30 miles. The building of an electric railway to run from Georgetown to Briggs, by way of Florence, a distance of 22 miles, is under consideration. The right of way for the proposed road is being secured. The building of an electric railway between Houston and Galveston, a distance of 51 miles, now seems to be assured. It is stated that the road will cross Galveston Bay upon the new causeway that is to be constructed. The surveys for the proposed road have been made and the right of way and franchises secured. It is announced that the right of way and liberal bonuses for an electric railway that is to be built between Taylor and Giddings, a distance of about 30 miles, have been secured.

THE OUTLOOK FOR COPPER.—It is thought by the leading electrical manufacturers that the tremendous demands for copper in 1907 will doubtless cause an advance of prices for Lake and electrolytic that will make present quotations seem low. American manufacturers of electrical supplies find by studies of plans decided upon in North America and Europe for hydro-electric power and railroad and telephone installations in 1907 that the volume will be largely in excess of the contracts awarded in the last eighteen months. In hydro-electric power transmission undertakings alone that have been determined upon for construction in Europe and America during 1907, according to the *New York Sun*, statistical engineers estimate that 175,000,000 pounds of copper line material will be required. Switzerland is planning the nationalization of her sources of water power in order to electrify her railways. Italy in pushing Genoa to be the first port of the Mediterranean is going to add largely to her electrified roads. Germany, France, Austria, Belgium, Holland and Great Britain are about to begin electrical engineering works of great magnitude. The London County Council has decided upon building fourteen great electric power installations, and the amount of work coming on in North America is astonishing electrical engineers. Telephone engineers at home and in Europe are all certain that 1907 will break all records for the consumption of copper wire. Neither in copper refining nor in copper working industries allied to the engineering trades has production provided for the strain that will come next year.

CROCKER-WHEELER ORDERS.—The Sandusky Portland Cement Company has placed orders with the Crocker-Wheeler Company, of Ampere, N. J., for two engine-type, 750-kw, 400-volt, alternating-current generators, and two engine-type, 125-kw, 125-volt, direct-current generators to furnish light and power for driving its cement machinery at its new plant at Dixon, Ill. The city of Natchitoches, Natchitoches Parish, La., has placed an order for an engine-type, 105-kw, alternating-current, 2,300-volt generator to be installed in its municipal lighting plant. The Crocker-Wheeler Company has received an order from the Seton Leather Company, of Newark, N. J., for one 90-hp, 115-volt, direct-current motor to operate the company's leather machinery. The Independent Brick Company, of Trenton, N. J., has placed orders for motors and generators of the following capacities: One 80-kw, 250-volt, direct-current generator and four direct-current motors ranging from 3 to 25 hp, all of 230 volt, the entire equipment to be installed at the company's brick yard at Trenton, N. J.

THE WESTINGHOUSE MACHINE COMPANY, of East Pittsburg, Pa., has recently received an order from the Portsmouth, O., Street Railway & Lighting Company for a 500-kw turbine. The turbine is to be of the multiple-expansion, parallel-flow type, and direct connected to a 500-kw, 60-cycle, two-phase, 220-volt Westinghouse generator. Two 400-kw Westinghouse-Parsons turbines are already operating at this plant, serving the city with light and power. The plant was built entirely for turbine machinery. Superheated steam and high vacuum are used, condensing water being obtainable from an artificial lake which has been constructed upon the property. A rotary converter in the plant serves the nearby traction lines with 500-volt direct current, but the main power is transmitted over high-tension lines into the city and outlying districts. Steam turbines of the same make as installed at Portsmouth have been adopted by the Durham Traction Company, Durham, N. C., and the Columbia Electric Street Railway Company, Columbia, S. C., for traction service.

THE SWEDISH STATES RAILWAYS.—The Swedish States Railways are on the eve of executing very extensive tests on their lines in order to decide the important question of electrical traction for their systems, and on what principles the Swedish railways should be electrified. Besides other manufacturing companies, the Maschinenfabrik Oerlikon has been approached by the Swedish authorities on this subject, and the board of directors of the Swedish Railways has shown great interest in the experiments carried out by the Maschinenfabrik Oerlikon. They propose to start trials immediately with the Oerlikon system, and for this purpose a stretch of 3 km. between the central railway station of Stockholm and Tomtaboda has been fixed upon for these experiments, and is being equipped with an overhead contact line. At the same time, one of the electric motor cars and one of the locomotives are being equipped with Oerlikon current collectors.

THE CANADIAN WESTINGHOUSE COMPANY, LTD., is doing a large business in steam turbo-generator equipments. The Northern Electric & Manufacturing Company, of Montreal, duplicated an order recently for a 300-kw Westinghouse-Parsons turbo-generator unit, to be installed in its power house alongside one of the same capacity now in service. The generator is 220-volt, three-phase, 7,200 alternations, operating at 3,600 r.p.m., and will be of the latest enclosed type, while the turbine will operate at 150 pounds steam pressure with 100 degrees superheat. Its present turbine is operating part of the year condensing and through the winter non-condensing, the exhaust steam being used during the winter for heating purposes. It was the satisfactory operation of this unit which led the company to order the one about to be installed.

LONG TROLLEY IN TENNESSEE.—The Lakeview Traction Company, capitalized at $100,000, Thomas Taggart, of Indiana, president, proposes to build an electric railway from Memphis, Tenn., to Clarksdale, Miss., about 75 miles south, in the heart of the Mississippi delta. The survey as proposed will parallel the Yazoo & Mississippi Valley Railroad. The engineering department expects to effect a traffic arrangement with the Memphis Street Railway Company for entrance to the heart of the city. It is proposed to carry both freight and passengers. The vice-president of the company is Henry Craft, who is resident agent. C. P. Farnsworth, W. A. Percy, R. F. Tate, M. Rosch and Walter Goodman are stockholders. The capitalization is not indicative of the amount to be expended.

ORDERS FOR BARRIETT MOTORS.—The Barriett Electric Manufacturing Company, of Cincinnati, O., has recently equipped the plant of the Empress Glass Company, Grafton, W. Va., with individual motor drives. It has also shipped a large consignment of electric motors to its agent at No. 6 Mission Street, San Francisco, Cal., to fill orders.

NEW CARBON FACTORY.—The Crouse-Tremaine Carbon Company, Fostoria, Ohio, is erecting a new plant, consisting of an office building and six manufacturing buildings, of fireproof construction, with over 500,000 square feet of floor space, including a large furnace building and a central power station.

NEW RAILWAY SWITCH FACTORY.—The Union Switch & Signal Company, Swissvale, Pittsburg, has completed a new building with a floor space of 16,000 square feet. It will be used as an assembling shop for signalling apparatus.

NEW YORK TELEPHONE RATES.—Mr. U. N. Bethell, vice-president of the New York Telephone Company, announces an important reduction in rates beginning July 1, for this whole territory. After that date the charge to message rate subscribers in Manhattan and The Bronx will be $48 for 600 local messages, instead of $60 as at present, and the pay station charge will be 5 cents instead of 10 cents. The pay station charge in Brooklyn will also be 5 cents, and there is a reduction all along the line to the more remote points in the entire urban territory served by the New York Telephone Company and the New York & New Jersey Company, which are operated under one management. The rate from Manhattan to Brooklyn and all other nearby points will be 10 cents, and to Staten Island 15 cents, instead of 20 and 25 cents. In addition to this, discounts of from 20 to 40 per cent will be allowed to large users of the interborough service, making the actual cost of the messages from 6 to 12 cents. A reduction in the rentals of the extension telephones will also be made to private branch subscribers. After July 1 they will be $6 a year each flat, instead of $12, $9 and $6 as at present. The rates of auxiliary lines, extension stations, etc., will be modified and reduced and exchange rates will be cut down in Brooklyn, Queens, Richmond, Jersey City, Hoboken, Bayonne and Newark. Moreover, the range of local messages will be greatly increased. The New York Telephone Company decided to make these reductions last November, but it was impossible to put them into effect until the plant had been enlarged sufficiently to meet the increased business that is bound to follow. The work on the enlargement began as soon as the plans had been prepared, and in the past six months the company has spent $4,500,000 on construction, as against $1,500,000 in the corresponding six months of the previous year. One of the most important phases of the new schedule, as far as subscribers and patrons are concerned, is the extension of the range of local messages which are to be sent under the 5-cent rates. In this respect there will be a radical change in the present system. Manhattan and The Bronx have been divided into three overlapping zones. The first zone extends from the Battery to 110th street, the second from 110th street to Melrose and Tremont, and the third to the city line.

PLANT FOR ROCHESTER, N. Y.—Contracts have been made for the power house to be erected at the Middle Falls by the Rochester Railway & Light Company. The structure will stand on the west side of the river, close to the Middle Falls. The outside walls will be about 50 ft. in height on the river side and about 20 ft. on the land side. The building will cover an area about 60 by 80 ft. It is expected that the building will be completed and the equipment installed ready to operate by September 1. The plans for the new station were laid out by General Manager W. M. Eaton. The consulting hydraulic engineer was S. Howard Rippey, of the office of Coleman Sellers, of Philadelphia. The construction and installation work will be under the immediate direction of J. T. Hutchings, superintendent of the electrical department of the Rochester Railway & Light Company. The station will be of fire-proof construction throughout, principally of concrete, although considerable quantities of brick and steel will be used. The construction work, including the rock excavation preparatory to the erection of the foundations and walls, will be done by the John W. Allison Company, of Philadelphia. The power to run the generators will be generated by two turbine water wheels of 900 hp each, giving an aggregate of 1,800 hp. The contract for the turbines and their installation has been given to the S. Morgan Smith Company, of York, Pa. The governors for the water wheels will come from the Sturgess Engineering Department of the Ludlow Valve Manufacturing Company, of Troy. The turbines will run two 500-kw generators of the same type as those in the Lower Falls station of the company. The generators, together with all of the other electrical equipment for the occasion, including the motor-generator sets, the switchboards and electrical connections, will be supplied by the General Electric Company.

STANDARD OIL TELEGRAPHS.—A special dispatch from Cleveland, Ohio, of May 26, says: "That the Standard Oil Company maintains telegraph lines covering nearly 200,000 miles, by which messages can be constantly exchanged between the head office of the trust, at 26 Broadway, New York, and the various branches of the Standard all over the country, was admitted before the Interstate Commerce Commission to-day. A few witnesses were examined along this line, but as they were Standard employes not much information was elicited. Attorneys for the Standard, however, agreed to produce maps showing where the lines run. They say so large an institution must have its own telegraph system. It is said by the attorneys who are conducting the investigation that the Standard has an arrangement with the Western Union Telegraph Company by which these lines are maintained. It is the workings of the alleged arrangement that the commission wants to investigate. Attorney Monnett to-day explained that through the telegraph department of the Buckeye Pipe Line Company in the Lima oil fields private messages of independent producers and refiners were copied and forwarded to the Standard Oil offices at 26 Broadway." The evidence to support this alleged state of facts seemed difficult, however, to elicit.

OUTLOOK ON COPPER.—In discussing the copper market, the *Wall Street Journal* says: "Copper producers are of the opinion that consumption has overtaken and passed production. While inquiries for the metal are not numerous, this is because consumers have covered their wants pretty far ahead. It is figured that concerns that have high-grade copper for delivery in June can easily obtain from 18⅞ and 19 cents a pound for it. One copper mine owner figures that the General Electric Company is consuming at the rate of 1,000,000 pounds of copper a week, and the Western Electric between 1,500,000 and 1,750,000 pounds a week. Mr. John R. Stanton said: 'The copper situation is as strong as it could be. Sales are reported as far ahead as January 1 of next year but few producers care to quote for delivery so far ahead. There is very little copper for sale and producers are paying more attention to making their deliveries on specified time than to securing new business. There will be no pronounced increase in copper production this year, perhaps 6 or 7 per cent. Consumption is increasing rapidly, and I don't see anything to interrupt this present period of prosperity.'"

STERLING TELEPHONE SWITCHBOARDS.—Now that the patent situation has been cleared up, the Sterling Electric Company, of Lafayette, Ind., reports that orders have been pouring in to such an extent that it has become necessary to put on a night shift in the switchboard room in order to keep up with the company's numerous contracts. In addition to the 5,000-line board at Galesburg and the 1,400-line extension to the Toledo board now nearing completion, there are also installations progressing at Uhrichsville, Ohio; Marion, Ohio; Lima, Ohio; Bloomington, Ind.; Belvidere, Ill.; Cedar Rapids, Iowa; Joplin, Mo.; Wichita, Kan.; Hattiesburg, Miss.; Whittier, Cal., and Callao, Peru. Magneto call boards have been shipped to Benton, Ky.; Plymouth, Ind.; Millerton, N. Y., and Germantown, N. Y., within the last month, the last two being equipped with the new self-restoring drop recently brought out by the Sterling company, in regard to which very favorable reports are received.

DEVELOPMENT AT CHATTANOOGA.—The Chattanooga, Tenn., Electric Company will spend between $75,000 and $100,000 adding machinery to its power plant to produce about 2,200 hp more than the plant is capable of supplying at present. Manager Bryon T. Burt states that these additions are necessitated by the rapid increase in the use of electricity in Chattanooga as well as the extra amount of power now required by the Chattanooga Railways Company for the operation of its system. At present the plant has a capacity of about 3,000 hp, so that the addition to be made will almost double the plant. No addition will be made to the buildings themselves. One 750-hp unit has been ordered for delivery within the next three months and the other machinery will be secured within a short time. It is stated that the amount of electricity used for commercial and domestic purposes at present is almost double the consumption of three years ago, and that the increase is expected to continue at its present rate with the rapid growth of the city.

WIRELESS IN PHILIPPINES.—Plans have been completed by the Navy Department for the installation of six new wireless telegraph stations in the Philippines. The station to be located farthest north will be at Cape Bojeador, on the extreme northern end of the Island of Luzon. Other stations in Luzon will be at San Fernando and near Sorsogon, in the province of Sorsogon. Another station will be on Romblon Island, a fifth on the highest point on Cujo Island, and the station farthest south will be on Sulu Island, probably near the city of Sulu.

THE MOORE ELECTRIC COMPANY, of Newark, N. J., installed in Pittsburg last week two or three hundred feet of Moore tube light. It has also recently made several installations in Atlantic City, one of them being on Young's Pier. It is expected that this tube will form one of the most prominent features in connection with the National Electric Light Association meeting at Atlantic City. Thousands of feet of Moore tubing are now in commercial use.

ELECTRIC TRACTION IN CHILE.—United States Vice-Consul R. S. Atkins, writing from Valparaiso, says that the President of Chile has signed a decree accepting the bid of the "Public Works Syndicate" for the construction of the railroad from Arica to La Paz, the building of which by Chile was stipulated in the treaty of peace and friendship between Chile and Bolivia of October 20, 1904, and the railroad convention of July 22, 1905. The total cost of the new railroad will be $10,500,000, the official description being as follows: A steam railroad, of a gauge of 1 meter, to connect the port of Arica with the height of La Paz, having branches to the sulphur beds of Tacora, to the port on the Desaguadero River, and to the mines of Corocoro, said railroad to run by way of Lluta. The syndicate has appointed Josiah Harding, who is well known on this coast in connection with several important engineering enterprises executed under his supervision, to be engineer in chief of the railroad, and his appointment has been approved by the Government. Preliminary work will be commenced after the inauguration of the construction works, which will probably take place about the middle of April, under the auspices of the President and a numerous party of Chilean and Bolivian functionaries. The entire length of the line is 265 miles, of which the first 115 reach the first and highest summit, 19,850 feet above sea level. The last 18 miles of this section will be a rack railroad, the maximum grade being 6 per cent and the average grade 4½. It is proposed to use electric traction on the first 100 miles, the power to be obtained from the Lluta Falls. Arrangements will be made to develop 30,000 horse power, this being ample for traction, workshops, lighting, and all other purposes.

OPPORTUNITIES FOR ORDERS.—The bulletin of the Bureau of Manufacturers of the Department of Commerce and Labor notes the following opportunities: The town of Zalamea la Real, Spain, desires bids for electric lighting of place for twenty years from July 1, 1906. The upset price is about $835 gold per 125 lights. Address El Alcalde, Zalamea la Real. The Wellington, New Zealand, City Council proposes to borrow $1,320,000 for municipal works, including $500,000 for starting new electrical lighting works. The Societe de l'Esperance-Longdoz (Belgium) propose to erect a central station with steam turbines and dynamos to produce current for its forges.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was dull and listless early in the week, but developed activity and strength later on under the lead of the anthracite coal stocks. Attempts were made to utilize the reports of a new Pennsylvania bond issue having been placed in Paris and unfounded allegations that the United States Steel Corporation contemplated issuing $50,000,000 of bonds with which to finance its Indiana plant. The fact that the San Francisco banks were reopened for business without any difficulty, and that this step was followed by the return of $1,400,000 in cash from that city to New York, had an excellent effect upon the market. The new Interborough-Metropolitan stocks were listed last week at the Stock Exchange and were objects of a good deal of speculative attention. Tractions were generally weak, Brooklyn Rapid Transit closing at 81¾, a decline of 1½ points, and Metropolitan Street Railway at 111, a net loss of 5 points. Interborough-Metropolitan common closed at 51¼ and preferred at 85½, the former being a decline of ⅜ point and the latter a gain of ¾ point. Both issues of Allis-Chalmers are higher, common closing at 21¾ and preferred at 57½, these being net gains of 1 and 1¾ respectively. General Electric was quiet, closing at 167½, which is a net decline of 1¼. American Locomotive common closed at 69½ and preferred at 114½. American Telephone & Telegraph made a net gain of 1½ points on the week's trading, closing at 137, and Western Union gained ½ point, the last quotation being 92¾. The curb market had only two or three features. The principal one was a spurt in Mackay common stock on rumors that it is to be placed on a regular 4 per cent basis. Trading in it totalled nearly 20,000 shares. After rising about 3 points, it lost two-thirds of the gain. The preferred rose but little, and long stock appeared to be distributed on the advance. Chicago Subway lost most of the improvement of the previous week. Of the 25,000 shares dealt in, a good deal probably represented distribution of long holdings by insiders. Copper stocks were irregular, but mostly lower, at the end of the week. There was small demand for them. Following are the closing quotations of May 29:

NEW YORK

	May 22	May 28		May 22	May 28
Allis-Chalmers Co.	20¾	21¾	General Electric	167	167
Allis-Chalmers Co. pfd.	55¾	57½	Hudson River Tel.	...	...
American Dist. Tel.	*30	*30	Interborough Rap. Tran.	226	226
American Locomotive	68⅝	69	Mackay Cos.	74⅛	73¾
American Locomotive pfd.	114⅜	114	Mackay Cos pfd.	73⅛	73¾
American Tel. & Cable	90	90	Marconi Tel.	...	42
American Tel. & Tel.	137	135	Metropolitan St Ry.	110	110*
Brooklyn Rapid Transit	81⅞	80⅝	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	92⅛	92¾
Electric Boat pfd	66	66	Westinghouse com.	158	156
Electric Vehicle	11	11	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	May 22	May 28		May 22	May 28
American Tel. & Tel.	137⅛	137¼	Mass. Elec. Ry. pfd	68½	68⅝
Cumberland Telephone.	...	...	Mexican Telephone	...	4
Edison Elec. Illum.	246	246	New England Telephone	...	138
General Electric	168	...	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	19¾	20	Western Tel. & Tel. pfd.	90	90

PHILADELPHIA

	May 22	May 28		May 22	May 28
American Railways	52	52	Phila. Electric	7¾	7¾
Elec. Co. of America	11⅛	11¼	Phila. Rapid Trans.	25⅛	25⅜
Elec. Storage Battery	72	72	Phila. Traction	98¾	98¾
Elec. Storage Battery pfd.	...	...			

CHICAGO

	May 22	May 28		May 22	May 28
Chicago City Ry.	190	190	National Carbon	88	88
Chicago Edison	...	149½	National Carbon pfd.	120	120
Chicago Subway	58	57¼	Union Traction	...	...
Chicago Tel. Co.	122		Union Traction pfd.	...	...
Metropolitan Elev. com.	26	27			

* Asked

ELECTRICAL TRADE IN ENGLAND.—The reports at annual meeting of the Brush Electrical Engineering Company, Limited, show electrical trade in England to have improved. A gross profit on trading, etc., was reported of $369,645, as compared with $316,140. The chairman stated: "In their manufacture of steam and electrical machinery great progress had been made. The development of their Brush-Parsons turbine and their new type of reciprocating engine had occupied the close attention of their expert staff for some years. They looked for a large business in this department at home and abroad. Their output in electrical apparatus—such as dynamos, motors, transformers, etc.—continued to increase. They had been devoting attention to the supply of electrical machinery to the textile and colliery industries, the special requirements of which had been carefully investigated by experts appointed for the purpose."

RAILROAD SECURITIES.—*The Railroad Manual Appendix*, just issued by Poor's Railroad Manual Company, 68 William street, New York City, is of growing interest to those who watch the conversion of steam lines to electricity and the manner in which the new motive power builds up earnings and profits. This handy volume contains statistics from the income accounts of the steam and electric railroads of the United States, together with details of bond issues. Gross earnings of the companies by months for a period of years are also given, with annual dividend payments, date of annual meetings, when and where books are closed and location of transfer agencies, etc. The whole thing is thoroughly well done.

GROWTH AT MONTREAL.—The Montreal Light, Heat & Power Company has closed a most successful year. The gross earnings of the company show an improvement over the preceding year of $284,839, and net increase $155,763, or approximately 10 per cent. There was no material change in the fixed charges, and the bulk of the increase in net was available to swell the fund for the payment of dividends. The dividends, however, required the same disbursement as for the preceding year, or $680,000, and as a consequence the year's surplus increased $150,000, and stood at $598,486 for the period. The company has earned, leaving out of account for the present any appropriations which may be made for special purposes, approximately 7.5 per cent on its $17,000,000 of stock. The increase in net during the period was equal to almost 1 per cent on the stock. The company operated for 45 per cent of the gross earnings.

KANSAS CITY EARNINGS.—The income account of the Kansas City Railway & Light Company for the month of April and eleven months ended April 3, 1906, is as follows:

April gross	$435,007
Expenses	228,689
April net	$206,318
Charges and taxes	138,445
April surplus	$67,873
Eleven months' gross	4,693,381
Expenses	2,685,383
Eleven months' net	$2,007,998

AMERICAN TELEPHONE BONDS.—A large block of the $100,000,000 4 per cent convertible bonds of American Telephone & Telegraph are to be placed in Europe, and arrangements to this effect have been considered by J. P. Morgan.

HEAVY TELEPHONE INVESTMENT.—Attention is being attracted by the heavy investments in telephony that are being made by what is known as the Brailey syndicate, which has just acquired control of the independent properties in Cleveland. The Toledo-St. Louis group of capitalists now have in their control the following capitalization: Stocks—Louisville, Ky., $1,400,000; St. Louis, $4,000,000; Kansas City, $2,500,000; Detroit, $3,000,000; Toledo, $1,300,000; Indianapolis, $1,000,000; Cleveland, $2,500,000; Cleveland (long distance), $2,300,000; total, $18,000,000. Bonds—Louisville, Ky, $1,500,000; St. Louis, $4,000,000; Kansas City, $2,500,000; Detroit, $2,500,000; Toledo, $1,300,000; Indianapolis, $1,500,000; Cleveland, $2,700,000; Cleveland (long distance), $2,100,000; total, $18,100,000. Among the reports which have been suggested by the new deal is that an outright consolidation of the various local and long-distance telephone companies is to be effected. The whole development of the middle west, according to this report, is ultimately to come under the head of the United States Telephone Company, of New York. This is denied by Mr. Brailey, who says that no combination is anticipated at present, and, in fact, none is necessary to accomplish the desired ends, which are a saving of operating expenses and a close working arrangement between the local and long-distance companies. The thing that is desired and intended, he asserts, is a community of interest between the various telephone companies, and this has been assured by the consummation of the latest deal.

UNITED GAS IMPROVEMENT.—At the annual meeting of the United Gas Improvement Company, the report of President Dolan showed a profit for the fiscal year ending December 31, 1905, of $5,070,165.32, representing 13.8 per cent of the capital stock. Following the balloting for president and directors, and the re-election of the present officers, the shareholders voted to increase the capital stock from 734,500 shares, of a par value of $50 each, to 918,005 shares of a par value of $50 each, representing a monetary increase in the working capital of over $9,000,000. According to the provisions of the issue of this new series, present holders of the stock will have the privilege of subscribing at par on a basis of 25 per cent of their holdings on record at the close of business on the 12th of this month. The additional capital is to be used in improvements and in buying and developing recent investments purchased or negotiated for by the U. G. I. The report, which showed the banner year in the history of the corporation, sets forth that during the past year the properties outside of this city increased on an average of 9.8 per cent, while the increase in the sale of gas in Philadelphia was 3.8. Of the properties of the company, the electric light and trolley companies increased 14 and 9.2 per cent, respectively.

NEW YORK TRACTION MERGER.—With the delivery of actual certificates of stock of the new Interborough Metropolitan Company an interesting point has been raised, it is said, as to what becomes of the guaranteed 7 per cent dividend on the $42,480,000 Metropolitan stock deposited under the terms of the traction merger. Of course the dividend must be paid on the $9,520,000 Metropolitan stock still outstanding, but the main object of the new company was to pull the Metropolitan out of the hole where it had landed on its back in trying to pay the 7 per cent dividend on the $52,000,000 stock. The guaranteed 7 per cent dividend will be paid on all of the $52,000,000 Metropolitan stock, but while the $2,973,000 received annually by the Interborough Metropolitan on the $42,480,000 stock held will be shown in "other income," it will also be included further down in the income account as a "fixed charge," one item balancing the other. What effect the continued drain will have on the resources of the New York City Railway, the company actually guaranteeing the 7 per cent dividend, is the most interesting question of all.

KEYSTONE-EASTERN TELEPHONE.—By the purchase of 80 per cent of the stock, the Keystone Telephone Company, of Philadelphia, has acquired control of the Eastern Telephone Company, of Philadelphia. A traffic agreement has been in force between the two companies for some time, and the change in ownership will cause no interruption in the service, although the Keystone Company will, its officers say, within a few months very much improve the service of the local corporation. The Eastern Telephone Company was organized in 1899 and began operations in 1901, and at the present time has about 2,500 subscribers. The capital stock of the company is $250,000. The stock has a par value of $25. There was $16 paid in on the stock, and the price paid for the controlling interest of the stock was $30 per share. The Keystone Company also assumes the indebtedness of the Eastern Company, which is about $75,000. There is also a bond issue of $250,000 and the Keystone Company has the option of taking the bonds at par. The Eastern Telephone Company operates its service in Camden, Gloucester and a portion of Burlington County.

SAN FRANCISCO TRACTIONS.—According to reports received by the United Railways Investment Company, which controls the San Francisco traction lines, more than 2,000 men are now employed on reconstruction work. The company has secured a franchise for electric lines in place of the old cable franchises, and the road will be equipped with overhead trolley wires as rapidly as possible, the intention of the company being to electrify virtually the whole system. Less than 101 cars out of a total of 1,000 were destroyed by the fire. The total losses are now estimated at $1,250,000. Earnings from the portion of the road in operation are sufficient now to meet the fixed charges and one-half the preferred dividend requirements. Leading holders of the securities are confident the company will recoup its losses within a reasonable time and be in a better position than ever.

CLEVELAND TELEPHONE MERGER.—At a meeting in Cleveland on May 22 the merger of the branches of the Federal Telephone Company was consummated and control of that company's properties passed to a syndicate headed by James S. Brailey, Jr., of Toledo, and including Charles A. Otis, A. H. Hough, other Cleveland financiers, and a number of financial concerns in Toledo, Columbus and St. Louis. Mr. James A. Brailey was elected president, succeeding Frederick S. Dickson. The Federal Telephone Company is probably the largest of the so-called independent systems and includes the Cuyahoga Telephone Company of Cleveland and the United States Telephone Company.

CONSOLIDATION AT PENSACOLA.—Stone & Webster, of Boston, have acquired the entire electric railway and lightning system of Pensacola, Fla., through the purchase of all the securities of the Pensacola Electric Terminal Railway Co. and the Escambia County Light & Power Co. A new company will be organized to operate these systems. The street railways now include about 12 miles of track operated by electricity and seven miles of steam power. It is proposed to convert the steam trackage to electricity and to give a through line to the government for Barrancas and the navy yard and military post.

TELEPHONY IN CANADA.—The Bell Telephone Company, of Canada, in applying to the Dominion Parliament for permission to increase its capital from $10,000,000 to $50,000,000, outlines the uses to which the new capital will be put as follows: Subscribers and exchanges, $21,000,000; underground conduits, $33,000,000; long distance service, $11,000,000. Total, $65,000,000. The capital investment by provinces was given as: Ontario, $5,500,000; Quebec, $4,500,000; Manitoba, $2,000,000; Western Provinces, $300,000. The new stock will be issued from time to time, and the first issue will be made at $125 for each share of a par value of $100.

NORTH AMERICAN STOCK.—The capital stock of the North American Co., a $30,000,000 issue, has been listed on the St. Louis Stock Exchange. This is the largest issue of a single corporation ever approved on the St. Louis Exchange. The North American Company controls the United Railways, the Laclede Gas Light Company and all the properties in the Union Electric Light & Power Company consolidation in St. Louis, besides extensive interests in other cities. Since it acquired the United Railways, a year ago, the local trading had to be made through New York. The company has only one issue of stock and no bonds.

OHIO ELECTRICAL CONSOLIDATION.—The consolidation of the New Castle, Youngstown, Warren, Sharon, and Niles street car lines and the connecting lines has been effected under the name of the Shenango & Mahoning Valleys Light & Power Company. The capital stock is $10,000,000. This will give through trolley service from Cleveland to Pittsburg, when the New Castle & Harmony trolley line is extended to Pittsburg.

CHICAGO TRACTIONS.—It is stated that all of the $1,500,000 South Side elevated bonds delivered to the Illinois Trust Company on May 1 have been sold in lots of $1,000 to $5,000 to small purchasers. The syndicate which underwrote the entire issue of $8,000,000 still has $1,000,000 to deliver to Illinois Trust on May 1, 1907. The bonds bear 4½ per cent and are quoted at 102 to 103.

DIVIDENDS.—The American Graphophone Company has declared the regular quarterly dividend of 1¾ per cent on the common stock, payable June 15.

GENERAL NEWS.

Construction News.

GADSDEN, ALA.—A new lighting and power plant will be built by the Gadsden Railway, Light & Power Company, at 5th and Locust Streets, to cost about $500,000.

GOODWATER, ALA.—Hall Brothers, of Atlanta Ga., and Dadeville, Ala., are engineers for the proposed municipal electric light plant to be constructed at Goodwater, at a cost of $12,000 to $15,000. J. S. Gilliland is president of Council.

SHEFFIELD, ALA.—The Muscle Shoals Power & Development Company has been organized at Sheffield, with J. S. Kernachan, of Florence, and C. B. Ashe and Joseph R. Coleman, of Sheffield, as incorporators; capital, $10,000. This company proposes developing the power of Muscle Shoals in the Tennessee River, to generate and distribute electricity, to manufacture electrical machinery and build and operate street and interurban railroads.

TEMPE, ARIZ.—At a recent meeting of the City Council, R. E. Fuller, of Mesa, was present with plans and specifications for the construction of an electric lighting plant for the city.

FORT SMITH, ARK.—The Southwestern Telephone & Telegraph Company is making arrangements for the rebuilding of its system in this place. The company will place all of its wires underground and install a new switchboard and instruments.

BRIDGE, CAL.—The Edison Power Company contemplates building a bridge at Trimmers Springs, and proposes to establish light and transmission stations along the Kings River.

FLORIN, CAL.—The Florin Electric Light & Power Company has made connection with the lines of the American River Electric Company, and the town of Florin is again illuminated by electric light. Electricity is received at 50,000 volts and is reduced to 10,000 volts.

SAN FRANCISCO, CAL.—An ordinance has been passed by the Board of Supervisors granting the United Railroads Company permission to establish overhead electric railways on Market and Sutter Streets. The company expects to have cars running on Sutter Street within thirty days.

REDDING, CAL.—The Redding & Red Bluff Electric Railway Company has made application to the Board of Supervisors of Shasta County for a right-of-way franchise for a single-track railroad to be operated by electricity along and upon the public highway running from Cottonwood to Shingleton.

STOCKTON, CAL. The American River Electric Company has completed a second line from its power house in the mountains to this city, thereby guaranteeing an uninterrupted service to its patrons. The lines are independent of each other, and in case of accident the power can be switched to the other line.

RIVERSIDE, CAL.—Decisive steps have been taken for the better illumination of the principal thoroughfares. It is practically decided to place a series of pillars supporting clusters of incandescent lamps along the different streets which are to be lighted. The city is to pay for half of the cost of the wiring.

EUREKA, CAL.—The North Mountain Power Company has received a steam turbine of 1,100-hp capacity for its sub-station at East End. When the turbine is installed the plant will be completed and the company will be prepared to furnish all the electricity used in Eureka, including the power necessary for the operating of the street car lines.

NAPA, CAL.—The Vallejo, Benicia and Napa Valley Electric Railroad Company is making extensive improvements to its roadbed and in the equipment. When the improvements are completed the voltage will be increased from 750 to 3,000 volts. The company contemplates an extension of the railroad from Napa to St. Helena. W. F. Botsford is president.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is securing rights of way for the proposed extension of the Monrovia line to San Benardino, and the towns in that valley. Rights of way have been secured for the extension of the San Bernardino system to Arrowhead, and the construction of the road will soon begin. A scenic line up Arrowhead Mountain will also be constructed.

ROCKY FORD, COLO.—Bids will be received until June 6 by E. L. McKelvey, city clerk, for furnishing a 50-kw direct-current generator with switchboard and wiring, belted type; a 50-hp direct-current motor, vertical; a 50-kw, three-phase alternating-current generator, belted type, with exciter, switchboard and wiring, and a 50-hp induction motor, vertical type.

DENVER, COL.—At a recent meeting of the directors of the Northern Colorado Power Company, the issue of the $2,000,000 bonds recently authorized was ordered. Contracts for the power and transmission lines were let to the Westinghouse, Church, Kerr & Company, and to the Westinghouse Company for the steam turbines. The contracts include the central plant, lines, main generating stations and sub-stations, to cost $1,150,000. The company is now preparing plans for the large central power plant to be erected at Lafayette, with 197 miles of transmission lines. The total amount to be expended is about $2,000,000. The company has recently purchased the plants at Boulder, Col; Cheyenne, Wyo., and the two plants of the Consumers' Electric Company, at Louis and Lafayette. The amount paid for the four plants was $750,000.

GREENWICH, CONN. The New York, New Haven & Hartford Railroad Company has made a contract with the Mianus Motor Works of this place for a portion of the water supply for the new electric power house at Cos Cob.

THOMPSONVILLE, CONN.—The plant of the Enfield Electric Light & Power Company has been acquired by the Enfield Gas Company, and these, with the Windsor Locks Electric Light Company, will be consolidated under the name of the Northern Connecticut Light & Power Company. The main plant will be at Windsor Locks and the Thompsonville lighting plant will be run as a sub-station. The purchase price is reported to have been about $43,500. Gas and electricity can now be furnished by the one company in Enfield, Windsor Locks, South Windsor, East Windsor and Somers. It is stated that extensive improvements are contemplated. The Northern Connecticut Power Company, of Hartford, chartered by the last General Assembly, will be used as a holding corporation for the companies in the merger. The company has a maximum authorized capitalization of $2,000,000, and it is granted rights to operate under certain restrictions, in Hartford.

SANDPOINT, IDAHO.—John F. Reynaud, of Newport, Wash., manager of the electric light and water companies at Sandpoint, has decided to make improvements to the plant, adding new machinery.

MERIDIAN, IDAHO.—Seymour H. Bell, of Ontario, Ore., writes that it is proposed to construct an electric light plant at Meridian, to cost about $10,000. Mr. Bell will purchase the material for construction.

CORNELL, ILL. The Cornell Telephone Company has increased its capital stock from $8,000 to $10,000.

CAMP POINT, ILL.—An election will probably soon be held to vote on issuing $10,000 bonds for an electric light plant.

MULBERRY GROVE, ILL. The Mutual Telephone system has certified to an increase in capital stock from $1,500 to $5,000.

AURORA, ILL.—It is stated that work on the construction of the new municipal electric lighting plant will commence in a few days.

BELLEVILLE, ILL.—The Looking Glass Prairie Telephone Company has voted to increase its capital stock from $2,500 to $10,000. The company will build a line over the eastern sections of St. Clair County, with exchanges in Mascoutah, Summerfield, Trenton and Lebanon.

FORT WAYNE, IND.—The Home Telephone Company has increased its capital stock from $250,000 to $650,000.

INDIANAPOLIS, IND.—The Varney Electric Supply & Manufacturing Company, of Indianapolis, Ind., has increased its capital stock from $90,000 to $150,000.

GREENFIELD, IND.—The Central Telephone Company, John O. White, president, is in the market for material and labor for the construction of a new telephone plant.

MUNCIE, IND.—The Central Union Telephone Company contemplates the erection of a new exchange building and the installation of a conduit system this summer, at a cost of about $125,000.

KENDALLVILLE, IND.—Bids will soon be called for by the Indiana Light & Power Company for the construction of a $25,000 electric light plant. Directors: A. D. Shepherd, F. B. Perkins and Wm. Robins.

VINCENNES, IND.—The Michigan Hydraulic Company, promoted by Eugene Rush of Frankfort, Ind., and a number of Chicago capitalists, are proposing to furnish light, heat and power for this city, Evansville, Princeton, Washington, Mt. Carmel, Sullivan and other towns. It will construct a 25-ft. power dam on White River, a few miles west of this city. The engineer reports that 25,000 horse-power is available at a cost of $500,000 or $600,000. The company is asking for franchises to furnish light for four cents per kw-hour less than the companies are now furnishing.

MUNCIE, IND.—Municipal ownership as applied to street lighting has proven a failure in this city. No attempt will be made to repair the municipal lighting plant recently wrecked by the bursting of a huge flywheel. The city authorities say it would have been possible to have lighted the city cheaper for years by private contract with a commercial lighting company than by the operation of the municipal plant. Now that the city plant is crippled and full of antiquated machinery it is proposed that a contract be made with a private company to light the streets of this city.

MUSCATINE, IA.—F. X. Schaefer writes that he proposes constructing an electric light and power plant.

READING, KAN.—L. D. Patterson is figuring on putting in a small electric light plant here.

BELLEVILLE, KAN.—W. A. Fuller, of St. Louis, Mo., has secured the contract for constructing an electric light plant for Belleville, to cost about $24,000.

PADUCAH, KY.—The trustees of the municipal electric lighting plant contemplate an expenditure of about $20,000 in improvements and extensions to the plant.

MAYFIELD, KY.—Peter Burnett, representing St. Louis capitalists, purchased the street railway franchise, which was recently sold by the City Council. It is the intention of the company to build an electric railway from Paducah via Mayfield to Columbus and other western points.

LAFAYETTE, LA.—The citizens have voted to issue $35,000 bonds for extending the water works and electric light plant.

AMITE, LA.—The New York & New Orleans Electric Railway Company has asked the Town Council for a right-of-way through First and Second Streets for an electric railway leading from Brookhaven to Hammond.

BINGHAM, ME.—A number of the prominent citizens of Bingham have formed an organization for the purpose of installing an electric lighting plant in this village. Bids will be asked for in a few weeks.

PORTLAND, ME.—The Consolidated Electric Light Company of this city is about to issue $250,000 4½ per cent first consolidated mortgage bonds, of which $200,000 are to be used for refunding purposes and the balance devoted to additions. The company does an electric lighting and power business and is now paying 5 per cent dividends. It has paid 4 per cent for the past 12 years.

QUINCY, MASS.—C. S. Swingle & Company have recently installed a new power plant in their works at South Quincy.

BOSTON, MASS.—The Metropolitan Home Telephone Company has applied for a franchise to construct a telephone system in the city of Boston.

FT. STRONG, MASS.—Bids will be received until June 15 by Capt. George L. Goodale, Quartermaster, U. S. A., Boston, for furnishing and installing electric light fixtures, wattmeters, etc., in certain buildings at Ft. Strong.

FITCHBURG, MASS.—At a recent meeting the directors of the Fitchburg Gas & Electric Light Company voted to proceed at once with the construction of the extension of underground conduits. The directors also voted to add another 500-hp boiler unit to its works.

SOUTH FRAMINGHAM, MASS.—At the annual town meeting held recently the citizens voted to appoint a joint committee, comprising the Selectmen and the committee on public lighting to investigate the subject of municipal lighting, and to make a report at the next annual town meeting. William H. Walsh is chairman.

ORANGE, MASS.—The Orange Electric Lighting Company commenced improvements on its plant that will require several months to complete. Besides the new steam power plant at Wendell Depot, the station there will be supplied with new generators, and the old street lights will be replaced by enclosed arc lamps. When the improvements are completed the company will furnish a day circuit for light and power. A. W. Hubbard is secretary and treasurer.

DETROIT, MICH.—The Edison Electric Light Company has been given a franchise for 30 years and a contract for ten years for lighting the city with arc lights at the lowest Detroit rates.

HASTINGS, MINN.—Nels Enge, treasurer Hastings Electric Light & Water Power Company, writes that $30,000 will be expended for new work in Hastings. Bids are now wanted for 6¾ miles of No. 4 and No. 6 wire. Engineer, William Robertson, of Minneapolis.

ACKERMAN, MISS.—The Board of Mayor and Aldermen have contracted with Prof. Eugene Campbell, of Oxford, to install a water works and an electric light plant to be in operation by September 1.

KANSAS CITY, KAN.—The Metropolitan Street Railway Company will convert the Dodson dummy line from steam to electricity.

JOPLIN, MO.—The Home Telephone Company will make extensive improvements on its lines in this city, and has already ordered a new switchboard.

ST. LOUIS, MO.—The Suburban Telephone Company has been granted permission by the Board of Aldermen to erect its poles in Webster Groves, a suburb of St. Louis. It is said that the new company will connect with the Kinloch system.

ST. CHARLES, MO.—The St. Charles City Council granted a twenty-year electric light franchise to a company which is composed of Walter S. Ashton, Edgar C. Parker, George T. Mathews and Victor H. Becker, Jr., of St. Louis. The new company may try to buy out the city street lighting plant and also the present incandescent electric light plant, which is owned by a private company.

ST. LOUIS, MO.—The Bell Telephone Company is having plans drawn for a new office and branch exchange building at Maple and Beach Avenues. The structure will cost from $50,000 to $65,000. A new building will be erected in Belleville at a cost of $30,000. The new $65,000 building in East St. Louis is nearing completion. The company now has all its wires underground in practically the whole district bounded by Washington and Delmar Avenues, Mill Creek Valley, the river and the western city limits.

BUTTE, MONT.—The City Council has granted the Montana Independent Telephone Company permission to install an exchange and lines in this city, and it is expected that work on the construction will soon commence.

OMAHA, NEB.—The Nebraska Telephone Company is preparing to extend its conduit system and place the wires underground in parts of the residence district in this city.

TECUMSEH, NEB.—The Johnson County Home Telephone Company has bought the entire holdings of the Johnson County Telephone Company. This acquisition gives the company about 400 additional telephones, and includes the exchanges at Cook and Graf. H. F. Canon is manager.

DAKOTA CITY, NEB.—The Village Board and the Board of County Commissioners have each granted a franchise for thirty years to the Sioux City, Homer & Southern Railway Company to operate an interurban railway between Sioux City, Ia., and Homer. Steam power may be used in operating the line until July 1, 1907.

ELIZABETH, N. J.—A resolution has been adopted by the joint finance and street lighting committees to take up the question of street lighting, with a view to acquiring a municipal plant, if possible to have one, or the reduction of the present rates, when the present contract expires in September.

JAMESBURG, N. J.—The Borough Council has granted a five-year franchise to the Manalapan Lighting Company, of Freehold, to erect poles throughout the borough for the purpose of furnishing electricity for the illumination of the borough streets. The company will furnish the borough hall and fire headquarters with lights free. Twenty-four candle-power incandescent lamps will be used in streets at a cost of $11 a light per year each.

ALBUQUERQUE, N. M.—The Colorado Telephone Company will place its wires in this city in the thickly settled districts underground.

ROCHESTER, N. Y.—The Stromberg Carlson Company has filed plans for a brick power house at Culver Road and University Avenue, to cost $5,000.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad Company is considering a plan for building a line the entire length of Fort Hamilton Avenue.

BINGHAMTON, N. Y.—The New York & Pennsylvania Telephone & Telegraph Company has petitioned the Council asking permission to lay conduits in this city.

BATAVIA, N. Y.—The Village Trustees have granted the Genesee County Electric Light, Power & Gas Company a franchise for the transmission and distribution of electricity in Batavia.

NEW HARTFORD, N. Y.—The Board of Trustees has renewed the lighting contract with the Utica Gas & Electric Company for a term of five years. The company is to furnish 30 arc lamps at $1,065 per year.

NEW BRIGHTON, S. I., N. Y.—The Commission on Electric Lighting for the City of New York has presented to the Board of Estimate and Apportionment a plan for lighting by electricity the streets, parks, public places, etc., in the Borough of Richmond, and estimates the cost of a plant complete to supply 2,000 arc lamps and 20,000 incandescent lamps, including land, building power house of 3,000-kw capacity, equipment of power house of 2,000 kw, cables, transformers, subways, poles, fixtures, etc., at $1,161,000. Cary T. Hutchinson is chairman.

WILMINGTON, N. C.—The Great Pee Dee Electric & Power Company, with headquarters in this city, has been granted permission by the State to change its name to the Rockingham Power Company. It is the purpose of the company to develop water power on the Pee Dee River.

GRAND FORKS, N. D.—The engineer of the city electric lighting plant recommends exchanging the 55-light dynamo for one of 75-light capacity.

OBERLIN, OHIO.—The Rawson Company, of Elyria, has purchased the controlling interest in the Oberlin Telephone Company.

MINGO JUNCTION, OHIO.—The Mingo Junction Council has granted a 25-year franchise permitting the National Telephone Company to install an exchange in this place.

FOREST CITY, OHIO.—H. T. Yaryan, of Toledo, will make application to the City Council for a franchise to operate a power, lighting and heating system in this city.

SHELBY, OHIO.—The City Council has granted the Shelby Traction Company a twenty-five-year franchise to construct an electric railway on the unimproved streets of Shelby.

ELYRIA, OHIO. The Cleveland & Southwestern Traction Company has purchased a large tract of land in Elyria, and will erect a large repair shop and power house for its entire system in that place.

FINDLAY, OHIO.—The Findlay & Marion Railway Company, which proposes to build from Findlay to Marion, is planning to form a loop entrance into Findlay, and operate a belt line in that city.

CLEVELAND, OHIO.—George S. Rider & Company, consulting engineers of this city, are placing contracts for a large power house to be erected at Ravenna, Ohio, for the Cleveland Worsted Company.

AKRON, OHIO.—The People's Telephone Company has let the contract for the construction of its new building to George W. Carmich & Company, to be erected on High Street at a cost of $16,000.

NEWARK, OHIO.—The Newark, Utica & Mt. Vernon Electric Railway has completed surveys for its proposed line between Newark and Mt. Vernon by way of Utica. It is stated that work on the line will start this fall.

TOLEDO, OHIO.—The Toledo Railways & Light Company has made a contract with the city to place 24 arc lamps in the various city parks to be illuminated four months in the year, for which the city is to pay at the rate of $15 per lamp.

NEWARK, OHIO.—The Licking Electric Light & Power Company has discontinued the use of its boiler and steam plant, which have been replaced with three gas engines of 500-hp each. The engines were installed by the Westinghouse Machine Company.

CLEVELAND, OHIO.—The contract has been let by the Cleveland Short Line for the construction of its line from the city limits at the intersection of the Brecksville road west to Rockport. The contract was made with John Marsch, of Green Bay, Wis., and calls for an expenditure of $1,000,000.

CLEVELAND, OHIO.—The Lake Shore Electric Railway has definitely decided on the route for the new branch which will shorten the mileage on that road between Toledo and Sandusky. The line has been surveyed and the right of way is now being secured. This route will not only shorten the distance between Toledo and Sandusky, but will afford an outlet for the pleasure traffic to points on the lake shore from the roads leading south of Fremont.

TOLEDO, OHIO.—The Toledo Railways & Light Company, which is back of the Ottawa Beach & Southern Railway, is planning to make Ottawa Beach one of the finest resorts on the Great Lakes. The company owns 1,200 feet of lake frontage and several hundred acres of land, and is having plans prepared for improvements which it is stated will involve an outlay of about $300,000. The beach is seventeen miles from the city and will be reached by the new interurban road, which will be ready for operation about July 1.

CLEVELAND, OHIO.—The Cleveland Board of Public Service has secured a site for the new municipal lighting plant to replace the present South Brooklyn plant. Plans for the new building are now being prepared by the city engineers. The contract has already been placed with the Allis-Chalmers Company, for a turbo-generator set and contracts for the other equipment are to be closed in the near future. Two hundred additional arc lamps are now being installed on the south side of the city. It is expected that the new plant will be in operation in 90 days.

CLEVELAND, OHIO.—The Northern Ohio Traction & Light Company will not use its treasury bonds for the construction of the line from Barberton to Wadsworth and Seville, which it is now building, but will finance it as a separate corporation known as the Barberton & Western and on this will be placed a bond issue of $500,000. The parent company will guarantee the bonds and the payment of interest. This leaves the Northern Ohio Traction & Light Company with a larger amount of treasury bonds, which can be sold for the improvement of the main property.

ALBANY, ORE.—A. Welch, of Portland, and I. W. Anderson, of Spokane, Wash., who recently purchased the electric light and water works here, are contemplating improvements to the system.

WAYNESBURG, PA.—The Waynesburg Council has granted the Greene County Telephone Company a franchise, with the right to put in a conduit system over certain streets.

PHILADELPHIA, PA.—Bids will be received until June 15 by Lieut.-Col. J. W. Pope, Depot Quartermaster, U. S. A., for furnishing and installing electric fixtures, wattmeters, etc., in new office building at this depot.

IRWIN, PA.—The Pittsburg, McKeesport & Westmoreland Company has acquired the property of West Newton & Webster Street Railway Company, and will build a line from Irwin to the Monongahela River at Donora, a distance of 18 miles. The contract for the construction of the line has been let to the South Penn Construction Company.

ALLEGHENY, PA.—The Allegheny County Light Company has submitted bids for lighting to the Councils for $80 per arc lamp per year, if the wires are above ground, and $96 if the service is by conduits. Mayor George W. Guthrie considers the bids excessive and has rejected them, and has recommended that the city shall take light from the company under its franchise contract, which provides that light shall be furnished for 75 per cent of the price charged to private consumers. A resolution has been adopted by the Council to present an ordinance at the next meeting looking to the building of a municipal electric lighting plant.

WATERTOWN, S. D.—The Council has granted a franchise to the Waterloo Telephone Company to lay conduits in the business section of the city.

MEMPHIS, TENN.—The Lakeview Traction Company proposes to build an electric railway from Memphis, Tenn., to Clarksdale, Miss., a distance of about 75 miles.

KNOXVILLE, TENN.—The East Tennessee Telephone Company has asked for bids for the construction of the extension to its exchange building on Vine Avenue and Prince Street. A new switchboard will be installed as soon as the building is completed.

BEAUMONT, TEX.—The Southwestern Telephone Company has increased its capital stock from $50,000 to $100,000.

McKINNEY, TEX.—R. C. Strickland, president of the company that is to build the Dallas-Sherman Interurban Railway, has submitted a proposition to the citizens of this place to locate the $[illegible] power house here and construct four miles of electric street railway in this city, provided McKinney citizens take 350 shares, the par value of which is $[illegible]. It was decided to accept the proposition.

SALT LAKE CITY, UTAH.—J. S. Manley and L. H. [illegible] have petitioned the City Council for a franchise for an electric lighting, power and heating plant for this city.

PROVO, UTAH.—The Telluride Power Company, of Provo, has decided to construct a power plant on Utah Lake, west of Provo. It will have a capacity of [illegible] hp and electricity will be supplied to Salt Lake City, Ogden and smaller towns between Provo and Ogden. Another pole line will be constructed to Mercur and Eureka for operating machinery at the mines.

BENNINGTON, VT.—The Bennington & Hoosick Valley Street Railway Company is increasing the capacity of its power plant by the installation of a 500-hp engine for the operation of a new generator.

EMPORIA, VA.—The plants of the Emporia Light & Power Company and the Emporia Ice Works were destroyed by fire on May 22. Both plants were owned by the Emporia Light & Power Company. The original cost of the combined plants was about $25,000. It is reported that the plants will be rebuilt at once, on a much larger scale.

RICHMOND, VA.—Orders have been placed for additional machinery for the power house of the Virginia Passenger & Power Company. The machinery consists of two 1,500-hp horizontal turbine wheels and two 1,000-kw General Electric generators. The wheels are being built by the James Leffel Company of Springfield, Ohio. The machinery is to be installed by September 1.

WINCHESTER, VA.—The power plant of the Winchester & Washington City Railway Company, which is in course of construction at Millville, W. Va., will be soon completed. When the plant is completed plans will be mapped out for a railway project, which is to connect the nearby towns in this section and then extend eastward to connect with a line running from Washington, D. C.

TACOMA, WASH.—Russell & Babcock, architects, have plans for a building for the Home Telephone Company. The company will expend $200,000 on its system in this city.

GARDENA, WASH.—Engineers in the employ of the Columbia & Walla Walla Traction Company have commenced the surveying for the proposed electric railway between Wallula and Dayton.

SEATTLE, WASH.—In anticipation of an early sale of the $600,000 bonds voted at last election, L. B. Youngs, superintendent of the municipal lighting department, has placed orders for large quantities of wire. Immediately on securing the bonds plans will be perfected for the installation of another power unit at the lighting department head works at Cedar River.

SPOKANE, WASH.—Jay P. Graves' Inland Empire Railway Company has decided to expend about $700,000 for the development of a power site about 12 miles northwest of Spokane and supplying electricity for lighting in Washington and Idaho and also furnishing electricity to the electric railway systems. F. A. Blackwell, chairman board of directors, Coeur d'Alene, Idaho.

FORT WRIGHT, WASH.—Bids will be received until June 15 by Capt. Edward A. Shuttleworth, Quartermaster, U. S. A., for furnishing and installing fixtures, wattmeters and transformers and making service connections for the electric lighting of two double barrack buildings, one field officers' quarters, one double captains' quarters and one eight-set bachelor officers' quarters, at Fort Wright.

KEYSER, W. VA.—The question of municipal ownership of an electric light plant is under consideration here.

GREEN BAY, WIS.—The Green Bay Traction Company has presented a petition to the City Council for a franchise to extend its lines to Bay Beach this summer.

WEST MILWAUKEE, WIS.—The Milwaukee Light, Heat & Traction Company has petitioned the Village Council for a franchise to construct, maintain and operate an electric light and power plant in West Milwaukee.

LANDER, WYO.—The Wyoming Power & Light Company, which was organized for the purpose of supplying Lander and the surrounding settlements with electricity, has been financed, and arrangements are now in progress for the installation of the company's plant, which will be operated by water power. The company intends to supply electricity to South Pass, Atlantic, Fort Washakie, Arapahoe agency and other places.

VANCOUVER, B. C.—The Stave Lake Power Company is working on the large dam, and when this is completed will at once commence the construction of a power plant. G. J. O'Loane is general manager.

VANCOUVER, B. C.—J. Buntzen, managing director of the British Columbia Electric Street Railroad Company, announces that the company has plans for extensions and improvements around this city, to cost $500,000. R. H. Sperling is general superintendent.

ROSTHERN, CAN.—The Town Council is about to install an electric light plant. Various plants are now being visited and data secured. Address Mayor Hamm.

LACOMBE, ALBERTA, CAN.—The Council has made an agreement with the Blindman River Electric Company to light the town and supply power. The company will at once commence the construction of a plant here.

WINDSOR, CAN.—The Canadian Westinghouse Company has closed a contract for the equipment of the Windsor, Essex and Lake Shore Railway, which is to connect Windsor, Kingsville, Leamington, Chatham and other towns in the western peninsular. The construction work is being done by the Keystone Construction Company, of Philadelphia.

CARDSTON, MAN.—The rate payers of this town will vote on a by-law at the end of the month to spend $30,000 on an electric light system.

GUADALAJARA, MEX.—E. Schondube, of Mexico City, has secured the contract for the electric street railway to be built here by the Compania Industrial de Guadalajara, the French light and power company in this city.

WINNIPEG, MAN.—The Winnipeg Electric Street Railway Company has been awarded the contract to supply electrical energy for city street lighting and water pumping for a term of three years. The present price for arc lamps is 20 cents per night; by the terms of the new contract this will be reduced to 15 cents.

PUEBLA, MEX.—It is reported that the same interests which recently purchased from Wehren, Beit & Company, of London, control of the Mexico City street railway lines, has also concluded negotiations for the purchase of the street railway and lighting interests at Puebla, and that the Mexican Light & Power Company, whose interests are closely allied with the new Canadian syndicate, will enter Puebla with electric power from Necaxa, and at the same time, the transmission lines of the company will be extended to Pachuca, and there to supply electricity to the mines of Pachuca, Real del Monte, Zimapan and the neighboring districts.

ST. JOHN, N. B.—The New Brunswick Telephone Company is making arrangements to place its wires underground in this city.

AMHERST, N. S.—J. F. Wyse, an electrical engineer of Toronto, is preparing plans for the Maritime Railroad & Coal Company, of Amherst, for a transmission line to run from the company's mines to this town.

CHATHAM, N. B.—Alderman MacLachlan submitted to Town Council on May 19 a report of the Electric Light Committee on the electric light plant, which recommends remodeling the plant at a total cost of $28,600.

PETERBORO, ONT.—The Canadian General Electric Company has plans for enlarging its plant here, which will cost $400,000 or $500,000. Address E. G. Patterson.

TORONTO, ONT.—The Independent Long Distance Telephone Company has been incorporated here, and in return for a franchise agrees to construct lines during the next year to cost $200,000.

TORONTO, ONT.—R. J. Fleming states that the Toronto Railway Company has decided to expend $1,500,000 this year in improving the system. Two new loops will soon be opened; seventy new cars will be constructed, at a cost of $500,000, and this, together with the laying of new rails and roadbed on King and Queen Streets, and various extensions, will make up the expenditure mentioned.

PANAMA.—Bids will be received until June 8 by D. W. Ross, General Purchasing Agent, Isthmian Canal Commission, Washington, D. C., for equipment for electric light plant, line material, boiler plate, lead pipe, wire rope, etc.

MONTREAL, QUE.—The Montreal Light, Heat & Power Company has awarded to the Canadian White Company, the contract for a power house at Soulanges, to cost about $416,000.

MONTREAL, QUE.—The Montreal Light, Heat & Power Company has plans for a 15,000-hp electrical power plant to be erected at Cedar Rapids at a cost of approximately $1,500,000. W. McLea Walbank, vice-president and chief engineer, Montreal.

MONTREAL, QUE.—The Provincial Light, Heat & Power Company, of Montreal, have contracted with the Canadian Westinghouse Company for about 55,000 hp of various apparatus. There will be three 3,750-kw revolving field, alternating-current water wheel driven generators of 4,000 volts, three phase, and twelve 44,000-volt transformers of 2,500-kw capacity each. The machinery is to be installed in a new power station to be built about 40 miles from Montreal. The energy will be transmitted by the Montreal Light, Heat & Power Company.

WEYBURN, SASK.—John Galt, of Toronto, Ont., is preparing plans for water works and an electric light plant. N. D. McKinnon, Mayor.

Company Elections.

WINDSOR LOCKS, CONN.—At the annual meeting of the stockholders of the Windsor Locks Electric Lighting Company recently, the following officers were elected: President and treasurer, William Mather; vice president, Burdett Loomis, Jr., of Hartford; secretary, Henry Douglass.

NANTUCKET, MASS.—At a recent meeting of the Citizens' Gas, Electric & Power Company, Franklin Folger was elected treasurer and John C. Ring general manager.

KEENE, N. H.—At the annual meeting of the Citizens' Electric Company the old board of officers was re-elected. The company, which was organized a year ago, reports the growth of its business as being very satisfactory. The company has the city contract and is [illegible] selling light and power to many private consumers. An increase in [illegible] capital stock of the company, which is now $50,000, is being considered. Daniel R. Cole is president.

WOODBOURNE, N. J.—At the annual meeting of the Woodbourne Electric Light, Heat & Power Company, the following officers were elected for the ensuing year: President, C. A. Wilson; vice-president, C. H. Crisman; secretary and treasurer, A. W. Bedell.

LEXINGTON, OKLA.—At the annual meeting of the Oklahoma City, Lexington & Sulphur Springs Electric Railway Company the following officers were elected: Jay Sherman, president; E. J. Keller, vice-president; Geo. A. Teague, secretary; H. A. Hawk, treasurer.

YORK, PA.—At a recent meeting of the New Haven Water & Power Company the following officers were elected: President, George Poole; vice president, Eugene Ivins, secretary, H. Gordon Nes. The company has decided to transfer its main office to York.

WALHALLA, S. C.—At a recent meeting of the directors of the Oconee Water, Light & Power Company, the following officers were elected: J. A. Steck, president; C. E. Jaynes, vice-president; James Thompson, secretary; Frank Head, treasurer.

New Industrial Companies.

MULTIPHONE OPERATION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000. The company proposes to manufacture patented articles. The directors are Isaac Thorman, F. G. Wesel, and E. J. Campbell, of New York.

THE COLUMBUS ELECTRICAL CONSTRUCTION & SUPPLY COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $15,000. The incorporators are James W. Keating, Olive L. Erwin and William Rubin. The company will manufacture and deal in electrical supplies.

New Incorporations.

SELMA, ALA.—The Selma Electrical Supply Company of this city has been organized with a capital stock of $5,000 by A. W. Cawthorn and others.

BENSON, ARIZ.—The Benson Water Company has been incorporated to furnish water, gas and electricity to Benson. Directors: Peter Jensen, Milton Fairlee and F. H. Hereford.

HARRISON, ARK.—The Batavia Telephone Company has been organized with a capital stock of $5,000, of which one-third has been paid in. The officers are Dr. H. L. Routh, president; Danile Sanders, vice-president; Loy K. Butts, secretary; and Charles Routh, treasurer.

EUREKA SPRINGS, ARK.—The Kings River Electric Light & Power Company has been incorporated by G. W. Matthews and others, with a capital stock of $75,000. The company proposes to build and operate a system of urban and interurban lines in Carroll County and to operate a light and power plant.

LOS ANGELES, CAL.—Articles of incorporation have been filed by the Pacific Light & Power Company, with a capital stock of $10,000,000. H. E. Huntington is president. The directors are: I. W. Hellman, A. Borel, C. de Guigne, M. G. Kerckoff. These capitalists are also promoters of the Kern River Power Company, which is operating a power plant on Kern River with the power house at Borel and the intake of its canal at Kernville. It is the object of the corporation to build the much talked of electric road to the coast, and to construct a new power plant just above Kernville.

BOISE CITY, IDAHO.—The International Electric Company has been incorporated with a capital stock of $25,000,000 by European financiers. The company will construct an electric railway from Preston, Idaho, to Nephi, Utah.

MILLSTADT, ILL.—The West Side Telephone Company, of Millstadt, has been incorporated with a capital stock of $1,140. The incorporators are William Kropp, Jacob Fischer and George A. Mueller

CHICAGO, ILL.—The Manufacturers' Telephone Company has been formed and has made application for a charter. The committee which is directing the organization of the company is composed of LaVerne W. Noyes, John E. Wilder, C. H. Smith, Gustav Hessert, Jr., and John M. Glenn.

INDIANAPOLIS, IND.—The Central Telephone Company has been incorporated with a capital stock of $750. The incorporators are J. Q. White and others.

KENDALLVILLE, IND.—The Kendallville & Goshen Traction Company has filed articles of incorporation with the Secretary of State. The initial capital stock is $10,000. The directors are: Arthur B. Shepherd, F. L. Welshermier, T. A. Redmond and William Robbins.

KENDALLVILLE, IND.—The Indiana Light & Power Company has filed articles of incorporation with the Secretary of State. The capital stock is $25,000. The company proposes to construct a large plant to supply light, heat and power to citizens of Kendallville, Ligonier Rome City, Wawaka, Millersburg, Goshen, Wolcottville, Lagrange, Garrett, Auburn, Butler, Waterloo and Syracuse. The incorporators are Wm. Robins, Arthur Shepard, F. B. Perkins and T. A. Redmond.

HENRYETTA, I. T.—The Coal Creek Power Company has been organized with a capital stock of $10,000. The company proposes to build a large power plant. The incorporators are J. W. Stewart, W. N. Martin and William Stockleberg.

SOUTH McALESTER, I. T.—The Ardmore & Northwestern Electric Railway has been chartered with a capital stock of $1,000 by J. T. Denton and others.

TOPEKA, KAN.—A charter has been granted to the Southern Kansas Railway, Light & Power Company, with a capital stock of $4,000,000. The company will construct a new interurban electric railroad through southern Kansas and Missouri. The incorporators are R. C. Rawlins and others.

MONTICELLO, KY.—The Monticello Electric Light & Power Company has been incorporated, with a capital of $6,000.

MT. STERLING, KY.—Articles of incorporation have been filed by the Mt. Sterling Railway. The company contemplate building a railway from this city to Paris, via Sideview and North Middletown. The survey has all been completed and most of the right of way secured. The incorporators are John T. Collins and W. A. Thomason, of North Middletown; D. C. Talbot, Henry A. Power, R. J. Neely, of Paris; H. Clay McKee and J. M. Bigstaff, of Mt. Sterling.

LOVELL, ME.—The West Lovell Telephone Company has filed articles of incorporation with a capital stock of $1,000. The incorporators are W. S. Fox and others.

BOSTON, MASS.—Articles of incorporation have been filed by the Boston Independent Telephone Securities Company with a capital stock of $750,000 The incoporators are W. F. Lakin and others.

CHARLOTTE, MO.—The Charlotte Telephone Company will soon be incorporated with a capital stock of $1,000, of which $500 has already been paid in. A committee composed of J. W. McFadden and others will have charge of the construction, and work will commence at once.

ST. LOUIS, MO.—The Independent Electric Company has filed letters of incorporation with a capital stock of $10,000, of which half has been paid. The object of the corporation is to do a general electrical engineering and construction business, etc. The incorporators are John J. Dowd, George Clark and Eli F. Cunningham.

BUTTE, MONT.—The Montana Independent Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of $1,500,000. The company has been granted franchises in the cities of Butte and Anaconda. The directors are Harry A. Gallway, Charles J. Kelly, Cornelius F. Kelly, Andrew J. Davis, Sellers M. Largey and others.

LINWOOD, NEB. The Linwood Telephone Company, has been incorporated with a capital stock of $15,000. The incorporators are A. A. Hayek and others.

LINCOLN, NEB.—The Medicine Valley Telephone Company, of Hayes County, has filed articles of incorporation with a capital stock of $1,500. The incorporators are R. P. Chase and J. P. Ready.

FALLS CITY, NEB.—The Southeastern Nebraska Telephone Company has filed articles of incorporation with capital stock of $100,000. The incorporators are J. H. Miles, W. S. Korner, Edwin H. Yowle, P. B. Weaver, A. E. Kannt, J. H. Morehead and G. W. Duerfeldt.

ELLICOTTVILLE, N. Y.—The Ellicottville Electric Light Company has been incorporated, with a capital of $5,000, by J. C. McMahon, E. Hickey and M. Murchy.

MONTOUR FALLS, N. Y.—The Montour Falls Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are George F. Barton and others.

WESTCHESTER, N. Y.—The Westchester-Putnam Trolley & Land Improvement Company has been chartered with a capital stock of $100,000. The incorporators are John S. Ludd and others.

NEW YORK, N. Y.—Articles of incorporation have been filed with the Secretary of State by the Triangle Telephone Company, with a capital stock of $1,000. The incorporators are Charles B. Self and others.

HARWICK, N. Y.—The Oneonta & Mohawk Valley Railroad Company, a reorganization of the Oneonta, Cooperstown & Richfield Springs Railroad Company has been incorporated with a capital stock of $1,800,000. The directors are Stephen Tilton, P. S. Babcock, W. U. Moore, W. L. Trowbridge, H. W. Acton, H. F. Poor, C. L. Schurz, New York; W. V. Varin, Brooklyn; W. G. Atkinson, Paterson.

BARLOW, N. D. The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $15,000. The incorporators are J. R. Tingberg and others.

OAKWOOD, OHIO The Oakwood Bell Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are W. S. Crater and others.

CLEVELAND, OHIO.—The Cleveland Heat & Power Company has been incorporated with $10,000 capital stock by A. H. Miller, U. S. Mackey, C. M Saxsen and W. R. Purdy.

OAKLAND CITY, OHIO. The Oakland City Telephone Company has filed articles of incorporation with a capital stock of $10.000. The incorporators are C. F. Stevens and others.

PATTERSONVILLE, OHIO.—The Farmers' Mutual Telephone Company, with a capital stock of $10,000, has been incorporated by W. D. Cassidy, John Shankleton, J. S. Mills, M. C. Brice and John Clark.

DEFIANCE, OHIO.—The Northwestern Ohio Electric Railway Company, of Defiance, has been incorporated, with $100,000 capital stock, by G. A. Rigrish, John Crowe, E. C. Bell, J. H. Hockman and J. W. Miller.

BOUGHTONVILLE, OHIO.—The Boughtonville Telephone Company, of Huron County, with a capital stock of $10,000, has been incorporated by W G. Blackmore, J. O. Palm, G. B. Catlin, S. E. Gleason, F. E. Hoie, William Howard and others.

VAN WERT, OHIO.—The Indianapolis, Decatur & Ohio Traction Company has been incorporated, with $10,000 capital stock, by R. H. Moltz and J. B. Holthouse, of Decatur; J. R. Tudor, of Van Wert; S. M. Young, E. A. Gessner and J. Y. Todd, of Toledo.

STEUBENVILLE, OHIO.—The Republic Telephone Company has filed articles of incorporation with a capital stock of $25,000, to operate a telephone line at Toronto, Empire and New Cumberland. The incorporators are J. G. Gilchrist, R. Gilson, W. C. Jones, Lee O. Smith and and J. T. Campbell.

NORWALK, OHIO.—The Todd Corners Telephone Company of Huron County has been incorporated with $3,000 capital stock by C. H. Todd, M. I. Todd, W. H. Hoyes, A. J. French, F. W. Arnold, C. A. Russell and others. It is the intention to install a farmers' community system radiating from Todd's Corners with connection with the independent exchange at Norwalk.

COYLE, OKLA. The Coyle Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are O. L. Jewett and others.

SAYRE, OKLA.—The Modern Telephone Company has filed articles of incorporation with a capital stock of $10,000. The directors are D. E. Grubs, O. J. Ivester and others.

HEASTON, OKLA.—The Heaston & Elreno Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are Charles Brandley and others.

MOUNTAIN PARK, OKLA.—The Farmers' Mutual Telephone Company, of Mountain Park, has been chartered with a capital stock of $5,000. The incorporators are J. L. Collins, C. D. Williams, E. E. Kerb and J. E. Fairchild.

PORTLAND, ORE.—The Oregon Electric Railway Company has been incorporated by T. Scott Brooke, H. L. Corbett and R. W. Lewis, with a capital stock of $2,500,000.

PHILLIPSBURG, PA.—The Chester Hill Electric Light, Heat & Power Company has been incorporated with a capital stock of $5,000.

WHITE LAKE S. D.—The Crystal Lake Telephone Company has been incorporated with a capital stock of $3,500.

WHITE LAKE, S. D.—The Crystal Lake Telephone Company has filed articles of incorporation with the Secretary of State with a capital of $3,500. The incorporators are Mathais Gales and others.

COLMAN, S. D.—Articles of incorporation have been filed by the Farmers' Union Telephone Company, with a capital stock of $9,000. The incorporators are A. S. Harvey, Andrew Ulstad and Ole Mickelson.

CENTREVILLE, S. D.—The Citizens' Telephone Company has filed articles of incorporation with the Secretary of State, with a capital of 50,000. The incorporators are J. A. Crowe, T. J. Gunderson and others.

HITCHCOCK, S. D.—Articles of incorporation have been filed by the Westside Telephone Company with capital stock of $5,000. The incorporators are B. W. Lamphier, W. P. Price and Frank Gilley, of Hitchcock.

NASHVILLE, TENN.—The Indian Mound Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are J. B. Lahiff and others.

SEATTLE, WASH.—The American Electric Company has been incorporated with a capital of $5,000 The incorporators are G. A. Hastings, N. A. Prescott and J. R. Bosch.

MILWAUKEE, WIS.—The Premier Lighting Company has been incorporated with a capital stock of $5,000. The incorporators are A. J. Meyer and others.

TRURO, N. S. The Midland Electric Company has been incorporated with a capital of $100,000. The directors are W. F. Linton, R. T. Cragg and L. Spencer, all of Truro.

TORONTO, ONT. The Dinorwic & Gold Mines Telephone Company has been incorporated with a capital of $40,000. The directors are A. Campbell, Detroit, Mich.; J. G. Shaw and J. Montgomery, Toronto, Ont.

Legal.

CUTTING TELEPHONE WIRES.—It would appear that the criminal law of Ohio furnishes no protection to telephone companies against wilful molesting or destroying of their property. A circuit court has held that the statute attempting to make such provision applies exclusively to "magnetic telegraph companies." A later section intending to cure the old law was held to be insufficient in such an action. The question came up in the case of the State against Charles Melota, who was convicted of molesting telephone wires. The case was carried up and the decision reversed, the lower court holding that the demurrer to the indictment should have been sustained.

VENTILATING DYNAMO ARMATURES.—A decision has been handed down by Judge Seaman in the United States Circuit Court of Milwaukee, Wis., in a suit of the General Electric Company against the National Electric Company, in which the former charged that a patent controlling certain features of construction in an electric generator was infringed. This feature refers to a form of ventilating the armature, which prevents an overheating of the machine, is essential to its successful operation, and adds about [illegible] per cent to its given capacity The decision of Judge Seaman is a concurrence with a similar opinion of Judge Thompson of the Ohio District Court.

LIABILITY OF MUNICIPAL PLANTS. The Supreme Court of North Carolina has affirmed a decision against the city of Newbern for negligence in the management of its electric light plant, resulting in the loss of life. The main points in the decision are as follows. (1) Priv. Laws 1899, p. 164, c. 82, § 54, incorporating the city of Newbern, authorized the construction or purchase of an electric light plant; and Priv. Laws 1903, p. 81, c. 41, amending the charter, established the water and light commission to manage the water, sewer and electric light system, which commission is given entire control of such systems, and is to be elected in the manner provided for the election of mayor. Held, that this commission is not a separate corporation, but is an agency of the city, for the negligence of which the city is liable. (2) In so far as a municipal corporation is engaged in discharging the powers and duties imposed upon it as a Governmental agency, it is not liable for breach of duty by its officers, who, while so acting, are agents of the State; but, when acting in the management of property used for their own benefit or profit or discharging powers and duties voluntarily assumed for their own advantage, municipal corporations are liable to persons injured by negligence of their servants, agents or officers. (3) Where the charter of a city authorized it to own and operate an electric light plant not only to illuminate the streets, but to sell the power to its citizens for private use, the operation of the plant could not be regarded as a purely public function, so as to render the city exempt from liability for the negligence of its officers and servants in operating the plant. (4) In an action for death by wrongful act, an instruction that negligence is the failure to observe for the protection of another that degree of care which the circumstances justly demand, whereby such other person suffers injury, was proper.

Educational.

CORNELL UNIVERSITY.—The Trustees of Cornell University have recently assigned to the Department of Electrical Engineering of Sibley College the major portion of Franklin Hall, now occupied by the Department of Physics. The latter department is now moving into commodious quarters in the new Rockefeller Hall of Physics just completed. The Electrical Engineering Department will thus be supplied with new quarters for conducting various lines of work. The electrical engineering laboratory will continue to occupy a part of the main building of Sibley College as Franklin Hall does not contain sufficient floor space to accommodate all of the apparatus. Franklin Hall, after the remodeling which will be necessary this summer, will contain large designing and lecture rooms, a number of smaller recitation rooms and offices, and the telephone and railway laboratories. It is understood that the new arrangement will be only temporary as the enlargement of the main Sibley College building will be an urgent necessity if the present rate of growth continues.

Personal.

MAJOR F. V. HAUSEN, director of the Swedish canal work, is in this country on a mission for the Swedish Government to report on the development here of electric canal towage.

MR. H. M. DAVIS, manager of advertising department of the Sprague Electric Company, New York, is back at his desk again after an illness of about ten days suffering from a severe attack of la grippe.

MR. W. D'A. RYAN, of the General Electric Company, Lynn, Mass., last week delivered a lecture before the Toledo Society of Engineers on the subject of electricity for illuminating purposes and the effect to be obtained by the use of various colored lights.

MR. WALTER ROBBINS, assistant to the manager of the apparatus department of the Western Electric Co., of Chicago, has resigned his position with that corporation, and will enter the service of the Wagner Electric Manufacturing Company, of St. Louis, as assistant to the manager of that company. This change will become operative on July 1.

MR. DOUGLASS BURNETT, manager of the electrical department of the Consolidated Gas, Electric Light & Power Co., of Baltimore, was in New York last week, and reported a large and steady growth of business. The city has fully recovered from the great fire, and electricity has been prominent in the new development.

MR. H. M. LAURITZEN, of the sales department of the Holophane Glass Company, will start about June 9 on a trip to the Pacific Coast, spending a week each in Los Angeles and San Francisco. He will then go to Portland, Oregon, spending six weeks with the Portland General Electric Company on some special illuminating engineering work; two weeks in Seattle, and return to New York about the middle of September. Mr. Lauritzen is one of the active members of the Illuminating Engineering Society.

COMMANDANT F. V. HANSEN, director of the canal and hydro-electric plant at Trollhattan Falls, Sweden, and Lieut. G. Holm, are in this country on behalf of the Swedish Government to study electrical power development with special reference to long-distance, high-voltage work at the Trollhattan Falls. They will make special visits to Niagara, Massena, Shawingan, Montreal, St. Anthony's Falls, Duluth, Sault Ste. Marie and other places, where large hydro-electric plants have been installed or are under construction. On their return home a report is to be made.

MR. ARTHUR STRINGER is the author of "The Wire-Tappers," a novel that has just been issued by Little, Brown & Co., of Boston. The hero, an electrical inventor, and the heroine, a beautiful English girl, become, by force of circumstances, associated with a man who attempts by wire-tapping to beat a pool-room in New York City. The efforts of the girl to uplift the man she loves and to extricate him and herself from evil associations, make an entertaining story. The usual run of telegraph fiction deals with the train dispatcher or way station operator, but this opens up a new field.

MR. H. S. STEVENS has been elected to the vice-presidency of the Hudson River Telephone Company, succeeding the late Mr. H. E. Hawley. This has necessitated the following changes: Mr. L. F. Greenleaf has been appointed general manager of the Hudson River Co.; Mr. Stevens retains the vice-presidency of the Central New York Telephone & Telegraph Co., the Empire State Telephone & Telegraph Co., and the New York & Pennsylvania Telephone & Telegraph Co., but has resigned as general manager of these companies; Mr. W. W. Nicholson has been appointed general manager of the Central New York Co. and the Empire State Co.; Mr. E. B. Rogers has been appointed general manager of the New York & Pennsylvania Co.; Mr. Stevens' headquarters will be at Syracuse, N. Y.

Trade Publications.

MACHINE TOOLS.—Catalogue No. 43 of the Newton Machine Tool Works is devoted to cold saw cutting off machines. A large portion of the machines illustrated are driven either directly or through belting by means of electric motors.

ARC LAMP CUT-OUT.—The A. F. Hamacek Company, Chicago, Ill., has issued an illustrated leaflet devoted to its automatic lamp cut-out. This device is mounted on a substantial insulator, and serves to close the circuit around one lamp of a series while it is being lowered for repairs or adjustment.

"COPPER FACTS" is the title of a very interesting pamphlet issued by Mr. M. J. O'Shaughnessy, Jr., 30 Broad Street, New York City. It bristles with data, as to price, production, etc., and has a valuable list of copper producing companies with their capitalization and other conditions determining market value of their stocks.

MULTIPLE DRILLING ATTACHMENT.—The Francis Reed Company, 43 Hammond St., Worcester, Mass., has issued an illustrated circular dealing with a multiple drilling attachment which is applicable to any drilling machine without special fixtures. The attachment is designed for use in any case where two or more holes are to be drilled in constant relation to each other.

BUCKEYE ELECTRIC COMPANY, of Cleveland, O., has issued a pretty folder entitled "Sidelights on the Buckeye," illustrating a central station, a trolley car, and a summer resort, all using Buckeye lamps to advantage. There are views also of a hotel restaurant, a theatre sign, a store, and a silk mill all equally well illuminated with the same brand of lamp made for each specific purpose.

THE CENTRAL LABORATORY SUPPLY COMPANY, Lafayette, Ind., has issued the following bulletins, which will be mailed upon request to those interested: No. 108. Models for illustrating armature windings. No. 110. Physical apparatus for experiments in heat. No. 111. Electric tachometers. The company has received orders for a large number of small alternators, ranging in output from 1 to 15 kw.

THE CENTRAL ELECTRIC COMPANY of Chicago, general Western agents for Deltabeston magnet wire, is sending out literature descriptive of the good qualities of this wire and its adaptability to use on the field and armature coils of railway motors and on arc lamp coils. It is an asbestos covered wire and proof is submitted that it will withstand the highest temperature without the least injury to the insulation. Prices and samples will be sent on request by the Central Electric Company, 264-270 Fifth Ave., Chicago.

"KINKORA."—Note has been made in these pages of the industrial "Model City," Kinkora, that is being built by the John A. Roebling's Sons Co. to house the employees of their new factories in New Jersey. A full descriptive article on the subject has now been reprinted by the firm from the pages of the *New York Herald*. The project has now been fairly well completed under the direction of Mr. C. G. Roebling, who has made no attempt to create an ideal, semi-charitable town, but has sought merely to provide good homes for the men on a utilitarian but not an altruistic basis.

"GREEN PLANING MILL EXHAUSTERS" is the title of a booklet issued by the Green Fuel Economizer Co., of Matteawan, N. Y., describing a new type of fan or exhauster for handling shavings, bark, wool, hair, saw dust and other finely divided substances. The novel feature of the new exhauster is the fan or blast wheel, which instead of having floats or paddles mounted upon spokes, consists [illegible] a solid sheet iron cone with floats mounted upon its convex side. There are no corners or crevices in which fibrous materials can catch or clog and the cone also serves to divert the entering column of air and missles towards the discharge.

MOTOR STARTERS.—The Ward Leonard Electric Company, of Bronxville, N. Y., has issued a catalogue, No. 19,063, covering Ward Leonard motor starters equipped with "tight casing enclosing all current-carrying parts." These motor starters were designed to fulfill the requirements of the National Electric Code, which reads that "all starting rheostats and auto starters, unless equipped with tight casings enclosing all current-carrying parts, should be treated about the same as knife switches, and in all wet, dusty or linty places, should be enclosed in water-tight, fire-proof cabinets." This catalogue is complete with diagrams of connections, etc.

MOTOR-DRIVEN MACHINE TOOLS.—An illustrated leaflet, recently issued by the Gisholt Machine Company, Madison, Wis., shows two new forms of motor drives for machine tools. In one of these the motor is mounted directly on the extended base of a horizontal boring and drilling machine, the armature shaft extending into the bed under the headstock where it is connected to the spindle gear through a silent chain. In the other a 5-hp direct-current motor, with a speed range from 400 to 1,600 r.p.m. is mounted on the bed of a bore lathe and connected through a silent chain, slots being cored in the bed to allow the chain to pass through. A ¼-hp constant speed motor is used for operating the turret fast-moving device, and also for operating an oil pump with which the lathe is fitted.

News of the Trade.

ECK DYNAMO AND MOTOR WORKS.—The business of the Eck Dynamo & Motor Works, Belleville, N. J., has increased so much recently that they have found it necessary to double the capacity of their factory by installing new machinery, etc.

THE WESTERN ELECTRIC COMPANY, New York, has moved its downtown store from 22 Thames Street, to 17 Murray Street, where it has commodious quarters more centrally located for the retail trade. Manager Robert Edwards, Jr., reports business as exceedingly good.

OHMEN ENGINE WORKS.—The Ohmen Engine Works, San Francisco, were among the sufferers by the recent earthquake and fire, and the plant was almost entirely destroyed. They are now re-establishing themselves at 15th and Utah Streets, and would be glad to receive engineering catalogues of all kinds at that address.

KEYSTONE INSTRUMENTS.—The Keystone Electrical Instrument Company, of Philadelphia, will have an exhibit at Young's Hotel during the convention of the National Electric Light Association. The exhibit will be in rooms 217 and 219 and will include new models of instruments of interest to the central station manager.

THE GOULD STORAGE BATTERY COMPANY was among those who suffered a loss at San Francisco, the Crossley Building in which it was located having been destroyed by fire. It has, however, opened temporary offices at 1701 Geary Street, San Francisco, to which address all communications intended for its San Francisco office should be sent.

THE HOLOPHANE GLASS COMPANY, 227 Fulton Street, New York, reports very large sales on its new "Pagoda Reflecting Arc." Owing to the use of ordinary, standard, small-unit incandescent lamps in connection with this arc, dealers and jobbers in all parts of the country are placing these in stock, and selling them for all kinds of places, large and small. The scientific accuracy of reflecting prisms is combined with the artistic, altogether making a most efficient and pleasing looking fixture.

ON YOUNG'S PIER.—Alfred F. Moore, the well-known manufacturer of insulated wire, has secured a location on the pier for the N. E. L. A. Convention. His interests will be in charge of his able representative, Wm. W. Pawling. This house is one of the oldest, if not the oldest, manufacturer of covered wire established in this country, and the quality of its goods, particularly its magnet wire, has been long and favorably known. It is prepared to supply all classes of magnet wire, weatherproof wire, feeder cables, rubber covered wire, etc.

BECK ARC LAMP.—Mr. Louis J. Auerbacher, president of the Beck Flaming Lamp Company, 56 W. 15th Street, New York, has just returned from abroad, where he investigated the flaming arc situation and also studied the manufacture of the Beck lamp at the factory of the German Beck Company at Frankfort, Germany. The Beck Flaming Lamp Company has started to manufacture the Beck lamp at its new factory, 58 West 15th Street, New York, but at present is filling orders from import stock. Agencies are now being placed throughout the country.

AN "INDESTRUCTIBLE" FLAT IRON.—It is probable that many odd electrical incidents will come to light as progress is made in reconstructing the city of San Francisco. As has been mentioned in these columns, the warehouse of the San Francisco office of the General Electric Company was completely destroyed by the earthquake and fire. The apparatus included a stock of the company's heating devices. Recently in cleaning up the ruins, the workmen found a flat iron, with its wooden parts burned away. On testing, it was found that the electrical element was still as good as new. This iron has been advertised as indestructible, and the statement will probably never be better proven than in the present instance.

MOTORS FOR SAN FRANCISCO.—The Crocker-Wheeler Company, of Ampere, N. J., shipped recently to San Francisco a carload of its celebrated form L motors, ranging in outputs from ¼ to 3 hp, to be used in the rebuilding of San Francisco. These motors are being sold from the company's temporary office at 2611 Broadway, by Mr. H. C. Baker, Crocker-Wheeler manager in the San Francisco territory, who gives his personal attention to all propositions. The company is now building at its plant at Ampere, N. J., the fourth or last of the 4,000 kw alternators ordered by the California Gas & Electric Corporation. Three of these machines installed in the suburb of San Francisco successfully weathered the recent disaster.

ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, Boston, has recently made several changes and additions to its list of agencies. In addition to its two branch offices, which are located in New York and Chicago, the following is a list of its agencies at present: Boston, Mass., Pettingell-Andrews Company; Baltimore, Md., Universal Railway Supply Co.; Denver, Col., E. M. Messiter; New Orleans, La., J. H. Ashby; San Francisco, Cal., Eccles & Smith Co.; St. Louis, Mo., T. C. White; Toledo, O., W. G. Nagel Electric Co.; Toronto, Ont., H. J. Surtes; London, Eng., Robert W. Blackwell & Co., Ltd.; Paris, France, L'Industrie Internationale. The Anderson Co. is filling many large orders for Aetna insulating material which is being shipped to all parts of the civilized world. The switchboard department is very busy and its sales are quite as extensive.

AMERICAN INSTRUMENT COMPANY.—One of the most interesting exhibits at Atlantic City in connection with the N. E. L. A. Convention will be made by the American Instrument Company. For some months past this company has been equipping a factory at Newark, N. J., and the first instruments shown anywhere will be those displayed at Atlantic City. Those who go to Atlantic City will have every opportunity to make thorough inspection of the details of design and construction. The exhibit will include direct current voltmeters and ammeters of switchboard and portable types, together with instrument parts unmounted and a most important line of ammeter shunts of new design. Mr. A. O. Benecke, chief engineer of the company, will have personal charge of the exhibit and will be assisted by Mr. James G. Biddle, president, and Mr. T. G. Seixas, New York representative.

WAGNER ELECTRIC MANUFACTURING COMPANY.—The Instrument Department of the Wagner Electric Manufacturing Company of St. Louis, Mo., invites switchboard builders and contractors and central station men to call at its booth, west aisle of Young's Pier during the Atlantic City convention, and examine the line of switchboard and testing instruments made by the Wagner Electric Mfg. Co. Two instruments of particular interest to central station managers are the new combination voltage and frequency indicator, and the new lamp testing volt-wattmeter. This latter instrument is used with great success by the complaint department and the new business department of central stations. A novelty in the way of exhibiting transformers also will be found at the booth. The Wagner Company has taken a standard transformer and cut away part of the case so that the coils and sheet iron may be plainly seen. This is a very good method of showing graphically the actual construction, and even the non-technical visitors to this convention will not be slow to avail themselves of the opportunity of seeing "how it is made."

THE GOULD STORAGE BATTERY COMPANY, of New York, has recently organized a special telephone battery department to look after its rapidly increasing business in storage batteries for telephone service. A corps of experienced engineers have been engaged to devote their entire time to this application of the battery. It was over three years ago that one of the most important telephone companies in this country placed their first order for Gould battery as a trial installation, which was subsequently followed by orders for the similar equipment of six additional exchanges. The Gould plate has a large contact surface for active material which is developed out of the lead of the blank itself by "spinning" the surface of the blank into numerous thin ribs. Only chemically pure rolled lead is employed, the great density and uniformity of which are prominent factors in securing high economy and long life. The success of the storage battery in replacing gravity and other forms of primary cells in the modern telephone exchange has been due to three factors: First, the less space occupied; second, less care and attendance required and third, considerable savings in the cost of maintenance.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting, New York City, September or October, 1906.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York. Next convention, Columbus, Ohio, Oct. 15-20, 1906.

Association of Edison Illuminating Companies. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting, September, 1906.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., June 21 and 22, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George H. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y. Next meeting, Syracuse, N. Y., June 19, 1906.

Electric Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings second and fourth Thursdays each month.

Electrical Trades Association of Canada. Secretary, Wm. R. Staveley, Royal Insurance Building, Montreal, Can. Next annual meeting, January 14, 1907.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electrical Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, New Haven, Conn., Aug. 16-18, 1900.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., Oct., 1906.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electric Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

Missouri Independent Telephone Association. Secretary, James F. Barnett.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn. Next meeting, Chicago, June 26, 27 and 28, 1906.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

New York State Independent Telephone Association. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Elmira, N. Y., June, 1906.

Northwestern Electrical Association. Secretary, B. C. Adams, Madison, Wis.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, O.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, F. W. Bullard, Cleveland, O.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, O.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore. Next annual meeting, June 19, 1906.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D.

Southwestern Electrical and Gas Association. Secretary, E. B. Meginnis, Dallas, Tex.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt. Next meeting, July 10 and 11, 1906.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 22, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

820,977. ELECTRIC TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed June 10, 1905. The impulses from the cable are received in a polarized relay which is connected by a special arrangement of circuits to other relays, the purpose of which is to transmit uni-directional or ordinary Morse code signals to the local sounder by the alternating waves received from the cable.

820,978. ELECTRICAL MEASURING INSTRUMENT; Wesley E. Daird, Pittsfield, Mass. App. filed Oct. 12, 1904. A form of hot wire volt meter, in which the deflection of the taut wire carrying the current is multiplied by a second taut wire connected thereto, and the deflection of which is measured on a dial.

820,997. ARMATURE WINDING; Charles P. Steinmetz, Schenectady, N. Y. App. filed Oct. 10, 1904.

821,000. AUTOMATIC MOTOR REVERSER; George H. Whittingham, New York, N. Y. App. filed Dec. 9, 1902. An electrical system to protect a motor against the introduction of current until it has first been stopped and is in a condition to receive the current safely to drive it in the opposite direction.

821,017. COMPOSITION OF MATTER FOR ELECTRIC CONDUCTORS; Walter G. Clark, New York, N. Y. App. filed Jan. 24, 1906.

821,020. MAGNETIC CLUTCH; Henry H. Cutler, Milwaukee, Wis. App. filed Jan. 18, 1902. In order to avoid the two members of a magnetic clutch from sticking together by reason of residual magnetism, the patentee provides a device by which one or more sharp hammer blows are delivered against the magnetic members to destroy the magnetization thereof and cause the clutch to be released.

821,021. ELECTRICAL STEP-BY-STEP CONTROLLER; Henry H. Cutler, Milwaukee, Wis. App. filed May 10, 1902. Relates to automatic mechanism for controlling electric motors by cutting out the resistances thereof through a pilot circuit. Has means for varying the time required for de-energizing the magnet to vary the rapidity of operation of the resistance cutting out movement.

821,022. MAGNETIC CLUTCH; Henry H. Cutler, Milwaukee, Wis. App. filed Aug. 5, 1903. A form of magnetic clutch in which the residual magnetism is destroyed by a supplemental winding which is energized to just sufficient strength to overcome the residual magnetism due to the main windings.

821,023. PHASE-SPLITTER; Henry H. Cutler, Milwaukee, Wis. App. filed Jan. 7, 1905.

821,024. MAGNETIC CLUTCH; George A. Damon, Chicago, Ill. App. filed Apr. 15, 1903. A modification of the above in which two exciting coils are used which are alternately energized, and each of which acts to destroy the residual magnetism of the other.

821,028. REMOVABLE ANVIL CONTACT AND BRIDGE SUPPORT FOR ELECTRIC VIBRATORS; Willard F. Dow, Braintree, Mass. App. filed Mar. 13, 1905. A form of vibrator for an induction coil which can be inserted into place or removed whenever desired. The object is to enable motorists to render their machine inoperative by removing the vibrator of the induction coil.

821,029. ELECTRIC BINDING POST; Willard E. Dow, Braintree, Mass. App. filed Aug. 21, 1905. The binding post is made with an inclined slot and spring pressed plunger, the wire being placed in the slot and held from displacement by the plunger, which locks the wire in the bottom of the slot.

821,043. TELEGRAPHIC TRANSMITTING DEVICE; Isidor Kitsee, Philadelphia, Pa. App. filed May 27, 1903. A transmitting device to be used with submarine telegraphy, the object being to obtain alternating impulses by an ordinary form of transmitting key. A local sounder controls an escapement of a clock train mechanism which serves to produce the desired signals.

821,032. **STORAGE BATTERY**; Thomas A. Edison, Llewellyn Park, N. J. App. filed Sept. 28, 1904.

821,044. INDUCTION MOTOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed Feb. 27, 1904.

821,056. INCANDESCENT ELECTRIC LAMP; Herschel C. Parker, New York, N. Y. App. filed Apr. 21, 1904.

821,061. AUTOMATIC ELECTRIC METAL WORKING MACHINE; Adolph F. Rietzel and George E. Barstow, Lynn, Mass. App. filed Dec. 5, 1904. Relates to an electric metal working apparatus wherein the work is heated to the desired extent by the passage of electric currents from the section of the metal to be welded, forged or otherwise operated upon. The main object is to provide a machine which shall be automatic in all its actions.

821,062. WIRE AND INSULATOR HOLDER; Arthur J. Seguin and Ernest P. Gingras, Ottawa, Canada. App. filed Mar. 6, 1905. In order to hold an electric conductor from sliding through its insulating tube, the patentee provides a spiral spring which surrounds the conductor and is anchored to the tube so as to tighten upon and grip the conductor when any tension thereon takes place.

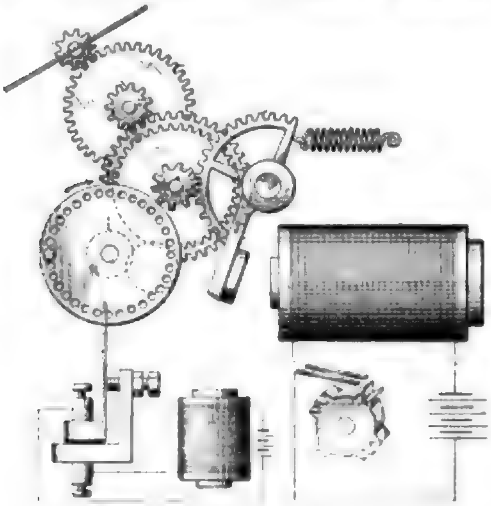
821,064. DYNAMO ELECTRIC MACHINE; Ferdinand Sieber, Wilkinsburg, Pa. App. filed May 1, 1905.

821,069. TELEPHONE SELECTING DEVICE; William D. Watkins, San Jose, Cal. App. filed May 16, 1904.

821,077. SYSTEM AND APPARATUS FOR OPERATING ELECTRIC SWITCHES; Henry P. Ball, New York, N. Y. App. filed Sept. 30, 1902. The switch elements are in the form of studs which are spring pressed toward one another in an oil bath. Lever connections are arranged to an electric motor so that the switch elements are abruptly separated when it is desired to break the circuit.

821,098. AUTOMATIC FIRE ALARM; John W. Griffin, Pawtucket, R. I. App. filed Apr. 10, 1905. A soldered connection normally holds a spring pressed plunger against movement, but in case of undue temperature, the plunger is released and a conical cup driven against a pair of metallic tongues.

821,140. SELF-WINDING ELECTRIC CLOCK; Bernard Tropp, New York, N. Y. App. filed July 16, 1904. An electromagnet acts on a pivoted armature in the manner of an ordinary vibrating bell, and the movements of the armature are effective through a pawl and ratchet connection to rewind the main spring until a predetermined tension is attained.



821,504.—Retarding Device for Electromagnets.

821,151. SYNCHRONIZER; Melzer L. Ballard, Durango, Col. App. filed Aug. 10, 1905. Details of construction of an apparatus for switching two dynamos into synchronism, including an impedence coil, the core of which is forced into varying positions by a worm and screw.

821,197. BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES AND THE LIKE; Chas. W. Speirs, London, and Julius Frith, Manchester, England. App. filed Aug. 20, 1905. The brushes are entirely controlled by small pneumatic cylinders, each having a separate piston, connected to the individual brush elements.

821,249. DYNAMO ELECTRIC MACHINE; Robert Lundell, New York, N. Y. App. filed May 20, 1905.

821,252. RAILWAY SIGNAL; James P. Norwood, Chicago, Ill. App. filed June 23, 1905. The track is equipped with contacts along its length and circuits are provided to various local stations in which registers are arranged to record the movement of the trains.

821,251. SWITCHBOARD; Albert T. Newman, Greeley, Kan. App. filed June 14, 1904. Details of construction of a switch box having connections adapted to connect any one of a plurality of local sounders into a telegraph circuit.

821,287. MULTIPLE UNIT CONTROL SYSTEM; Henry M. Harding, New York, N. Y. App. filed Jan. 6, 1906. This patent covers an unusual method of train control through a pilot circuit. Instead of the multitude of wires ordinarily employed in the pilot circuit and which have to be connected between all the cars of a train, the patentee makes use of only one wire connected between the different cars and which secures all of the well-known and standard traffic conditions of the present forms of multiple unit control systems.

821,292. ELECTRICAL MEASURING INSTRUMENT; Adrian H. Hoyt, Penacook, N. H. App. filed June 7, 1904. A hot wire volt meter in which the wire is led over certain pulleys and levers and finally connected to a drum. This drum has a lever arm connection with a second drum which carries the pointer. Atmospheric temperature variations are arranged to be compensated for.

821,317. CONDUCTOR FOR ELECTRIC CARS; Frank L. Sessions, Columbus, O. App. filed Aug. 14, 1902. A complete system including details of construction of the car, for mining locomotives in which the power is supplied through a flexible cable which unwinds from a drum on the car as the latter moves along.

821,352. TRACTION INCREASING DEVICE FOR STREET CARS; Harry H. Fox, Duquesne Junction, Pa. App. filed Dec. 5, 1905. A pair of magnets are arranged to establish an electric circuit including the track and car wheels, to increase the traction.

821,360. FILTER; Frank B. Hinkson, New Castle, Pa. App. filed May 3, 1905.

821,381. SIGNALING SYSTEM; Wilmer W. Salmon, Buffalo, N. Y. App. filed May 22, 1905. Has a continuously rotating shaft and a magnetic clutch which engages a winding mechanism for hoisting the semaphore arm. Also has means for releasing the clutch to restore the arm to safety position.

821,385. RAILWAY SWITCHING AND SIGNALING APPARATUS; John D. Taylor, Buffalo, N. Y. App. filed Feb. 10, 1903. Provides means for guarding against the bad effect of crossed wires and of an open common wire, and permits an operator to determine readily which wires are in trouble and to reduce the effects of the fall in potential in the common wire on the safety apparatus itself.

821,386. APPARATUS FOR OPERATING AND CONTROLLING RAILWAY SWITCHES AND SIGNALS; John D. Taylor, Buffalo, N. Y. App. filed June 20, 1903. Additional details of the above.

821,400. BALL-BEARING ELECTRIC TROLLEY WHEEL; Robert S. Boyle, Fort Branch and Walter G. Cleveland, Cynthiana, Ind. App. filed June 16, 1904. Journal bearings of the trolley wheel are made in two parts so as to be capable of receiving the race-ways of a ball bearing and which is thereby removable when desired.

821,401. INSULATOR; Taylor Carter, Frankfort, Ky. App. filed May 23, 1905. The insulator has a diametral hole for the wire and a zigzag slot by which the wire is introduced into the hole. A plate with forked ends is afterwards positioned to preclude removal of the wire.

821,418. AUTOMATICALLY REGULATING LIQUID RHEOSTAT OPERATED BY MEANS OF COMPRESSED AIR; Coloman De Kando, Budapest, Austria-Hungary. App. filed Nov. 27, 1903.

821,431. TIME LIMIT DASH POT; William B. Potter, Schenectady, N. Y. App. filed July 25, 1903.

821,435. RAILWAY SWITCHING AND SIGNALING APPARATUS; Wilmer W. Salmon, Buffalo, N. Y. App. filed Mar. 28, 1904. A small magneto generator has a rack and pinion connection with the semaphore arm so as to be rotated and transmit a signal whenever the semaphore arm is moved to safety position.

821,444. ROSETTE; Julius Ch. Tournier, Schenectady, N. Y. App. filed Sept. 28, 1904. A two-part rosette, the inside base or block of which has terminals for the engagement of the wire. The outside block is screwed to the moulding and constitutes a support for the inside base or block.

821,459. SIGNALING DEVICE; Neal A. Butler, Hampton, Va. App. filed Aug. 4, 1905. A mercury thermometer has a piston in the tube therof which is connected to mechanically close an alarm circuit when the temperature rises to an undue degree.

821,470. ELECTRIC LAMP; John T. H. Dempster, Schenectady, N. Y. App. filed Dec. 19, 1903. In order to avoid the heating filament of a mecury vapor lamp from fusing to the glass supports along its length, graphite bushings are provided for these supports through which the filament extends.

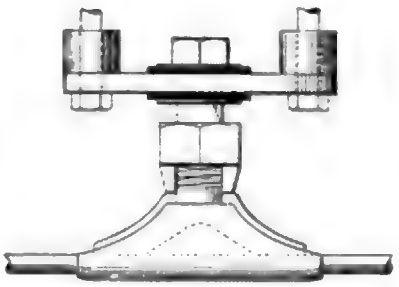
821,482. TELEPHONE SYSTEM; James H. Gorden, Copper, Tex. App. filed June 10, 1903.

821,495. RAILWAY SWITCHING AND SIGNALING APPARATUS; Winthrop K. Howe, Buffalo, N. Y. App. filed Aug. 29, 1905. Mechanical details of a motor connection for throwing the switch point, positioning the usual guard, and transmitting a signal.

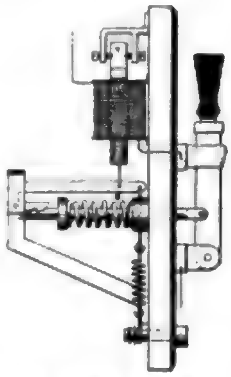
821,504. RETARDING DEVICE FOR ELECTROMAGNETS; Patrick Kennedy, New York, N. Y. App. filed Feb. 13, 1905. Automatic means for actuating make and break device for an electric circuit actuated by a power magnet which attracts its armature slowly, retarded by a clock train and fan.

821,506. ELECTRIC TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Aug. 26, 1905. Has two sources of unequal electromotive force connected in opposition to one another, a single contact Morse key connected in shunt around one of said sources, and a capacity connected in series between the terminals of said sources.

821,512. TROLLEY WIRE HANGER; Adam J. Laverty, Athens, O. App. filed Apr. 21, 1905. The hanger has grooves to receive the wire and a yoke with a screw connection for pressing it into the groove so as to bind the wire and hold it in place. The device is applicable to joining the ends of a broken conductor.



821,512.—Trolley Wire Hanger.



821,586.—Circuit Breaker.

821,515. RAILWAY SIGNAL; John B. Lineback, Siloam Springs, Ark. App. filed Dec. 14, 1905. The patentee provides electric lights along the whole extent of the roadway where one or another of them is constantly in view of the engineer and prescribes a code of signals based on the fluctuations of the lamps for transmitting messages to the trains.

821,516. PROCESS OF RECOVERING COPPER AND OTHER VALUES FROM CERTAIN ORES; Thomas J. Lovett, Chicago, Ill. App. filed Jan. 16, 1906.

821,521. METHOD OF OPERATING A MULTIPHASE TRANSFORMER HAVING THE WINDINGS FOR ONE PHASE INOPERATIVE. Walter S. Moody, Schenectady, N. Y. App. filed Oct. 22, 1904.

821,581. FIRE ALARM SYSTEM; Benjamin F. Beane and Roy P. Bennett, New Paris, O. App. filed July 10, 1905. Details of a fire alarm system for small towns and villages. Provides for ringing a church bell by means of a drum and weight which is released by the alarm.

821,586. CIRCUIT BREAKER; Edgar W. Gough, Great Barrington, Mass. App. filed Dec. 30, 1904. A knife blade switch of the ordinary form has an extension extending through the panel of the switchboard which is spring pressed to open the switch, but restrained by a detent under the control of a circuit breaking magnet.

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NEW YORK, SATURDAY, JUNE 9, 1906.

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Atlantic City Convention of the N. E. L. A..........Supplement

National Electric Light Convention.

As we go to press the Atlantic City Convention of the National Electric Light Association is in full swing, with every promise of being one of the most successful meetings in the history of that body. As the report of the proceedings cannot be prepared in time for printing in the body of this issue, abstracts of the papers and of the discussion of the papers read prior to Thursday will be printed in a supplement forming part of this number.

Lightning Protection.

The N. E. L. A. report on this subject, presented at Atlantic City, makes, as usual, interesting reading. Obviously, the information obtained by the committee regarding individual troubles must be rather meagre, since only immediate investigation on the ground can do the matter up with real thoroughness; but when enough reports are received to give the statistical method proper weight, the conclusions are valuable. The fact which stands out very conspicuously in the results here reported is the impartial way in which Jove distributes his favors. All classes of plants suffered, the low-tension and the high-tension in about equal proportion, and as usual the transformers bore the brunt of the attack. It seems probable that the high-tension lines should be credited on the whole with a rather better chance of immunity than the low-tension ones, perhaps because of higher factors of safety in some parts of the insulation; but the difference is not very great. It appears mainly in the matter of accidents from lightning per mile of line, and even this information is far from definite. If two companies, each working with a factor of safety of, say, 3 in the insulation, operate one at 2,300 volts and the other at 10,000 volts, the former should have on general principles rather the more trouble from lightning since it has an absolute margin of safety of 4,600 volts as against 20,000 volts in the latter. A certain rather large proportion of lightning discharges of the less severe sort would break down the former and would fail against the higher insulation, which is perhaps enough to account for the observed facts. In case of severe discharges the difference in insulation strength becomes insignificant.

We note one case in which a plant with small 6,600-volt generators suffered repeated damage to the armatures in spite of the lightning arresters. In such an instance the resonance theory propounded by the committee offers a simple explanation of the facts, although we think a still simpler one may be the lack of a proper factor of safety in the armature insulation, the generators being of exceptionally high voltage for their output, so that there would be a considerable chance of reduced insulation to save space in the slots. In general, armatures seem to have suffered little, the transformers being the weak point or at least the point of greatest danger. As to the means taken for protection, there seems to have been gradual improvement in the performance, the complaints being directed mainly at some weak points in the arresters themselves, notably the resistances. It is no easy matter to provide high resistance of large instantaneous carrying capacities, which at the same time shall be cheap and compact. In order that the series resistance may be enough to prevent disastrous results, it cannot be reduced with impunity, and being kept high, there is a tremendous concentration of energy when trouble comes.

To our notion the arrester with shunted gaps offers by far the best chance for good general results, but neither it nor any other form can be greatly reduced in size without getting into trouble. Arresters are best made big enough and robust enough to stand hard knocks without being put out of service. One matter of interest in the reports relates to the grounded guard wire. On the face of the facts the guard wires cut very little figure in the results. Ten cases of their use were reported and six companies suffered from lightning. Of companies not using such wires, 94 reported, and of these 48 had injuries to report. As the committee remarks, such wires on distribution systems are a nuisance. If used anywhere with effect, it would be in our judgment on particularly exposed parts of certain transmission lines, where it might pay to install stranded cables of size sufficient to avoid mechanical difficulties. Next year we hope the committee will turn special attention to the effect of steel poles and tower construction upon troubles from lightning. Owing to the freedom with which such construction is now employed, the coming year should yield data enough to be of real value. One of the most valuable suggestions in the report is that for the symtomatic treatment of lightning troubles. Experience certainly shows that lightning does strike twice in the same place—in fact shows an apparent liking for certain localities, sometimes exposed hill tops, at other times narrow valleys. The topographical relations of thunderstorms need investigation, and lacking general data, the individual engineer should look into it on his own account. One cannot determine the location of his line on this basis, but he can at least lay out a special system of protection to cover points shown by experience to be dangerous. Dealing with lightning at present is a frankly empirical matter, which needs united effort for its elucidation.

Measuring Sparking Voltages.

The sparking distance in air with varying voltage is always an interesting problem and practically important in many ways. The results are also very discordant, as a general rule. Every thing depends upon the experimental conditions. Air has, perhaps, a definite electric strength at a given pressure and temperature, depending upon the conditions permitting and suppressing ionisation. There are, however, at least two sources of disturbances in observing this dielectric strength. One is the action which occurs at the surface of any electrode, no matter how flat or smooth, possibly in a surface condensation layer of gas, whereby an initial voltage must be applied to split this film electrically, before allowing for the strength of the air between the electrodes. The other disturbing cause is the wedge cleavage action of points, edges or convexities on the electrodes. Air which would stand three kilovolts per millimetre as a slab between opposed flat electrodes, may give way at one kilovolt per millimetre between slightly rounded electrodes, at 800 volts per mm. between sharply rounded electrodes and at 500 volts per mm. between sharp needle points. An interesting method of measuring direct-current sparking voltages appears in a paper read by Mr. E. A. Watson before the Birmingham Section of the British Institution of Electrical Engineers, an abstract of which is given in the Digest. A Wimshurst electrical machine charges a pair of condensers in series, and the average current strength of the charging current is observed. The number of spark discharges per minute over a measured spark-gap is also observed. From these data the average total electric quantity in each discharge is readily obtained, and hence the average discharging voltage of the condensers. Using discharging knobs of different sizes the mean electric strength of the air in the spark gap varied between 3.5 kilovolts per mm. between 1¼" balls at 1 cm. apart, and 1.05 kilovolts per mm. between ¼" balls at 9 cm. apart.

Current Locus of the Induction Motor.

The graphic method set forth in the articles of Dr. A. S. M'Allister appearing in our issues of the 21st of April and 26th of May, and commented upon elsewhere in this issue by Mr. B. A. Behrend, constitutes a distinct advance in the engineering theory of the polyphase induction motor. A similar advance was made in the engineering theory of the transformer by the convention of the equivalent level transformer and its equivalent conductive circuit. This convention overjumped the insulating barrier between primary and secondary windings and made them both parts of one and the same circuit. The polyphase induction motor was also known to be capable of similar treatment, with the further convention of a fictitious resistance load in the secondary part of the circuit, the magnitude of this fictitious resistance being a function of the slip. Owing, however, to the large magnetizing current in the induction motor, viewed as a transformer, the equivalent circuit diagram did not much simplify the theory; because, according to that theory, the leakage circuit representing the excitation, had to be placed midway between the primary and secondary winding. By boldly transgressing this rule and placing the leakage circuit across the outside mains, Dr. M'Allister has greatly simplified the problem, without incurring an excessive penalty of error. He has been cruel to rigid accuracy, only to be kind to the student of engineering and the designer of induction motors. On the basis of the new convention, and assuming the locus of the vector primary current in a polyphase induction motor to be a simple circle, as first pointed out by Behrend and Heyland, all approximate computations connected therewith are now greatly abridged.

The Maintenance and Calibration of Service Meters.

The paper on this subject by Mr. William Bradshaw, read at the Atlantic City Convention of the National Electric Light Association, well illustrates the types of apparatus necessary in order to maintain customer's recording watt-hour meters in good operating condition. First comes the portable standard watt-hour meter, which is carried by the inspector to the house where the meter to be tested is installed. The portable standard is placed in circuit with the tested instrument, and the test is made by observing the difference in speeds on selected loads. The portable standard is calibrated to a declared degree of accuracy of 2 per cent, at all loads from 2 per cent to 150 per cent of full load. It is checked from time to time, at the office, by comparison with a precision wattmeter calibrated to a declared precision of one-seventh of 1 per cent at full load. This precision wattmeter, or station standard, is itself checked, at longer intervals, by comparison with potentiometers, either in the station, the factory, or a standardizing bureau. Consequently there is a sort of apostolic succession between the primary standards kept at Washington and the customer's watt-hour meters in Maine or Texas, whereby, by the laying on of hands, in a succession that may often be remote, the international volt as determined by standard cells, acquires sway over the dials of the distant meter, the degree of possible inaccuracy ever broadening as the pathway from Washington gets longer, and time or decay assert their influence. Sooner or later, however, the watt-hour meter which rebels against the international watt becomes withdrawn from service and the international watt is kept on tap all over the land with a reasonable or commercial degree of precision.

LINE CONSTRUCTION.

The paper read by Mr. Paul Spencer before the Atlantic City N. E. L. A. convention on line construction is a very valuable résumé of good practice, which may be well taken as a guide to first-class work. If its suggestions are carried out the result will be a system which should give singularly efficient and reliable service. We especially would call attention to his sharp condemnation of so-called temporary work which has been responsible for no small amount of bad service and many accidents. There are occasions when hasty work has to be done, but there is no time when it should be allowed to rest as good enough. Construction in ordinary distributing plants is so frequently careless that an unnecessary prejudice against overhead circuits has been created, to the great cost of many a company thereby forced into conduit work long before conditions have warranted it. And we want to add to Mr. Spencer's remarks concerning danger from foreign wires, the suggestion that not only are telegraph and telephone wires usually the first to go down under stress of weather, but that their number is so great in many places that only extraordinary watchfulness can keep them in good condition. On the whole, the electric light wires are much less unsightly and much less likely to fail than these others which have every year become more numerous. If the electric light wires can be kept above them, a reasonably safe condition is assured.

If it were not for the fact that telegraph and telephone wires, being numerous and of no very aesthetic appearance, have usually been massed themselves on rather high poles, it would be easy to keep above them. It now requires poles often 50 feet high or more to accomplish the purpose. If a systematic effort were made to simplify all overhead wiring of every kind, much could be done in the way of averting the costly and troublesome necessity of going into conduits. Mr. Spencer's suggestion of using poles in common is often put into practice, but rarely in any complete fashion. Even trolley feeders could thus be accommodated, and when a trolley system is thus practically reduced to its necessary working conductor, such a system is altogether neat and inoffensive in appearance. In this way, too, interference with trees, often very annoying, could be reduced to a minimum. By the time a city tree has encountered the telephone lines, the electric railway feeders and the electric light wires, it needs more lives than a cat to escape destruction. By good and carefully planned work, such as Mr. Spencer lays out, extended so far as may be needful to all electrical conductors, an overhead system can be made entirely suitable for any city too small—as most cities are, and will be—to justify the cost of going to conduits. This happy condition, however, can be reached only through the hearty co-operation of all electrical interests with the municipal authorities. Nor can it be reached unless the powers-that-be deal out even-handed justice to all comers, letting none escape, instead of browbeating one with threats of conduits while letting veteran sinners continue undisturbed in their reprehensible ways.

THE MEASUREMENT OF TEMPERATURE BY ELECTRICAL MEANS.

There are two different methods of measuring temperature electrically, namely, the e.m.f. method and the resistance method. These are totally different and depend upon different properties of metallic substances. The e.m.f. method depends upon thermoelectric action. According to the electronic theory, if a certain metal, say copper, possesses a given average number of free negative corpuscles per cubic centimeter, while at the same temperature iron possesses a larger number of such free corpuscles, then, when these two metals are brought into contact the iron will tend by surplusage to diffuse free corpuscles across the mutual bounding surface at the junction, and the copper will be made negative by the reception of negative electricity, while the iron will correspondingly become positive. Since the rate of diffusion of free corpuscles increases in each metal with the temperature, so, also will the e.m.f. of the junction. In order to have a resultant thermal e.m.f. in a closed bimetallic circuit, a difference of temperature is, of course, necessary between the two junctions. Conversely, by the measurement of this resultant e.m.f., the difference of temperature becomes known. The resistance method depends upon the fact that metals increase in resistivity with temperature. According to the electronic theory, the mean free path of the corpuscles in metal diminishes as the temperature rises. This has the same effect on the electric conductivity as though the length of path remained unchanged, but the number of free corpuscles diminished. But however we try to picture the action to our minds, the fact is perfectly definite that at the standard temperature of melting ice, pure metals increase in resistivity about four-tenths of one per cent per degree Centigrade. Moreover, the rate of increase follows a straight-line law with respect to temperature up to at least moderate temperature elevations, such as 100° C. For high temperatures the straight-line law appears to be deviated from, in some metals at least.

An interesting paper on the measurement of temperature by electrical means was read at the Milwaukee Convention of the American Institute of Electrical Engineers by Dr. Edwin F. Northrup. The paper is addressed almost entirely to the electric resistance method, and suggests a number of important details in the technique of the manufacture, use and maintenance of resistance thermometers, such as go to make the difference between satisfaction and dissatisfaction in their application. In the first place a special brand of nearly pure platinum is recommended for its uniformity and relatively high temperature coefficient. Then precautions have to be taken to prevent the platinum from dissolving or absorbing metallic vapors at high temperatures. Pure nickel wire is also recommended for moderate temperature thermometers. The beautiful principle of the Kelvin double Wheatstone bridge is also recommended for use with low-resistance thermometers. In such cases the resistance coils can be made very compact, and of dimensions comparable with those of a thermo-junction. For direct reading purposes a special form of D'Arsonval differential galvanometer, called a ratiometer, is described, in which the control is magnetic instead of elastic. That is, the coils lie flat in a dissymmetrical magnetic field, such that the differential magnetic actions cause the movable system to seek a definite magnetic displacement. The three leading-in wires are arranged to exert jointly a negligible torque about the axis of pivot rotation. Some of the results reported with the various types of instruments described constitute jointly a valuable research on temperature measurement and its automatic recording.

N. E. L. A. Presidential Address.

The first portion of the address of President W. H. Blood, Jr., before the Atlantic City Convention was devoted to administrative matters. He pointed out that at the time of the Boston meeting, two years ago, the total membership was 588, while to-day it is 1,014. An increase of the dues of companies operating in the largest cities and the lowering of the dues of companies operating in small towns were suggested. He recommended the abolition of Class C—college professors—and that henceforth professors be treated as honorary members, and that no fees be exacted; that they be admitted upon invitation only, and that each case be passed upon annually by the Executive Committee. He considered that while the fellowship was desired of earnest educators for their own sake and because of the influence which they have over the hundreds of young men they are sending out each year from the technical schools, the association has no place for the instructor, with only academic ideas as to corporate management, who in his capacity as consulting engineer either ignorantly or wilfully misrepresents the facts. He referred to the central station advertising display as emphasizing the fact that "business-getting" is one of the important parts of the successful electric lighting enterprise.

The past year, he said, has shown a healthy growth of the electric lighting business, but it is not notable as having given birth to any marked innovation in the physical part of the business. The size of generating units continues to increase, distribution by high-tension alternating current is becoming more and more general, and minor improvements all along the line are extending the utility of this system. Undeveloped water powers, which a few years ago were valueless are to-day being eagerly sought out, and by means of improved water wheels and high-tension lines are being made available for large sections of the country. Gas engines, steam turbines and other prime-movers are receiving the careful attention of enterprising engineers, because we are all beginning to realize, more and more forcibly each year, that the great losses between the coal pile and the dynamo must be cut down.

There has been a marked increase in centralizing the ownership of electrical undertakings. This has benefited the communities served, by bringing to their service better managerial as well as improved operating methods. This centralization is causing electrical managers to look more closely to their markets, and to-day the company that has not a "New Business-Getting" department is sadly behind the times.

For many years by far the largest portion of the manager's time was spent in trying to better the physical condition of his plant and in reducing operating expenses to a minimum. To-day he is reaching out to supply all possible demands and through his corps of trained solicitors is endeavoring to load the plant with long-hour users of current, thus giving to the customer a low rate, while the company is better enabled to make a fair return upon its investment.

Allied with the question of rates is the problem of government supervision or regulation. This matter is demanding serious consideration at the present time. Witness the Massachusetts Gas and Electric Light Commission, which has been in existence many years, the newly formed New York State Lighting Commission and the bill just passed by the Massachusetts Legislature adopting the English automatic method of control called "The Sliding Scale System."

A study of the municipal undertakings in Great Britain and the constantly growing list of municipal failures in the United States shows that municipal ownership is, in fact, no longer as popular as it once was. Some agitation, however, is being kept alive by the socialist, by the unscrupulous political agitator and by the "yellow journal," whose whole fabric is based upon class hatred, whose teachings are that all riches come through stealing from the poor and whose very existence depends upon its ability to pervert the facts and to "fake" reports so as to make interesting reading for that part of the public loving sensation.

The proper treatment for the wilful perversion of public opinion by the press is a difficult problem. Our laws as to the deliberate publication in newspapers of false and wilfully misleading statements are not sufficiently severe. However, there still remains a powerful antidote in the hands of the public. The main support of the newspaper is its income from advertising. Its value as an advertising medium depends upon the quality and quantity of its circulation, and if those who advertise will exercise a healthy discrimination between those journals whose policies and performances are calculated to promote or to destroy the interests of their advertisers, the power for evil of some of them will be reduced.

A general reduction in price for electricity and a readjustment of rates is constantly taking place all over the country. Flat rates are fast becoming things of the past, and watt-hour meters, in conjunction with various kinds of demand systems, are now almost universally used. Although the public has been for years trying to understand the "demand" system of charging, it still objects to it, and there is a feeling in some quarters that we may have to return to the straight meter rate, which, although admittedly unjust and unfair, still has a decided advantage in its simplicity.

Along with the general reduction in rates is a lowering of the charges for street lighting, and in this connection it should be borne in mind that the lower this rate is the less liable is there to disturbance by municipal ownership agitation or by competition of any kind.

It is an unfortunate fact that, from time to time, we see in the public press erratic and even false assertions in regard to electric lighting properties. Public speakers also are altogether too prone to make unwarranted statements. Let us be more active, more aggressive to refute these unwarranted charges and by voluntary publicity of the facts as to our properties, by fair rates and by straightforward dealings with those in authority and with the public, show to all people that the electric lighting business of the United States is done "on the square."

Electric Heating in New Jersey.

Appreciating the importance of educating the general public in the use, as well as the construction of domestic electric appliances, the United Electric Company, of New Jersey, co-operated heartily with the Stevens Club, of Newark, N. J., recently, in making a success of an entertainment given in that city by that body. The lecture was delivered on that occasion by Mr. Max Loewenthal on "Household Uses of Electricity," with special reference to electric cooking and heating. A great variety of cooking and heating utensils and other domestic current using appliances were displayed on a table set on a platform.

Mr. Loewenthal sketched in a few words the development of the electric heating industry and the relation of this branch of electrical engineering to others with which the public is better acquainted and showed by a number of interesting experiments the great utility and economy of the devices which were exhibited. During the course of the lecture Mrs. Loewenthal prepared on the electric cooking utensils a complete meal, which was served to those present, who were desirous of tasting the food so wholesomely prepared. Before and after the lecture vocal selections were rendered by the Stevens Quartette. It was near midnight when this very interesting and entertaining affair came to a close.

The United Electric Company, of New Jersey, not only placed at the disposal of the club all the utensils exhibited by the lecturer, but furnished all the wiring from the nearest outlet to the various switches at the table and had special leaflets prepared which were distributed during the evening. A clever point also was made in noting on the menu the particular cooking device with which each dish had been prepared.

Canadian Electrical Trades Exhibition.

An electrical exhibition will be held at Victoria Rink, Montreal, Can., September 17 to September 22, inclusive, under the auspices of the Electrical Contractors' Association. Mr. E. W. Sayer, 204 St. James Street, is chairman of the managing committee.

The Murray Automatic Printing Telegraph System in Europe.

By Donald Murray.

The Murray automatic page-printing telegraph system has now been installed between St. Petersburg and Moscow. Some remarkably successful trials of the system have been carried out on long Russian telegraph lines. On February 23, 1906, a telegraphic loop line was made up as follows: St. Petersburg, Moscow, Smolensk, Vitebsk, St. Petersburg. The loop was triangular in shape and the length of the line was 1,106 miles (1,770 km.). The wire was 5-mm. iron (about 600 lb., 8.88 ohms per mile), and there were two Wheatstone repeating stations, one at Moscow and one at Vitebsk. The Wheatstone automatic system (using the Morse alphabet) got 55 words per minute perfectly, but failed at 60 words per minute. The Murray system (using the Baudot alphabet) under exactly the same conditions, got 90 words per minute perfectly, but failed at 100 words per minute.

On February 24, 1906, the following loop was made up: St. Petersburg, Yaroslavl, Kazan, Moscow, St. Petersburg, a distance of 1,926 miles (3,082 km.), 5-mm. iron wire (600 lb. per mile), with repeating stations at Yaroslavl, Kazan and Moscow. The speeds obtained were indefinite as one of the sections was not in good condition. The Wheatstone got about 35 to 40 words a minute, and at times a little higher. The Murray system got 56 words per minute, and ten messages were transmitted and printed. They were found to contain two wrong letters, a remarkably good result considering the condition of part of the line. This is the first time on record that a printing telegraph has worked over such a distance as 1,900 miles, even of copper wire, and in this case the wire was iron.

On February 25, 1906, a trial was made of a loop without a repeater from St. Petersburg to Moscow and back, 800 miles (1,280 km.), 5-mm. iron wire, about 7,100 ohms in the line and 800 ohms in the receiving relay, battery 140 volts, and arriving current 13 milli-amperes. The maximum speed of the Wheatstone (Morse alphabet) was 25 words per minute. The Murray system (Baudot alphabet) under exactly the same conditions got 63 words per minute easily and perfectly. Ten messages were transmitted and printed without an error.

On March 9, 1906, a trial of the Murray system was made from Berlin to St. Petersburg direct without a repeater. The length of this line is about 1,080 miles (1,728 km.). From St. Petersburg to Eydtkuhnen on the German frontier the line consists of 600 miles of 5-mm. iron wire, and from Eydtkuhnen to Berlin 480 miles of 3-millimetre copper wire (4.37 ohms per mile). The total resistance of the line was 7,425 ohms. The trial was from 8.30 to 9.30 a.m., Berlin time. Berlin tested the wire and reported that it was "not clean" (nicht rein) and wet snow was falling in St. Petersburg, where there was a thaw. After a few experiments a speed of 70 words per minute was reached perfectly with the Murray system on this line, the German typewriter sentence containing all the letters of the alphabet, "Kaufen Sie jede Woche vier gute bequeme Pelze xy 1234567890," being transmitted and received over and over again perfectly for about ten minutes. Traffic requirements did not permit of further experiments, but it is probable that by the use of a shunted condenser and increased battery power the speed might have been raised up to 80 or 90 words per minute. The highly favorable results obtained with the Murray system during these trials are explained by the inventor as being chiefly due to the employment of the Baudot alphabet, which is shorter than the Morse in the ratio of five to eight. It may also be mentioned that the inductive interference from neighboring wires was very severe on these long lines and was an important factor in limiting the speeds obtained. The Wheatstone apparatus was well adjusted by skillful mechanics, and the results were as good as could be expected from it under the conditions. Special artifices such as shunted condensers were not employed.

Whatever truth there may be in the newspaper reports about other departments of the Russian Government, the Russian telegraph service appears to be efficiently managed. Both in St. Petersburg and Moscow, the head telegraph offices were up-to-date and well equipped and arranged, and the officials hard working, capable and well instructed. The volume of messages handled in Russia is far less than in Great Britain, about 20 millions as against 90 millions per annum; but on the other hand the territory served by the Russian telegraphs is vastly greater, and the enormous Russian distances and the arctic winters have introduced special technical difficulties which have been surmounted in a way that would do credit even to American telegraphic enterprise. There is a general demand on the part of the public for an extension of postal and telegraph facilities, and there are hopes that the newly elected Duma, or Imperial Parliament, will recommend the appropriation of sufficient funds to enable these increased facilities to be provided. Meanwhile the Russian post and telegraph department has made the best use of the means at its disposal, and succeeds in bringing in a very large annual profit to the State.

For working over moderate distances the Hughes is employed, and nearly all the long-distance circuits are equipped with the Wheatstone automatic, the received tape being handed to typewriter girls for transcription, a considerable number of typewriters being used for this purpose both in the St. Petersburg and Moscow telegraph offices. Nearly all the telegraph wires are 5-mm. iron (about 600 lb. per mile) and this fact combined with the colossal distances renders the use of an automatic system such as the Wheatstone inevitable. There are about 16 Wheatstone circuits in Russia, among others St. Petersburg to Rostov, 1,100 miles and two repeaters, Kazan and Omsk, 1,000 miles and one repeater; Omsk and Irkutsk, 1,200 miles and two repeaters; St. Petersburg to Odessa, 1,000 miles and two repeaters. From Irkutsk to Vladivostok is roughly about 1,800 miles, and from St. Petersburg to Vladivostok about 5,000 miles. The longest Wheatstone circuit in Russia is the special wire from St. Petersburg to Irkutsk on Lake Baikal. This is 6-mm. iron wire (about 800 lb. per mile), and the length of the circuit is about 3,800 miles with six repeater stations. Pekin is roughly about 1,000 miles from Irkutsk, and on one occasion the experiment was made of working through direct from St. Petersburg to Pekin. A speed of 30 words per minute was reached quite clearly, a noteworthy achievement considering that the line consists of over 4,500 miles of iron wire.

The Murray system has now been working for about two years between Edinburgh and London, and a complete duplex installation is being constructed for London-Dublin. The system has also been working for more than a year between Hamburg and Berlin, and it is working between St. Petersburg and Moscow. The Indian Telegraph Department has ordered a complete duplex equipment for use between Calcutta and Bombay, a distance of 1,200 miles, and the Austrian Administration is having an experimental set constructed for trial between Vienna and Prague. When sets have been installed between London and Berlin and between Berlin and St. Petersburg it will be possible (owing to the power of retransmitting messages automatically from the received Murray tape) for any of the cities—Edinburgh, Dublin, London, Berlin, Hamburg, St. Petersburg and Moscow (and by and by Vienna) to exchange telegrams with each other automatically without disturbing the local traffic between any two of these cities.

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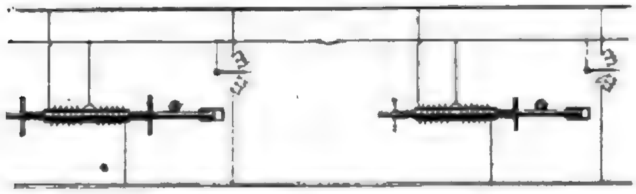
New Multiple-Unit Control System.

A patent issued May 22 to Mr. H. McL. Harding and Charles Martin Clark describes a new multiple unit control system, the main feature of which is the use of a single pilot wire extending throughout a train. With this single wire the motors of all the cars can be controlled to standstill, full speed forward, full speed reverse or any intermediate relation. The essential feature of the control mechanism lies in a differentially wound magnetic operating device. Assuming a solenoid with two equal differential windings in series, one end is connected to the line, the other end through the car to ground, and the middle to the pilot wire. In connection with this arrangement is a rheostat, one side of which is connected to line, the other side to ground, and the contact handle to the pilot wire.

With the rheostat handle in mid-position (where it may be on a "dead" contact) the potential of the pilot wire is 250 volts, assuming a circuit voltage of 500 volts. If now the rheostat arm is moved so as to cut out resistance on the line side, the voltage of the pilot wire is increased; and if moved in the reverse direction toward the ground side, the pilot wire voltage is decreased. When the voltage of the middle point of the solenoid is 250, at which the m.m.f's of the two windings neutralize each other, the core is held by springs in a mid-position. With increase or decrease of pilot wire voltage, this balance is destroyed, one coil carries more current than the other, and the core is moved in one direction or another, the amount of movement depending upon the change of voltage in the pilot wire which, in turn, depends upon the arc through which the rheostat handle is moved. It is this movement of the solenoid core which operates the motor controller. Movement of the rheostat handle in any car causes, of course, all of the motor controllers of a train to be operated synchronously to stop, start, reverse or change speed. The accompanying cut illustrates the system diagrammatically.



MULTIPLE-UNIT CONTROL SYSTEM.

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A. I. E. E. Presidential Address of Dr. S. S. Wheeler.

ENGINEERING HONOR.

While I have prepared in writing something of an annual address, as required by the Constitution, I shall try to express the substance of my theme to you directly, because I attach some importance to the emphasis that can be given only in this way. All that I would say has been summarized by Francis Bacon in the preface to his "Maxims of the Law" where he says:

"I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto."

I feel that I cannot make a better use of the opportunity afforded me by this occasion to reach electrical engineers and the engineering profession, nor can I do our profession a greater service, than by raising my small voice in support of the principle so admirably stated by Lord Bacon. I will use my opportunity to urge that engineers interest themselves in improving the moral standard or the ethics of the profession and in strengthening their sense of the obligation that binds all engineers to a course that is particularly honorable.

We, as engineers, are accustomed to hearing ourselves referred to as professional men. The habit of calling us professional, though not strictly accurate, does no harm, and by encouraging us to greater care and conscientiousness ought to benefit. The relations between the clergyman, physician, or lawyer and his parishioner or client are regarded by law and usage as especially sacred and inviolable, and the obligation imposed upon the professional man to be faithful to the interests of the client or protege is equally strong. It is not in my mind to dwell upon these relations or even to attempt to describe them, because they are well known and established and the subject has been treated by many great authorities.

My wish is to draw the attention of engineers and others who are engaged for the people in handling the forces of nature and in interpreting its laws, to the propriety and necessity of regarding themselves as in the same category with the strictly professional man. The attitude of the public contributes to this obligation. The public considers (much more than there is reason for) that the several branches of engineering are special subjects and not easily within the comprehension of the layman, and therefore it places itself in the hands of the engineer. He is thus put under the utmost moral and professional obligation. The duty is as great as that of the physician to his patient, although engineers as yet do not generally recognize such responsibility.

On the other hand, the public finds no such declaration of high standards in the engineering profession as in the older professions. It is therefore inclined to treat the engineer lightly in ethics, and to withhold from him that deference which, if rendered, would in itself encourage a higher professional standard.

That much thought has already been given to the subject by engineers, architects, etc., is shown by the numerous discussions which have taken place in many of the societies. The conclusions reached by many of them, as expressed in the several codes of ethics formally adopted for the guidance of members, are very interesting and helpful. I ask "leave to print" at the close of these remarks, reference to these discussions and codes, with acknowledgment for the valuable assistance of my friend, Mr. Edwin Burt Douglas.

In a few cases, however, being prepared principally with a view to the relations of the members of the profession to each other, these codes are rather narrow and in the style of labor union rules. This suggests that greater weight be given in them to the interests of the client and the interests of the public.

The electrical branch of engineering, being the youngest, has not yet formally taken up the question of ethics, but should do so and will have the aid of the experience of all other branches of the profession.

The moral duties of the engineer may be summarized as follows:

First, the duty to the client. To see that his interests are protected, that he is wisely educated, or advised as to what he ought to have. That he gets it. That information pertaining to him does not reach others.

Second, the duty to the public. To see that the public is not imposed upon by misinformation. The newspapers are full of descriptions of schemes which mislead the public and of wildcat stories that are a reflection on the engineering profession. Engineers are frequently called upon to discuss such schemes and to point out their absurdity; and are frequently unable to convince the layman that they are without merit, because the public mind is not sufficiently educated in engineering matters and because the professional standing of engineers in the community is not high enough.

Third, the duty to the engineering societies, which involves contributing to their welfare, both in time for administration and the preparation of technical contributions and discussions, and in money. There are three reasons for this obligation: first, the society represents the art or craft by which the engineer supports himself. Surely he owes it some debt; second, it is to his advantage that the branch to which he belongs should attain a position of strength and recognition, and that it should command respect for its opinions and endorsements; third, he should so conduct himself as to stand well in his society, whose members are his peers, and are therefore the men whose commendation the world will accept.

THE ENGINEER'S DUTY TO HIS CLIENT.

This is, of course, the most important obligation to be considered, and the one to which all others must give way if there is any conflict. This is the direction in which improvement in the attainment of loftier ideals, which may be expected from natural evolution as time goes on, will be most appreciated by the public, since in this direction the public is most affected. It is hardly necessary to say that the client is entitled to the very best there is in the engineer in thought and in service or execution, and I mention it only to make the statement complete. In drawing a comparison between our profession and the older or recognized ones with a view to selecting the lines along which we should try to guide our evolution and improve our standards, while I believe that the essential principles involved are the same, and that we should set our aim at as high and even a higher standard, there are some considerations which must not be neglected and which necessarily call for the employment of slightly different means in attaining the same end.

Many supposedly independent consulting engineers have affiliations with engineering or manufacturing concerns interested in the introduction and use of a particular apparatus. The engineer usually recommends the same apparatus, and its manufacturer recommends the engineer to clients. It is often held that the best engineers are subject to such affiliations, because the best are sought after and the absence of such affiliation is an indication of lack of capacity. This is not completely true, and there are many good men doing general work, though not nearly so large a proportion as of general practitioners in law or in medicine. The circumstance, however, imposes upon those who are subject to such relations the obligation to be especially careful when advising a client to acquaint him fully with the fact of such relation and to divest themselves at the moment of any influence which might bias their judgment. Their advice will then have the increased value due to their special knowledge and experience.

Another fact which differentiates engineering from other classes of professional work is that study and work for a client takes the shape of drawings and data, which are usually regarded as the property of the engineer and not of the client. Such records are often voluminous, and are an exact statement of the affairs of the client as far as they go. Obviously, the custody of such matter involves important points in the relation of the engineer and the client, and if misused the consequences to the client may be serious. Even when an engineer is on the simple basis of an employe, it is sometimes suggested that sketches and data, such as may be contained in note books, are his personal property. In this connection the fact that nearly the entire work of the engineer is reduced to and is represented by drawings and figures as stated, gives the subject great importance. Perhaps here is the greatest difference between the engineering and the other professions. There is no parallel in the so-called learned professions, and the client or patient, almost without exception, employs aid simply for experience and advice, and at no time does occasion arise for the reduction to a minute record of the preliminary or final results. In this respect moral responsibility devolves upon the engineer in greater degree than upon others. The point may well be illustrated in a more ordinary connection by considering the possibility of a manufacturer, founder or artisan, furnishing to strangers articles made from designs, drawings or patterns, the property of others which happen to be in his possession.

Professional relationship between the engineer and client in respect to its confidential nature and its inviolability is not thought to be like that of the physician or lawyer to client or patient, and is not so recognized by law. I believe the courts should so recognize it, and in any event the engineer should so regard it as applying to himself, and if anything should be even more scrupulous than the physician or lawyer. In these days most engineering is done for corporations, but while corporations are "artificial" persons, they are, nevertheless, created by the State, and therefore the State has the right to dissolve them, to examine their books, to ask questions, etc.—rights which the State does not possess in the case of individuals. While this difference between the legal rights of corporations (which form the bulk of the clients of engineers) and the legal rights of individuals (who form all of the patients of doctors, all of the charges of clergymen, and many of the clients of lawyers) is not the cause of the difference in the legal status of the engineer's confidential advice compared with the advice of the physician or lawyer, it is yet suggestive of it and throws light upon it. Therefore, engineers should be the more careful in regard to matters of confidence.

To the engineer whose work is educational and whose clients are, therefore, his students is given the opportunity to exercise at once the most direct influence for engineering honor, by his teaching. We may, therefore, expect that the profession will receive its greatest help from him.

THE ENGINEER'S DUTY TO THE PUBLIC

Is largely educational or instructive. If the public believes that engineering is a subject it is not fitted by talent or training to deal with, whether it is justified or not in this belief, is not the engineer under the strongest obligation to guide it aright? When a man trusts you, you are bound to respect the trust, or you will lose your standing. We all know that a mass of misleading, foolish and sometimes deliberately deceptive information on engineering or scientific subjects is given out, circulated and published. All of this by its ultimate failure brings our occupation into disrepute. Many engineers, when asked, reply correctly, pointing out the misstatements and errors; but how many of us try to be good teachers? How many of us take care to see that the real facts, the real situation, the real need or the real possibilities are made plain to the layman? Take an ordinary case, such as the almost daily statement that someone has invented a new motor (not necessarily electric), so powerful that trains can be run a hundred or two hundred miles an hour by it. Assume that there are ten thousand engineers in the United States. I suppose that one thousand of these say each time the subject is brought to their attention that it is absurd; that they don't believe it; that it has been tried two or three times but never successfully, etc. How many of even the thousand do you suppose take enough interest in setting the public right, to spend enough time to say that travel at any such speed is entirely a question of roadbed and right-of-way, that it is easy enough to make motors of almost any kind having power enough to pull a car or train at these speeds, but that practical roadbed conditions prohibit it, and that the most perfect track ever built is so irregular that the train would be liable to jump the track at such a speed. Those who give true educational explanations in form digestible by the laymen do their duty to the public, and do it and their profession a service. It ought to be clear to every engineer, and it probably is, that the more the public is enabled to understand the real facts, the more discriminating an audience it will become for the appreciation of really meritorious feats of engineering. At present I fear that in the public estimation, telegraphing to Mars is far ahead of getting the drydock *Dewey* to Manila. When a man who is in a position to know, either as a result of training and education, or of Heaven-sent talents, is asked, by one who does not know, any question about engineering, physics, or the laws of nature, and he does not set that man right to the best of his ability, he is shirking his duty. Possibly he is assuming that he has a patent on some of the laws of nature, or a part interest. This view would not raise him in any one's estimation.

Another example occurs to me. I have seen a man as a witness in court, after qualifying as a patent expert, which means that he is officially clothed with authority as an engineer, and that he is there for the information of the court, spend hours and even days framing numerous answers to a single question, his sole object being to avoid, if possible, making a simple statement of the truth. The mistake, of course, is that the man confuses his duties and acts as an advocate, while the public understands that he is there as an engineer to make clear the facts. The result is well known and gives rise to the saying, "Liars,—liars and patent experts." The example serves my purpose well in illustrating by extremes what I mean when I say that it is the duty of an engineer to give the public the truest and simplest explanation of each engineering question when it comes up in his community, taking care to put it in such form as will be understood.

THE ENGINEER'S DUTY TO HIS PROFESSIONAL SOCIETY.

The other duties of the engineer I have placed before his duty to his professional society, because this latter relates to his solicitude for himself and his fellow engineers as distinguished from his solicitude for his client and for the public. The principle of doing something, however, for "your crowd" is so well established and recognized that it does not need full discussion here. I think even some animals act upon this principle. The institutions of crafts, societies, fraternities, guilds and the like, is very old, and the reasons for them are sound and well known. Yet there are those who pay no attention to the official society representing the profession to which they belong. Rare and peculiar birds.

Unfortunately, some societies are at times not well run. The meetings are sometimes monotonous, owing to the presentation of matter which does not happen to relate particularly to or interest the members then present. The groups of men are not well balanced, some being older men with wide experience, while others are the beginners, and sometimes the meeting quarters are not comfortable. None of these things is an excuse. If the profession is young and poor, so are you. If you have prospered you are a member of an important and successful profession, and then if the quarters are poor and the society not strong, it is your fault, because you have not contributed enough to make a society important in proportion to the position you have attained by work in the sphere of activity which it represents. There are many ways in which you can support, encourage, and contribute to the dignity of your professional society, and you can select those means which are most agreeable to your own methods. Even the mere attitude of approval of the society is of great value. It is well to give your profession and the public to understand that you believe in your society and follow its recommendations and standards.

A more commonplace but none the less positive reason for your obligation to contribute to the support of your society is that you are earning your living out of the art which it represents and which it is trying to dignify. Your obligation is, therefore, definite. It is also greatly to your interest that your profession be made as important and its position before the world as commanding as possible; and it would not be right were you to allow other professionals to bring about this result without your aid and then for you to reap any benefit from it.

In conclusion, I will mention what I believe to be the broadest and most important function of professional relations—an engineer's standing or the way in which he is regarded by his contemporaries. All the world recognizes that the best judgment of a workman is by other workmen, of a woman by other women, of a lawyer by other lawyers; likewise the best estimate of an engineer as a man and engineer is by the members of his own profession.

CURRENT NEWS AND NOTES.

THE WIRELESS TELEGRAPH CONFERENCE.—On the suggestion of the British Government, the International Wireless Telegraph Conference, which was to have taken place in Berlin this year, has been postponed from June 28 to October 10.

AMERICAN CIVIC FEDERATION IN GLASGOW.—The American National Civic Federation's committee inspected the Glasgow municipal electrical system on June 1. According to a dispatch the members expressed surprise at the efficiency of management and low rates for current.

PENNSYLVANIA INDEPENDENT TELEPHONE ASSOCIATION.—The next meeting of the Pennsylvania Independent Telephone Association will be held in Allentown on September 11, 12 and 13 next. Mr. H. E. Bradley, 135 South Second Street, Philadelphia, is the secretary of the association.

STATE CONTROL OF WIRES IN MASSACHUSETTS.—Governor Guild of Massachusetts has signed the bill authorizing the State of Massachusetts to assume control of telephone and telegraph wires operated within the State. The wires will be under the supervision of the State Highway Commission.

PROF. DR. OSTWALD has resigned the professorship which he held in the University of Leipzig for nearly twenty years, having decided to retire to his country house, where he has a private laboratory, and devote himself to experimental and literary work.

NATIONAL PHYSICAL LABORATORY.—The buildings which have been added to the National Physical Laboratory in London for electrotechnical and photometric work will be opened June 25 by Mr. R. B. Haldane, the Secretary of State for War. This is the first day of the tour of the members of foreign societies received by the Institution of Electrical Engineers, and they will be invited to attend the ceremony.

CONVENTION OF NATIONAL ELECTRICAL CONTRACTORS.—The National Electrical Contractors' Association of the United States will hold its sixth annual convention at Cleveland, Ohio, July 18, 19 and 20, next. Mr. Alex. Henderson, master of transportation, has just issued a circular regarding the railroad arrangements.

CONGRESSES AT MILAN EXHIBITION.—Among the congresses to be held during the exhibition at Milan this summer are the following: September 5 to 9, Electrobiology and Radiology; September 23 to 30, Engineers and Architects; September 17 to 22, International Union of Tramways and Railways, and September 17 to 21, Commercial Training. Among the congresses for which the dates are not yet fixed is one devoted to meteorology and a congress of tramway associations. The congress on automobiles was held May 24 to May 29

COURT SCIENCE.—During a suit recently in London involving payment for electrical conductors, the counsel on both sides were not deterred by lack of scientific knowledge from plunging into technical detail. According to a London contemporary, one of them announced triumphantly that "braided wire is not a dielectric"; and another explained how dust and damp "sucked the electricity" out of a wire. An expert for one of the litigants having specified that the best materials were used, one of the counsel drew attention to the fact that brass eyelets were scheduled and asked "Isn't gold the best 'non'-conductor there is? Then why not gold eyelets; gold is better than brass." Whereupon the referee suggested somewhat sarcastically that diamonds would be better still.

INSTITUTION OF ELECTRICAL ENGINEERS.—The report of the Council of the Institution of Electrical Engineers (British) at its recent annual meeting shows that since the last annual general meeting up to May 17 inclusive, 505 proposals for election have been considered, and there have been elected 10 members, 159 associate members, 13 associates and 251 students. To the class of members there have been transferred 32 associate members and 4 associates; to the class of associate members there have been transferred 55 associates and 31 students. The change in the roll during the last 12 months is shown in the accompanying table:

	1905.	1906.
Honorary members	6	6
Members	994	1,024
Associate members	1,610	1,820
Associates	1,609	1,509
Students	1,321	1,487
Foreign members	131	127
Total	5,671	5,973

This statement is of interest in comparison with the report of membership of the American Institute of Electrical Engineers.

VACUUM TUBE REGULATOR.—Two patents were issued May 8 to Mr. D. McFarlan Moore on a means of maintaining a constant degree of attenuation in a vacuum tube. Difficulties have heretofore been met with in the operation of such tubes from variation in vacuum, and it has been necessary either to open a tube and renew the contents and then re-exhaust, or else provide within the tube some solid material which would act as a generator or regenerator of gas, to repair automatically the impaired vacuum. The present invention consists in means for automatically maintaining the vacuum in the vacuum tube at a substantially constant degree by feeding gas to the tube from a body of gas having a higher density or tension than that to be maintained in the tube. This involves the use of a feed device in the nature of a valve interposed in a passage between the tube and the body of gas of higher density. A magnet connected in circuit with the tube responds, directly or indirectly, to changes of electrical resistance accompanying variation in the vacuum. This change of strength in the magnet is employed to operate the valve in such a way as to admit more gas to the tube and thus bring the vacuum back to normal; the strength of the magnet then decreases and the flow or admission of gas from the source is automatically cut off.

WITH REGARD TO COBALT.—Mr. Edison, who has been investigating the resources of North Carolina, states that cobalt available for his storage batteries has been found in seven counties of that State. The supply is said to have come hitherto in a limited way from Germany.

JAPANESE LUMBER ENTERPRISES.—United States Consul-General Miller, in advices from Yokohama says that important developments are about to be made with the aid of foreign capital in the timber industries in Japan. A concern has been formed with a capital of $475,000 gold, which will carry on the lumber and sawmill business in Japan, three or four mills being established in different parts of the country. The principal branch of this business will be the export trade, and Canadian engineers will be in charge of the newest and best machinery, to be driven by electricity. The capital is furnished by French, English and Japanese capitalists, and all the shares are taken by the promoters.

THE CONNECTICUT RIVER.—It is stated that the approach of the final hearing which the board of review of the War Department will hold in Springfield, Mass., this week, in the matter of opening up the Connecticut River for navigation between Hartford and Springfield has given new life to the project for a company to be formed to utilize the water power at King's Island, below the Enfield dam. Certain Springfield capitalists have been approached and it is said that the promoters plan the formation of a company to be capitalized at between $2,000,000 and $3,000,000 for the purpose of erecting the necessary dams, bulkheads and flumes. The Connecticut River company, of Windsor Locks, is reported to be behind the scheme.

SUSQUEHANNA RIVER POWER.—It is stated that Attorney-General Carson, of Pennsylvania, is working on the papers in the proposed suit to compel the McCall Ferry Power Company to stop work on the mammoth dam across the Susquehanna River at McCall's Ferry. The attorney-general claims the company has no legal right to utilize the water rights of the Susquehanna River for its own purposes perpetually and without compensation to the State or the public, and states that it is his purpose to take vigorous measures to protect the State's interests. He alleges that if this company has the right to build a dam across the river at McCall's Ferry there is nothing to prevent any private corporation from damming this or any other river and using the water rights wherever and whenever it pleases. The object of this attack is not clearly understood, as the utilization of the waste water power is said to be a popular scheme that will prove of great benefit to the community.

THE AVAILABLE COAL.—A recent estimate of the coal supply of the world by *Stahl and Eisen* gives figures particularly favorable to Germany, whose deposits are placed at 280,000,000,000 tons, which will last, at the present rate of consumption, a couple of thousand years, and in any case making allowance for probable increased demand, should suffice till the year 3000. The other European countries are given a less favorable position. The coal deposits of Great Britain and Ireland are placed at about 193,000,000,000 tons, and with an annual consumption twice that of Germany, that supply will be exhausted in less than 400 years. The estimated coal deposits of Belgium are 23,000,000,000 tons; of France, 19,000,000,000; of Austria, 17,000,000,000, and of Russia 40,000,000,000. North America's coal deposits are estimated by the same authority at 681,000,000,000 tons. The total for all Europe, adding minor supplies to the preceding figures, is placed at 700,000,000,000. But these gigantic figures are said to be dwarfed by Asia's deposits, which cannot at present be even approximately estimated. China is supposed to possess inexhaustible supplies of coal. Indeed, a German scientist is credited with estimating the deposits of the Province of Shansi alone at 1,200,000,000,000 tons. Siberia and the Island of Sakhalin are also credited with vast deposits, of unestimated extent.

ENGLISH UNDERGROUND TELEGRAPHS.—The underground telegraph cable system between London and Glasgow appears to be nearly complete. The actual length of line is only 409.5 miles, but the total mileage of wire exceeds that of any similar line. Over 37,700 miles of wire have been laid. The route followed by the cable is from London to Birmingham, then through Stafford, Warrington, Preston, Kendel, Carlisle, Beattock and Glasgow. The conduit consists of cast-iron pipes, each 9 ft. long, not including the socket, and having a nominal internal diameter of 3 in. The average diameter is 3⅛ in. The line is divided into sections about 150 yards long between Birmingham and Carlisle, and 220 yards between Carlisle and Glasgow. The pipe is laid on an average not more than 14 in. below the surface of a footway and not more than 2 ft. below the surface of a roadway. At intervals of five miles the cable conductors are led into connection boxes fitted in pillar test boxes. These boxes provide facilities for making all ordinary electrical tests, also for air-drying the cable in case the insulation becomes defective. The cable line from London to Birmingham is 117 miles long and contains 76 conductors, each weighing 150 lb. per mile.

THE SAN FRANCISCO FIRE.—Discussing the San Francisco fire, the *Electrical Magazine*, of London, says: "Judging by reports, gas seems to be mainly responsible for the outbreaks, as the bursting of the huge pipes would release many thousands of cubic feet. Had San Francisco depended solely for light and power upon electricity we are convinced the fire terror following the earthquake would never have been experienced, and much valuable property might now be still unharmed. We hope that in the reconstructed city gas will not be allowed an entrance, especially if substantial evidence is produced by which the fire can be fixed upon this particular public service. Earthquakes no man can control, but their consequences can in some measure be mitigated. Steel buildings are to be had which will withstand earth tremors, and precautions are possible to prevent conflagrations when buildings are shaken to the ground. San Francisco, before any city, is in touch with natural power sources which would, if properly applied, make it the foremost electric city in the world. Gas, coal, coke and wood fires need find no place within its walls when cheap transmitted electricity is so near at hand. Nature has stepped in and shaken this fair city of the West as if to awaken it from slumber and summon it to the task of casting out all that threatens its citizens' welfare. Let us hope her teaching will not be lost on the men whom, while she admonishes, she endows with the means of defence against the consequences of her chastisement. May we soon point to San Francisco as *the* electric city of the world."

NEW YORK TELEPHONE COMPETITION.—Mr. John M. Shaw, President of the Atlantic Telephone Company, has formally presented its two-cent telephone rate proposal to the New York Board of Estimate. The company is willing, with two exceptions, to agree to the terms proposed for the company by the Bureau of Franchises, if the city desires to operate on that basis, but if the city desires to operate on the basis informally discussed by Controller Metz and Martin W. Littleton, counsel for the company, at the recent public hearing on its application, an agreement can be reached along those lines. Mr. Shaw objects to the requirement of an initial $250,000 payment to the city and the clause allowing the city to control the capitalization of the company. He insists on $100,000 as a first payment, and wants no restrictions in regard to capitalization. He also wants the city to guarantee the right of entry to the conduits of the Empire City Subway Company. If the company can have free use of the subways it will "enter into a contract to furnish telephone service from any part of New York City to any other part of New York City at a flat rate for business purposes and unlimited service of $108 per year, and a flat rate for residences and unlimited service of $66 per year, and for such subscribers who do not wish to enter into a contract for unlimited flat rate service the Atlantic Telephone Company will agree to furnish them measured service at 2 cents a call wholly within any borough and 5 cents a call between boroughs."

TELEPHONES IN MINES.—A dispatch from Australia states that at a recent conference the mine owner of Victoria and Tasmania voted unanimously in favor of installing telephones in mines as a precaution and preventive in regard to accidents and disasters.

POST OFFICE TELEGRAPHS.—Congressman S. W. Smith, of Michigan, has introduced a bill to establish a limited telegraph service in connection with the post office department. All post offices at incorporated cities, villages and boroughs are made stations. It provides for leasing lines of telegraph companies now in existence.

INSTITUTE FOR ST. LOUIS.—It is announced that Mr. David Ranken, Jr., one of the wealthiest men in St. Louis will devote the sum of $2,000,000 to founding a school in that city on the lines of the Massachusetts Institute of Technology. The items in regard to it, however, give the institution proposed more the character of an industrial or trade school "for the benefit of those too poor to acquire special training otherwise."

A BAD FIRE starting during the day on May 26 on the premises of Zucker, Levett & Loeb Co., the manufacturers of electro-depositing apparatus and supplies on West Twenty-fifth Street, New York City, resulted in the destruction of six buildings, one death and the injury of five persons, some of the employes of the concern being included. The force of the Connecticut Dynamo & Motor Company on the second floor of one of the buildings had an exciting and dangerous time before it could escape.

DRIVING IT HOME.—In a recent general communication, the Co-operative Electrical Development Association says that one of the advertising agencies in the electrical field has already made contracts with various central stations covering advertising services which involve, during the coming year, the issuance of 459,306 pieces of advertising matter to residences, stores, business places and power "prospects," all of whom have doubtless never before received attractive advertising from the central stations. It is obvious that such a large amount of missionary work must bring definite results.

TROLLEYS IN SOUTH AUSTRALIA.—The Government of the British colony of South Australia and the directors of the Adelaide Tramway Company have arrived at an agreement for the purchase by the Government of all the tramways in the city of Adelaide for the sum of $1,362,620. The conditions are that, subject to parliamentary approval of the agreement and the shareholders' acceptance of the terms, the Government guarantees to pass the agreement during the next session of parliament and also to introduce a bill for the municipalization of the system and the conversion of the lines to electric traction. This should provide a large opening for American electrical material.

PLATINIZED ELECTRODES.—In a paper presented before the British Faraday Society, Mr. H. D. Law described some experiments made with a view to finding an electrode on which the reduction of the aromatic-aldehydes and similar easily reducible compounds could not be effected. Platinized platinum, as being the metal from which hydrogen is liberated at the lowest potential, was tried as the cathode in an acidified alcoholic solution of benzaldehyde. At first energetic reduction took place; the activity of this, however, diminished in successive experiments, and was extremely small after twelve hours' polarization. The reaction is probably catalytic in its origin. In the discussion Dr. N. T. M. Wilsmore drew attention to Tafel's work, which the author's results appeared to contradict.

ELECTRICALLY-OPERATED CABLE WINCHES.—Electric cable winches have been recently taken into use by the German telegraph department in connection with the laying of underground cables that are being substituted throughout for the overhead lines. The process followed in laying these underground conductors consists of first constructing cement ducts. Hitherto the insertion of the cables was made by hand, requiring the work of 10 to 12 men. The electrically-operated cable winch which replaces this hand operation, is distributed over two cars, viz.: a smaller car on which the electricity to operate a motor is generated by means of a benzine engine of 6 hp capacity actuating a dynamo, and a larger car containing the 3-hp motor and the winch. The latter is provided with a self-acting cut-out switch, in case of an excessive strain. The tension on the cables is thus most accurately regulated, a result quite unattainable in the case of a direct-acting benzine engine. The heaviest cable 200 meters in length, is hauled in in about 7 minutes.

NOVEL USE OF THE FAN MOTOR.—The fan motor has proved useful in the ventilation of store windows since the earliest days of its commercial availability, but the arrangement of two 16-in. electric fans in a Boston shop window to display the attractions of about 50 toy balloons is a new suggestion. Streamers of ribbon have often been displayed with a fan motor, but in the case above mentioned, a beautiful effect was produced by setting the two motors at the opposite lower corners of a large window and setting free some 50 gaily colored toy balloons in the window face. The balloons followed the air currents up and down, sweeping through long fascinating curves like huge bubbles, and a large crowd was drawn in this way to appreciate what the concern had for sale in the balloon line.

IOWA STATE COLLEGE THESES SUBJECTS.—Following is a list of the subjects of theses presented by the graduating class of Iowa State College, Ames, Iowa: J. L. Anderson and C. A. Peterson, "Test of the Nevada Electric Lighting Plant"; R. W. Atkinson and J. W. Patch, "The Effect of Insulation Upon the Carrying Capacity of Wires"; R. I. Caughey, "A Study of Tin-Lead Alloys as Solders"; L. E. Coates, "Design of an Alternating-Current Railway Motor"; D. H. Cogswell and A. M. Weise, "Fuse Tests"; W. D. Elwood, "Plans and Specifications for Telephone Plant"; L. S. Ickis, F. T. Rowat and Ed Reese, "Comparison of Methods for Mean Spherical Candle-power Measurements"; F. A. Johnson and Max Nelson, "A Study of Telephone Line Disturbances and Their Prevention"; E. N. Jory, "Design of an Alternating-Current Equipment, Ames & Des Moines Railway"; G. R. Kenny and W. A. Marsden, "Design and Construction of Synchroscope"; W. G. Rubel, "Test of the Ames Electric Lighting Plant"; H. V. Nye and T. R. Williams, "Design of an Induction Motor"; K. R. Ogden and C. G. Throckmorton, "Design of a Lighting Plant for Chariton, Iowa"; H. M. Smith, "Design of Gas and Electric Lighting Plant."

TAXATION IN WASHINGTON.—Advices from Washington, D. C., state that taxation at the rate of 12 per cent of the net earnings of the street car, gas and telephone companies doing business in the District of Columbia is the feature of a bill reported favorably to the Senate by the Committee on the District last week. The measure, which was the product of the sub-committee which had framed it, met with vicissitudes in the Senate, however, and was referred back to the committee for further consideration. What its ultimate fate will be, with the chairman of the committee opposed to it, is problematical. Senator Hansbrough, chairman of the sub-committee which prepared this measure, states that this committee made a most searching examination of the records of these companies and of similar companies in other cities, and determined that a 12 per cent tax on the net earnings of Washington companies would result in their paying almost the same rate of taxation as is now paid by private individuals. There are six railroad companies and one gas and one telephone company involved, and taking their net earnings for 1905 as a basis, it is said to be found that had the proposed law been in operation then they would have paid $400,000 into the District treasury. The committee in its investigations found that the trolley companies of Baltimore paid taxes amounting to 20 per cent of their gross receipts, in addition to the regular tax on all real and personal property.

The Electrical Transmission System of the Long Island Railroad.

OUR issue for November 4, 1905, contained a description of the main features embodied in the electrification of the Long Island Railroad, and information concerning the general arrangement of the large power house of the Pennsylvania Railroad, which supplies electric energy to the L. I. R. R., was given in our issue for January 7, 1905. We are able to supplement these accounts by more detailed descriptions of the electrical transmission system.

GENERATING SYSTEM.

Following is a brief resumé of the generating system. The arrangements for electrification as planned by the Pennsylvania Railroad include tunnels under the Hudson River, New York City and the East River in order to connect its tracks with those of the Long Island Railroad at its terminal to be established in the heart of New York City between 31st and 33d Streets and 7th and 9th Avenues. There will be two main generating stations, one of which will be located in New Jersey and the other near the East River in Long Island City. Short descriptions of the latter generating station were given in the articles referred to above.

This station contains at present three 5,500-kw steam turbines and generators, a size which has been adopted as standard for future work. The station is designed so that it can accommodate within its present walls six generating units of this size and two of 2,500 kw for lighting the tunnels. The ultimate capacity when extended will be about 105,000 kw in electrical machinery. The over-all dimensions of the present building are 200x262 ft., outside measurement. The boiler house is 103 ft. wide inside, the engine room 66 ft., and the electrical galleries 25 ft. wide. The boiler house proper is 82 ft. high to the top of the parapet. The coal pocket enclosure, superimposed on the boiler house, is 60 ft. wide, and its parapet is 118 ft. high. The turbine room is 70 ft. high to the top of the parapet. The superstructure of the building consists of steel frame work. A sectional elevation of the station is given in Fig. 1.

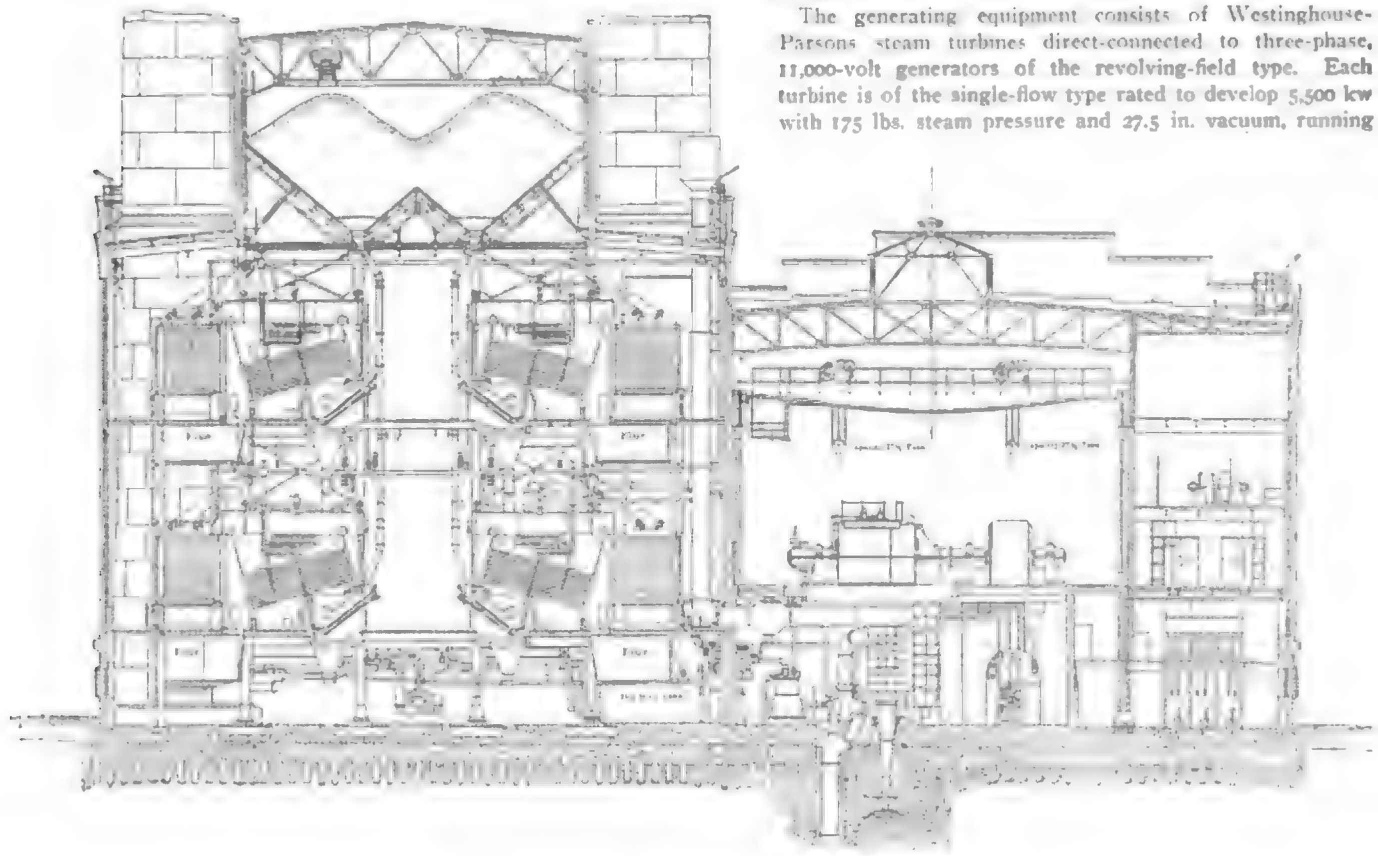


FIG. 1.—SECTIONAL ELEVATION OF POWER STATION.

The location of the power station is such that it can receive coal either by water or by rail, but the plant was designed more particularly to deal with coal carried to the station in barges. The ash and coal conveying equipment consists of three parts, a coal hoisting tower, a cable railroad for conveying the coal from the tower to the coal pocket, and an ash bin structure. The top of the hoisting tower is 170 ft. above the dock, making it the highest hoisting tower in existence. The tower has a capacity for 400 tons of coal in five working hours. It is operated by Lidgerwood steam engines located in an engine room at the base of the tower.

The boiler plant consists of 32 Babcock & Wilcox water-tube boilers set in batteries of two boilers each, eight batteries being on the first floor and eight on the second floor immediately above. The boilers are designed for a working pressure of 200 lbs. per square inch, and they are supplied with superheaters capable of superheating the steam by 200° F. Each boiler is fitted with a Roney stoker, the bars of which are rocked by a Westinghouse steam engine, there being one engine to eight stokers.

The generating equipment consists of Westinghouse-Parsons steam turbines direct-connected to three-phase, 11,000-volt generators of the revolving-field type. Each turbine is of the single-flow type rated to develop 5,500 kw with 175 lbs. steam pressure and 27.5 in. vacuum, running at 750 r.p.m. The bearings of the turbines, which are water-jacketed, are supplied with a forced circulation of oil.

Each turbine is provided with a separate condenser placed in a large arched opening made in the turbine foundation. The vacuum pump for each condenser is driven by a horizontal engine with Corliss valves and automatic governor on the steam end and positive-motion valves on the vacuum end. In order to prevent the deterioration of the condenser from the salt condensing water forming a convenient path for stray electric railway return currents, a shunt circuit is provided between the incoming water pipes and the condenser flume for the purpose of diverting as large a portion as possible of the current from the condensers. A small booster-generator, which is connected in the shunt circuit, serves to neutralize the effect of such current as might still leak past the insulating joints which are inserted in the water main.

Three separate sources are provided for supplying current to the field coils of the main generators, namely, two steam-driven exciters, one motor-driven exciter, and a storage battery. The storage battery, which is intended mainly as an absolutely reliable source of supply for the exciter-bus system and the other more important auxiliaries, is normally kept "floating" across the exciter bus-bars.

The generators are designed to operate in parallel on either of two sets of main bus-bars, called the "working" and the "auxiliary," only one set of which is generally in use. The cables are run through the turbine foundations into the basement, then to the main generator circuit-breakers which are placed on the feeder gallery. All of the circuit breakers have remote electrical control, and are worked from the main operating gallery on the upper floor. Each pole of a circuit-breaker is enclosed in a separate fireproof chamber of brick, capped with a slab of alberene stone upon which the operating gear is mounted. These switches are operated through solenoids actuated by current received from the auxiliary bus-bars.

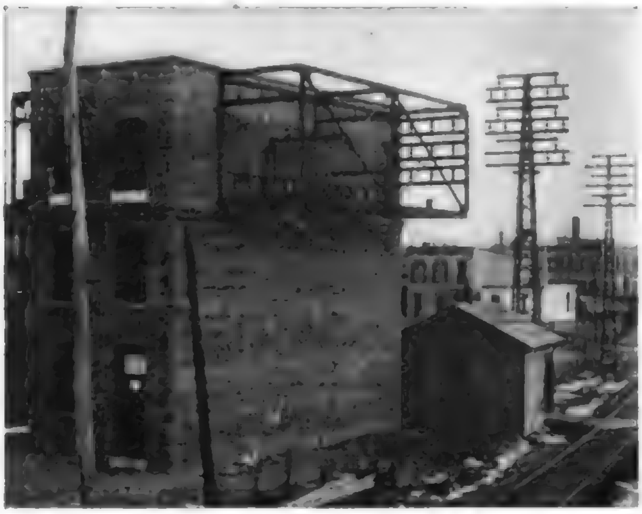


FIG. 2.—ARRESTER HOUSE AT DUTCHKILLS STREET.

TRANSMISSION SYSTEM.

The feeder cables connecting to the high-tension transmission system are of the three-conductor type. They pass through ducts, laid in the floor of the basement gallery, which lead to a manhole directly outside of the building. The transmission circuits pass from this manhole in conduits through a portion of Long Island City, and then connect to overhead lines.

The lengths of the various sections of the transmission lines are as follows: Conduit section of trunk line, power station to Dutchkills Street, 1.12 miles. Overhead trunk line, Dutchkills Street to Woodhaven Junction, 7.85 miles. Conduit section from Woodhaven to East New York, 3.23 miles, and from East New York to Grand Avenue, 3.04 miles; Woodhaven to Dunton, 1.7 miles. Overhead from Dunton to Rockaway Junction, 1.73 miles, Rockaway Junction to Springfield Junction, 3.35 miles, Springfield Junction to Valley Stream, 2.57 miles. Woodhaven Junction to Hammel, 6.98 miles. The total length of conduit lines now in use is therefore 9.09 miles and that of pole lines 26.19 miles.

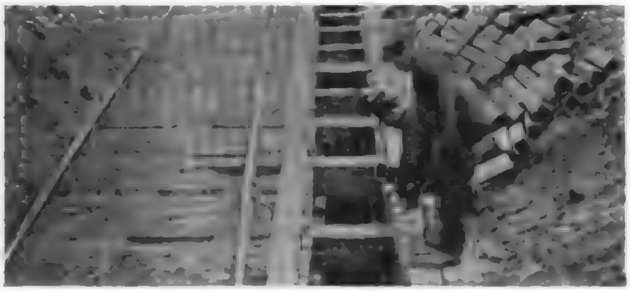


FIG. 3.—CONDUIT CLOSE TO TRACK, SHOWING FORM OF DUCTS USED.

Conduits.

The major portion of the route of the conduit line connecting the arrester house (Fig. 2) at Dutchkills Street with the power station lies along the edge of the railroad right of way, as shown in Fig. 3. Much of it is situated below the level of the ground water, so that special provision for the drainage of the ducts and manholes was necessary. This conduit line is so pitched as to bring all of the drainage into three sumps, from which it is removed by automatically-controlled, electrically-driven, submerged centrifugal pumps which discharge into the city sewer system.

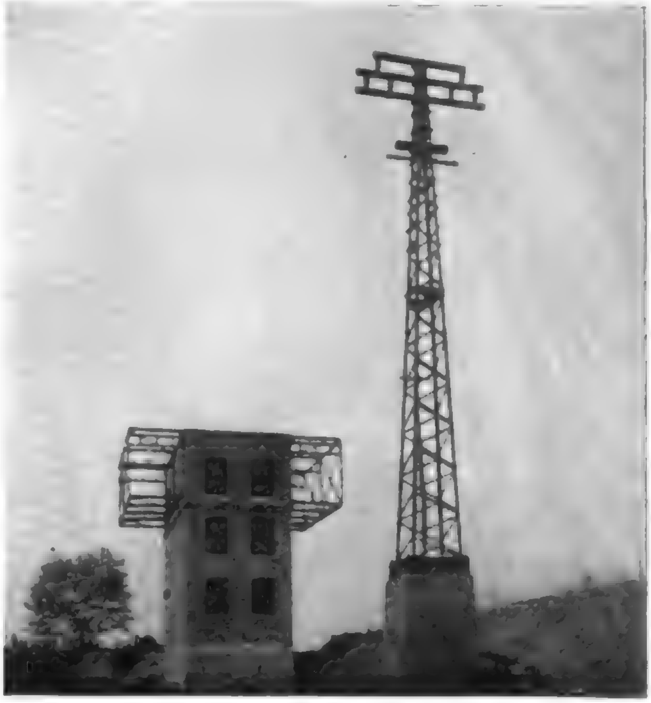


FIG. 5.—CIRCUIT-BREAKER HOUSE AT DUNTON.

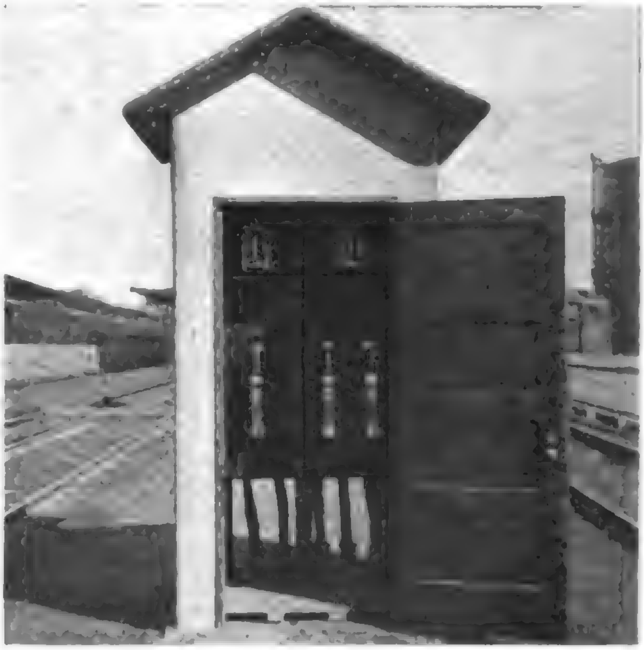


FIG. 5.—CIRCUIT-BREAKER HOUSE AT DUNTON.

The conduit is constructed of single vitrified clay ducts 18 in. long, with square holes 3 13/16 in. inside measurement and walls ¾ in. thick. The ducts are laid in cement mortar, and are arranged three wide and six high. Manholes for drawing in and splicing the cables are located 400 ft. apart on straight work, and a shorter distance on curves. The standard manhole for straight line work is 8 ft. long, 4 ft. wide and 6.5 ft. high, inside dimensions.

The conduit system on Atlantic Avenue comprises two kinds of construction. For a distance of 4.4 miles a construction identical with that described above is used. The other portion is built up of four-way vitrified clay duct 36 in. long with square holes 3⅜ in. on a side. The manholes along the subway portion of the Atlantic Avenue improvement consists of niches in the side walls, 5 ft. wide, 8.5 ft. in length and 15 ft. high. These manholes are accessible from the street through regular manhole openings, and can also be reached from the subway. On the other portions of the Atlantic Avenue improvement the manholes are built of concrete, and are generally oval in form, 7 ft. long, 5 ft. wide and 6.5 ft. high.

Cables.

Each of the conductors of the high-tension, three-conductor underground cables has a cross-section of 250,000 circular mils, and is composed of 37 copper wires. Each conductor is covered with a wrapping of impregnated paper 7/32 in. thick, and a 7/32-in. layer of paper is wound over the whole group, the interstices being filled with jute. The completed cable including a 9/64-in. lead sheath has an external diameter of 2⅞ in. After the cable was ready for service it was tested for a period of 30 minutes by 30,000 volts between each pair of conductors and 27,000 volts between each conductor and the sheath.

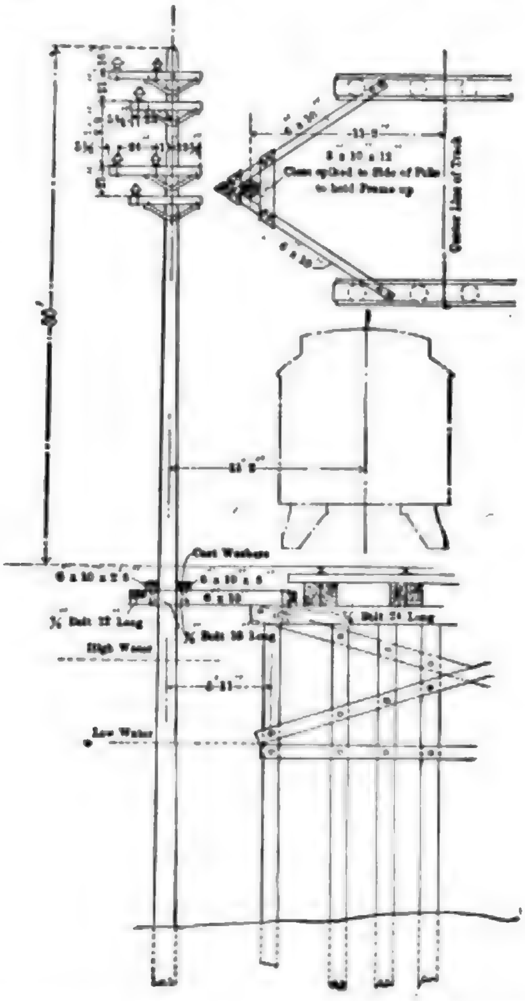


FIG. 6.—HIGH-TENSION POLE CONSTRUCTION AT TRESTLE.

At the drawbridges in the Jamaica Bay trestle the cables are of the armored submarine type, the conductors being insulated with 7/32 in. around each strand and 7/32 in. of rubber around the group of three. The insulation is composed of 30 per cent of pure Para rubber. The sheathing is of lead 9/64 in. thick, and over this is an armor of No. 4 B. & S. galvanized-iron wires laid spirally with a thin layer of jute between the sheath and the armor. There are two such cables at each drawbridge. The cables are laid across the channel and allowed to settle to the bottom. They were then sunk into the mud by means of a water jet, supplied by pumps at 100 lbs. pressure.

There is in all about 25 miles of high-tension underground cable installed, in addition to .418 miles of armored submarine cable.

Wherever the underground cable section of the transmission line is joined up with the overhead system, lightning arresters and choke coils are installed. Suitable houses are provided to shelter this apparatus, there being one on the main transmission line at Dutchkills Street, Long Island City (Fig. 2), and another at Dunton, on the branch line running east of Woodhaven (Fig. 4). Smaller houses were also provided for the same purpose at the two drawbridges.

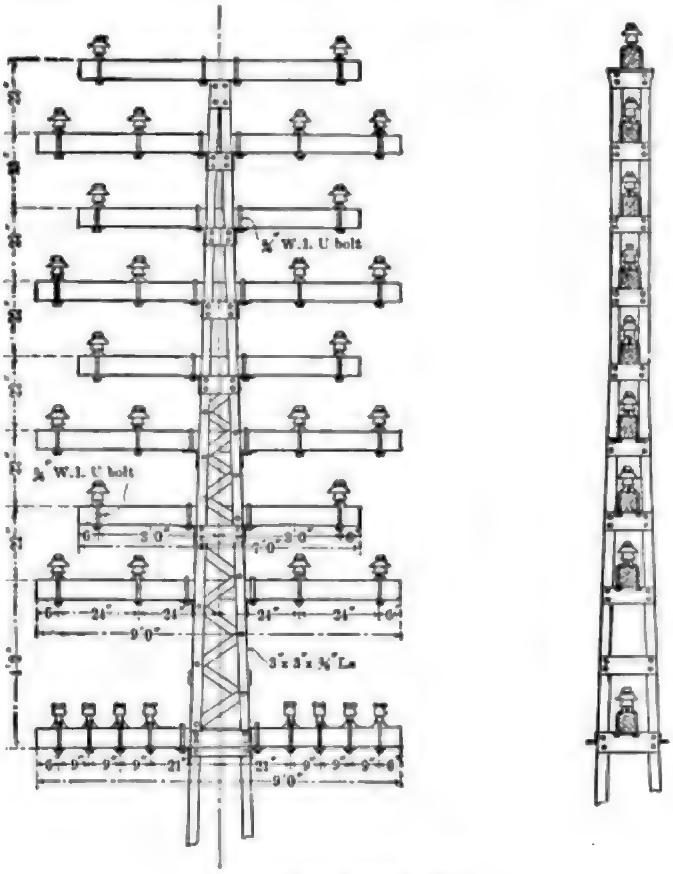


FIG. 7.—TOP OF STEEL POLE.

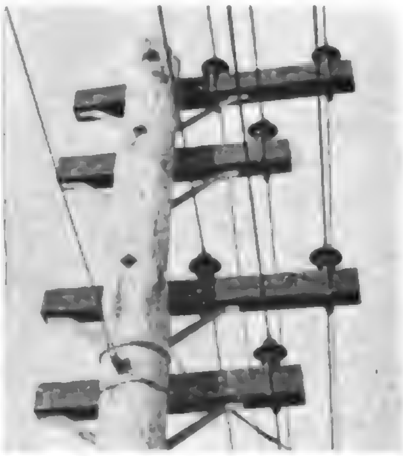


FIG. 8.—TOP OF WOOD POLE, SHOWING INSULATOR PINS.

Overhead Lines.

The overhead line construction is of the most substantial character. Over the main portion of the route the poles are of steel, but between Ozone Park and Hammel they are of wood, and wood poles are also used on the branch lines from Rockaway Junction to the separate outlying substations. The trunk line is designed to carry eight three-phase transmission circuits consisting of three 25,000 c.m. cables each, together with eight low-tension cables each. The latter are placed 25 ft. above the ground. The branch lines are designed to carry not more than two three-phase transmission circuits and four low-tension cables on a single line of poles.

The spans between steel poles average 150 ft. in length, except where turning corners or carrying the cables over railroad tracks. The poles are built of four corner angles connected together by angles and plates forming a lattice type of construction. They are tapered uniformly to the top on two sides and to within about 7.5 ft. of the top on the other two sides, the taper being ⅜ in. per foot. This taper is the same for all lengths of poles. In each case the top measures 6 by 11 in. At the bottom the corners are tied to a base composed of plates and channels through the corners of which four anchor bolts pass. The standard poles are made in four lengths, increasing by 5 ft., from 39 ft. to 54 ft. in length; the 39-ft. pole is the type generally employed, the other poles being used only where necessary.

The poles are designed to withstand a side pressure corresponding to a wind velocity of 100 miles per hour, that is, about 27 lbs. per square foot for the flat surfaces of poles and cross-arms, and 13.5 lbs. per square inch for the projected area of cylindrical conductors.

For standard straight line poles, without side strains other than wind pressure, the corner angle irons are 3x3x⅜ in. For the heavier strains at curves and corners, the general design of the poles is the same, but they are given greater strength by using heavier corner angles.

The design of the poles for curves was made dependent on the distance by which the pole is offset from a straight line joining the two poles on either side of it. For offsets up to 6 ft., the corner angle irons are 3.5x3x7/16 in., while for offsets between 6 and 10 ft., the angle irons are 3.5x3x.5 in.

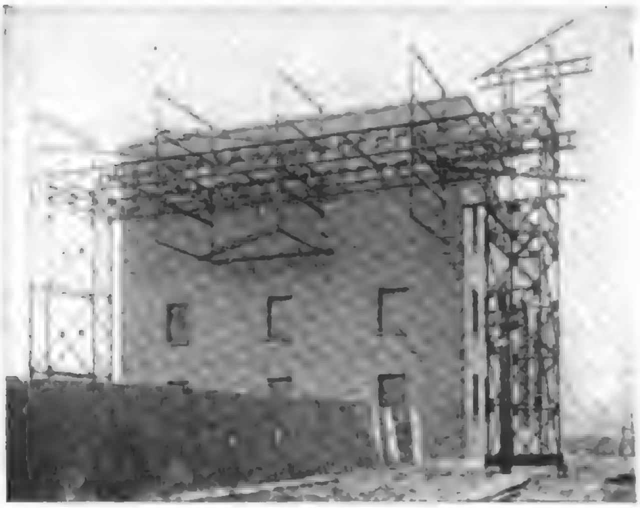


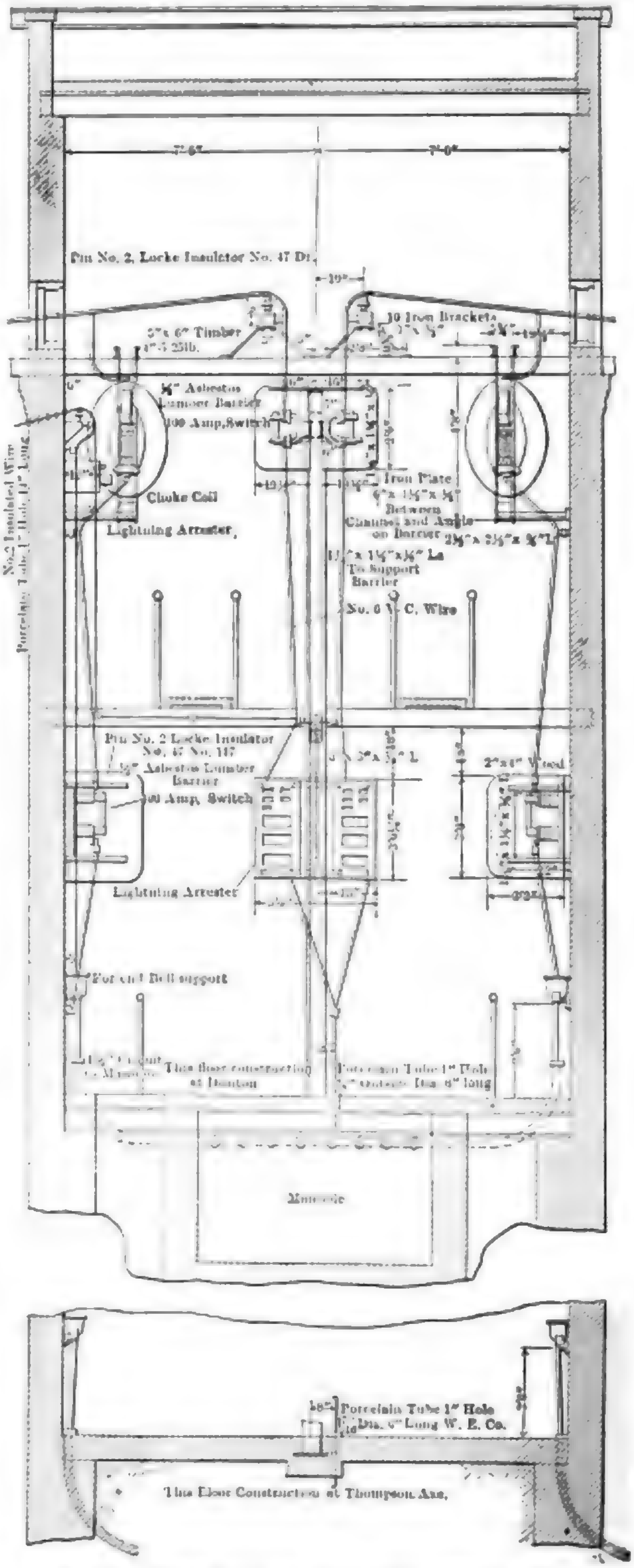
FIG. 9.—TERMINAL CABLE RACK AT ROCKAWAY JUNCTION.

In addition to the standard poles above described, which were designed to meet the ordinary conditions, an extra heavy strain pole was designed in three lengths. (See Fig. 4.) This type is used for offsets up to 32.5 ft., for turning sharp corners, and for anchoring the line at special points. These poles are similar in design to the standard poles, but the taper is increased to ½ in. per foot, and all four sides taper uniformly all the way to the top, which is 8.5x12 in. The strain poles used for anchoring are guyed fore and aft to the bases of the adjacent poles with 7/16-in. galvanized-steel cable.

The ability of the steel pole to act as a lightning rod is turned to advantage, and each pole is thoroughly grounded to a copper plate beneath the foundation and connected to one of the anchor bolts by a copper wire.

The poles were transported from the steel works without "knocking down," and were erected whole on their foundations with the aid of a gin pole. After erection, cement grout was run underneath the base and the pole was permanently set by tightening the foundation bolts. There are now in position in the line 358 of the standard straight line and curve poles, and 19 of the heavier type of strain poles.

The wooden poles are of two kinds: Chestnut, which is the standard for ordinary work, and creosoted yellow pine, which is used only along the trestle over Jamaica Bay. The chestnut poles are 45, 50 or 55 ft. in length, and 25 in. in circumference at the top. The creosoted poles are from 60 to 80 ft. long, with 25-in. tops; they were treated with 15 lbs. of dead oil of coal tar per cu. ft. of timber. Each creosoted pole was set 15 ft. into the bottom of the bay by means of a water jet, so as to have its top 30 ft. above the rails. Each pole was braced to the



Pin No. 2, Locke Insulator No. 47 Dr.
10 Iron Brackets
3"x 6" Timber
¾" Asbestos Lumber Barrier
100 Amp. Switch
Choke Coil
Lightning Arrester
Iron Plate
Between Channel and Angle on Barrier
To Support Barrier
No. 6 ... C. Wire
Porcelain Tube 1" Hole 12" Long
No. 2 Insulated Wire
Pin No. 2 Locke Insulator
¾" Asbestos Lumber Barrier
100 Amp. Switch
Lightning Arrester
For end Bell support
Thin floor construction at Denton
Manhole
Porcelain Tube 1" Hole Dia. 6" Long W. E. Co.
Thin Floor Construction at Thompson Ave.

FIG. 10.—CROSS-SECTION OF LIGHTNING ARRESTER HOUSE.

trestle with creosoted yellow pine timber. (See Fig. 6.) The total number of chestnut poles employed is 490, and of creosoted yellow pine poles 204.

The cross-arms are of yellow pine, 5x6 in. cross-section housed on top to a 12-in. radius, and they are painted with one coat of asphaltum paint. On each steel pole the cross-arms pass through the pole structure, and are bolted in place on seats formed of angle irons, as shown in Fig. 7. On each wooden pole the cross-arms are gained one inch into the pole, and held in place by means of through bolts and angle-iron braces.

The insulator pin consists of a malleable iron casting clamped to the cross-arm by means of V-bolts threaded through the body of the pin, and held by a plate fitting over the V-bolts and against the cross-arm, as shown in Fig. 8. This type was first used on this transmission line, and represents a new departure in pin design, inasmuch as by its use all boring of the cross-arm is avoided, and the pin used possesses a maximum of strength.

The straight line insulators are 6.5 in. in diameter and 5 in. high, made of porcelain in two parts cemented together. The tests to which they were subjected by the manufacturers, included an artificial rain test at 30,000 volts, and a salt water test at 50,000 volts for two minutes. After the insulators were erected and the cables strung upon them ready for operation, they were tested by applying 30,000 volts between the conductor and the ground for 4 minutes. The insulators were secured to the pins before erection by means of a cement composed of litharge moistened with a mixture of glycerine and water.

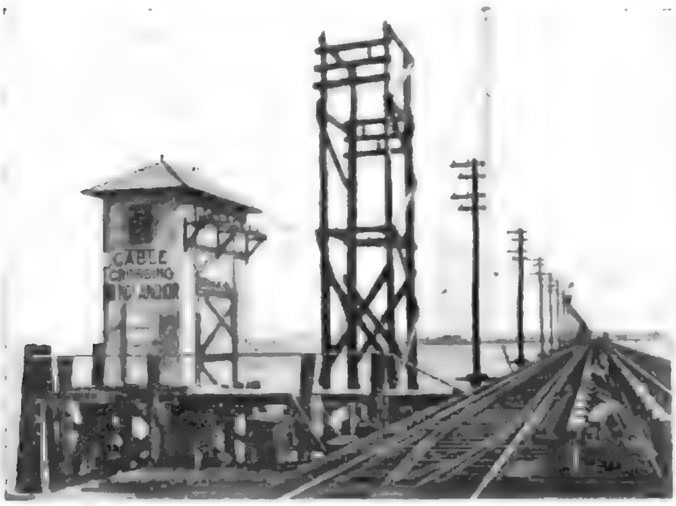


FIG. 11.—BROAD CHANNEL ARRESTER HOUSE.

The transmission cables are of 260,000 c.m. stranded copper, and are fastened to the insulators with ties of No. 6 copper wire 3 ft. long. The cables were strung for the most part by means of teams of horses running lines of 1,000 ft. or more in length, the cable reels being mounted on stationary racks. On the trestle, however, this method could not be so readily followed, and the cables were strung in the following manner: The reel of wire was carried on a flat car, upon which was placed a boom capable of being swung sidewise to the position which would be occupied by the wires. At the end of the boom was a snatch block through which the wire passed and by which it was guided on the cross-arm. The car was moved along slowly by the locomotive and the wire paid out, the boom being raised at each cross-arm so that the wire would drop down on to the arm. This method proved very economical.

Sub-Stations.

At the Woodhaven and Rockaway Junction sub-stations, special terminal poles or racks are provided to distribute the overhead circuits along the face of the building parallel to the high-tension switching galleries in such a manner that the disposition of the cables after entering the building will be most convenient. An idea of the method by which the requirements were met is best given by a view of a cable rack, as indicated in Fig. 9, which shows the terminal pole at Rockaway Junction. The location of this sub-station is such that the entering circuits coming from the west had to be taken around to the east side of the building and distributed from the rack there situated. The entering circuits are kept on the west side of the cable rack next to the building, while the outgoing circuits, which continues eastward, are kept on the east or outer side of the rack, thus preventing crosses and making it possible for either set of circuits to be repaired independently of the other set.

At the large lightning arrester houses, the terminal cable racks are integral with the building framework, and project from the side of the building. All circuits are carried with the cables in a horizontal plane, the uppermost circuits run to the rear end of the rack, jumpers being used to couple up to the interior apparatus. The arrangement of the equipment of an arrester house is shown in Fig. 10.

In Fig. 11, of the lightning arrester house at the Broad Channel drawbridge on the Jamaica Bay trestle, is shown the method of anchoring the longitudinal strain of the high-tension line. This anchorage consists of a tower-like structure of four creosoted poles latticed and braced together with heavy timbers, the cables being dead ended on standard strain insulators in a horizontal plane. Jumpers pass down through the inside of the tower and across to the lightning arrester house where they are connected to the submarine cables. This construction is strong, self-contained, and extremely simple, and it enables side and end guying to be dispensed with.

Operation.

The operation of the transmission line, which was first put in service on April 27, 1905, has been remarkably free from interruptions. The line has demonstrated its effectiveness as a substantial and reliable transmission system for a suburban railroad on whose regularity of operation thousands of people are daily dependent.

The design and construction of the system was carried out by Westinghouse, Church, Kerr & Company, engineers for the Long Island Railroad Company. The entire work was under the direction of Mr. George Gibbs, chief engineer of traction of the Long Island Railroad, subject to the approval of an electrical committee, consisting of the chief operating officials of the road, with the president as chairman.

Self-Synchronizing of Alternators.

A paper by Prof. Morgan Brooks and Mr. M. K. Akers, read at the recent Milwaukee convention of the American Institute of Electrical Engineers, described a convenient method of placing alternators in parallel without causing the circulating current to exceed a certain desirable limit. Instead of directly closing the switch between two machines and thus subjecting them to a possible impulsive rush of current if the machines are not in the proper phase positions and revolving at the proper speeds, an inductance without an iron core was inserted between the two alternators. The inductance prevented a dangerous rush of current even at maximum difference of phase, and yet the current which did flow produced an adequate synchronizing force to draw the machines into step.

The experiments were conducted with 60-cycle current and the results were very satisfactory. The circuit between the machines could be closed while the machine to be brought into step was at a standstill; when the speed was approximately synchronous, it would automatically fall into step, after which the excitation could be adjusted and the inductance cut out.

In the case of a synchronous converter, started from the direct-current side, the use of coreless inductance to permit the closing of the connecting switch at any instant was sometimes found to cause the converter to race as a direct-current motor, owing to the weakening of its field and consequent increase of armature current. This objectionable tendency was overcome by the use of a second inductance connected in series with the direct-current armature and additional to the starting box.

The Lighting of Churches.

A paper dealing with the lighting of churches was presented at the annual convention of the American Institute of Electrical Engineers, at Milwaukee, by Mr. Edwin R. Weeks. After having outlined the defects which characterize the illumination of ecclesiastical structures, the author stated that the chief requisites in church lighting are adequacy and uniformity. The maximum variation throughout the auditorium should not exceed 20 per cent. This uniformity is seldom secured with daylight, but there is no reason why it should not be attained with artificial light, since electricity can easily be transmitted to all parts of the building and practically moulded to suit the demands of distribution as well as the needs of the architecture and decoration. In this respect the electric light may be said to "beat daylight."

The amount of light in the reading plane should not be less than two candle-feet; that is, about twice the light required by the average person for reading without the impairment of eyesight. The frugal vestryman may ask: "Why double the amount of light?" The answer is that the best and most attractive lighting is not only an excellent advertisement and a means of grace, but it may be quite economically employed in assembly rooms which are occupied only six or eight hours each month, if the controlling devices be properly designed and used. Furthermore, a religious gathering, more than any other concourse of people, contains persons of all ages, many of whom have failing eyesight. With an expense of two dollars an hour for an illumination which gives perfect satisfaction to every one in the audience, and makes of the auditorium a beautiful and attractive place for young people, there can be no question of extravagance.

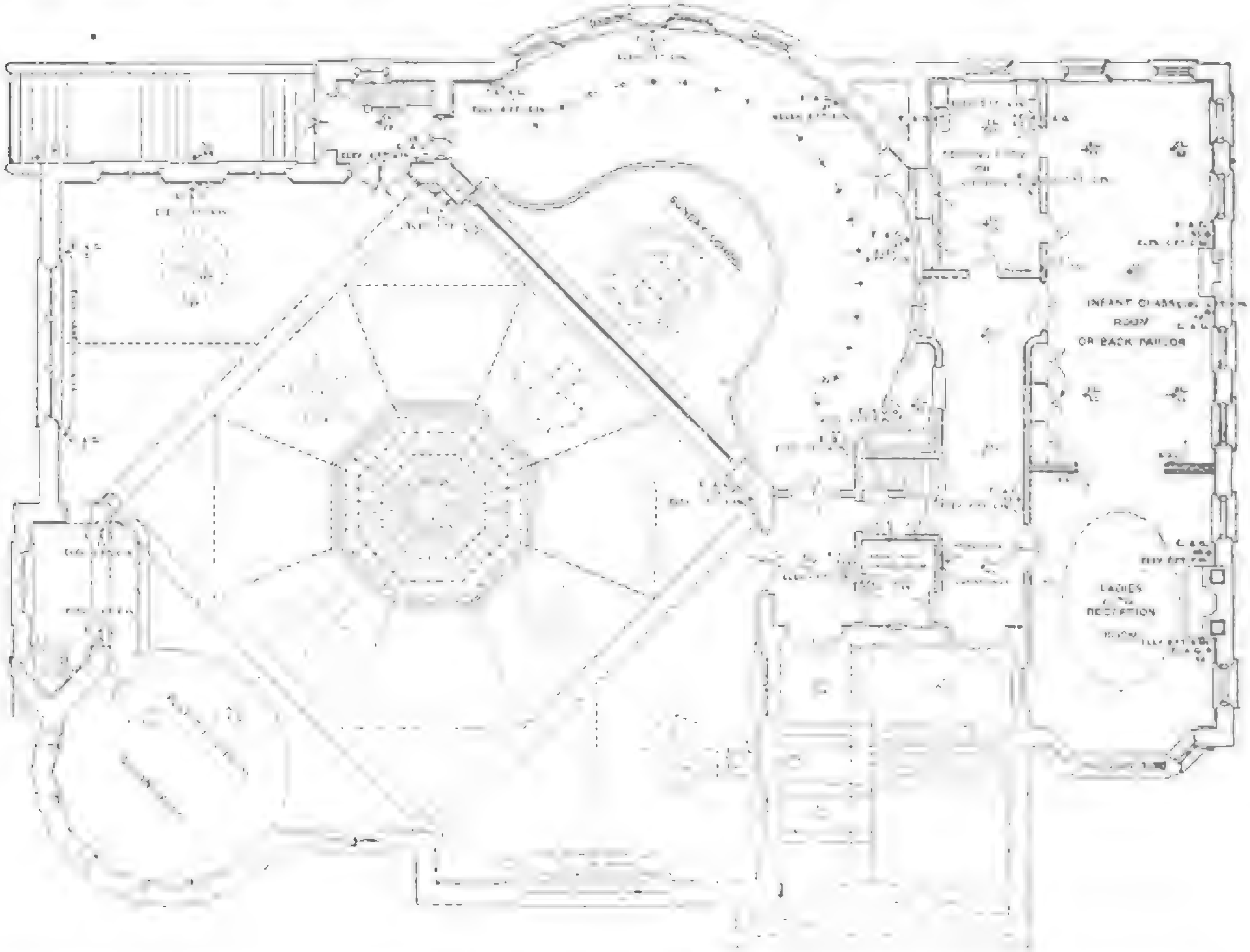


Fig. 1.—Plan of Church Lighting.

There are two general systems of interior illumination, the indirect and the direct. In the indirect system, the lamps are entirely concealed from view and their light is distributed by means of reflecting or diffusing surfaces. The installation of this system is costly, and uniform distribution is difficult. In the direct system the lamps are so placed that though they may be seen they are not in the usual line of vision. The installation by this method is less costly, and its operation much less wasteful, since nearly all of the light emitted does useful work. It also facilitates uniform distribution, and lends itself more readily to decorative effects and the expression of symbolism.

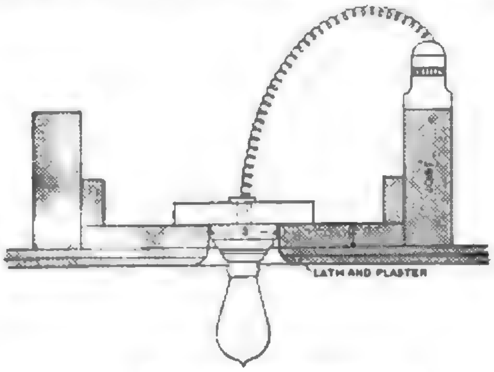


Fig. 2.—Ceiling Outlet.

The accompanying illustrations may serve to show the application of these principles to a case wherein the expenditure is to be moderate. The results are a good distribution of light and a satisfactory illumination in each room. All parts of the auditorium are visible; each seat receives a minimum of two candle-feet, and the variation is less than 20 per cent. No more conclusive justification for the degree of control and lighting here provided for could be desired than the enthusiastic commendation of the parishioners, and the fact that the monthly bills for electricity at the rate of 10 cents per kw-hour, with the usual church services, and including that used for the organ motor, range from $15 to $23.20.

The installation is three-wire, with neutral equal to the sum of the outside wires, and with 104 volts on each side; the drop inside the entrance is slightly less than 2 per cent with full load. The entrance switch, fuses and watt-hour meter are mounted on slate bases in a fire and dust-proof box in basement. All cabinets have white marble backs and sides, beveled plate glass doors, trims of polished wood and are set flush with the finished walls.

Cabinet No. 1, which is in the basement corridor, in addition to fuses, contains five triple-pole, single-throw knife switches; one to control each of cabinets II, III and IV, one on feeders for future use in proposed assembly rooms in the basement, and one on feeders to supply lamps, not yet installed, for lighting the stained glass over the auditorium dome.

Cabinets Nos. II and III, which are in the south passage on the main floor, in addition to fuses, each contains 20 double-pole, single-throw knife switches, 10 on each side of the system, controlling circuits supplying the ceiling outlets in auditorium, schoolrooms, main entrances, vestibules, corridors, cloakrooms, young people's assembly rooms and parlors.

Cabinet No. IV, which is in the main corridor, contains cartridge plug fuses to protect 16 circuits, 8 on each side of the system, supplying choirrooms, organ loft, pastor's study, kitchen, closets, boiler room and coalroom, brackets in the auditorium, schoolroom, vestibules, corridors and parlors, and lamps in all parts of the building intended for use at times when full lighting is not needed.

The lamps over the pulpit platform (see outlet No. 6 on Fig. 1) being back of the pulpit arch, are not visible from the auditorium, and furnish over 2 candle-feet on the pulpit, console and music rack. The outlets in the ceiling of the auditorium are so constructed (Fig. 2) that the lamps may be drawn up into the attic for cleaning or renewal.

The bracket lamps are used when light is needed only in certain places as for choir practice, janitor's work, pastor's study, etc., and are not a part of the general illumination, which is always from above.

In the wall and ceiling decorations deep cream predominates, and the designs for all fresco work in the building have special reference to the location of the lamps, and the figures employed in their distribution.

Characteristics of Mercury-Vapor Apparatus.

The fundamental characteristics of the Cooper Hewitt types of lamps and converters were outlined by Mr. Percy H. Thomas in a paper read at the annual convention of the American Institute of Electrical Engineers at Milwaukee, Wis. It was shown that the voltage consumed in the mercury-vapor lamp consists of three parts more or less different in character; that is, the vapor loss, the positive electrode loss, and the negative electrode loss. The voltage loss in the vapor is directly proportional to the length of the vapor and inversely proportional to the diameter of the vapor path. It increases with increase of vapor pressure, and more or less closely in proportion to this pressure. The voltage loss varies only slightly with a change in the current strength, as shown in Fig. 1, which represents the voltage-current characteristic of a 3.5-amp. lamp. This curve indicates the total voltage across the apparatus, but virtually represents the resistance of the vapor, plus a constant loss of perhaps ten volts at the electrodes.

The loss of voltage which occurs at the positive electrode is practically independent of the current strength. It frequently has a value of more than five volts. A similar loss of about four volts occurs at the negative electrode during normal operation. Both of the electrode voltage losses together with the abnormal negative electrode starting resistance were discussed at length.

The specific consumption of a mercury vapor lamp, which in a long tube is as low as 1/3 watt per candle (exclusive of resistance losses) is obtained only with the proper vapor pressure, current and tube diameter. The consumption has a minimum at a certain pressure, and it is nearly independent of the current strength within certain limits. Superheating that portion of the vapor emitting light seems to have little effect on the consumption.

The principle of the alternating-current lamp is generally well understood by this time, the circuits being shown in Fig. 2. Referring to this figure it is evident that during one alternation current is supplied from one-half of the transformer secondary through the lamp tube back to the neutral point, and during the other alternation by the other half of the transformer secondary through the tube to the same point, and that the choke-coil in the negative lags the current over the zero points.

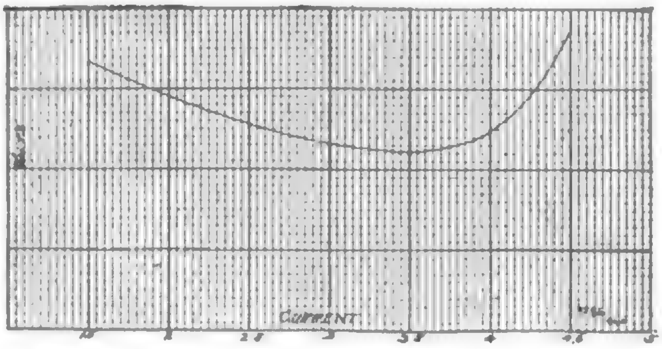


FIG. 1.—RELATION BETWEEN CURRENT AND VOLTAGE ACROSS A DIRECT-CURRENT LAMP.

On 25 cycles, by providing a larger choke coil in the negative than is necessary in the 60-cycle lamp, the natural tendency to a flicker with the period of the 25 cycles is eliminated.

The light from the alternating-current lamp is practically equivalent to that from the direct current, since in the light giving portion of the tube the current is unidirectional and practically constant.

The mercury-vapor apparatus may be utilized to supply direct current from an alternating-current source, by virtue of the negative electrode resistance. No further description of the general method of accomplishing this result is necessary at this time. The converter may be run single phase, in which case a connection similar to that already described in Fig. 2, except for starting circuits, is generally used, though it may be three-phase, four-phase, etc., in which case no choke coil in the direct-current circuit is usually required.

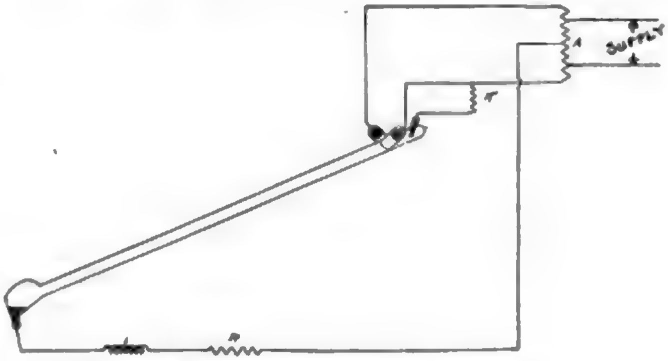


FIG. 2.—ALTERNATING-CURRENT LAMP.

In a converter a very short vapor path is purposely provided, and the starting is easily accomplished by breaking a metal circuit in the vapor path, for the current is here easily transferred from the starting to the main positive electrode. The method can be easily seen from Fig. 3, which shows a form of commercial bulb used for a single-phase converter together with starting circuits. There are two electrodes of mercury, one being the main negative and the other a starting electrode. By shaking these two together, passing current through and separating them, the negative electrode resistance is broken down and the voltage upon the main positive electrodes forces current to flow to the main negative. The supplementary positive should then be cut out of the circuit. Converters can also be started by a starting-band and a high-tension impulse, or by the direct application of sufficiently high potential.

The author stated that the ratio of the converter is a rather uncertain term, but it may be determined in any given arc as follows: Any single-phase vapor converter operated from a three-wire source, or a transformer with a middle point, is practically equivalent, as far as the direct-current circuit is concerned, to the application of the original alternating-current to the direct-current circuit (including the sustaining coil) with the negative supply alternations reversed. This gives a pulsating voltage, the pulsations being of sine form and running to zero for one instant twice every cycle. The choke-coil smooths out the current pulsations more or less according to its power and the character of the direct-current load. The smoothing action is much greater with a load of ohmic resistance than with a storage-battery or motor or other consuming device having a constant potential feature. The direct voltage is measured ordinarily by a voltmeter which gives the average reading, not the effective reading, of the pulsating voltage, while the alternating voltage is measured by a voltmeter which measures effective values; so that the direct-current instrument will show a reading on the same voltage of approximately 9/10 that of the alternating-current instrument. This difference appears in the ratio of the vapor converter.

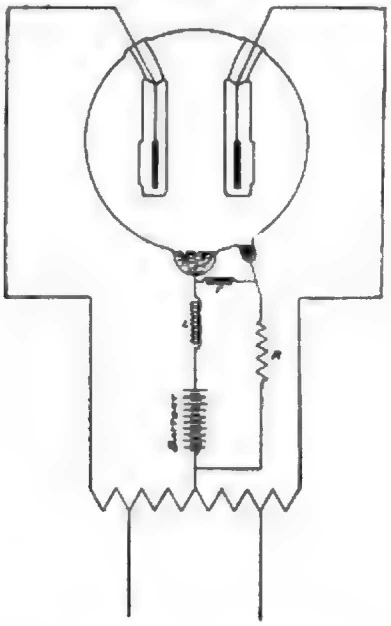


FIG. 3.—SINGLE-PHASE CONVERTER.

Since only one-half of the voltage across the positives is operative at any one time, we have in addition the factor ½ between the voltage across the positives and that in the direct-current supply, so that the voltage on the direct-current side, measured by a direct-current voltmeter, will be 0.45 of the voltage across the positives in the condition assumed. In this case the voltage on the bulb and all auxiliary losses must be included in the direct-current load. If an alternating-current instrument be used for measuring the direct voltage a somewhat higher ratio (.50 as a maximum) may be obtained according to the degree of smoothing accomplished in the choke coil, the smoother the direct current the lower the ratio. Both alternating-current and direct-current instruments will, of course, read the same on a perfectly steady current, such as would result from an infinitely powerful sustaining coil.

A power factor meter on a vapor converter, having a resistance load, will show less than unity power factor under most conditions, and yet there is no lag between the zero point of the current and the zero electromotive force of the supply. This condition results from a distortion of the current wave resulting from the action of the sustaining coil in the direct-current circuit. The power factor appears less than unity since the distortion of the current is equivalent to the addition of higher harmonics which being of a different periodicity from the supply can deliver no real power while still increasing the effective value of the current.

Self-Excitation of Synchronous Converters.

At the Milwaukee convention of the American Institute of Electrical Engineers, Mr. W. L. Waters read a paper on the subject of shunt and compound-wound synchronous converters for railway work. By the use of a sufficient inductive reactance in the supply leads and a series winding on the magnets of the converter the terminal voltage of the machine will rise as the load comes on, so that a synchronous converter may be compounded in a manner similar to that employed with direct-current generators.

This system, which gives automatic control of the voltage, is obviously extremely useful and convenient. Unfortunately, however, the system presents a number of disadvantages in practice: a series winding is needed on the converter magnets, artificial reactance coils are practically always needed to insert in the alternating-current line so as to bring its reactance up to the required value, and there is need for extra switchboard arrangements. This means increased complication and cost and a loss of efficiency. A compound-wound converter costs about 7 or 8 per cent more than a shunt-wound converter. Reactance coils usually cost about 5 per cent as much as the converter. The efficiency of the system is lowered probably 1 to 2 per cent. Moreover, the system is more complicated, and in consequence more liable to break down. There is also liable to be trouble in operating the system. A series field winding on a synchronous converter is always a source of danger on account of the liability of its reversing. When starting a converter the series field coils can be short-circuited and the danger at that time avoided; but if the attendant forgets the short-circuiting switch at any time, there is liable to be trouble.

The results from the overcompounding of synchronous converters are not always satisfactory, due to the fact that as solid steel field magnets are always used, the magnetism cannot change quickly, and there is often a considerable time lag before the voltage changes to correspond with the change in the load. However, when the converter is flat-compounded instead of under or overcompounded, the result is more satisfactory, as the natural tendency of the solid poles is to hold the magnetism and the voltage constant.

In small sub-stations which are supplied from comparatively small power stations, the effect of the variation in speed of the engines often masks all of the results of the compound winding. Moreover, this method of compounding is often a nuisance. The power factor of the system very often varies widely with the load. A shunt-wound converter, however, tends to keep the power factor the same at all loads. In any case the power factor can be adjusted by means of the field rheostat without in any way upsetting the regulation.

The result of all the complication and disadvantages of a compound-wound converter with reactance coils is that often after the system has been in operation for some time the series magnet coils and the reactance coils are cut out and the converter is run as a straight shunt machine.

Probably the best system for general work is to have shunt-wound converters, standard transformers and no reactance coils. The converters should be overexcited somewhat so as to keep the introduced wattless currents leading at all times, and then the machines should be left to take care of themselves, the excitation being adjusted in case they fail to divide the load properly.

With shunt-wound converters instead of compound-wound machines with reactance-coils, there results an outfit less liable to cause trouble and which will give better results both in large and in small stations. The time seems not far distant when the compound-wound converter will be considered as a special type of machine.

Measurement of Temperature by Electrical Means.

In a paper presented at the Milwaukee convention of the American Institute of Electrical Engineers, Mr. Edwin F. Northrup gave an interesting discussion of electrical resistance thermometry, outlining the construction and operation of resistance thermometers, and described a new instrument, termed a "ratiometer," which reads temperatures as readily as a voltmeter reads volts.

Fig. 1 gives the diagram of connections of the instrument, and Fig. 2 illustrates details of the deflecting system and the shape of each of the two pole pieces. C_1 and C_2 (Fig. 1) are two flat coils mounted on the movable system, *a*, *b*, *c* (Fig. 2), having a damping frame of aluminum.

The two coils have *like* polarity on the same side. The system rotates between two iron crescent-shaped pole pieces of opposite polarity (Fig. 2) *p*. The axis of rotation of the system approximately coincides with the center of the outside circle of the crescent. Hence, when the system rotates, one coil moves so as to get more under the pole faces, and the other coil more from under the pole faces. Now, if currents flow through both coils, and in such a direction as to cause both coils to try to move from under the pole faces, the system will seek a position of equilibrium which is independent of the actual value of the currents flowing and which depends only upon the ratio of the portions of the main current, which divides to flow in the two coils. This is true, provided only that the system is under no spring control. The leading-in wires, three in number, are, in fact, made of such delicate strips of silver that they exercise a negligibly small control as compared with the control of the magnetic forces. If, now, the ratio of the currents in the two coils is altered, the system seeks a new position of equilibrium again, independent of the value of the battery current.

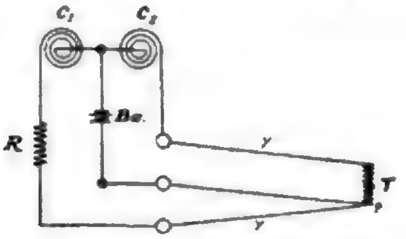


FIG. 1.—DIAGRAM OF RADIOMETER.

Referring to the diagram of connections (Fig. 1), *R* being a fixed resistance and *T* a resistance which varies with the temperature, the extent of the deflection of the moving system, as indicated on a scale reflected by a mirror attached to the moving system, determines the ratio *T*/*R* whatever be the value of the battery current. The source of current may be three or four dry cells connected in series, or a commutated current may be obtained from a hand-driven magneto.

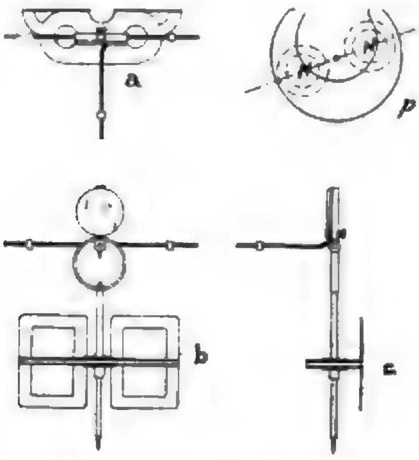


FIG. 2.—SYSTEM OF RADIOMETER.

To read any temperature it is only necessary to place the thermometer, joined by a lamp cord to the instrument, in the place where the temperature is required, and look into the telescope. The scale appears to move under the cross-hair of the eye-piece to the temperature reading.

The ratiometer may be made sensitive to temperature changes of about 0.1° C., or less, and can be relied upon to be as accurate as the scale is originally calibrated, with the exception of possible fluctuations of 1°, or at the most 2°.

Comparison of Two-Phase and Three-Phase Motors.

An interesting contribution relating to the relative merits of two-phase and three-phase motors was given by Mr. Bradley McCormick in a paper read at the annual convention of the American Institute of Electrical Engineers. The author propounded the following problems: Given two similar frames without windings, how shall the two-phase and the three-phase windings differ in order to secure proper operation? What will be the comparitive losses, if the two machines are given the same rating, or if not rated the same, how shall their ratings differ? He discussed the leakage factor, the current density in the rotor and the stator, the flux variation factor which shows how nearly the field conforms to the perfect sinusoidal revolving field, and the distribution factor, which takes into account the effect on the voltage of distributing the windings into a number of slots.

The following are the principal points brought out in the paper. They are intended to aid the designer in deciding upon the proper ratings for machines when wound for two-phase or three-phase service:

1. A two-phase machine should have 22 per cent more conductors per slot than the corresponding three-phase Y-connected machine designed for the same voltage and flux per pole.
2. The magnetizing current is the same in both two and three-phase machines, when expressed in per cent, of the current which corresponds to the full load output.
3. The copper loss of the two-phase machine is 12 per cent higher than that of the three-phase.
4. The leakage factor of the two-phase machine averages 25 per cent greater than that of the three-phase machine.

Even machines of the same phase and rating which are made as nearly alike in every respect as is commercially possible, vary widely among themselves in their characteristics when put in test. This fact makes it very difficult to determine by test the relative behavior of two and three-phase machines, especially with regard to those characteristics which differ only slightly. There can be no doubt as to the higher temperature rise of the copper in the two-phase motor, occasioned by the higher copper loss. For the same reason the efficiency of the two-phase motor is slightly lower, the difference depending upon the relative magnitude of the iron and copper losses. Since the slip is equal to the ratio of the secondary copper loss to the total power input to the secondary, it is evident that the slip is greater in the two-phase motor. Calculations and tests indicate that the slip in two-phase motors is about 20 per cent greater than in three-phase motors. Due to the increased leakage, the power factor in the two-phase machine is from 1 to 3 per cent lower than in the three-phase motor.

Interurban Test Car.

Prof. T. M. Gardner presented at the recent annual convention of the American Institute of Electrical Engineers a paper containing a description of an interurban test car at the University of Illinois. The car is of the double-truck type equipped with four 40-hp, 500-volt motors, and weighs complete 27.5 tons. The testing apparatus installed in the car include a watt-hour meter for reading the energy supplied to the lighting circuits and to the air-compressor motor and also one for reading the total energy supplied to the car. Recording ammeters and voltmeters serve to measure the current and the voltage used at the car. The speed is determined by a magneto generator in circuit with which is connected an ammeter and the primary coil of a transformer. The current varies directly with the speed and its rate of change corresponds to the acceleration. A voltmeter connected to the secondary circuit of the transformer is arranged to read the acceleration directly in miles per hour.

Experience in an Electrically Driven Printing Plant.

In the *Electrical World and Engineer* of June 3, 1905, there appeared an article describing the electrically driven printing plant of F. S. Blanchard & Co., Worcester, Mass. This installation has now been in operation practically a year, and it is interesting to note that the production of the plant has been increased some 20 to 25 per cent by the use of the direct electric drive, in comparison with the possibilities of the old belt and shafting drive. The conditions of working are much more favorable on the score of cleanliness, convenience in operation and compactness than were found in the company's old plant.

The present equipment of the plant covers two job presses, each driven by a ¼-hp motor; an art jobber driven by a ½-hp motor, and a universal press run by a ⅔-hp motor; a four-roller press operated by a 3-hp motor, and another of slightly different make run by a 4-hp motor; two four-roller rear-delivery presses run by a 3-hp motor in each case; a press run by a 1-hp motor, a 3-hp paper cutter outfit and two linotype machines, each driven by a ¼-hp motor. All the motors but one are of the Sprague Electric Company's make, the exception being a Peerless machine.

The proprietors of the plant state that electricity has been generally satisfactory; the operating cost has not been lowered in comparison with the old power bills, but the output has been increased. The employers like the motor drive in contrast with the old equipment. The company has not advertised its use of electricity as an auxiliary to the securing of better work, preferring to let its product speak for itself. When the plant was started, it was lighted by mantle gas burners, but the advantages of electric illumination soon became apparent and the gas lamps were displaced by a modern layout of incandescents. Power is still supplied by 500-volt, direct current from the Worcester Electric Light Company, whose generating station is about a mile away.

A few minor troubles have developed since the plant started, but these have been eradicated. Some of the motor field coils had to be replaced, and the fuses gave more or less trouble by frequent blowing. The potential sometimes approached rather close to 600 volts, and before the employes became thoroughly accustomed to the service several slight shocks were experienced.

It is no small problem to design very small motors to operate with perfect success at 600 volts, but the indications are that the equipment has now been brought to the point where thorough satisfaction can be expected. At no time were the interruptions to service of a serious nature, but within the last few months the smoothness of the service has been much improved. The printing company states that if the installation were to be established again, substantially the present equipment and arrangement would be selected.

Recent Electrochemical Developments.

ELECTROLYTIC PRODUCTION OF CAUSTIC SODA AND CHLORINE.

Among the numerous designs of diaphragm cells for electrolysis of sodium chloride for the production of caustic soda and chlorine the McDonald cell has found repeatedly applications in practice, for instance in a paper mill in Pennsylvania and in chlorination works in Colorado. A patent recently granted to F. McDonald, while referring in general to the arrangement of the plant, shows quite clearly the fundamental point which is to be met in the design of diaphragm cells. It is of fundamental importance to keep the chlorine evolved at the anode, separate from the caustic formed at the cathode. The diaphragm serves for preventing the two solutions from mixing mechanically, but it cannot prevent hydroxyl ions (the number of which increases in the catholyte with the increasing strength of the caustic solution during operation) from participating in the electrolytic conduction and traveling over to the anode side of the cell. Hence it is necessary to prevent this in some other way.

The method generally applied is to feed the fresh sodium chloride solution into the anode compartment and produce a mechanical flow towards the cathode, so as to counteract the traveling of the OH ions in the opposite direction. McDonald uses an automatic device for keeping the level of the electrolyte in the anode compartment at the desired height; for this purpose he controls the supply of NaCl from the reservoir to the anode compartment of the electrolyzer by means of a valve operated by a float the position of which depends on the level of the anolyte solution.

AMMONIA.

In the endeavor to solve the fertilizer problem, which is of such eminent commercial importance, attempts to produce ammonia synthetically from its elemental constituents are apparently not without promise. The fact that this synthesis should evolve a considerable amount of heat points in this direction. But the fact that no success has so far been achieved in this line is a suggestive illustration of the limitations of the application of thermochemical data. According to the old rule of Berthelot, a chemical reaction goes on if it evolves heat, or in other words if the energy evolved by the reaction (generally measured in calories) is positive. We know now that this rule is not strictly correct; a consequent application of the two principles of thermodynamics shows that the criterion of a reaction going on in a certain direction is not that the total energy of reaction is positive, but that the decrease of "free energy" (according to Helmholtz) is positive. However, we also know, that in general at ordinary temperatures the free energy is not very different from the total energy (while at high temperatures they may be quite different). This is the reason why Berthelot's rule may be used in practice without making great mistakes, and it will undoubtedly be used for some time to come, especially as we have infinitely more numerical data on the total energy of reactions than on their free energy.

However, from thermochemical data we cannot say what will be the speed of the reaction, and this is often of the greatest importance, as in the case of the synthesis of ammonia. Here the reaction velocity is practically zero under ordinary circumstances. We must make this restriction, "under ordinary circumstances," since it is an experimental fact that we often can change the speed of a reaction by bringing the reacting substances in contact with an apparently inert substance (called a catalyzer). The catalyzer itself does not change during the reaction, but changes enormously the speed of the reaction between the other substances with which it is in contact. The most famous industrial application of this principle are the contact processes for making sulphuric acid, which have brought about almost a revolution in this industry. Now with respect to the synthesis of ammonia, various experimenters have worked in this line, but so far without success. From a thorough recent investigation of Prof. Haber it appears that even with the best catalyzer known —iron—the reaction producing ammonia is so slow as to make the process practically impossible. But this does not mean that the problem cannot be solved. The chief difficulty is that we know practically nothing concerning the rationale underlying catalytic action. We undoubtedly classify under this name various effects which may be very different in character.

While not directly in this line, a recent patent of J. A. Lyons and E. C. Broadwell for the electrolytic production of ammonia may be mentioned here. The fused borate of sodium, potassium or any other positive metal is electrolyzed in a crucible forming the cathode, while the anode is a carbon rod in the center. On account of the much smaller active surface of the carbon rod, the anodic current density is high and an intense heat is produced there. Metallic sodium, potassium, etc., is set free at the cathode, while at the anode (under the reducing action of the carbon) boron is obtained. A tube around the carbon anode serves as diaphragm and prevents the boron from passing over to the cathode. At the same time nitrogen is introduced through this tube and combines with the boron to form boron nitride. This is brought in contact with steam, forming boric anhydride and ammonia.

ELECTROPLATING.

A recent patent of C. G. Backus and G. L. Wallave refers to details of mechanical construction of a rotatable receptacle for plating a large number of small articles at the same time.

A patent recently granted to J. W. Aylsworth, refers to a modification of his apparatus for plating long perforated strips of steel with nickel, for use in the Edison alkaline storage battery.

LETTER TO THE EDITORS.

Induction Motor Circular Locus.

To the Editors of Electrical World:

SIRS:—I have read with interest Dr. A. S. McAllister's article, entitled, "Simple Circular Current Locus of the Induction Motor," which you published in your issue of May 26. As it is just about eleven years ago that I developed and published a circle diagram for the induction motor and transformer, and as this diagram has since been my guide in designing several hundred thousand horsepower of induction motors, I have been particularly pleased with the thoughtful article of Dr. McAllister's in which he gives a method of arriving, in a very lucid manner, at the diagram of the general alternating-current transformer. It is interesting to look back to the day when the phenomena in induction motors were still very hazy, even in the minds of those who were then the best experts in the field, and to ponder upon the fact that how little, after all, our knowledge on the subject has been advanced since that day. The mark of progress shows itself invariably in simplification and we, therefore, must congratulate Dr. McAllister on the simple and logical manner in which he has succeeded in developing and building up the circle diagram of the induction motor and transformer.

CINCINNATI, OHIO. B. A. BEHREND.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Mechanical Design of Commutators.—LIVINGSTONE.—The first part of an article on the mechanical design of commutators for direct-current generators. They should have an ample wearing depth of copper. If every commutator is designed to last the same length of time and the amount of wear on a bar due to sparking and friction every time it passes under a brush is a constant, then the wearing depth should equal $c N n$, where N is revolutions per minute, n the number of brush spindles, and c a constant depending upon the desired life of the commutator. For ordinary generators a value of c equal to 0.005 to 0.0055 may be taken when getting out a design for a new machine. In order to design the commutator so that when worn down to the limit the stresses in the materials will not be unduly increased, the type of construction shown in Fig. 1 is, according to the author, the best one. The commutator should, further, be assembled so rigidly that a blow on the surface with a light hammer will not displace any bar. The only way to provide for this is to design the commutator so that a tension in the bolts of 12,000 lb. per square inch will give a pressure on the mica, between bars, of 25 D lb. per square inch when $D =$ the diameter of the commutator in inches. Mica of such a quality should be used that the copper and the mica will wear uniformly. Experience shows that for this purpose soft mica about 0.03 or 1/32 in. thick between bars of hard-drawn copper is best. It is important that the strains due to initial tension and expansion due to heating and centrifugal force shall be well within the elastic limits of the materials so that there will be no permanent set and consequent loosening of the bars on cooling down. The author gives the mathematical expressions for the stress at different points. The paper is to be continued.—Lond. *Elec.*, May 18.

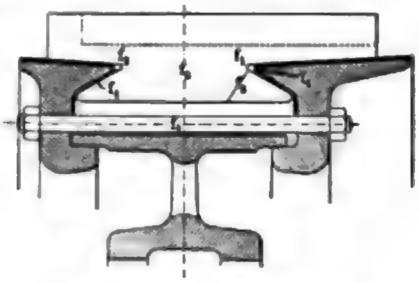


FIG. 1.—COMMUTATOR DESIGN.

Design of Generators.—HORSNAILL.—A mathematical paper on the use of comparative empirical formulas in the mechanical design of electrical generators. He first considers the diameter of the shaft required to carry the revolving parts without undue flexure or vibration. The size of the shaft is discussed from the point of view of stiffness only. The second problem dealt with is the size of bearings and the third problem, the stiffness of alternator armature frames and dynamo magnet yokes. Formulas are given and illustrated by numerical examples from actual practice.—Lond. *Eng'ing*, May 11.

Single-Phase Motor.—OSSANNA.—A communication giving a formula which shows the influence of the transformation ratio of the exciting transformer of the Winter-Eichberg motor upon the speed at which full compensation is obtained.—*Elek. Zeit.*, May 17.

Repulsion Motor.—An abstract of an English patent of the Union Electricity Company, of Berlin, for an improved compensated repulsion motor.—Lond. *Elec.*, May 11.

Polyphase Induction Motor Winding.—CHAPMAN.—A mathematical article indicating a rapid method of determining approximately the most suitable winding from the point of view of power factor and overload capacity, for a motor whose mechanical dimensions are already fixed.—Lond. *Elec.*, May 18.

Direction of E.m.f.—OBILE.—A brief note with a diagram on an easy method of determining the direction of e.m.f. in generators and the direction of rotation of motors.—*Elek. und Masch.*, May 13.

Lamps and Lighting.

Long-Flame Arcs.—ANDREWS.—The conclusion of his paper on long-flame arc lamps in general and the Carbone lamp in particular. After some data on the general effect and distribution of light he speaks on alternating-current arcs which are said to be very unpopular in England on account of their low useful efficiency. This is due in a great measure to the fact that about 50 per cent of the light is thrown up into the air, where for many purposes it is entirely wasted. This defect, however, disappears in long-flame, downward-feeding carbon arcs as the light emitted by both craters is thrown down so that the efficiency of the alternating-current and the direct-current arc is about the same. The author then gives some observations showing that a downward-feeding carbon lamp on a 50-period circuit gives the same effect as an ordinary lamp on a 100-period circuit, so that the use of downward-feeding carbon arcs obviates to some extent the disadvantage of flickering. In the discussion which followed some statements of Patchell from his experiences are interesting. He referred to the new system of lighting of the Charing Cross station in London, where competitive tests were made between gas and electric light. The electric light company had 8 Sale-Onslow, high-pressure gas lamps to compete with and put up 5 Oriflamme arc lamps and price for price "they beat the gas company hollow." On the basis of price for price the electric arcs gave 45,000 cp as against 25,000 cp for the gas lamps. He had made extended tests of various arc lamps and especially flaming arc lamps and gave the following figures in which the cost per 1,000 cp-hour is given at the rate of 4 cents per kw-hour.

Type.	Watts.	Cost per 1,000 cp-hr.
Oriflame	350	0.8 cents
Weinert	350	1.10
Excello	470	1.14
Santoni	420	1.4
Carbone lamp	1,000	2.0 (excluding trimming and carbons.)
Open arc	500	3.0
Enclosed arc	500	4.0
Enclosed midget arc	250	6.0

"He had been much struck when in the United States last year that there were practically no flame arc lamps, and he attributed that to two causes. One was that the lighting was almost entirely in the hands of the big companies, and the enclosed lamp was favored, due to the lesser labor, for this lamp would burn longer hours, and the companies seemed to appreciate that better, because one man could trim 600 lamps, whereas in England 40 lamps was considered ample for one man. This applied both to street lighting and store lighting. Another reason for their not having the flame lamp in the United States was—and this had been confirmed by the engineer of one of the largest American undertakings—that they simply did not know what high-pressure gas was." He considered that the chief disadvantage of the present flame-arc lamps is that they do not burn long enough hours, and he thought that the magazine arc lamp was the lamp that the manufacturers of flame arcs would have to put their money into. He had not, so far, found the gas and fumes from flame lamps cause any deleterious effects. The maintenance he had found, after running a good many, was a mere bagatelle. Answering some questions he replied that the above figures do not include carbons and are for mean spherical candle-power.—Lond. *Elec.*, May 11 and 18.

Standardization of Arc Lamps.—Two committees appointed by the Assoc. of German Elec. Eng. and by the Assoc. of German Central Stations make the following proposals with regard to the rating of arc lamps. An arc lamp is to be rated for practical purposes according to its most important field of application, namely, the direct illumination of the space below a horizontal plane laid through the radiating point. It is to be rated, therefore, by the mean lower hemispherical candle-power designated by *J*⌓ and measured in hefner candles (indicated by *H K*⌓). The measurement is to be made with the arc lamp in the position as used in practice but without external reflector and with clear glass globes of the same dimensions substituted for the globes used in practice. With alternating-current arc lamps the test is to be made with sinusoidal e.m.f's and a frequency of 50 periods. "Practical power consumption" of an arc lamp is the total power consumption of an arc lamp circuit (measured at the points where this circuit is connected with the network) divided by the number of lamps. By stating this practical power consumption, the voltage of the network is also to be stated. "The practical specific power consumption" is the practical power consumption just defined divided by the mean hemispherical candle-power and is designated by "*W/H K*⌓ at *n* volts in the network" (watts per hemispheric hefner candles, etc.). With alternating-current arc lamps it must be stated in every case whether non-inductive or inductive series resistances are assumed. The value "*H K*⌓/*W*" at *n* volts in the network" is called "practical light output" (Lichtausbente). Rules are also given on photometric tests of arc lamps. The above rules are explained and defended in a long memorandum. It is stated that in the committees it had been repeatedly suggested to state not simply the hemispherical candle-power, but also the mean spherical candle-power. However, this suggestion was not adopted because it was thought it would introduce confusion.—*Elek. Zeit.*, May 17.

Spherical Photometer.—Corsepius.—An illustrated description of a new form of construction of the spherical photometer of Ulbricht. It is shown in Fig. 2. The internal diameter is 2 meters. The sphere is made of gypsum. The whole sphere is divided vertically into two halves of which one is stationary, while the other is set on rollers and may be moved. In the stationary half a metallic ring is placed at the top, which in the construction of the author has a diameter of 20 cm. and a height of 11 cm., so that it suspends somewhat into the interior of the sphere, the thickness of the walls of the sphere being 4.6 cm. The window, *M*, at the right, has a diameter of 20 cm. The opening of the screen, *S*, placed in the zero point of the photometer, is normally 16 cm., but may be diminished at will. The screen, *B*, is placed so that not only the window, *M*, itself, but also a border around it is shadowed. The distance of the lamp, *L*, from the upper wall of the sphere is 28.5 cm., the distance from the center of the screen 34 cm. The screen is placed in an inclined position and is of oval form. The calibration of the photometer is made with two incandescent lamps, the mean spherical candle-power of which has been determined by the Reichsanstalt. The author urges that arc lamps should be rated according to their mean spherical candle-power. He describes a simple method of determining the distribution of light with the aid of photographic papers placed at different points. Some results of tests of various lamps are given and it is pointed out that the new metallic filament lamps are more efficient than alternating-current arc lamps. —*Elek. Zeit.*, May 17.

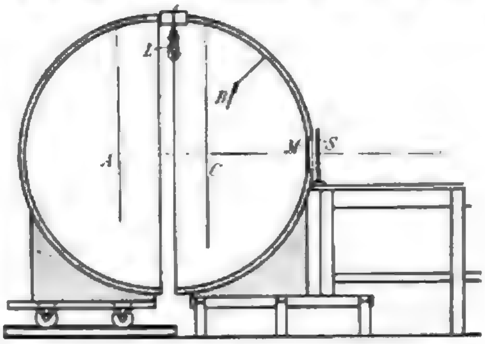


FIG. 2.—DIAGRAM OF SPHERICAL PHOTOMETER.

Tungsten Filament Lamp.—Kuzel.—A brief communication, in which the writer first gives some notes on former work on tungsten lamps and mentions that Lodyguine took two patents out in 1894. The writer's own process is stated to be based on two new inventions: one is that metals in the colloidal condition form plastic masses without the addition of a binding material, and can be formed easily into colloidal wires. The second is that wires formed in this way and dried undergo a physical change when subjected to strong heat; without breaking or disintegrating into powder they pass over from the colloidal condition into the crystalline condition and the lamp filament is thereby finished. The author says he can change in this way the metals into filaments. He gives some results of tests of his lamps which have been already fully noticed in the Electrical World.—*Elek. Zeit*, May 10.

Metal Filament Lamps.—Ballois.—A review of recent inventions in metal filament lamps. The article does not seem to contain anything new.—*L'Eclairage Elec.*, May 12.

Power.

Swiss Transmission Scheme.—A note stating that the city of Zurich will spend a sum of $2,137,000 for the installation of a generating plant in the Albula Valley, where water power of 24,000 hp is available. There will be 8 generating sets, each consisting of a turbine and generator. Two projects have been proposed, one for the generation and transmission of three-phase currents at an initial pressure of 46,000 volts and a final pressure of 70,000 volts; the other for power transmission by direct current at 79,000 volts between the two conductors with an intermediary neutral point connected to earth so that a voltage of 39,500 exists between each conductor and earth. In both cases the line must have two conductors and in the case of three-phase currents the conductors must have a cross-section of 50 sq. mm. and in the case of direct current a cross-section of 30 mm. The cost of $957,000 for the hydraulic installation and $1,180,000 for the electrical installation with the three-phase project and $1,110,000 for the direct-current project.—*L'Eclairage Elec.*, May 12.

Traction.

Single-Phase Traction.—FUMERO.—An illustrated description of the Finzi single-phase traction system installed on the Milan exhibition. The track is double throughout and has a length of about 1,500 yards. The working pressure is 2,000 volts, but a series of experiments will be made with voltages varying from 2,000 to 10,000. Fig. 3 shows the arrangement of the high and low-tension circuits on the train. The most important characteristic of the system consists in the easy control from either end, which is obtained by the division of the transformer into two parts, one of which is in the front carriage and the other in the last. The high-tension, 2,000-volt, 15-period current after first passing through the choking coil of the lightning arrester, is led into the relay of the main switch, which can be operated either manually or automatically. From the relay it passes through the switch, main fuse and thence to the primary of the transformer in the first carriage. Then it goes through one of the three wires placed on the roofs of the carriages, to the primary of the second transformer in the last carriage and finally to earth. The third high-tension line serves to put in parallel the primary of the first transformer with either of the main switches, and hence with the trolley. The end carriages are equipped each with two Finzi single-phase motors of 30 hp each, while the intermediate carriages have each a single motor. The complete equipment of a train, therefore, consists of six motors, of which a group of three is coupled up in series with the secondary of the transformer. By means of the special device of dividing the transformer in two, the first position of the controller handle applies to the terminals of the motors a pressure corresponding to the secondary of the transformer placed in the last carriage, or the half of the whole available pressure. Experience has shown that this amount is the best adapted for starting the single-phase motors in series. Passing from position 1 to 2, 3, 4, 5, 6, 7, the pressure is increased by steps of 30 volts each time, thus bringing it up from 180 to 360 volts. As there are always three motors in series on the secondary side, each obtains an initial pressure of 60 volts, which is stepped up by 10 volts successively to a final value of 120 volts. The arrangement is quite symmetrical for operating from either end of the train, and thus it is possible, by manipulating the controller, to obtain any secondary pressure that is required. To reverse the motors the action of the controller is the same as for continuous-current working. The original intention was to use two bow trolleys, one for the outward and the other for the return journey. But in view of accidents which might happen if it were forgotten to lower one bow, a new type of trolley has been designed with a double collector, to minimize sparking. The rhomboidal arrangement of the links (Fig. 4) is very elastic and insures that, when one of the rollers momentarily leaves the wire as it passes a point of support, the other is making good contact. The rollers were carefully designed to revolve easily in their bearings. The provision of two rollers has the further advantage for high-tension lines that it renders it unnecessary for the driver to break the circuit when passing section insulators. The Finzi motors have laminated poles and a compensating winding for the production of a flux at right angles to that of the field. This neutralizes the effects of the armature self-induction, increases the power factor and maintains a high efficiency. The armature is built up of stampings on a steel spider and has 65 conductors in slots. The commutator segments are each composed of a large number of thin plates connected up without resistances to the conductors. Choke coils are used in passing from one position of the controller to the next.—Lond. *Elec.*, May 11; from *L'Elettricita*, April 17.

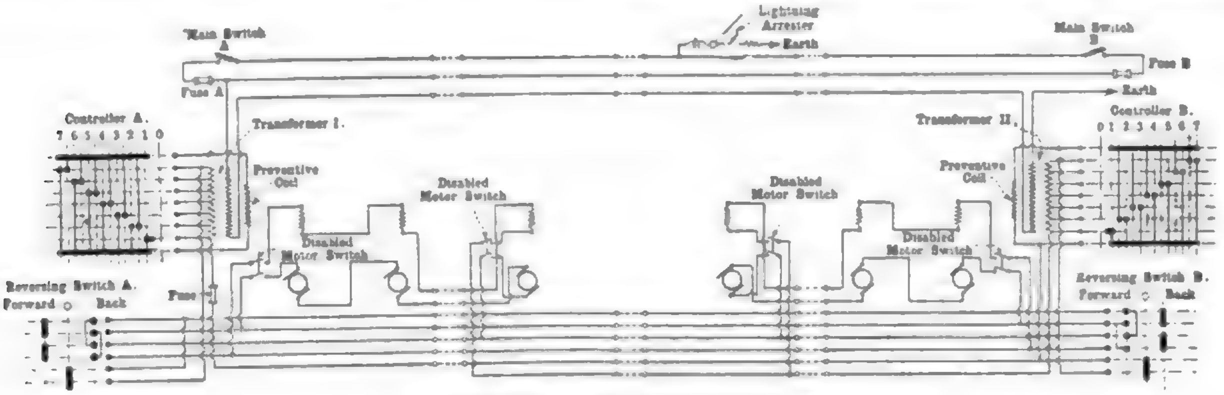


FIG. 3.—DIAGRAM OF TRAIN CIRCUITS.

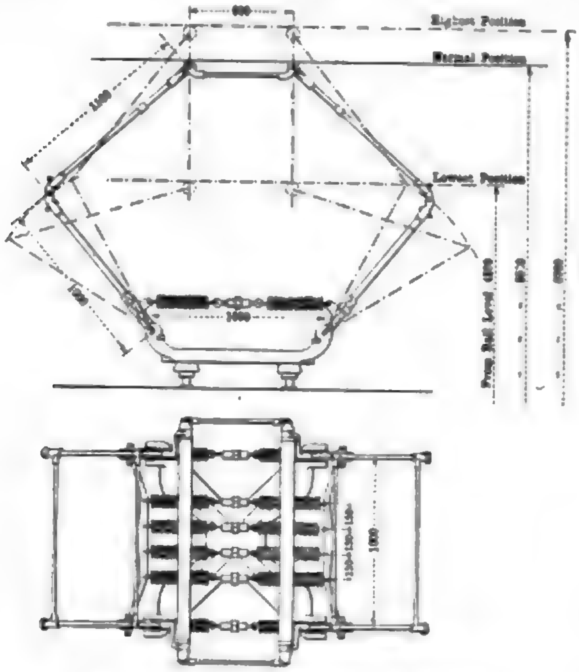


FIG. 4.—ELEVATION AND PLAN OF TROLLEY.

Regulations for Electric Traction.—Extended safety regulations proposed by the committee of the German Assoc. of Elec. Eng. for electric traction systems.—*Elek. Zeit.*, May 17.

Installations, Systems and Appliances.

Lighting Plant of a Summer Resort.—WERTENSON.—An illustrated description of the municipal lighting plant of Kissingen, which is a refined summer resort in Germany. The consumption of electricity during the winter by the residents of the town is small, while during the summer months the load is a maximum between 8 and 10 o'clock in the evening due to the consumption of electricity in the hotels, theatres, etc. Since the place has a refined character there are comparatively few motors for workshops, etc. For this reason the city hesitated a long while before erecting a plant and the contractor had to guarantee that the works would pay interest on the capital. The capital was provided by the city. The connected load is about 600 kw and a gradual increase up to 900 kw is expected. For this reason the capacity of the station was made 400 kw in the beginning, which will be increased to 600 kw later on. The three-wire, direct-current system with a storage battery giving 1,700 ampere-hours for a three-hour discharge is used. For the most part of the year a single attendant is sufficient and only during times of highest load are two men required. In order to make the station pay, the prices charged in summer months are high compared with the prices charged in winter. The price for electricity is in summer 17.5 cents, in spring and autumn 13.75, and in winter 11.25 cents per kw-hour for the first 150 kw-hours consumed during one month; for further kw-hours consumed up to 300 the price is reduced by 1.25 cent and for further kw-hours above 300 again by 1.25 cent. The price for electricity varies, therefore, between 17.5 and 8.75 cents per kw-hour. For motor purposes the fundamental rate independent of the season is 6.25 cents per kw-hour on which a discount is allowed according to consumption, so that electricity consumed for power purposes above 2,000 kw-hours per month costs only 2.5 cents per kw-hour.—*Elek. Anz.*, May 13 and 17.

Regulating the Voltage of Lighting Batteries.—Hollis and Alexander.—The first part of an illustrated paper read before the New Castle section of the British Inst. Elec. Eng. The authors compare the following two methods of keeping the voltage of a battery constant during discharge, one by means of a booster in series with the battery and the other by additional cells and a regulating switch for cutting them in and out. Of these two methods the former seems to be generally adopted in England, but the authors do not think that this is due to any special advantage of the former method, but because the latter case has not had a sufficient and fair consideration as regards the capital costs. In the present installment they compare the batteries required in both cases. The paper is to be continued.—Lond. *Elec. Eng.*, May 18.

Resistances with Lightning Arresters.—Benischke.—A paper read before the Berlin Elec. Society and explaining in detail the function of the resistances in the earth connections of lightning arresters. For these resistances there is an upper and a lower limit. The upper limit is such that the atmospheric discharge flows off quickly to earth while the lower limit is such that the short-circuit current following is as small as possible. The author described resistances made of carborundum and their advantages over water resistances are pointed out. An account of the discussion is also given.—*Elek. Zeit.*, May 17.

Economy of Central Stations.—Some notes by an American visitor on the British electrical industries. The American has noticed in England that some of the later projects have been engineered with an eye single to commercial efficiency—as distinguished from technical efficiency—and the capital has been held down to the figure on which returns are reasonably certain. This means a general drift away from over-refinements that do not pay for themselves. On the other hand, concerning English central stations he complains that they do not yet realize that the engineering side of the station work has become of secondary importance; that the main question to-day is not how to give a constant supply, but how to build up a good solid load in the face of ever increasing competition. There is a general apathy among central station managers. "The corporation-owned properties are the worst of all, but the limited companies are bad—very bad—many of them. They seem to take such business as a kind providence sends them." Hunting for business can be done in many ways, for instance, getting merchants to light their show windows after business hours. "The first thing is to turn the mind from penny economies of operation to the pound possibilities of additional business." As to economies of operation, the English stations are excellent. They run as cheaply as the best American ones—or would run as cheaply if the management would procure them the business to run on.—Lond. *Elec. Times*, May 17.

Electrochemistry and Batteries.

Metallurgy.—Hadfield.—A lecture on unsolved problems in metallurgy. After some remarks on the variation of the magnetism of certain alloys with a change of temperature he speaks of the use of electric furnace for making iron and steel. "Where water power and suitable iron ore can be found together, then, no doubt, satisfactory electrical smelting practice will be developed, but this can only come slowly." He does not think that the old type of crucible steel smelting has been threatened with extermination by the electric furnace. He makes some remarks on alloys and their special properties and on recent rapid progress in pyrometry.—Lond. *Elec.*, May 11.

Storage Battery.—Some notes on the "X" storage battery of Oppermann, the feature of which is the mixture of the active material with very finely divided inert hair and fibre to make them more porous.—Lond. *Elec.*, May 11.

Units, Measurements and Instruments.

Measuring Small Alternating Currents.—Voege.—An illustration of a new hot-wire instrument for measuring small alternating currents with direct-current instruments. Its principal features are the small consumption of energy and its high sensitiveness. The principle is indicated in Fig. 5, in which *H H* represents a platinum wire which serves as heating wire, the alternating current to be measured being passed through it. At the point *P* of this platinum wire two wires are soldered to it, one consisting of iron (Fe), the other of constantan (K). The free terminals of these two wires are connected to the direct-current instrument, the system representing a thermo-electric circuit. The wires are as thin as possible in order to get the masses to be heated as small as possible. The deviation of the needle of the galvanometer is almost independent of the direction of the current passed through *H H*, but the readings are not absolutely equal in both cases for the reason that the point *P* is not a mathematical point, but has a certain elongation. For this reason the very small drop of voltage within the point *P* of the heating wire increases the current of the thermo-electric circuit for one direction of the current and decreases it by the same amount for the other direction. To overcome this difficulty it is only necessary to calibrate the instrument by passing direct current through *H H* in opposite directions, and they take the average of the two readings. This gives the correct calibration for alternating current. The apparatus is placed in a kerosene bath and is set into a second glass vessel and is then practically independent of external variations of temperature. Fusing of the heating wire with overload is prevented by connecting it in series with an iron wire of 0.02 mm. thickness and about 2 mm. length. The sensitiveness can be still further increased by evacuating the glass vessel. It is then possible to obtain continuously 10 millivolts at the terminals of the thermo-cell with about 0.1 amp. With mirror galvanometers of suitable sensibility currents down to 1 milli-ampere may be measured. In measuring 1 milli-ampere the power consumed by the instrument itself is about 0.00005 watt.—*Elek. Zeit.*, May 17.

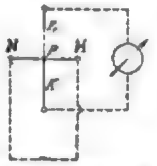


FIG. 5.—DIAGRAM SHOWING PRINCIPLE OF HOT-WIRE INSTRUMENT.

Alternating-Current Galvanometer.—Abraham.—A note on a French Academy paper giving a description of a moving-coil galvanometer for measuring alternating currents of the order of 0.01 micro-ampere in which the field is excited by an alternating current of the same frequency as that to be measured, by means of a small transformer. The apparatus was constructed with the collaboration of Carpentier. The general arrangement is similar to the ordinary D'Arsonval galvanometer. The alternating-field magnet induces currents in metallic parts of the instrument which tend to react on the moving-coil circuits so that if there is any dissymmetry in the construction, the moving coil is lightly deflected one way or the other. This effect can be compensated for by placing in the air-gap a small metal sheet in a correctly-adjusted position. If the magnet be excited and the moving coil short-circuited with a low resistance, it instantly takes up a position where it is not traversed by any flux. If moved from this position a powerful directing couple is produced, due to the current induced in the coil. This couple, which is due to the lag in phase of the induced current, would considerably reduce the sensitiveness of the instrument, but is avoided in actual use by including a capacity shunted by an adjustable resistance in the moving-coil circuit. By overcompensating with too large a capacity, a couple is produced which opposes the torsion of the suspension, so that a smaller net controlling couple can be obtained than that corresponding to the suspension alone. In one instrument constructed, the moving coil had a resistance of 200 ohms and a period of swing of 10 seconds. The compensation of the electrical directing couple was affected by a 0.5 microfarad condenser shunted with 2,000 ohms. The sensitiveness with a scale at 1 meter distance was 275 mm. per micro-ampere.—Lond. *Elec.*, May 18.

Uniform Notation.—Strecker.—A report of a committee of the German Assoc. of Elec. Eng., which has worked together with committees of the German Phys. Soc. and the Society of German Engineers as well as with other German and foreign societies to discuss a system of uniform notation. The proposals and the different opinions held by the different societies are very clearly tabulated.—*Elek. Zeit.*, May 10.

Calculating Springs.—Edler.—The conclusion of his mathematical paper on the calculation of springs for electrical and mechanical apparatus.—*Elek. und Masch.*, May 13.

Miscellaneous.

Electric Blast Apparatus.—Maurice.—The first part of an illustrated serial on electric blast apparatus with special reference to its use in coal mines. In the present installment he describes constructions of fuses and exploders.—Lond. *Elec.*, May 18.

BOOK REVIEWS.

Wiring Handbook. By Cecil P. Poole. New York: McGraw Publishing Company. 85 pages, 61 illustrations, 32 tables. Price, $1.00.

This is an excellent treatise for wiremen and practical workers in the electric lighting and motor field. The book treats of wiring terms and measurements of feeders and mains, three-wire circuits, determining wire sizes, direct-current motor wiring, alternating-current wiring, determining the size of bus-bar conductors, switch connections, motor connections, transformer connections, watt-hour meter connections. It also contains a digest of the Underwriters' rules applying to interior wiring, fundamental formulas and 32 labor-saving tables. The latter are printed on separate sheets of tough paper and bound in the back of the book in order that they may be spread out conveniently for use and without reference to the text after the user has become familiar with them. For a book of modest dimensions the treatise is unusually complete. The absence of a table giving the diameter, area, weight, length and resistance of standard copper wire, however, is a regrettable omission.

Die Elektrolyse Geschmolzener Salze. Dritter Teil: Elektromotorische Kräfte. By Richard Lorenz. Halle: Wilhelm Knapp. 322 pages, 75 illustrations. Price, 10 marks.

This third part completes the admirable treatise which Prof. Lorenz has written upon the electrolysis of melted salts. These 790 pages are worthy of being styled a classic; in them is brought together not only all that was previously known on this subject, but almost as much again of entirely new matter, contributed outright by Prof. Lorenz. Not since Moissan's classical "Le Four Electrique" has a scientific work of this magnitude contained so much original work, therein first published. This third part treats of polarization phenomena in melted electrolytes, cells with molten electrolytes, theoretical calculations on these cells, decomposition tensions, and applications of the ionic theory. Not only are all the facts classified and tabulated, but most illuminating discussions of the theory of the phenomena are set forth. We venture to say that in future no electrochemist dare pretend to be posted on the electrolysis of molten salts until he has read and digested this monumental treatise.

Standard Telephone Wiring. For Common Battery and Magneto Systems. By James F. Fairman. New York: McGraw Publishing Company. 91 pages, 74 illustrations. Price, $1.00.

This handbook is intended particularly for telephone wiremen, and as such its information is all of a direct practical nature. A short introductory section gives an account of electrical units and electrical circuits. Following is a section on telephone apparatus, in which well-illustrated descriptions in simple terms are given of telephone receivers and transmitters, condensers, various types of telephone bells, magnetos, lightning arresters, etc. The following sections are on installation, common battery systems, magneto systems and troubles, respectively. Plain instructions are given for connecting different types of apparatus to both the common battery and magneto systems, and all connections are clearly shown by lettered diagrams. In the section on troubles, the troubles likely to be encountered are classified, and the symptoms, causes and remedy given. The final pages of the book contain such rules of the National Electrical Code as apply to telephone installations. To all connected with the practical side of telephony this book should be of great assistance in their daily work.

Practical Electric Railway Handbook. By Albert B. Herrick. Second Edition, revised and corrected. New York: McGraw Publishing Company. 459 pages, 329 illustrations. Price, $3.

The second edition of this excellent electric railway manual has been thoroughly revised. A number of sections have been rewritten and expanded and new subjects introduced to accord with recent developments in electric traction. New methods of testing are also given and data added on new types of apparatus. The 450 pages of text in small print contain an immense amount of matter, almost all of a practical character, and of value to every one connected with the electric railway industry. The subjects of the nine sections in which the book is divided are as follows: General tables, testing the track, the power station, the line, the car house, the repair shop, the equipment, the operation. The section on testing is of particular value for the reason that all of the methods are of direct application of electric traction work, and many of them have been specifically devised for this sole purpose. In the section on the equipment, data of all the latest types of motors and controllers are given, including those of the General Electric & Westinghouse single-phase systems.

A Practical Treatise on the Steam Engine Indicator and Indicator Diagrams. Second Edition, Revised and Enlarged. By W. Worby Beaumont. New York: D. Van Nostrand Company. 250 pages, 128 illustrations. Price, $2.50 net.

This treatise, though primarily written for English engineers, is also applicable to American practice. It is written in a plain and comprehensive style which makes the instruction interesting, holding the reader's attention closely from cover to cover. It gives examples of the application of the indicator to simple, compound, triple and quadruple-expansion stationary steam engines, dealing with pressures up to 350 lb. per square inch, thus bringing the work up to date. The indicating of both simple and compound locomotives is given due attention, with numerous diagrams from them, taken under various conditions.

A chapter on the indicating of gas and oil engines contains diagrams taken from engines of these kinds developing as low as 8 and as high as 875 hp; using pressures ranging from 25 to 500 lb. per square inch. These diagrams are fully explained, and as the internal combustion engine is rapidly assuming a commanding position among the world's prime-movers, every engineer who would be considered an expert along this line should understand the principles involved in indicating such engines and making the necessary calculations. Careful study of this work will supply much of the required information. Only simple mathematics are used, and these are presented in acceptable form to those engineers who are not college graduates.

American Telephone Practice. By Kempster B. Miller. Fourth Edition, enlarged and entirely rewritten. New York: McGraw Publishing Company. 888 pages, 643 illustrations. Price, $4.00.

This standard work is so well known that it is unnecessary to give, in a notice of a fourth edition, a general review of its contents. The present edition has been very largely rewritten, obsolete methods and equipment have been eliminated and much of the historical matter in former editions cut out, in order to make room for an account of modern methods and apparatus. The classification has been considerably altered, some of the old chapters having been combined with others in order to effect a more logical arrangement. A chapter treating generally of the telephone exchange has been added as an introduction to subsequent chapters which deal with the various parts of the exchange, particularly the switchboard system, appliances and auxiliaries. The common battery, or central energy system, is, in this edition, treated exhaustively, and a complete description is given of the modern Strowger automatic telephone system. The present edition contains 42 chapters, of which 20 are almost entirely new. Subjects such as trunking between common battery offices, private branch exchange service, measured service, toll switchboard systems and power plants, are also treated at length in this edition for the first time. The author has performed a service of high value to the telephone public in undertaking from time to time the enormous labor which in such a rapidly growing art must be necessary to keep a book of this exhaustive character up to date.

BOOKS RECEIVED.

Telegraphie und Telephonie. Elementare Vorlesungen. By Dr. Richard Heilbrun. In nine parts. Berlin: Georg Siemens. Price, complete, 15 marks.

Trattato di Telefonia. By I. Brunelli and E. Longo. In twelve parts. Rome: G. Scotti & Company. Price, each part, 1.25 lire.

Lexikon der Elektrizitat u. Elektrotechnik. By Fritz Hoppe. Issued in 20 parts. Wien: A. Hartleben. Price, complete, 10 marks.

Backstrom-Smith Steam Turbine.

The first Backstrom-Smith turbine was recently successfully tested in the Oneida Street plant of the Milwaukee Electric Railway & Light Co. The interest of this turbine lies in the fact that it operates under constant stage-pressures to suit varying loads from the maximum down to the minimum, and that it is instantly available for either condensing or non-condensing work, the output of the machine remaining unchanged. Another feature of the machine is the simplicity of its mechanism and the methods of its construction which enable it to compete with other forms of prime-movers in economy, first cost and maintenance expense.

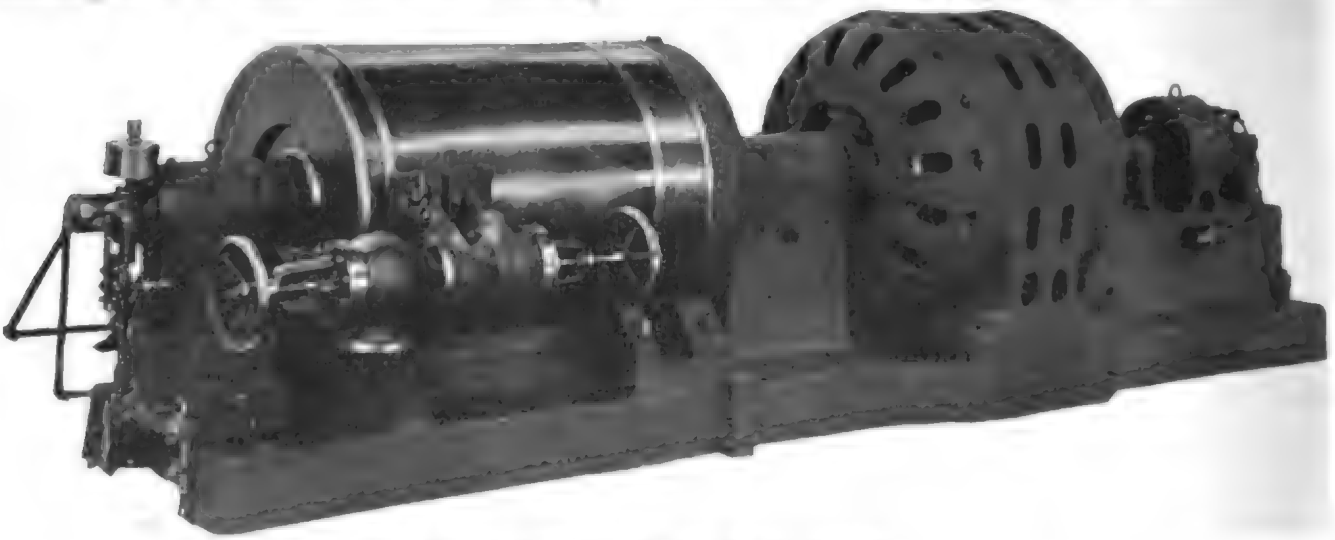


Fig. 1.—Backstrom-Smith Steam Turbine.

In general, the Backstrom-Smith steam turbine may be described as a multi-cellular turbine of the inflow type. Its general form is shown in Fig. 1. Special means are provided for direct coupling to alternator and exciter. It is claimed that this turbine is the first to be provided with means for meeting the requirements of changing loads without throttling, thereby making it nearly as economical for light loads as for the heaviest. The mechanism by which this is accomplished is as follows:

Flexible steel bands are secured to the periphery of the nozzle sections and to spools or rollers (Fig. 2) mounted on a collar or ring which has a limited rotary travel around the housing, inside of which each turbine wheel revolves. A movement of this collar winds or unwinds the steel tape on each of the spools, uncovering or covering the series of nozzles or ports which admit steam to the active buckets of the turbine wheels. This winding or unwinding is done automatically, the device being so arranged that the flow of steam is always in proportion to the load, steam entering the different stages at a predetermined and constant pressure, but in varying quantities, depending upon the number of nozzles uncovered by the steel tapes. This automatic regulation is accomplished by means of a shaft running the full length of the turbine in the bottom of the housings. At proper intervals on this shaft are keyed pinions which engage corresponding teeth cut in the ring or collar on which the several tape rollers are mounted, these rollers engaging with short racks secured to the nozzle ring or housing. The minutest motion of the shaft results in winding or unwinding the tape on the rollers, thus closing or opening more or less of the nozzles. The motions of the shaft operating this ingenious cut-off mechanism are controlled by the governor shown at the left in Figs. 1 and 3. The governor controls a flow of oil under constant pressure, which by means of a pressure cylinder and a rack and pinion, rotates the shaft in one or the other direction. The governor is dependent upon the proper action of the lubricating mechanism, as any accident to the latter results in an automatic stopping of the turbine, thus insuring the machine against self-destruction.

In addition to this governor with its two important functions, a safety device is provided in the shape of a safety governor controlling a butterfly valve, which closes automatically when the turbine speed reaches 5 per cent above the normal and is otherwise inoperative.

In the size illustrated (400 kw) recently tested in the Oneida Street plant of the Milwaukee Electric Railway Company, there are ten turbine wheels or runners, the general form of which is shown in Fig. 4. This illustrates a runner in one of the earlier stages, the bucket face of each successive wheel being wider. All the runners have an equal number of buckets of a uniform cross-section. This feature applies as well to the nozzles.

It is the claim of the inventor, Mr. C. A. Backstrom, that superheated steam is not as essential to the economical operation of this type of turbine as is the case in others for the reason that there is a minimum of condensation, because of the constant pressure and temperature maintained at all loads in all the stages of the turbine; that all the water contained in the steam is separated and shifted or drained into the succeeding stage by automatic means, where it is at once in part, if not wholly, re-evaporated, thus becoming useful energy; and that, by using high steam velocities, the surplus velocity appears in the form of superheat, which greatly reduces internal condensation and skin friction. As an illustration, steam at 150 lbs. gauge pressure reaches the first stage of the turbine at a temperature of 366° F. Any water contained in this steam is separated from it, falling to the bottom of the stage-chamber, from which it passes through an automatic device into the second stage, where the pressure is, say 91 lbs. and the temperature 332° F. An instantaneous evaporation naturally follows from these differences in pressures and temperatures.

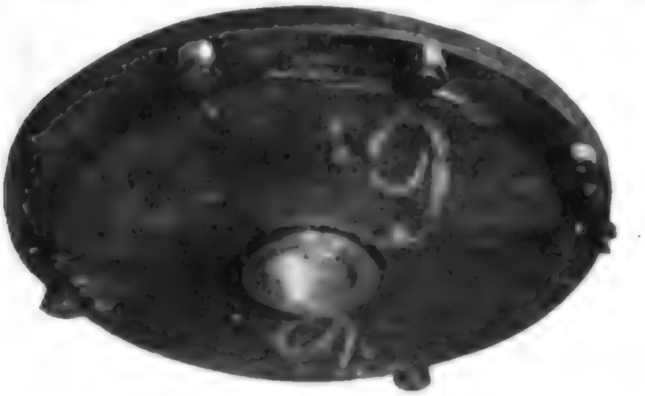


FIG. 2.—FLEXIBLE BAND ON ROLLER.

The turbine as built and installed for use in connection with a condenser, is arranged so that it may be quickly converted into an economical non-condensing type, should the condensing apparatus get out of order or become inoperative. This is done by providing an auxiliary exhaust at a point favorable for exhaust to atmosphere. This early exhaust relieves the turbine from a certain amount of back pressure which would arise from forcing a large volume of fully expanded steam through a number of useless and idle turbine wheels, causing a considerably reduced efficiency and other unfavorable effects. A narrow opening in the housing is provided for this auxiliary exhaust, a wider opening at the end being the exhaust to the condenser.

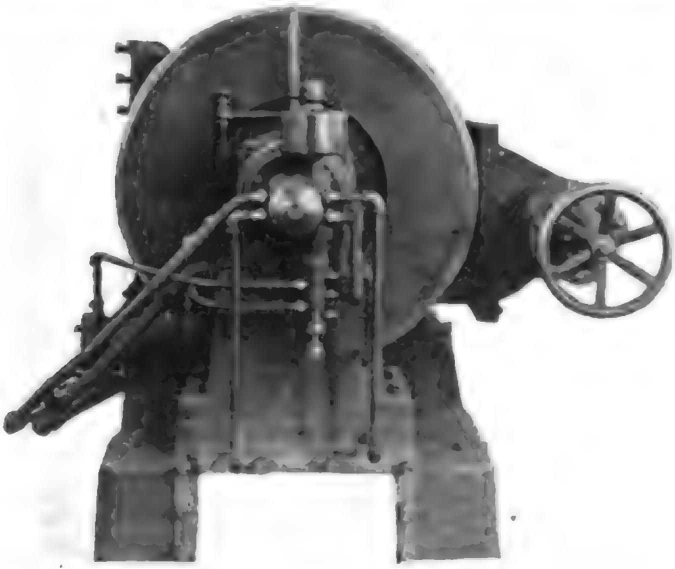


FIG. 3.—VIEW OF GOVERNOR.

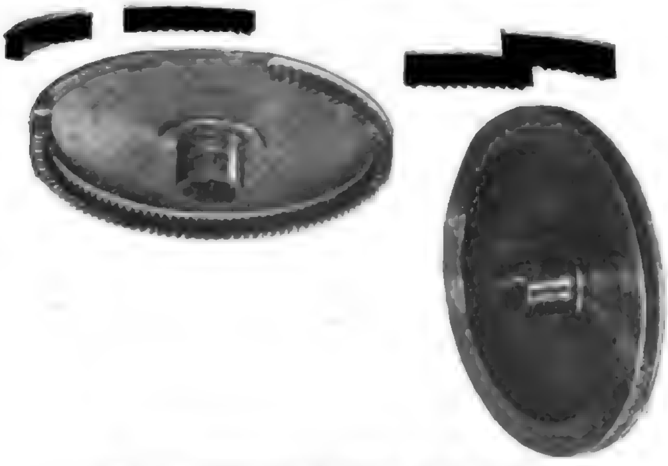


FIG. 4.—SECTIONS OF BUCKETS AND WHEELS.

The builders have means by which the buckets to each of the wheels are cast in sections, all machining of these difficult and important parts being dispensed with. By the liberal use of fine polished, non-corrosive nickel steel, they claim to have succeeded in producing an inexpensive and very effective casing for runner-buckets as well as linings for nozzle openings, cast into attachable sections, as shown in Fig. 4. Assembling is facilitated by the fact that the turbine is made in separate, independent, standardized sections, easily bolted to each other in erecting. The usual practice of making parts in halves is not resorted to, and yet any part is readily accessible and can be easily replaced when repairs are necessary.

The builders are now prepared to supply units of not less than 400 kw nor more than 2,500 kw. A new type of alternator of excellent design, recently perfected by the Western Electric Company, will be used in connection with the turbine.

British Type of Meridian Lamp.

A type of the Meridian incandescent lamp is being introduced by the British Thomson-Houston Company to meet the demand for a lamp possessing all the characteristics of the original B.T.-H. spherical globe lamps, but having a globe of smaller diameter. It is not intended to occupy the same place as the Meridian, but to fill the gap between that lamp and the standard Edison 16-cp incandescent lamp. The new lamp is scientifically designed, accurately made and has a long, useful life, with but a small consumption of power. The special "Prismo" glass shade is very efficient and is accurately fixed to the lamp holder by the use of a small shade carrier, or gallery, for attaching the shade to standard fittings, so that the lamp may be burned in any position—often an important consideration. The lamp has a rating of 32 to 35 cp with a power consumption of 60 watts. It is supplied with standard bayonet cap, special "Prismo" glass shade and gallery, and can be fixed in the ordinary fitting without alteration. It is made only in 4-in. frosted or obscured spherical bulbs, and for voltages of 100-125 and 200-250.

BRITISH MERIDIAN LAMP.

Liquid Tachometer.

The tachometer, illustrated herewith, has been designed for indicating revolutions per minute of motors, generators, shafting, etc. The readings are shown by the height of a colored liquid in the indicator tube in connection with a graduated scale. The only moving part in the instrument is the paddle wheel in the centrifugal pump, the latter constituting the lower part of the instrument. When the paddle wheel is revolved, the centrifugal force draws down the liquid in the reservoir and forces it up in the indicator. The bottom of the reservoir communicates with the center of the pump, and from the periphery of the pump there are passages to the indicator tube.

The vertical height between the surface of the liquid in the indicator tube and of that in the reservoir will be approximately proportional to the square of the speed of revolution. The reservoir is concentric with the indicator tube, so that a slight inclination does not vary the level of the liquid in the tube. The small handle at the front of the instrument may be used for throttling the passage from the pump to the indicator, to prevent the vibration of the column of liquid due to sudden fluctuation in the speed. Thus, if desired, the readings may be made "dead beat." A displacement plunger is provided for adjusting the zero level of the liquid. Pure alcohol, colored with analine dye, is used.

Fig. 2 shows the course of the liquid when the instrument is in operation. From the reservoir the liquid flows down through the chamber where the displacement plug is located, down into the space surrounding the pump chamber. Passages conduct the liquid to both sides of the pump casing. When the pump paddle is revolved, the liquid enters the pump chamber through four small apertures on each side of the casing, close to the shaft. The centrifugal action of the paddle wheel whirls the liquid from the center to the periphery of the pump chamber, forcing it out through a number of small passages into the equalizing ring, thence up through the throttle or choke valve into the indicator tube, the rise being dependent upon the speed at which the paddle is revolved.

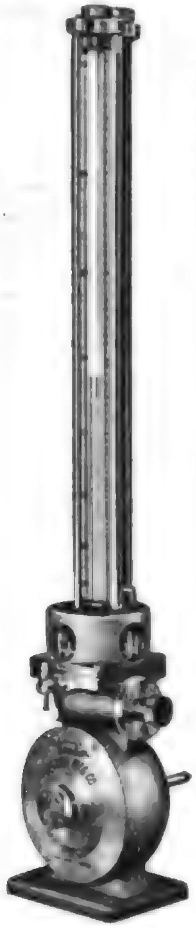


FIG. 1.—TACHOMETER.

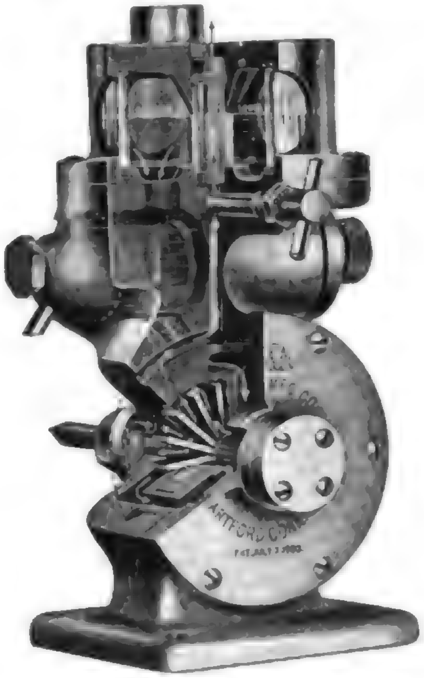


FIG. 2.—CUT-AWAY VIEW OF TACHOMETER.

The construction shown provides against any inaccuracy of the reading due to the wear of bearings. Even if, through long usage and wear of the bearings, the paddle or shaft were to become eccentric or displaced in the case, the accuracy of the readings would be unaffected, since the equalizing ring passages would compensate the irregularities. As the wear of the hardened steel shaft in its bearings is the only mechanical wear to which the instrument is subjected, no springs being employed, it will be seen that with the elaborate provision made for such wear as may occur, long service will not lessen the trustworthiness of the readings.

The standard length of scale is 12 in., for fixed maximum readings of 500, 1,000, 1,500, 2,000 or 2,500 revolutions per minute, respectively. When the tachometer is intended for general use a ball thrust bearing is provided on the end of the shaft. It is made by the Veeder Mfg. Co., Hartford, Conn.

Electric Heating Iron.

W. J. Barr Manufacturing Company, of Cleveland, is manufacturing an extensive line of electric heating appliances. Among these is the Eureka line of flatirons, which are made in thirty different styles from the small traveler's iron, weighing 3½ lb. to the heavy tailor's goose, which weighs 30 lb. Special attention has been given to appearance in the manufacture of this iron and artistic lines and high nickel polish make it very attractive. In the design of the heating element special attention has been paid to efficiency and length of life, and it is claimed that the heating element of the Eureka will last for ten years with a reasonable degree of care. In case of accident or burning out, the renewal can be made by anyone with the use of a screwdriver, as the top is not connected electrically with the bottom and the heating element is held by a screw. Another important feature in the construction of the iron is that the entire surface of the bottom is covered by the heating coil. The coil not only covers the entire bottom, but extends down to the point where it is most desirable to have good heat. One of the recent improvements made in the iron is a patent spring cord protector, which relieves the strain on the cord where it enters the iron, and makes it impossible for the cord to wear off at this point.

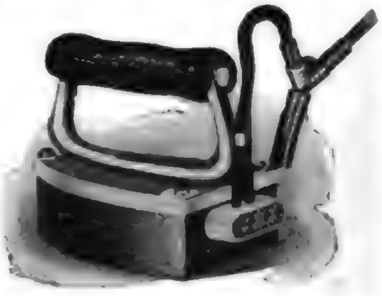


FIG. 1.—ELECTRIC HEATING IRON.

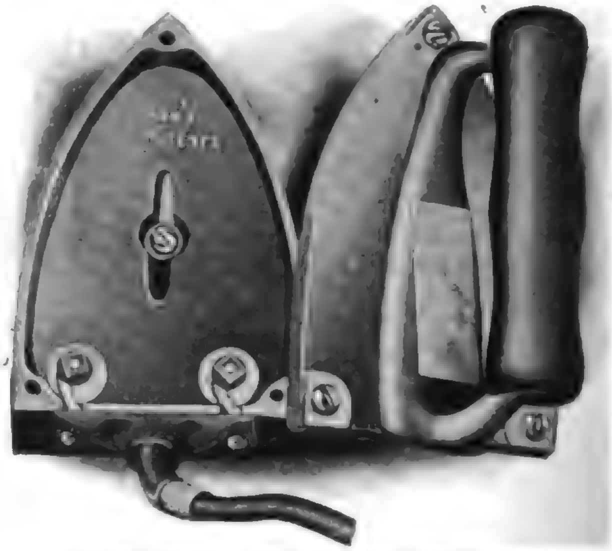


FIG. 2.—ELECTRIC HEATING IRON TAKEN APART.

In order to supply the needs of residents of those cities where the fire underwriters require an automatic cut-off when the iron is not in use, the company has recently brought out a patented device for this purpose. Instead of being in the handle, where it is difficult to repair in case of accident, the automatic feature of the Eureka is encased in a small nickel box, the front plate of which can be taken off and any of the parts removed and replaced by the use of a screwdriver.

The company has recently sent out some literature outlining a plan for co-operating with central stations in the sale and distribution of these irons and other apparatus. It has successfully introduced this plan to a large number of central stations in all parts of the country.

Laying New York Central Cables.

On May 12, 13 and 14 there were laid in the Harlem River, just ast of the New York Central & Hudson River Railroad bridge, 19 ables as described below, under the direct supervision of W. H. Rodier, superintendent of construction of the Safety Insulated Vire & Cable Company, and in the presence of E. B. Katte, elecrical engineer, and J. D. Keiley, assistant electrical engineer of he New York Central & Hudson River Railroad Company. The ower cables were manufactured by the Safety Insulated Wire & able Company, the telephone cables by the John A. Roebling Sons' Company and the signal cables by the Okonite Company. Owing to the exceptional facilities of the Safety Insulated Wire & able Company, the armoring and finishing of cables in all cases was done at the works of the Safety Insulated Wire & Cable Company, at Bayonne, N. J., its plant being located on tide water.

FIG. 1.—CABLE HOUSE.

The cables were laid eight at a time—the first time this has been accomplished successfully—and to insure that they were n proper position in a trench that had been dredged across the river, a diver was sent down and his investigation proved that all the cables were in exact position.

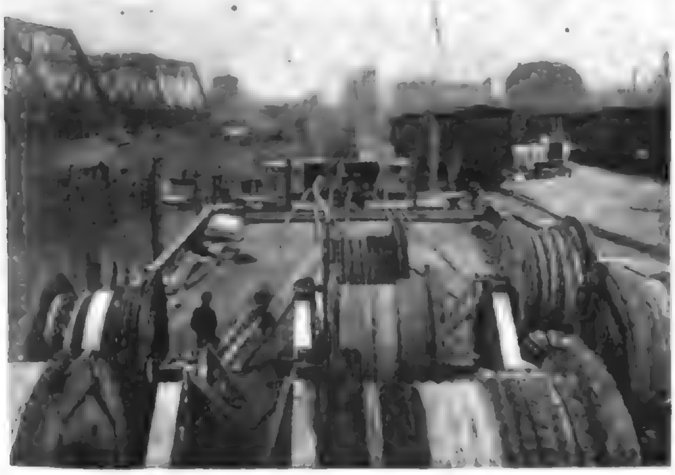


FIG. 2.—CABLES ON SCOW READY TO LAY.

Following is a description of the cables:

Four lengths, approximately 730 ft. each, of three-conductor No. 4-0, each conductor composed of 19 strands tinned copper wire, insulated with 13/64-in. wall of 30 per cent fine, pure Para rubber, taped. The three conductors thus insulated and taped are laid up with jute, covered with 13/64-in. jacket of same compound, covered with tape, 9/64-in. lead, sheathed, juted and armored with No. 4 galvanized-steel wire and finished with two layers tarred jute over all. This cable was tested at 40,000 volts for five minutes, and showed an insulation resistance of 2,000 megohms per mile. The weight per foot is approximately 18 lb. and the outside diameter 3⅞ in. This cable is designed for a working pressure of 11,000 volts.

Five lengths, approximately 750 ft. each, 1,000,000 cir. mils, composed of 91 strands insulated with 7/64-in. wall 30 per cent pure Para rubber, taped and covered with 9/64-in. lead, juted and armored with No. 4 galvanized-steel wire, with two layers of jute over armor. The cable was tested at 5,000 volts and is designed for a working pressure of 600 volts. The insulation resistance is 500 megohms per mile, weight of cable approximately 12 lb. per foot, and the outside diameter over all 2 9/16 in.

One length, 730 ft., 1,250,000 cir. mils, composed of 127 strands and approximately same specifications as the 1,000,000 cir. mil cables. The weight is approximately 13 lb. per foot and the outside diameter 2 11/16 in.

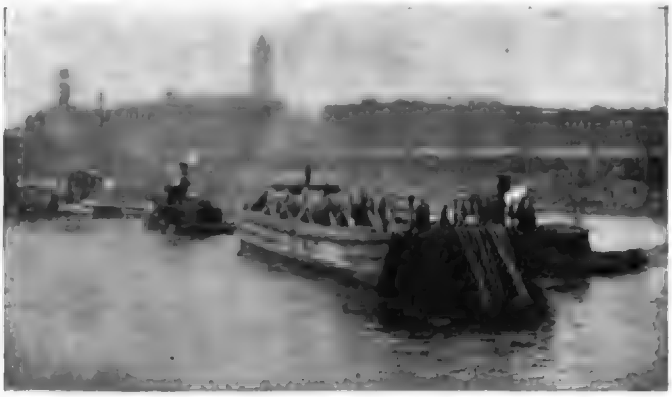
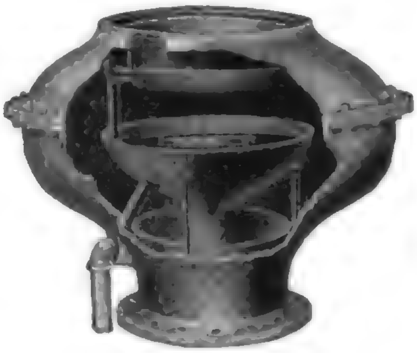


FIG. 3.—LAYING POWER CABLES.

Four cables 700 ft. long, 1,250,000 cir. mils bare, composed of 127 strands; weight, approximately 4 lb. per foot. Three cables 710 ft. each for signal cables. Two telephone cables, 730-ft. lengths, one 10-pair and one 30-pair.

Cast-Iron Exhaust Head.

The Hoppes Manufacturing Company, Springfield, Ohio, is placing on the market a new exhaust head which is made entirely of cast iron with the exception of the drain pipe. The apparatus, as will be noted from the accompanying illustration, is symmetrical in design and liberal in its proportions. The principles involved in the construction are those used in the company's well-known steam separators and oil eliminators. Intercepting troughs partly filled with water prevent entrained water and oil in the exhaust pipe from passing through and falling on the roof of a building, while the cone in the center prevents excessive moisture in the steam from passing out without coming into contact with the inner surface of the head and having the moisture and oil removed. A special feature is an annular groove surrounding the outlet, which prevents condensation and oil from running over and down the outside of the head and pipe.



EXHAUST HEAD.

The exhaust head is made in sizes for pipe up to 48 in. in diameter. Being constructed of cast iron, which is impervious to the deteriorating influence of gases and the atmosphere, it is free from the corrosive action to which sheet metal is subject.

Portable Maximum Demand Indicator.

The Stanley-G. I. Electric Manufacturing Company, of Pittsfield, Mass., has recently placed on the market a special portable outfit for the use with the Wright demand indicator in outdoor work, which is shown in the accompanying illustration. The outfit includes a weather-proof housing and insulating board fitted with hangers to be attached to the cross arm of the pole beside or near the transformer. Mounted at the bottom of the board is a "Wood" arc circuit cut-out which serves to shunt the indicator and to disconnect it from the circuit without interrupting the latter. The attaching plug is permanently connected to the indicator leads so that the entire equipment is self-contained and may be removed intact. To test a transformer it is only necessary to install the equipment on the cross arm and substitute the attaching plug for one of the fuse plugs from the primary fuse box. The indicator will show the maximum load which the transformer has had to carry since it was connected. The instrument may be connected in either the secondary or the primary circuit.

PORTABLE MAXIMUM DEMAND INDICATOR.

Steam Superheaters.

Within the last few years no greater step has been taken in the increase of steam plant efficiency than by the introduction of superheated steam. Great interest is being taken in this development by progressive engineers and the fuel economies resulting from its adoption have been very pronounced.

One of the types of apparatus for this service is the Foster superheater, illustrated in the accompanying cuts. The construction is clearly indicated in Fig. 1, which shows a pair of elements and the return header connection. Each element consists of a seamless drawn-steel tube, *A*, on which are shrunk cast-iron rings, *B*. Inside the tube, *A*, is placed an inner or spreading tube, *C*, closed at one end, which thereby forms a thin annular space between *A* and *C*, through which the steam flows. The tube, *C*, is held central in the tube, *A*, by spacing rivets, *D*. Tube *A* of each element is expanded into a cast-steel header.

This construction makes the apparatus capable of withstanding very high pressures, as the strength of the tube, *A*, is greatly increased by the shrinking on of the cast-iron rings, while it will be noted that these rings completely protect the tubes from contact with the flame. Owing to this latter feature, no flooding device is necessary to protect the superheater while steam is being raised in a boiler, and the attachment of the superheater to a boiler does not call for any change in the method of operating the boiler plant.

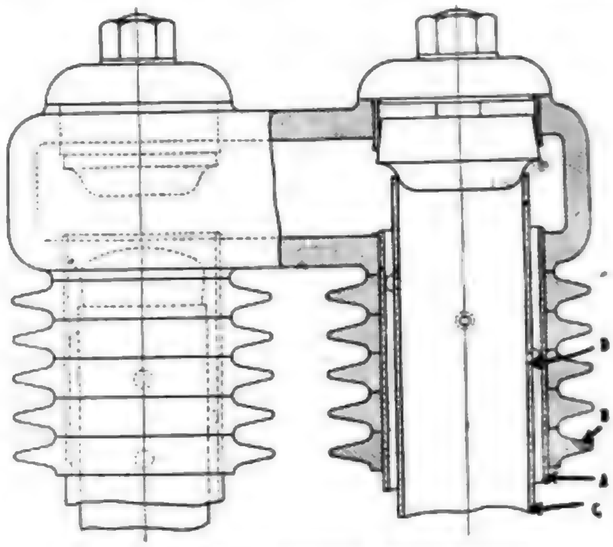


FIG. 1.—DIAGRAM SHOWING CONSTRUCTION.

This type of superheater is made for attachment to any type of boiler and can be easily installed in existing plants. It is also made in separately fired units to meet different requirements of superheat from the same boiler plant and to superheating exhaust steam for various purposes.

Fig. 2 shows a horizontal return tubular boiler equipped with the Foster superheater. In this type of boiler the superheater is placed in the combustion chamber in the rear of the boiler. In water-tube boilers the superheater is placed in the path of the gases after they have made the first pass, or is placed so that part of the gases are shunted directly from the furnace through it.

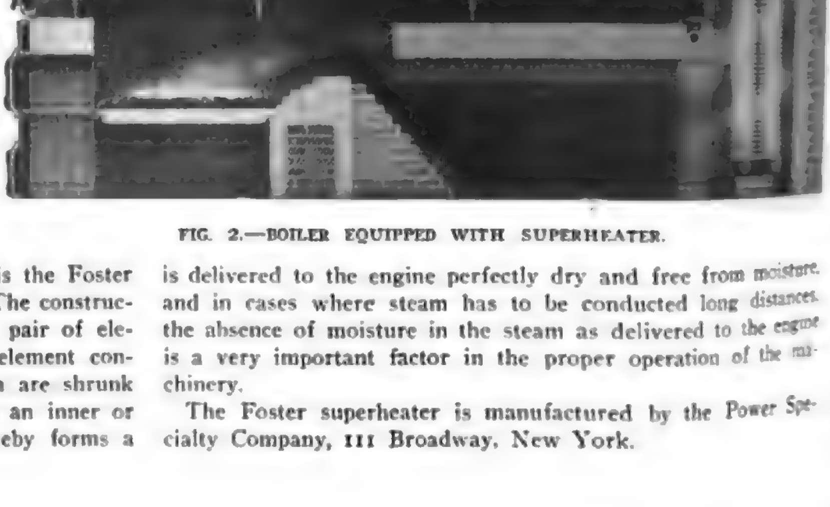


FIG. 2.—BOILER EQUIPPED WITH SUPERHEATER.

A great advantage arising from superheating is that the steam is delivered to the engine perfectly dry and free from moisture and in cases where steam has to be conducted long distances the absence of moisture in the steam as delivered to the engine is a very important factor in the proper operation of the machinery.

The Foster superheater is manufactured by the Power Specialty Company, 111 Broadway, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The rains of the past week had a quieting effect upon retail trade, which, however, is usually dull at this season. Taken as a whole, the month of May was a very active one in retail and wholesale trade and industry, in which the best records of preceding years were surpassed. Crop reports are irregular, due to uneven distribution of rainfall. Winter wheat conditions, on the whole, are about equal to those of a year ago; corn, though backward, has been helped by rains, while the cotton area will be larger and the condition better than a year ago. Building has been active, with corresponding effect upon the market for material. The labor situation in general is quite favorable. Settlements in the Western soft-coal fields are indicated, but the iron molders' strike is an unsettling element in the market for foundry iron. Finished products are reported quiet, but business in steel rails for future delivery is still active. Structural material is being freely ordered by railways, but general demand is comparatively quiet. Money is returning from the Pacific coast and is easier as a whole, though collections share the irregularity noted in retail demand. Railway returns are still in a high degree favorable. Copper is strong, with a good foreign demand for August delivery. One interest, it is stated, disposed of 1,500,000 pounds of electrolytic for British account on Friday at 18¼c. net at London, for August delivery. Heavy buying of Lake and electrolytic for September shipments is expected by domestic producers from this week's European market. For home market account buying is moderate. The larger consumers are covered for Lake, electrolytic and casting under deliveries up to September. Several domestic proffers for August electrolytic are in the market, but there is little metal available for September. A buyer of Lake, it is said, paid 19¼c. for 600,000 pounds, to be shipped in August. Casting copper continues in large request for all grades. Current quotations are: Lake, 18⅞ to 19c.; electrolytic, 18¾ to 18⅞c.; for August and September, casting copper, best grades, in large tonnages for thirty days' shipments, 18⅝ to 18¾c. Exports of copper for the first five months of this year were 25,174 tons less than in the same time last year, with a total for the first five months of this year of 82,531 tons, compared with 107,705 in the corresponding period last year. Exports for May this year were 18,860 tons, against 23,758 tons in the corresponding month last year, a decrease of about 5,000 tons. *Bradstreet's* reports 127 business failures in the week ending May 31, against 170 the week previous and 154 in the corresponding week last year.

ELECTRIFICATION OF THE WEST JERSEY.—Work on the construction of the electrified section of the trunk line railroad between Camden and Atlantic City is progressing rapidly. It will be remembered that the contract for the equipment and construction of this road was let to the General Electric Company last December, and that the equipment was to be in operation by July 1, 1906. When the magnitude of the work is considered, the necessity for rapid and systematic construction can be realized. In the first place, the work must not interfere with the regular operating schedule of the present steam trains. As a consequence, much track work has been done during certain hours at night. In addition to track work, bonding and pole-line construction, an 8,000-kw generating station and seven separate sub-stations are being erected and equipped. Progress on some of the sub-stations has been phenomenal. At South Camden, Glassboro, Newfield, and Reega, the sub-stations are well under way, each containing two 750-kw rotary converters with auxiliary apparatus, with arrangements for a third complete set. At Mizpah and Clayville the equipment consists of two 500-kw rotary converters, with room for a third, while at Atlantic City two 750-kw machines are being installed, with an ultimate equipment to consist of two additional 1,000-kw units. The eighth sub-station is at the main generating plant, and contains two 750-kilowatt rotary converters. The progress of the work will be clearly evident to visitors during the Atlantic City conventions. The third-rail construction has progressed rapidly, the over-running type of rail being mounted on reconstructed granite insulators. At crossings special jumper cable construction is employed. The cable is laid in bituminized conduit, itself embedded in cement. The cable ends in a bonding terminal, by which it is connected to the third rail. A terra-cotta cap completely protects the cable entrance of the conduit from the weather. The bonding on the 140 miles of track is well in hand. In conjunction with the third rail and track bonding, a double transmission line is being run on a single set of poles. The conductors are arranged on two cross-arms, with the three respective three-phase wires on each side of the pole in the usual triangle. A ground wire extends along the top of the pole line. Current for the transmission circuits will be generated by three 2,000-kw Curtis steam turbines at 6,600 volts, and stepped up to 33,000 volts for transmission. At the sub-stations the rotary converters will deliver direct current to the third rail at 650 volts. With few exceptions the over-running third rail will be used throughout. In Camden and between Newfield and Millville the over-head trolley will be installed.

SINGLE-PHASE EQUIPMENT.—The Anderson Traction Company, of Anderson, S. C., is now actively engaged in building the first section of an interurban road which will eventually connect the city with Greenville, 35 miles away. Anderson is the center of the cotton mill district in the South and the new line will place it in touch with the surrounding cotton mill towns as well as in closer connection with the main line of the Southern Railway. In the city there is already a direct-current railway and the first branch of the interurban is a continuation of the present lines as far as Belton, a distance of ten miles. Complete station apparatus and motor equipments for single-phase operation have been ordered for the extension. The new cars are of the heavy interurban type and are each equipped with four 75-hp, single-phase motors, adapted for operation at 3,300 volts alternating current on the interurban section of the road and at 550 volts direct current on the present direct-current city lines. Each car is fitted with air brakes, for which the motor compressors are adapted for operation on either direct or alternating current, this apparatus as well as the car motors and equipment being furnished by the General Electric Company. Power will be purchased from the Savannah River Power Company, delivered at a sub-station in Anderson at 66⅔ cycles. In the sub-station there will be a three-unit motor-generator set, consisting of an induction motor driver, direct-connected to an alternating-current generator for the single-phase portion of the line and a direct-current machine to supply the present city line. The driving motor consists of a two-phase, 66⅔-cycle, 1,150-volt induction motor, receiving its current from the 66⅔-cycle supply above mentioned. Direct-connected to this is a 300-kw, 25-cycle, single-phase, 3,300-volt, alternating-current generator which will furnish the ten-mile single-phase section now under construction with current directly to the trolley at 3,300 volts, without sub-stations. The remaining machine for furnishing the direct current consists of a 250-kw, 600-volt railway generator, complete with an exciter on the same shaft as the other three machines. The officers of the Anderson Traction Company are: Mr. J. A. Brock, president; Mr. F. G. Brown, vice-president; Dr. Geo. E. Coughlin, general manager. The road is being constructed under the direction of Mr. J. E. Sirrine, engineer, of Greenville, S. C., with Mr. E. F. Lilly, of Columbia, as consulting electrical engineer. General Electric Company apparatus is being used throughout.

HEANY FIRE-PROOF WIRE.—An important meeting of the Heany Fire-proof Wire Company, a new local industry of York, Pa., was held on May 29, when the American patents on insulated wire and the machinery for its manufacture were acquired from the Teter-Heany Development Company, which has perfected the new method of wire insulation. Plans were suggested at the meeting for launching the new company, and application has been made for a charter. The new industry will be an important addition to the manufacturing interests of York. A plant giving employment to a large number of persons will be established somewhere near the town. Capital from York, Hanover and other towns is interested in the new venture. Persons who have been mentioned in connection with the new venture are Hon. W. F. Bay Stewart, Hon. D. F. Lafean, R. H. Shindle, W. H. Griffith, Frank Lehman, John E. Baker, and Dr J. Frank Small, all of York; ex-Sheriff A. R. Brodbeck and Dr. J. W. Bittenger, of Hanover; Hon. Harvey Haines, of Yorkana, and Joseph Velt, of New York City.

MICHIGAN CENTRAL WORK.—The date of opening bids for the power and electric equipment for the Michigan Central Railroad has been extended from June 1 to July 1. The specifications cover the power station and substations and the installation of machinery and all material for electric traction, including water tube boilers, turbo-generators, surface condensers, electric traveling cranes, boiler feed pumps, horizontal feed water heaters, turbo-exciters, induction motors, mechanical stokers, coal and ash handling machinery and submerged vertical centrifugal pumps direct connected to motors. The part of the line that is to be electrified is that connected with the proposed new tunnel under the Detroit River.

CONDUIT FOR TORONTO.—G. M. Gest, the expert subway contractor of New York and Cincinnati, has closed a contract, through his New York office, for the construction of 500,000 feet of conduit for the Toronto Railway Company at Toronto. This will complete the subway system for that company, and will give it one of the most complete underground conduit systems of the kind.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was heavy and there was little speculative activity, the comparatively easy money obviating liquidating tendencies. At the close of the week the market was languid, with a fairly firm tone. The electric and tractions were generally stronger, with higher prices commanded at the close of the week. Allis-Chalmers common and preferred closed at 23⅛ and 60⅛, the former representing a net gain of 2⅛ points and the latter 2⅛. General Electric closed at the highest point of the week—169¼—this being a net gain of 1¾ points, and Westinghouse was steady throughout the week at 158. American Locomotive common closed at 70¼, which is an advance of 1½ points; but preferred lost ½ point net, closing at 114. A narrow business was done in Brooklyn Rapid Transit and high prices were maintained, the closing quotation being 83, which is a net gain of 1½ points. Interborough-Metropolitan common closed at 51⅛, a net loss of ⅛ point, and preferred at 85¼, which is a net gain of ½. Western Union receded ¼ point, the closing quotation being 92½. The curb market was stagnant throughout the week, except for efforts to bid up the copper group. In Mackay and Chicago Subway, which had recently been run up sharply, there were manifest efforts to take profits. As a result, the latter reacted and Mackay closed higher at 75⅛, which is a net gain of 3½ points. Following are the closing quotations of June 5:

NEW YORK

	May 28	June 5		May 28	June 5
Allis-Chalmers Co.	22¾	23⅛	General Electric	167	173
Allis-Chalmers Co. pfd.	57¾	60	Hudson River Tel.	...	...
American Dist. Tel.	*30	35	Interborough Rap. Tran.	220	...
American Locomotive	69	70	Mackay Cos	72⅝	75⅛
American Locomotive pfd.	114	114⅛	Mackay Cos pfd.	73¼	74⅛
American Tel. & Cable	90	90	Marconi Tel.	42	...
American Tel. & Tel.	135	138	Metropolitan St. Ry.	*116	*112
Brooklyn Rapid Transit	80⅛	84	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	92¾	92½
Electric Boat pfd.	65	65	Westinghouse com.	158	158
Electric Vehicle	11	11	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	May 28	June 5		May 28	June 5
American Tel. & Tel.	137¼	138⅝	Mass. Elec. Ry. pfd	68½	70¼
Cumberland Telephone	...	..	Mexican Telephone	4	3¾
Edison Elec. Illum.	248	248	New England Telephone	135	...
General Electric	...	173¾	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	20½	Western Tel. & Tel. pfd.	90	...

PHILADELPHIA

	May 28	June 5		May 28	June 5
American Railways	52	51¾	Phila. Electric	7⅛	7½
Elec. Co. of America	11¼	11⅜	Phila. Rapid Trans.	25⅝	25
Elec. Storage Battery	72	74	Phila. Traction	98½	98¾
Elec. Storage Battery pfd.	...	..			

CHICAGO

	May 28	June 5		May 28	June 5
Chicago City Ry.	160	160	National Carbon	86	86
Chicago Edison	149¾	..	National Carbon pfd.	120	117
Chicago Subway	67¾	...	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd.	...	...
Metropolitan Elev. com.	27	28			

* Asked

BELL TELEPHONE CAPITALIZATION.—The sub-companies of the American Telephone & Telegraph Company are most emphatically, says the *Wall Street Journal*, the property of the stockholders, rather than the bondholders. During the past two years, ended December 31 or January 31 last, the thirty-four operating sub-companies of the American Telephone & Telegraph Company increased their bonded debt but $100,000. During the same time the increase in stock was $57,781,122. Of the total increase in capitalization during the two years, amounting to $57,881,122, only .17 of one per cent was due to an increase in bonded debt. At the close of the 1903 year the total amount of bonds outstanding was $33,653,500, or 12.4 per cent of the entire capitalization. At the close of the last fiscal year the total of bonds was $33,753,500, or only 10.3 per cent of the entire capitalization. The thirty-four companies taken are identical with those mentioned in the last annual report of the American Telephone Company, with the exception of the Western Electric Company, which is a manufacturing company, and the Delaware & Atlantic, which is included for purposes of comparison. Of these thirty-four companies, nineteen, or more than half, have no bonded debt whatever. Seven of the companies have decreased their bonded debt during the past two years through the operating of sinking funds, and only three have increased their outstanding bonds. The total capitalization of the sub-companies in 1905 was $293,636,960 in stock, and $33,753,500 in bonds, making $327,390,460, or 21 per cent more than in 1903.

MONTREAL LIGHT, HEAT & POWER COMPANY.—The figures of the annual report of the Montreal Light, Heat & Power Company have already been noted. President Holt says that the directors have appropriated $251,818 of the year's surplus to provide for renewals and depreciation, and also $50,000 for the insurance fund. The latter now has at its credit $150,000. During the year $396,000 of the company's 4½ per cent bonds were issued. Of this amount $358,000 was used to repay the company 75 per cent of the amount expended for extensions in the gas and electric departments; $38,000 was used for the retirement of a like amount of the debentures of the Royal Electric Company. There were also issued $64,000 of the company's 5 per cent bonds to retire the balance of the outstanding bonds of the Standard Light, Heat & Power Company. The president states that the increased demand for power has caused the directors to decide to develop in the present season the power of the surplus water of the Soulanges Canal.

NEW YORK TRACTIONS.—The New York City Interborough Railway Company has opened the first section of its road to traffic. This portion of the line extends from the subway station at One Hundred and Eighty-first Street, Aqueduct Avenue, to Fordham Road, and thence by Fordham Road and One Hundred and Eighty-ninth Street to Bronx Park. Cars will also be run down the Southern Boulevard from One Hundred and Eighty-ninth to One Hundred and Eightieth Street and west on One Hundred and Eightieth to Third Avenue. This company is a natural feeder of the subway and elevated lines and of the Union Railway, which is owned by the Metropolitan Street Railway Company. In turn, it will derive a large part of its earnings from traffic delivered to it by these lines. Its Board of Directors is made up almost entirely of Interborough and Metropolitan Street Railway men, but the stock is apparently in private hands. An eight-cent transfer is issued between its lines and the elevated and subway lines.

INDEPENDENT TELEPHONY IN NEW YORK CITY.—The United States Automatic Telephone Company, with offices at 116 Nassau Street, New York, has applied to the Board of Estimate for a franchise in New York City. In its application the company states that it owns the patents of new telephonic devices, and promises that if the city will give it access to the existing subways and ducts, with only nominal rental charges, it will establish a telephone system at $12 a year for private residences and $24 for business houses, with a charge of 2 cents for pay calls in each borough and a 10-cent interborough rate. Mr. Elias E. Ries is president of the company.

DIVIDENDS.—The Butte Electric & Power Company has declared a dividend of 1 per cent on the common stock, payable June 15. The regular quarterly dividend of 2¼ per cent on the Chicago City Railway stock is payable June 30. Directors of the Union Traction Company, Philadelphia, have declared the regular semi-annual dividend of 2 per cent, payable July 2. A semi-annual dividend of $3 per share, payable July 9, has been declared by the El Paso Electric Company, a Stone & Webster property. The Boston Elevated has declared a regular semi-annual dividend on the preferred of $2 per share, payable July 2.

TWIN CITY RAPID TRANSIT.—The directors of the Twin City Rapid Transit Company, which operates the entire street railway systems of St. Paul and Minneapolis, have voted an issue of $2,100,000 additional common stock. The common stock previously authorized amounts to $17,000,000, and the company has outstanding $3,000,000 preferred. Privilege will be given to holders of common and preferred stock to subscribe for the new issue at par to the extent of 10 per cent of their holdings. The proceeds of the new issue will be used to pay for extensions to St. Paul and Lake Minnetonka.

GENERAL NEWS.

Construction News.

SKAGWAY, ALASKA.—The Town Council has passed an ordinance granting a telephone franchise to the Alaska General Electric Company.

PHOENIX, ARIZ.—The Phoenix Light & Fuel Company has recently substituted new enclosed arc lamps for the old open arcs for street lighting.

JONESBORO, ARK.—The City has purchased the electric lighting and water works plant of the Jonesboro Water & Light Company.

CAMDEN, ARK.—The electric light plant, which was owned by non-residents, is now the property of Camden citizens. The officers are E. Harper, president; Arthur Ellis, vice-president; George Belky, secretary and treasurer, and D. L. Ellis, general manager.

EUREKA SPRINGS, ARK.—The City Council of Berryville, 12 miles east of here, has granted a ninety-nine-year electric light franchise to the King's River Electric Power Company. This company was recently granted a similar franchise here. The King's River will be dammed at a point nine miles from here and six from Berryville.

LOYALTON, CAL.—The electric light system will be extended to take in the residence part of the city. A fire alarm system will also be installed.

LOS ANGELES, CAL.—Plans have been completed for a two-story brick telephone sub-station for the Pacific States Telephone & Telegraph Company at a cost of $14,600.

YREKA, CAL.—The Weed Lumber Company will construct a new power house, in which an 800-hp engine will be installed. Individual motors will be used in all the different stations.

LOS ANGELES, CAL.—Preparations are reported to be under way for the construction of a telephone line from Crafton, on the Southern Pacific to Salt Lake City, a distance of 1,000 miles.

LOS ANGELES, CAL.—The Coachella Valley Home Telephone Company, recently organized, will construct a telephone system connecting the towns through the Coachella Valley, the lines extending from Mecca to Indio

SELMA, CAL.—The San Joaquin Light & Power Company of Fresno is extending its system to this town. The work of installing the local plant will be completed in a few weeks, when electricity will be furnished for lighting and power.

ANAHEIM, CAL.—The Valley Home Telephone Company, which is being formed in this city, will establish a telephone system covering all of northern Orange County. The company contemplates an expenditure of about $125,000 in this district.

SAN DIEGO, CAL.—The Home Telephone Company is planning to extend its lines into the Imperial Valley. The company proposes to build a line from Julian and Cuyamaca across the desert, thus affording direct telephonic communication with Los Angeles and San Diego.

MARE ISLAND, CAL.—Bids will be received until June 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yard, Mare Island, Cal., a quantity of naval supplies as follows: Incandescent lamps, ventilating sets, thermostat springs, wire, cable, voltmeters, electrical supplies, etc. Applications for proposals should refer to Schedule 593.

LOS ANGELES, CAL.—The new Kern River plant of the Edison Electric Company will be completed within 90 days. It will have a capacity of 20,000 kw, and will cost about $2,000,000. The plant was begun in 1902, at which time it was thought that the proposed increase of power would serve the company's demands for several years, but patronage has increased so rapidly that it has been necessary to install a 1,000-hp steam engine in the city in addition to the Kern River plant. This will be in operation in September. The Edison Electric Company is now supplying electricity for 20 cities and towns. About 18,000 acres of land in Southern California is irrigated by water pumped by electric power furnished by the company.

TELLURIDE, COL.—The Telluride Power Company has commenced work on its irrigation and power plant project in Montpelier Valley in Idaho. The company will expend about $3,000,000 on the system.

MERIDEN, CONN.—The Bradley & Hubbard Manufacturing Company is installing an electric power plant to operate and light its entire plant.

NORWICH, CONN.—The Commissioners of the municipal electric light plant are considering the question of installing enclosed arc lamps to replace the open arc lamps now in use.

FAIRFIELD, CONN.—Decisive steps have been taken toward the installation of electric lights in the town. It is stated that if arrangements are not made with the Bridgeport Electric Light Company by fall the village will have its own electric light plant.

NORWICH, CONN.—The report submitted by the Board of Gas and Electrical Commissioners to the Mayor, showing the receipts and expenses for the first year's operation of the electric and gas plant by the city, is said to be very gratifying. The gas and electrical department has paid into the city treasury during the current year $119,678, and shows a net profit to the city of $9,103. The Mayor has recommended an expenditure of $22,000 for further improvements to the plant, which recommendation was approved by the Council.

WASHINGTON, D. C.—Bids will be received until June 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards at Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 577—Drills, hydraulic jacks, etc. Schedule 578—Electrical wire and supplies, bolts, steel plates and shapes, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

WASHINGTON, D. C.—Bids will be received until June 12 at the Bureau Supplies and Accounts, Navy Department, Washington, to furnish at the Navy Yard, at Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 570—Incandescent lamps, wire, conduit, interior mechanisms, electrical supplies, etc. Schedule 575—Brass and copper wire, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

ATLANTA, GA.—The Georgia Railway & Electric Company is contemplating the construction of a line to Stone Mountain.

OCILLA, GA.—The municipal water works and electric light plant was put into operation, May 22. The combined plants cost more than $30,000. J. L. Thrash is superintendent.

BRUNSWICK, GA.—Mayor Hopkins has been appointed one of a committee to confer with the Mutual Water & Light Company regarding the purchase of the lighting plant by the city. The town of Brunswick has granted a street railway franchise to Mr. Neff and associates, to build an electric street railway system in Brunswick.

ATLANTA, GA.—The Atlanta, Griffin & Macon Electric Railway Company, which will soon be formally organized, will make application for right of way into Atlanta on streets now occupied by the Georgia Railway & Electric Railway Company. The plan of the company is to build a line from Atlanta to Macon, a distance of more than 100 miles. The men interested in the project are N. B. Drewery, of Spaulding County; W. J. Massee, Minton Wimberly and J. T. Moore, of Bibb County; N. P. Pratt, Clifford L. Anderson and W. A. Wimbish, of Atlanta.

DEPUE, ILL.—A franchise has been given to George Beyer by the Village Council, giving him the privilege to erect and operate an electric lighting plant in this village.

CARROLLTON, ILL.—Bids will be received until June 15 by E. Z. Curnutt, chairman committee on lights, for lighting the city with 47 arc lamps of 2,000-cp each. A 5-year contract and a 10-year franchise will be granted.

MASON CITY, ILL.—The City Council has been considering plans for a municipal electric light plant and bonds will soon be issued. Work on the plant will begin in the near future. The plant will cost about $10,000, and will be for street lighting only.

CHICAGO, ILL.—Plans have been completed for an addition to the Chicago Telephone Company's headquarters on the corner of Washington and Franklin Streets. The cost is estimated approximately at $750,000. Pond & Pond are the architects.

MORGAN PARK, ILL.—The village of Morgan Park has entered into a contract with the Drainage Board to purchase 125 hp of the sanitary district's electrical energy, when ready for use next January, at $2.20 per hp per month. The lease is for a period of twenty years. The power is to be used to operate the water and lighting system of the village.

CHICAGO, ILL.—The Drainage Board on May 29 directed Chief Engineer Randolph to prepare plans and procure bids for a transforming and distribution station for the hydro-electric power. It will be located at 48th Avenue and Robey Street at the end of the high tension transmission line which is to convey the electric power from Lockport to Chicago; the probable cost is $60,000.

INDIANAPOLIS, IND.—The Marney Electric Company has filed notice of increase of its capital stock from $90,000 to $150,000.

RICHMOND, IND.—The City Council has ordered the drawing up of an ordinance appropriating $35,000 for an additional unit for the municipal lighting and power plant.

EVANSVILLE, IND.—The A. and G. Telephone Company will build and operate independent telephone lines in Vanderburg, Posey and Gibson Counties. Cornelius Roeder is president.

INDIANAPOLIS, IND.—The Indianapolis, Crawfordsville & Western Traction Company has increased its capital stock from $2,000,000 to $3,000,000. The road will be completed in sixty days. Edward Hawkins is president.

COLUMBUS, IND.—The Central Union Telephone Company has commenced the construction of a $45,000 exchange building. The company will install a new and up-to-date switchboard and hang several miles of new cables.

EVANSVILLE, IND.—Work on the construction of the Evansville & Eastern Traction Company's line between this city and Rockport has been resumed. The line is expected to be completed and ready for operation by October 1.

DECKER, IND.—We are informed that Eugene Rush, of Decker, is the principal promoter for the proposed dam to be constructed on White River at Decker, for the Indianapolis Hydraulic Company. H. von Schon, of Detroit, Mich., is engineer.

EVANSVILLE, IND.—Plans for the underground system of the Cumberland Telephone Company have been approved by the Board of Public Works. The company will proceed at once with the letting of contracts for the construction of the conduits.

WINONA LAKE, IND.—The Winona Interurban Railway Company has completed its line from Warsaw to Goshen and the line is now in operation. The electricity is secured from the plant which operates the electric railway from Warsaw to Winona Lake. The company is now building an electric plant on the shore of the lake at a cost of $300,000.

JEFFERSONVILLE, IND.—A trust deed for $1,250,000 in favor of the Colonial Trust Company, of Pittsburg, Pa., has been filed by the Indianapolis & Louisville Traction Company to cover the cost of the construction of its line between Sellersburg and Seymour, which is the last link connecting Indianapolis and Louisville. Work has been commenced and will be pushed as rapidly as possible.

CRAWFORDSVILLE, IND.—The Indianapolis, Crawfordsville & Western Traction Company has filed a $3,000,000 mortgage in favor of the Central Trust Company, of Indianapolis. Of this amount $1,500,000 is available to be applied on the construction of the extension of the line from Crawfordsville to Danville, Ill. The More-Mansfield Construction Company has the contract. A. F. Ramsey, of Crawfordsville, is president.

MUSKOGEE, IND. TER.—This city is considering the construction of a dam on Grand River for electric power purposes, to cost about $100,000. The Commercial Club is interested.

TAHLEQUAH, I. T.—Water power is to be developed on the Illinois River near this place. H. von Schon, of Detroit, Mich., has made examination and is preparing a report. Frank R. Lewis, of Tallequah is president.

TISHOMINGO, I. T.—Water power developments are being planned by H. von Schon, of Detroit, Mich., on the Blue and Pennington Rivers in behalf of the Pennington Water Power Company. Stephen B. Treadwell is secretary.

BURLINGTON, IA.—Extensive improvements are being made in the plant of the People's Gas & Electric Company. Four new boilers of 500 hp each are now being installed; these with other improvements will cost about $20,000.

OSKALOOSA, IA.—The Oskaloosa & Buxton Electric Railway Company has authorized an increase in its capital stock from $500,000 to $750,000 and the purchase of the property of the Oskaloosa Traction & Light Company, pending the examination that is now being made.

TOPEKA, KAN.—A charter has been granted to the Southern Kansas Railway & Light Company, to construct a new interurban electric railway through southern Kansas and Missouri. The company has a capital stock of $4,000,000 and owns property valued at $500,000. The directors are R. C. Rawlins, L. Rosenthal, John J. Jones, Frank C. Dixon, of Chanute, and J. W. T. Stephens, of New Orleans. The headquarters of the company will be at Chanute.

DANVILLE, KY.—The contract has been let for an electric plant at the Kentucky School for the Deaf at Danville, Ky., and work will be started at once. The plant will cost $6,000.

LEXINGTON, KY.—The East Tennessee Telephone Company will make extensive improvements to its system in Frankfort. A common battery or central energy system will be installed.

LOUISVILLE, KY.—The Louisville Lighting Company is contemplating the construction of a distributing station on Third Avenue, which will cost, with other improvements, about $75,000.

NEW ORLEANS, LA.—It is announced that the plant of the Consumers' Electric Company will be ready for operation within six weeks. The plant is equipped with Westinghouse generators and machinery. The company is also building a sub-station on South Rampart Street, which will cost when completed $125,000. The company has just closed contracts for lamps, meters and transformers, which will cost over $100,000. Jules Dreyfous is president.

ROCKLAND, ME.—Work has commenced on the construction of the new Plymouth County Street Railway line from Rockland to Brant Rock. The new road will be about 14 miles in length and will connect the inland towns of Plymouth County with the shore resorts. The company intends to build the power station in Pembroke.

HYATTSVILLE, MD. The Council has not yet employed an engineer to supervise the construction and prepare plans for the proposed electric light plant. Harry W. Shepherd is chairman lighting committee.

AMHERST, MASS.—The Selectmen have granted the New England Telephone Company permission to lay its wires underground in the center of the town.

GREAT BARRINGTON, MASS.—The Consolidated Company contemplates the extension of the Berkshire Street Railway to Canaan, Conn., a distance of about twelve miles.

FALL RIVER, MASS.—The Fall River Electric Light Company has applied for permission to lay a conduit from Hathaway Street to its sub-station on Hartwell Street. The work will commence immediately.

MANCHESTER, MASS.—The Manchester Electric Company, which has been in operation for two years, is reported to be in a very satisfactory condition. The company now has two hundred meters placed, with the number fast increasing.

NORTH ABINGTON, MASS.—The Electric Light & Power Company of Abington and Rockland is considering the question of extending its service to Hanover. The company may also provide electricity for the new Plymouth County Street Railway.

EAST CAMBRIDGE, MASS.—Bids will be received until June 19 by the Board of County Commissioners (Levi S. Gould, chairman) for furnishing material and installing a steam and electric combined generating set in House of Correction. For further information apply to Warren Crane, chief engineer, House of Correction.

PITTSFIELD, MASS.—Electrical engineers in the employ of the Consolidated Railroad have been making an inspection of the Hoosac Valley and Berkshire Street Railway systems preliminary to changes to be made in the power plants of each road. It is understood that the high tension current generated at the Berkshire power plant on East Street will be transmitted to Zylonite on the north and to Canaan, Conn., on the south, and that the Zylonite plant will furnish electricity for North Adams, Williamstown and the proposed extension to Bennington, Vt.

MARINE CITY, MICH. The City Council has granted Messrs. Hart, Ottaway and Marshal an electric light franchise.

HILLSDALE, MICH.—The Bryan Telephone Company will run its lines into Hillsdale County from Pioneer, Ohio. The company is also seeking a franchise to enter the city of Hillsdale.

TRAVERSE CITY, MICH.—A company has been organized here, with D. J. Albertson, president, and William H. Umlor, secretary, with a capital of $50,000 for the purpose of furnishing electric power for manufacturing purposes.

ALEXANDRIA, MINN.—Engineers Claussen, Burch & Pillsbury, of St. Paul, have recommended the construction of an electric light plant.

STAPLES, MINN.—Claussen, Burch & Pillsbury, of St. Paul, have estimated the cost of water works and an electric light system for Staples at $43,000.

CANNON FALLS, MINN.—We are informed that bids have not yet been requested for the proposed power plant on Cannon River. They will probably be called for during June.

BEMIDJI, MINN.—Dr. W. R. Morrison and H. W. Haines, of Bemidji, have secured permission to build a dam 12 miles up Mississippi River in the town of Jones.

ST. CLOUD, MINN.—The St. Cloud Electric Power Company has been formed to construct a dam and develop power at St. Augusta. O. T. Hougen, of Grand Rapids, Wis., is secretary.

DULUTH, MINN.—The Missable Electric Company has been formed by Fred B. Spelman and others, of Duluth, to develop electric power in Lake County by constructing dams on Birch River and Birch Lake.

DULUTH, MINN.—The Board of Water & Light Commissioners has awarded to the General Electric Company of Schenectady, N. Y., the contract for installing an electric pump at the Lakewood pumping station for $16,000.

VICKSBURG, MISS.—Houston Brothers have applied to the City Council for a franchise to operate electric cars on all streets in the city, and to furnish electricity in the city.

YAZOO CITY, MISS.—Kirkpatrick & Johnson, of Jackson, have been engaged to supervise the construction of an electric railway, for which bonds have been provided by the city and are to be sold by E. J. Pourse, city clerk. Engines, electric equipment, cars and track material will be wanted.

HATTIESBURG, MISS.—A plan is on foot to combine the power plants of towns near Hattiesburg and to build and operate a line 40 miles long to connect Hattiesburg, Laurel, Eastabuchie and Ellisville. The enterprise will have no connection with the other lines.

KANSAS CITY, MO.—Burns & McDonnell, Dwight Building, Kansas City, have completed plans for utilizing the waters of Big Niagara River in Camden County and building a dam and established a plant for the purpose of generating electric power to be transmitted to Kansas City, which is about 118 miles distant, also all the surrounding towns.

JEFFERSON CITY, MO.—The Secretary of State has issued a certificate of increase of capital stock of the St. Louis Terminal Railroad from $100,000 to $1,000,000. This road was recently incorporated by interests allied with the McKinley Electric System of Illinois. The company has a bill pending granting it franchise rights for the St. Louis terminals.

TWIN BRIDGES, MONT.—The Madison River Power Company contemplates building another large power plant on the Madison River.

BILLINGS, MONT.—B. P. Moss contemplates installing a second telephone exchange in Livingston and also proposes to extend and improve the Moffatt telephone system.

LIVINGSTON, MONT.—The Bell Telephone Company contemplates the erection of a new local exchange building and making improvements to its system in this city.

MISSOULA, MONT.—Work has commenced on a $2,000,000 electric plant at Thompsons Falls on Clarks Fork in Montana, and the promoters of the enterprise contemplate extending their transmission lines into the Coeur d'Alene district. The company is now planning the development of 10,000 hp. The company has secured rights from the Government to build its pole line into the Coeur d'Alenes. J. Stout, of New York, N. Y., is financing the project.

LINCOLN, NEB.—At the annual meeting of the Citizens' Street Railway Company the directors authorized the construction of ten miles more of street railway. The officers were authorized to purchase additional cars and construction material.

LINCOLN, NEB.—The Omaha, Lincoln & Beatrice Railway Company will soon commence to operate a portion of its line between Bethany and Lincoln. Electricity to operate the road will be purchased from the Lincoln Traction Company. A new power house is being built by the Lincoln Traction Company at a cost of about $30,000.

LEBANON, N. H.—The electric light plant of the Lebanon Electric Light & Power Company is to be entirely rebuilt. A new brick building is to be erected. The machinery to be installed is as follows: A new 150-hp engine, with a heating and condensing plant, two generators of 200-kw capacity each, an additional boiler of 150 hp, and a new switchboard. The cost of the work is estimated at about $17,000. It is planned to give a 24-hour service when the improvements are completed. W. S. Tucker has resigned as president of the company and George S. Rogers has been elected to fill the vacancy and Charles M. Hildreth has been elected vice-president. The president and superintendent, Herbert M. Tucker, will have charge of the construction work.

CORTLAND, N. Y.—The Inter-Ocean Telephone Company has purchased a site on East Court Street, on which it will erect a telephone exchange building.

EAST ORANGE, N. J.—The City Council has renewed its present contract for street lighting with the Public Service Corporation of New Jersey for one year.

CAMDEN, N. J.—At a recent meeting of the water committee, Robert Hollingsworth, chief engineer, recommended that an electric light plant be installed in the Morris Pumping Plant, stating that the cost would not exceed $2,000.

OSWEGO, N. Y.—The Empire Telephone Company contemplates making extensive improvements on its building on West Second Street, which will cost about $100,000.

WADDINGTON, N. Y.—A special election will soon be held to vote on the proposition of selling the village water works plant and the electric light plant to A. A. Logan, of Morrisburg, Ont.

OSWEGO, N. Y.—The Oswego River Power Company has commenced the construction of a transmission line along the east side of the river from Syracuse through Phoenix and Fulton to the Oswego city limits.

DUNKIRK, N. Y.—The Common Council has granted a 99-year franchise to the Dunkirk Street Railway Company for a surface system in fifty streets. The promoters are W. J. Sheehan, W. J. Hillery and others.

FT. WOOD, N. Y.—Bids will be received by Capt. G. C. Burrnell, Constructing Quartermaster, U. S. A., until June 22, for repairing power house and for constructing a coal shed addition to power house at this post.

NEW YORK, N. Y.—Bids will be received until June 11 by C. B. J. Snyder, superintendent of school buildings, for installing electric equipment in additions to and alterations in school 158, Borough of Manhattan.

DOLGEVILLE, N. Y.—Bids will be received until June 12 by Thomas George, village clerk, for constructing a concrete block building, with reinforced concrete floor and roof, to be used as a municipal power station. Charles E. Collins is engineer.

INWOOD, L. I., N. Y.—Steps are being taken for the establishment of a lighting district in the town. A committee has been appointed to investigate the subject, and will make a report at a meeting of the Inwood Improvement Society, to be held June 22.

ALBANY, N. Y.—The new contract for electric lighting which the City has entered into with the Municipal Gas Company, and by which the City will save $16,615 a year, will go into effect on June 21. This saving will enable the City to add 50 or 60 lamps to the present service within a short time. There are 690 lamps now in use. The new agreement permits the city to increase the service to 800 lamps after December 1, 1906, at the same rate as the original number, which is 27 cents per lamp per night. The contract is for five years. An ordinance will be introduced at the next meeting of the Common Council, which will permit the commissioner of public works to add the proposed lamps to the present service.

LOCKVILLE, N. C.—The Lockville Power Company, has been incorporated, with a capital of $100,000.

WILLISTON, N. D.—Bids will be received at the office of the U. S. Reclamation Service, Williston, until July 9 for the installation of steam and electric pumping plants and electric generating and transmission apparatus, including three pumping stations, containing centrifugal pumps of 20 and 30 cubic feet per second capacity, driven by steam engines and electric motors aggregating 1,200 hp; also two 300-kw steam turbine generating units, a 1,000-hp boiler plant, a 3-mile transmission line, etc. Particulars can be obtained from Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, at Williston, N. D.

LAKEWOOD, OHIO.—An election will be held on July 5 to vote on issuing bonds for water works and an electric light plant.

SANDUSKY, OHIO.—The Sandusky Telephone Company, of which George Frick is president, has increased its capital stock from $75,000 to $200,000.

LOGAN, OHIO.—The Logan Home Telephone Company, of Logan, has increased its capital stock from $50,000 to $75,000 and will make improvements to its system.

MARIETTA, OHIO.—The Parkersburg, Marietta & Interurban Railway Company is extending its Muskingum line north for a distance of two miles to a new park, which it has laid out.

MALVERN, OHIO.—The Malvern Telephone Company, with a capital stock of $5,000 has been incorporated by T. E. Hoppel, J. A. Riehl, J. C. Lewis, Fred Smith and Geo. B. Richards.

SPRINGFIELD, OHIO.—A motion to establish a municipal light, heat and power plant has been introduced in the city council. There is a strong sentiment in favor of the proposition.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Valley Traction Company will soon place contracts for the construction of its line extending from Leavittsburg to Garrettsville, a distance of 13 miles.

FINDLAY, OHIO.—The City Council has granted a franchise to the Findlay-Marion Electric Railroad to operate an electric railway in the city. The company is constructing a line between Findlay and Marion.

COLUMBUS, OHIO.—A building permit has been issued for the erection of the new telephone building of the Central Union Telephone Company at the corner of Third and Lynn Streets, which will cost $90,000.

ALLIANCE, OHIO.—The City Council of Alliance has passed an ordinance placing the maximum price for electricity furnished to the citizens at 12½ cents per kw-hour and 5 cents per kw-hour to users of more than 30 kw-hours per month.

HARRISON, OHIO.—A receiver has been appointed for the Harrison Light & Water Company. The failure is the result of the defalcation of A. L. Rich, president of the company, who recently disappeared after issuing a lot of bogus bonds.

CLEVELAND, OHIO.—The Cleveland Heat & Power Company, recently incorporated by Otto Miller and associates, will erect a plant for supplying heat, light and power for several groups of buildings in the down town section of the city.

CLEVELAND, OHIO.—Bids will be received until June 11 by the Board of Public Service (A. R. Callow, secretary) for boilers, superheaters, stack, pumps, feed water heater and appliances for the extension of the municipal electric light plant.

PORTSMOUTH, OHIO.—The Portsmouth Street Railway & Light Company has placed a contract with the Westinghouse Machine Company for a 750-kw turbine for its railway power house. The station is already equipped with two 600-kw Westinghouse turbines.

CLEVELAND, OHIO.—It is stated that the Cleveland, Ashland & Mansfield Traction Company, which proposes to build a railway from a point on the Cleveland & Southwestern near Seville to Ashland and Mansfield will probably place contracts for the work within two weeks.

NILES, OHIO.—Bids will be opened in a few days for new equipment for the city lighting plant. The material to be purchased will include an engine, an alternating direct-connected generator and 150 series-alternating arc lamps. Bids are in charge of City Engineer Wilson.

CINCINNATI, OHIO.—The Tennis Construction Company has arranged for financing $250,000 of bonds for the Evansville Eastern Electric Railway, which is in process of construction between Evansville and Rockport, Ind. The road will be a combined steam and electric railway.

CLEVELAND, OHIO.—The Forest City Railway Company, of which Fred Albers is general manager, is now making arrangements for the purchase of cars, overhead equipment, and machinery for the power plant. The power plant will be a temporary affair to take care of the line on Dennison Avenue, now under construction.

STEUBENVILLE, OHIO.—It is reported that W. Carl Ely, of Buffalo, has purchased the property and holdings of the Steubenville Traction & Light Company. The deal includes the lighting and power plants, lines to Empire and Toronto, the city lines in Steubenville, together with Stanton Park. It is stated that the lines are to be extended and improved.

CLEVELAND, OHIO.—The Cleveland Electric Company contemplates extensive improvements to its system during the coming year, among which is the purchase of 50 additional cars at a cost of $250,000, a new generator and engine for the viaduct power station, which will cost $50,000, and expenditure of about $300,000 for track improvements and possible extensions.

COLUMBUS, OHIO.—An ordinance to provide for an issue of $140,000 in bonds for the purchase of additional equipment for the municipal electric light plant will probably be passed by the Council at its next meeting. The manager of the plant recently announced that unless additional equipment was purchased immediately that it would be necessary to cut out about 600 arc lamps.

TOLEDO, OHIO.—The directors of the Toledo-Ann Arbor & Detroit Railway have appointed a special committee to arrange for the refinancing the project. The company has about 20 miles of track laid and considerable additional grading completed. The company became financially embarrassed through the recent failure of the Patrick Hirsch Company, of Toledo, which was financing the project.

CLEVELAND, OHIO.—The White Sewing Machine Company, which is building a large automobile plant in Cleveland, has recently purchased from the General Electric Company a 500-kw, three-phase, alternating-current generator and several induction motors. The plant will be one of the largest in the world of its kind and all machinery will be driven by motors. The power equipment will also include an Erie City Iron Works engine and boilers.

CLEVELAND, OHIO.—The Cleveland Worsted Company, of this city, which is erecting a large plant at Ravenna, Ohio, has contracted for one 600-kw General Electric three-phase generator, one 150-kw three-phase generator, two 50-kw direct-connected exciter sets, switchboard and induction motors for driving machinery. The larger generator will be driven by a Buckeye engine and the smaller machine by an Ide engine. The contracts were placed through George S. Ryder & Company, of Cleveland, consulting engineers.

LOVELAND, OHIO.—The electric lighting plant of the Loveland Citizens' Electric Company has been completed and commenced operation June 1. The equipment consists of two four-valve engines of 175 hp each, direct connected to 125-kw, 2,200-volt, 60-cycle, three-phase alternators and two Atlas water tube boilers. The company also operates the water works plant and system in conjunction with the lighting plant. The company has a capital stock of $100,000. Frank M. Couden, of Cincinnati, is president, and H. C. Hubbell, of Loveland, is secretary and general manager.

CINCINNATI, OHIO.—The Schoepf syndicate has placed a contract with the Westinghouse Electric & Manufacturing Company for four 2,000-hp steam turbines with electric generators, rotary convertors, switchboard appliances, etc. Two of the outfits will go to the Hamilton power station of the Cincinnati Northern Traction Company, as the two large generators originally built for that station have been transferred to the Medway station on the Appleyard lines. The other two equipments go to the Indianapolis & Western Traction Company, a line being built from Indianapolis to Terre Haute, Ind.

DESHLER, OHIO.—The plant of the Deshler Electric Light Company was recently thrown out of service by the boilers giving out and the smoke stack blowing down. The owners of the company notified the City that the plant would not resume operations unless the city would add ten more arc lights to the street lighting service. The city gave the company three days in which to make preparations in which to resume the service threatening to annull the franchise and give it to some other party. Sumner Cottingham, owner of the Crescent Telephone Company, has applied for the franchise and will probably get it. The town is in darkness at present.

OKLAHOMA, OKLA.—The Pioneer Telephone & Telegraph Company will erect a five-story building on Third Street and Broadway, at a cost of $125,000.

NEWKIRK, OKLA.—The Newkirk, Tonkawa & Southern Electric Railway Company has been granted a franchise by the County Commissioners of Oklahoma County to construct an electric railway on the public roads in that county. The company proposes to construct an interurban line from Newkirk to Oklahoma City.

PORTLAND, ORE.—The Mt. Hood Electric Railway Company has been incorporated by G. P. Copp, C. W. Callett and C. W. Miller. The capital stock is stated to be $5,000.

PORTLAND, ORE.—The Condor Water & Power Company, which owns a large electric plant on the Rogue River, has applied for electric railway franchises through the streets of several cities and towns in Jackson County and Grants Pass in Josephine County. Dr. G. R. Ray is president.

EASTON, PA.—An election will probably be held to vote on issuing bonds for placing electric wires in conduits.

YORK CITY, PA.—The Edison Electric Light Company, of this city, has decided to extend its system to the village of Hellam.

WASHINGTON, PA.—S. A. Gilmore, Attorney for the West Penn Railways Company, of Pittsburg, has filed applications for a number of electric light, heat and power companies for Washington County.

MEADVILLE, PA.—Bids will be received by the Water and Light Committeee until June 23 for electric light equipment to consist of engines, boilers, arc light generators, arc lamps, boiler feed pump, etc. H. Ellsworth is superintendent.

MEDIA, PA.—The Bell Telephone Company has placed a contract with John Stuckert, of Philadelphia, to construct a new telephone exchange building at the corner of State Street and South Avenue, which will cost about $21,000.

WELLSBORO, PA.—A contract has been made with the Wellsboro Electric Light Company to light the borough of Wellsboro for a term of five years, with not less than 30 series enclosed-arc lamps of 2,000 cp, and as many 50-cp incandescent street lamps as the Council may direct. The price is $76 per year for each arc lamp and $25 per year for each incandescent lamp. The borough building, with the exception of the fire companies' room, is to be lighted free of charge.

WOONSOCKET, R. I.—The Woonsocket Electric Machine & Power Company is constructing a large addition to its power plant.

CLINTON, S. C.—The Piedmont Electric Company, of Anderson, has secured the contract for constructing an electric light plant for $4,965. Charles C. Wilson, of Columbia, is engineer.

DEADWOOD, S. D.—Edwin N. Henderson, representing Chicago capitalists, proposes developing the old Home Telephone Company's system.

CHATTANOOGA, TENN.—The Chattanooga Electric Company has decided to expend about $75,000 for additional machinery. Byron T. Burt as manager.

KNOXVILLE, TENN.—An ordinance is before the Council requiring all telephone and telegraph companies to place their wires under ground in the first fire limit.

AUSTIN, TEX.—William Gallatin Carroll & Company have petitioned the city for franchise and right of way for a belt line of street railway in this city. The line is to be a continuation of the proposed interurban line between Austin and Lockhart which the company contemplates financing.

SALT LAKE CITY, UTAH.—Mayor Thompson has approved the Manley and Curtis franchise, for the installation of an electric system throughout the city.

EPHRAIM, UTAH.—The municipal electric lighting plant is completed and commenced operation May 27. The power plant is situated two miles east of the city; the equipment consists of a 150-kw General Electric three-phase alternating-current generator, direct-connected to Pelton water wheel operating under a head of 540 feet. The street lighting system consists of arc lamps of 1,200 cp each, and 132 incandescent lamps of 32 cp each. Service can be obtained twenty hours in the day. The plant was designed by Frank C. Kelsey, of Salt Lake City.

SUFFOLK, VA.—The Norfolk & Portsmouth Traction Company has just been granted a franchise in the town of Suffolk, Va., insuring local service in connection with the interurban service.

SPOKANE, WASH.—The Pend d'Oreille Development Company, of Spokane, has decided to construct a power plant at the new town of Metalline on Pend d'Oreille River.

SUNNYSIDE, WASH.—W. B. Bridgman, Mayor, writes that bids will soon be asked for the construction of water works and an electric light plant. The probable cost is placed at $16,000. O. L. Waller, of Pullman, is engineer.

MARSHFIELD, WIS.—The Council has in contemplation improvements to the water and light plant, to cost about $25,000.

PORT WASHINGTON, WIS.—W. G. Kirchoffer, of Madison, has been selected by this city to prepare complete new plans for water works and electric light plant, to cost about $75,000.

CHIPPEWA FALLS, WIS.—Lang & McNulty, of Eau Claire, have secured the contract for constructing a concrete dam at Kehl mill, for the Consolidated Milling Elevator & Power Company, for about $7,000.

MILWAUKEE, WIS.—Mayor Becker is planning to build a municipal light plant on a small scale on Jones Island. He proposes to secure power from the Jones Island pumping station, which lights the garbage plant.

ARGYLE, WIS.—E. J. Manning, of Monroe, has been employed by the Village Board to take charge of the construction of its water works and electric light plant. No contracts will be let, the Village Board will purchase all material in the open market.

MILWAUKEE, WIS.—The new municipal lighting commission was organized on May 21 with Irving B. Cary president, and Fred A. Landeck secretary. The matter of purchasing site and constructing municipal electric light plant has been referred to this commission. The commission now has $60,000 at its disposal to purchase a site for the plant, and will soon ask for proposals for the same.

CHILLIWAC, B. C.—A company of local men is being formed for the purpose of constructing some 70 miles of telephone lines through the Chilliwac Valley. Address, S. A. Cawley, care Cawley & Paisley, Chilliwac, B. C.

ALLAHABAD, INDIA.—The Allahabad Municipal Board is prepared to negotiate with applicants for the supply within the limits of the municipality, of electric lighting, fans and tramway. For detailed information apply to the Secretary of the Municipality. (H. V. Lovett is Chairman, Allahabad, India.) For copy of terms, apply to the office of ELECTRICAL WORLD, 114 Liberty Street, New York.

CHATHAM, N. B.—The Council has decided to repair the electric light plant at a cost of $20,650 and has asked Engineers Lea & Coffin to prepare estimates in accordance with the specifications.

HALIFAX, N. S.—The Camaguay Electric Company has been incorporated with a capital of $350,000 to carry on a general electrical business, including the erection of a power plant. The directors are: R. V. Sinclair, A. F. May, C. T. Moffatt, Ottawa, Ont.

KINGSTON, ONT.—L. W. Shannon, City Clerk, writes that the citizens voted May 31 to issue $85,000 bonds to extend the power plant. J. M. Campbell is engineer.

MOUNT ALBERT, ONT.—The Mount Albert Telephone Company has been incorporated with a capital of $10,000. The provisional directors are: T. Graham, Township of Uxbridge, Ontario, and W. D. Stokes, Township of Scott, Ontario.

MONTREAL, QUE.—The Montreal Street Railway Company will erect two power houses, one in St. Henry ward and the other in St. Denis ward; also large car shops in Hochelaga ward, which will cost $200,000.

New Incorporations.

MONTGOMERY, ALA.—The Tidewater Development Company has been chartered, with a capital stock of $100,000 by J. M. Dewberry and others. The purpose of the company is to build electric railways in the State and develop water power. The headquarters are in Birmingham. J. M. Dewberry is president.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Nadeau Light & Power Company. It will have duplicate engines and generators of 750 kw capacity. The capital stock is $100,000. The directors are John A. Pirtle, Simon Maas, Walter A. Stone, J. M. Kellerman, J. T. Boyd, C. C. Gibbons and L. A. Mesmer.

DANBURY, CONN.—The Danbury & Port Chester Railway Company has been chartered with a capital stock of $100,000. The directors are John G. Parker, E. W. Buckland, of New Haven, Conn., and William E. Greenough, of New York.

MILLSTADT, ILL.—The West Side Telephone Company has been incorporated with a capital stock of $1,140. The company proposes to carry on a general telephone business. The incorporators are William Kropp, Jacob Fischer and G. A. Mueller.

MURPHYSBORO, ILL.—The Southern Illinois Transit Company has been chartered to build an electric railway from Murphysboro. The company has a capital stock of $5,000. The directors are Phillip Decker, A. J. Woodward, John L. Cox, W. F. Hughes and R. A. McCord.

ELKHART, IND.—The Elkhart Independent Telephone Company has been incorporated with a capital stock of $1,250. The incorporators are G. G. Taylor and others.

INDIANAPOLIS, IND.—The Indianapolis & Ohio Traction Company has been chartered with a capital stock of $10,000, for the purpose of building an electric railway from Bluffton to Decatur and thence to the Indiana-Ohio State line, a distance of twenty-four miles. The directors are Harry R. Moltz and J. B. Holthouse, of Decatur; J. R. Tudor, of Van Wert, Ohio; S. N. Young, G. A. Gessener and J. Y. Todd, of Toledo, Ohio.

MARION, IND.—The Citizens' Automatic Telephone Company, has filed articles of incorporation with the Secretary of State. The amount of the capital stock is $300,000. The company will at once construct and operate an automatic telephone exchange in Marion with telephone lines extending to the towns, cities and rural districts of Kosciusko and Marshall Counties. The directors are: O. L. Barge, E. K. Seymour, C. L. Fisher, Fred Edwards and James S. Sisson.

RAMONA, KAN.—The Ramona Farmers' Mutual Telephone Company has been incorporated with a capital stock of $3,000.

TOPEKA, KAN.—Articles of incorporation have been filed by the Topeka Electric Company, with a capital stock of $200,000. The incorporators are C. R. Maunsell and others.

MARION, MICH.—The Marion Electric Light & Power Company has been incorporated, with a capital of $250,000.

COLUMBUS, MISS.—The Columbus Light & Traction Company has been incorporated by L. Marx, G. T. Heard and others.

HATTIESBURG, MISS.—The Hattiesburg Home Telephone Company has been incorporated with a capital stock of $150,000. The incorporators are S. A. Jones, H. S. Stevens, L. J. Wetsel and others.

ST. LOUIS, MO.—The Century Lighting Company has been chartered with a capital stock of $100,000. The incorporators are T. P. Cronin and others.

TYRONE, MO.—Articles of incorporation have been filed by the Tyrone Local & Long Distance Telephone Company with a capital stock of $5,000. The incorporators are H. P. Clarke and others.

YUKON, MO.—The West Point Telephone Company has been incorporated with a capital stock of $2,170. The incorporators are A. C. Deming, J. H. Brass, O. D. Gardner, W. C. Gillespie and Lyman Allard.

JEFFERSON CITY, MO.—A certificate of incorporation has been issued to the St. Louis & Florissant Valley Railroad Company, of St. Louis, capitalized at $50,000. The incorporators are: Eugene C. Slevin, James W. Darst, Ben Blewitt, Charles A. Cunningham and Edward Schneiderhahn.

BENNETT, NEB.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000.

OMAHA, NEB.—Articles of incorporation have been filed for a new telephone company with a capital of $2,000,000. The incorporators are J. E. McPherson, F. W. Judson, C. J. Greene, W. C. Bullard, N. B. Updyke, H. H. Baldridge, all of Omaha, and G E. Woods, of Lincoln.

WATERTOWN, N. Y.—Articles of incorporation have been filed by the Watertown Light & Power Company with a capital stock of $1,000,000. The directors are J. T. Lynn, of Detroit, Mich.; J. D. McMahon, of Rome; C. C. Middleton, G. S. McCartin and E. R. Brown of Watertown.

GROVER HILL, OHIO.—The Country Home Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are J. M. Hutchinson and others.

GEORGETOWN, OHIO.—The Brown County Independent Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are Louis Nischler and others.

PAINESVILLE, OHIO.—A company has been formed for the purpose of building an electric railway from Painesville to Warren. S. Stoughton, of Painesville, is at the head of the company.

TORONTO, OHIO.—The Republic Telephone Company, with a capital stock of $25,000, has been incorporated by J. G. Gilgrist, Richard Gilsons, A. C. Jones, L. O. Smith and T. J. Campbell.

CADIZ, OHIO.—The Farmers' Telephone Company, of Cadiz, has been incorporated by A. M. McCombs, James Love, J. M. Megaw, S. E. Adams and Louis Peck. Capital stock is $2,000.

MARIETTA, OHIO.—The Mile Run Mutual Telephone Company, of this County, has been formed by W. F. Watkins, L. F. Wern, Jesse Thomas, John Swynne and Roger Fish. The capital stock is $3,000.

COLUMBUS, OHIO.—Articles of incorporation have been filed with the Secretary of State by the Wolverine Telephone Company with a capital stock of $4,000. The incorporators are F. E. Hoffee and others.

CLEVELAND, OHIO.—The Cleveland, Brooklyn & Elyria Railway has been formed with a capital stock of $100,000 by B. E. Ottaman and W. E. Elliott, of Cleveland; L. J. Weadock and J. H. Kniseley, of Toledo, and O. A. Thomen, of Elyria.

MOUNTAIN PARK, OKLA.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are H. L. Collins and others.

PORTLAND, ORE.—Bids have been opened by the Mount Hood Electric Company for the construction of the power plant on the Sandy River, and are being reviewed by the engineers. The plant will be located on Bull Run Site, and will generate 30,000 hp. Bids range from $650,000 to $800,000.

FAIRCHANCE, PA.—The Fairchance Light & Power Company has been incorporated with a capital stock of $30,000. The incorporators are M. A. McCormick and others.

SALT LAKE CITY, UTAH.—Articles of incorporation have been filed by the Garfield County Telephone & Telegraph Company, with a capital stock of $25,000. The company will construct a telephone line in Garfield County, with headquarters at Panguitch. The incorporators are H. M. Steele and others.

NORFOLK, VA.—The Eastern Light Company has been incorporated with a capital stock of $50,000, by W. H. Carr, president; Joseph H. Hopkins, vice-president; W. W. Miller, secretary, and J. R. Perry, treasurer.

PEARISBURG, VA.—The Giles County Electric Railway Company has been chartered with a capital stock of $25,000. The officers are: C. T. Painter, president; Thomas J. Pearson, vice-president; M. P. Farrier, secretary and treasurer.

CLARKSVILLE, VA.—The Eagle Falls Light & Power Company has been incorporated, with a capital of $5,000,000, to supply electricity in the states of Virginia and North Carolina. A dam will be constructed across Roanoke River, near Taylor's Ferry, Va. Henry G. Murray, of Baltimore, Md., is president.

CHENEY, WASH.—The Spokane, Cheney & Southern Railway Company will be incorporated with a capital stock of $150,000. Charles P. Lund is interested.

SEATTLE, WASH.—The American Electric Company has been incorporated with a capital stock of $5,000. The incorporators are George A. Hastings and others.

New Industrial Companies.

THE AMERICAN CONCRETE BUTT COMPANY, of Philadelphia, Pa., has been chartered with a capital stock of $2,000,000, to manufacture butt attachments for telegraph and telephone poles.

THE CLEVELAND ELECTRIC FIXTURES COMPANY, of Cleveland, Ohio, with a capital stock of $250,000, has been incorporated by B. G. Tremaine, W. C. Hine, R. W. Hine, H. A. Tremaine and J. B. Crouse.

Obituary.

MR. C. K. HILL.—We regret to note the death of Mr. Charles K. Hill, aged 35, president of the C. K. Hill Electric Company, and identified with other enterprises, who died in New York City last week, of appendicitis. Mr. Hill was born in Pittsburg, Pa., and was a son of the late George B. Hill, who before his death was one of the oldest and most enterprising business men of Pittsburg. About four years ago, when George B. Hill died, the son took charge of the business, which he conducted successfully. He was a director of the Central Trust Company, member of Dallas Lodge of Masons, of the Duquesne Club and Automobile Club, of Pittsburg, and New York Athletic Club. Mr. Hill's widow, who before her marriage was Miss McKeown, and three children survive.

MR. WILLIAM THOMAS BOUCHELLE, who died at his home in Greenwich, Conn., on May 19, was one of the pioneer telephone men of the country. He entered the service of the old Metropolitan Telephone & Telegraph Company of New York City over 22 years ago, and in the period that followed witnessed at close range the development of that great system of communication. His was an active part in this remarkable enterprise, and the presence of so many men at the funeral services, representing, as they did, such wide interest, testified to the high position in which he was held. He was born in Baltimore, Md., on January 22, 1848, came to New York in 1869, and entered the employ of Dodd's Express (now the New York Transfer Company), holding a responsible position with that company up to 1883. In the year of 1876 he married Miss Mary Ennis Woodruff of New York, who now survives him. It was not until 1884 that Mr. Bouchelle entered the service of the New York Telephone Company (then the Metropolitan Telephone & Telegraph Company). For 17 years he was connected with the executive office as confidential secretary and assistant to the president. His distinguished characteristics, unselfish fidelity and amiability, gave great value to his work, and won for him there a very large circle of friends. His business connections placed him in many responsible positions. In addition to the position he held with the New York Telephone Company, he was treasurer of the Empire City Subway Company, as well as a director of that company. He was also a director of the American District Telegraph Company, the Holmes Electric Protective Company, and the Northeastern

Telephone & Telegraph Company. His unfailing good nature and geniality was a rare gift. He was a member of the New York Athletic Club, the Fairfield County Golf Club, the Indian Harbor Yacht Club, as well as the Masonic, Royal Arcanum and other fraternal orders. Mr. Bouchelle was attentive to his duties, however, up to within a few days of his death. Although unknown to most of his friends, he had suffered for over a year from ulceration of the stomach, and while he was known to be far from well, his death was sudden and unexpected, the stricken man being conscious up to the end and recognizing those around him. The wide popularity of the man made the funeral necessarily large.

Educational.

UNIVERSITY OF MICHIGAN.—The board of regents has awarded to the Michigan State Telephone Co. contracts for the installation of a telephone system for the university buildings and campus. The proposition has been under consideration for several months and Special Agent E. V. Chilson, of Lansing, has spent considerable time there lately working out the details with Managers Krech and Harbough, of the local exchange, and the regents. As finally adopted by the regents the plans call for the installation of a complete model telephone plant, with from sixty to seventy-five stations or terminals, located in the different departments, which will be run to a switchboard to be located in the office of Secretary Wade. Trunk line facilities are also provided to the downtown exchange. The installation is to be made at once and the new system will be in working order for the opening of school in October. The proposition of the Michigan company to the university is a very generous one and means practically the establishment of a telephone course in connection with the engineering department. Every piece of apparatus that goes into the construction of the plant is to be duplicated and labeled and placed in a glass case, which will be presented to the university.

Personal.

MR. J. H. LAWTON, of Humboldt, Ia., has taken over the management of the electric light system at Alquona, Iowa.

MR. ERNEST LEE CLARK, of Waterbury, Conn., has accepted a position as electrical engineer with the New York, New Haven and Hartford Railroad Company, with headquarters at New Haven.

MR. ISAAC L. RICE, who is interested in a large number of electrical enterprises, has sailed for Europe. Submarine boat developments are said to be impending on the other side, requiring his presence.

MR. L. J. SCHLESINGER, former manager of the Muncie, Hartford & Ft. Wayne Company, has been appointed superintendent of motive power for the entire system of the Indiana Union Traction Company.

MR. H. H. COCHRANE.—Mr. Harry H. Cochrane who has been an instructor at Cornell University for the past three years, has resigned his place at the university to accept one as electrical engineer with the Helena Power Transmission Company at Helena, Montana.

MR. E. H. DUNLAP, superintendent of the municipal electric lighting plant, Columbia City, Ind., has resigned to accept a position with an electrical company in Bartow, Fla. Mr. J. E. Spicer, chief electrician of the municipal water and light plant at Napannee has been appointed to succeed Mr. Dunlap.

MR. FREDERICK C. R. SPENCE has severed his connection with the Stanley Instrument Company, Great Barrington, Mass., and is now with the Fort Wayne Electric Works, Fort Wayne, Ind. His headquarters are at Fort Wayne, and he is acting in the capacity of a special representative for the sale of meters.

MR. J. B. NEWHALL, hydraulic engineer, 114 Liberty Street, New York City, has been engaged to make an examination and report upon the water power at McKeevers Falls on the Roanoke River, near Brookneal, Va. The water power will be used for electric purposes and the energy may be transmitted to Lynchburg, Va., a distance of thirty miles.

MR. S. O. OCHS, who was formerly associated with the Stanley Instrument Company, is now representing the Fort Wayne Electric Works in its New England territory with his headquarters at Boston. He is well known to the electrical fraternity throughout the New England States, including New York. Mr. Ochs has just suffered a severe bereavement in the loss of his sister, who died in Kansas City recently.

MR. E. W. STEVENSON, electrical engineer and cable expert of the Hazard Manufacturing Company, of Wilkesbarre, Pa., has sailed for England with his family on the "Caledonia." He will stay a couple of months on the other side, which he has not visited for several years. Part of the vacation will be spent with his father, Mr. E. A. Stevenson, one of the staff of the Telegraph Construction & Maintenance Company. The rest of it will be taken up with the trip and hospitalities planned by the Institution of Electrical Engineers for its colleagues of the American Institute of Electrical Engineers.

MR. P. R. TODD.—Advices from New Haven, Conn., say that First Vice-President Percy R. Todd of the New York, New Haven & Hartford Railroad Company is to become head of a large electric railway enterprise in Canada. The project, it is stated, contemplates the construction of an electric road several hundred miles long, paralleling largely the Grand Trunk Railway and reaching several of the most import Canadian cities. Mr. Todd last November received leave of absence lasting for one year, until November of the present year, when his connection with the New York, New Haven & Hartford Railroad, it is understood, will cease.

MR. E. KOERTING.—At the celebration of the seventy-fifth anniversary of the Koeniglich Preussische Technische Hochschule of Hanover, Germany, one of the most prominent institutions of its class, the honorary degree of doctor of engineering was conferred on Mr. Ernst Koerting, the noted European engineer, of the well-known firm of Gebr. Koerting, A. G. Koertingsdorf, Hanover, for his scientific researches and discoveries in gas engines, and other important branches of engineering. Dr. Koerting lives at Pegli, Italy. He is interested in a number of large enterprises in the United States, among them the De La Vergne Machine Co., of New York, as well as the Schutte-Koerting Company, of Philadelphia, and is at present visiting the United States.

MR. R. PITCAIRN.—Mr. Robert Pitcairn, resident assistant at Pittsburgh to President A. J. Cassatt of the Pennsylvania Railroad, having reached 70 years, has gone on the retired list after fifty-three years in the employ of the company. His last day was spent receiving congratulations of friends, including a letter from Andrew Carnegie, his old fellow telegrapher. He entered the employ of the company as a telegraph operator at Altoona. In 1885 he succeeded Andrew Carnegie as superintendent of the Pittsburg division. Later he became general agent and finally resident assistant to the president. He will devote his time now to managing his private fortune, estimated at $20,000,000. He owns stock in hundreds of coal companies and other concerns along the Pennsylvania lines.

SOUTHERN BELL APPOINTMENTS.—Mr. W. B. Roberts, manager of the Atlanta Bell exchange, has been named as assistant superintendent of the second district, retaining an interest in the management of the Atlanta exchange; L. J. Oliver, manager of the Columbus, Ga., exchange, has been appointed superintendent of the seventh district, with headquarters at Charleston, succeeding Mr. Therrell; H. L. Smith, superintendent of the fifth district, with headquarters in Savannah, is made special agent to General Manager J. Epps Brown, of Atlanta, while David Laird, of Richmond, Va., manager of the local exchange, becomes superintendent of the fifth district, with headquarters in Savannah. Mr. D. M. Therrell, superintendent of the seventh district of the Southern Bell Telephone Company, has been appointed superintendent of the second district, with headquarters at Atlanta, Ga.

MR. CABOT STEVENS, for many years electrical engineer of the Edison Electric Illuminating Company of Brooklyn, severed his connection with that company, on June 1, having accepted a responsible position with Stone & Webster, of Boston. Mr. Stevens' associates in the Brooklyn Company heard of his decision with regret and on Tuesday, May 29, tendered him a farewell dinner at the Brooklyn Club. General Manager W. W. Freeman, General Superintendent Walter F. Wells and others expressed their appreciation of Mr. Stevens' character and services and voiced the universal regret at his departure. Mr. Joseph Becker, Jr., superintendent of the meter department, on behalf of the staff council of the company and as some slight token of their esteem, presented Mr. Stevens with a diamond pin and link cuff buttons. Mr. Stevens' first work in his new field will be at Columbus, Ga., where he will represent Stone & Webster in the construction and operation of a large light, power and railroad plant.

Trade Publications.

KELLOGG SWITCHBOARD & SUPPLY COMPANY, of Chicago, Ill., has issued a neat little "Everybody's Rule Book," containing a lot of handy useful data in tabloid form, sandwiched in with information as to the telephonic apparatus manufactured by the concern.

THE SPRAGUE ELECTRIC COMPANY has just issued a new instruction book as to the method of installing the Greenfield flexible steel conduit and armored conductor. All the parts of this standard system are shown in detail and the instructions are carefully full and specific as to the proper way of installing the conduit.

DODGE & DAY, Drexel Building, Philadelphia, have just issued pamphlet No. 15, which describes and illustrates their work as improvement engineers on a large number of old and new industrial power plants, some of which are of a most interesting character, serving a larger field than the word "industrial" would imply, as for example, that of the Lehigh Coal & Navigation Company.

ALLIS-CHALMERS DEVELOPMENTS.—The Allis-Chalmers Company, Milwaukee, Wis., has reprinted from the Milwaukee *Sentinel* a description in detail of the development of its different departments. Views are given of the Chicago works Nos. 1 and 2, of the West Allis works, the Scranton works, the Reliance works and south foundry and the electrical department at Cincinnati.

ELECTRIC HOISTS.—The Yale & Towne Mfg. Company, 9 Murray Street, New York, has just issued an attractive catalogue dealing with electric hoists, which should prove of much interest to users of lifting apparatus. By means of a ball bearing swivelling hook, the hoist may make a dragging lift at an angle of 45 degrees, thus covering a large floor area. All of the tensile strains are taken on wrought metal only, and the compressive strain on cast metal only. Turntable collector rings are used to permit the hoist to swivel continuously in one direction without twisting up the leads. A solenoid brake attachment allows the controller to be placed at a distant point when desired.

PEERLESS ELECTRIC COMPANY, Warren, O., has issued a neat circular devoted to its power motors. The bulletin is called "The Pigeon

Hole," and is illustrated with the motor operating a candy making machine, the motor being placed vertically under the candy maker, entirely out of the way of the operator. The circular makes some very good points as to the gain in cleanliness, economy, etc., in adopting direct drive.

HOT WATER BAGS.—The Standard Electric Heater Co., of Ozark Building, St. Louis, has issued a neat little circular devoted to its ingenious form of electric hot water bag heater. The ordinary stopper has associated with it a nickel-plated brass tube heating element which can be inserted in the bottle and which will thus keep the water hot indefinitely. It takes about 30 per cent less current than a 16-cp lamp. Each heater is furnished with 12 feet of lamp cord and a plug to screw into any lamp socket. The temperature maintained is 125° F. The device is quite inexpensive.

RUBBER PACKING.—The Mechanical Rubber Company, Cleveland, Ohio, has issued a profusely illustrated catalogue describing and setting forth the various qualities of the "Marco" packings. The cuts, which are made from actual photographs practically without retouching, give an excellent idea of each style of packing to which the descriptive matter refers. The printing is done in two colors, so that the different materials used in the formation of the packings can readily be distinguished. Complete instructions are given as to the selection and use of packing for various purposes.

WARD LEONARD DIMMERS.—New catalogues showing all types of Ward Leonard theatre dimmers have been issued by the Ward Leonard Electric Co., of Bronxville, N. Y. Cuts of both front and back of board interlocking theatre dimmers are shown. A complimentary letter received from the electrical engineer of the New York Hippodrome, reads as follows: "Enclosed we hand you our order for 124 dimmers, being the equipment used in the installation of our New York Hippodrome. This order we are placing with you without asking for competitive bids, having used your apparatus extensively for the last 5 years, and being confident that it is the most reliable apparatus of its kind on the market. We take great pleasure in saying that we are entirely satisfied with your apparatus, and care to look no further for this installation."

"BATTERY SPARKS" is the striking title of a 16-page pamphlet issued by the Edison Mfg. Company, Orange, N. J., and describing the Edison primary battery and spark coil for gas engines. The subject is gone into very extensively and figures are given showing the comparative cost of sparking an engine with Edison cells, dry cells and other classes of batteries. The Edison spark coil differs from most of those on the market in being wound with shorter and heavier wire and in transferring a larger proportion of the battery energy to the gas-engine cylinder. It is stated that it is the heat of the spark that fires the engine and not the voltage of the spark and that the arc drawn out by the contacts of the break-and-make sparking device is more effective than the thin, high-voltage spark of the jump spark arrangement, besides which, it is said, there is a great saving in the complication of the apparatus employed.

STURTEVANT ECONOMIZERS.—Bulletin No 132, in the Engineering Series issued by the B. F. Sturtevant Co., Boston, Mass., illustrates and describes Sturtevant economizer installations in the power houses of the Interborough Rapid Transit Co., the New Orleans Railways Co., the Boston Elevated Railway Co., the South Covington and Cincinnati Street Railway Co., and the Burlington Municipal Electric Lighting Co. The Interborough installation includes 28 economizers sufficient for the 26,000 hp of boilers now installed. Those in the New Orelans plant are operating under the unusually high pressure of 225 to 250 pounds per square inch. The Boston Elevated Railway Co., after deciding to remove three of their economizers and put in new ones which should include features designed by its own engineers, found that the Sturtevant type embodied practically all of the suggested improvements. As a result these economizers were purchased.

EDISON PRIMARY BATTERIES are used in immense quantities, as for the operation of railroad signals, the sparking of gasolene engines and for places where a limited amount of electrical energy is needed constantly and unformly. The batteries now being supplied are an improvement over the old cells, and their manufacture and design have been reduced to scientific perfection. We have before us a pamphlet entitled "Edison Primary Batteries," published by the Edison Manufacturing Co., of Orange, N. J. This pamphlet describes Edison's improvement of the Lalande caustic potash cell, which, as the pamphlet shows by quotation from Prof. Carhart, "has a capacity of work per unit weight greater than any other either primary or secondary." It is stated that the energy of the Edison cell applied through a perfect motor would raise the cell 16.17 miles. The improvement made by Edison consists in forming the copper oxide depolarizer into firm briquettes which reduces both the internal resistance of the cell and the tendency to polarize, at the same time making the renewal of the cell much more convenient. The cost of electrical energy from these cells for some purposes would not be excessive, as, for instance, a 600-ampere hour renewal comprising all the perishable parts of the cell costs only $2.52, which is less than ½ cent per ampere hour. It is stated that this cell gives rise to no fumes, that the liquid does not corrode machinery, that there is no creeping of salt and that the cells do not freeze in ordinary cold weather. The pamphlet shows and describes also the Edison spark coil and gives a variety of useful data and information as to care and handling of batteries. As a whole, the publication is an admirable piece of work, well calculated for its purpose.

News of the Trade.

CHANGE OF ADDRESS.—The Manufacturers Agents' Association at Los Angeles, Cal., has taken larger quarters and its new address is 461 Pacific Electric Building.

H. M. BYLLESBY & COMPANY, the engineers and contractors, etc., announce the removal of their general offices in Chicago to the American Trust Building, Clark and Monroe Streets.

HOPPES MANUFACTURING COMPANY, of Springfield, O., maker of steam feed and exhaust purifiers, has established a branch of its business at 40 Dearborn Street, Chicago, in charge of Fishurck & Scudder.

MOTOR GENERATOR FOR WIRELESS TELEGRAPH.—The New York Navy Yard, Brooklyn, N. Y., has recently ordered from the Crocker-Wheeler Company, of Ampere, N. J., a motor-generator to be used in connection with its wireless telegraphic equipment.

EMILIO LATTES FRIAS & CO., 704 Casilla Correo, Buenos Ayres, South America, announce their readiness to conduct a commission and consignment business. The firm is duly registered with the Tribunal of Commerce and consists of Mr. Frias and Mr. Salvador A. Pratto.

CHANGE OF ADDRESS.—The new address of the India Rubber & Gutta Percha Insulating Company, makers of the famous Habirshaw wires and cables is the Postal Telegraph Building, 253 Broadway, New York City. Mr. J. B. Olson reports very large orders. The contract on the huge new Hall of Records has just been completed.

THE JOHNS-PRATT COMPANY, of Hartford, Conn., manufacturer of electric insulation and supplies, contemplates extensive additions to its plant. The plans call for a three-story manufacturing building, 48x132 feet; a factory building, 43x95 feet, four stories high, and a one-story addition, 26x35 feet. One of the present buildings will be carried up two additional stories.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, has recently established a department for illuminating engineering, and is now prepared to furnish plans for lighting factories, shops, offices, hotels, apartment houses, dwellings, etc. The company will be glad to furnish advice upon this subject on receipt of plans or drawings showing the construction and arrangement of the building to be illuminated.

THE STROMBERG-CARLSON TELEPHONE MFG. COMPANY, Rochester, N. Y., has closed contracts for switchboards for the following places: Exeter, Neb.; Portsmouth, N. H.; Bedford, Ind.; Hartford, Conn.; Rochester, N. Y. Also a 3,000-line multiple board for the People's Home Telephone Company, Morgantown, W. Va., and one for the Marietta Home Telephone Co., Marietta, Ohio.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 29, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 114 Nassau St., N. Y.]

820,931. FURNACE FOR BURNING COMMINUTED MATERIAL; Hosea K. Kriebel, Philadelphia, Pa. App. filed Dec. 29, 1904.

821,611. TROLLEY FOR ELECTRIC RAILWAYS; Edward F. Creevy, Chicago, Ill. App. filed July 11, 1900. The patentee makes use of round electric rods or wires stretched throughout the length of the conduit and has carriages with rollers to contact therewith in place of the usual shoe.

821,615. MAGNETIC SEPARATOR; Myron Dings, Milwaukee, Wis. App. filed Sept. 15, 1904. The pulverized ore is delivered upon the apex of a rotating cone and falls therefrom over a series of steps or terraces exposed to a magnetic field. The rotary displacement of the magnetic particles is greater than that of the non-magnetic particles, so that separation is effected.

821,623. STORAGE BATTERY FILLING APPARATUS; Thomas A. Edison, Llewellyn Park, N. J. App. filed Nov. 2, 1904.

821,624. GAS-SEPARATOR FOR STORAGE BATTERIES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Nov. 2, 1904.

821,625. PROCESS OF TREATING ALKALINE STORAGE BATTERIES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Nov. 5, 1904.

821,626. PROCESS OF MAKING METALLIC FILMS OR FLAKES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Mar. 30, 1905.

821,628. PROCESS FOR MAKING CONDUCTING FILMS; Thomas A. Edison, Llewellyn Park, N. J. App. filed May 26, 1905.

821,639. FIREMAN'S SIGNALING SYSTEM; Alan J. Hart, Montreal, Canada. App. filed Dec. 12, 1904. The different sections of the hose have springs or conductors thereon which are automatically engaged with one another when the hose sections are coupled. In this way a signal circuit is completed from the engine to the location of the fireman.

821,655. RADIUM SURFACE; Hugo Lieber, New York, N. Y. App. filed July 30, 1904.

821,672. AUTOMATIC CONTROLLER FOR MOTOR COMPRESSORS. Walter J. Richards, Milwaukee, Wis. App. filed Mar. 9, 1904. Provides a constantly opposed shunt magnet, operating a main switch for a motor compressor, such shunt magnet being directedly operated by a primary switch. Further provides means for inserting an external higher resistance in series with the shunt magnet when the main switch is closed.

821,673. SYSTEM OF FLUID PRESSURE CONTROL; Walter J. Richards, Milwaukee, Wis. App. filed Mar. 21, 1904. Has a continuously revolving electric motor and a magnetic clutch intermediate the motor and the air pump. The operation of the magnetic clutch is dependent on the air pressure in the reservoir.

821,697. ELECTRIC CURRENT CONTROLLER; Lynde Bradley, Milwaukee, Wis. App. filed June 9, 1904. Has a plurality of tubes filled with granular carbon on carbon wafers and plungers therefor arranged to compress the carbon so as to vary the resistance thereof. Means are provided by which the operating handle moves with a uniform pressure at all the different stages of compression of the carbon.

821,719. TROLLEY; Minas H. Kashian, Amesbury, Mass. App. filed Sept. 26, 1904. In order to avoid the expense of frequently renewing trolley wheels the patentee provides a structure in which the tread is removable and in which the axle is journalled in special lubricating boxes.

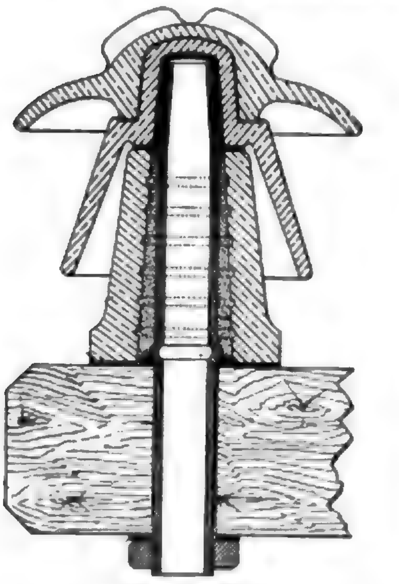
821,741. TELEGRAPHY; Michael I. Pupin, New York, N. Y. App. filed Jan. 28, 1895.

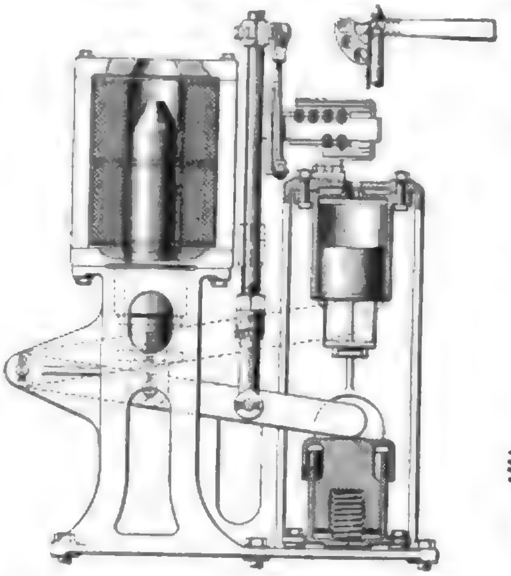
821,746. INSULATOR; Augusto Richard, Milan, Italy. App. filed Mar. 17, 1904. The insulator has a metallic post which is surrounded by a cylindrical porcelain block and which serves as a firm support for the insulator proper. The insulator is supported from the block by a washer to prevent breakage.

821,747. CONTROLLING APPARATUS; Walter J. Richards, Milwaukee, Wis. App. filed July 2, 1903. In order to take the load off of an air compression motor when it is first starting up, the patentee provides special valves in the compression cylinder which are magnetically opened until the motor arrives at its proper working speed.

821,753. PORTABLE TELEPHONE; Will A. Shimer, Rochester, N. Y. App. filed Oct. 3, 1905.

821,767. RAILWAY SIGNALING SYSTEM; Louis H. Thullen, Edgewood Park, Pa. App. filed Jan. 12, 1906. The motors for working the signals are operated by a three-wire polyphase system the circuits of which are closed by relays operated by short circuiting the track rails. The latter are normally maintained at a direct current difference of potential.


821,746.—Insulator.


821,899.—Railway Signal Operating Mechanisms.

821,768. CONTROLLER REGULATOR; Joseph V. E. Titus, Keokuk, Iowa. App. filed Apr. 11, 1904. A device for use with that style of controllers in which rapid movements of the controller arm are prevented. In case the trolley leaves the wire, a magnetic device permits rapid motion of the controller arm, so that the motors may be quickly put in parallel to exert a magnetic braking effect.

821,800. LOCK-OUT DEVICE FOR TELEPHONES; Ruben C. M. Hastings and Thurston Matheny, Athens, O. App. filed Apr. 4, 1905.

821,801. ELECTRIC RAILROAD SIGNALING DEVICE; Henry A. Hoeschen, Omaha, Neb. App. filed May 2, 1905. A form of tappet adjacent to the track rails which transmits a signal when depressed by the car wheels. Has a finger which is rocked so as to operate a current generator by a movement of the train in one direction, but not in the other.

821,807. MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES; Milo G. Kellogg, Chicago, Ill. App. filed Nov. 30, 1898.

821,820. SELECT RINGING AND LOCKING DEVICE; Orris H. Newman, Pekin, Ill. App. filed Apr. 3, 1905.

821,830. METALLURGICAL FURNACE; Isaiah L. Roberts, New York, N. Y. App. filed May 31, 1904.

821,832. ELECTRICAL DISCHARGE APPARATUS; James E. Seeley, Los Angeles, Cal. App. filed Jan. 25, 1905.

821,835. RAILWAY SIGNAL; William A. D. Short, Lexington, Ky. App. filed Sept. 14, 1905. Mechanical details of a semaphore signal employing an oil lamp, and a shutter with a small magnet operated windlass for raising the same.

821,837. DYNAMO-ELECTRIC APPARATUS; William Stanley, Great Barrington, Mass. App. filed May 25, 1905.

821,877. MUFFLER FOR TELEPHONE TRANSMITTERS; George A. Long, Hartford, Conn. App. filed Mar. 1, 1904.

821,898. CENTRAL-ENERGY TELEPHONE SYSTEM; William A. Taylor, Chicago, Ill. App. filed Feb. 4, 1901.

821,899. RAILWAY SIGNAL OPERATING MECHANISM; Louis H. Thullen, Edgewood Park, Pa. App. filed Mar. 24, 1906. An electrically operated semaphore having a power solenoid or magnet and an armature which moves against pneumatic buffers at the respective limits of its throw.

821,902. STATIC INDUCTION GENERATOR; Henry B. Todd, Meriden, Conn. App. filed Feb. 18, 1905. A generating plate or cylinder for induction machines composed of a body of fibrous material saturated with sulphur by immersion in a melted bath.

821,909. APPARATUS FOR THE REGULATION OF ELECTRIC SYSTEMS; George A. Wells, Jr., New York, N. Y. App. filed Nov. 10, 1903. Employs a dynamo electric machine with a heavy fly wheel in combination with a booster to increase its sensitiveness. This compensating machine is designed to run as a motor, but when the supply of electric power diminishes, the fly wheel causes it to act as a generator to deliver additional current.

821,914. AUTOMATIC ELECTRIC SIGNALING DEVICE FOR RAILWAY SWITCH SYSTEMS; David C. Wolfe, Lyons, Kan. App. filed Aug. 9, 1905. A special trolley is laid adjacent the usual track rail and an arm depending from the locomotive cab makes contact therewith and completes a signal circuit in the engine.

821,916. RAILWAY SIGNALING SYSTEM; Azel Ames, Jr., Cleveland, O., and John S. Hobson, Edgewood Park, Pa. App. filed Feb. 24, 1906. Details of circuits for an overlap railroad signal system employing track rails energized to direct current difference of potential and polarized relays to give the overlap feature.

821,920. INSULATING APPLIANCE; William A. Bonnell, Brooklyn, N. Y. App. filed Apr. 3, 1905. A form of outlet box for conduit wiring designed to give efficient insulation.

821,923. RAILROAD SIGNAL; Walter C. Burton, Fitchburg, Mass. App. filed Sept. 30, 1905. A box adjacent the track rails has a magazine of torpedoes and an electro-magnetic feeder impels the torpedoes in the path of a plunger depressed by the train whenever desired.

821,936. CURRENT REGULATOR; William K. Gibboney, Buffalo, N. Y. App. filed Nov. 19, 1904.

821,948. ANTISEPTIC TELEPHONE-MOUTHPIECE ATTACHMENT; George W. Merritt, San Francisco, Cal. App. filed Mar. 28, 1905.

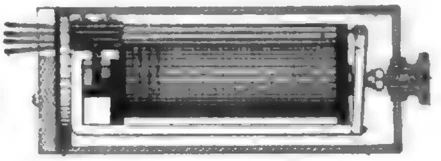
821,981. TELEPHONE SWITCH; Addington L. Brinckle, Philadelphia, Pa. App. filed Dec. 13, 1904.

821,992. RELAY DEVICE; John P. Downs, Cleveland, O. App. filed May 1, 1902. A telephone relay having a freely movable armature carrying a roller for displacing the contact making springs of the relay, which lie parallel with the core for this purpose.

822,028. RAILWAY SIGNALING SYSTEM; Jacob B. Struble, New York, N. Y. App. filed July 13, 1904. Employs batteries for the motor signal which are of high e.m.f. and has means for opposing a counter e.m.f. to such batteries for the energization of the track rails, whereby the latter are maintained at a low potential difference.

822,036. ELECTRICAL SWITCH; Earl C. Bacon, Indianapolis, Ind. App. filed Dec. 8, 1904. Mechanical details of a switch for directing the current from one set of lamps into another automatically at periodic intervals. It is operated by the expansion of a toggle or link connection under the influence of the current.

822,043. AUTOMATIC INSULATORS; Gaetan M. Corell, New York, N. Y. App. filed Dec. 21, 1904. The line wires are stretched between specially constructed insulators having spring pressed plungers which are normally tensioned apart by the wires. In case the wire breaks the plungers approach one another and complete a new path for the current.


821,992.—Relay Device.

822,084. ELECTRIC CIRCUIT BREAKER; George G. Stout, Parkersburg, W. Va. App. filed Mar. 30, 1905. A magnetic cut-out or circuit breaker having a balance lever which is displaced by excessive current in a solenoid. The displacement closes a local circuit through a magnet which opens the switch.

822,095. LIFTING MAGNET; Charles E. F. Ahlm, Cleveland, O. App. filed Aug. 28, 1905. A form of lifting magnet having a pair of concentric annular grooves in which magnet wire coils are placed and which are connected so as to produce three poles in concentric rings adjacent to the coils.

822,109. ELECTROLYTIC CELL; George A. Gabriel, New York, N. Y. App. filed Feb. 26, 1906.

822,167. BED WARMER OR COOLER; Charles C. Vaughn, San Francisco, Cal. App. filed June 19, 1905. A bell-shaped receptacle or basket has a lamp receptacle to receive an ordinary incandescent lamp, or a small fan motor for warming or cooling purposes, respectively.

822,168. CHANNEL PIN; Eugene W. Vogel, Chicago, Ill. App. filed July 27, 1905. A device for connecting bonds to rails comprising a copper pin of crescent-shaped section which is driven through the rail around the bond.

822,175. PROCESS OF LOCATING AND EXTRACTING METALS BENEATH THE EARTH'S SURFACE; Edson R. Wolcott, Golden, Cal. App. filed Sept. 5, 1905.

822,193. RELAY DEVICE; John P. Downs, Boston, Mass. App. filed Oct. 14, 1904. A telephone relay having an electrio-magnet with a protective shell or casing, and a thumb nut permanently secured to said shell and adapted to secure the same removably in position over the parts of the relay.

822,211. INSULATOR; Fred M. Locke, Victor, N. Y. App. filed June 23, 1902. In order to provide an increased arcing distance for an insulator, the patentee provides the usual saddle with a petticoat supported at the apex of a very large vitreous conical block.

822,223. AUTOMATIC CONTROLLER FOR PRESSURE SYSTEMS; Walter J. Richards, Milwaukee, Wis. App. filed Apr. 6, 1905. In order to secure the starting of the apparatus by the pressure in the air reservoir, the patentee provides a solenoid having a pair of coils respectively in shunt and series with the motor, and which are specially connected in circuit with the pressure gauge.

12,490. CONTROLLING MEANS FOR ELECTRIC CIRCUITS; Julius K. Lux, St. Louis, Mo. App. filed Apr. 5, 1906. Details of a snap switch having a cylindrical casing with a button projecting from its upper face and having spring and cam means for imparting an abrupt movement to the switch blades therefrom.

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Of this issue of the ELECTRICAL WORLD *16,000 copies are printed. Total circulation for 1906 to date, 458,500, an average of 19,104 per week.*

NEW YORK, SATURDAY, JUNE 16, 1906.

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THE ATLANTIC CITY MEETING.

The recent convention of the National Electric Light Association at Atlantic City can only be described as an unqualified success. The attendance was large, approximating 1,500 persons; the exhibition was admirable, and the papers were numerous and varied. The discussions were generally practical and useful, and would doubtless have been even fuller if less time could have been consumed by the authors of the papers, in reading them or in presenting abstracts. But this is always more or less of a difficulty at such meetings. Particularly noteworthy was the zest with which the members attended the sessions, neglecting the countless distractions of the famous boardwalk. In this respect the meeting was an agreeable disappointment to many who had feared that the regular work might suffer from the competition of the rolling chair, the auction room and the shooting gallery. As a matter of fact, an excellent programme of business was carried through with a steadiness and an enthusiasm unsurpassed at any other meeting of the body.

In the new president, Mr. Arthur Williams, the association has a man who has spent his whole life in the development of the electric lighting art, and who even more than others has gradually shifted his thought and occupation from the technical side to the commercial. He thus typifies felicitously at this juncture the newer attitude of the association in studying business problems and in exploiting business-getting methods. It is along these lines increasingly that the association must find its mission and career, not overlooking engineering questions but giving at least equal prominence in its transactions to those that relate to the consumption end of the circuit and to the needs of the consumer. Mr. Williams, in this regard, is unusually well equipped to lead the association forces, for some of his best work has been done in connection with the treatment of current-selling questions; the relations of public service corporations to the people, the press and the legislator, and the burning topic of municipal ownership.

PHYSIOLOGICAL FACTORS IN ILLUMINATION AND PHOTOMETRY.

The paper on this subject, read last week before the Illuminating Engineering Society, by Dr. Louis Bell, an abstract of which appears elsewhere, contains some important considerations from the engineering standpoint based on physiological data. We are all hampered in the exact measurement of light and illumination by the fact that light is a purely physiological stimulus and the eye has always to be the measuring instrument of what the eye discerns. As regards our other sensations of warmth, touch, audition and smell, the first two relate to quantities that can be measured by independent apparatus with great precision. Sound can also now be measured precisely, although it has only recently emerged from the same condition as the eye in regard to measurements. Smell remains like light to the eye, immeasurable by any mechanism independent of the nose. Edison's tasimeter is the only independent instrument capable, as yet, of recording a smell, and this only in a very limited and indirect fashion. The paper shows that in feeble illumination, to wit, one-sixteenth of a candle-foot, the human eye becomes blind to red, and its remaining sensibility is keenest to blue and green. In this condition it is pointed out that the retinal cones have ceased to respond, and only the retinal rods are active in conveying luminous stimuli to the brain. The idea is suggested that the cones, whose action is so necessary to color appreciation, have been developed more recently in evolutionary times, and that the primitive eye had only rods, or blue perceivers. It may possibly be a significant circumstance, in relation to this idea, that sea water rapidly absorbs light from the red end of the spectrum, the last rays to be absorbed as we descend in the ocean being the indigo. The eyes of fishes ought, therefore, to be good blue-perceivers.

The paper suggests that a consumption of 0.5 watt-per-candle, or an illumination of 2 candles-per-watt, is as much as may reasonably be expected from illuminants having a good color. On the other hand, 50 candles per watt might be realized in a light that was off color or that was distinctively colored, and was, therefore, unfitted for indoor illumination. Much progress has yet to be made, however, before even one candle-per-watt can be realized in commercial practice with incandescent lamps. A remarkable relation is given in Lambert's law between the area of the normal human eye pupil and the intensity of the illumination falling thereon. It means that if the intensity of the light falling on the eye be quadrupled, the virtual surface of the pupil will be halved, so that the quantity of light falling on the retina will be approximately doubled. The iris, therefore, does not regulate for constant flux of light on the retina, but only for a rough protection to the retina, by reducing the luminous intensity on the fovea as the square root of the luminous intensity on the eye-ball. There remains a wide field for laboratory investigation connected with the eye and its functions. We require to know what is the relation between the intrinsic brightness of an object and the size of the pupil surveying it, both alone at different distances, and also in conjunction with a background of varied illumination. Again, Fechner's fraction needs to be determined with different colors of illumination. Visual acuity should also be investigated under a definitely varied series of conditions. These and a host of other questions may be investigated by the physicist without encroaching upon the fields of physiology or dissection. The results could not fail to be both of great interest and distinct value in industrial application. Anything which will teach us how to group and place luminous sources with the greatest effectiveness and artistic effect, at minimum outlay and maintenance cost, is of great value to the whole process of civilization.

THE SPHERICAL REDUCTION FACTOR OF TANTALUM LAMPS.

The tantalum incandescent lamp, like the heathen Chinee, is peculiar. Its filament is remarkable in its drum-cord form, in its physical properties, in its relatively high efficiency and in its power of reconnecting itself after fracture, often refusing to consider itself broken and starting upon a new lease of life, for the moment fresher than ever. But its peculiarities do not stop here. In an article on page 1249 of this number, Dr. Clayton H. Sharp draws attention to a remarkable variation in the space distribution of light from tantalum lamps, not only among different specimens of new lamps, but also in one and the same lamp at different service ages. Thus among nine tantalum lamps, for which the photometric data are published in his article, the difference between the greatest and least spherical reduction factors observed when these lamps were new amounted to nearly 8 per cent of the average, 0.731, representing a probable deviation for any individual lamp of over 2 per cent from this average. The same lamps, when old, had each a probable deviation of 2 per cent from an average 23 per cent greater than the average when new. The article indicates that at least a large part of this increase in the factor with age is due to the horizontal band of black deposit on the inner surface of the globe, which reduces the horizontal candle-power markedly. Not only then is it an even chance that such tantalum lamps will have a spherical reduction factor, when new, outside the limits 0.717 — 0.745, but when they are old the factor will depart from this range and rise to the relatively high value of about 0.9.

The clear indication of these facts, as pointed out in the article, is that tantalum lamps should be metered for luminous intensity by a spherical photometer, if consistent results are to be obtained; for carbon filament lamps rated in mean horizontal candles, but differing only in spherical reduction factor to the extent of 2.5 per cent, are thereby caused to differ in life time by 10 per cent. It would be a great blessing if all lamps could be rated in terms of mean spherical candle-power, only their subsidiary specification giving the candle-power in the tip direction; or in the horizontal direction, as might be desired. Nature will not blind her eyes to the plain truth of the total flux of light or its equivalent, the mean spherical candle-power, of a luminous source, however, inclined we may be to shut our eyes to all light but the horizontal. An interesting fact reported in the article concerning the ageing of tantalum lamps is that their mean spherical candle-power was in several cases greater when they died than when they were new. The suggestion of possibly increasing the mean efficiency of tantalum lamps by enlarging their globes is also interesting from a theoretical as well as from a practical standpoint. Here is a case where the mean free path of tantalum particles, molecules, atoms or corpuscles, whatever they may properly call themselves, has a distinctly commercial bearing. A few years ago one would have thought that the mean free path of a tantalum particle in a certain degree of vacuity and at a certain temperature, was a private property of those minute projectiles that could only be of interest to the dry-as-dust philosopher.

POLICY TOWARD HIGHER EFFICIENCY LAMPS.

Ever since the tantalum lamp appeared as a commercial illuminant of the immediate future central station men have been giving considerable thought to the policy to be adopted toward these new higher efficiency incandescent lamps. Since the tantalum lamp first appeared the new graphitized (so-called metallized) carbon filament lamp has been put on the market in quantities. Now comes the introduction of high-efficiency carbon filament lamps in small units, soon to be followed by the introduction of the tantalum lamp on the American market. Assuming the technical performance of these new small high-efficiency units to be as stated by the manufacturers, some interesting questions come up for immediate solution by every central station company. Manufacturers have doubtless planned wisely in deciding to make lamps take the same watts as existing common incandescent lamps, but giving an increased light. The tendency will then be for customers to take more light and spend the same amount of money as before rather than to reduce bills without increasing their illumination. None but the narrowestminded central station manager can fail to welcome increase of lamp efficiency, for every such increase puts in his hands the means of more successfully meeting the competition of gas, gasoline and kerosene. Whether they are welcome or not, they will have to be reckoned with, because if a central station company is unprogressive enough not to introduce a higher efficiency illuminant, it will be placed on its lines by outsiders, for local dealers will soon learn of the higher efficiency obtainable and begin to market these lamps in every community, just as the Welsbach mantle was and is at present being sold.

The astonishing argument was used at the convention that customers will purchase the cheapest lamp without regard to its efficiency. If this were true, gas mantle burners could never have been introduced because open gas jet tips are infinitely cheaper than gas mantles. The American public knows a good thing and there will be plenty of salesmen to help point it out to them. Where a central station is furnishing free renewals the policy must manifestly be based on one of three alternatives: (1) Furnishing the new high-efficiency lamps free. (2) Furnishing them at the difference in price between the new high-efficiency lamps and the common carbon filament. (3) Furnishing only the old type free and charging full price for the new high-efficiency lamps. In view of competition, we are inclined to think that one of the two first-mentioned courses should be pursued. If a company does not furnish free renewals the matter practically takes care of itself, although it will be to the company's interest to push the introduction of high-efficiency lamps for competitive reasons.

NEW ILLUMINANTS.

Professor Clifford's N. E. L. A. paper on this subject gives an instructive, if somewhat undiscriminating, compilation of tests, which will not be without interest to the central station man who desires to compare the claims made in behalf of various commercial newcomers. It is particularly full in data upon various forms of flaming arc. We must take vigorous exception, however, to the author's insisting that the metallic filament lamps are disqualified in their present state of development. It is not necessary, for example, that an enclosed arc lamp should operate in a horizontal position and should be adapted without change for direct and alternating current in order that it should assume commercial importance. No more is it necessary for a Cooper Hewitt lamp to run on 120 volts, or for a Nernst lamp to work on direct current in order to take important place in the art. In point of fact the metallic filament lamps are being used in considerable numbers abroad, and their efficiency is so great that at all usual prices for electricity they are even at present figures cheaper than ordinary carbon lamps at any price. This fact is amply demonstrated by the data given by Mr. Willcox for the graphitized filament lamp, which has an initial consumption of 2.5 watts per candle as against 1 to 2 watts per candle for the various metallic filament lamps now under way. As between a 2-watt lamp and a 3-watt lamp, there is a saving in energy of one watt-hour per candle-power for each hour of burning, which offsets considerable difference in cost of renewals.

With illuminants which greatly reduce the cost of energy, limitations in field of usefulness can be very comfortably endured. Even in the case of the flaming arc with its excessive cost of upkeep, it is worth noting that it is cheaper per light unit than other arcs at all prices of energy usually paid by the private consumer. Such arcs will, therefore, find for themselves useful fields, as for instance in the case of the magnetite arc, which gives a form of distribution particularly well adapted for street lighting. In treating flaming arcs Prof. Clifford might well have pointed out that flaming arcs of low current lose greatly in efficiency. For example, the magnetite arc at 4 amp. requires 1.48 watt per m.s.c.p., while at 7 amp. it gets down to less than 1 watt. Taken as a whole, the data presented for the flaming arcs are very inconsistent, showing the vagaries usually found in commercial tests during a period of exploitation and recrimination. The correlated facts will appear later. We do not at all share Prof. Clifford's fear of high intrinsic brilliancy. It is perfectly well understood that sources having this quality must be used with diffusers; but since every known illuminant that has a claim to present commercial consideration is too bright to be safely used unshaded, the honors are rather even. We note with curiosity the figures furnished for a new street incandescent lamp by Prof. Clifford. He gives data from these lamps rated at 125 watts and 50 mean hemispherical candle-power, showing for the clear lamp 40.66 m.s.cp. and for the frosted lamp 39.52 m.s.cp. We would really like to know who rated those lamps and what kind of frosting it was that absorbed so little light. Frankly, the data on most of the illuminants as given here and elsewhere are badly muddled, and all the questions of efficiency and distribution need overhauling by careful and unbiased experimenters.

A large part of Prof. Clifford's paper is taken up with the consideration of the Moore vacuum tube system, with which he is apparently sympathetic. We cannot discover from the context whether the data upon this subject are original or selected, but they are at least interesting as giving some line on the efficiency of the system, which appears to be moderately good, the consumption claimed being in the neighborhood of 1.5 watts per cp. It is not stated how this candle-power was measured or in what direction, but we should infer that it was, so to speak, the semi-cylindrical candle-power as given normal to the section of tube considered. The scheme of simplifying the installation by using immensely long tubes is certainly interesting, but figures on cost of maintenance would be desirable before endorsing it. Apparently from a patent recently issued to Mr. Moore, some difficulties have been met in maintaining the proper degree of vacuum. Mr. Moore's original vacuum break, really a very pretty and ingenious device, seems to have been lost in the shuffle. One good thing that can be said for the system is that the color of the light can be admirably governed, which is more than one at present can say for the mercury arc. Prof. Clifford speaks cheerfully of the practice of tempering the color of the latter by using it in conjunction with incandescents, but refrains from adding the cost of this amelioration to his general estimate. Lamps like the Moore tube are interesting as showing the opening of a new field of investigation. But upon the whole, considering the time that has elapsed since the beginning of these attempts at gaseous glow lamps, the results up to date are hardly as encouraging as one might wish. The line is worth following, however, for it might take a new turn leading to important results. Meanwhile we certainly have modified arcs and incandescents capable of doing much more efficient work than those now in use; and while still in process of development, they have already assumed too much importance to be overlooked as immediate resources. We hope that the next convention will have brought them further to the front, and that complete information regarding them will be available.

Sections of the Illuminating Engineering Society.

The Illuminating Engineering Society at a recent meeting of the council disposed of a question which had commenced to assume a threatening aspect, namely, the relative status of the New York meeting and of the meetings of the several branches of the society. At present there are branches of the society in Boston, Chicago and Philadelphia, and in these places it appears that considerable dissatisfaction had arisen on the score that the New York meetings were conducted as meetings of the society at large, thereby giving a dubious status to the branch meetings. That the council recognized there was cause for complaint is evident from the adoption of the following resolutions, which were carried unanimously, and presented June 8 at the New York meeting:

1. In order to distribute as equitably as possible the benefits and privileges of membership in the Illuminating Engineering Society, the organization of sections is authorized in any city or locality where the local membership is fifty or more.

2. The membership of New York City and vicinity shall be organized as a section, to be known as the New York Section of the Illuminating Engineering Society.

3. Each section organized shall nominate and elect for the local conduct of the section a chairman, two vice-chairmen and a secretary.

4. The expenses of sections incurred for postal card notices and stenographic report of discussions shall be paid from the general fund of the society. Other expenses than these, such as rent of auditorium, if any, must first be authorized by the council.

5. In order to insure that the conduct of sections shall always be in conformity with the general policy of the society, any proposed action of a section not relating to the holding of meetings and the discussion of papers, shall be submitted to the council of the society for approval prior to be being put into execution.

6. In order to facilitate the timely issue of the *Transactions* the meetings of all the sections shall be held before the 20th of the month.

7. The secretary of each section shall distribute the stenographic reports of discussions to members of the section for correction, and forward the corrected report to the general secretary of the society.

8. The sections shall abide by the Constitution of the society and conform to the regulations of the council.

At the New York meeting on June 8 it was announced that the total membership of the society was 572. It was also announced that a badge for the society, designed by Mr. Waldo S. Kellogg, member, had been adopted, and could be obtained by members on application on payment of $3.00, this sum slightly exceeding the cost of the badge.

Illuminating Engineering in Great Britain.

Our British contemporary, the *Electrical Magazine*, in commenting on a series of articles in its columns by Mr. L. Goster on "The Need for the Illuminating Engineer," expresses the hope that its readers will respond heartily to the appeal for aid in the formation of a British Illuminating Engineering Society. No time, it says, should be lost, as the present position of illumination demands co-ordinate interest and co-operative effort for its establishment on an authoritative basis in this country. "America has led off well. Already it can boast a society and two independent journals devoted to the subject. The state of affairs here needs both of these, and just as soon as they can be fashioned from the materials at disposal. We want the gas and oil men as well, and hope they will stand by the movement, as their interests are likely to be safeguarded equally with those of other illuminants represented. We have now done with the talking. The sooner the practical business is got down to the quicker the end in view will be attained."

That in this country the formation of a society to foster the interests of illuminating engineering was entirely justified, is shown by the rapidly growing membership of the present society, which is now little short of 600 and promises to reach 1,000 by the end of the year, by the high character of the contributions available for its *Transactions* and by the lively interest in the meetings as manifested in the discussions. Our British friends should not delay getting into line with this latest branch of technical specialization.

The Institute British Trip.

Note has already been made in these columns of the hospitalities which the Institution of Electrical Engineers of England proposes to extend this month to visiting members of the American Institute of Electrical Engineers. The subjoined is the list of the A. I. E. E. participants, and it is matter of regret that more of the members are unable to avail themselves of this opportunity: President Wheeler, Mrs. Wheeler; J. W. Lieb, Jr., Mrs. Lieb; Ralph W. Pope, E. W. Stevenson, Mrs. Stevenson; Morgan Brooks, Henry Brooks, F. B. Crocker, C. A. Perkins, Mrs. Perkins, Miss Perkins, Miss Perkins; A. E. Kennelly, C. H. Sharp, J. H. Siegfried, F. H. Taylor, Mrs. F. H. Taylor, C. L. Edgar. The following foreign members of the Institute, ditto: W. C. Burton, J. R. Crawford, Mrs. J. R. Crawford; W. H. Donner, E. T. Goslin, Kaleb Hedin, Richard Heinrich, W. S. Hunt, Paul Letheule, J. W. McCrosky, Charles H. Merz, Edwin J. Murphy, M. Osborne, Mrs. Osborne; Edwin S. Reid, Mrs. Reid; Harrison Smith, Herbert Laws Webb, Ragnar Wikander, A. E. Winchester, J. G. Lorrain, R. H. Zafitz.

Single-Phase Equipment for Richmond and Chesapeake Bay Railroad Company.

In the early days of electric railroading, Richmond, Va., was among the first to install a trolley railway and in the year 1888 the Sprague system was installed and successfully operated in the city on a commercial basis. This glimpse of early railroad history is called to mind by the fact that Richmond is taking the same initiative by adopting the latest development in railway traction, the single-phase, alternating-current system. To this end the Richmond & Chesapeake Bay Railway Company has been incorporated, and, in accordance with its plans, about 15 miles of track will be equipped immediately with single-phase apparatus. Eventually this single-phase road will extend from Richmond to Chesapeake, but the portion about to be electrified comprises that part lying between Richmond and Ashland. The contracts for the entire equipment of this section have been let to the General Electric Company.

The line in general will follow the plans which several roads in the Middle West have adopted, but the trolley voltage will be higher. The catenary method of suspension will be used, adapted for a trolley potential of 6,600 volts. Each of the cars will be shipped with four single-phase motors with multiple-unit control. The air brake system will be of the combined straight and automatic type with motor compressors.

Power for the operation of the new road will be furnished by the Virginia Passenger & Power Company and the arrangements for furnishing the single-phase current are of especial interest. Two generating sets will be furnished, both to be operated ordinarily by water power, but arranged for electrical drive when that is necessary. The first unit will consist of a 750-kw, 6,600-volt, three-phase, 25-cycle generator, mounted on the same shaft with a 750-kw, 2,300-volt, 60-cycle, three-phase generator, the shaft being extended at one end for connection with a water wheel of sufficient power to drive both generators at their rated output.

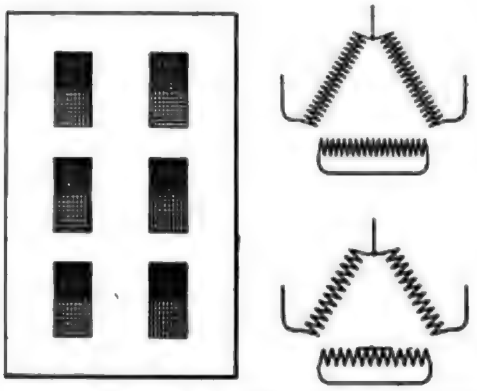
The second set will be made up of a 25-cycle, 6,600-volt generator, a duplicate of the first, but instead of being mounted with a 60-cycle machine, this generator will be mounted on the same shaft with a 750-kw, 550-volt, direct-current machine. When there is sufficient water to operate all of the water wheel generators in the station, these sets will be driven by the water wheels; if at any time there is insufficient water to drive the generators or flood conditions render it advisable to close the gate valves, the sets will be disconnected from the wheels and operated as straight motor generator units. In their respective cases the 60-cycle generator will run as a 60-cycle synchronous motor and the 550-volt machine will operate as a direct-current motor. Power for driving the motor and of the 25-cycle sets in this way will be obtained from the engine-driven units of the Virginia Passenger & Power Company, already installed. When the motor generator units are operated as water wheel-driven machines, the 60-cycle generator will be operated in parallel with the present 60-cycle machines, and the 550-volt machine in the other set will run in multiple with the present 550-volt machines. The 750-kw, 25-cycle generators in each set will, for the present, be operated as single-phase machines and will supply current directly to the trolley of Richmond & Chesapeake road at 6,600 volts.

In addition to the main apparatus outlined for the road, there will be a lighting station at Ashland. This will consist of a 100-kw, 2,300-volt, 60-cycle, three-phase generator mounted upon a common base with a 150-hp, 440-volt, 25-cycle, single-phase induction motor. This set will be operated from the 6,600-volt trolley through a 150-kw, single-phase, oil-cooled transformer. The motor generator set will be provided with a direct-connected exciter mounted on an extension of the shaft. The voltage will be controlled by a Tirrill automatic regulator, which will insure a uniform voltage at the generator end of the lighting service, regardless of the fluctuating trolley voltage.

The Richmond & Chesapeake Bay road to be so equipped will practically parallel the Richmond, Fredericksburg & Potomac steam road from Richmond to Ashland, and it is the intention of the trolley company to maintain a fast schedule between these two points, operating cars at very frequent intervals.

Operation of Disabled Three-Phase Transformers.

It has frequently been urged against the use of a three-phase transformer with interlinked magnetic circuits that if one or more windings become damaged by short-circuiting, grounding, or through any other defect it is impossible to operate from the undamaged windings of the other phases, as would be the case if a single-phase transformer were used in each phase of the multiple-phase system. In a patent issued May 22 to Mr. W. S. Moody means are described for operating such a transformer exactly as one would operate the remaining undamaged single-phase transformers used for three-phase work. A view of a shell-type, three-phase transformer is given in Fig. 1, while Fig. 2 shows the method of using the coils when the windings of one phase become damaged.


FIGS. 1 AND 2.—OPERATION OF DISABLED THREE-PHASE TRANSFORMERS.

The damaged transformer windings are electrically separated from the other coils. The high potential winding of the damaged phase is short-circuited upon itself and the corresponding low potential winding is also short-circuited upon itself. The windings thus short-circuited will choke down the flux passing through the portion of the core surrounded by them without producing in any portion of the winding a current greater than a small fraction of the current which would normally flow in such portion at full load.

President Williams of the National Electric Light Association.

Mr. Arthur Williams, who has just been elected president of the National Electric Light Association, was born August 14, 1868, and is the son of a well-known Methodist Episcopal clergyman. He was educated in public and private schools in New York, Hartford, etc., and in 1885 entered the service of the New York Edison Company as assistant in the chemical meter department. He became electrician of the company, then operating only the old Pearl Street station, 1887-8, and in 1888 was made the superintendent of the third district. The following year he became superintendent of the underground department. About 1890 he was appointed as general inspector, and in 1893 general agent; and he has exercised the functions of both these departments ever since. Such a career is remarkably well rounded and embraces a wealth of experience rarely enjoyed by a man still so young. Mr. Williams is also vice-president of the Yonkers Electric Light & Power Company, of whose system a description appeared in these pages on April 21.

PRESIDENT WILLIAMS.

Mr. Williams has from the first been interested in the work of the National Electric Light Association, and has already served as second vice-president, 1904-5, and first vice-president 1905-6. He has also been active in the Association of Edison Illuminating Companies. In 1901-2 he was president of the New York Electrical Society and had a very successful year of office. He was elected as an associate member of the American Institute of Electrical Engineers in 1897. His broad interest in social affairs is shown by his membership in the Union League Club of New York, the Brooklyn Riding and Driving Club, the National Arts Club, the Electrical Club, and the Yonkers City Club.

Variable-Pole Self-Starting Single-Phase Induction Motor.

It is well known that a polyphase motor requires a higher secondary resistance when starting than when running in order to insure a large starting torque. In a single-phase motor it is still more important that the secondary winding have a relatively low resistance when running, since the maximum torque or "pull-out" torque of the motor is dependent upon the amount of resistance in the secondary circuit, while in a polyphase motor the pull-out torque is independent of such resistance. The accompanying illustration shows a scheme proposed by Mr. B. G. Lamme in a patent issued May 22, for obtaining a high resistance under starting conditions without the employment of short-circuiting devices. The secondary winding is of the squirrel-cage type, having high-resistance end rings at certain points along which are connected low-resistance conductors. The primary winding is arranged to produce twice as many magnetic poles at starting as when running. The low-resistance secondary connectors are attached at points corresponding approximately to the polar pitch when the primary winding is connected for the smaller number of poles; that is, for the running conditions of the motor. Thus low-resistance secondary circuits are provided for the motor under running conditions and relatively high resistance secondary circuits for starting conditions.

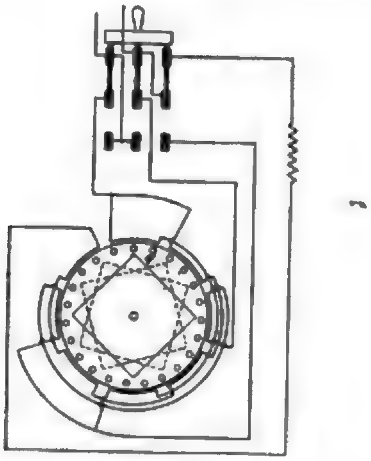


DIAGRAM OF MOTOR CIRCUITS.

Regulation by a Municipality of Maximum Rates for Lighting.

An interesting and important report has been filed by the special master appointed by the Circuit Court of the United States for the Southern District of Ohio, Eastern Division, in the complaint of the Columbus Railway & Light Company vs. the City of Columbus. The principles which have been contended for in this case have been that in the regulation by the municipality of a maximum rate for electric light, the authorities must consider the maximum cost of rendering the service to any substantial class of customers; and that the cost of service must be recognized as being based on the hours of use. These points have been established by the master's findings in both fact and law.

Under the provisions of the act of 1904, giving city councils power to regulate rates, for light, water, etc., the City of Columbus passed an ordinance fixing the rate for electricity for electric lighting at 5 cents the kilowatt-hour. Prior to that time there was no rate fixing ordinance. Thereupon the complainant brought action by a bill of equity, alleging that if the ordinance were enforced it would sustain a large annual deficit and would never be able to derive any revenue from its investment. The ordinance was also in violation of contract rights guaranteed to the company and "if enforced will deprive complainant of its property without due process of law, and will take the property of complainant for public use without compensation; and such ordinance is in contravention of the Constitution of the United States." The complainant in view of the fact that it had no adequate remedy at law asked for an injunction to restrain the city from enforcing the ordinance, and secured a temporary injunction.

The case having been referred to the master, he made an elaborate investigation of the question for the court and has now filed a voluminous report, which deals with decisions as to rate regulation on railroads, etc., and then discusses in detail the evidence presented as to the investment in the plant, operation, expenses, depreciation, etc. Then taking up the effect of the proposed rate the report says:

"The total earnings of complainant for the year 1904, $333,000 in round numbers, were based on the net maximum rate during that year of 10 cents. Had the maximum rate during that year been 5 cents, as fixed by the ordinance, the difference between the amount actually received and that which would have been received under the maximum rate prescribed by the ordinance, is admitted to be $33,000. Deducting this $33,000 from the net amount, after providing for the annual depreciation, the net amount left applicable to rental charges would have been $26,500, or $69,000 less than sufficient to pay that rental. The evidence shows that while the maximum rate charged by complainant during the year 1904 to its customers was 10 cents, competition with rival companies supplying light and power and competition from natural and artificial gas, compelled complainant, in order to maintain its business in certain quarters of the city, to fix a voluntary maximum rate of 5 cents, and in other quarters to vary its maximum rate between 5 cents and 10 cents. The proof shows that out of 3,134 customers only 564 were charged the maximum rate.

"The section of complainant in so meeting competition, even though it might have resulted in temporary loss, an action similar to that of many other corporations both public and private, taken voluntarily in order to hold business, and in the hope of ultimate profit, should have no legal effect upon determining the issues in this case. It would seem to be axiomatic as a legal proposition that while one may voluntarily if he so chooses, devote his property to the public service without compensation, he cannot by law be compelled to do so."

The report goes into an analysis of the classes of the 3,134 customers, and shows that the total cost to the company of serving one-hour customers was 12.434 cents per kw-hour, two-hour customers 6.869 cents, and three-hour customers 5.013 cents. It is held, upon very extensive argument, that this would be unfair and confiscatory. The conclusions of fact are as follows:

The total amount of money expended upon complainant's property up to December 31st, 1904, amounted to..	$2,000,000	
The fair value of complainant's property in the year 1904, was	1,650,000	
The gross earnings of complainant during the year 1904 were	333,000	
Of this amount there was earned from rates in excess of 5 cents per kw-hour..................	33,000	
The operating expenses of complainant during the year 1904 were	191,000	
The proper amount to be added to such operating expense for depreciation is 5 per cent. upon the value of the property, or..................	82,500	
The value of meters, and arc lamps included in the valuation of complainant's property is..................	165,000	
The maintenance and renewal of arc lamps and incandescent lamps charged to operating expenses during the year 1904 amounted to..................	25,000	
The cost, without depreciation, of furnishing 1580 one hour consumers during the year 1904, per kilowatt-hour, was		5.394c.
The cost, including depreciation, was..................		8.594c.
The cost, without depreciation, for furnishing 803 two hour consumers during the year 1904, per kilowatt-hour, was		3.349c.
The cost including depreciation was		4.949c.

Based upon this, operating expenses, including depreciation upon the valuation found for the property of complainant, under the maximum rate provided by the ordinance as applied to its receipts during the year 1904, the company would have received as compensation less than 2 per cent upon its investment.

The conclusions of law are subjoined: 1. The court has jurisdiction of the case and power to grant the relief prayed for. 2. Meters, arc lamps and incandescent lamps are a proper part of the property account of complainant, and their repair, renewal and maintenance is a proper charge against its operating expenses. 3. The amount which complainant could have earned upon a fair valuation of its property during the year 1904, had the ordinance been in force, was not a fair compensation within the meaning of the law, and for that reason said ordinance, if enforced, would have deprived complainant of its property without due process of law. 4. The fact that 75 per cent of complainant's customers under the rate fixed by the ordinance would receive their light at cost, or less than cost, including depreciation, is in itself a violation of the constitutional rights of complainant, and deprives complainant of its property without due process of law. 5. For the reasons above stated, the ordinance of July 5, 1904, is unconstitutional in that its enforcement would deprive complainant of its property without due process of law, and deny to complainant the equal protections of the laws, and, therefore, the injunction should be made perpetual.

Some Physiological Factors in Illumination and Photometry.

In a paper presented at a meeting of the Illuminating Engineering Society, held in the Edison Auditorium, New York City, on June 8, Dr. Louis Bell pointed out some of the bearings of physiological optics upon practical illumination, its measurement and the limitations of its efficiency. According to Fechner's law, the human eye can perceive a fixed fractional difference of illumination, irrespective, within wide limits of its absolute amount. This fraction varies in general from about 1 per cent to about 0.55 per cent assuming ordinary sources of illumination and normal eyes. Now for the purposes of practical lighting, the illumination should be generally kept within the range for which Fechner's law holds good, and once well within that range of normal sensibility nothing is gained virtually by increasing the strength of the illumination, so far as difference of luminosity is concerned. Experience shows that at one or two foot-candles the eye is working so near its normal sensibility that further increase in illumination is of relatively very small value.

The essential point in good seeing, however, is that the values here specified should be those affecting the eye and not merely those by which objects are illuminated. Since objects are each in virtue of differences of reflected light the illumination which affects the eye is determined by the coefficients of diffuse reflection of the objects in the field of view. The surface observed acts as a secondary source of illumination, and for details small compared with the normal visual distance the law of inverse squares holds, hence the tendency to get the eyes close to the work in insufficient illumination. In weak light, say 0.1 or 0.2 foot-candle, variations of shade are perceived only with difficulty. At 0.5 foot-candle conditions are very greatly improved and useful illumination begins, and above 1 foot-candle they may be considered normal, unless close detail is concerned, in which case more light is of some assistance. But the controlling factor in practical illumination is the luminosity of the colors concerned, producing apparent color relations which entirely mask the real ones already described. Given, therefore, the general kind of work which is to be done under artificial light and one can reckon from general physiological and physical data the approximate intensity of illumination required. The lowest permissible illumination is, of course, for coarse work on approximately white objects, the highest for close discrimination of detail and shading in dark objects.

For very weak and very bright illumination the effect of pupillary diameter must be taken into account. So far as objects in the visible field are concerned there is every reason for keeping the illumination received from them quite near to the critical amount, and so long as this is done the pupillary diameter, so far as these objects are concerned remains reasonably constant. The iris diaphragm of the eye responds by reflex action to light and other stimuli, varying in diameter from hardly more than a point in very intense light to a width in complete darkness so great that the iris actually retreats under the margin of the cornea. If a bright light causes the pupil to contract abnormally the illumination available from objects in the field of vision is cut down and the normal sensibility of the eye may be greatly reduced. Suppose, for instance, an eye receiving 1 foot-candle at its normal pupillary diameter, in such case not far from 4 mm. Let now a light enter the field of vision bright enough to contract the pupil to 2 mm., and the effect is the same so far as the general field is concerned, as if the available illumination were cut down to 0.25 foot-candle, which is too low for decent seeing. Hence, the importance of keeping bright radiants out of the field of vision.

The actual relation between pupillary aperture and intensity of illumination has been investigated with somewhat various results, much depending on the state of adaptation of the eye. In examining the classical experiments of Lambert on this subject a simple approximate relation appeared between the area of the pupil and the illumination, to wit: that the former varied with the reciprocal of the square root of the latter. It is probable that the pupillary aperture is affected by the intrinsic brilliancy of the source as well as the illumination from it, but the exact relation remains undefined. This much is certain, that a light of too high intensity or intrinsic brilliancy within the field of vision tends to defeat its own purpose by automatically stopping down the iris. This is quite apart from the well-known and serious effect of such lights in causing retinal irritation, to which the loss of many an eye may be attributed. Any violent contrast in the field of vision is objectionable for the same reason, in less degree, so that if conditions are such as to require powerful illumination in a part of the field a very bright background in the rest of the field should be avoided, it being preferable to have there merely enough light to avoid excessive contrasts.

As most objects are colored, the relative luminosities of various colors are important considerations in illumination. That the eye is affected by various colors in very different degrees is well known, and the fact is responsible not only for great difficulties in photometry, but also for serious limitations on the possible efficiency of illuminants. Fig. 1 shows several luminosity curves from the experiments of Abney. Curve 1 is that for the normal human eye taken with fairly bright light. It has a strong maximum in the yellow of the spectrum, while in the scarlet on the one hand and the full green on the other the apparent luminosity has fallen to half the maximum. In the deep crimson and the blue respectively it is below a quarter and rapidly falling. While the luminous part of the spectrum lies mainly between wave lengths 700 μμ and 400 μμ the effective part of it lies between wave lengths 630 and 530. Energy outside these limits is for the most part wasted so far as vision is concerned.

At first sight, therefore, the eye would seem to be very inefficiently organized. Such, however, is not the case, for the eye has been evolved not for artificial light, but to meet the exigencies of natural light, and its point of maximum luminosity falls very near to the point of maximum energy of the solar light, in fact, between that and the maximum energy point for skylight, so that the adjustment of the sensibility for natural conditions is excellent. Moreover, were it not for the adjustment of the eye for a sharp maximum of sensibility, we should be totally unable to see clearly on account of the effect of chromatic aberration. When the eye is accommodated for yellow light, images due to deep red and deep blue light are badly out of focus and were they comparable in brightness to the yellow image, near vision would be very indistinct, and aside from this we should lose much of the contrast which helps to render objects visible.

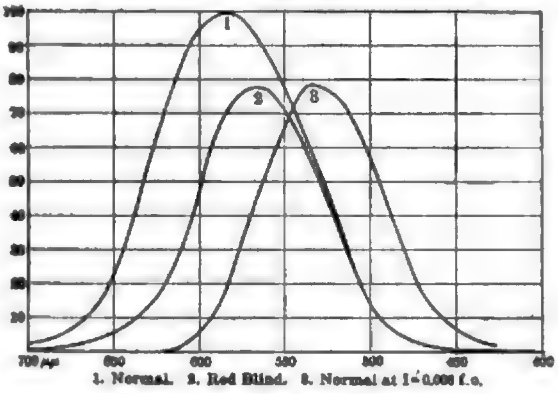


FIG. 1.—LUMINOSITY CURVES.

As was long ago noted by Purkinje and Dove, the relative luminosity of different colors is greatly affected by the absolute intensity of the illumination, a fact at once curious in itself and in photometry very troublesome. Curve 3 of Fig. 1 shows the relative luminosities for white light of an intensity of about 0.066 foot-candle. Its maximum lies in the full green instead of the yellow and the luminosity for yellow and red is very low. To be strictly comparable to Curve 1 it should be plotted with the same maximum, but its shape plainly shows that in light of so low intensity, the normal eye is red blind. Curve 2 shows the luminosities in an actual case of color blindness. Red blindness varies in amount, but no case is so severe as that of the normal eye in weak light.

The comparison of colored lights involves this phenomenon to a very serious extent, and in particular all extinction methods are vitiated by it save when used merely for the comparison of lights of similar color or for the actual measurement of very low intensities. In fact, any photometric device which can be used on colored lights with coherent results by both the normal and the color-blind, owes its apparent efficacy to disregard of part of the spectrum generally useful.

Now in using artificial illuminants the real usefulness of the light evidently depends upon the amount of energy which falls within that part of the visible spectrum to which the eye is reasonably sensitive. In fact, the photometric principle laid down by Crova, of comparing lights by their respective components in the neighborhood of 590 μμ wave length had much to recommend it in dealing with sources which give a continuous spectrum. The position of the energy maximum in the spectrum of an incandescent body is a function of the temperature, and unfortunately the temperatures available in flames, incandescent lamps and so forth are too low, say, 1,800° to 2,200° absolute, to place this maximum where it will do the most good. In fact, to put the maximum where it ought to be requires the solar temperature itself. Fig. 2, from the researches of Nichols, gives with arbitrary ordinates the distribution of energy in the visible part of the spectrum for various familiar sources of light. The first three curves are for ordinary incandescent solids and bear a striking resemblance to each other. Curve 4, from the electric arc, shows relatively more blue and less red than the others, thus corresponding to its higher temperature. Curve 5, from a Welsbach mantle, shows a considerable departure from the distribution of the normal incandescent body, due not to enhanced temperature, but to powerfully selective radiation. It indicates a very high luminous efficiency, since the maximum lies within the visible spectrum. Curve 6 is the solar radiation, which is from a temperature so enormous that the maximum is pushed up into the orange. Were one sure that the radiation is quite non-selective a pretty close value for the solar temperature could be obtained. As it is, it is only safe to say that the temperature is probably between 5,000° and 6,000°.

Now these curves are, so to speak, the mere fag-ends of the total energy curves. Fig. 3 shows their relation to the whole radiation. Curve 1 shows the immense advantage in efficiency of the solar radiation. All ordinary illuminants give curves lying between 2, the Hefner lamp and 3, the acetylene flame, which is not far from the result given by the arc, the only artificial light of higher temperature.

The efficiency of an illuminant in the sense in which the expression is ordinarily used is the ratio between the luminous energy and the total energy. In this estimate the luminous spectrum is commonly taken as beginning at wave length 760 μμ. All of it that is good for anything, however, lies practically between the limits shown on Fig. 3.

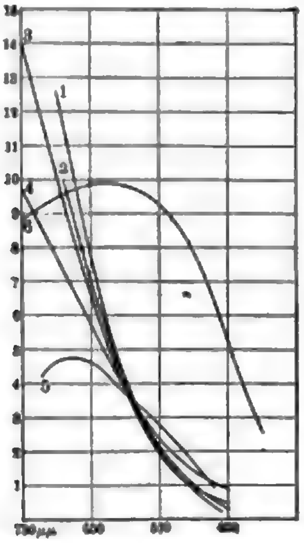


FIG. 2.—DISTRIBUTION OF ENERGY IN VISIBLE SPECTRUM.

Angström has found for the particular energy curve of the Hefner lamp that one square centimeter of surface 1 m. from the flame receives 8.3 ergs per second of luminous energy, which gives for this particular source a luminous efficiency of 0.9 per cent. Other things being equal, if all the energy were converted into light on the basis of this mechanical equivalent of light, we should obtain for a radiation wholly within the visible spectrum, a candle at a consumption of 0.115 watt. But the visible light is really the summation within the visible spectrum of each element of energy multiplied by its corresponding coefficient of luminosity, and this summation is very different for different energy distributors. Nichols, from the application of Crova's criterion that lights of equal intensity at wave length of 590 μμ are equal, has made some most interesting approximations to the mechanical equivalents as derived from other illuminants reaching for sunlight 4.85 ergs per second and for the Welsbach on account of its selective radiation, as low as 4.39 ergs per second.

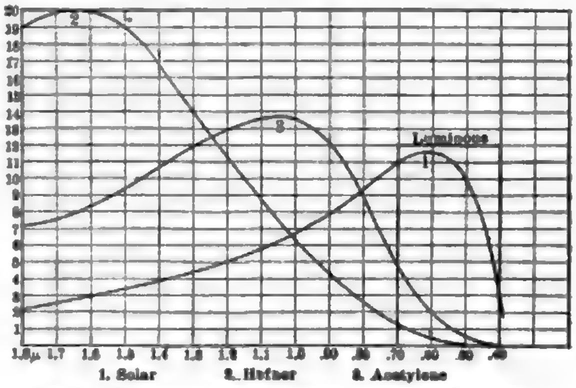


FIG. 3.—DISTRIBUTION OF TOTAL RADIANT ENERGY.

A rigorous summation made as above would change these quantities somewhat, but the main point of the matter is that if one could confine radiation to the visible spectrum with as good a distribution as is given by the Welsbach or by sunlight one could secure artificial light at a consumption of about 0.06 watt per candle-power. This, however is not the limit, for if in addition one could crowd all the radiation into the neighborhood of wave length 590 μμ one could get light at a consumption of approximately 0.01 to 0.02 watt per candle-power, which is about the theoretical minimum. This would, however, be practically monochromatic light by which color vision would be impossible.

The flaming arc is the most efficient illuminant yet found, and M. Blondel has been able to obtain from it a mean spherical candle at a consumption of 0.1 watt, due to the very high luminosity of the two calcium fluoride bands near to wave length 600 μμ. The light, however, has a large color error which can be corrected only by a considerable sacrifice of efficiency. Undoubtedly, a discontinuous spectrum gives the best chance for high efficiency, but only at the cost of serious color errors. Even if one could obtain a discontinuous spectrum of the three primary rays only, it would be at a sacrifice, and there would be some doubt of its value as an illuminant on account of chromatic aberration in the eye.

Could one steal the fire-fly's secret, the result would be, if Langley's experiments correctly represent it, a light of high efficiency it is true, but of about the color of a superannuated Welsbach. From all appearances, it will be extremely difficult to do much better than to obtain a candle at a consumption of 0.5 watt with an illuminant of reasonably good color quality.

DISCUSSION.

The discussion was opened by Dr. Percy Friedenberg, president of the Harlem Medical Association, who spoke from the viewpoint of the oculist, of the general effect of light on the eye. After explaiinng the ability of the eye to detect certain differences in intensity of illumination, he stated that the amount of light admitted to the eye depends upon the size of the pupil, and objects can be seen clearly even when the pupil is much contracted. The pain experienced when passing to and fro between dimly lighted and brilliantly lighted rooms is due to the attempt of the pupil to adapt its opening to the illumination. The most perfect illumination is that in which there are no marked changes in brilliancy. In regard to the effect upon the vision and the fatigue of the eye, the comparison of lamps is more largely a question of distribution than of quality or quantity. The pain felt when even a shaded lamp is placed near the eye is due less to the brilliancy of the illumination than to the heat of the lamp, which tends to dry off the surface of the eye. Lamps should always be placed so that no light falls directly into the eye; only the object to be seen should be illuminated. Any form of monochromatic light is disadvantageous, because it tires one set of eye nerves without using the others.

Dr. N. J. Hepburn, of the Manhattan Eye and Ear Hospital, remarked that too much light is worse than too little; a well subdued light is best of all. Experience shows that the yellow light, such as is obtained from a kerosene lamp, is much less fatiguing to the eye than the white light, which comes from a brilliant incandescent lamp. A pleasing effect is obtained by using a light yellow or gray color for the walls of rooms, the lamps being concealed.

Dr. William S. Dennett expressed his approval of the method used in illuminating the Edison Auditorium, where all of the lamps are either completely concealed or are covered with frosted globes, most of the light being reflected from a white ceiling. The prime requisite in illumination is uniformity of distribution and constancy of intensity. It cannot be too strongly urged that light of great brilliancy should not strike the eye directly.

Mr. W. D'A. Ryan expressed the opinion that too much illumination is not now being used, and that even though the light be increased three or four times it will not be excessive. A law should be passed to prohibit the placing of the lamps in public assembly halls where the light will strike the eye directly. In explanation of the pleasing effect obtained from yellow light, it may be stated that an incandescent lamp which gives a yellow light is operating at a low intrinsic brilliancy.

Mr. J. R. Cravath believed that the statement by Dr. Bell at or near one or two foot-candles the eye is working so near its normal sensibility that further increase in illumination is of relatively very small value and can be used as a criterion of general illumination for ordinary purposes. Such intensity, however, is not sufficient for draughting, where at least 10 foot-candles should be used. For reading purposes it is frequently restful to have the room as a whole less brilliantly lighted than the book, though the contrast should not be too great.

Mr. E. L. Elliott expressed the opinion that even when lamps are high up along the walls the effect is disagreeable to the eyes so long as the lamps remain within the line of indirect vision.

Mr. V. R. Lansingh stated that the Government now specifies a low surface brilliancy from diffusing globes which surround incandescent lamps, namely, ½ cp per square inch of diffusing globe.

Mr. N. J. Neall.

Newitt Jackson Neall was born in Philadelphia, February 7, 1875, and attended the public schools in that city until graduation from the Boys' Central High School. Following this came four years in a special apprentice course with the Pennsylvania Railroad at Altoona, Pa., intended to train young men for positions of responsibility in railroad work. Feeling at the end of his apprenticeship the need of a further engineering training, Mr. Neall entered the Massachusetts Institute of Technology as a student in the mechanical engineering course. While pursuing this course electrical engineering made a most strong appeal to his taste; from this latter course he was graduated in 1900 with the degree of S. B.

Immediately after graduation Mr. Neall associated himself with the Westinghouse Electric & Manufacturing Company at East Pittsburg, Pa., becoming later assistant to Mr. Percy H. Thomas, engineer of protective apparatus for high-voltage transmission lines. When Mr. Thomas went over to the Cooper Hewitt Electric Company Mr. Neall assumed the responsibility for this section of the engineering department. In connection with this work Mr. Neall traveled extensively over the United States, and has kept in close touch with the latest developments of high-tension engineering. By arrangement Mr. Neall has lately enjoyed the advice and co-operation of Mr. Alexander J. Wurts, the well-known authority on, and inventor of, lightning protective devices.

Mr. Neall has contributed to the engineering press a series of semi-historical articles; he has recently presented a paper before the American Institute of Electrical Engineers, entitled, "Performance of Lightning Arresters on Transmission Lines," and took part in the discussion of papers presented before the high-tension committee of that body, as well as of those presented before the International Electrical Congress at St. Louis. Mr. Neall is thoroughly conversant with and greatly interested in the German language and German technical literature, having visited Germany to extend his knowledge thereon, and later was elected a member of the Electrotechnischer Verein, of Germany, and of the Deutsch-Amerikanischer Techniker-Verband.

Mr. Neall recently resigned his position with the Westinghouse Company to work further afield, and has now opened an office in Boston. He will make a specialty of lightning protective apparatus, in connection with which so few men are working independently, and also engage in a more restricted sense on local problems of alternating-current applications, particularly for high-voltage installations.

MR. N. J. NEALL.

CURRENT NEWS AND NOTES.

MARRIAGE BY TELEPHONE.—A telephonic marriage ceremony was performed recently at Pearlington, Miss. The minister lost his way and returned home about 11 at night, when he was called up by the anxious couple, who were miles away, and the ceremony was performed over the telephone line.

RESULTS OBTAINED WITH GAS POWER.—The Franklin Electric Company, Franklin, Pa., has recently decided to increase its gas power lighting plant, and has accordingly placed an order for a Westinghouse 125-hp, three-cylinder vertical type gas engine. The company has operated a gas engine plant for several years, and has done away entirely with the use of steam. The present plant consists of five belted units of similar type, which have been giving uninterrupted service since the change over from steam to gas, and the present order is the outcome of the successful experience which the company has had with gas power. Natural gas is used in the plant, obtained from local wells, and is exceedingly rich; both the gas and oil occurring in this district being the richest known in any part of the country.

INDIANAPOLIS TELEPHONE RATES.—The Indianapolis Board of Public Works has denied the petition of the Indianapolis Telephone Company asking for a material modification of the company's franchise. The board, however, was not a unit. Two members said they could not vote to increase the rate for telephones and extend the franchise of the company in the face of public sentiment and the opposition of the press against it. President Elliott said he thought the company was entitled to relief and that public sentiment sometimes overlooked the equity and justness of a petition. He thought it advisable to attempt some sort of compromise. The other members of the committee thought a compromise out of the question and voted to deny the petition. The local press made much of the fact that the company got a franchise upon practically its own terms with the boastful purpose of reducing the cost of telephone service in Indianapolis, in the meanwhile earning good interest, etc. But because it had sold out to outside capitalists no concessions should be granted. The company asked for the right to increase rates from $24 to $32 for residences and from $40 to $54 for business telephones, and an extension of its franchise.

TANTALUM MINERALS.—The United States Geological Survey refers to a recent discovery of a tantalum mineral in a feldspar quarry at Henryton, Carroll County, Md. Near Glastonbury, Conn., an old feldspar quarry is being investigated as to the quantity of columbite or other tantalum mineral that may be found in this feldspar. A mineral from Tinton, S. D., gives on analysis 44 per cent of tantalic oxide and 30.5 per cent of niobic oxide.

QUESTION BOX FOR ELECTRICAL SALESMEN'S CONVENTION.—The general advancement committee of the Electrical Salesmen's Association is planning for the next convention in January a question box on topics of interest to electrical salesmen. All interested are invited to send in questions which they would like to have discussed, to Mr. C. A. S. Howlett, chairman of the general advancement committee, 3300 Beacon Street, Chicago, Ill.

CHICAGO ELECTRICAL SHOW.—The first announcements have been sent out for the second Chicago Electrical Show by the Electrical Trades Exposition Company. A handsome booklet dealing with the last show is issued. The date is set for January 14-26, 1907, at the Chicago Coliseum. The first show was a truly remarkable success both in the number of central station men and in the popular interest attracted. The managing director this year is Mr. Homer E. Niesz, of the Chicago Edison Company.

GAS AND OIL ENGINES.—Mr. James T. Allen, of the United States Patent Office, will soon publish a digest of the United States Patents on oil, gas, air and caloric engines, issued from 1789 to 1905. The work will comprise four volumes, including about 1,000 pages of briefs and claims, 2,000 pages of drawings and 500 pages of indexes, the latter comprising a complete list of the citations by number, name and date, of interferences and decisions. The work will be ready for delivery within a few months, and will be continued by annual supplements.

TECHNICAL STUDY IN INDIANAPOLIS.—The directors of the Technical Institute of Indianapolis are highly gratified over the progress made in its development with the close of the first year. The big buildings on the 76 acres of ground, formerly the United States Arsenal, have been turned into trade school buildings, few alterations being necessary. The power house plant, which heats all the buildings with steam, lights them with electricity and provides all the machinery in all the departments with electric power, attracted unusual attention on commencement week. Adjoining the power plant is the electrical school. Students in this department are already in demand. In his commencement address Mr. Frank A. Vanderlip, of New York, said that the reason that many processes of manufacture and of electrical construction are becoming more difficult and expensive is the lack of skilled workmen.

TELHARMONY IN NEW YORK.—A few months ago we described the beautiful and ingenious system of Dr. Thaddeus Cahill for producing and distributing music electrically by means of his "telharmonium." The apparatus made and tried at Holyoke, Mass., has been removed to New York City and will be assembled again here with the object of making regular demonstrations of the system. A hall has been secured at a central point in the theatre district on upper Broadway, and in the early fall telharmonic concerts will be given for the general public. The plant is being so arranged that the auditors can also be spectators and see the music-making machinery in operation, and the distribution of the music by wire to distant points in the city will also be illustrated.

ELECTRICAL FITTINGS ON NAVY SHIPS.—A dispatch from Washington states that instructions have been sent to the navy yards, including that at Brooklyn, where the battleships are being docked and overhauled preliminary to the summer exercises, to have changes made in the electrical appliances of the turrets. This is the result of the investigation into the accident on the *Kearsarge* some weeks ago at Guantanamo. It was found that the loss of life and the menace to the ship were due to sparks, which ignited powder, and came from the contact of a metal implement with an unprotected electrical fixture. Certain fixtures will be covered with insulating material, which will prevent any such disaster as that on the *Kearsarge,* while other electrical fixtures which can be moved will be transferred from the turrets and placed in another part of the ship.

CANDLE-POWER CONFUSION.—The present unsatisfactory condition with respect to candle-power rating is indicated in the announcement of a lamp manufacturing company that in a new type of lamp which it is placing on the market, candle-power values will not be given on the label. The reason offered for this is that "candle-power is used to express concentrated values due to reflection from supporting frames in such lamps as the Nernst; to express values given by reflectors used with the lamps, as in the case of the Meridian and General Electric units, etc. Candle-powers have as the result of this indefinite use become misleading and confusing, and it has been considered desirable to omit them from the lamp label and to give them only when required, and then fully and accurately defined as 'mean horizontal,' 'mean spherical,' 'values with a given form of reflector,' etc."

A. S. M. E. AFFAIRS.—The well-known headquarters of the Amercian Society of Mechanical Engineers, 12 West Thirty-first Street, New York City, have just been sold for $120,000. The society has thus done very well owing to the rapid advance in the price of real estate in that vicinity. The money will go toward paying for the society's share in the real estate on which the new United Engineering Building stands. Another important event in the affairs of the society is the offering to Mr. Calvin W. Rice the secretaryship of the society, of which he has long been a member. Mr. Rice has had a great deal to do with the new building and was for a time chairman of the Building Fund Committee of the American Institute of Electrical Engineers, so that he is thoroughly familiar with the general situation. His wide acquaintance and his methodical habits of industry would insure great success in the new work.

TELEPHONE COMPETITION IN BOSTON.—The Boston Independent Telephone Company has asked for a franchise to conduct a telephone business in Boston. At present there is an independent company in that city known as the Massachusetts Telephone Company, which is doing business in opposition to the New England Telephone & Telegraph Company, the Bell concern. The Massachusetts Telephone Company, however, does only a small business, having in the neighborhood of about 1,000 telephones. It caters particularly to the wool trade. The new independent company which proposes to enter the field offers rates considerably below those of the Bell Company. The situation in Boston appears to be much the same as it is in New York. The New England Telephone Company is very strongly entrenched in Boston just as the New York Telephone Company and the New York & New Jersey Telephone companies are.

NEW CENSUS WORK.—The President has signed the act of Congress broadening the duties of the Director of the Census. It provides that after the completion and return of the enumeration and of the work upon the schedules relating to the products of agriculture and to manufacturing and mechanical establishments provided for in Section 7 of the act of March 3, 1899, entitled "An act to provide for taking the twelfth and subsequent censuses," the Director of the Census is authorized in addition to other work, every five years to collect statistics relating to street railways, electric light and power, telephone and telegraph business. The Director of the Census shall prepare schedules contaiinng such interrogatories as shall in his judgment be best adapted to elicit the information required under the subjects, with such specifications, divisions and particulars under each head as he shall deem necessary to that end; and all reports prepared under the provisions of this section shall be designated as "Special Reports of the Census Office." For the purpose of securing the statistics required by this section the Director of the Census may appoint special agents when necessary, and such special agents shall receive compensation as hereinafter provided.

Hydro-Electric Plant at Albany, Ga.

By R. W. Hutchinson, Jr.

Until comparatively recent years a hydro-electric plant in the far South of any appreciable size was a rarity, especially so when such a plant is located below the "Southern fall line" of Georgia in an almost flat country. The Southern fall line of Georgia is a line connecting approximately Columbus, Macon and Augusta and contains within a radius of 50 miles on either side some of the best water powers in the State. Below this "line" the country becomes undulating and more flat the farther south one goes, so that while the element of abundant water supply in the streams is found to a considerable degree, shoals of any magnitude are relatively scarce. Hence for several reasons—the most salient of which are the undeveloped condition of this section of the State and the comparatively high cost of water power development under the physical conditions above mentioned—very few water power developments have been made in Southern Georgia.

The plant of the Albany Power & Manufacturing Company is, therefore, interesting as being one of the pioneer developments on an extensive scale south of Columbus. The location of this plant is at the Big Shoals on the Muckafoonee River, about one and a half miles north of the City of Albany. Muckafoonee River, which is about one and a quarter miles in length, is formed by the junction of Muckalee Creek and Kinchafoonee Creek, and flows into Flint River a short distance above the city limits. The watershed of these two large creeks covers about 1,025 square miles of slightly undulating country, which contains numerous large springs and brooks of constant flow. The soil of the section drained by these streams is almost entirely of a limestone base, and the water of the streams is largely free from silt or any other organic matter in suspension. At the site of the power plant the banks of the stream are abrupt and precipitous and of limestone formation, so that the conditions for a water power development were quite favorable. From a careful study of the stream measurements for some years the lowest flow in average or ordinary years is estimated to be 650 cu. ft. per second, with an average flow of 1,200 cu. ft. per second.

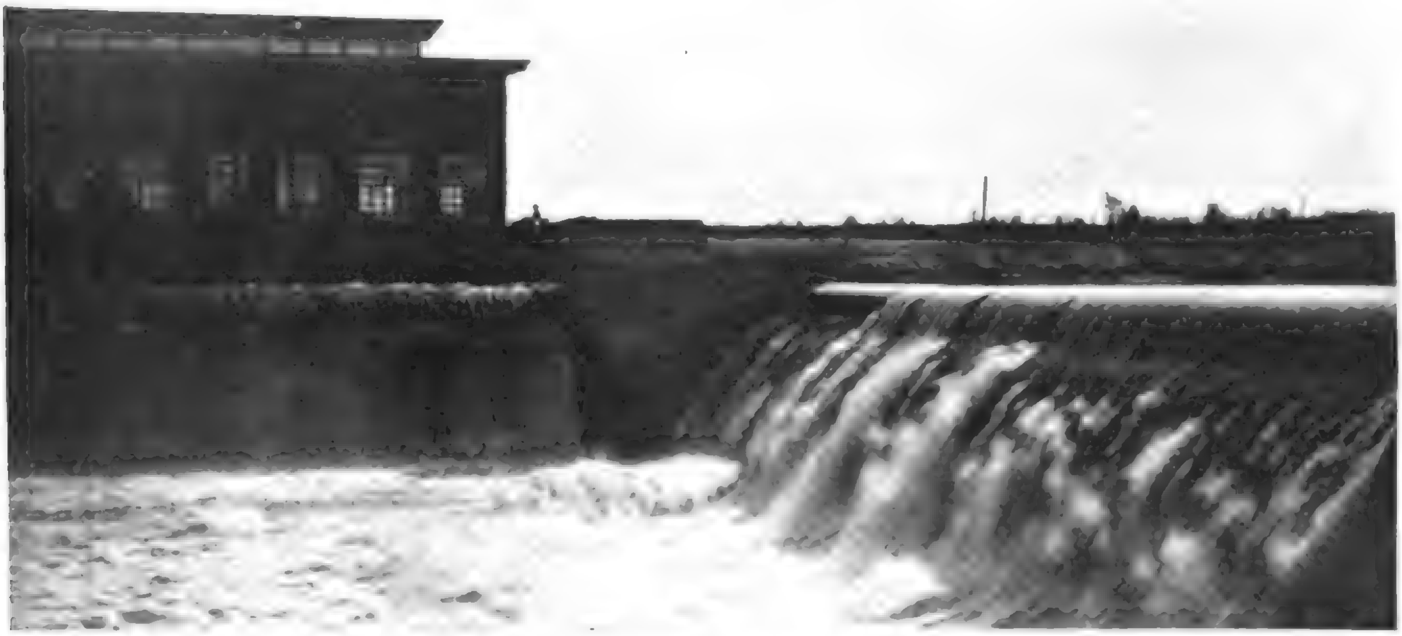


Fig. 1.—View of Dam and Power House.

THE DAM.

The dam is 20 ft. in height and rests upon and abuts at both ends upon a limestone formation. It is perfectly straight and is 360 ft. long with a spillway in its center 150 ft. long. The left abutment of the dam is 150 ft. in length, the right abutment 60 ft. in length. The dam is constructed of concrete masonry, and both the upstream and downstream faces are finished in Portland cement concrete. Much difficulty was experienced in the construction of the dam owing to the necessity of transporting the rock for the concrete from a distance, as all the rock obtainable in the neighborhood is of limestone origin and unsuitable for use in the making of concrete. The bulkhead portion of the dam is 23 ft. rising about the crest of the dam. Trash racks, sand gates and the head gates are placed in the upstream side of the bulkhead. Fig. 1 shows the dam and power house. The picture was taken during the flood season when the depth of water over the spillway was about 4 ft. In order to provide for low water 2-ft. flashboards are used on the dam to impound water.

POWER HOUSE.

The power house is situated on the right bank of the stream and its upper end forms a part of the bulkhead of the dam. The building is 30 by 80 ft. and is of fire-proof construction throughout, with walls of brick laid in Portland cement concrete, and floor of concrete finished in cement granolithic. The roof is supported on steel trusses and is covered with tile and gravel. Fig. 2 shows a cross-sectional view of the power house through the rear elevation, and also shows the setting of the turbines and the arrangement of generators in the station. The building is fitted with a 15-ton Niles traveling crane for transporting machinery and materials of construction.

GENERATING EQUIPMENT.

The turbines are four in number and are of the horizontal radial inward-flow type made by the S. Morgan Smith Co. Each unit comprises four wheels 33 in. in diameter mounted in a cast-iron housing 1¼ in. in diameter. The discharge through each pair of turbines passes through a draft tube 7 ft. 9 in. in diameter made of ¼-in. steel plate. The head on the turbines is 23 ft. and each unit is capable of developing 900 hp at full gate. Each unit is direct-connected to its generator through a flange coupling. In addition there is an 18-in. McCormick turbine for driving one of the 45-kw exciters. All of the turbines are controlled by Lombard governors, there being a separate governor for each unit. These governors are fitted with electrical control and can be actuated from the switchboard.

Eventually there will be four generators, all of the same capacity, only two of which are, however, yet in operation. Each machine is a 500-kw General Electric three-phase, revolving-field type, generating current at 2,300 volts and 60 cycles, at a speed of 180 r.p.m. The armature windings are of the distributed type laid in slots formed in the laminated-field structure. The windings are so designed as to give an inherent regulation of 8 per cent.

The generators are excited by two machines of 45 kw capacity each, one of which is belt-driven from the generator nearest the southerly end of the building. The speed of the belt-driven exciter is 900 r.p.m. The other exciter is chain-driven from the 18-in. turbine and rotates at a speed of 600 r.p.m. The output of each exciter is 125 volts and 36 amp., and either is of sufficient capacity to supply full-load exciting current to all machines. The two will be operated intermittently, however, so that one will always be ready to take up the exciter load.

SWITCHBOARDS AND CONTROL.

The current from the generators is conducted to oil switches located in the switchboard gallery, through paper-insulated, lead-covered cables which are enclosed in vitrified ducts laid in the wall. These cables are of the standard high-voltage pattern. The oil switches have circuit-breaker attachments and the separate terminals are protected from each other by marble slabs.

The switchboard comprises four panels of Tennessee marble, with the usual instruments. The connections on the exciter panel are so arranged that either exciter may supply current to any or all generators, or the exciter may be operated in parallel and excite the fields of main generators. The feeder panel is equipped with three ammeters, a polyphase watt-hour meter, a power factor meter, a frequency indicator, a synchronism indicator and an operating handle for actuating the automatic circuit-breaker. Each generator panel is provided with a field rheostat, a field-discharge switch and a main oil switch and the usual synchronizing receptacles, in addition to a wattmeter, a voltmeter and an ammeter.

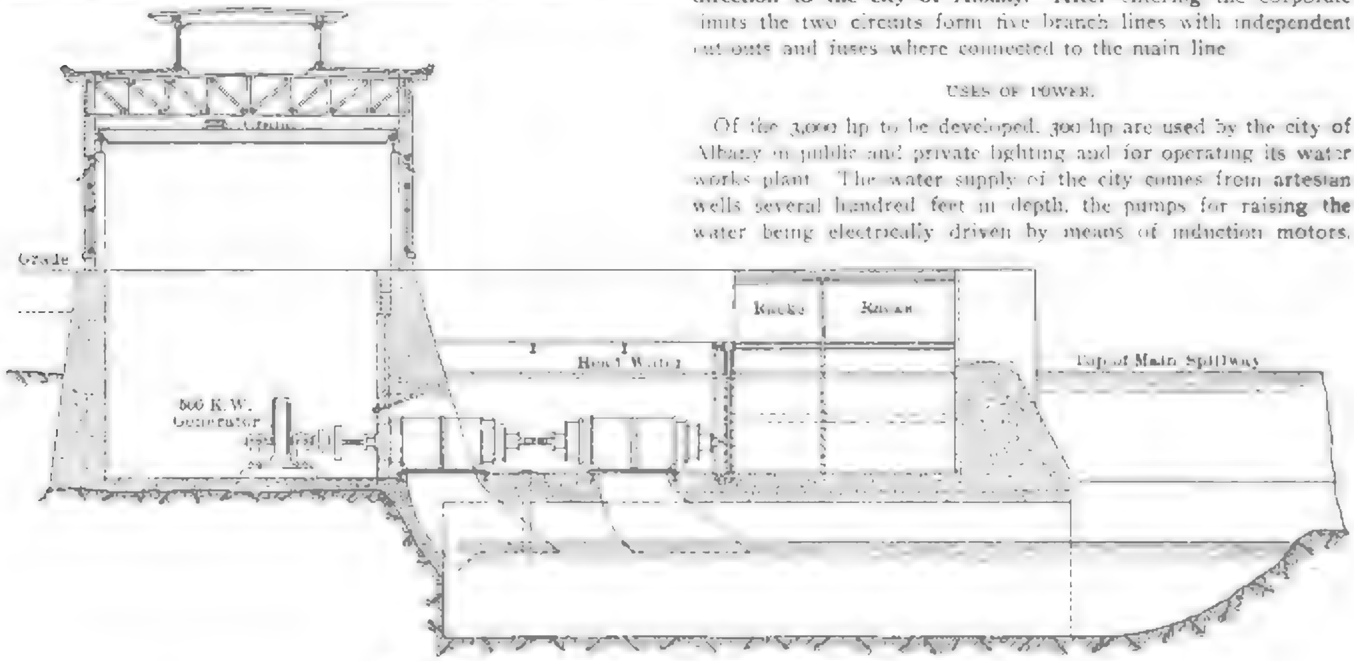


Fig. 2.—Cross-Sectional View of Albany Power Plant.

Each outgoing circuit is protected by a "carbon ball" lightning arrester mounted on the wall behind the switchboard. The ground wires of the three arresters are bunched together and conducted to a copper plate buried in charcoal covered over with moist earth.

TRANSMISSION LINES.

There are three independent 2,300-volt transmission lines, two of which run to the city of Albany about one and a half miles distant. The other circuit supplies power to a large phosphate fertilizer works. The three circuits leave the station through porcelain tubes in the wall. The poles used in the transmission lines are red cypress and are 25 ft. in length outside of the city limits and 35 ft. inside the city. The poles average 7 in. across the top and are set 150 ft. apart. The butts of the poles are tarred to a distance of 2 ft. above the ground line. The gains in the poles were coated with white lead before the cross arms were placed in position and the arms coated with red metallic paint.

The cross arms are all of heart yellow pine and are exceptionally large for the conditions of transmission. There are two arms per pole, each of which is 4 in. by 5 in. in diameter, each fastened to its pole through the medium of ⅝-in. bolts and braced by galvanized-iron pieces supported by lag screws. The upper arms are 42 in. long and carry one pin on each side of the pole. The lower arms are 68 in. long and have two pins on each side of the pole. The insulator pins are of locust of the combination wood and iron type with bolt through wood and bolt on top. All pins were treated with paraffin before being put in use. The insulators are of brown porcelain, double-petticoated, Locke pattern; they are 4 in. in diameter across the outer petticoat and guaranteed to withstand a pressure of 6,000 volts.

The circuits consist of stranded aluminum, the cables being of 39,100 circular mils cross-section. The circuits are strung in the form of the familiar triangle, the distance between wires being 16 in. The transmission lines parallel each other for a short distance after leaving the power house, and then branch off, the circuit supplying the phosphate works running in an easterly direction to the point of utilization, which is about three-quarters of a mile distant. The double-circuit line runs in a southerly direction to the city of Albany. After entering the corporate limits the two circuits form five branch lines with independent cut-outs and fuses where connected to the main line.

USES OF POWER.

Of the 3,000 hp to be developed, 300 hp are used by the city of Albany in public and private lighting and for operating its water works plant. The water supply of the city comes from artesian wells several hundred feet in depth, the pumps for raising the water being electrically driven by means of induction motors. The Albany Power & Manufacturing Company has a 17-year contract with the city of Albany, ratified by the citizens on June 9, 1904, to supply the city with 3,000 maximum hp, the average being 200 hp. The city has its own steam-driven plant, which was shut down in September, 1905, on account of the low price of $27 per hp-year, which the city made with the company. The contract which the company has with the city contains the following provision: "The Albany Power & Manufacturing Company to operate, in the event of its inability to furnish power to the city of Albany from its plant on account of flood, backwater, breakdowns or from any cause whatsoever, the present steam plant of the city of Albany, during such time as it is unable to furnish power from its own plant, paying the expenses of fuel, engineers, firemen and the labor incident to the operation of the said plant."

The largest private customer is the Albany Phosphate Company, which uses 300 hp in operating a fertilizer plant, which has a capacity of 100 tons per day. There are in use in the fertilizer plant one 150-hp, one 75-hp, five 30-hp and two 3-hp motors, all of which are of the three-phase induction type.

Other uses of the power are the operation of the printing plant of the Albany *Daily Herald*, the driving of a grist mill, the running of an ice plant, a ginnery, oil mills, the machinery of one of the largest brickmaking plants in Southern Georgia and the operation of several hotel elevators.

The City Council now has under discussion a municipal street railway system which will likely be constructed and operated with power from the plant of the Albany Power & Manufacturing Company.

OPERATION.

At the present time there are two 500-kw units in continuous operation. The other two units are a reserve to be put in service as the conditions demand. The entire plant was designed by Mr. J. E. Sirrine, of Greenville, S. C., and was constructed by Mr. B. H. Hardaway, of Columbus, Ga., under the supervision of Mr. W. D. Dent. The officers of the company are: Mr. Smith D. Pickett, of Atlanta, president; Mr. Elmer Smith, vice-president; Mr. William Markham, secretary and treasurer. Mr. E. S. Killebrew, is superintendent, and to him the author is indebted for much of the information herein concerning the plant.

The Spherical Reduction Factor of Tantalum Lamps.

By Dr. Clayton H. Sharp.

On the introduction of a new type of lamp, such for instance as the Nernst or the tantalum, a question should be immediately raised whether the ordinary methods of testing, such as are commonly employed with previously existent types can properly be applied. It is well known, for instance, that the illuminating value of the Nernst lamp cannot be properly estimated from a measurement of its luminous intensity in a horizontal direction, as is done with the incandescent lamp of the ordinary types, but that the more complicated determination of its mean spherical or mean hemispherical candle-power must be made. In the case of the tantalum lamp it is not evident that the mean horizontal candle-power taken in connection with a single determination of the horizontal reduction factor (the ratio of mean spherical to mean horizontal candle-power) is not a sufficiently good criterion of its luminous flux. In other words, it is not clear than the method of photometering which is ordinarily applied to the carbon filament lamp cannot and ought not to be applied to the tantalum lamp. In the case of the carbon filament lamp this method is satisfactory, since it has been thoroughly established that the spherical reduction factor has substantially the same value for all the lamps of a given type. In passing from one type to another, the existent difference between their spherical reduction factors must be taken into account. This is more important than is usually supposed.

If, for instance, a comparison is made of the useful life of carbon filament lamps having a spherical reduction factor of 0.82 with those having a factor of 0.80, operating them so as to give the same mean horizontal candle-power with the same watts, it will be found that the life of the lamps with the lower reduction factor is approximately 10 per cent longer, provided they are equally well made lamps. This is easily explained. The lamp with the smaller reduction factor gives less total flux of light when yielding the same horizontal candle-power than does the other type. Hence its watts per mean spherical candle-power are higher, and it is operating actually at a lower efficiency, and the lower the efficiency the longer the life. If operated at the same mean spherical efficiency as the other lamp it would give a higher horizontal candle-power, but at the same time a candle-power in other directions enough lower to counterbalance it, the total light emitted being the same, and the life being the same.

An inspection of the tantalum lamp would lead one to suppose that its spherical reduction factor would be substantially as unvarying as is that of a given type of carbon filament lamp. Moreover, since the theory indicates that the spherical reduction factor of a filament consisting in a straight, black, non-lustrous rod must be 0.785, the factor for the tantalum lamp should be lower rather than higher than this, its surface being metallic, smooth and bright when the lamp is new. As far as the writer knows, all tests of tantalum lamps which have been published are based on horizontal candle-power values, no attention being given to the fact that this procedure, while allowable with carbon filament lamps, may not be valid with the new lamps. As has been said, there is nothing to indicate that this is not the case. Values of the spherical reduction factor have been published in at least one instance, 'Kennelly and Whiting: Electrical World and Engineer, March 25, 1905, these values being smaller than 0.785 and varying considerably among themselves.

In the course of tests of a considerable number of these lamps it was found that the spherical reduction factor of tantalum lamps is by no means constant, but varies considerably from lamp to lamp. This variation is so large that a typical value for the reduction factor of these lamps cannot be established. It follows, therefore, that the value of the mean spherical candle-power of a tantalum lamp cannot be accurately obtained from a measured mean horizontal candle-power multiplied by a typical reduction factor, as is done in the case of the carbon filament lamp, but the mean spherical candle-power must in every case be measured.

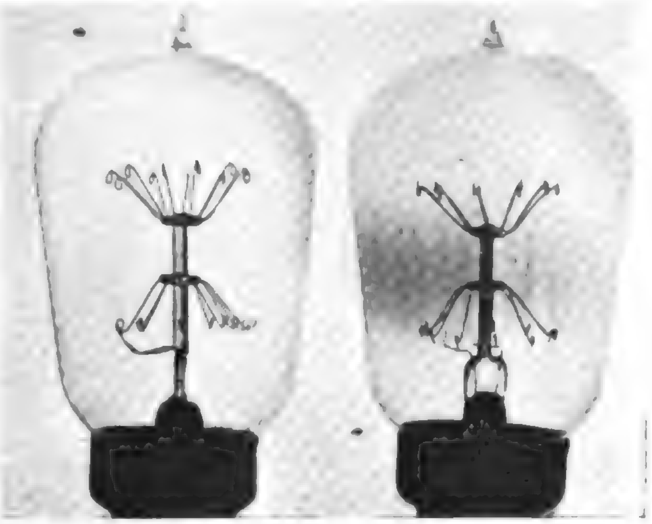


FIG. 1.—TANTALUM LAMPS.

Moreover it was discovered in the course of a life test of these lamps that the spherical reduction factor attains a larger and larger value as the lamp ages. Data on this point are contained in the following table:

Spherical Reduction Factor of Tantalum Lamps.

New.	Old.	Change.
0.764	0.856	12%
.715	.878	23
.760	.886	16.5
.738	.938	27
.726	.888	22
.688	.864	25.5
.716	.909	27
.742	.924	24.5
.707	.902	27.5
.711	.925	30
Mean 0.726	0.897	23.5

It will be seen that the variation with age is a very large one, amounting in one case to as much as 30 per cent of the initial value. This indicates that a smaller and smaller proportion of the total light of these lamps is emitted in the horizontal plane and, operating unfavorably to the lamp if the test is made on a horizontal candle-power basis, is of great importance in testing. The decrease of candle-power with age, as shown from horizontal readings alone, is exaggerated. In fact, it was found that in making measurements of mean spherical candle-power instead of mean horizontal, the light yielded by several of the lamps was actually greater near the end of their life than it was initially. It should be stated, however, in this connection that the candle-power usually rises very rapidly at first, and that the intensity of the old lamp is always lower than the maximum intensity which the lamp yields. This effect is increased by short circuits occurring between adjacent spires of the filament which cause the remainder of the filament to glow with an increased intensity. In any case, the conclusion is strongly emphasized that tests of tantalum lamps, if they are to represent the facts, must be made on a basis of mean spherical candle-power readings.

Evidently this change in spherical reduction factor must be accompanied by a change in the distribution of the intensity of the light in a vertical plane. That this is the fact is illustrated by the two curves of the accompanying figure, which show the distribution for a new lamp and for an old one.

It is interesting in the next place to inquire the explanation of this peculiarity. One reason is obvious from an inspection of an old lamp. The bulbs of the tantalum lamps become blackened with age just as the bulbs of carbon filament lamps do. There is, however, this difference, that whereas the black deposit on the bulb of a carbon filament lamp is distributed in a fairly uniform manner on the whole interior of the bulb, the deposit on the tantalum bulb is much denser in a horizontal zone of a width substantially equal to the length of the spires of filament stretched between their supports. In other words, the deposit is most copious in those parts of the glass which are parallel to the spires of filament and nearest to them. This effect is clearly shown in the accompanying illustration.

The effect of this zonular deposit is to decrease the horizontal intensity of the light in much greater degree than the intensity in the other directions, and so to effect a redistribution of the luminous intensity in the proper sense to make the spherical reduction factor larger than before.

Another reason can be found in the changes which the surface of the filament undergoes with use. The filament of a new lamp looks under the microscope like a polished steel wire with a surface entirely smooth except for slight pittings here and there. As has been indicated above, the spherical reduction factor of a straight filament must be theoretically less than 0.785. The better the reflecting power of the surface of the filament, the lower will be the factor. In accordance with this law it is found that the spherical reduction factor for the new tantalum filament varies about an average value of approximately 0.73.

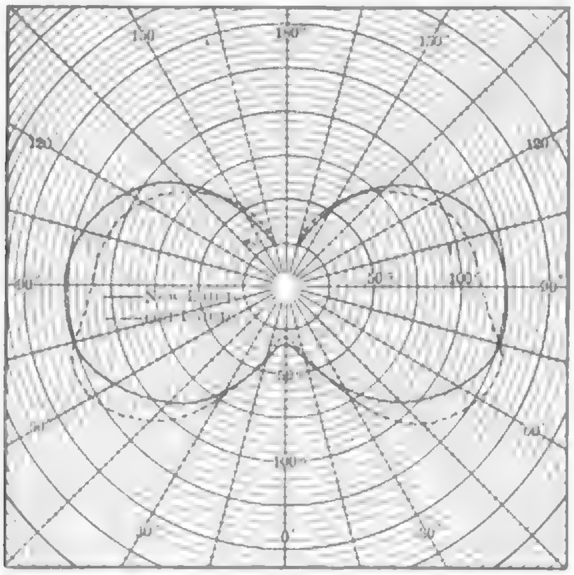


FIG. 2.—VERTICAL DISTRIBUTION OF CANDLE-POWER OF NEW AND OLD TANTALUM LAMP.

It has been found, however, that the nature of the surface of the filament changes radically with age. The smoothness disappears and the outside becomes scarred and pitted and broken. This change must result in a relative increase in the radiation in directions not at right angles to the filament and hence in a larger spherical reduction factor. These two changes, the localized blackening of the bulb and the roughening of the filament, taken together account for the large increase in the spherical reduction factor. Of these two causes, the blackening is of much the greater importance. It would be of practical interest to ascertain the effect of enclosing the tantalum filament in much larger bulbs, perhaps spherical in form. If the distance between the filament and the glass is greater than the mean free path of the tantalum particles expelled, the blackening might be decreased or uniformly distributed over the surface, either of which would result in an improved efficiency of the lamp.

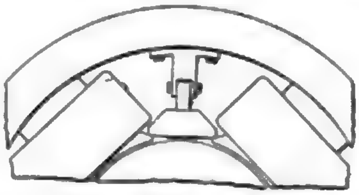
The procedure in photometering tantalum lamps differ in another particular from that practised in dealing with carbon filament lamps. It is the usual practice in this country to determine the mean horizontal candle-power of the carbon lamp by rotating the lamp on the photometer at a rate of about 180 revolutions per minute. The statement has been made that on account of the zig-zag shape of the filament of the tantalum lamp its intensity is the same in all directions in the horizontal plane. If this were the case the mean horizontal candle-power could be determined by measuring the candle-power of the lamp in any horizontal direction. It is found, however, that this is by no means true. The horizontal distribution curve of this lamp, far from being a smooth circle, is rather after the nature of a circle with a great many long saw teeth running from it. That is to say, the lamp gives a great many bright streaks of light in the horizontal direction just the same as the carbon filament lamp does, only that there are many more of them with the tantalum filament lamp.

It follows from this that the mean horizontal candle-power must be determined by some method which will yield an integrated value on the photometer disc. The natural procedure is to treat this lamp exactly as the carbon filament lamp is treated, placing it in a rotator running at 180 revolutions per minute and photometering it. It is found, however, that when this is done the action of the centrifugal force on the vertical spires of the filament is sufficient to cause them to bow outward perceptibly. This results in a change in the vertical distribution curve of the lamp, the candle-power in the direction of the tip being strengthened at the expense of the horizontal candle-power. It will be seen, therefore, that this also works to the disadvantage of the lamp if the horizontal candle-power is taken as the criterion. The filaments which have been bowed by too rapid rotating will come back to their normal form if allowed to burn for a while stationary.

One way to obviate this difficulty is to reduce the speed to 40 revolutions per minute when this effect is no longer apparent. Another way to obviate the difficulty is to make measurements on some form of spherical integrating photometer. The Matthews photometer may, with advantage, be used for this purpose. Evidently the indications of this instrument are independent of the form of the filament. At the same time it is deemed better practice to reduce the speed of the rotator to the lowest practicable limit even when the integrating photometer is used, as this reduces greatly the mechanical stresses which otherwise might endanger the lamp.

Commutating Pole for Direct-Current Motor.

A patent issued May 22 to Mr. F. Sieber and assigned to the Westinghouse Electric & Manufacturing Company, discloses a method for economically winding the commutating poles on variable-speed, direct-current motors. The construction employed is shown in the accompanying illustration. It consists in concentrating the convolutions of the coils of the auxiliary winding as near the armature as possible, so that the winding may serve both as an effective compensating winding for the field produced by the ampere-turns of the armature and as an exciting winding for the commutating poles.



COMMUTATING POLE AND WINDING.

The patent contains six claims, one of which reads as follows: In a dynamo-electric machine, the combination with an armature, of a field-magnet frame provided with main polar projections and with auxiliary polar projections of smaller cross-section that are located between the main polar projections and are provided with coils that are concentrated in close proximity to the armature.

The Testing of Incandescent Electric Lamps.

By Preston S. Millar.

BECAUSE of its delicate nature and susceptibility to variations in conditions the performance of the incandescent electric lamp is in many instances erratic. This, combined with the fact that even the best manufacturer's product includes a certain percentage of poor lamps which, when they are new, cannot be distinguished from the good lamps, has led to a recognition of the need of purchasing lamps subject to tests. The conditions are such that this need is recognized in the case of incandescent electric lamps more readily and more universally than in the case of any other electrical supplies. The result is that all over the country purchasers are applying tests in an endeavor to determine which manufacturer produces lamps of the highest candle-hour value. All along the line, from central stations to department stores, one may find such tests being made. This is commendable in that it tends to the advancement of the art of lamp manufacture, since each manufacturer strives to improve his product and to submit to such test the best lamps he has at his disposal. One might be excused for thinking that in this respect conditions are as they should be, were it not for the great inconsistencies shown in the results obtained. There is hardly a lamp maker of importance in the country who cannot point to some tests made by independent parties which have resulted in showing his product to be better than all other products submitted to the test. Every lamp has its adherents who sing its praises with the greatest enthusiasm and will not listen to claims of superiority for any other lamp. It is a fact that there is a variation of as much as 50 per cent between the average products of different manufacturers, and yet the manufacturers of poor lamps have repeatedly been awarded contracts based upon tests in which good lamps were represented.

As instances of the fallacious conclusions which may be arrived at as the result of lamp tests as sometimes conducted, the following are cited:

A representative of a certain State institution stated that he had made an exhaustive study of various prominent makes of lamps. As the result of a number of years testing he had concluded that *X* lamps were not worthy of consideration, and he did not propose to include them in such tests as he might make in the future. On the other hand he had found the *Y* lamp to be generally of high quality and had, during the past year, placed a contract with the maker of this lamp. The facts of the case were that the *X* and *Y* lamps were made in the same lamp factory by precisely the same process and operators, but received different labels before being issued.

A certain central station whose annual lamp purchases numbered many thousands decided to conduct a lamp test in order to determine whether or not they were purchasing the best lamps available. The matter was placed in charge of one of the engineers of the company who had the valuable assistance of a certain lamp salesman in conducting the test. The result was that the contract for the following year was placed at a higher price with a manufacturer of lamps which were so designed as to take advantage of the present fallacious method of rating, but possessed no higher value than the lamps which had previously been purchased. Incidentally, the lamp salesman who assisted in the conduct of the test was in the employ of the manufacturer to whom the contract was awarded.

These instances serve to illustrate the uncertain nature of the results which are secured as the result of lamp tests conducted by private parties. It is the purpose of this article to inquire into the causes of such inconsistencies, to point out some of the difficulties which must be met and overcome if lamp tests are to prove valuable, and to indicate conditions which should be aimed at as ideal when such tests are to be made.

In laying out plans for tests upon lamps three points must be borne in mind:

1. The candle-hour value of every lamp manufacturer's product varies from time to time.
2. Every manufacturer makes both good and poor lamps.
3. The average product of some manufacturers is better than the average product of other manufacturers.

With these axiomatic statements before us it is apparent at once that basing sweeping conclusions as to the merits of various makes of lamps upon the results of a test upon one group of each make is unwarrantable. It is also patent that each make must be represented by a sufficient number of lamps to afford a representative value. Each group must be large enough to prevent the performance of erratic individuals from exercising undue influence upon the average.

One may frequently hear manufacturers of lamps complain because conclusions are based upon tests of ten lamps only, yet they invite such comparisons by instructing their salesmen that "No more than six lamps shall be furnished as samples to any consumer without full, regular charge." The writer has known of contracts which have been based upon the results of test of three lamps of each of a number of makes.

It is equally important that care be exercised in establishing proper conditions for the tests. Different types of lamps are rated in different manners; some by mean horizontal candle-power, others by maximum horizontal candle-power, others by end-on candle-power. A rather complete photometric equipment is necessary to determine the mean spherical candle-power of lamps of these various types. Those not possessing such equipment are prone to accept manufacturers' directions as to the manner in which the lamps should be measured or to ignore entirely the photometric differences between lamps of various types. This sometimes results in establishing unfair conditions which tend to vitiate a comparison between different types of lamps.

Again, lamps of different voltages are sometimes placed upon test. These differences necessitate separate circuits, controlled individually by rheostats. This results in the introduction of possibilities of error in the establishment and maintenance of the voltage on separate circuits—always a difficult matter because of the varying pressure which is likely to prevail.

Failure to provide lamps of substantially the same efficiency likewise results in difficulty in drawing proper conclusions from the tests. The only safe criterion by which to judge the relative efficiency of lamps is the specific consumption or the watts per mean spherical candle-power. When lamps of only one type are to be tested, the watts per mean horizontal candle-power or the watts per candle-power in a particular direction may serve as a basis of comparison, but when lamps of different types are to be tested the comparison must be based upon considerations of mean spherical candle-power and watts per mean spherical candle-power.

The best practice is to procure the test lamps directly from the manufacturer, stating frankly that they are to be used for test purposes. This suggestion usually meets with the objection that the plan affords the manufacturer an opportunity to submit lamps which are better than his average product. So strongly does this impression prevail that instances are known where an engineer has received samples from manufacturers for purposes of test and has exchanged such samples at supply houses for other lamps of the same manufacture, placing the latter upon test, and permitting them to suffer or profit because of too high or too low voltage rating, as the case may be. The facts are that the manufacturer is unable to select lamps which will be better than his average product with the sole exception of his ability to eliminate lamps which are obviously faulty. As such lamps should not be placed on test in any event, their elimination from a test group becomes desirable. The object should be to secure lamps which are as closely rated as possible, in order that the test may serve to demonstrate the value of the lamps independently of their rating. Those purposing to conduct a lamp test should be glad, therefore, to avail themselves of every opportunity to permit the manufacturer to deliver to them closely rated lamps, representative of his best quality. The lamps delivered under the contract awarded after the completion of the test should then be inspected at the factory before shipment and should be expected to be closely rated and free from obvious faults. Unless the lamps shipped under the contract are so inspected, the competitive test is of little avail, since the poorly rated product of the best maker of lamps is not so desirable as the well-rated product of a manufacturer who is not capable of making first-class lamps.

Instances are known where, because of insufficient equipment, the test has been divided, the sample lamps of some manufacturers being tested first, while the samples of other manufacturers were submitted to a supplementary test after the completion of the first test. This practice cannot be too strongly condemned. If the results are to be comparable all the lamps must be operated throughout the entire test under exactly the same conditions. There are probably not over three laboratories in the country where conditions are sufficiently constant to insure the validity of comparisons made under other conditions.

In order to guard against sources of difficulty which enter into the situation the following precautions should be observed:

Not fewer than twenty lamps of each make should be included in the test.

The lamps should be as closely rated as possible.

At a given voltage the average candle-power and watts of each group should be substantially the same.

Where more than one type of filament is tested, as for example the oval, elliptical coil and spiral filament, all candle-power measurements should be in terms of mean spherical candle-power.

The lamps should all be burned upon the same line without any variable resistance.

The entire test should be stopped whenever the lamps are to be photometered, so that all the lamps shall have burned all the way through their lives under exactly similar pressure conditions, even though those pressure conditions be wrong.

The average mean horizontal candle-power values, or if more than one type of filament is included, the average mean spherical candle-hour values of the sample groups tested should be taken into consideration in awarding the contract.

A single test, however, should not be regarded as conclusive since any one or more of the groups tested may not have been representative of the average product of the manufacturer. Samples of the lamps shipped under the contract should be tested from time to time in connection with samples of some other maker's product, which there may be reason to believe represents a high standard of quality. In these tests the same precautions noted above should be observed.

Lamp tests, to be of greatest value, should attain the following objects: First, they should determine the relative values of different makes and types of lamps; second, they should secure good selection and accurate rating for lamps supplied under contract; third, they should assure fulfillment of guarantee as to life and candle-power maintenance.

As has been pointed out, the first of these objects may be attained by exercising care in securing comparable conditions for a life test upon lamps. The second object can best be accomplished by tests and inspections applied at the factory of the manufacturer before the lamps are shipped. The third object can be secured only by an equipment especially provided and designed to afford conditions which are as nearly as possible perfect.

In connection with the foregoing, a brief description of an actual equipment for lamp testing and which meets the above requirements may not be out of place. In the tests made with this equipment the lamps, as a rule, are operated upon a 60-cycle circuit. When desired they may be tested at any commercial frequency or upon direct current. Any voltage from 1 to 300 is available. Six thousand sockets are provided, giving ample facilities for tests at any required voltage. In most cases the lamps are tested at voltages at which they give either their rated candle-power or some candle-power which will secure a higher efficiency for the purpose of a forced test. In either case it becomes necessary to determine the test voltage with precision. Twelve photometers of seven different types are provided. These include integrating photometers for determination of mean spherical candle-power. The standard of candle-power, which plays so important a part in the determination of candle-hour values, consists of copies of authentic master standards. These have been compared directly or indirectly with the standards of the National Bureau of Standards, at Washington, the Physikalisch-technische Reichsanstalt, of Germany; the Laboratoire Central D'Électricité, of France, and the National Physical Laboratory, of England. The equipment also includes Hefner and pentane lamps as primary standards. The stock of secondary standard lamps numbers about 800.

The electrical instruments used in photometry are either a potentiometer used with the standard cell and a standard resistance for the determination of volts and amperes, or laboratory standard voltmeters and millivoltmeters standardized by the potentiometer.

The lamps are adjusted on the life-test racks to a voltage which is within about 1/10 of 1 per cent of that desired. This voltage is measured in an adjoining room by instruments of precision, standardized by the potentiometer and standard cell. Automatic regulators, supplemented by hand control, secure very close voltage regulation, average variations not exceeding ¼ of 1 per cent. At frequent intervals the lamps are removed from the life-test racks for measurements of candle-power and watts. Particular precautions are taken to determine with accuracy the expiration of the useful life period. Useful candle-hours are computed by polar planimeters from curves plotted upon cross-section paper. Results are presented in illustrated reports in terms of either mean horizontal or mean spherical candle-power hours, as the conditions may require.

The facilities and methods are such as to permit of accurate forced tests; that is, tests at consumptions higher than normal. These serve every purpose since it becomes possible to determine correctly ratios for the interpretation of the results of forced tests into terms of tests made at normal consumption. As a result tests which will secure information on a sufficiently large number of lamps to insure representative values may be made which, under less accurate conditions would restrict the lamps tested to a number too small to secure representative results.

Electrical Engineering Laboratories at Worcester Polytechnic Institute.

Some weeks ago we referred to the new laboratories for the Electrical Engineering Department of the Worcester Polytechnic Institute, and are now able to present a general description of the building and some of the more important features of the equipment. The laboratories have been planned by the members of the Electrical Engineering Department of the Institute with Messrs. Peabody & Stearns of Boston serving as architects, and Professor A. W. French, of the Civil Engineering Department of the Institute, as consulting engineer and superintendent of construction. A contract for the building has recently been placed with the Central Building Co., of Worcester, at a cost approximating $125,000, exclusive of equipments, and it is expected that it will be ready for the accommodation of students early next year.

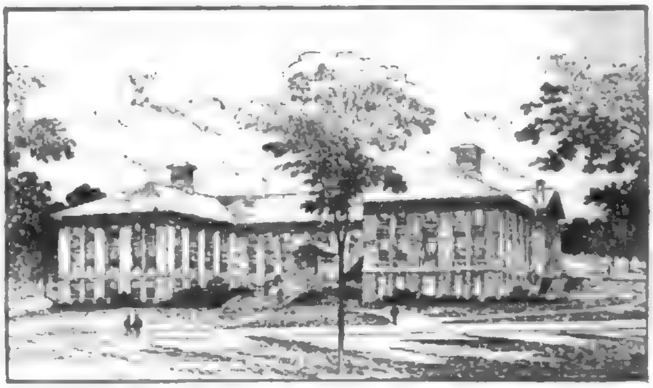


FIG. 1.—ELECTRICAL ENGINEERING LABORATORIES.

The perspective elevation gives a good idea of the general appearance of the building, which will be constructed of a selected red brick with darker red brick and brownstone trimmings and a roof of light green slate. The building will be located 75 ft. from the street at the northerly end of the Campus, and facing to the north upon Institute Park from which the perspective view is taken.

On the lower, or basement floor plan, there are shown in the easterly wing, three recitation rooms and two offices. These rooms are so placed as to be readily available either for recitation or lecture work before small sections, or for use as special laboratories as the growth and future demands of the department may require. It is proposed to use one of these rooms as a telephone laboratory at an early date, and a second room may be occupied by magnetic testing apparatus. Under the east end of the general laboratory is space for a storage-battery room and storage for heavier apparatus, which may be deposited on this floor by an electric crane traveling over the general laboratory above. An entrance and vestibule at the east end of the building gives ready access to this part of the building. Ample accommodation for toilet, locker rooms and heating equipment are shown at the center of the building and under the main entrance vestibule and stairway. In the westerly wing, at the right and under the lecture hall, is located the standards laboratory, where standard reference instruments and apparatus will be found and where the more exact work of calibration and standardization will be conducted. At the extreme westerly end and under the lower portion of the lecture hall will be located a large storage room where heavy pieces may be lowered by an electric crane. A portion of this storage space may be used for a photometic laboratory. Under the western vestibule is located a fireproof vault for the storage of records, lecture notes and manuscript, experimental data and the more valuable and delicate instruments of the department. A pit for the two railway tracks entering the general laboratory above is shown in the basement plan.

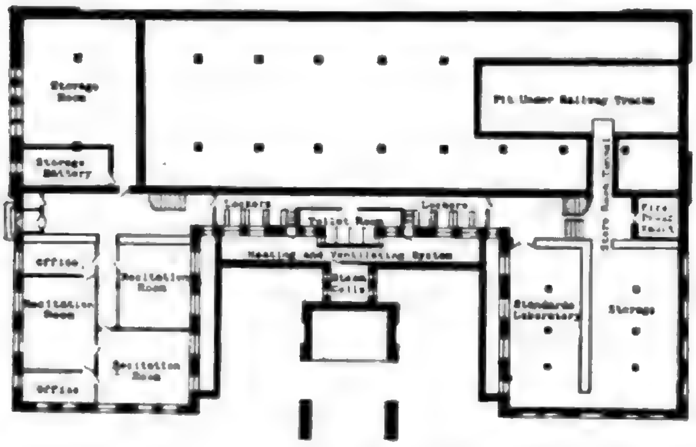


FIG. 2.—BASEMENT PLAN.

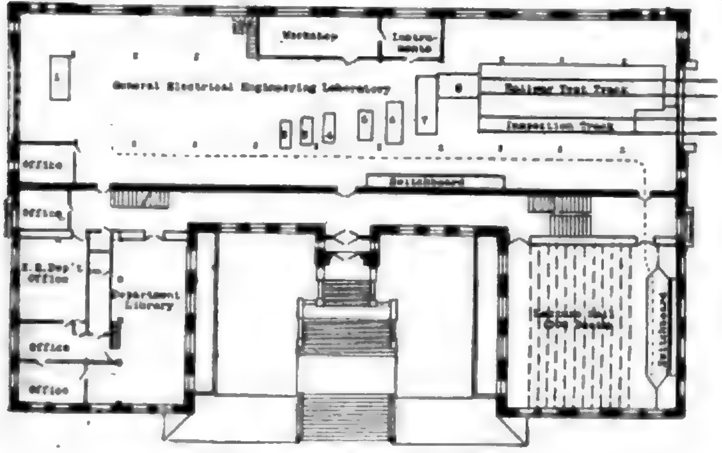


FIG. 3.—FIRST FLOOR PLAN.

Referring to the first floor plan, there are three features of primary importance. First, is a large general laboratory, having a length of 200 ft. and width of 55 ft., containing, with the three galleries shown in the transverse section, a floor area of 19,400 sq. ft. and volume of about 400,000 cu. ft. (the entire building containing nearly 1,000,000 cu. ft.) thus constituting what is undoubtedly the largest electrical engineering laboratory in the world. This laboratory is served by a 10-ton electric traveling crane covering the entire central portion of the laboratory between the galleries. On this main floor space under the crane will be located all the heavier pieces of equipment. Reference to this transverse section through the center of the building gives an idea of the location of galleries and traveling crane. The galleries are designed to accommodate the lighter and accessory laboratory equipment such as the switch-signal, air-brake and controller apparatus for electrical railway work, the arc-lighting apparatus, transformer and all other equipments not having heavy rotating or reciprocating parts. The galleries are served by 2-ton trolley hoists covering their entire length. The large volume of the room ensures ventilation, and ample lighting is secured by the immense windows at each end of the laboratory, one of which is seen at the end of the building in the perspective, and large windows the entire length of one side.

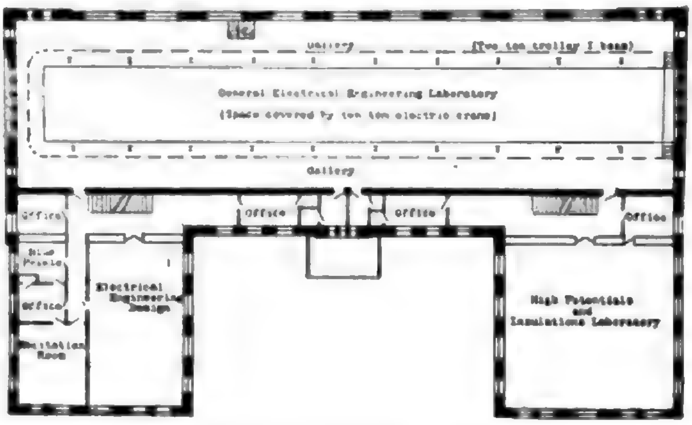

Gallery
(Two ton trolley I beam)
General Electrical Engineering Laboratory
(Space covered by ten ton electric crane)
Gallery
Office
Office
Office
Office
Blue Prints
Office
Recitation Room
Electrical Engineering Design
High Potentials and Insulations Laboratory

FIG. 4.—SECOND FLOOR PLAN.

Opposite to the main entrance to the general laboratory will be found the workshop and instrument room under the south gallery and so located as to be reached conveniently from all portions of the laboratory. The workshop will be equipped with motor and machine tools necessary for ordinary maintenance and repair of equipment, and the building of such special equipment for the laboratories as can be undertaken advantageously. The instrument room will contain the general supply of portable instruments for common use in the laboratories. On the main floor are indicated a few of the larger features of the equipment: No. 1 is a hatchway permitting the crane to lower apparatus to the storage room below. No. 2 is an 18-kw, 110-volt, direct-current compound dynamo directly connected to a 30-hp induction motor. No. 3 is a 30-kw, 110-volt, direct-current compound dynamo directly connected to a 50-hp induction motor. No. 4 is a single-phase, 220-volt, 60-cycle alternator directly connected to a 30-hp induction motor. No. 5 is a 50-kw, 500-volt, direct-current compound dynamo directly connected to a 100-hp induction motor. No. 6 consists of two 60-kw, single, two or three-phase, 60-cycle alternators directly connected. No. 7 is a 300-hp, motor-driven, 200-kw, double-current generator delivering 25-cycle, alternating-currents, either single or two-phase, from one end and 500-volt, direct-current from the other end. No. 8 is the foundation for a traction

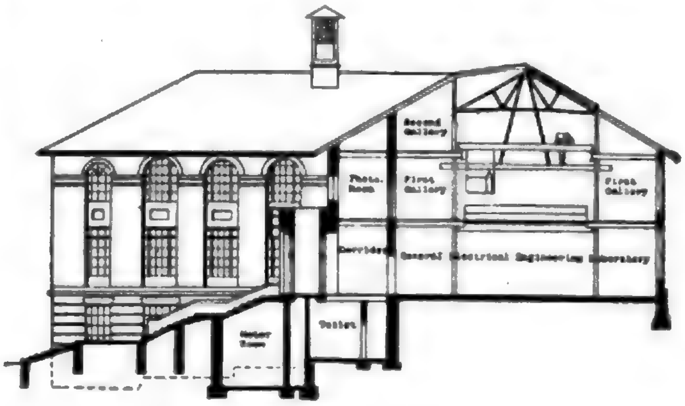


FIG. 5.—TRANSVERSE SECTION.

dynamometer at the end of the railway test track. This test track will be very completely equipped for the study of car, motor, brake and controller operation. On this test track may be placed any foreign car up to 60 ft. in length, or the Worcester Polytechnic test car may be used upon this track for all purposes of instruction in this class of electric railway equipment and operation. The Institute test car will be fully equipped for all classes of track and run tests and may be run upon any lines.

The above generators and motors are all controlled from the switchboard at the right of the main entrance to the laboratory. This board will be of black slate, 7 ft. high and 40 ft. in length. On the board are panels for each of the above motor-driven generators and the experimental and the general supply and distribution circuits for the building.

The large collection of smaller pieces of equipment will be located at the eastern end of the general laboratory and in the galleries. The supply of current is received from the Power Laboratory of the Institute, where about 500 kw, in two-phase, 60-cycle currents will be available upon completion of developments which are now taking place and which will be finished prior to the completion of the Electrical Engineering Building. The wall separating the general laboratory from the main corridor and the two wings of the building is a fire wall throughout and all openings through it are protected by automatic metal fire doors.

In the west wing of the building is located the second principal feature, namely the lecture hall, which is capable of comfortably seating 300 persons. There is a difference in level of 8 ft. from front to back of the room, so that a good view of the demonstration table is obtainable from every seat. Because of the arrangement of the hallway and outside entrance and vestibule at the west end of the building, the lecture hall has two entrances, both of which are at the level of the lecture hall floor, although one is at the back and the other at the front of the room. Back of the demonstration table is a switchboard controlling circuits reaching any equipment of the department, and the power units of the Power Laboratory. An overhead trolley hoist will take equipment from the crane in the general laboratory to the demonstration table. Facilities for darkening the room and for the projection of lantern slides will be provided.

In the east wing is located the third principal feature, namely the department library and reading room, which will be attractively and conveniently fitted for its purpose. On shelving extending the entire length of the side next to the offices and upon the other wall spaces of the room, will be room for 3,000 volumes. Reading and study tables will occupy the center of the room, and periodical cases the space between the windows in the west side of the room. The room is conveniently located for use in connection with the recitation and electrical engineering design rooms immediately above, the general laboratory opposite, or the several laboratories in other parts of the building. Most of the department offices are located upon the first floor and along the east end of the building.

Upon the second or upper floor of the building—actually the third floor of the two wings—in the west wing is a large high-potentials and insulations laboratory where are located the high-potential transformers, permitting the use of voltages of any desired frequency and potential up to 750,000 volts for the study of the various problems of long-distance, high-potential power transmission and the dielectric and electrostatic phenomena of insulating and other material. It is proposed to develop this laboratory work on a most comprehensive scale, the Institute being a pioneer among the colleges in the study of very high-potential phenomena as well as a pioneer in the establishment of a chair of electric railway engineering, and in the provision of extensive facilities for both of the above lines of work.

In the east wing is located the electrical engineering design room where instruction will be given in the actual design of electrical apparatus and systems. In this work the Institute stands among the first few engineering colleges of the country to establish a distinct course under men experienced in the actual commercial design of electrical engineering equipment.

Upon the completion of the building and installation of its equipment, the Institute may congratulate itself upon possessing the largest and most complete electrical engineering laboratories to be found in any college in the world.

The Electric Tramway and Electric Omnibus in England.

By W. V. Picton.

When the locomotive was introduced in England some 70 years ago, the gradual disappearance, if not the total extinction of the horse was freely predicted. It was thought that steam would supplant animal power. Similarly, when electric light first came to be used instead of gas a fall in gas stocks was predicted, and those who had interests in undertakings of this character were fain to sell their stocks and seek other lodgment for their savings. Both the above prophesies have been utterly falsified. In the case of horses, at the present time there are more horses owned and used by English railway companies than there were horses in England when George Stephenson ran the "Rocket" for the first time; in the case of gas companies the sale of by-products is often so profitable that some companies aver that they might give away every cubic foot of gas which they produce, and yet make a profit!

Mention is made of these prophesies and of their falsification for the purpose of drawing attention to the present condition and prospects of electric traction in England. Having regard to the fact that many American engineers are closely interested in the development and prosperity of electric traction in England, it is anticipated that a short presentation of this question may not be out of place in the columns of an American technical journal.

The last decade has witnessed an enormous increase in the use of electricity as a motive power. Though slow at first to adopt this means of locomotion, the British public, represented by the private company or the municipal body, suddenly woke up to the fact that no city or decent-sized country town should be without its system of electric tramways, and that wherever possible the old and steady going horse tram should be abolished. It was anticipated that town might be connected with town by this means, and that, even though the traffic returns might at first be somewhat poor in a thinly populated district, the advent of the electric tram would promote the building of houses all along the route, and a corresponding increase in traffic. These anticipations have been fully realized. It is now possible to travel from Leeds to Manchester—a distance of some 40 miles—by tram. This may seem a trifling distance to those who are accustomed to the broad acres of the United States, but to the Britisher the establishment of a mere tramway 40 miles in length is a matter of no small importance.

It may be mentioned that in England the right to run tramways in streets is conferred by Act of Parliament. It is what is known as a "franchise" in the United States. So profitable, so important to the public have electric tramways in England proved to be that these undertakings are now for the most part in the hands of local authorities, and with respect to those which are not already in municipal hands, provision has been made in each Act of Parliament to enable the local authorities to buy them up, after the expiration of a certain number of years at "old iron" prices. The prosperity of electric tramways has been such that until very recent times they have been regarded as the universal panacea for every trouble which besets the municipal path. On the one hand the profits made go in relief of the taxes; on the other, the provision of an easy and swift means of locomotion for the working man goes far towards the solution of the overcrowding problem. By some it is claimed, however, that municipalities have gone beyond the bounds of prudence in this direction, and that "municipal" trading in electrical utilities have placed a burden on the tax payer which in time will lead to catastrophe.

While dealing with the question of electric traction, mention should be made of the adoption in England of electricity as a motive power on railways. Several of the older railways—notably the North Eastern in Northumberland, and the Metropolitan in London—are running electric trains on their old rails, while it is well known that subterranean London is now in a fair way to be honeycombed with tubes along which trains are run which could not have been thought of before electricity was introduced.

Enough has been said to show that, if use may be made of a hackneyed phrase, electricity as a means of traction has "come to stay" in Great Britain. It has supplied a want; and although in the matter of suburban traffic electric tramways have proved to be serious competitors to the older railways, the railways continue to flourish. This, it may be noticed in passing, is a further illustration of the principle which the writer attempted to illustrate in the commencement of this article.

Why, it will be asked, was it necessary to refer to or to illustrate that principle? The answer is not far to seek. It is that the competitor of the electric tramcar and the electric railway is already on the road, and that the pessimistic prophet is already at work. It is said that the motor omnibus will work the undoing of electric tramway enterprise. Many of these vehicles are to be seen daily in the streets of London. They carry large numbers of passengers, are supplanting the horse omnibuses almost entirely, and have sprung rapidly into popular favor. It is said that a motor omnibus, which can carry 34 passengers, is able to earn $60 a day (running 120 miles in the day). Further, given a life of five years, each omnibus will not only be able to pay a dividend and the cost of repairs and upkeep, but will be able to earn, in addition, the price of a new vehicle which can replace the old one at the end of that period. This is, however, a matter for speculation, inasmuch as the life of these vehicles has not yet been put to the test.

The prophets, to which allusion has already been made, are asserting that the motor vehicle will supplant the electric tramway. It is obvious that the proprietors of the new vehicle have many advantages. In the first place they need not incur the expense of obtaining parliamentary powers and they have no track to maintain; secondly, their vehicle can run on any route, and that route may be varied according to the requirements of the traffic; thirdly, in its course along a street the bus is not confined to one narrow strip, but may thread its way through the traffic. Finally, experience in South London has shown that they may be the successful competitors of electric trams along the very route of these vehicles. In the result there is a distinct tendency on the part of the public to invest their money in motor omnibus companies, notwithstanding another tendency to apply the fearful term "electrobus" to the vehicle exploited.

Having raised up the dummy it is now necessary to see whether it cannot be demolished. Just as prophecy was falsified in the case of steam versus horse power, so it is anticipated that the forebodings of those who bear the competition of motor omnibuses with electric tram cars will prove to be without foundation. So far from competing, it may be found hereafter that motor omnibus and tramcar will each assist the other. The latter will tempt people to go far from their homes; the former will make them go still further afield.

Besides this it has to be remembered that each new means of locomotion which is discovered to some extent creates its own traffic. The fact that there are omnibuses provided along a particular route will tempt people to travel by that route, and it will not, therefore, be necessary for those who provide these vehicles to run them in direct competition with electric trams.

Composite Incandescent Lamps.

A patent recently granted to Mr. H. C. Parker describes a form of incandescent electric lamp in which the current path is composed chiefly of refractory non-conducting substance, but with a small percentage of conductive substance mixed therewith. Thorium oxid or carborundum is mixed with a small portion of graphite, the whole mass being compressed into a pencil. The current, which may be passed through the pencil when it is cold, raises its temperature to a value to cause it to become an effective illuminant. To form the pencil three or four parts of the oxid are mixed with one part of graphite and reduced to a fine powder. The parts are then held together by a suitable binder forming a sort of dough which can be forced through a die to make the pencil of the right size and the pencil can be cut into the requisite lengths and dried and baked. It is stated that the pencil is of such a nature that it will not flame, but will glow with a bright incandescence when sealed within a tube from which the air is partially exhausted.

The Proceedings of the National Electric Light Association.

A SPECIAL supplement of the Electrical World of 24 pages was devoted last week to the proceedings of the twenty-ninth annual meeting of the National Electric Light Association at Atlantic City. As the meeting was prolonged until Friday evening the report was not closed when that issue went to press on Friday morning. Subjoined will, therefore, be found the record of the later work of the body, including the election. The choice for president gave great satisfaction, as Mr. Williams has not only been a loyal and enthusiastic member for years, but has taken for himself lines of study and discussion—as for example in regard to municipal ownership—that have made him a man of mark. He is one of the youngest electric light managers to fill the chair, and his very youth and activity are a pledge of continued good work for the general cause.

A notable feature throughout the week was the manner in which the "active members" stuck to their job, and would not be distracted from the regular business. A curious instance of this was given late on Friday afternoon when after a long and rather heavy executive session the "rolling chair parade" was due. President Blood put it to the meeting whether work should be dropped for the occasion, but all the 250 men present rose to their feet and voted solidly to go right ahead, let who will ride in easy chairs. Such a spirit of earnestness can only be commended, and after all the delegates did contrive to get lots of fun in during the week.

One incident that aroused interest was the selection of two men for honorary membership. The association has a list of several leaders in electricity thus distinguished, but has not added to their number for some years. It is now proposed to choose one or two contributors to the art each year or so, and in resuming the practice choice was made of Messrs. C. P. Steinmetz and T. C. Martin, the latter of whom was in attendance and mentioned the fact that it was 21 years since he had first read a paper before the association.

The total registration up to Thursday afternoon was over 1,400, and as many arrived after that time it is pretty near the actual fact to say that the Atlantic City Convention had an attendance of about 1,500, thus exceeding considerably the figures of Denver and Boston—a very healthy sign of activity and growth.

Invitations were received the last day of the convention from Norfolk, Minneapolis and Saratoga Springs asking the association to hold its convention in those places. The Committee on President's Address recommended that the matter of annual dues should receive the prompt consideration urged by the president, and that the incoming president appoint a committee to make recommendations at the next annual meeting. The arrangement for offices in the new United Engineering Building, New York, seemed to be well considered, and should adequately meet the growing requirements of the association. As to the matter of general relations with the Underwriters, the committee was decidedly of the opinion that a representative of the association be immediately retained by the association, who should devote part of his time to the question of fire hazards and harmonious relations with the Underwriters. The central exhibition idea having been successful this year should be continued wherever it is possible to make satisfactory arrangements. The policy of relieving local parties of the necessity of making financial arrangements for the annul meeting, judging by this meeting, was a wise one.

Mr. Paul Lupke, editor of the "Question Box" and "Wrinkles," presented the volume, the introduction to which was read by Mr. John B. McFeeley, of Newark. The following officers were elected for the ensuing year, in accordance with the report of the Committee on Nominations: President, Arthur Williams, New York; first vice-president, Dudley Farrand, Newark, N. J.; second vice-president, Alex. Dow, Detroit, Mich.; secretary and treasurer, W. C. L. Eglin, Philadelphia, Pa. Members of the Executive Committee to serve three years—Charles R. Huntley, Buffalo, N. Y.; F. M. Tait, Dayton, Ohio, and Louis A. Ferguson, Chicago, Ill.

CENTRAL STATION ADVERTISING.

The exhibit of central station advertising and publicity methods made by the Committee on Progress was one of the most interesting features of the convention. Unfortunately the construction of the pier did not allow the exhibit to be massed in one place, but necessitated a scattering of the display; but in the aggregate the effect was very impressive and complete. The chief contributors were the Philadelphia Electric Company, the Boston Edison Company, the New York Edison Company, the Denver Gas & Electric Company, the Portland General Electric Company, the United Electric Light & Power Company, of New York; the Chicago Edison Company, Detroit Edison Company, and the Edison Electric Illuminating Company, of Brooklyn. Some of these exhibits were quite extensive and pretentious. The Boston, Brooklyn, New York, Portland and Philadelphia companies sent a large number of original paintings, designs and drawings employed chiefly for the covers of their monthly bulletins, and this part of the exhibit represented a value of several thousand dollars, five of the water colors alone from Boston having a value of $1,250, while the New York exhibit included the famous Cooper sketches that have become so popular. All these designs and the reproductions were displayed artistically on the walls of the exhibition part of the pier, and were carefully inspected. Many of the exhibits also included samples of billboard and newspaper advertising, the Brooklyn exhibit being very rich and effective in this respect, while other exhibits included follow-up letters, etc. The Philadelphia and Chicago companies furnished part of their exhibits on revolving standards, and the Chicago Edison Company sent also one of its large date calendars and one of its huge billboard posters. The New York Edison Company included in its exhibit the handsome calendar issued for this year and the aluminum telephone rack for telephone numbers. Albums containing data as to special newspaper advertising, follow-up letters, etc., were furnished by the New York Edison Company, the Boston Edison Company and the Denver Gas & Electric Light Company, while the United Electric Light & Power Company, of New York, had a very interesting series of photographs illustrative of its billboard advertising, which has proved very successful in the Borough of the Bronx.

In addition to this spectacular exhibit the Committee of Progress did a good piece of missionary work in securing from some of the companies named above as well as from the Electric Illuminating Company, of Cleveland, and the General Electric Company, of Buffalo, a number of their monthly bulletins. These were furnished in such large editions that the committee was able to establish a booth from which not only the delegates but the public as well could obtain complete sets supplemented by other interesting material. In this manner some twenty or thirty thousand pieces of literature were given away during the four days of the convention and the interest in this feature was shown by the large demand and inquiry. Many of the central station men secured complete sets, not only for themselves but for their friends, and many intimated that they were likely to attempt similar work. On the other hand, casual visitors to the pier who secured copies were generally stimulated to an interest in the subject, and came back to the booth with inquiries as to this or that appliance or method of illumination. The chairman of the Committee on Progress, Mr. Martin, was assisted in this work by the heads of the publicity departments connected with these various companies, including Messrs. Mohr, Seelman, Nast, Smith, Gilchrist, Fredenburgh and Hammond, and the success was so encouraging that these gentlemen have determined to concentrate their efforts upon an even more complete and useful exhibit at the next convention, it being realized that this feature can not only be made annual and permanent, but can become valuable to all the active members.

ELECTRIC HEATING AND THE RESIDENCE CUSTOMER.

A paper presented on this subject by Mr. James I. Ayer consisted mainly of a number of practical suggestions as to the introduction of electric heating goods. It has been well settled that more goods of any kind can be sold by personal presentation than by advertising. This is, in his opinion, the only way to get the largest returns at the lowest cost. It is necessary to send out articles and leave them for trial after explaining fully how to put them in operation and how they should be cared for, as well as to leave complete printed instructions which manufacturers usually send with each article. The customer should be called on at the expiration of a trial period, to learn his conclusions. This is better than leaving or sending a blank to sign, because it is frequently the case that further interest has been developed and other articles are wanted. If the office is centrally located on the ground floor, as it should be, an assortment of samples in glass cases should be maintained so that if a customer is interested he can be supplied at once. Exhibitions at food shows and similar entertainments prove attractive as advertisements, but direct results are usually few. The universal use of smoothing irons makes this an ideal article for first introducing electric heating devices. The success which has followed systematic efforts with this article is too well known to allow further argument in favor of its selection for such purposes. Because of the quick appreciation of the electric iron you will be called on for other devices. Using the flatiron as an opening wedge you will do well to follow with circulars or folders describing such articles as water cups, heating pads, foot warmers, milk warmers, curling irons and chafing dishes. Stove or disc heaters should always be supplied with utensils made for them with suitable proportions and with perfectly flat bottoms. The difference between the application of electric heat and other sources of heat is not difficult for any one to understand perfectly, but there is a difference and for best results this difference must be understood. The importance of acquainting yourself with the different appliances is essential in placing them with customers. Take all of the articles into your own home and give your solicitors a similar opportunity, and you will get results. Experience has shown from a great variety of sources that the number of watt-hours per meal for a person can safely be taken at 300, or 900 per day per person. Allowing, however, one kw-hour for a person, we have 30 kw-hours per month, which at a five-cent rate, is $1.50, or for a family of four, $6 per month. While these rates are absurdly low to-day, compared to lighting rates in residences, there are many cases where the service may be given from separate wires at a satisfactory profit. In his judgment the policy to pursue is to personally press the sale of small household devices constantly without complicating the situation by trying to interest customers with the larger problems until from experience with the smaller they have become prepared for further ventures. He gave a table showing the cost of heating various quantities of water a certain number of degrees at various rates for electric energy.

DISCUSSION.

Mr. Max Lowenthal, of New York, said that electric heating had now passed the fancy period and had settled down to an established business. Nevertheless the development was as yet very small. He pointed to the small number of those within reach of central station service in this country that are using such service, as showing how great an opportunity there is for development. It was not sufficient to talk and advertise heating appliances. They must be introduced by actual demonstration with the customers. With energy at 5 cents per kw-hour, all the ironing and cooking for a family of six or seven people could be done at about $6 per month, as had been shown by numerous trials. He gave a warning against attaching heavy heating devices to ordinary sockets, as there would certainly be trouble with sockets, which would result in dissatisfaction.

Mr. McCabe, of Williamsport, Pa., thought the trouble was not altogether with the slowness of central station managers to take hold of heating devices. Some of them had been willing enough to take up these devices as soon as they were satisfactory.

Mr. H. L. Wallou, of Cleveland, said that with 30-cent natural gas, as in Cleveland, cooking and water heating for a family could be done at about 90 cents per month, which made it hard to make much headway with electric cooking.

Mr. Ayer said that nevertheless the market for appliances was excellent in Cleveland. The proper course was not to go out and try to introduce the big heating devices at first, but begin with the small things which will not cost much to operate, and which will be great conveniences to customers and help make electric service popular. In the meantime central station men should try the larger devices themselves so that when the time comes to introduce these larger devices the managers themselves will be acquainted with them.

AUTOMATIC VOLTAGE REGULATORS.

In a paper dealing with alternating-current systems of distribution and their automatic regulation presented by Mr. C. W. Stone, it was stated that there are two general types of automatic voltage regulators; regulators that are arranged to work directly or indirectly to change the potential of the generators, and regulators for operating directly on the feeders. The former of these is illustrated in the Tirrill regulator, the operating circuits of which are shown in Fig. 1.

There are two main controlling solenoids, one energized from the alternating-current generator that is to be regulated, and one energized from the exciter circuit. Each of these solenoids contains a movable iron core which is hung on a balanced lever carrying a platinum point at its other end. When the alternating-current generator is operating with a light load, the exciter voltage is at a minimum, and the pull of the exciter solenoid is therefore much weaker than when the generator is full loaded, and the exciter voltage is at a maximum. It will be seen therefore that the place of contact between the platinum points varies in space relatively to the load carried by the alternator, and hence it has been very aptly termed a "floating contact." When these contact points are closed, the relay magnet is energized from the exciter circuit, and this in turn closes the main contacts that short-circuit the resistance in series with the exciter field coils. The main contact points may thus be made large and heavy so that they will not readily wear or burn away, and the power of the relay magnet insures a positive make-and-break action. By the application of a simple compounding device to the alternating-current solenoid, any desired voltage can be constantly maintained at a distant center of distribution.

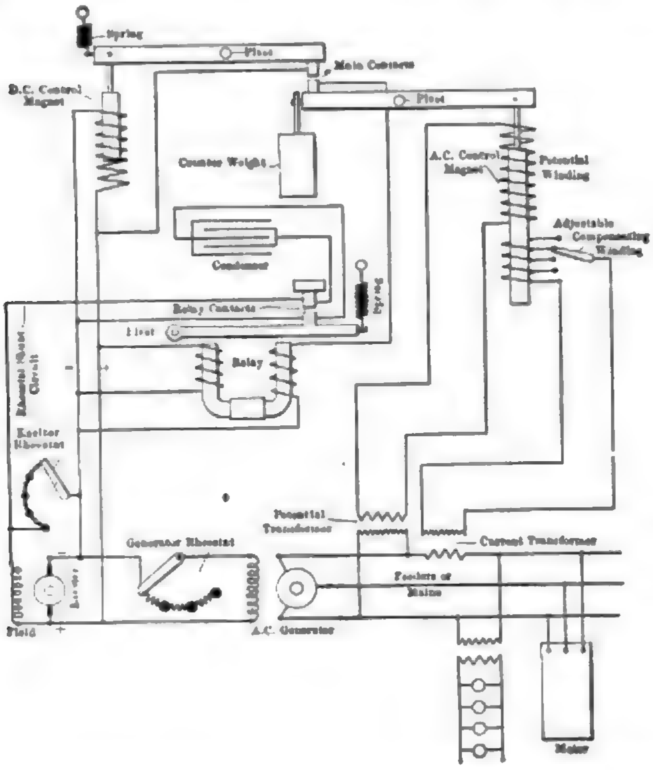


FIG. 1.—DIAGRAM SHOWING THE OPERATING CIRCUITS OF A TIRRILL VOLTAGE REGULATOR.

There are two types of automatic feeder regulators now obtainable. Both of these types of regulators are transformers or compensators in principle. One of these depends on the movement of a dial switch and the other is dependent on the shifting of the magnetic flux through the two coils and cores. In the dial-switch type of regulator there are two sets of coils which are wound around a core like that of a core-type transformer. One of the coils is connected across the circuit, and the other coil is connected in series with the circuit, and is provided with a number of taps which are connected to the dial switch. This switch consists of three separate parts: the stationary contacts placed on the inside of a cylindrical cast-iron pot; the stationary set of collector rings; the moving part which carries the contact fingers. The moving part consists of a metal carrier which has mounted on it ten fingers of different length, all insulated from one another. These fingers bear on the contacts of the stationary part, and are also connected to the ten collector rings on the central stationary part. By thus designing the contact arms several of these fingers are in contact with the stationary contacts at the same time. If these fingers were not insulated from one another, a short-circuit would take place between the taps on the transformer. They are therefore insulated from one another and a resistance is connected between them, as shown in Fig. 2. Their resistance limits the flow of current between the different taps, and no sparking occurs. A potential relay serves for energizing one or the other of two motor-driven magnetic clutches which raise or lower the potential as may be required.

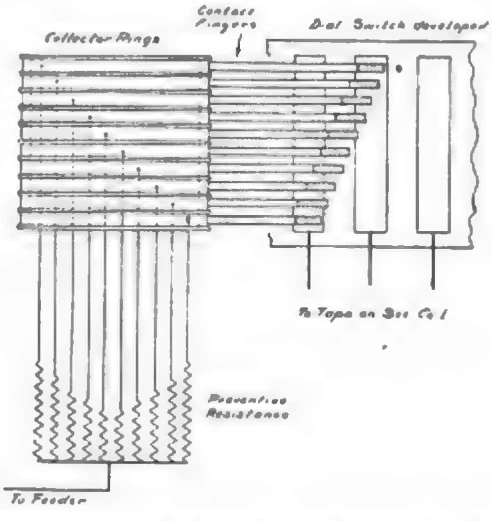
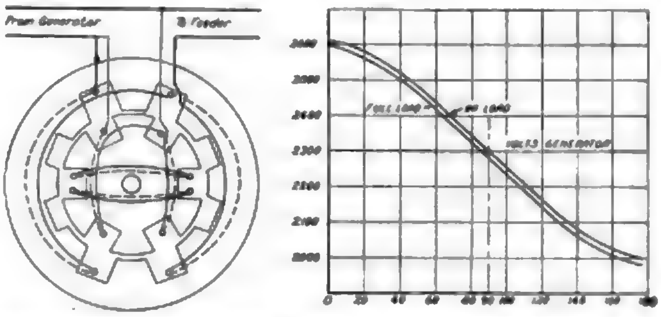


FIG. 2.—DIAGRAM OF CONNECTIONS OF SWITCH AND RESISTANCE.

The second type of automatic feeder regulator is in principle a variable-ratio transformer. The regulator is made with a primary or shunt winding, which is connected across the line. It also has a secondary or series winding, which is connected in series with the line. The primary or shunt winding is placed on a movable core, and the secondary or series winding is placed on the stationary core, as is shown in Fig. 3. The shunt winding produces a magnetizing flux that has a constant value, the direction of which is constant in the movable core, and consequently with respect to the series or stationary winding. The passing of this flux through the secondary coils in one direction produces a potential in these coils which is added directly to the line potential, or subtracted when the direction of the flux is reversed by rotating the primary core through an angle of 180 deg. As the core is rotated gradually, the direction of the flux, and consequently the amount forced through the secondary coils, is similarly varied, and produces gradually a varying potential in the secondary from the maximum positive through zero to the maximum negative value.



FIGS. 3 AND 4.—DIAGRAM OF REGULATOR AND REGULATION CURVE.

The effect of rotating the core through its entire range is represented graphically in Fig. 4, which shows the variation in the feeder-voltage with no-load and full-load current. The slight difference in these curves is due to the loss in the regulator itself.

The rotating core is provided with two windings: The active or shunt winding connected across the lines, and a second winding which is short-circuited on itself and arranged at right angles to the former. The object of this short-circuited winding is to decrease the reactance of the regulator. If the movable core were not provided with a short-circuited winding, and it were rotated from one position to the other, a gradually increased potential would be required to force this current through the series winding; thus introducing a reactance in the feeder. By adding this winding, however, the reactance of the regulator is cut down to the minimum, and it thus has very little effect on the power factor of the line. In this respect it is vastly superior to any of the other resistance and reactance types of regulators heretofore built. The amount of reactive effect on the feeder is directly proportional to the range of regulation of the the regulator. That is, as the range in the regulator increases, the effect on the power factor of the circuit is increased; thus with a twenty per cent range on the regulator, the power factor of the feeder would be lowered only a trifle over one per cent, and with a total range of ten per cent, it will be lowered about one-half of one per cent.

The rotor is moved through a worm gearing driven by a motor whose direction of motion is determined by a potential relay inserted in the feeder circuit.

DISCUSSION.

Mr. Wallau said they were operating in Cleveland an 11,000-volt Y-connected transmission system with neutral grounded both at the main station and at all substations. He asked Mr. Stone if this was likely to cause trouble from stray railway currents. Mr. Stone did not think that with so few grounds, which were probably some distance from the railway, that there would be any trouble. In one congested area on the west side of the city they had a comparatively large district with approximately 400 kw maximum load, which was distributed entirely underground by a 3-phase 4-wire secondary system giving 115 and 200 volts, the primary being 3-phase, 3-wire at 2,300 volts. As originally installed, this secondary was well balanced, but as new connections have been made and other customers disconnected the balance became quite bad and the regulation on that type of secondary is getting hard to maintain. For that reason they had discarded the 3-phase 4-wire secondary, except where it already existed and could not be changed. They had adopted the single-phase 3-wire secondary system fed from 3-phase primaries. They are about to install a Tirrill regulator in connection with a new turbine. They have decided, however, that they could not regulate from one principal feeder alone, for the reason that they now have three substations in use, and the total number of feeders will be something like 33, the average load on feeders being from 150 to 200 kw. As the substations are quite a distance apart it is hard to regulate any particular feeder to give any kind of regulation on the others. They had adopted the use of compensators, having one compensator cut in each leg of a 3-phase primary feeder and one induction regulator in each leg of such feeders. The regulators are motor operated but controlled by the station operator, who adjusts them to keep the potential balanced as shown on the station voltmeters. They found that they had very little difficulty in obtaining good regulation by this means, and got rather better efficiency out of such 3-phase transmission lines than with a single-phase feeder system balanced on a 3-phase bus.

Mr. Hallberg called attention to the fact that lightning arresters when connected to a system on a grounded neutral should not be of the double pole type connected to each side. On such systems the double pole arresters should be connected in tandem, one after the other. Otherwise the current is likely to jump across the arresters.

Mr. Stone, in response to questions, said there are a large number of these automatic regulators in use in Chicago and Toledo. The present regulators require but little attention. The only maintenance required is to see that the bearings are well oiled and that the contacts on the potential relay are in good condition.

THE AGITATION FOR MUNICIPAL OWNERSHIP IN THE UNITED STATES; ITS ORIGIN, MEANING AND PROPER TREATMENT.

Mr. Everett W. Burdett, of Boston, addressed the national convention on the evening of June 7 on this subject. Great accumulations of wealth in the hands of a few generally employed by corporate organizations, he said, had so abused the privileges which wealth and organization puts at their disposal that the average citizen is disgruntled and inclined to demand a change of some kind which will tend to remove the inequalities of which he deems himself the victim. In short, a great socialistic agitation is upon us. He then reviewed at length some of the corporate abuses which have given rise to this agitation. Forgetting the munificent results which have been obtained only through the accumulation of great wealth derived from corporate organizations, the dissatisfied citizen sees only the abuses of financial and corporate power of which he has been, or imagines himself to be, the victim. And yet, of course, this wholesale distrust and condemnation of wealth and corporate power is unreasonable. It loses sight of the fact that we are unable to assert from what other sources the people at large would have derived the blessings which have come from the establishment and maintenance of a special fund for supporting hospitals, libraries, colleges, parks, museums and the encouragement of learning. It forgets that it has been only by the uniting of the funds of the rich and the savings of the poor in corporate organizations that the country has been developed by the establishment and exploitation of numberless forms of industrial enterprise. All the wonders of development in the central station, electric lighting, electric railway and telephone industries are due to corporations. They have given free play to the enterprise of the individual energy of our people and have made that enterprise and energy vastly more powerful and effective than it otherwise could possibly have been. And it has not been the organizers, managers and stockholders of these enterprises who have chiefly benefited by them, but the general public. A glance at the net divisible incomes earned and the dividends paid by the electric public service corporations of the United States, contrasted with the character and extent of the service rendered, will furnish ample demonstration of this assertion. He then cited as an example the electric light and railway companies of the State of Massachusetts, where only about one-third of the 58 strictly electric lighting companies paid a dividend in 1905, and the dividends paid ranged from 4 to 10 per cent.

He reviewed at length the agitation in favor of municipal ownership in England. He pointed out that successful English methods were not necessarily successful in the United States under our different conditions. Municipal ownership, he pointed out, was undertaken in England as the means of accomplishing undertakings which would not have been entered upon by private corporations, rather than as a substitute for private corporate enterprise. He then gave an outline of his ideas as to the proper treatment of the present agitation for municipal ownership. In the first place the companies engaged in furnishing public services must in their own interests strive more and more to give good service at fair rates. He who serves the public best serves his company best. Second, the abuses of great wealth and corporate privileges, to which he had already alluded, must cease, these abuses being overcapitalization, poor service, high prices, discrimination between consumers, and, above all, the attempt to control the law making power for selfish ends. He did not include among these objectionable practices that reasonable inflation of capital necessary to induce men to embark in new enterprises where to offset the chances of loss the amount of possible profit may reasonably be increased over that of ordinary investments. For such an inflation we have the warrant of the Supreme Court of the United States and the recent statement of President Elliott, of Harvard, that much can be said in defense of it. The difference between such an inflation and the objectionable stock watering referred to needs no elaboration. Third, the public must be educated in sound, economic lines. Except as a choice of necessary evils, municipal ownership has no standing in the court of economics. It is not sufficient in itself to effect the results desired, nor is it the best means which can be employed for the purpose.

The State of Massachusetts has for twelve years been trying the experiment of public control of gas, electric lighting, railroad, street railway and other public service corporations, and has developed a most complete system. While there are imperfections in the system, and there is at times in specific cases dissatisfaction with its application, it has been on the whole an advantage to all concerned. It is by no means perfect; it might easily be made intolerable, but the sober sense of the people of Massachusetts, as represented in their legislative assembly, has prevented any gross perversions of its objects or confiscatory applications of its principles. The public is better and more cheaply served and the capital employed is more amply protected. The relations of producer and consumer are more satisfactory than is the case in most, if not all, other portions of the country. The evils of stock watering have been eliminated or minimized, while reasonable returns upon legitimate investments have been insured if earned. Such laws unwisely framed or viciously applied could do an immense amount of damage, but in the older of our communities certainly, where the people at large are to be credited with a reasonable degree of intelligence, and a real desire for a "square deal" for all alike, it offers in his opinion a vastly better solution of existing difficulties than does municipal ownership.

NEW ILLUMINANTS.

Prof. H. E. Clifford presented a paper giving a review of the recent developments in low consumption lighting units. He discussed the 2.5-watt graphitized filament lamp, the 1.85-watt and 2.2-watt tantalum lamps, the 1.5-watt osmium lamp, the 1-watt Kuzel metallic filament lamp, the luminous arc lamps, the Nernst lamp, the Cooper Hewitt mercury vapor lamp and the Moore vacuum tube lamp. He stated that the results already achieved with osmium, tantalum and zirconium have greatly stimulated the search for a substitute for the carbon filament. Until, however, these metallic filament lamps run equally well in all positions, give satisfactory service on both alternating and direct-current circuits, operate at commercial voltages and can be manufactured at a much lower cost, the carbon filament lamp with reasonable rates for electricity and the development indicated by the recent gain in efficiency, will continue to maintain the supremacy it has so long enjoyed.

The production of fumes and the lack of steadiness have combined to render the flame arc lamp undesirable for interior illumination, although it is claimed for one of the most recent types that these objectionable features have been overcome. For street lighting too large a proportion of the light falls near the vertical, although undoubtedly some reflector might be devised to remedy this defect.

As a scientific principle it may be stated that the most efficient means of obtaining light from electricity is electrical conduction through rarefied gases or vapors. The Cooper Hewitt and the Moore lamps represent the present-day commercial systems of vapor lighting. The mercury vapor lamp possesses the disadvantage of lacking in red rays. The best way of supplying the lacking rays is to use incandescent lamps in conjunction with the mercury vapor lamp. The writer stated that the Moore vacuum tube lamp has a promising field in the illumination of large areas.

He concludes that the concentration of effort in the securing of higher efficiency tends to make one lose sight of the danger of further increasing the intrinsic brilliancy, a danger all too plainly indicated in some of our modern illuminants. The last word in increased efficiency has not yet been spoken, but even so the time seems ripe for greater devotion to questions of distribution.

The paper gave photometric tests on a 125-watt General Electric new high-efficiency carbon filament lamp, both with and without reflectors, and both frosted and unfrosted. The mean spherical candle-power of the lamp without reflector or frosting is about 40, thus giving a consumption of about 3.1 watts per mean spherical candle.

Tests were also given on a number of flaming arc lamps, including the magnetite arc made in this country and several flaming arc lamps made in Europe. A fuller abstract of this paper will be published in a later issue.

DISCUSSION.

Prof. Clifford said, in presenting his paper, that he was a poor advocate of the high-efficiency metallic filament incandescent lamp. In the first place, most of these new metallic filament lamps are made for voltages far below those in common commercial use. He cited some tests carried out by the Electrical Testing Laboratories of New York, and also some which he carried on personally on some tantalum lamps operated on 133 and on 60-cycle alternating current. Of ten such lamps on 133 cycles, five with clear and five with frosted globes, not one gave a life of more than 99 hours; the average of the clear bulb lamps was 37; the average of the frosted bulb lamps was 46. On the 60-cycle test the maximum life of any lamp was 308 hours; the average life of the clear bulbs 178, and the average life of frosted bulbs 129. He had a feeling that the tantalum lamps which were originally put on the market were much better than the tantalum lamps of recent manufacture. Then, too, the fact that tantalum lamps are suited only for direct-current service greatly limits their usefulness. In closing he urged very strongly consideration of auxiliary devices for saving stray light. Saving this light is quite as important in the present state of development as the focusing of our attention wholly on the question of high-efficiency illuminants, and in doing so failing to consider how we may get a cheap illuminant (perhaps not quite so efficient), and improve it by using the light which is now thrown away.

Mr. D. McFarlan Moore was called upon to give further information about his vacuum tube lamp, one of which was in commercial use on the pier. He stated that the consumption of this tube as a light source was 1.5 watts per candle. The candle-power of the tube was 2,200, and the total wattage of the tube was 3,300. The great field of usefulness for this tube will be lighting large areas. Eighty per cent of all the incandescent lamps in use to-day throughout the world are used for lighting large areas. He claimed the gain and efficiency was between 75 and 67 per cent over ordinary incandescent lamps. The vapor in the tubes will now last indefinitely. Repairs can easily be made by glass plumbers. It is now possible to illuminate any area with no wires or purely electrical apparatus in the area. Several thousand feet of this tube are now in commercial use. A tube can be repaired and refilled with gas in about an hour. The power factor is about 75 per cent.

ECONOMY FROM USING GRAPHITIZED FILAMENT LAMPS.

A paper read by Mr. F. W. Willcox before the convention of the National Electric Light Association at Atlantic City gave an exhaustive discussion of the effect on central station service of the introduction of the General Electric graphitized-filament lamp. It is stated that the new type of lamp saves 20 per cent in the energy consumed for the same candle-power and life, or it will give 25 per cent more illumination for the same candle-power and cost for energy and maintenance. It is assumed that the new lamp costs 20 cents as compared to 16 cents for an ordinary carbon-filament lamp for the same illumination; that is, from 16 to 20 cp. The author gave estimates to show that a customer can buy his own renewals of the new 2.5-watt lamp and save money at all rates for energy above 5 cents per kw-hour in comparison with paying merely for the energy for the ordinary lamp consuming 3.1 watts per candle. From the viewpoint of the central station manager the important features of the low-consumption lamp reside in the improvement in service in meeting and resisting competition, in adding desirable business, in improving the load factor and in the resulting increase in net earnings. In order to cope with the competition of the Welsbach gas lamp an incandescent lamp should have a candle power greater than the usual 16. The author suggests that the standard low-consumption unit should be a 20-cp, 2.5-watt lamp. This plan gives the central-station company the same output per consumer as at present, thus avoiding the necessity of having to increase the number of consumers or the number of lamps per consumer.

DISCUSSION.

President Blood thought the gist of the paper was summed up in the one paragraph which read: "The central station cost standpoint is not the correct basis on which to determine the proper efficiency of lamps where light is sold by the kilowatt-hour. It neglects to consider the effect upon the customer and the selling end of the business. Whether a central station supplies free lamp renewals or not, and whether its costs are thereby changed or uneffected, the success of the business demands the lowest practical cost to the customer; that is, it requires the use of high efficiency lamps of that efficiency which gives the lowest cost of light (including power and lamp renewals) at the rate paid."

Mr. A. C. Dunham, of Hartford, Conn., thought the metallized filament lamp the greatest improvement made in electrical appliances in the last five years. The complaint most usual among customers was that they could not get enough light for the money they paid. They pay all the money they can afford and are hungry for more light. This company had doubled its output every 3½ years for the past 10 years, and had done it without any solicitors. He believed this was due entirely to a steady decrease in the cost of light. The first four months of this year their output has been increased $28,000, of which $4,500 per month was for light. He believed this entirely due to the use of Meridian and similar lamps with reflectors which would deliver the light just where it was wanted. They had reduced their prices steadily for five years. Every time they reduced the price they increased the output and increased the profit. He had experimented with the tantalum lamp and found that to secure a long life it could not be disturbed after it had burned the first 50 hours without shortening its life.

Prof. Clifford thought that one of the alternatives suggested in Mr. Willcox's paper, namely, that of increasing the rates to make up for increased cost of lamp renewals with high-efficiency carbon lamps, was entirely impracticable.

THE EDISON SYSTEM OF SOUTHERN CALIFORNIA.

A paper by Mr. R. H. Ballard gave an outline description of the Edison Electric Company's system in Southern California. This system was treated at some length in our issues for February 24, March 4, March 11 and March 25, 1905. The plans of the company contemplate the eventual construction along the Kern River of four water power plants, in addition to the one now nearing completion. The water head will vary from 340 to 1,200 ft., and will give a total output of 50,000 kw at the ordinary low water flow of the stream.

In discussing the character of the load on the system, the author stated that there is a certain kind of power business which is perhaps peculiar to Southern California, and this is of importance, owing to the conditions under which the power is required. Owing to the fact that for six months in the year no rain falls, it is necessary to do a large amount of irrigating. Only a small proportion of the water needed has a natural flow, and as a consequence the requirements of the country have largely to be met by pumping water from beneath the surface. The pumping season usually lasts from the first of May until the end of October; fortunately, just at the time of the year when there is the least demand for electricity for lighting purposes. As a rule, the pumping plants are operated during the day hours only, and the very great number of these plants that are being operated in all the districts is a considerable factor in the building up of the day load.

THE LONDON SLIDING SCALE.

Mr. W. H. Gardiner, Jr., prepared an elaborate description containing 133 printed pages in addition to three tables dealing with the London sliding scale as a method for the government regulation of public service corporations. The principle of the London sliding scale is a permanent arrangement between the public and the corporation whereby net allowable earnings interdependently go up as prices go down, and vice versa. The basic factors of the scale are the sliding dividend and net earnings; the initial price and reductions; the ratio of increase in net earnings to decrease in price.

The essential point in the determining of the standard dividend is that it shall yield a dividend commensurate with the investments in the business and a fair return from the conduct of the business as a going concern under present conditions The uniform practice seems to have been to fix the initial price a very little above the price that would be necessary to but exactly meet in amount the interest and dividend charges under the old or new capitalization. The initial sliding scale price is thus usually raised by a slight increase above the old price The object of so fixing the initial price may be found in the desire of the public and its officials to induce lighting companies to adopt the sliding scale system because it works so well to the public good. Therefore, the initial price may be set at a slight advance over the former price so that the company may forthwith make a reduction therefrom and consequently increase the amount of its dividends. The practice in connection with the ratio of increase in net earnings to decrease in price has been to allow the company to increase the rate of its dividends by a constant and predetermined amount for each reduction of stated size from the initial price, and conversely. The stock of an English company may thus be allowed to pay, say, at the rate of one per cent more for each reduction of, say, one cent from the initial price per kilowatt-hour. Furthermore, this ratio is constantly maintained.

The writer stated that the initial price, returning a fair earning on the initial capital, should be the average price per unit of service at the initial period, unless economic results and equity to all concerned are to be wilfully sacrificed to sociological expediency. In this latter event the initial list price may be substituted for the initial average price. The net premium earnings should be only such as will most efficiently, economically and equitably stimulate the company to the best service of the public in every respect. The net premium earnings are best fixed by allowing them to equal the actual money saving the company's efforts effect for the public, as indicated by the periodic reduction in the index price and the contemporaneous volume of the service. Deficits and surpluses in earnings and reductions should be carried forward for eventual balance. The period of duration of a sliding scale agreement should be of at least such length as to warrant the company in operating practically on a permanent basis. The English practice is not to limit the duration of the agreement, but to provide for occasional revision.

RATES FOR CENTRAL STATION SERVICE.

The committee on rates and costs, which was composed of Messrs. C. L. Edgar, L. A. Ferguson, S. Scovil, F. W. Frueauff, P. G. Gossler and R. S. Hale, submitted a report on various methods for determining the maximum demand for electricity made by each customer. Eight methods were considered, as follows:

1. The connected load method. This consists in taking the maximum load that can possibly be thrown on the station if all the customer's lamps are used at one time. A minor point of interest, if this method is used, is the question as to whether motors should be taken at their rated power or at their overload capacity.

2. The demand may be taken, not at the connected load, but at the maximum power that can be thrown on the station as limited by a flicker device or circuit-breaker. A minor point, if this method is used, is as to whether the customer should be entitled to change this amount from month to month, or whether he should make a year's contract for the amount of demand that he may use.

3. The demand may be determined by a Wright or other form of demand indicator and the bill for each month calculated according to the monthly readings.

4. The demand may be determined from a Wright or other form of demand indicator, read yearly, and yearly settlements made. A minor point, if this method is used, is as to whether the highest reading of the demand indicator should be used, whether the average of three or four of the highest readings should be used, or whether the average of three or four winter readings should be used. Another variation of this method is the original method used at Brighton, by which the highest readings of the indicator during the six months from January 1 to July 1 and from July 1 to January 1 are taken, and half yearly settlements made.

5. Another method is the method used in Boston, by which the yearly readings of the demand indicator are used, but, instead of making yearly settlements, the reading of the demand indicator for one year is used as a basis for all the months the next year, thus enabling monthly settlements to be made. A minor variation of this method is as to whether the single highest reading should be used or an average of two or more of the readings.

6. The Detroit method is to estimate the demand for residences

in proportion to the number of rooms in the house, paying no attention to the demand.

7. A variation of the method of taking connected load is that used at Cleveland and New York, by which only certain portions of the connected load are taken. Thus, in New York, only the lamps and motors are taken, the heating and miscellaneous devices not being considered. In Cleveland only the lamps connected in the living rooms of the house are considered, lamps in halls, bedrooms, etc., not being included.

8. Another method that is frequently used in the case of power is to estimate the demand by the judgment of the central station manager, or by a single test. Another method, which, strictly speaking, is not a method at all, but a way of getting around the use of the demand, is to consider different classes of business as uniform among themselves, and to make one rate to apothecaries, another to residences, another to saloons, another to elevators, etc.

LAWS RELATING TO THE THEFT OF ELECTRICITY.

The report concerning the laws of the several States and jurisdictions of the United States governing the theft of electricity which was originally prepared by Mr. Robert L. Elliott in 1903 has been revised by Mr. E. H. Davis for the National Electric Light Association. With the exception of Alabama, Arkansas, Delaware, Indian Territory, Kansas, Mississippi, Missouri, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Vermont, West Virginia and Wyoming, all of the States and Territories, the District of Columbia and Porto Rico have laws on this subject. In most of the States the offense is considered a misdemeanor and is punishable by a short term of imprisonment or by a small fine. Mr. Davis states that the laws enacted by most of the States are capable of considerable improvement. A proper and satisfactory law should forbid and provide:

1. Fraudulently making any connection with any electrical connection, or fraudulently diverting electricity in any other manner whatever so as to use or waste it, without the consent of the company, or without the electricity passing through a meter set by the company; or fraudulently preventing any meter from duly registering, or altering its index, or interfering in any manner with its proper action or just registration.
2. Any one aiding or abetting or counseling the above acts to be equally guilty with the principals.
3. A penalty of a fine not exceeding $500, or imprisonment not exceeding one year, or both.
4. Proof that any of the above acts were done on the premises of the accused, or that he received the benefit of such electricity fraudulently obtained, shall be *prima facie* evidence of his guilt.

In our report of the National Electric Light Convention last week, on page 1227 the discussion by Messrs. Rhodes, Partridge, McCabe, Wells, Hutchinson and Morrison, printed as part of the discussion on the "Grounding of Secondary Circuits," should have been inserted as part of the discussion on the paper by Mr. Paul Spencer on "Overhead Line Construction."

Telephone System in Wanamaker's Philadelphia Store.

We called attention in our issue of April 14 to the elaborate system of conduit installed in the Wanamaker store at Philadelphia for low-potential circuits; that is, for telephone, fire alarm, call bell and signal service. We are now enabled to give some information on the very complete telephone system in use in that portion of the building already complete. Almost 19,000 miles of telephone wire are connected to a switchboard requiring twelve operators. There are at present in use 2,000 telephones with 1,000 more to follow. One hundred and twenty trunk lines connect the Wanamaker store with the Bell Company's central offices, the trunks being distributed so as to terminate in several offices in order to prevent congestion of traffic. The reason for this distribution is obvious when it is understood that possibly 6,000,000 messages, incoming and outgoing, will pass over these trunk lines within a year. The telephones afford almost instant communication between every part of the store, and at each instrument is an automatic coin box, making every telephone a pay station for the convenience of customers. It is expected to add more sections to the switchboard as the other portions of the store are completed. The telephone plant is built exactly on the lines of a large city exchange, and a twenty-four-hour service is maintained, operators being on duty day and night. The equipment is indicative of the absolute necessity of the telephone in modern department store systems. Time was when one or two telephones were considered adequate for most establishments; but the convenience and value of the telephone for department store work is now appreciated. The satisfaction of speaking directly with one's regular salesperson, or with the clerk who handles and knows most about the classes of goods desired, adds considerably to the prestige of this, the largest store system in the world.

New Telephone Patents.

METAL LAMP SOCKET.

M. Setter has invented a metal frame lamp socket strip with a hard rubber face strip. The plate is pressed so that a ridge is raised at the rear upon which the socket springs are built up. Incidentally a recess for the screw heads is formed. In order to prevent a confusion due to light breakage, a wall of metal is bent up from the strip at one side of each lamp mounting.

AUTOMATIC APPLIANCES.

When a fire call wire is connected to an automatic system of the Strowger type, there is trouble in case of false alarms due to the inability to locate the culprit. Some time ago a method was devised for overcoming this difficulty, but it disabled the machine for the time being. J. Erickson, of Chicago, has now patented a signal, one of which is associated with the switch of each line, and this signal becomes displayed only upon a call of fire from the corresponding instrument, and it in no way interferes with the proper operation of the instrument. T. G. Martin has patented an attachment for the same automatic system, by means of which storage batteries at an associated exchange may be charged over the trunks at idle times. This is, of course, an adaptation of a well-known practice in manual systems.

LETTER TO THE EDITORS.

Water-Wheel Tests.

To the Editors of Electrical World:

Sirs:—In your issue dated May 26 appear the data of some tests made on the Pike's Peak Hydro-Electric Company's wheels at Manitou, which I think call for some explanation.

Mr. Taff claimed that the wheels were not developing the guaranteed efficiency, and the writer was asked to go there and be present at an efficiency test. As soon as I reached Manitou and examined the wheels, I told Mr. Taff it appeared to me that there was a great deal of air in the water. One thing which indicated this was the wear on the buckets and wheel center. Some of the water was taken out of the tanks into which the wheels discharged, and it was found to contain a good deal of sand. The water, under such a high head, of course would compress the air very greatly, and as soon as the water left the nozzle, this air would expand and throw water and sand against the wheel centers and buckets, and act very much like a regular sand blast. These conclusions were reached before I saw the manner in which the water was taken into the pipe. My conclusions were explained to Mr. Taff, but he did not agree with me because he said he had a riser on the pipe which allowed the air to escape.

As stated in the article, both the pipe and riser are 20 in. in diameter. The effective head is 2,100 ft., and when two machines are running this means a velocity of some 4 ft. per second in the pipe, or 2 ft. when one wheel is running. Anybody who knows anything about hydraulics can see that but a very small portion of the air could possibly escape through the riser. Upon going up to the intakes I found the water was taken into the pipe from three little ponds with practically no means of preventing sand and dirt from entering the pipe, and a man was employed to rake the sand away from in front of the intakes. A part of the pipe on top of the mountain is common tile pipe and the joints are very poor. The velocity of the water in this is so high that the pipe is above the hydraulic gradient and consequently a negative pressure exists in the pipe. At quite a number of places I could hear the air being drawn into the pipe.

As I explained to Mr. Taff, I did not consider a test under such conditions a fair one.

New York, N. Y. Geo. M. Peek.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Alternating-Current Commutator Motors.—Fynn.—The first part of an article in which the author endeavors to give, with the aid of diagrams, a classification of alternating-current commutator motors which has a rational basis. The author starts with some remarks on the "repulsion motor"; he believes that the use of this term has brought about considerable confusion.—Lond. *Elec.*, May 25.

Commutator Design.—Livingstone.—In a continuation of his article on the design of commutators for direct-current generators the author gives mathematical formulas for the stresses in commutators.—Lond. *Elec.*, May 25.

Lamps and Lighting.

Mercury Arc.—Bastian.—A paper read before the Glasgow section of the British Inst. Elec. Eng. on observations on the mercury arc and some resultant problems in photometry. The author distinguishes between the mercury arc lamp which has mercury electrodes and the mercury vapor lamp containing mercury vapor electrodes of iron or carbon. The author refers to the altogether unexpected gain in luminosity which is obtainable by combining the characteristic green light of the mercury arc with the red light of the carbon filament lamp. Every color produces a certain degree of visual effect and white light produces the greatest visual effect of all. He thinks it is reasonable to conclude that an actual gain is effected by combining two colors to produce white light. He refers to some tests made at the Central Laboratory of Electricity in Paris where a mercury lamp tested at 1.86 meters from the standard was returned as being of 14 cp. but when tested again the same standard at the increased distance of 21.5 meters it was returned as being of 25 cp. The explanation offered was that a discrepancy was due to the Purkinje phenomena, but the present author adduces two additional causes; first, the difference in the intrinsic light density of the two illuminations and second the different resistances offered by the atmosphere to the passage of different luminescent wave lengths. The law of inverse squares is based on the fact that light rays diverge in a definite manner and on the assumption that the source of light is a point. But this is not true with the mercury lamp. The intrinsic light density of a carbon arc lamp as compared with a mercury arc lamp is about the ratio of 40,000 to 10 as nearly as can be computed. Concerning absorption of light the author reaches the conclusions that the penetrating quality of light is a function of the light conductivity of the atmosphere, the conductivity of which is different for each distinct wave length. The absorption of light in the atmosphere between any source of light and an illuminated body varies directly as the density of the light at its source, all other conditions being equal; and it also varies directly as the distances vary between the source of light and the illuminated body. The author then describes some observations made on mercury lamps. One of the earliest difficulties encountered in the construction of a mercury arc lamp arose from the fact that the mercury apparently migrated from the positive electrode through the arc to the negative electrode, and consequently, sooner or later, the positive electrode became depleted of all its mercury; arcing then took place from the platinum leading-in wire, which, becoming hot, cracked the glass around it and destroyed the lamp. It did not seem possible that this migration of mercury was due to vaporization from a hot positive electrode and condensation at a cooler negative, because all the observations seemed to indicate that the positive was the cooler of the two. He thinks that "the migration was due to an attraction of mercury atoms from the positive to the negative electrode through the arc." In order to compensate for this the author produces an opposite transfer by means of evaporization of mercury at the negative electrode and condensation at the positive electrode by making the surface of the negative electrode smaller than that of the positive electrode. When an arc is struck by separating the column of mercury in the center of a small, straight tube, the mercury forming the positive electrode steadily recedes as the formation of vapor in the arc increases the pressure; but the mercury forming the negative electrodes does not recede steadily in the same way; but on the contrary commences a regular pumping motion, to and fro, and unless the burner is specially constructed to prevent it, this pumping motion continues indefinitely. No satisfactory explanation can be found, unless it be caused by the impact of mercury atoms attracted from the positive. Another observation that might be suggestive if it were not so inexplicable, is that two mercury arcs cannot be struck between one common negative and two positive electrodes. It is possible to modify the color of the mercury arc light almost as desired by alloying other metals with the mercury, but it has not yet been found possible to do this except at great sacrifice of life and efficiency.—Lond. *Elec.*, May 11.

Tantalum Lamp.—A note stating that the price of the tantalum lamp in England has been reduced from $1.25 to 68 cents, and this will doubtless considerably extend its sphere of utility.—Lond. *Elec.*, May 18.

Measuring Illumination.—Uppenborn.—A translation in abstract with several illustrations of his German article which was recently noted in the Digest.—Lond. *Elec.*, May 18.

Traction.

Liverpool Tramways.—An abstract of the annual report of the municipal tramways of Liverpool for 1905. The total number of cars in service was 479, the average number of miles run per car 2,452. The total electrical energy used during the year 1905 for tramway purposes was 21,186,782 kw-hours (including 315,780 kw-hours for lighting of car sheds, works and routes, and power for works motors) as against 20,045,629 units for the year 1904, an increase of 5.69 per cent. Of the above quantity 1,047,918 kw-hours were supplied by the Bootle Corporation. The average kw-hours used per car-mile has been as follows:

Year.	Kw-hours used per car-mile.	Percentage increase over preceding year.
1903	1.448	6
1904	1.566	8
1905	1.677	6

The average charge made by the Electric Power and Lighting Committee for energy supplied during the year 1905 was 2.214 cents per kw-hour, as against 2.318 cents during 1904, being a decrease of 4.4 per cent. The price charged for energy includes the total working and capital charges and delivery of the electricity at the section boxes. The percentage of operating costs to total revenue was 65.9 per cent in 1904 and 67.3 per cent in 1905, and the passengers carried per car-mile amounted to 9.88, as against 9.58 in 1904.—Lond. *Elec.*, May 11.

Motor Vehicles.—McGeorge.—A discussion of the heavy motor vehicle in practice, with a comparison of electric propulsion with steam and oil motors. The author deals with the subject "from the American point of view" and says that the electric truck "seems to have its advantage for short hauls, for goods that would be affected by gas fumes or damp, or where quietness is an essential, or where a natural source of power, such as a water fall, is available. But nearly all the advantages inuring to the steam and electric systems for commercial work are closely approached by the gasoline engine."—*Eng. Mag.*, June.

Installations, Systems and Appliances.

Compounding.—NOUGUIER.—In order to keep the voltage at the bus-bars constant with varying load in a direct-current station the author recommends the use of shunt-wound generators in combination with boosters in the excitation circuit, as indicated in Fig. 1. The field poles of the shunt dynamo, *G*, must not be too highly saturated, since the method requires that an increase of the exciting current produces a noticeable increase of the magnetic flux. The exciting winding must be made from wire thick enough to withstand a considerable increase of the exciting current. If a small booster, *S*, is inserted in the exciting circuit of *G* and if the current, *I/m* passes through the exciting winding of *S* (where *I* is the total load current and the exciting winding of *S* is connected in parallel to the terminals of a suitable resistance, *s*, in the main circuit), then the voltage at the terminals of the field winding of *G* and the excitation of this machine will increase with an increase of the load current, *I*, and consequently the voltage at the terminals of *G* will rise. However, no exact compounding is possible in this way for two reasons: first, the additional voltage furnished by *S* is not proportional to the excitation, *I/m*, on account of saturation and armature reaction in *S;* even if the increase of the voltage at the terminals of the field winding of *G* was proportional to the increase of the main current, *I*, yet the voltage at the brushes of *G* would not rise in the proper proportion necessary to compensate for the total armature reaction of *G* at any load, since this reaction increases more quickly than the main current. Therefore, if exact compounding is obtained, for instance, at full load, the machine will be overcompounded at less than full load. Let us now provide the motor, *M*, which drives *S* with a winding of thick wire, in parallel to a resistance, *s'*, in the main circuit, so that the current, *I/n*, passes through this winding. If the direction of the flow of this current is such that the action is differential (i. e., that this action weakens the field of *M* when the current, *I*, increases), then the speed of *M* and *S*, and therefore the additional voltage produced by *S* will increase simultaneously with the main current, *I*, and this effect will be added to the effect described before. This second method, however, has the same disadvantages as the first one. The additional voltage gives a greater compounding effect for lower loads than for full load; first, the increase of speed is not proportional to the diminution of the exciting ampere-turns, and, second, the increase of the additional voltage generated by *S* is not proportional to the increase of the speed. If we combine, however, both methods in such a way that we employ the first method in an exaggerated manner (overcompounding) and compensate this effect by the second method (by passing the current, *I/n*, through the thick wire excitation winding of *M* in such a direction that its action increases the magnetic flux of *M* with increasing main current, *I*), then by properly proportioning everything it is possible to produce exact compounding at any load. Fig. 2 illustrated diagrammatically the above considerations. Curve (1) represents the voltage at the brushes of *G*, where there is no compounding; (2) is the additional voltage produced at the brushes of *G* when *S* revolves with constant speed; (3) the voltage at the brushes of *G* when *S* revolves with constant speed; (4) the negative voltage produced at the brushes of *G*, due to the decrease of speed of *M* and *S*; (5) is the voltage at the brushes of *G* if the two methods, described above, are employed, the second compensating for the first. It is then $m\,e = m\,a + m\,b - m\,d = m\,c - m\,d =$ constant. In the case of a central station with several identical generators, like G_1, G_2, G_3, etc., in Fig. 3, it is feasible to use one single booster for the whole station, if both *S* and *M* are shunted by as many resistances, *s* and *s'*, in parallel as there are machines. The following advantages are claimed for the method. The generators, *G*, are shunt-wound and their operation in parallel is extremely simple. The booster needed is a very small machine. For instance, if the generator, *G*, gives 600 amp. at 500 volts (300 kw), the exciting current will be not more than 20 amp. and the additional voltage required for compounding 100 volts. Both *S* and *M* may then have a capacity of 2 kw. In the case of a simple booster for three 300-kw generators (Fig. 3), *S* and *M* must have a capacity each of 6 kw. This method of compounding can be employed with two stations, situated at a distance from each other and supplying current to the same network. This method may be easily employed in stations containing shunt-wound generators, if the field of the same is not too highly saturated and if the excitation winding has a sufficiently large diameter.—*L'Eclairage Elec.*, May 19.

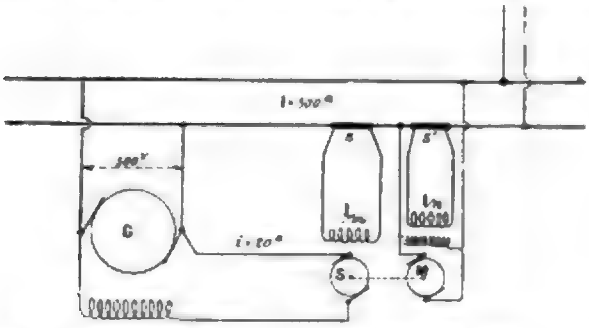


FIG. 1.—DIAGRAM OF DYNAMO AND BOOSTER CONNECTIONS.

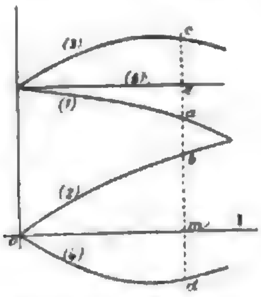


FIG. 2.—VOLTAGE CURVES.

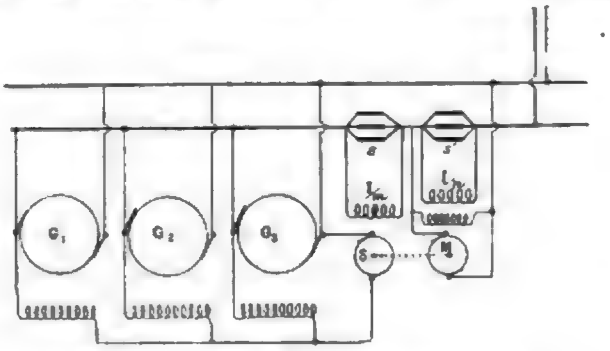


FIG. 3.—ONE BOOSTER AND THREE GENERATORS.

British Central Station Finance.—An abstract of an annual report of the Ipswich municipal lighting and tramway station. The following figures give a comparison between the results obtained at Ipswich and the average of 176 other municipal stations, the figures meaning cents per kw-hour.

	Coal, etc.	Oil, waste water, and stores.	Wages of workmen.	Repairs and and maintenance.	Total works costs.
Ipswich	0.92	0.060	0.592	0.284	1.856
Average of 176 towns.	1.10	0.152	0.560	0.462	2.274

The number of kw-hours sold for lighting at Ipswich were 235,749, for power 159,734, for traction 728,020; hence the total number of kw-hours sold was 1,123,503. The generating cost was 1.678 cent, the distributing cost 0.178; hence total works cost 1.856; management charges 0.566, hence total costs excluding capital charges, 2.422 cent; and total cost, including interest and sinking fund, 4.490 cents. The capital expenditure on permanent way per route-mile is approximately $27,350, on overhead equipment $4,740, and on feeders and mains $2,565.—Lond. *Elec.*, May 18.

Wood as Insulator.—WERNICKE.—A discussion of the influence of a polish on the insulating properties of wood. Several kinds of wood were tested. Even if the polish is applied with great care the insulating qualities of wood are not improved. Polished switch handles of wood have no advantage over unpolished ones with respect to their insulating strength. It is practically impossible to polish a handle of wood without flaws since any polish suffers by the influence of the weather and by the continuous handling of the wood.—*Elek. Zeit.*, May 17.

Canvassing.—BROWN.—In an article on "getting new business for electric central stations," the author recommends the organization of a special department for cataloging and tabulating all kinds of data which are to be used later on by the canvasser for new business. Some remarks are also made on the hiring of motors and kindred subjects.—*Cassier's Mag.*, June.

Wires, Wiring and Conduits.

Wiring Regulations.—A set of rules proposed by a committee of the German Association of Elec. Eng. concerning the construction of plug sockets in which mistakes in the current strength are made impossible by using different distances between the plugs for different currents, while mistakes in polarity are made impossible by making the diameters of the plugs different. The regulations proposed are discussed in an article by Hermann. Another set of regulations refers to the construction of insulating pipes covered with a metal tube or wound with metal strip for protecting cables. This set of rules is discussed in an article by George.—*Elek. Zeit.*, May 10.

Units, Measurements and Instruments.

Single-Phase Induction Meter.—An official communication from the Reichsanstalt, describing a single-phase induction meter of the Allgem. Elek. Ges., which has been admitted by this bureau for calibration. The instrument is essentially a two-phase induction motor with a magnetic brake and a counting device. The general construction is indicated in Fig. 4, which shows the revolving aluminum disc, *A*. The connections are shown in Fig. 5. The aluminum disc revolves in the gap between the terminals of the three iron cores, E_1, and the iron piece, E_2. The two iron cores, E_1, at the two sides are provided with the shunt winding, f_1 and f_2, in series with an inductance, *D*, and in parallel with a non-inductive resistance, *w*. The middle core, which is shorter than the other two, has the main winding. In the shunt winding a current flows which lags about 80° in phase behind the applied voltage (for the mean width of the adjustable air-gap of the inductance, *D*). The provision of the resistance, *w*, in parallel with f_1 and f_2 has the effect that the eddy currents generated by the shunt winding flux in the aluminum disc are in phase with the flux of the main current for non-inductive load and that the eddy currents produced by the main current flux are in phase with the shunt field. The reaction of each of the two fields upon the eddy currents produced by the other produces a force which causes the disc to revolve and which is proportional to the main current, the voltage at the terminals and the cosine of the phase different between the same. The power is consumed partly by friction and partly by the eddy currents generated by the braking magnet, *M*, in the aluminum disc. To compensate for the friction, a small additional torque is produced by fastening an adjustable iron sheet to the front core. In order to prevent the meter from revolving when no current is flowing, the hub of the armature disc is provided with a small piece of iron wire which is so bent that it is arrested when passing the brake magnet, as long as the current in the main coils is below 1 per cent of its maximum value. The instrument is described in great detail. The same issue contains an illustrated description of a three-phase induction meter of the Allgem. Elek. Ges.—*Elek. Zeit.*, May 24.

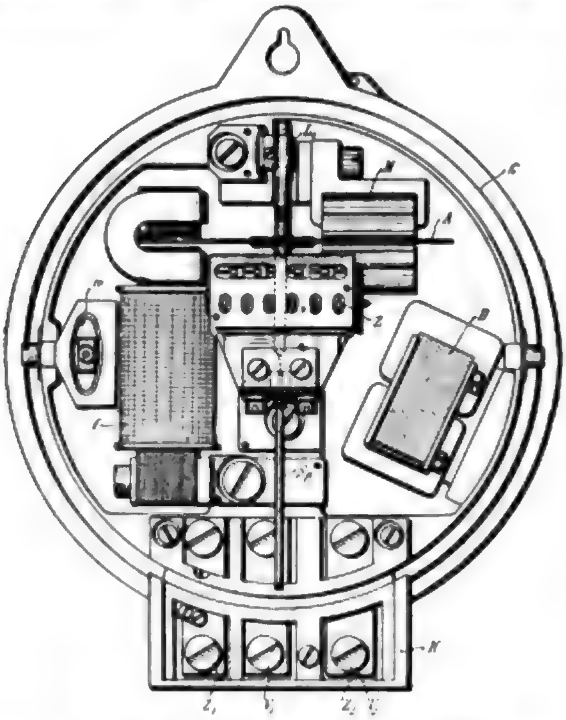


FIG. 4.—SINGLE-PHASE INDUCTION METER.

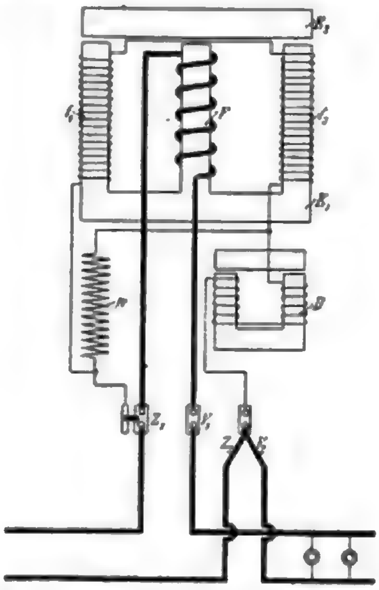


FIG. 5.—DIAGRAM OF METER CONNECTIONS.

Dead Points of a Galvanometer Needle for Transient Currents.—RUSSELL.—An abstract of a British Phys. Soc'y paper. When many types of needle galvanometer are connected with a condenser and a battery in the ordinary manner by a charge and discharge key the following phenomena can easily be observed. When the needle is initially at right angles to the axis of the galvanometer coil, and the spot of light is in the center, *X*, of the scale, the throws on charge and discharge are equal. If the controlling magnet be turned through a small angle, or if the suspending fibre be twisted slightly so that the spot of light is not in the center of the scale initially, the throws on charge and discharge are not equal. The algebraic difference between them, however, is constant. Hence, for an initial position, P_1, of the spot of light there is no throw on charge, and similarly for another initial position, P_2, there is no throw on discharge. These points the author calls the dead points. If the resistance of the charging and discharging circuits are the same, $X P_1 = X P_2$. In this case the distance, P_1P_2, varies directly as the resistance of the charging circuit, and inversely as the applied voltage. If the initial position of the spot of light be outside of P_1P_2, the throws on charge and discharge are in the same direction. The author shows that these effects can be explained with considerable accuracy by supposing that the magnetism of the needle consists of two parts, one permanent and the other proportional to the magnetizing force. Lord Rayleigh formerly showed that this supposition is sufficient to explain the permanent deflection produced by an alternating current passing through the galvanometer coil, and that a galvanometer is a very imperfect instrument for indicating whether the integral sum of the transient currents through it is zero or not; he also mentioned the limitations this imposes on Maxwell's method of comparing mutual inductances. The author finds that it is easy to arrange with a low-resistance galvanometer so that a, relatively speaking, gigantic charge can be passed through the coil without producing any throw at all. He also finds that all the galvanometers he has tested, whether needle or moving coil, will produce throws when certain transient currents pass through them, even though the integral value of these currents is zero. It also appears that the effective internal resistance of ordinary condensers is appreciable in certain cases. These results are of importance in connection with several of the customary methods of testing.—Lond. *Elec.*, May 25.

Telegraphy, Telephony and Signals.

Magnetic Detector.—At the recent soiree of the Royal Society in London, Walter exhibited a new magnetic detector for wireless telegraphy. Two small continuous-current magneto machines, with shuttle-wound armatures, are connected with their voltages in opposition, and are so adjusted that normally no current flows. The core of one armature, instead of being made of the usual laminations, is formed of a coil of iron wire, the ends of which are brought out and connected to the receiving circuit. Electric oscillations are thus passed through the core, and produce the well-known effect of increasing its permeability. Hence the winding of that armature revolves in a stronger field, and generates a higher voltage, upsetting the electrical balance of the system, and providing an external direct current which will affect a galvanometer every time an electric wave is received. The signals may be heard in a telephone receiver, as the current is only momentary, or may be taken down by a recording instrument worked through a delicate relay.—Lond. *Eng'ing*, May 11.

Directed Wireless Telegraphy.—Braun.—The first part of a mathematical article describing his method of sending wireless telegraph messages in a certain direction, the principle of which was described and illustrated in the Digest, December 16, 1905, p. 1041. The same issue contains a long editorial summary of the various attempts which have been made on directed wireless telegraphy.—Lond. *Elec.*, May 25.

Submarine Signalling.—Miller.—A paper read before the London Society of Arts on submarine signalling by means of sound. —Lond. *Elec.*, May 11.

Electrophysics and Magnetism.

Variations of Resistance of Thin Metallic Films by Influence. —Bose.—A very thin metallic film is inserted in a Wheatstone bridge arrangement, which enables one to measure the resistance of the film. This thin metallic film is placed between two insulating glass or mica plates against the outer surfaces of which thicker metallic plates are pressed which are connected with one pole of an influence machine. These two plates thereby receive an electrostatic charge of a certain sign, while the thin film in the center receives a charge of the other sign. This is applied directly by the author to electronic considerations. If, as is usually assumed, the negative electrons alone have a high mobility, it follows that when the two external plates are positively charged, the resistance of the film in the center must decrease; when negatively charged, the resistance must increase. This was in fact confirmed by the experiments of the author. This gives a direct and easy method of determining the numbers of negative electrons in metallic conductors. For platinum the author finds as an average 10^{22} electrons per c.c.—*Phys. Zeit.*, June 1.

Energy, Duration, Damping and Resistance of Condenser Sparks.—Heydweiller.—The art of wireless telegraphy has given a new importance to the study of electric sparks. The present author points out the necessity for adding another term to Lord Kelvin's celebrated differential equation, which expresses energy relation in regard to the discharges of a condenser. This new term expresses the spark energy. The resulting differential equation is complicated and its integration in the words of the author must remain a pious wish; still several solutions can be obtained by making suitable suppositions in regard to the electrical constants of the circuit. The author finds that the resistance of the condenser sparks which are usually employed in wireless telegraphy is less than an ohm.—*Am. Jour. of Science*, June; from *Ann. d. Phys.*, No. 4.

BOOK REVIEWS.

Fowler's Electrical Engineers' Year Book. Manchester, England: Scientific Publishing Company. 643 pages, 100 illustrations, numerous tables. Price, 1 shilling, sixpence.

This is the 1906 edition of Mr. Fowler's well-known pocket book for electrical engineers. The present edition has been revised and somewhat enlarged. Among the new material may be mentioned a section dealing with the design of alternators and a section treating on steam turbines and turbo-generators. Power and cost of electric distribution are matters on which additional information is given, and some notes on insulating materials used for electric machines are added. The usual Board of Trade Rules for lighting and traction, and also the new regulations for the use of electricity in mines, have been included.

Illustrated Technical Dictionary. In Six Languages—English, German, French, Russian, Italian and Spanish. Vol. I, Machine Details and Tools. New York: McGraw Publishing Company. 403 pages. Price, $2.00.

This is the first volume of the American edition of a series of technical dictionaries of which eleven volumes are now under preparation, the compilers being K. Deinhardt and A. Schlomann. The second volume to be issued will be on electrical subjects, and other volumes will cover steam boilers and steam engines, hydraulic machinery, hoisting and conveying machinery, small tools and machine tools, metallurgy, etc. The dictionary is on a new plan and one that appears to meet more nearly than other technical dictionaries published the numerous difficulties involved in the production of a successful technological dictionary covering a number of languages. The main feature of the dictionary consists in a classification whereby related subjects are brought together, reference to any desired subject being obtained through a general index of the terms for all languages covered, which comprises about one-half of the volume. Another admirable feature consists in the use of simple illustrations in line whereby one who refers to the dictionary can determine which one of several related entries is that which he is seeking. For example, in the present volume, if the foreign term for a certain kind of a saw is desired, or if in reading, the foreign term for a saw is encountered, the reader first refers to the index for the page number, which passes him to the section on saws. There he will find illustrations of all the various classes of saws, and thus if he wishes to find the exact foreign word for a particular kind of a saw he is guided by the illustration; or if, on the other hand, a foreign word refers to a kind of saw with which he is not acquainted, he is informed by the illustration. In the case of subjects having a number of parts, such as a steam cylinder, all of the parts of a general illustration are lettered, and instead of repeating illustrations of details in the middle column, letters corresponding to the various parts shown in the general illustration are substituted.

The pages contain three columns, with the illustrations, and references to illustrations, in the middle column. The column on the left contains the words in German, English and French and in the third column are the words in Russian, Italian and Spanish. The general index contains, of course, every term in the dictionary, alphabetically arranged, without distinction of language. The index to Russian terms is printed separately, owing to the variation of the Russian alphabet from that of the other five languages covered.

BOOKS RECEIVED.

Shaft Governors. By W. Trinks and C. Housum. New York: D. Van Nostrand Company. 97 pages, 24 illustrations. price, 50 cents.

Electric Power Plants. By Norman H. Schneider. Revised Edition. New York: Spon & Chamberlain. 274 pages, 203 illustrations. Price, $1.50.

Practical Telephony. Fourth Edition. By James Bell and S. Wilson. London: S. Rentell & Company. 381 pages, 322 illustrations. Price, 3s. 6d.

The Practical Telephone Handbook. Third Edition. By Joseph Poole. London: Whittaker & Co. 533 pages, 473 illustrations. Price, $2.00.

Entwurf von Schaltungen und Schaltapparaten. Vol. I. By Robert Edler. Hannover: Max Janecke. 192 pages, 186 illustrations. Price, 6 marks.

Motive Power and Gearing for Electrical Machinery. By E. Tremlett Carter. Second Edition. New York: D. Van Nostrand Company. 654 pages, 199 illustrations. Price, $3.00.

A Practical Treatise on the Steam Engine Indicator and Indicator Diagrams. Second Edition, Revised and Enlarged. By W. Worby Beaumont. New York: D. Van Nostrand Company. 250 pages, 128 illustrations. Price, $2.50 net.

A New Induction Watt-Hour Meter.

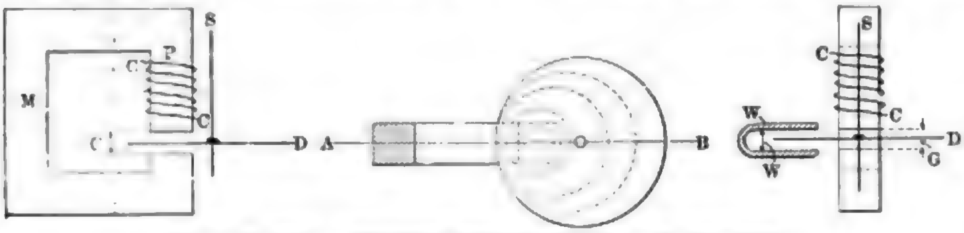
By G. Faccioli.

The subject of this article is the description and the study of a new induction watt-hour meter recently invented by Mr. William Stanley. The motor device used in this meter, although operating on the induction principle, is a decided departure from anything that has been made heretofore, and does not employ the phase-differing principle of Ferraris.

Its principle of operation may be seen from Fig. 1. *M* is an iron core provided with an air-gap, *G*. In this gap is a metal disc, *D*, mounted on a shaft, *S*; the pole, *P*, is wound with a coil, *C*. If alternating current is sent through the coil, *C*, a magnetic flux will be produced in the gap, *G*, and a system of eddy currents will be set up in the disc, *D*. The paths of these eddy currents are circles with their centers on the diameter, *AB*, as represented in Fig. 2.

The eddy currents of the disc, *D*, will set up a reaction flux which will be intense in the gap, *G*, under the pole, *P*, and naturally very weak outside of the pole, *P*, on account of the high reluctance of the magnetic circuit.

In the gap, *G*, there will be, therefore, a flux due to the resultant of the magnetomotive force of the current in the coil, *C*, and of the eddy currents in the disc. Let this resultant flux be represented by *F*. It is easily seen that with these conditions the disc will not rotate because the reaction of the eddy currents upon the flux, *F*, is such as to tend to compress each eddy current toward its center all along its path, and, consequently, the torques on one side of the diameter, *AB*, will be equal and opposite to the torques on the opposite side and thus cancel each other's effects. If, however, the value of the torques is artificially increased on one side of the diameter, *AB*, then the disc will rotate. In order to obtain this result, Mr. Stanley provides the apparatus with a third element, the wing or armature, *W*, which embraces the disc on one side only of the pole, *P*, as shown in Fig. 3. This wing is simply an iron leaf affording a magnetic circuit of low reluctance to the flux set up by the eddy currents on one side of the pole, *P*. Fig. 4 shows one of these wings.



FIGS. 1, 2 AND 3.—SKETCHES SHOWING PRINCIPLE OF OPERATION.

As a result of this arrangement there is again a resultant flux, *F*, in the gap, *P*, due to the resultant m.m.f. of the current in the coil, *C*, and of the eddy currents of the disc, and a flux, *f*, in the gap of the wing, *W*, due to the eddy currents only and in phase with them. Evidently, the flux due to the eddy currents on the other side of the pole, *P*, is negligible.

Fig. 5 represents a disc with a section of the exciting pole and the wing in the right position. The shape of the wing is designed to give the maximum torque for the weight used.

It is interesting to note that the main flux set up by the current in the coil, *C* (Fig. 1), is not a torque factor; that is to say, this flux does not react on the eddy currents to produce rotation, but its function is simply to excite the eddy currents in the disc, the torque being caused by the reaction of these eddy currents upon the flux that they themselves have set up in the gap of the third element, *W*. In other words, the flux, *f*, of the gap in *W*, attracts the eddy currents of the disc, *D*, which will, therefore, continuously rotate from the pole, *P*, towards the wing, *W*.

The torque is proportional to the product of the eddy currents times the flux, *f*, of the gap in *W*, and since this flux, *f*, is proportional and in phase with the eddy currents producing it, the torque is proportional to the square of such eddy currents. For fixed mechanical dimensions of the motor and fixed frequency of the supplied current the eddy currents are proportional to the flux, *F*, and consequently, the torque is proportional to F^2.

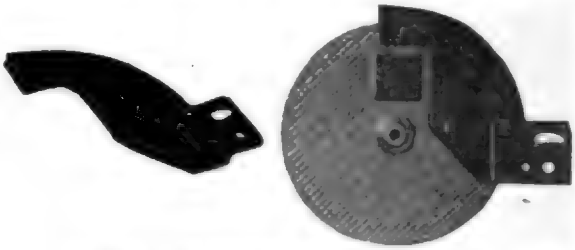
In order to measure the watt-hours properly it is necessary to have an apparatus whose torque acting upon the disc shall be proportional to $EI \cos \theta$, where *E* and *I* are respectively the electromotive force and the current of the circuit to be measured, and θ the angle representing their difference of phase.

At first sight it seems impossible to use the motor above described to measure electrical energy, because its torque is proportional to the square of the flux, *F*, and consequently proportional to the square of the m.m.f. of the coil, *C*. This m.m.f. can be made proportional to the voltage or to the current of the circuit to be measured, or to a combination of both, but in any case, it is impossible to reach a torque proportional to $EI \cos \theta$. It is, therefore, necessary to automatically extract the square root of the torque produced by the m.m.f. upon the motor.

To solve this difficulty, Mr. Stanley combines two motors of the type above described in a differential system, as illustrated in Fig. 6. Fig. 7 represents the iron cores and windings of the two motors one on top of the other. Fig. 8 represents the movable part of the system consisting of two aluminum discs of identical dimensions mounted on the same staff, each disc being energized by one of the two motors represented in Fig. 6. The system is a differential system; that is to say, the torques of the upper and lower motor are in opposite direction (Fig. 6), in fact, the wing of the upper motor is on the right-hand side of its pole, tending to produce a counter-clockwise rotation of the movable system, while the wing of the lower motor is on the left-hand side, tending to rotate the movable system in a clockwise direction.

The resultant torque which will actually produce rotation of both the discs will then be the difference of the individual torques of the two motors. The value of these torques and of their resultants is easily found by referring to the diagram of connections in in Fig. 9. *A* and *B* represent two coils which are wound on the pole of the upper motor of the system. *A'* and *B'* are two coils which are wound on the pole of the lower motor of the system. *A* and *A'*, which are identical and constitute the shunt winding of the apparatus, are wound in the same direction and are connected in series across the mains of the load circuit. *B* and *B'* constitute the series winding of the apparatus; they are identical and are connected in series one with the other, and are traversed by the current of the load circuit. This current, however, flows through the coil, *B'*, in a direction opposite to that in the coil, *B*. The arrows in Fig. 9 show the direction of the currents flowing at a certain instant through the system.

To clearly understand the operation of the apparatus, consider the case of non-inductive load, and suppose for the moment that the m.m.f. of the current in the coils, *A* and *A'*, is proportional and in phase with the e.m.f., *E*, of the system, and that the m.m.f. of the coils, *B* and *B'*, be proportional and in phase with the current, *I*, of the system. In this case, the fluxes of all four coils will be in phase (load power factor = 1). If the flux produced by each one of the coils, *A* and *A'*, be denoted by *a*, and *b* denotes the flux produced by each of the coils, *B* and *B'*, then the total flux of the upper motor (coils *A* and *B*) is $a + b$, while the total flux of the lower motor is $a - b$. It follows that the torque of the upper motor will be proportional to $(a + b)^2$, and that the torque of the lower motor will be proportional to $(a - b)^2$. The resultant torque of the system will be proportional to $(a + b)^2 - (a - b)^2 = 4ab$. The resultant torque will then be proportional



FIGS. 4 AND 5.—VIEWS OF WING AND DISC.

to the product of *a* and *b*, and since *a* and *b* are respectively proportional to the e.m.f., *E*, and the current, *I*, of the circuit, the resultant torque of the apparatus will be proportional to *EI*; that is to say, to the power in the circuit.

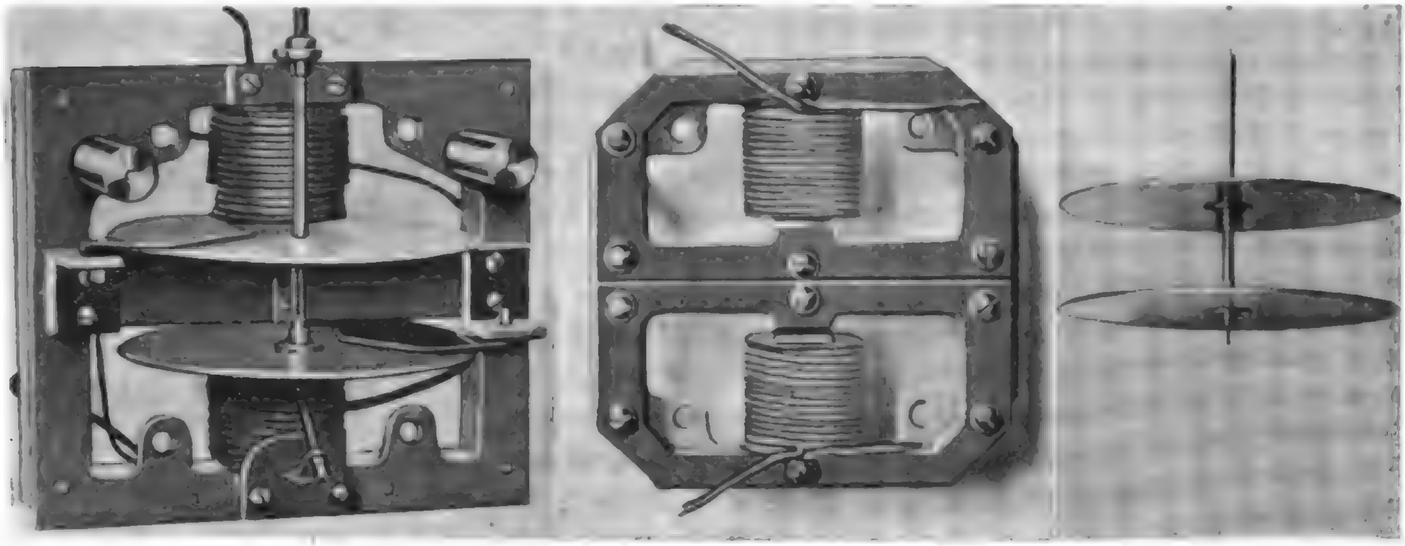
It may easily be demonstrated that the torque is proportional to the true watts of the circuit, even in the case of inductive load. Referring to Fig. 10 where the vectors, *a* and *a'*, *b* and *b'*, represent in magnitude and phase the fluxes produced respectively by the currents in the coils, *A* and *A'*, *B* and *B'*, *a* and *a'* are of the same value and direction, and are supposed to be proportional to, and in phase with, the e.m.f., *E*, of the circuit. Similarly, *b* and *b'* are of the same value but of opposite direction, and are proportional to and in phase with the current, *I*, of the circuit. If Θ is the angle formed by *a* and *b*, $\cos \Theta$ is the power factor of the load circuit. The upper motor (energized by coils *A* and *B*) will have a resultant flux represented in magnitude and phase by *c*, the value of *c* being represented by the formula

$$c = \sqrt{(a + b \cos \Theta)^2 + b^2 \sin^2 \Theta}$$

The lower motor (energized by coils *A'* and *B'*) will have a resultant flux represented in magnitude and phase by *d*, the value of *d* being given by the formula

$$d = \sqrt{(a - b \cos \Theta)^2 + b^2 \sin^2 \Theta}$$

The torques of the two motors will be respectively proportional to c^2 and d^2, and the resultant torque of the system will be proportional to $c^2 - d^2 = 4\,ab \cos \Theta$. In other words, the torque of the apparatus is proportional to the true watts of the circuit for a load at any power factor.



FIGS. 6, 7 AND 8.—COMPONENT PARTS OF MOTOR.

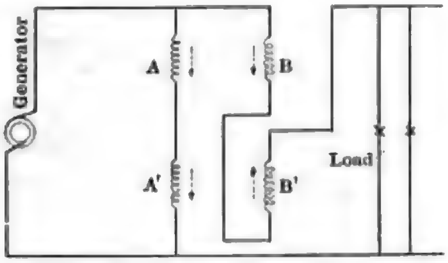


FIG. 9.—DIAGRAM SHOWING METHOD OF PRODUCING TORQUE.

It has thus far been assumed that the m.m.f's of the shunt coils, *A* and *A'*, are in phase with and proportional to the e.m.f., *E*, of the circuit, and that the m.m.f's of the series coils, *B* and *B'*, are in phase with and proportional to the current, *I*, of the circuit. It is to be noted, however, that the coils, *A* and *A'*, constituting the shunt winding of the meter, are wound with a large number of turns, and, therefore, the shunt current flowing through such coils and their m.m.f's will lag considerably behind the e.m.f., *E*, of the circuit on account of the high self-induction of the coils, *A* and *A'*. On the other hand, the m.m.f. of the coils, *B* and *B'*, are in phase with and proportional to the load current, *I*, of the circuit. If the simple connections of Fig. 9 were used the resultant torque of the meter would be proportional to the e.m.f., *E*, of the circuit, but lagging behind it; *b* would be proportional to and in phase with the current, *I*, of the circuit, and the angle, Θ, between *a* and *b*, would be different from the phase displacement between the e.m.f., *E*, and the current, *I*, of the circuit. It is obvious that in order to obtain a torque proportional to the true watts it is necessary that the angle between *a* and *b* be equal to the angle between the electromotive force, *E*, and the current, *I*, *a* and *b* being respectively proportional to *E* and *I*. To reach this result it is then necessary to lag the m.m.f. *b*, behind the current, *I*, by the same angle by which the magneto-motive force, *a*, lags behind the electromotive force, *E*. In other words, the current, *i*, actually flowing through the series coils, *B* and *B'*, of the meter must be proportional to the load current, *I*, of the circuit and lag behind it by the same angle by which the current flowing through the coils, *A* and *A'*, lags behind the electromotive force, *E*. To shift *b* behind *I* by the required angle the arrangement shown in Fig. 11 is used.

The series coils, *B* and *B'*, are shunted by a non-inductive resistance, *R*, so that the total load current, *I*, will be split in two, a part, *i*, flowing through the meter coils and originating the m.m.f., *b*, and the part, *j*, flowing through the non-inductive resistance, *R*. By conveniently proportioning the value of *R* for a given resistance and inductance of the meter coils, *B* and *B'*, it is possible to lag *i* behind *I* by the required angle.

The shunt resistance, *R*, must be smaller in value the larger is the required angle, and it is evident that the smaller the resistance, *R*, the larger will be the amount of current shunted away from the meter windings. The result is that, for certain requirements the angle should be kept as small as possible, but on the other hand, the following considerations of the performance of the meter suggest the use of a considerable phase displacement between the m.m.f's, *a* and *b*, and the e.m.f. and load current of the circuit. We have seen that for given mechanical dimensions of the apparatus and for a given frequency the torque of each motor is proportional to the square of the magnetizing flux of such motor, and the resultant torque of the instrument is proportional to the power in the circuit. If, however, the frequency of the circuit is changed, the same value of the energizing flux,

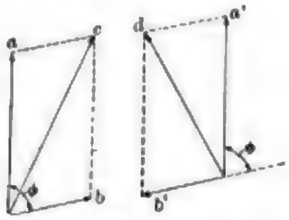


FIG. 10.—COMBINATION OF FLUXES.

F, will produce in the disc eddy currents whose value increases with the frequency of *F*, consequently, the torque of each individual motor which is proportional to the square of the eddy currents will increase with the applied frequency, and almost proportionally to the square of such frequency. Evidently, the resultant torque of the instrument will follow the same law as the torque of each individual motor.

To compensate the meter for variations of frequency it is necessary that the flux, *F*, depend not only on the voltage, *E*, and the current, *I*, of the system, but on its frequency also; that is to say, for the same amount of power in the circuit the flux, *F*, must decrease when the frequency increases, and increase when the frequency decreases. This result can be obtained by controlling the shunt and series currents of the meter by the inductance of the windings rather than by their resistance, so that within a certain limited range of frequency the meter readings will be practically correct.

The value of the shunt current flowing through the coils, *A* and *A'*, is inversely proportional to the impedance of the circuit, and will, therefore, decrease with the increase of the applied frequency, and this shunt current will lag in phase behind the e.m.f., *E*, of the circuit by an angle whose tangent is equal to the ratio of the reactance to the resistance. Similarly, the current flowing through the series coils, *B* and *B'*, of the meter, which are shunted by a non-inductive resistance, *R*, depends upon the frequency of the system, and its variations in phase and value are nearly identical with those of the shunt current of the meter.

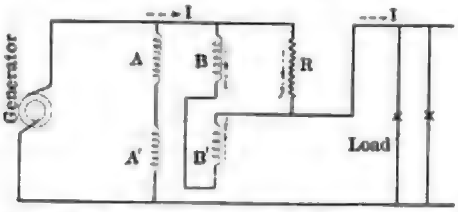


FIG. 11.—DIAGRAM SHOWING METHOD OF LAGGING THE SERVICE CURRENT.

It is to be noted that the shunt circuit of the apparatus, although superimposed on the poles of the series circuit, is absolutely independent of it. In fact, the fluxes produced by the current in the shunt coils, *A* and *A'*, thread through the coils, *B* and *B'*, in opposite directions and similarly, the fluxes produced by the current in the series coils, *B* and *B'*, thread through the coils, *A* and *A'*, in opposite directions; consequently, the mutual induction of the two circuits is zero. Similarly, the whole flux of the upper motor is independent of the flux of the lower motor; they are carried by separate magnetic circuits and work on separate discs, making impossible any interaction between the fluxes of the two motors.

The mechanical construction of the apparatus is extremely simple. The upper and lower motor are identical and each motor consists of a laminated iron core provided with one gap only, this gap being energized by two superimposed coils. The element which plays the most important part in the operation of the apparatus, the wing, is also the simplest in mechanical construction. The torque of each motor depends, naturally, upon the area of the disc embraced by the wing and can be easily varied by changing the position of the wing. Each wing is, therefore, adjustable in position, and thereby the apparatus can be easily and perfectly balanced. To complete the apparatus it is only necessary to provide one of its discs with permanent brake magnets and connect the staff to a train in the usual manner. See Fig. 12.

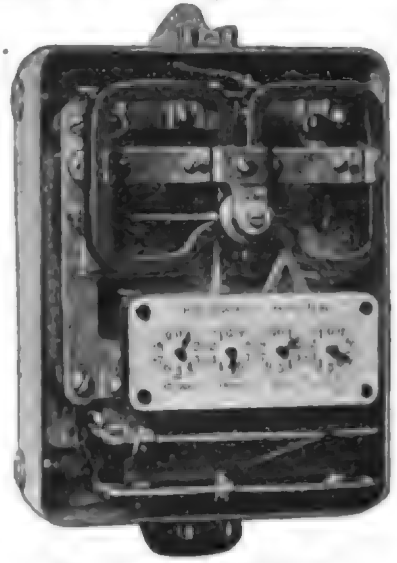


FIG. 12.—WATT-HOUR METER.

Many meters of this type have been built and experimented upon and the results of the tests are most excellent and corroborate the theory here given. The load curve and the voltage curve of the meter at different power factors and frequency are almost perfect.

Koerting Four-Stroke Cycle Gas Engine.

Fig. 2 herewith shows the single-cylinder Koerting four-stroke cycle gas engine which is built in this country by the De La Vergne Machine Company, of New York City, in sizes ranging from 75 to 350 hp. The engine, which is of massive and stiff construction, is fitted with open-end, trunk-type pistons, by means of which cross heads and guides are obviated and the number of working parts reduced. The cylinder is water-cooled and is securely held by the main engine frame casting. The crank end is packed against the cooling water in the jacket by a small stuffing box which allows longitudinal expansion. The joint at the head end of the water jacket is made by a thin gasket inserted between the flange of the cylinder and the main frame casting against which it is securely held by the main cylinder head studs. The double-seated mixing valve, to which this engine owes its popularity, is operated automatically by the incoming complements of gas and air. The exhaust valve being closed when the engine passes dead center, the piston starting on its forward stroke tends to form a vacuum within the cylinder. A slight reduction in pressure, however, suffices to open the mixing valve and admit air by one of its seats and gas by

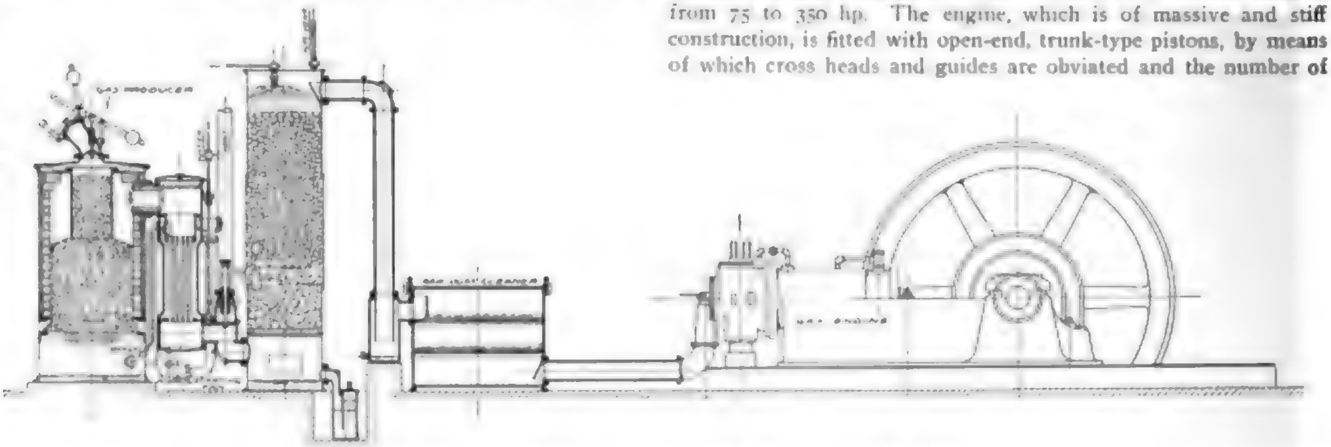


FIG. 1.—SECTIONAL ELEVATION OF KOERTING SUCTION GAS PRODUCER.

the other. Gas is supplied to the mixing valve in proper proportions to insure perfect combustion by means of an outside set valve.

The governor does not regulate the speed of the engine by varying the proportions of gas and air, but by measuring out the amount of mixture required by the load on the engine. It is very sensitive and operates a butterfly valve. Ignition of the mixture is effected by an oscillating magneto and the plugs carrying the rods and contact points are readily removable. The time of ignition can be varied at pleasure while the engine is running. Compressed air stored in a receiver is used to start the engine, the air pressure being maintained by an auxiliary compressor driven by the engine itself. The valves are operated by push rods from cams on a shaft driven by skew gear from the crank shaft. Three brackets rigidly support the boxes of this shaft, the spur gear which runs the governor being situated near one of the brackets. The exhaust valve is located a little above the bottom of the cylinders so as to prevent back fire due to oil residuum passing from the cylinder into the valve. A relief valve is provided on the bottom of the cylinder for blowing out any oil residuum which might gather.

The Koerting suction gas producer is shown in Fig. 1. This consists essentially of a generator, an evaporator, a scrubber or purifier and a sawdust purifier. The construction is evident from the engraving. The producer is started by building a fire on the grate of the generator and charging it with coke or coal. Air is forced through the generator by means of a small hand blower until the charge is well ignited, a vent valve permitting the smoke to escape up the chimney. The fuel having become incandescent up to the bottom of the hopper, the chimney passage is closed and the gas tested. If it burns with a reddish-blue flame not easily extinguished, the valve leading to the mixing valve may be opened and the engine started. As soon as the engine has made a few revolutions it will pump its own gas, and unless the exhaust fan is required to force the gas through an outside system it can be stopped. Simplicity and low first cost are among the numerous advantages claimed for suction gas producers. The De La Vergne Machine Company has at its works a 75-hp engine in continuous operation in connection with a suction gas producer developing, it is claimed, one brake horsepower with less than one pound of coal.

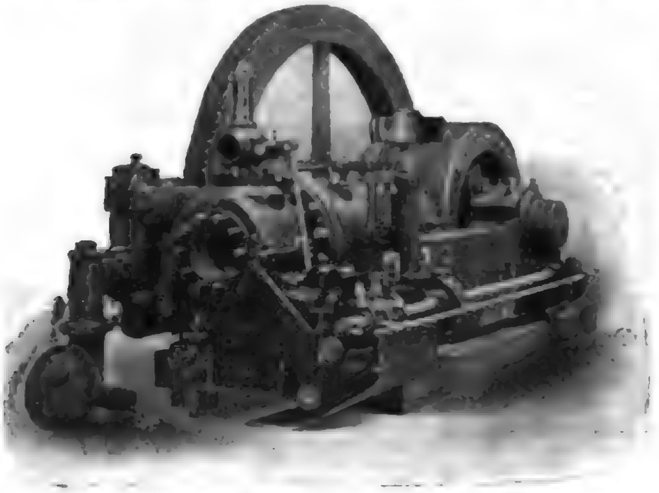


FIG. 2.—KOERTING FOUR-STROKE CYCLE GAS ENGINE.

Electrification Plans of the Erie Railroad.

The contract for the electrification of the Rochester division of the Erie Railroad, between Mt. Morris and Rochester, N. Y., was awarded last week to Westinghouse, Church, Kerr & Co. This section is about 35 miles in length and extends south from Rochester to the junction of the Rochester branch with the Delaware, Lackawanna & Western Railroad. Work has already been commenced.

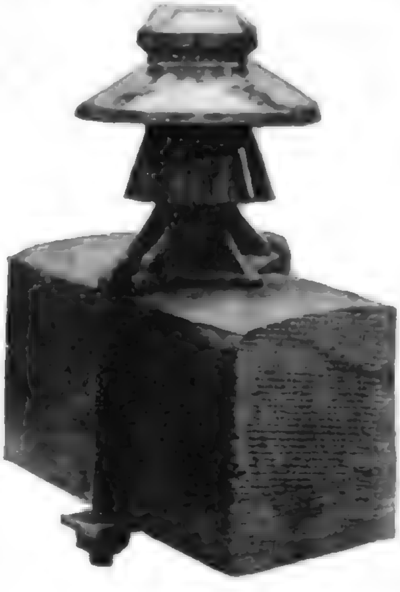
The next section of the Erie Railroad Co.'s system in western New York to be equipped is from Avon to Corning, a distance of about 70 miles. The single-phase system has been adopted and the operating voltage will probably be the same as that adopted by the New York, New Haven & Hartford Railroad, or 11,000 volts. In this case only one sub-station, located about the middle of the line, will be required. Power will probably be taken from the transmission lines of the Ontario Power Company, which cross the tracks on that part of the Erie Railroad to be electrified.

The cars to be used will be very similar to the standard Erie Railroad passenger coach, but slightly shorter and slightly heavier. It is proposed to run the cars in trains with the multiple-unit system and part of each train will be composed of trailers. Later locomotives may be used on some trains.

The Electrical Commission of the Erie Railroad has now practically completed its work of preparing estimates upon the cost of electrification of the Greenwood Lake and other suburban divisions of the Erie Railroad near New York by the various systems in most common use, and these estimates will be considered by the Executive Committee at an early date.

A New Insulator Pin.

The accompanying illustration shows the type of insulator pin used on the overhead circuits of the Long Island Railroad Company. The pin, which is the invention of Mr. W. N. Smith, of Westinghouse, Church, Kerr & Co., who has applied for a patent on the device, will be placed on the market under the name of the "Smith-Grip Insulator Pin." More than 8,000 of these pins are used on the transmission lines of the Long Island Railroad, carrying 250-cir.-mil cables in spans averaging 150 ft. in length, and no failures have been reported after a year of service. A dozen or more standard sizes of an improved design of the pin are being worked up, to fit various sizes of cross arms and pole tops and to carry insulators of various sizes. While designed particularly for use with wooden cross arms, the pin can be readily adapted to steel cross arms or any special pin support, and also used in heavy catenary trolley construction.



NEW INSULATOR PIN.

The claims made for the pin are as follows: It does away with the necessity of boring holes in the cross arms, thereby conserving the whole strength of the arm and lengthening its life; the metal composing it is distributed in the most effective manner possible, and its cross-section is greatest next to the arm where the greatest resistance to bending is required; and finally the shrinkage of the arm can more effectively be taken care of by the U-bolt and strap than by any of the other forms of pin fastening in common use, as there is no tendency to distort the bolt, and consequently there is no possibility of the pin standing crooked upon the arm after the shrinkage has been taken up. Furthermore, it is practically indestructible, and instead of being one of the weakest factors in line construction it will be the strongest, as the cross arm will not be weakened by holes.

Convention Exhibits.

Considerable space was devoted in these pages last week to notes of the exhibits, etc., at the Atlantic City Convention of the N. E. L. A. Further data are given below:

The Samson Cordage Works, of Boston, was represented by Mr. F. J. Coakley.

Mr. Arthur Bosley, of the Electrical Material Company, of Baltimore, attended the convention.

Messrs. Walker & Kepler, of Philadelphia, were represented by Mr. H. G. Walker and Mr. Fred Dolbier.

The Sterling Varnish Company, of Pittsburg, was represented by Mr. Alvin S. King, Eastern manager.

The Frank H. Stewart Electrical Company, of Philadelphia, was represented by Mr. Frank H. Stewart, president, who had some samples with him.

Harvey Hubbell, Inc., of Bridgeport, Conn., manufacturer of the well-known Hubbell shades, reflectors, etc., was represented by its New York agent.

The Franklin Electrical Manufacturing Company, of Hartford, Conn., was represented by Mr. Henry A. Truitt, who also represented the Imperial Electric Company, of Philadelphia.

The Southern Power Company, of Charlottetown, N. C., are building a new plant on the Catawba River. Mr. F. D. Sampson, superintendent, attended the convention to study apparatus and secure data.

The Safety Insulated Wire & Cable Company, of New York and Bayonne, N. J., was represented by Mr. A. P. Eckert, sales manager, and Mr. James Ferguson, superintendent. It had an exhibit with the Electric Service Supplies Company. Mr. Eckert handed out to his friends a very attractive little note book.

The Electrical Trades Exposition Company, of Chicago, was ably represented at the convention by Mr. Henry F. Frosch, who made many friends and did good work on behalf of the second annual electrical show to be held in Chicago next January under the auspices of his company. A large number of applications for space have already been filed by the Atlantic City N. E. L. A. contingent.

Metropolitan Engineering Company, of New York, showed its new sign made of stamped steel with letters raised from the background finished in baked glazed enamel. This exhibit attracted much attention owing to the fact that these signs could be so readily read from any part of the pier. The company was represented by Mr. George Howe, general manager; Mr. Benjamin Wall, assistant general manager, and Mr. W. R. McDaniel, manager of sales.

The Baseball Game.—One of the entertainments provided at the N. E. L. A. Convention was a baseball game between the representatives of the East and the West. Captain Vaughan (Schenectady) and Captain Gilchrist (Chicago) were successful in securing two very evenly matched teams, who played a vigorous and exciting game, which resulted in a victory for the East, the score being 10 to 8. Umpire Wakeman was very successful in keeping the honors easy between the two teams, but escaped personal injury from the spectators.

The Rolling Chair Boardwalk Parade received proper zest from the happy thought of "The Silver King," Mr. W. P. Casper, of the Electric Service Supplies Company, Philadelphia, who at very short notice had printed a full batch of the touchingly sentimental ballad, "Why Don't You Try?" Mr. Casper, with his ostentatious modesty, disdained claiming the credit of the idea, which, he says, originated with the well-known general manager of the Union Electric Company, of Dubuque, Iowa, Mr. L. D. Mathes. That gentleman on being accused of the offence gracefully acknowledged his crime.

An Interesting Group was taken at the "Hylo" exhibit of four of the "Nestors" of the convention. The photograph is reproduced herewith. It is an excellent and faithful piece of work. On the left of the engraving is President G. R. Stetson, of the New Bedford Gas & Edison Company. Next to him is President A. C. Dunham, of the Hartford Electric Light Company. In the center is Mr. A. J. De Camp, manager of the Philadelphia Electric Company, and to the extreme right is Mr. Phelps, of the Hylo Company, between whom and Mr. Stetson a remarkable resemblance exists, much to the confusion of people who do not notice faces very closely.

New York Central Locomotive at Atlantic City.—One of the 100-ton electric locomotives which the General Electric Company and the American Locomotive Company are furnishing for the electrification of the New York Central lines in New York City arrived in Atlantic City June 8 from Schenectady, N. Y. During the attendance this month at various electrical and railroad conventions prominent officials from all parts of the country will have an opportunity to inspect the locomotive. Its capacity under ordinary working conditions is 2,200 hp, and it is said to be able to develop a speed of 80 miles an hour when in regular operation. It is the most powerful electric locomotive in the world. The locomotive is the same type as the famous "6000" which has so many times distanced its steam competitor while working out on the test track on the New York Central road near Schenectady, but bears on its side the number 3404 and the inscription "New York Central Lines." The locomotive is attracting much attention at the Pennsylvania side track where it is in charge of representatives of the two companies which have been co-operating in its manufacture.

The H. W. Johns-Manville Company was well represented with a complete line of "Noark" National Electrical Code standard enclosed fuses and fittings. This exhibit deserves special mention, on account of the number of new devices shown of the National Electrical Code standard type, which included several forms of service and subway boxes for 250 and 600-volt circuits. Several service switch boxes were shown, fitted complete with inlet and outlet attachments as required by the National Board of Underwriters. A complete line of "Noark" fuses and cut-outs of the National Electrical Code standard type for circuits of 250 and 600 volts were shown, as well as high-tension cut-outs and fuses for circuits of 10,000 volts and less. Another feature which attracted considerable attention was a line of high-tension porcelain insulators for transmission lines of 80,000 volts and less, and several special forms of giant strain insulators for circuits of 10,000 volts and less. The construction of the latter is such that all parts under strain are insulated with heavy sheet mica, and the entire exterior covered with moulded mica insulation, thus affording the greatest possible degree of surface insulation. Another product of the company is "Transite" asbestos fireproof doors for sub-station work and other similar purposes demanding a material combining insulating and fire-proof qualities which are necessary for the protection of property and attendants. "Niagrite" fire-proof cable insulation for insulating cables located in power houses, sub-stations and manholes was shown and is coming into general use, as this material effectually prevents short-circuits under these conditions. The company distributed a superb match safe and ash tray souvenir designed in the form of a "Noark" National Electrical Code standard enclosed fuse plug made of porcelain and bronze. The following representatives were present: Mr. J. W. Perry, manager electrical department, New York; Mr. C. G. Meek, of the New York office; Mr. C. N. Manfred, manager advertising department, New York; Mr. D. T. Dickson and Mr. H. M. Voorhes, of the Philadelphia office; Mr. A. D. Newton, of the Boston office; Mr. E. B. Hatch, president, and Mr. R. S. Cole, electrical engineer of the Johns-Pratt Company.

A GROUP OF OLD-TIMERS.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Although there was some quietness in wholesale and jobbing lines, business was more active than is usual at this season of the year and fall orders for dry goods and wearing apparel were of good volume. The warm weather has stimulated business in retail; and in the staple industries, with few exceptions, there was activity. Reports of grain crops become more irregular as the season advances, but on the whole the situation is equal to that of a year ago. The return flow of money from the country is large and easier rates are a feature. Railway earnings continue very heavy, the increase for May being 14 per cent on roads operating outside the anthracite coal fields. In the iron and steel market steel-making irons are scarce and firm and in good demand. The railroads are the heaviest buyers of structural material, the demand for bridge work being marked. Building operations in the City of New York, as well as in some of the other large cities, are being pushed with vigor. Dealers in building materials report good business, especially those who handle second-hand material. The high cost of building material generally turns the attention of builders to available second-hand stuff. In the copper market there was a good demand from domestic and foreign consumers of Lake and electrolytic. It is stated that an electrical engineering corporation bought 5,000,000 lb. of electrolytic for September delivery at 18½c. September Lake is in large request, and prices are firm at 18⅞ to 19c. to the larger domestic consumers. Casting copper is in fair supply for near-by delivery at 18¼c., 18½c. and 18⅝c. Liberal exports of copper are reported, and the outward movement so far this month is about 4,500 tons. The total exports during June last year were 22,000 tons; for 1904, 16,200, and for 1903, 8600 tons. *Bradstreet's* reports 162 business failures during the week ending June 7, against 127 the previous week and 194 in the corresponding week of last year.

SLIDING SCALE LAW.—The Governor of Massachusetts has signed the "sliding scale" law as applied to the price of gas in the city of Boston. The gist of it lies in these sections of the measure: Section 1. From and after the thirtieth day of June in the year nineteen hundred and six, the standard price to be charged by the Boston Consolidated Gas Company for gas supplied to its patrons shall be ninety cents per one thousand cubic feet of gas, which price shall not thereafter be increased except as hereinafter provided. From and after the said date the standard rate of dividends to be paid by said company to its stockholders shall be seven per centum per annum on the par value of its capital stock, which rate shall not hereafter be increased except as hereinafter provided. Section 2. If during any year ending on the thirtieth day of June the maximum net price per thousand cubic feet charged by the company has been less than the standard price, the company may during the following year declare and pay dividends exceeding the standard rate in the ratio of one-fifth of one per centum for every one cent of reduction of said maximum net price below the standard price. Governor Guild says: "The position of the Gas and Electric Light Commission is and has been that while it could not officially urge the sliding scale as a panacea for all gas difficulties, it has not, as has been alleged in some quarters, urged a veto of the bill, nor does it regard the measure as dangerous. The bill provides for the automatic method of reduction in the price of gas, but it does not remove the gas companies from State supervision in regard to the enforced publicity of accounts, prohibition of stock-watering and other matters. It substitutes the sliding scale for a limited period in lieu of the present method of attempts at reduction in price of appeals, hearings and rulings."

TROLLEY POWER PLANT EQUIPMENT.—The Cincinnati, Milford & Loveland Traction Company, of Cincinnati, the extensions of whose present line beyond the original ten-mile run between Cincinnati and Milford, were undertaken early last fall, have been rapidly nearing completion. The company, which is backed by local Cincinnati capital exclusively, had, up to the undertaking of these extensions, purchased its power from the outside. Upon the decision of the company to extend its system from Milford to Blanchester, a distance of 21 miles, it became necessary to consider the installation of a power outfit of its own. As a result a complete equipment of Allis-Chalmers power and electrical machinery was purchased and is now being installed, preparatory to the opening up of the new section. The power plant, when completed, will consist of two Allis-Chalmers horizontal cross-compound heavy-duty engines, 16 in. and 24 in. by 42 in. for direct connection to two Allis-Chalmers "Bullock" type 500-kw generators, 25 cycles, three-phase, 400 volts. In addition to engines and generators, the equipment will include two 22½-kw belted exciters, two 400-kw, 25-cycle rotary converters and miscellaneous auxiliary apparatus.

THE LACKAWANNA STEEL COMPANY, of West Seneca, N. Y., which recently decided to operate the greater part of its mills by electricity and contracted for electric power with the Ontario power transmission plant at Niagara Falls, is now installing the electrical machinery in its power house at West Seneca. This machinery will include seven 1,500-hp transformers and a number of motor-generator sets, which will transmit the power and make it available in the mills. These electrical improvements to the steel plant will involve the expenditure of several hundred thousand dollars, and when completed will add considerably to the operative efficiency and the producing capacity of the works. All of the electrical machinery will be furnished by the Westinghouse Electric & Manufacturing Company, of Pittsburg.

NEW TURBO PLANT FOR WILMINGTON.—A company has recently been organized known as the Delmarvia Construction Company for building an entire new power plant and distribution system for serving residents of Wilmington, Del. This undertaking, it is understood, is being financed by Baltimore interests. A new plant is now under construction and is designed entirely for steam turbines. Two 500-kw Westinghouse-Parsons units will be installed at the present time, with engine and motor-driven exciter units. The plant will furnish power to an alternating-current distribution system at a frequency of 60 cycles.

WESTINGHOUSE FOUNDRIES.—Application for a charter has been made to the Pennsylvania State authorities by the Westinghouse Consolidated Foundries Company, of Pittsburg, Pa. The object is for the various Westinghouse Companies, which now have foundries at Pittsburg, Allegheny City, Cleveland and Attica, N. Y., to have all their castings made in one factory, which is located at Trafford City, near Pittsburg. This plan is to assure greater economy and uniformity in the making of foundry products.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards in the following places: Lansford, N. D.; Willow City, N. D.; Beaumont, Tex.; Page, N. D.; Colton, S. D.; Osawatomie, Kan.; Carter, Wis.; Chicago, Ill.; Galias, Me.; Sutton West, Ont., Can.; Bedford, Ind.; Grimes, Iowa; Ames, Iowa; Larrabee, Iowa; Ludlow, Ill.; Dieterick, Ill.; Streator, Ill.; Hoople, N. D.; Ashland, Mo.

THE STANDARD OIL COMPANY has ordered two "Hornsby-Akroyd" oil engines of 25 hp each, which will be shipped to Chinkiang, China, and used for pumping purposes. These engines are supplied by the De La Vergne Machine Company, of New York, which states that the use of oil engines has increased enormously in the past few years, there being now over 14,000 oil engines of the "Hornsby-Akroyd" make alone in operation.

CATALOGUES AND PRICE LISTS.—The files of the United States Signal Office at San Francisco were destroyed during the recent disaster there, and Capt. L. D. Wildman would be glad to receive catalogues and price lists from manufacturers of electrical goods.

ALLIS-CHALMERS INDUCTION MOTORS FOR ALASKA.—The Tenana Electric Company, of Fairbanks, Alaska, has recently concluded the purchase of Allis-Chalmers induction motors as follows: One 10-hp, one 15-hp, two 20-hp.

CHICAGO TELEPHONE.—The Chicago Telephone Company reports a gain of 2,388 telephones in city and country for the month of May. The total now in use is 155,613.

AUGUSTA, GA., OFFICE BUILDING.—The Augusta-Aiken Railway & Electric Company will erect a ten-story office building in Augusta, Ga., at a cost of $250,000.

EQUIPMENT OF THE DAN RIVER POWER COMPANY.—In the cotton industry the rapidly increasing demand for electrical equipments is especially noticeable, one illustration being a recent order from the Dan River Power & Manufacturing Company, Danville, Va., for its new plant, placed with the Baltimore office of the Westinghouse Electric & Manufacturing Company. The contract is practically a duplicate of the present installation, which has been in operation about eighteen months. The new plant when completed will be one of the best electrical installations for cotton mill work in the country. The mills are designed by the well-known firm of Lockwood, Green & Company, of Boston, and have the latest type cotton mill machinery driven by Westinghouse induction motors. The power plant is on the Dan River, about a mile distant from the mills, and will contain when completed three 750-kw and three 500-kw alternating current, revolving field generators of the water wheel type, with two 125-kw direct-current exciters and complete switchboard equipment. The recent order for new apparatus includes one 750-kw revolving field, 6,600 volt, 25 cycle, two-phase water wheel generator; two 500-kw generators with the same characteristics; switchboard equipment, bank of three 600-kw, oil insulated, water cooled transformers complete with oil controlling switch; low-tension switchboard and twenty-four 440 volt, three-phase induction motors, which will be used for operating the different machinery in the cotton mills. The sizes of the motors are as follows: Fourteen 100-hp, five 150-hp, two 50-hp, two 40-hp and one 75-hp.

APPARATUS FOR JAPANESE STATION.—The Tokio Electric Light Company, which has under construction the largest water power station in Japan, in carrying out its extensive plans, has placed large orders with an American manufacturer for miscellaneous electrical apparatus. The main power station of this company is located about twenty-five miles from Tokio on the Tamagawa River, and high-voltage electrical transmission lines bring the power there generated to a sub-station just on the outskirts of the Japanese capital. With the exception of the water wheels and generators, which are of German manufacture, all the main station apparatus was ordered some time ago from the General Electric Company, of New York. At the substation the voltage is reduced by transformers and distributed underground to various smaller stations within the city, and the Tokio Electric Light Company has just ordered all the additional apparatus for this purpose from the same company. This order will include the shipment of fifty-five 250 kilowatt transformers and seventy-eight single-phase potential regulators, as well as switchboards and auxiliary apparatus. As electricity is used for both lighting and power, the potential regulators provide a means for keeping the voltage constant at the lamps so that their light will be perfectly steady and uniform.

EDISON ON COBALT.—The Asheville *Citizen* publishes an interview with Thomas A. Edison, who says that he has made discoveries of cobalt in North Carolina that will revolutionize the electrical world. He has been in this State some time prospecting for cobalt. He says: "There is a vein of cobalt running from a point just east of Nashville, Tenn., into this State. I have found cobalt in Lincoln, Gaston, Shelby and Jackson Counties. I made assays of the mineral in many places and I found the quality to be just what I was looking for. The electric vehicles have been under a great handicap because of the heavy storage batteries we have been forced to put into them. When I can equip an automobile with the cobalt system the storage battery weight will be one-half, and when the price is reduced so as to place electrics within the reach of everybody the horse will be a thing of the past. I have left a force of men in four counties in this State where I found cobalt, and they will make a thorough investigation. I may possibly return later in the summer. Most of the cobalt now known to the world is found in France and Australia."

ALLIS-CHALMERS ENGINE SALES.—A few of the more important orders for reciprocating engines reported by the Allis-Chalmers Company, Milwaukee, for the past week are the following: International Paper Company, of New York City; four 22-in. by 42-in. Reynolds Reliance Corliss engines; the Republic Iron & Steel Company, Thomas, Ala., four 44-in. by 84-in. and 84-in. by 60-in. cross-compound, disconnected type, vertical blowing engines; the Waterbury Rolling Mills, Inc., Waterbury, Conn., one 22-in. by 48-in. Reynolds heavy-duty Corliss engine; Rockdale Improvement Company, Rockdale, Tex., one 14-in. by 30-in. Reynolds Reliance Corliss engine; Winona Copper Company, Houghton, Mich., one 16-in. and 30-in. by 36-in. Reynolds heavy-duty, cross-compound Corliss engine, one 250-kw Allis-Chalmers generator and one 15-kw exciter. The engines for these orders will be built at the West Allis, Milwaukee, engine shops and the electrical apparatus at the company's electrical works, Cincinnati.

THE RAMSEY ENGINE COMPANY, with offices in the Bullitt Building, Philadelphia, has been formed for the purpose of exploiting the Ramsey crank mechanism, which is a device applicable to all single-acting engines. A number of advantages are claimed for this device, and it is stated that in a series of tests made under the supervision of the University of Pennsylvania on a vertical engine having a 9-in. cylinder and 7-in. crank, a total efficiency of no less than 25.9 per cent was obtained. The officers of the company are: President, Robert H. Ramsey, who is the inventor of the Ramsey crank mechanism; vice-president and general manager, Russell H. Ramsey; secretary and treasurer, R. Howard Eisenbrey. Mr. Russell H. Ramsey and Mr. Eisenbrey were formerly connected with the Harrison Safety Boiler Works, of Philadelphia. It is understood that the new company will not manufacture engines, but that it will issue license rights to engine manufacturers.

RUBBER.—The world's supply of rubber is now only a little less than 60,000 tons annually. The United States takes about one-half of the total output. Ten years ago this country, says the New York *Sun*, imported about 37,000,000 pounds, valued at $16,600,000; last year 67,000,000 pounds, valued at $49,900,000. Ten years ago rubber was worth about 45 cents a pound; to-day it brings about 75 cents a pound. South America and Africa are the principal sources of supply although an appreciable quantity is obtained from other lands. Within recent years a new and ever-increasing use for it has appeared in the demand for rubber tires for vehicles, notably automobiles. As yet cultivated rubber is a comparatively small factor in the total supply, and it is probable that for many years the world must depend mainly upon the crude methods of the natives of the rubber districts. Railway extension in Africa and South America will open new regions to the industry, but it is doubtful if even then supply will keep pace with the need.

THE WAGNER ELECTRIC MFG. COMPANY, of St. Louis, desires to advise the trade that the Denver territory will be handled and controlled by Hendrie & Bolthoff Manufacturing and Supply Company, located at No. 1621 Seventeenth Street, Denver. Hendrie & Bolthoff Manufacturing and Supply Company has been well and favorably known to the trade a great many years, having built up a large business in its particular fields. The Wagner Company feels particularly gratified at having made this connection in the Denver territory, and assures its customers that all inquiries will be handled in the best possible manner. The Hendrie & Bolthoff Company has given a great deal of attention to posting its salesmen and traveling men on the characteristics and operation of the Wagner product, and the forethought of the officers of the company in giving individual attention to the salesmen will be appreciated by the trade in the Denver territory.

THE ELECTRIC CABLE COMPANY, of Bridgeport, Conn., has just installed an underground conduit system for the American Railways Company at Altoona, Pa. This conduit system was laid in wooden trenches in which the wires were embedded in Voltax, the new insulating compound used by the railway companies throughout the country. The American Railways Company has found this system so effective that it has recently placed large orders with the Electric Cable Company for further work.

ORDERS FOR GENERATORS.—The following orders of recent date are reported: City of Casey, Casey, Ill., one 115-kw Allis-Chalmers type A.H. generator, one 25-kw type A.H. generator, and one 9-kw type B exciter; the Crown Cork & Seal Company, Baltimore, Md., one 200-kw type I generator; Chandler & Taylor Co., for Tuest & Bauman-Hunt Co., of Cleveland, Ohio, one 75-kw type I generator.

Financial Intelligence.

THE WEEK IN WALL STREET.—The strength of the speculative market was irregular. Prices improved on easier money and there was greater activity, though trading was professional in character. The granger stocks were strong, in spite of unfavorable crop reports, and attention was paid to prospective good annual reports by various railroads and industrial companies. Among the specialties Consolidated Gas was strong, advancing sharply on the announcement that the United States

Court has continued the injunction against the enforcement of the 80-cent gas law in New York City. A good deal of interest attached to the declaration of the initial quarterly dividend of 1¼ per cent, being the full rate of 5 per cent per annum, on the preferred stock of the Interborough-Metropolitan Company. At the same time a quarterly dividend of 2¼ per cent on the stock of the Interborough Rapid Transit Company was announced, being an increase of one-quarter per cent over the last dividend, while it was stated that this rate was adopted in order to provide fully for the 4½ per cent annual interest upon the bonds of the Interborough-Metropolitan, which were issued to acquire the Interborough Rapid Transit stock at 200 for the latter. The regular 1¾ per cent quarterly dividend was also declared upon Metropolitan Street Railway shares, this applying to both the stock which had not been exchanged for Interborough-Metropolitan securities and to the majority which was acquired by the latter company under the recent merger deal. Among the industrials there were no features of special importance apart from the renewed strength of the United States Steel stocks, which was checked, however, by unauthentic reports of a falling off in orders, while there was more or less manipulation of a bullish character in American Smelting and Amalgamated Copper. Allis-Chalmers, common, lost ⅞ point net, as did also the preferred stock, the closing quotations being 22½ and 59½, respectively. General Electric and Westinghouse both closed with net gains, the former at 172, an advance of 2¾, and the latter at 159, a gain of 1 point. American Locomotive common made a net gain of ⅛ point and preferred 2 points, the closing quotations being 70⅛ and 116, respectively. Metropolitan Street Railway closed at 113, a gain of 2 points, but both issues of Interborough-Metropolitan were down, ¼ point for common (closing price 50⅜) and ⅜ for preferred, the closing quotation of the latter being 84⅞. Brooklyn Rapid Transit closed at 84, a net advance of 1 point. Western Union's last quotation was 92¾, which is a net gain of ¼ point. On the curb Mackay common and preferred each made a net gain of 1⅛ points, the closing quotations being 75¼ and 75¾, respectively. Following are the closing quotations of June 12:

NEW YORK

	June 5	June 12		June 5	June 12
Allis-Chalmers Co.	23⅜	21⅞	General Electric	172	171½
Allis Chalmers Co. pfd.	60	57	Hudson River Tel.	...	...
American Dist. Tel.	26	25	Interborough Rap. Tran.	...	...
American Locomotive	70	72¼	Mackay Cos	75⅛	78
American Locomotive pfd.	114½	116	Mackay Cos pfd.	74⅛	74⅝
American Tel. & Cable	90	90	Marconi Tel.	...	...
American Tel. & Tel.	128	128	Metropolitan St. Ry.	*112	112
Brooklyn Rapid Transit	84	84½	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	92¼	92¾
Electric Boat pfd	65	65	Westinghouse com.	159	158
Electric Vehicle	11	11	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	June 5	June 12		June 5	June 12
American Tel. & Tel.	130¼	129¾	Mass. Elec. Ry. pfd	70½	73½
Cumberland Telephone	...	118	Mexican Telephone	3⅞	4
Edison Elec. Illum.	240	238	New England Telephone	...	124½
General Electric	173⅞	171½	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20¾	23¼	Western Tel. & Tel. pfd.	...	...

PHILADELPHIA

	June 5	June 12		June 5	June 12
American Railways	51¼	52	Phila. Electric	7⅞	8⅝
Elec. Co. of America	11⅝	11¾	Phila. Rapid Trans.	26	26
Elec. Storage Battery	74	73	Phila. Traction	98¾	99
Elec. Storage Battery pfd.	...	..			

CHICAGO

	June 5	June 12		June 5	June 12
Chicago City Ry.	180	174½	National Carbon	88	89
Chicago Edison	..	149	National Carbon pfd.	117	119
Chicago Subway	...	64½	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	...	...
Metropolitan Elev. com.	26	26¾			

* Asked

DIVIDENDS.—The directors of J. G. White & Co. have declared a quarterly dividend of 1½ per cent on the preferred stock, payable July 2. The directors of the General Electric Company have declared the regular quarterly dividend of 2 per cent on the stock, payable July 16. The directors of the Interborough Rapid Transit Company have declared a dividend of 2¼ per cent on the stock. It is payable to voting trust certificates of record June 20, on July 2. The directors of the Boston Suburban Electric Companies have declared the regular semi-annual dividend of 75 cents per share on the preferred stock, payable July 15. The directors of the Havana Electric Railway Company have declared a quarterly dividend of 1 per cent on the preferred stock, payable July 9. Directors of the United Traction & Electric Company, of New Jersey, have declared the regular quarterly dividend of 1¼ per cent, payable July 2. The Massachusetts Lighting Company's directors have declared a regular quarterly dividend of 1¼ per cent, payable July 16. The Cincinnati Gas & Electric Company has declared a quarterly dividend of 1⅛ per cent, payable July 2. The regular dividend of 1½ per cent for the quarter has been declared on the stock of the Cincinnati Street Railway Company, payable July 2. Directors of the Mackay Companies have declared a quarterly dividend of 1 per cent on the $41,380,000 outstanding common stock and have announced an intention to put the stock on a permanent 4 per cent basis. Dividends at the rate of 2 per cent a year have been paid since January, 1905.

CONSOLIDATION IN BALTIMORE.—A meeting of the stockholders of the Consolidated Gas, Electric Light & Power Company has been called for June 20 to consider and pass on a plan of consolidation of the company with the Consolidated Gas Company. The Consolidated Gas, Electric Light & Power Company owns all except about 42,000 shares of the total of more than 107,700 shares. At the last session of the Legislature a bill was passed which permits one lighting company to lease another in the same town and conduct the business as of one company, provided the holders of a majority of the stock agree. The bill also gives lighting companies the right to manufacture and sell gas in the territories in which they operate. The Consolidated Gas, Electric Light and Power Company was formed by the consolidation of the United Electric Light & Power Company, the Baltimore and the Wenstrom Electric companies last year. At the time the company acquired a majority of the stock of the Consolidated Gas Company, and since the adjournment of the Legislature the minority stockholders of the latter have expected it to announce some plan for the consolidation. Anticipating this two committees were formed several weeks ago to secure deposits of stock and guard the interests of the minority stockholders. Mr. N. Winslow Williams is chairman of one and the Safe Deposit & Trust Company is interested in the other.

THE AMERICAN DE FOREST WIRELESS TELEGRAPH COMPANY announces that the parent company has sold its entire Pacific Coast plant and rights to a subsidiary company known as the Oriental & Occidental De Forest Wireless Telegraph Company, for $1,000,000. The transfer includes all rights on the Pacific Coast and in Nevada, extending as far north as Alaska, and taking in the Pacific Ocean, Hawaii, Guam, China and Japan, together with the right to manufacture on the Pacific Coast all instruments needed in the establishment of stations. Headquarters will be in San Francisco. Orders are said to have been issued for the establishment of new stations at Sacramento, Eureka, Santa Barbara, Stockton and Fresno, and it is the intention of the company to extend its chain of stations as far north as Alaska as soon as the work can be done and the instruments turned out.

U. S. TELEPHONE.—One of the results of the recent sale of the control of the U. S. Telephone Company to the Brailey syndicate, of Toledo, is a proposition to increase the issue of common stock from $2,000,000 to $4,000,000, and the preferred stock from $500,000 to $1,000,000. The proceeds of the sale of these securities will be used in the extension of the company's service, which have long been under contemplation. It is not the intention to extend into new territory, but in improving the territory already occupied and in making better connections with other long-distance companies. Mr. James F. Brailey, Jr., has been elected president of the U. S. Telephone Company, and with A. H. Bauer, of St. Louis, and M. C. Harvey, of Cleveland, he will act as syndicate manager and give his time to the newly acquired properties.

NEW ENGLAND TELEPHONE.—The directors of the New England Telephone & Telegraph Company have decided to increase the outstanding capital stock of the company by the issue of $3,965,500 of new stock to the stockholders at par. Each stockholder of record on June 20 will have the right to subscribe for the new stock in the proportion of one share for each seven shares held by him on that date. The right to subscribe will expire on July 18, 1906. The new stock is issued for the purpose of providing funds for extensions of the property and for the payment of the fourth series of bonds, which is due in 1907.

PHILADELPHIA COMPANY STOCK.—According to a Pittsburg dispatch, the Philadelphia Company will issue an additional $6,000,000 of common stock. The proceeds are to be used in paying for the stock of the Beaver Valley Traction Company and the Washington & Canonsburg Railway Company, both of which were purchased last year, and for the purpose of making improvements and extensions. The directors have called a special meeting of the stockholders to be held August 14, when action on the proposition will be taken.

DETROIT HOME TELEPHONE COMPANY.—A dispatch from Philadelphia states that a syndicate deal taking over a $3,000,000 bond issue of the Home Telephone Company, of Detroit, has been closed by the Commonwealth Trust Company, of St. Louis. The bonds will be listed on the St. Louis Stock Exchange.

GENERAL NEWS.

Construction News.

BESSEMER, ALA.—The Bessemer Railway, Light & Power Company is installing new machinery in its electric lighting department.

ELBA, ALA.—The Pea River Power Company has recently ordered from the Crocker-Wheeler Company, of Ampere, N. J., a 50-kw, 2,200-volt belt type alternator to be driven by water power.

MOBILE, ALA.—The Electric Lighting Company, of Mobile, has been absorbed by the Mobile Electric Company. The company is capitalized at $3,000,000. The officers are: C. E. Groesbeck, president; S. C. Shaffner, vice-president; N. P. Zech, treasurer; S. S. Rubira, secretary. The company is identified with H. M. Byllesby & Company, which recently acquired the interests of the Electric Lighting Company, of Mobile. The company proposes to do a general electric lighting business and the manufacture and sale of gas-making apparatus, etc.

PHOENIX, ARIZ.—The entire stock, franchises and property of the Phoenix Light & Fuel Company has been transferred to the Pacific Gas & Electric Company.

BERRYVILLE, ARK.—The Town Council has granted to the Kings Rivers Electric Power Company a 99-year electric light franchise.

LAKE VILLAGE, ARK.—Engineer Bell is surveying the town, preparatory to submitting to the City Council plans and specifications for water works and an electric light plant.

BOONEVILLE, ARK.—A. Robbecke, of the Robbecke Light Company, writes that bids will be received until June 15 for the construction of an electric light plant, to cost about $5,000 or $6,000. J. W. Ivey is engineer.

JONESBORO, ARK.—The Automatic Telephone Company has filed an amendment to its articles of incorporation showing an increase in the capital stock from $25,000 to $100,000. The company proposes to put in automatic telephones in Jonesboro.

LONOKE, ARK.—Bransford & Daniels, owners of the electric lighting and water plant, have placed an order with C E Rosenbloom Machinery & Company, of Little Rock, for a 200-hp Atlas Corliss engine, and an Atlas high-pressure boiler, to increase the service of the power plant.

ELSINORE, CAL.—Plans are being made for an electric lighting plant and a telephone system, which will cost about $9,000. R. J. Dunn, of Redlands, is interested.

PASADENA, CAL.—Bids will be received by Heman Dyer, City Clerk, until July 3 for the purchase of $200,000 municipal improvement bonds of which $125,000 is to be used for the construction of an electric light plant.

VALLEJO, CAL.—The Vallejo Electric Light & Power Company is making improvements to its street lighting system. An order has been placed with the General Electric Company for two constant-current transformers of 75-light capacity each, making a total of 150 lamps for the system. The cost will be about $8,000.

LOS ANGELES, CAL.—The Home telephone companies of San Pedro, Long Beach, Santa Ana, San Bernardino, Ventura, Upland, Highland, Ontario, Fullerton, Colton and Corona have been consolidated and taken over by a syndicate of Los Angeles men, headed by Col. J. M. C. Marble, president of the National Bank of California. A stock company capitalized at $10,000,000 will be organized and incorporated with headquarters in Los Angeles. A bond issue has been effected by the promoters. The system will be extended and improved.

GREELEY, COL.—H. E. Churchill has presented a proposition to the Council from D. A. Canfield to build a street railway system for the city to cost $300,000.

COLORADO SPRINGS, COL.—Theoph. Harrison and F. E. Dow are interested in the construction of a power plant at Green Mountain Falls. Cost has not yet been estimated. Sawyer & Garston, of Colorado Springs, are the engineers.

COLORADO SPRINGS, COL.—The Colorado Light & Power Company will furnish electricity for operating the Canon City & Royal Gorge Interurban Railway Company's line extending to the top of the Royal Gorge. The line is expected to be in operation by July 1.

EAST HAMPTON, CONN.—The Rhode Island Contract Eng. Company, of Providence, R. I., has the entire contract for the installation and equipment, including lines, etc., for Salmon River Power Company, at East Hampton. The probable cost is $500,000.

NEW BRITAIN, CONN.—The city has entered into a contract with the Connecticut Railway & Lighting Company to light the streets of the city for a term of three years from April 1, 1906. While the price per arc lamp is the same as before, the service is for every night and all night, instead of moonlight schedule as under the old contract.

WILMINGTON, DEL.—The Wilmington Light, Power & Telephone Company has placed an order for an additional 1,000-kw Westinghouse steam turbo generator. This will double the original capacity of the company's new plant. The company expects to be able to furnish electricity not later than October 1.

WASHINGTON, D. C.—Bids will be received until June 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards, etc., Portsmouth, N. H., Boston, Mass., Newport, R. I., New York, N. Y., League Island, Pa., Annapolis, Md., Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 595—Electric cable. Schedule 596—Generating set, etc. Schedule 597—Electrical supplies, iron fencing, cypress, etc. Schedule 598.—Motor, blowers, etc. Schedule 599—Blacksmith's forges, hydraulic jacks, electrical supplies, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

WASHINGTON, D. C.—Bids will be received until June 19 by the Bureau of Supplies and Accounts, Navy Department, Washington, for furnishing at the Navy Yards, at Portsmouth, N. H., Boston, Mass., Newport, R. I., New York, N. Y., League Island, Pa., Annapolis, Md., Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 287—Renewing incandescent lamps, etc Schedule 589—Copper rivets, wire rope, nickel-steel, ingot copper, sheet copper, etc. Schedule 591—Electrical supplies, copper, plain and galvanized sheet iron, etc. Schedule 592—Steel enameled conduits, steel bolts, and nuts, hydraulic jacks, rivet forges, twist drills and sheet brass, rod and sheet copper, bar iron, steel bars, etc.

ATLANTA, GA.—The Georgia Railway and Electric Company has increased its capital stock $300,000 to $1,550,000.

TALBOTTON, GA.—H. B. Kimbrough, city clerk, writes that an election will be held on June 26 to vote on issuing $10,000 bonds for the construction of an electric light plant. J. M. McCrary, of Atlanta, is engineer.

AUGUSTA, GA.—The Twin City Power Company is having detail plans and specifications prepared for power development on Savannah River, 25 miles above Augusta. A masonry dam will be placed across the river and the power transmitted electrically to Augusta. It is estimated that 10,000 hp can be delivered in Augusta. It is probable that bids will be asked for in July. Nisbet Wingfield, of Augusta, is engineer.

LEWISTON, IDAHO.—F. M. Ogle reports that a site has been selected on the Salmon River near the mouth of Crooked River, for building a power plant for supplying the mining districts and operating mills in the Orogrande, Elk City, Dixie and Buffalo Hump sections. The cost is estimated at about $200,000.

LEWISTON, IDAHO.—The Lewiston-Clarkston Company will soon begin improvements to its steam power plant at Clarkston, Wash., and will also increase its electric power capacity from 1,500 hp to 3,600 hp. The 500-hp plant at Asotin will be replaced by a plant of 2,100 hp. The present equipment of the Asotin plant will be moved to Pomeroy Gulch, near Clarkston, where 500 hp will be developed. All of the equipment has been ordered. The company is now supplying electricity for Moscow and Genesee.

OREGON, ILL.—A Business Men's Association has been formed to co-operate with the Rochelle people for the purpose of carrying out the water-electric power scheme.

MASON CITY, ILL.—D. L. Waldron, city clerk, writes that bids will be received until June 18 for the construction of an electric light plant at a probable cost of $10,000. E. E. Saylor, of Saybrook, is engineer.

RICHMOND, IND.—Bids will be received by the City Clerk for improving and extending the municipal electric light plant.

NOBLESVILLE, IND.—The Indiana tin plate mill at Atlanta, has been sold to a company of Indianapolis and Atlanta citizens for $60,000.

SHELBYVILLE, IND.—A movement is on foot to organize another telephone company in this city for the purpose of constructing a new system.

INDIANAPOLIS, IND.—Instead of purchasing outright, as first announced, the Central Union Telephone Company has leased the Meridian Street Church property for a period of ninety-nine years. The company agrees to pay the owners $676,800 for the use of the site, on which they will erect an eight-story telephone exchange and office building. For the first fifteen years the company will pay $4,800 a year and $7,200 a year for the remaining eighty-four years.

MUSKOGEE, I. T.—Theo. Gulich, secretary of the Commercial Club, writes that the Spring River Power Company, of which Fred Lucas, of Joplin, Mo., is president is interested in the construction of a dam on Grand River for power purposes.

CLAREMORE, IND. TER.—A. Ross Moore, city recorder, writes that bids will be received about July 1 for the construction of water works and an electric light plant. The probable cost will be $40,000 or $50,000. W. P. Bullock, of Kansas City, Mo., is the engineer.

BEDFORD, IA.—J. J. Clark has made application to the City Council for a franchise to operate an electric lighting plant in this city.

DES MOINES, IA.—The Des Moines City Railway Company has completed plans for the construction of an interurban line from the Fair Grounds to Marquisville, a distance of six and a half miles.

OTTUMWA, IA.—The Ottumwa Railway & Light Company has awarded the contract for the construction of its new power house to the Ottumwa Mill & Construction Company. The plant complete will cost about $115,000.

CEDAR FALLS, IA.—The Corn Belt Telephone Company is planning to expend from $15,000 to $25,000 in improvements to its system in this city, and has asked the City Council for permission to place its lines in conduits on Main Street.

IOWA FALLS, IA.—The Petersen Heat, Light & Water Company contemplates a number of improvements to its plants in this city and in Alden. J. H. Dusenberry, of Des Moines, has been appointed secretary to succeed C. H. Baker.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company is considering extensive improvements to its Topeka exchange.

RICKTON, LA.—A local company has been organized to establish an electric lighting plant in this city.

HYATTSVILLE, MD.—Chas. L. Reeder, of Baltimore, has been selected as supervising engineer for the installation of the proposed electric light plant, which will cost about $12,000.

BALTIMORE, MD.—Subway Engineer Phelps has returned from a trip to Chicago, Detroit, Toledo, and other cities, where he inspected municipal and private lighting plants, for the Civic Federation. It is stated that he will shortly prepare a report for the Mayor and City Council with a view to establishing a municipal lighting plant in Baltimore.

ROCKVILLE, MD.—The Chesapeake & Potomac Telephone Company has purchased the property and franchises of the Enterprise Telephone Company, the consideration being $7,000. This gives the Chesapeake & Potomac Telephone Company control of all the telephone lines in the county. It is understood that many improvements will be made to the system.

BEVERLY, MASS.—The Beverly Gas & Electric Company is installing a 1,500 kw steam turbine in its power plant in this city.

WORCESTER, MASS.—H. H. Bigelow has petitioned the City Council for a right to operate wires in Worcester for the transmission of electricity under a franchise granted him in 1884.

WORCESTER, MASS.—A plan for lighting the city hall from the power plant in the basement is being considered by the City Council. If it should be decided to do this a 100-hp engine would be required.

HOLYOKE, MASS.—The Holyoke Street Railway Company has been authorized by the Railroad Commissioners to increase its capital stock by $150,000 to take up its floating indebtedness and to purchase additional equipment.

HUNTINGTON, MASS.—A contract for street lighting has been made with the Huntington Electric Light Company for the ensuing year at the rate of $15 for each 25-cp incandescent lamp, and $70 for each arc lamp.

FITCHBURG, MASS.—The Fitchburg & Leominster Street Railway Company has purchased a valuable water privilege located at the junction point of the towns of Ayer, Shirley and Harvard. The company proposes to develop power at this point.

REVERE, MASS.—An announcement has been made by the Suburban Gas & Electric Company that on July 1 a reduction of one cent per kw-hour will be made to the users of electricity for lighting purposes in Revere and Winthrop, and after that date patrons in both towns will be given free lamp renewals.

KINGSTON, MASS.—At a special town meeting held recently it was voted to authorize the committee chosen by the town of Kingston to purchase an electric motor or motors to be installed in the pumping station, and to contract with the Plymouth Electric Light Company for the extension of its lines to connect with the pumping station.

WORCESTER, MASS.—Arrangements have been made by which the Worcester & Providence Street Railway Company is granted the right to enter Providence over the tracks of the Rhode Island Company. The new company proposes to build a direct line from Worcester to Providence, a distance of 30 miles. Rights of way have been secured for the entire route.

NORTH ATTLEBORO, MASS.—At a recent meeting of the electric light commissioners it was voted to engage Sheaff & Jaasted, of Boston, to draw up plans and specifications and award the contract for installing the necessary machinery in the municipal electric lighting plant to furnish electricity for a commercial day power circuit. Considerable new machinery will have to be purchased and the town may have to be rewired.

MUNISING, MICH.—The citizens have voted to issue $30,000 bonds for water works and an electric light plant.

GRAND RAPIDS, MICH.—It is stated that the Thornapple Gas & Electric Company will expend about $200,000 in improvements.

BRONSON, MICH.—The electric lighting plant of W. H. Friedrich & Company has been destroyed by fire.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company contemplate an expenditure of more than $20,000 for additions to its underground and cable system in this city.

DETROIT, MICH.—The Detroit United Railway is preparing to extend its system from Flint to Saginaw and Bay City. The company will soon commence the extension of its system from Royal Oak to Almont.

DETROIT, MICH.—The Michigan State Telephone Company contemplates the erection of a large addition to its main buildings in this city and considerable extension of long distance lines through the State.

MANISTEE, MICH.—We are informed that the Manistee River development has been postponed for financial reasons, though it is possible that operation will be taken up this year. H. von Schon, of Detroit, is engineer.

MARINE CITY, MICH.—C. E. Blood, of Marine City, writes that Messrs. Hart, Ottaway and Marshall, are constructing a line through St. Clair County, and have an option on the private plant in Marine City. They expect to reconstruct the plant at Marine City.

NILES, MICH.—Traffic has been opened on the Niles-St. Joseph Railway Company's line between Niles and St. Joseph. It is stated the company contemplates the construction of a line from Niles to Buchanan, a distance of seven miles, and also a line from Michigan City to Carey, Ind., a distance of 25 miles.

SUPERIOR, MINN.—The City Council has authorized plans to be made for a municipal electric lighting plant for the city.

MINNEAPOLIS, MINN.—The Committee on Gas has awarded the contract for electric lighting for the balance of the year to the Minneapolis General Electric Company, at $7 per arc lamp per month.

ST. CLOUD, MINN.—O. T. Hougen, of Grand Rapids, Mich., secretary and treasurer of St. Cloud Electric Power Company, writes that this company will expend on its proposed dam and for the development of power about $400,000. J. C. Jacobson, of Grand Rapids, Wis., is engineer.

BROOKHAVEN, MISS.—The Board of Aldermen is considering the question of remodeling the water works and electric light plant. The probable cost of improvements is $30,000.

KANSAS CITY, MO.—Burns & McDonnell, Engineers, state that the probable cost of developing the water power of Big Mangua River, will be $1,200,000.

ST. CHARLES, MO.—The bill passed by the City Council at a special meeting held recently granting a twenty-year electric light franchise to St. Louis parties, has been vetoed by the mayor.

TWIN BRIDGES, MONT.—The Madison River Power Company, of Twin Bridges, is contemplating the construction of a new power plant on Madison River to furnish power to the Butte mines and smelters. Geo. H. Potter, of Butte, is making surveys for the work.

BEATRICE, NEB.—The Home Telephone Company has completed arrangements for the installation of a new switchboard equipment to be put in at once. The cost will be about $20,000.

CRETE, NEB.—The City Council is contemplating some extensive improvements to the municipal electric lighting plant, and is asking for bids for a 50 to 90 hp engine and for electric generators. L. C. Dredla is city clerk.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has purchased the property and rights of the Goff's Falls, Litchfield & Hudson Street Railroad and will construct the line at once. The road will be 18 miles long and will connect with the Manchester & Nashua street railway system.

BURLINGTON, N. J.—Municipal ownership of the lighting system of the city is under consideration here.

WEST ORANGE, N. J.—The Town Council has awarded to the Public Service Corporation, the contract for lighting the streets for 5 years at $85 per lamp per year.

SUMMIT, N. J.—The Morris County Traction Company has applied to the Common Council for a 40-year franchise for an electric railway from Summit to Elizabeth.

NEWARK, N. J.—A number of merchants on Broad and Market Streets are becoming interested in the individual power and lighting question. Marshall & Ball and J. Lissner & Sons have decided to produce their own light and power, and have engaged Edward J. Kunze to design plants for them. The electricity generated will be used for the running of elevators, fans, other apparatus, as well as for furnishing light.

MINEVILLE, N. Y.—The Witherbee Sherman Company, of Fort Henry, has made arrangements to erect a lighting plant. H. C. Pelton, of New York, is architect.

SYRACUSE, N. Y.—The Syracuse Lighting Company has ordered a 1,500-kw steam turbine and other apparatus, which will increase the capacity of the plant 3,000 hp. E. B. Doan is superintendent.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has announced to the users of electricity in dwelling houses a reduction in price of electricity from 14 cents to 10 cents per kw-hour, with a minimum charge of $1 per month.

ROCHESTER, N. Y.—The American Wood Working Machinery Co. has recently ordered from the Crocker-Wheeler Company, of Ampere, N. J., a 220-kw, 250-volt, direct-current generator, to supply power for additional equipment added to its plant.

WILLIAMSON, N. Y.—The Sodus Gas & Electric Company, of Sodus, has been granted a franchise to operate an electric lighting system in this village. The company has commenced work on the extension of its system, and will soon be ready to supply electricity in the town.

WAVERLY, N. Y.—G. Tracy Rogers, of Binghamton, has purchased the entire interest of J. A. Powers, of Troy, in the Waverly, Sayre & Athens Traction Company. The line has been owned jointly by Messrs. Powers and Rogers. The purchase of the Waverly trolley line carries with it the ownership of the electric lighting and power company of both places.

NEW YORK, N. Y.—Bids will be received until June 18 by C. B. J. Snyder, Superintendent School Buildings, for repairs, alterations and additions to the electric bell system, systems and electric lighting and telephone systems in Schools Nos. 1, 20, 34, 42, 92, 108, 120, 147, 160 and 177, Borough of Manhattan; also for installing electric equipment in School No. 78, Borough of Queens.

ALBANY, N. Y.—The United Message Company, of Albany, has increased its capital stock from $10,000 to $10,000,000. The company is an independent telephone concern. Of the capital stock heretofore authorized only $700 has been actually issued. Elyria, Ohio, telephone capitalists are interested in this company, which is to be a holding company for independent telephone companies in this State.

ROCHESTER, N. Y.—Governor Higgins has signed the bill which permits the city of Rochester to amend its charter so that a contract for city lighting may be awarded to the lowest bidder even when the company has no plant established in the city, and provides that the Council may grant a 50-year franchise to such company. Mayor Cutler is considering the immediate advertising for the municipal lighting contract. The present contract expires July 1, 1907.

ETON COLLEGE, N. C.—The faculty of Eton College has voted to expend $15,000 for electric lights, steam heat and water system for dormitories and college buildings.

SALISBURY, N. C.—At a recent meeting of the Salisbury-Spencer Electric Railway, the following officers were elected: E. M. Deane, of Grand Rapids, president; Dwight Smith, of Salisbury, treasurer. The company, it is said, will reduce the price of electricity and gas.

MOORESVILLE, N. C.—Bonds to the amount of $10,000 have been voted for the construction of a 75-kw arc and incandescent plant. Generating equipment, including boiler and pump, has been purchased. It has not yet been decided how the power line and arc lighting system will be arranged for. A. L. Starr is Mayor. G. Bonham Bird, of Biltmore, N. C., is the engineer.

PIQUA, OHIO.—The Council is considering the construction of an electric light plant, to cost about $18,000.

HUDSON, OHIO.—The question of issuing $10,000 bonds for an electric light plant will probably soon be voted upon.

ELYRIA, OHIO.—The Garford Company of this city has recently ordered from the Crocker-Wheeler Company of Ampere, N. J., three 150-kw, 250-volt, gas engine driven generators.

SPRINGFIELD, OHIO.—Stewart L. Statum, city solicitor, has been instructed by the Council to make an investigation of the project of erecting a municipal light, heating and power plant by the city.

LIMA, OHIO.—The city is making important improvements to its water works pumping station and is installing a 300-hp direct connected engine and generator for lighting the station and operating pumps at several distant points.

CINCINNATI, OHIO.—The Cincinnati & Eastern Electric Railway, operating from Cincinnati to New Richmond, and one of the three lines operated under the name of the Interurban Railway & Terminal Company, has been leased to the Union Gas & Electric Company, which was recently formed to lease the Cincinnati Gas & Electric Company.

YOUNGSTOWN, OHIO.—The Cherry Valley Iron Company, of Leetonia, has submitted a proposition to the Youngstown & Ohio River Railway, to furnish electricity for the operation of its line from its large power station at Leetonia. The station has a capacity of 2,500 hp at present and could easily be enlarged to operate the electric railway.

ASHTABULA, OHIO.—At a recent election held in this city the proposition to spend $50,000 to improve and enlarge the municipal lighting plant was defeated. The Council will consider a proposition recently made by a company to purchase the city lighting plant. The company will take a water franchise and erect a million dollar water, lighting and power plant.

TOLEDO, OHIO.—The Lima & Toledo Traction Company is securing right of way for an independent entrance to Toledo. It is stated that the company will locate a large power station near Miami on the Maumee River. When completed this will handle the Lima and Toledo line, the Lima city lines and the line being built from Lima to Bellefontaine.

TIFFIN, OHIO.—A company composed of Columbus, Pittsburgh and Philadelphia capitalists has secured the ownership or options on six water powers between Tiffin and Ft. Seneca on the Sandusky River. It is proposed to erect a power house near Ft. Seneca where there is a fall of 75 feet. It is estimated that from 2,000 to 3,000 hp can be secured for ten months in the year. The power is to be used in operating traction lines radiating from Tiffin and for the reduction of aluminum, as the clay deposits within a few miles of the river are said to be rich in this mineral.

OKLAHOMA CITY, OKLA.—The Oklahoma City Street Railway Company contemplates various improvements and extensions to its lines this year.

AURORA, ORE.—The Aurora Electric Company is making arrangements to install a day service on its entire system.

SALEM, ORE.—The Salem Electric Light & Traction Company is making extensive improvements and additions to its power plant. Two boilers have been added and a new 600-hp engine has been installed. The company is planning several extensions to its street car lines. B. K. Page is manager.

PRINEVILLE, ORE.—F. H. Goudy, of the firm of Forbes & Goudy, of Portland, has filed at Prineville notice of appropriation of the waters of Deschutes River, for the purpose of irrigating land in Agency Plains and Haystack Districts, to supply water for domestic purposes, and to furnish electricity for lighting and power purposes.

PENNSBURG, PA.—The Town Council has passed an ordinance in favor of the construction of an electric light plant.

LANCASTER, PA.—The City Council has awarded a contract to the Edison Electric Illuminating Company for street lighting for five years at $85 per arc lamp per year.

BLOOMSBURG, PA.—The Farmer's Mutual Telephone Company will be established in this city, and will also operate a telephone system in the upper end of Columbia and Montour counties.

FRANKLIN, PA.—The Franklin Electric Company has recently ordered of the Westinghouse Machine Company, of East Pittsburg, a 125-hp, 3-cylinder vertical type gas engine to increase the capacity of its lighting plant.

ALLENTOWN, PA.—The Consolidated Telephone Company has leased the plant of the Easton & Bethlehem Telephone Company for 999 years, and has purchased the plants of the Honesdale Telephone Company and the Berwick Telephone Company.

PHILADELPHIA, PA.—The Commonwealth Electric Company has withdrawn its application from the Councils for a franchise in this city. J. Collins Jones, counsel for the incorporators, states that the company has not abandoned its purpose to enter the electric field in this city. The company will submit new measures to the Councils next September for limited electric light franchises.

YORK, PA.—General Alexander Brown has announced that the Maryland & Pennsylvania Railroad will be operated by electricity instead of steam. The company has engaged electrical engineers to make an estimate of the cost of the necessary equipment. The electric power will probably be used at first as far as Belair and later into York.

HARRISBURG, PA.—It is reported the York Haven Water & Power Company has made arrangements with the Harrisburg Light, Heat & Power Company to supply it with electricity for general purposes, lighting, heating and operating motors. The York Haven Heat & Power Company will erect a sub-station at the eastern limits of the city of Harrisburg for the purpose of distributing the current. Transformers, switchboards and the necessary electrical equipments will be installed as soon as possible.

TIVERTON, R. I.—At the annual meeting of the Tiverton Light & Power Company, held recently, it was decided to begin work at once on the construction of a new plant. John R. Hicks is president, and George R. Lawton, secretary, both of Tiverton.

NINETY-SIX, S. C.—This town is considering the construction of water works and an electric light plant.

ST. MATTHEWS, S. C.—Bids will be received until July 2 by Leonidas Cain, Secretary Board Public Works, for $20,000 water works and electric light bonds.

MEMPHIS, TENN.—The Laclede electric plant is to be established. A site for the plant has been purchased, and work will begin at once on the plant. The machinery has already been ordered. L. G. Van Ness, of St. Louis, Mo., will be local manager of the company, which will be organized at once. It is understood that the plant will cost about $60,000.

McKINNEY, TEX.—Plans have been completed for improving the electric light plant. F. W. Perkins is Mayor.

AUSTIN, TEX.—The Southwestern Telephone & Telegraph Company, which operates in Texas and Arkansas and other Southern States, will increase its capital stock from $5,000,000 to $20,000,000.

MARBLE FALLS, TEX.—Reed & Badger have recently purchased an electric lighting plant. They will furnish electricity to light the town and use electric power in their lumber yard.

DALLAS, TEX.—The Southwestern Telephone & Telegraph Company contemplates laying about five miles of additional conduit, and will soon apply to the City Council for permission to do the underground work.

TEMPLE, TEX.—The Temple Electric Light Company is making extensive improvements and increasing the capacity of its power plant. Three new dynamos and a new Russell engine have recently been installed in the new addition to the power house.

PAROWAN, UTAH.—The citizens have voted to issue bonds for establishing a lighting plant.

AMERICAN FORK, UTAH.—The Intermountain Consolidated Railway Companies has applied to this city for a 50-year franchise to build and operate an electric railway.

HUNTINGTON, UTAH.—Wm. Howard, president and general manager of the Electric Light & Milling Company, writes that owing to complications in regard to franchises, the receiving of bids for constructing the proposed plant has been postponed indefinitely.

RUTLAND, VT.—The Rutland Railway, Light & Power Company will issue $1,200,000 40-year bonds for immediate use to acquire the property of the Rutland City Electric Company and to extend and improve its present holdings.

BURLINGTON, VT.—The special committee appointed by the Common Council to investigate the matter of a city lighting system, has reported in favor of municipal ownership. The Council has deferred action on the report until a further investigation is made by the committee to ascertain whether or not the city can legally furnish lamps for other than public use.

LEXINGTON, VA.—Robert Hutton, general manager of the Lexington Light & Power Company has placed orders for a 4,000-light dynamo and a 240-hp turbine. The equipment is expected to be installed by early fall.

RICHMOND, VA.—The question of a municipal electric lighting plant is under consideration in this city, and upon the report of the consulting engineer, E. W. Trafford, being read, it was decided to postpone further action to June 14.

FT. MYER, VA.—Bids will be received until June 20 by Capt. A. W. Butt, Quartermaster, U. S. A., Quartermaster's Department, Washington, D. C., for furnishing and installing electric fixtures and meter in bachelor officers' quarters, and constructing feeder line and making service connections at Ft. Myer.

WAVERLY, WASH.—A franchise has been granted to E. H. Morrison to operate an electric light and power system in the town.

OLYMPIA, WASH.—M. F. Kincaid and associates have been granted a franchise by the City Council to operate a lighting, heating and power plant.

TACOMA, WASH.—The Pacific Traction Company has made application to the County Commissioners for franchises for two electric railways into Tacoma. One of the roads will connect Tacoma and Olympia, and the other will connect Tacoma and Steilacoom.

TACOMA, WASH.—Work has been started by the Stone & Webster interests, who control the street railways of Seattle and Tacoma, and other large electrical properties in the Puget Sound region, on a large hydro-electric power plant near Buckley, this county. The plant will develop 50,000 hp, and two years will be required for its construction. The complete plant will be more than double the size of the plant at Electra, owned by the same company. The additional power will be used by Stone & Webster's present electric systems and new lines to be built. The plant will cost from $3,000,000 to $5,000,000.

MARTINSBURG, W. VA.—The City Council has granted Stuart W. Walker and James H. Thompson the right to construct an electric-railway in the city. Steps will be taken immediately to organize a company. The company proposes to build a line from this city to Shepherdstown, Harpers Ferry and Charlestown.

MARTINSBURG, W. VA.—Officers of the Martinsburg Power Company have awarded contracts aggregating $135,000 for the construction of a large power plant at dam No. 4 on the Potomac River, about 15 miles from this city. The company has secured the right to use the surplus water of the Potomac from the Chesapeake & Ohio Canal Company.

SPOONER, WIS.—This village will install a larger dynamo in the electric light plant.

STOCKBRIDGE, WIS.—The Stockbridge & Sherwood Telephone Company has been incorporated with a capital stock of $2,000 by Joseph Bast, G. P. McKenney and others.

EAU CLAIRE, WIS.—It is stated that the Chippewa Valley Electric Railroad Company is contemplating the construction of an electric railway to connect Eau Claire and Menomonie.

REGINA, CAN.—The Council has granted a franchise to the Grand Trunk Pacific Railway Company for an electric railway.

EDMONTON, CAN.—Plans have been prepared by the city engineer for an electric railway in this city at an estimated cost of $66,000.

WINNIPEG, MAN.—The new power plant of the Winnipeg Electric Street Railway Company, on the Pinnawa Channel, Winnipeg River, was put into operation on May 31. The plant is located sixty miles from the city and is capable of developing 10,000 hp, which is transmitted to Winnipeg for the company's street railway system, lighting and manufacturing purposes.

OAXACA, MEX.—An electric light and power plant is to be installed at Oaxaca. Governor Emilio Pimentel can give information.

MEXICO CITY, MEX.—The Compania Electrica Anglo-Mexicana has been organized in England for the purpose of installing electric power plants in Mexico.

GUERRERO, MEX.—Telesforo Macias has been granted a concession by the Federal Government to install an electric power plant on the Salado River near here.

MEXICO CITY, MEX.—Engineer Luis Espinosa, acting on behalf of the Federal department of public works, has entered into a contract with Schondube & Neugebauer, of this city, for the installation of four 100-hp, three-phase motors at the San Lazaro water plant.

GUADALAJARA, MEX.—The San Pedro Analco Mining Company is erecting a large hydro-electric plant at San Pedro Analco, State of Jalisco. The plant will have a capacity of 5,000 hp. It will furnish electricity for operating machinery and mills of the company's mines.

TAMOSOPA, MEX.—An electric light and power plant is being installed at the ranch of Dr. H. B. Tanner, near Tamosopa. The plant will furnish electricity for operating the machinery of a sugar mill and other plantation machinery and for lighting the buildings on the place.

MEXICO CITY, MEX.—A British company, which has its headquarters in London, Eng., is said to have purchased the Portezuelo waterfalls, situated in the State of Mexico. The company will install an electric power plant and transmit the electric power to Mexico City.

MEXICO CITY, MEX.—Garcia Brothers have been granted a concession by the Federal Government for the use of certain waterfalls on the Cupatitzio River, in the State of Michocan, for generating electricity. The electric power will be transmitted to mines and industrial concerns of that region.

MEXICO CITY, MEX.—The National Congress has approved the contract which was entered into by the Federal Government and the Mexican Light & Power Company, through its attorney, Charles H. Cahan, which authorizes the company to utilize the waters of the Tenango, Necaxa and Catepuxtla rivers, State of Puebla, for power purposes.

PARRAL, MEX.—The installation of the electric power plant for Pedro Alvarado at Parral will soon be completed. The plant has a capacity of 1,000 hp, and will furnish electricity for operating machinery in the Palmillo mine and the large stone quarries which are owned by Mr. Alvarado. The contract for installing the plant is held by Weisel & Kook, of Parral.

MEXICO CITY, MEX.—The Federal Government has granted a concession to the representative of an American company for the erection of a large hydro-electric plant on the Yaqui River, in the State of Sonora. The company is granted the authority to build long-distance transmission lines to towns and industrial centers of that part of Mexico. It will take seven years to complete the installation of the plant.

MAZATLAN, MEX.—A large electric power plant is being installed at the Guadalupe de los Reyes mines, in the State of Sinaloa. The plant will have a capacity of 5,000 hp and will cost about $800,000. The erection of the plant is being done under the direction of Engineer Robert McDoble, of San Francisco, Cal. The initial power for the plant will be obtained from water falls on the Piaxtla River. The plant will furnish electricity for the mines and mills of the Guadalupe de los Reyes Company.

COLIMA, MEX.—The Compania Potencia Electrica de Colima, which is installing a large electric power plant on the San Antonio hacienda at the foot of Mt. Colima volcano, will soon have its transmission line to the city of Colima completed. The distributing station at Colima has been finished. The company has secured private lighting contracts for 3,000 incandescent and a number of arc lamps in Colima and for furnishing electricity for a large number of industries. More than $300,000 has already been expended in the enterprise. Arnold Vogel is president.

PORT HOPE, ONT.—At a recent meeting of the Town Council a by-law was passed authorizing the issue of $7,400 bonds for the purpose of establishing a municipal electric lighting plant.

HAMILTON, ONT.—The shareholders of the Hamilton, Caledonia & Lake Erie Railway have decided to build an electric railway to Caledonia and Dunville.

KINGSTON, ONT.—The Kingston, Gananoque & Perth Electric Railway has applied to the Legislature for permission to build an extension of its line from Lanark to Arnprior.

TORONTO, ONT.—The Ontario government has plans for electrifying the Temiskaming Railway from North Bay to Englehart, a distance of 137 miles. The cost is estimated at $1,000,000.

OWEN SOUND, ONT.—Extensive improvements are to be made to the municipal electric lighting and gas plants, which will cost about $50,000. Joseph McLinden is chairman of the lighting commission.

New Industrial Companies.

THE STANDARD ELECTRIC COMPANY, of Portland, Ore., has filed articles of incorporation with a capital stock of $15,000. The incorporators are John C. Baird, Frank E. Harmar and Fred A. Waltz. The company proposes to carry on a general electric business, and to buy and sell electric and gas fixtures.

THE PIONEER ELECTRICAL CONSTRUCTION COMPANY, San Francisco, Cal., has been incorporated to engage in the electrical and construction business, with a capital stock of $1,000,000. The directors are R. Johnson, R. V. Whiting, F. H. Gould, L. Dunne, E. B. Gould, John H. Hensen and C. E. Arnold.

THE WIND MILL ELECTRIC COMPANY, of Noblesville, Ind., has incorporated to manufacture and sell electrical apparatus to produce light and power by the use of wind mills. The directors are C. C. Curtis, Fred. E. Heylman, J. C. Jones and R. W. Wilson.

THE SELBYVILLE FOUNDRY & MACHINE COMPANY, of Shelbyville, Ind., has been incorporated with a capital stock of $50,000. The company will build a large factory for the manufacture of gasoline engines and electrical apparatus. S. H. Meyers is president and C. D. John, secretary.

New Incorporations.

NEW CASTLE, PA.—The New Castle Telephone Company has filed articles of incorporation with a capital stock of $5,000.

MONTESANO, WASH.—The Grays Harbor & Puget Sound Railway Company has been incorporated to build an electric railway from Montesano to Olympia.

JONESBORO, ARK.—Articles of incorporation have been filed with the Secretary of State by the Automatic Home Telephone Company with a capital stock of $100,000. The incorporators are H. H. Houghton and others.

NAPA, CAL.—Articles of incorporation have been filed by the San Francisco, Vallejo & Napa Valley Railroad Company. The new company, has a capital stock of $1,500,000. The directors are: W. F. Botsford, of Los Angeles; Z. J. Hatch, of Oakland; L. J. Peroy, of Napa; J. T. York, of Napa, and T. W. Hatch, of Vallejo.

GRAND JUNCTION, COL.—The Red Lands Irrigation & Power Company has been incorporated, with a capital of $500,000, by Benjamin F. Kiefer, H. C. Wagner and others, of Grand Junction.

SHELLEY, IDAHO.—The Cedar Point Power & Light Company has been incorporated, with a capital of $25,000.

BOISE, IDAHO.—The Idaho Electric Light & Power Company has been organized for the purpose of building a dam and installing a 1,200 hp plant on the Payette River, three miles from Payette, for furnishing electricity to the city. P. A. Snyder is president, and W. A. Coughanour, vice-president.

GILMER, ILL.—The Gilmer Exchange Telephone Company has been incorporated with a capital stock of $850. The incorporators are George Steinagel and others.

PALMYRA, ILL.—Articles of incorporation have been filed with the Secretary of State by the Hannibal Light & Fuel Company with a capital stock of $160,000. The incorporators are John Dell and others.

MARION, IND.—The Citizens' Automatic Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of $300,000. The incorporators are O. L. Barger, Albert E. Wilson and E. K. Wilson.

SPURGEON, IND.—The Spurgeon Independent Telephone Company has been incorporated with a capital stock of $2,000. The company is in the market for a new switch board and material to install a new plant. B. A. Humphreys is president.

ANDERSON, IND.—The three local light and gas companies have been merged in a new corporation to be known as the Union Gas Light and Fuel Company. The new company has a capital stock of $500,000. The directors are C. W. Hoover, J. H. Millspaugh, H. L. Millspaugh, H. C. Sisco and Jasper Vance.

TOPEKA, KAN.—A charter has been granted to the Topeka Electrical Company by the State charter board. The company has been organized to furnish electricity for light and power. It is capitalized at $200,000.

OSWEGO, KAN.—The Kansas Traction Company has been organized for the purpose of promoting an electric railway from Cherryvale to Columbus. S. B. Miller is president and C. A. Wilkin, secretary.

COFFEYVILLE, KAN.—A company has been formed for the purpose of building an electric railway from this city to Forest Park, and application will be made immediately for a charter. The directors are W. H. Shepard, L. L. Birmingham, Dean Gill, S. D. Frazier, James Stanton, C. L. Hollingsworth and J. B. Tackett. The company will have a capital stock of $35,000.

AUGUSTA, ME.—The Consolidated Railway, Electric Lighting & Equipment Company has been organized with an authorized capital stock of $16,000,000. The promoters are Isaac L. Rice, James L. Weston, W. B. Lord and George W. Hoyt, of New York; M. H. Simmons, of Hallowell; Lewis A. Burleigh, I. L. Fairbanks, J. Berry and I. E. Chadbourne, of Augusta. The company proposes to deal in gas and electricity and build railroads and establish steamship lines.

GRASS LAKE, MICH.—The Portage Telephone Company has been incorporated with a capital stock of $900.

PALO, MICH.—The Fenwick Telephone Company has been incorporated with a capital stock of $8,000.

HARTWICK, MICH.—The Osceola Telephone Company has been incorporated with a capital stock of $3,000.

LANSING, MICH.—The Northern Light & Power Company has been incorporated with a capital stock of $625,000.

MONTROSE, MICH.—The Northern Light & Power Company has been organized, with a capital of $625,000, to develop the water power of Flint River, at Montrose.

RIVES, MICH.—The Rives Telephone Company has filed articles of incorporation with a capital stock of $1,000. The incorporators are Fred Marquedart, Henry K. Wood and others.

HANLEY FALLS, MINN.—The Hanley Falls Telephone Company has been organized with a capital stock of $10,000. The officers are I. Johnson, president; L. Orwoll, vice-president; W. E. Hanson, secretary; H. M. Hanson, treasurer.

TORONTO, OHIO.—Articles of incorporation have been filed by the Toronto & New Cumberland Telephone & Telegraph Company with a capital stock of $15,000. The incorporators are W. S. Hooloway and others.

LENZBURG, MO.—Articles of incorporation have been filed with the Secretary of State by the Risdon Telephone Company. The incorporators are Dan Waeltz, Adam Kirchoefer and others.

LEBANON, PA.—The Lebanon Electric Light Company has been incorporated with a capital of $10,000.

Obituary.

MR. J. W. RONEY.—We regret to note the death of Mr. J. W. Roney, the local manager of the Richmond, Ind., Light, Heat & Power Company for a number of years. He entered the gas business with Mr. James Starr in 1891 and went with the plant when it was sold to Mr. J. E. Lowes, of Dayton, in 1893. He remained with the company also when it was purchased by the well-known holding corporation, the United Gas & Electric Company, of New York City. He had in this way given continuous service from the date of his first connection with the plant in 1891, and his death is deeply felt by his associates.

Personal.

MR. N. A. CHRISTENSEN.

MR. NIELS A. CHRISTENSEN, whose services have just been secured by the Allis-Chalmers Company, of Milwaukee, which will make the brakes and air compressors bearing his name, was born at Toerring, Denmark, in 1865, and after a very successful career as a designer, engineer and inventor in Denmark and England, as well as in India and Chili, he came to this country in 1891, entering at once the employ of the Fraser-Chalmers Company, as a designer of Corliss engines and its valve gear, to which other duties were soon added. An accident on an electric railway led him to note the defects of hand brakes on trolley cars, and he then developed the Christensen scheme of applying air brakes to such cars, subsequently securing patents here and in Europe. The first practical tests were made at Detroit in 1893, and since that time the Christensen types of brake have become very widely known, the commercial exploitation dating from 1896. The Christensen Engineering Company was organized in Milwaukee, in the early part of the year 1897. At the outset Mr. N. A. Christensen did practically all the work of designing, selling, installing and collecting, but before the close of the first year the business had grown so that it demanded more assistance and Mr. F. C. Randall (now district manager of the Allis-Chalmers Co., at New York) was induced to associate himself with the company as chief of the sales department, and, with his active and successful management, the business grew so rapidly that the sales of air brakes in 1904 aggregated nearly $1,300,000. In the fall of 1902, against the judgment of Mr. Christensen, who was not himself a stockholder in the company, it was decided to broaden the scope of the business and include general electrical manufactures. This step led to his retirement as general superintendent and the Christensen Engineering Co. was later merged in a new corporation known as the National Electric Co. Mr. Christensen engaged in the business of constructing air compressors and others of his patented articles, leaving to the company the construction of air brakes for electric cars under his patents, he receiving a royalty for their use. The National concern went into the hands of a receiver in the spring of 1905, and was adjudged a bankrupt. During the early part of 1903 the company sought to avoid the payment of royalties to Mr. Christensen, and after being operated for ten months under a receivership, was sold at public auction to interests representing the Westinghouse Air Brake Company, which, it is stated, legally surrended all rights, title and interest to all the Christensen patented devices, and also settled the claims of Mr. Christensen against the National Electric Company and its receiver. Since this settlement, negotiations have been brought to a successful issue with Mr. Christensen for the consolidation of the Christensen air brake and compressor business with the great interests of the Allis-Chalmers Company, Mr. Christensen himself going to this institution as consulting engineer.

MR. R. A. C. SMITH, the financier, who has large electrical interests, has just returned home from Europe.

MR. GEORGE W. WOOD, of the Boston office of the General Electric Co., has accepted a position as superintendent of the municipal electric lighting plant of Mansfield, Mass.

MR. R. C. CLOWRY, president of the Western Union Telegraph Company, has just returned from a very pleasant trip around Europe, much benefited by the rest and change.

MR. R. W. POPE, secretary of the American Institute of Electrical Engineers, has sailed this week for London, to participate in the hospitalities extended by the Institution of Electrical Engineers.

DR. S. S. WHEELER, president of the American Institute of Electrical Engineers, sailed this week on the "Barbarossa" to attend the meeting in England with the Institution of Electrical Engineers of Great Britain, details of which have already been given.

MR. A. S. HILLHOUSE, general manager of the Stark County Telephone Company, Canton, O., has been appointed chief engineer of the Cuyahoga Telephone Company, of Cleveland. Mr. Morton Perdue, general superintendent of the Stark Company, has been promoted to the vacant position.

MR. FREDERICK C. HOWE, a well-known lawyer of Cleveland, partner of Professor Garfield of Princeton for many years, and author of a book on "The City," has written for the July *Scribner*, as a result of his personal investigations, an article on the municipal government of Glasgow.

MR. J. F. AHLERS has resigned his position as city electrician of Tampa, Fla., which he has held for thirteen years. He is manager of the Big Sandy Telephone Pin and Bracket Company, of Louisa, Ky., and is about ready to turn out locust pins and side brackets for the general electrical market.

MR. A. H. HACKEMAN, for many years prominent in the meter department of the New York Edison Company, has recently become engineer for the New York office of the Electric Storage Battery Company. He received some substantial testimonials from his old associates on making the change.

MR. JOSEF LEIDENER, electrical engineer, secretary of the Elektrotechnischen Verein of Vienna, and editor of the *Zeitschrift Elektrotechnik and Maschinenbau*, is a visitor to this country for the first time, and is making a study of American electrical methods and plants. He is an acute observer and is taking a deep interest in all that he sees differing from European practice.

PROF. K. OGURA, of the Imperial University of Kyoto, is in this country on an extended leave of absence in order to make a study of engineering practice prior to returning to his duties. For the past seven years Prof. Ogura has been the assistant of Prof. M. Namba, head of the University Electrical Engineering department, during part of which time he taught electrochemistry.

PROF. I. FUJIOKA, of Japan, who has been visiting this country again after a long absence, has sailed for England this week, taking with him his son now a student in this country. They will participate in the Institute hospitalities on the other side. Prof Fujioka, who is an honorary member of the National Electric Light Association, attended the annual meeting at Atlantic City last week.

MR. WILLIAM CLEGG, JR., who has been special agent of the Westinghouse Electric & Manufacturing Company in its St. Louis territory, has just received the appointment of acting manager of the St. Louis office. Mr. D. E. Webster, formerly manager of the office, has been transferred to a position in the Chicago sales office of the company. Mr. J. S. Trittle has been appointed acting manager of the new district office opened by the Westinghouse Electric & Manufacturing Company in the New England Building, Kansas City, Mo. Mr. Trittle was formerly connected with the St. Louis office of the Westinghouse Electric & Manufacturing Company.

PROF. ELIHU THOMSON addressed recently the Electric Meter and Instrument Association of Lynn, Mass., at its annual dinner, and gave some interesting details as to the Thomson meters, the first of which was made in 1888 and shown at the Paris Exposition the next year. In 1889 also, the Thomson recording wattmeter was invented, continuing in use up to the present time. Mr. Cox, the toastmaster, stated that in 1890 the Thomson meter factory started with a capacity of 50 meters a week, while at the present time nearly 5,000 weekly are turned out. The Association was founded about two years ago and has been very successful.

Trade Publications.

INJECTORS.—The Hayden & Derby Manufacturing Company, 85 Liberty St., New York, has issued an illustrated catalogue presenting a complete line of injectors, ejectors, jet apparatus and water heaters.

VENTILATORS.—The Burt Manufacturing Company, Akron, O., has issued a neat booklet devoted to the Burt combination sky-light and ventilator for factories, boiler houses, power houses, and other buildings where light and ventilation are needed.

ELECTRICALLY-OPERATED WATER-TIGHT DOORS.—Bulletin No 15 of the "Long-Arm" System Company, Cleveland, O., gives an interesting discussion of the features of electrically operated bulkhead doors including a convincing argument as to the special advantages possessed by electricity in comparison with hydraulic power for closing the doors.

DESIGN OF LOCOMOTIVES.—Catalogue No. 54 of Burnham, Williams & Company, Philadelphia, Pa., contains a most interesting and valuable record of recent constructions at the Baldwin Locomotive Works. The catalogue is divided into parallel columns printed in French and English. Photographs are reproduced of 14 locomotives, for each of which all of the principal dimensions are given in both French and English units.

TRAIN LIGHTING.—Complete constructional details of belt-driven electrical equipments for the lighting of railroad cars are given in bulletin No. 30 recently issued by the Bliss Electric Car Lighting Company, Milwaukee, Wis. One of the most prominent features of the Bliss system resides in the use of a counter-voltage generator which assists in keeping the electromotive force on the lamp circuit at a constant value independent of the variations of speed of the main generator.

THE CENTRAL ELECTRIC COMPANY, of Chicago, general Western agent for "Deltabeston" magnet wire, is sending out new lists announcing a reduction in price on this wire. It has been felt that the only objection heretofore against the use of "Deltabeston" wire in preference to a cotton covered magnet wire for winding field and armature coils on railway motors, has been the cost, and this objection has now been removed. As general Western agent for D. & W. material, the Central Electric is also sending out copies of the new D. & W. price list. This price list is an attractive booklet small enough to be carried in the pocket, and quotes revised prices on D. & W. enclosed fuses and safety devices.

LEEDS & NORTHRUP COMPANY, of 4901 Stenton Avenue, Philadelphia, has just issued an extremely interesting and well compiled pamphlet illustrative and descriptive of its new shops and laboratory near Wayne Junction, an ideal location for its work. The handsome building, erected with a special view to the class of high-grade electrical apparatus to be produced, is three stories high, fireproof, 110 by 55 feet. The material is reinforced concrete. The light is admirable. The views show excellent arrangements for manufacture, testing, etc., and the text shows clearly that the most modern methods have been adopted throughout. A list is given in some detail of the various scientific and commercial instruments of precision made by this young, energetic and enterprising firm.

News of the Trade.

THE LIMA INSULATOR COMPANY, Lima, O., has, through the G. E. Watts Co., Atlanta, Ga., obtained a contract from the Savannah River Power Company for between 6,000 and 7,000 high-tension insulators and pins, for a working voltage of 30,000 with a testing voltage of 70,000.

THE ELECTRIC CABLE COMPANY, of 17 Battery Place, New York City, has just received an additional order from the New York & Long Island Railroad Company for six miles of 300,000 c. m. Voltax cable. This order, coming as it does, after one placed some months ago, with the Electric Cable Company, by the same company, for 15 miles of cable, conclusively proves the satisfaction given by Voltax, the insulating compound.

KOHLER BROS., of Chicago, through their Pacific Coast manager, Abner Doble Company, have just finished installing a four-motor Kohler equipment for the new octuple Hoe press, which the San Francisco *Examiner* has installed and placed in operation in its temporary building in San Francisco. They have also closed a contract for a two-motor Kohler equipment for a sextuple Hoe press, which is now being shipped for the San Francisco *Call* for installation in its old building at Third and Market Streets.

OKONITE CABLES FOR N. Y. CENTRAL.- In the article in our issue of June 2 on laying eight cables simultaneously for the New York Central in the Harlem River, the language used gives the idea that the Okonite cables included were armored and finished at Bayonne. We are advised by Manager W. L. Candee that the Okonite cables referred to were made, armored and finished at the Okonite factory at Passaic, N. J., where the company has the facilities for manufacturing, and has made some of the very largest submarine cables without any kind of assistance from any other manufacturer.

DODGE & DAY, engineers, of Philadelphia, have completed plans for the new works of the Arthur Koppel Company of New York and Berlin, Germany. Construction work will be started at once and the plans contemplate the immediate erection of a section of the erection shop, the light car shop, the switch shop, service building and office building and a part of the power plant. The works are situated at Homewood, a place about 35 miles from Pittsburg, and will make many of the products which have hitherto been imported by the Arthur Koppel Company from Germany. Mr. H. A. Ellis will have charge of the new plant and is now arranging for the building of the plant. He has established an office at 1771 Frick Building Annex, Pittsburg, Pa.

WESTINGHOUSE GAS ENGINES.—The United States Steel Corporation was perhaps the first large mill operator which began the operation of gas engines with producer gas and that company has a number in use. In the rail mill at Braddock, Pa., gas engines run several immense electric generators which furnish power to the rolling mills and other machinery, and these gas engines are operated by blast furnace gas. In addition, the American Steel & Wire Company, which is an underlying company of the Steel Corporation, is now equipping the plant at Worcester, Mass., with an 800-hp gas engine to operate the mill machinery. All of these gas engines are manufactured by the Westinghouse Machine Co., of East Pittsburg, Pa., which firm makes a specialty of their production, and produces gas engines as large as 5,000 hp.

FEED-WATER REGULATORS.—The Williams Gauge Company, Pittsburg, Pa., has recently sold safety feed-water regulators to the Illinois Central R. R., 1,200 hp; D. L. & W. R. R., 25,000 hp; Republic Iron & Steel Co., 15,000 hp; Tenn. Coal, Iron & R. R. Co., 10,000 hp; Pennsylvania Coal Co., 7,000 hp; American Car & Fdry. Co., 9,000 hp; Morgan Engineering Co., 2,000 hp; Westinghouse Elec. & Mfg. Co., 2,000 hp; New York Central & Hudson River R. R., 3,000 hp; Pullman Palace Car Co., 2,000 hp; Illinois Steel Co., 4,000 hp; Carnegie Steel Co., 3,000 hp; Crucible Steel Co., 4,000 hp; Boston & Maine R. R., 12,000 hp. The total boilers equipped to date with the Williams Safety Feed Water Regulators will, it is stated, aggregate 4,100,000 hp. An office of the company has recently been opened in Montreal, which will be conducted by Mr. Wm. M. Courtenay. This is the third office in the Dominion of Canada now operated by this company to handle the business coming to it from that country.

GENERAL ELECTRIC OFFICES IN SAN FRANCISCO.- The General Electric Company, which established its main office in the Union Savings Bank Building at Oakland, Cal., immediately after the San Francisco disaster, as well as a local office at No. 1759 Geary Street, in the burned city, has already leased a suite of rooms in the new Monadnock Building, which it expects to occupy about June 15, 1907. For handling the present business, a half a block of land has been leased in Emeryville in close proximity to both the Santa Fe and Southern Pacific Railroad tracks. A temporary building is now about completed on this land for taking care of stock, and work has already been started on a new warehouse, containing about 80,000 sq. ft., which will be located at the south end of the block, bounded by Kansas, Rhode Island, 15th and Alameda Streets. At the temporary warehouse, forty cars of material have been housed and nineteen cars of additional apparatus are now in the yards waiting to be unloaded, with thirty or forty more cars en route from Schenectady. Additional cars are being shipped from the company's factories so that the stock at San Francisco will soon be complete. At present the company is in excellent condition to fill orders as rapidly as before the fire.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 5, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

822,234. MAGNETIC CUT-OUT APPARATUS; Leonard Andrews, Hastings, England. App. filed Mar. 13, 1901. A magnetic cut-out having an armature journalled between four pole pieces which are so wound that the armature moves in different directions when the current is reversed through the cut-out. This armature is connected to a trip which permits the switch lever to move whenever the polarity is reversed.

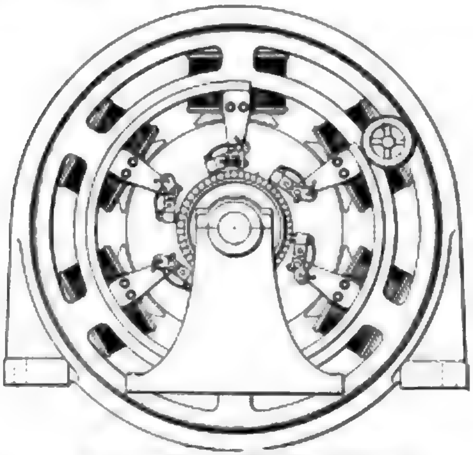
822,237. ELECTRIC SWITCH; Charles S. Barkelew, Middletown, O. App. filed Nov. 11, 1904. A switch lever has a pair of metallic clips thereon which embrace an ordinary tubular fuse through which the current passes instead of through the blade as in the usual construction.

822,240. ARC LAMP; Samuel H. Blake, Jersey City, N. J., and George R. Davison, Pittsfield, Mass. App. filed Sept. 22, 1904. The clip for holding the lower carbon is formed of a metallic piece which is bent to surround the carbon and has a pair of ears which are secured together by a screw. These ears are connected to the depending frame of the arc lamp. A set screw is used to hold the carbon in place.

822,250. ELECTRIC CABLEWAY SYSTEM; Maxwell W. Day, Schenectady, N. Y. App. filed Jan. 6, 1905. A device for keeping the traction cable taut when coaling vessels at sea. For this purpose the traction cable is connected to a hoisting motor at each of its ends, and its movement is produced by varying the relative e.m.f. of the two motors.

822,269. MOTOR STARTING RHEOSTAT; Henry Heisenhoner, Schenectady, N. Y. App. filed June 10, 1905. A pivoted arm is hollow and has a plurality of contacts therein of varying length. The arm also contains mercury which closes circuit with the contacts in succession, so that the resistance of the rheostat is gradually cut out as the arm is turned.

822,270. ELECTRICALLY HEATED HOLLOW BODY; Ernst Haagn, Hanau-on-the-Main, Germany. App. filed July 7, 1905. A resistance element for heating muffles having a piece of wire netting or fabric wound spirally round the muffle and traversed by the current. The purpose of having a fabric instead of a single wire is to avoid destruction by fusing. The network will stand a higher temperature than a simpler wire.



822,304.—Dynamo Electric Machine.

822,275. SYSTEM OF MOTOR CONTROL; George H. Hill, Schenectady, N. Y. App. filed Nov. 17, 1904.

822,282. SYSTEM OF MOTOR CONTROL; Sigvald Krohn, Berlin, Germany. App. filed Jan. 25, 1904.

822,290. STARTING RHEOSTAT; David Miller, Schenectady, N. Y. App. filed Nov. 29, 1904. A resistance box having a plurality of vertically projecting fingers and a lever arm which closes a circuit successively therewith when it is moved into horizontal relation. A magnet is provided for holding the lever down as long as the line voltage is applied.

822,293. TRANSFORMER; Walter S. Moody, Schenectady, N. Y. App. filed Nov. 18, 1904. Relates to the details of an oil transformer having the usual coils suspended in a tank containing oil. The invention particularly relates to the method of making the high potential connections which are led through the top of the box in specially constructed sleeves. These are jointed in such a way as to permit convenient assembling or dissembling.

822,304. DYNAMO ELECTRIC MACHINE; Robert H. Rogers, Schenectady, N. Y. App. filed Nov. 30, 1904. An ignition device for explosion engines capable of having a substantially uniform voltage regardless of the speed of the engine. For this purpose one of the brushes of the generator is capable of being annularly moved so as to receive a smaller percentage of the dynamo e.m.f.

822,305. PRODUCTION OF STEEL CONTAINING TITANIUM; Auguste J. Rossi, New York, N. Y. App. filed May 20, 1904.

822,311. ALTERNATING-CURRENT MOTOR; Charles P. Steinmetz, Schenectady, N. Y. App. filed Sept. 26, 1904.

822,312. RHEOSTAT; George E. Stevens, Lynn, Mass. App. filed Oct. 12, 1904. A rheostat having two parallel coils each wound with bare wire and a central rod on which is mounted a sliding brush or bridge having blades capable of contacting with both of said coils.

822,314. RAILWAY SIGNALING SYSTEM; Jacob B Struble, New York, N. Y. App. filed July 13, 1904. A railroad signal system having storage batteries which are connected to the track rails through a Ruhmkorff coil. In this way the track rails are energized to an alternating difference of potential. The storage battery also has connections to a direct current magnet operating the semaphore signal. This circuit is closed by short circuiting the track rails.

822,319. PORTABLE POTENTIAL-INDICATOR; John B. Taylor, Schenectady, N. Y. App. filed June 10, 1905.

822,323. THERMOSTATIC CONTROL; Elihu Thomson, Swampscott, Mass. App. filed Oct. 1, 1904.

822,325. CONTACT DEVICE; Knut Tornberg, Lynn, Mass. App. filed Nov. 3, 1904. In order to overcome the defect which has been found in those contact devices where a mercury globule flows from one end of a tube to the other the patentee provided a glass tube of special shape, which when rotated impels the mercury globule always in the same direction to make the contacts. This overcomes the defect hitherto found, namely, that of the mercury sticking to the glass.

822,332. INDUCTION-COIL; Montraville M. Wood, Schenectady, N. Y. App. filed Nov. 15, 1904.

822,336. THERMAL CUT-OUT FOR ELECTRIC CIRCUITS; James C. Armor, Pittsburg, Pa. App. filed June 8, 1903. A device for use with glower lamps and particularly in connection with the heater thereof. The heater has a cavity with a fusible material therein, said cavity being closed by a plug attached to a circuit wire and when the heater becomes warm the plug is expelled and the heating circuit broken.

822,345. CONTROLLING ALTERNATING-CURRENT MOTORS; Frank E. Case, Schenectady, N. Y. App. filed Jan. 25, 1904.

822,365. METHOD OF APPLYING TERMINALS TO THE GLOWERS OF ELECTRIC LAMPS; Marshall W. Hanks, Pittsburg, Pa. App. filed Mar. 23, 1901. A method for attaching the terminals of glowers of Nernst and similar lamps. The patentee fuses platinum globules to the ends of the metal by an arc lamp and then attaches the terminal wires to the platinum by fusing them in oxy-hydrogen flame.

822,376. SYSTEM OF APPLYING ALTERNATING-CURRENT ELECTRICAL ENERGY; Benjamin G. Lamme, Pittsburg, Pa. App. filed Sept. 22, 1904.

822,464. INCLOSING CASE FOR TELEPHONE SETS; Frank R. McBerty, Evanston, Ill. App. filed Dec. 10, 1904.

822,466. SIGNALING SYSTEM FOR PARTY TELEPHONE-LINES; James L. McQuarrie, South Orange, N. J. App. filed Jan. 29, 1903.

822,469. TERMINAL CONNECTOR; Joseph Opitz, New York, N. Y. App. filed Feb. 23, 1904. A plan for attaching the connection wires to electromagnets so as to avoid their being broken off in use. A disc is perforated with a pair of holes through which metallic legs project and the wires are wrapped around these metallic legs so that they will not become broken.

822,470. TELEPHONE-TRANSMITTER OR AUDIPHONE-RECEIVER; Hermann G. Pape, New York, N. Y. App. filed June 16, 1904.

822,492. BRIDGING-CONNECTOR AND TELEPHONE-LINES; Maurice C. Turner, New York, N. Y. App. filed Dec. 22, 1904.

822,508. RAILWAY TRAFFIC CONTROLLING APPARATUS; Clyde J. Coleman, New York, N. Y. App. filed Dec. 4, 1905. Relates to the circuits and details of a railroad signal system operated by the short circuiting of the track rail sections which are energized by an alternating current.

822,579. ELECTRIC SYSTEM OF TRANSMISSION; Charles G. and Edward J. Burke, Brooklyn, N. Y. App. filed Jan. 9, 1904. Relates to wireless telegraphy and includes a special system of relays by which the signals are transmitted and received at the stations.

822,590. DISTRIBUTING-BOARD; Franz J. Dommerque, Chicago, Ill. App. filed Oct. 11, 1902.

822,610. LIGHTNING-ARRESTER; Thomas J. Johnston, Brooklyn, N. Y. App. filed July 11, 1901.

822,611. MULTIPLE SWITCHBOARD FOR TELEPHONE-EXCHANGES; Milo G. Kellogg, Chicago, Ill. App. filed Apr. 24, 1893.

822,625. RAILWAY SIGNAL APPARATUS; Emil L. Nolting, Elgin, Ill. App. filed Sept. 18, 1905. In order that an engineer may know the condition of a switch in advance of his train, a circuit is made to a rail adjacent the track when the switch point is in open relation, and a trolley on the engine engages this rail and rings an alarm bell in the locomotive cab.

822,626. RAILWAY SIGNAL-APPARATUS; Emil L. Nolting, Elgin, Ill. App. filed Feb. 16, 1906. Relates to modifications of the above.

822,642. WOOD STRAIN INSULATOR; Thomas C. White, St. Louis, Mo. App. filed Aug. 7, 1905. A strain insulator having a wooden bar with conical ends with their apexes toward one another. The conical ends are enclosed by two-part clamps which are riveted together and have eyes for connection with the line wires.

822,697. DYNAMO-ELECTRIC MACHINE; William Stanley, Great Barrington, Mass. App. filed May 25, 1905.

822,709. TROLLEY STAND; John Zielinski, Detroit, Mich. App. filed Oct. 22, 1903. A trolley support comprising a pivoted arm having a spring impelled block sleeved thereon and link connections from said block whereby the spring action produces an angular movement of the pole.

822,715. BELL BOX; Sidney A. Beyland, Elyria, O. App. filed May 17, 1904. Details of construction of a telephone bell having a permanent magnet and an armature pivoted adjacent thereto so as to have uniform polarity. This armature connects with the bell clapper in the usual way.

822,719. TELEPHONE-CALL METER; Charles T. Bradshaw, Philadelphia, Pa. App. filed Oct. 3, 1903.

822,845. TROLLEY WHEEL; George W. Jobe, Indianapolis, Ind. App. filed June 23, 1905. The trolley wheel is made with a number of radial fingers each of which is capable of movement in an axial direction. These fingers close over the trolley wire in passing.

822,873. PROCESS OF COATING ONE METAL WITH ANOTHER AND THE RESULTING PRODUCT; Samuel H. Thurston, Newark, N. J. App. filed Apr. 1, 1905.

822,881. ELECTRICAL PIANO PLAYING MECHANISM; Carl E. Brown, Columbus, O. App. filed June 5, 1905. Details of construction of an electrical piano player having a perforated strip which allows the suitable electric contacts to be made and magnets which are connected by a special lever arrangement with the piano keys.

822,888. VISUAL-SIGNAL-RECEIVING SYSTEM; Ernest A. Faller, New York, N. Y. App. filed July 28, 1903.

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ENGINEERING ETHICS.

The presidential address of Dr. Schuyler Skaats Wheeler to the American Institute of Electrical Engineers, printed in full in our issue of June 9, is a timely reminder to the electrical engineering profession of the growth of its responsibilities and the dignity of the calling. Dr. Wheeler specifically draws attention to the need of creating an adequate code of ethics for the engineering profession, such as already exists in connection with the older and long recognized professions of divinity, law and medicine. Not only do we heartily support Dr. Wheeler's contentions, but we would also second them by the proposition that in the public mind it is the existence of an ethical code among the members which stamps and differentiates a profession from a craft. That is to say, when the members of any public service enter into a stage of development in their duties whereby they are bound by a recognized code of ethics, in their mutual relations on the one hand and in their relations toward the public on the other, the vocation is promoted in public estimation to the rank of a profession. If this proposition be valid, as we contend, then it follows that the recognition which the public is prepared to offer to the engineering profession depends upon the recognition which engineers offer to each other and to the dignity of their own labors. In the sociological system of mediæval Europe, the constructive powers of nations were entrusted to guilds. Each guild had its own officers, regulations and code of duties. Membership in the guild brought certain advantages and certain corresponding responsibilities. The engineers destroyed these guilds by creating machines and distributing the mechanical power that displaced muscular aptitude and ability. It remains now for the engineers to take the guild spirit from the body which their labors destroyed.

There is perhaps no class of highly trained public servants so devoid of training in co-operative effort as physicians. Their work tends to keep them segregated and apart, so that their opportunities for team play are necessarily limited. Nevertheless, there is no vocation in which professional ethics is more highly developed, or its dictates more scrupulously regarded. If, therefore, professional ethics can be highly developed among the members of a profession which keeps them independent and loosely connected, how readily should such ethics be developed among members of a profession like engineering, which requires so much intercommunication between its workers, and such close co-operation in many directions. Mr. Carnegie, who is manifestly actuated with the spirit of co-operative purposes and achievement, has either consciously or unconsciously had the development of engineering professional ethics in view, when he offered the engineering societies a handsome gift on condition that they assemble in a united headquarters in New York City. It would be fitting if the several societies which will inhabit the building were to recognize fully the principle of co-operation by the appointment at an early day of a joint committee to formulate a code of professional ethics for the engineering professions, to be submitted to all of the various engineering bodies for mature consideration in advance of any final action. And we would suggest that one of its sections might well define the length to which electioneering for engineering society offices may properly be carried on.

Speed-Voltage Variation in Shunt Motors.

As is well known, the armature of a direct-current motor runs at a speed such as to generate by the motion of its conductors across the field flux an e.m.f. less than the impressed e.m.f. by an amount sufficient to allow to flow through the resistance of the armature a current whose product with the field flux produces the torque demanded by the load. If, therefore, the resistance of the armature of a shunt-wound, constant-voltage motor is small, a very slight change in the counter voltage will produce a large variation in the armature current, and the machine will operate at practically constant speed at all loads. If the field flux of this same machine varies directly with the exciting magnetomotive force, then a change in the impressed armature e.m.f. will produce a similar change in the field flux, and the speed will remain constant even when the voltage is varied. Thus, such an ideal motor would operate at constant speed under all conditions of service. It is impossible to construct an armature without appreciable resistance, and the field flux of a commercial machine does not vary directly with the exciting magnetomotive force, so that the assumed ideal condition cannot be realized in practice. On page 1298 of this issue, Dr. A. E. Kennelly describes an interesting method by which the variation in speed with change in voltage of a shunt motor may be determined graphically when the armature resistance and the saturation curve or "saturation factor," are known. The treatment has been rendered extremely simple by assuming a constant IR drop in the armature and a certain determinable percentage change in field flux for each per cent of variation in exciting current.

Grounds for Secondary Circuits.

The paper and discussion on grounding secondary circuits at the recent National Electric Light Convention reveals the importance of immediately investigating further the question of procuring cheap and satisfactory grounds in soil which sometimes is lacking in permanent moisture. The paper on this subject by Mr. Sidney Hosmer, giving the experience at Boston, together with the subsequent discussion, which gave some sidelights on the Boston situation, showed that the method of grounding recommended in the National Electrical Code, namely, that of burying a copper plate in coke, is one which gives grounds which are far from having a low resistance in many cases. A poor ground for secondary circuits may be a little better than no ground at all, but it does not by any means afford complete protection. The Boston experience was corroborated by testimony from New York confirming the unsatisfactory character of such grounds. The solution adopted at Boston was to ground the secondaries at each customer's premises on the water pipes, while in New York it was found to be cheaper to run continuous secondary ground wires over the whole alternating-current district back to the power station, where a good water pipe ground could be obtained. In a very scattered distribution the cost of running such a continuous ground wire would probably be greater than that of grounding at each customer's premises. It is likely, however, that it will be found that this continuous ground wire plan has a much wider application than would be at first supposed. In small towns the expense of making a good ground on each customer's premises may cause the managers to hesitate to take this decidedly desirable step. It is important, therefore, that the method of grounding should be cheap as well as effective. Of course, nothing, however cheap, is to be considered unless it is effective, as a poor ground is like an investment in a bogus insurance policy. A collection of data on the resistance of various types of grounds in various soils would be of great value at this juncture, when many companies are in the midst of the work of grounding their secondaries.

Electrical Apparatus in Solar Eclipse Observations.

The Royal Society of Great Britain has recently published six reports on observations of the total solar eclipse of August 30, 1905. The observations were made in Spain, in northern Africa and in Egypt. One of the expeditions to Spain settled at Castellon de la Plana. Unfortunately, the sky became cloudy during the day of the eclipse, and so all observations were practically null and void. A peculiar form of thermopile was, however, set up for use, which may serve on some future more favored occasion. It consisted of a ring of ten bismuth copper junctions mounted on a mica disk and set in the eyepiece of the reflective telescope. A potentiometer method was used for measuring the e.m.f. developed in the ring thermopile when set into adjustment. The dimensions of the pile were such that at totality, the image of the coronal ring would fall upon all the ten heated junctions in the annulus. In full sunshine at Castellon the observed solar radiation intensity was about 1 calorie per square centimetre per minute; or each square centimetre of the earth's surface received nearly one megerg per second after the radiation had passed through the earth's atmosphere. Observations on the moon gave a radiation intensity of 150,000 times less than the sun, or about 5 ergs per square centimeter per second. The apparatus had a sensitiveness sufficient, it would seem, to detect some slight radiation from the planet Jupiter.

Explosion of Glass Tubes Containing Radium Salts.

The *Physikalische Zeitschrift*, of June 1, contains an interesting and important article by Prof. Paul L. Mercanton upon a research with a glass tube containing 15 milligrammes of radium bromide. The observation has been made, both by Mme. Curie and by Herr Precht, that a small glass tube containing radium salts, after having been sealed and set aside for many months, broke into shivers, without apparent cause. It is known that radium salts, contained in ordinary open air tubes, give off a gaseous emanation containing helium. The inference made from the explosion of the sealed tubes was, therefore, that the radium salts had kept steadily at work, week after week, generating gas, until finally the internal gaseous pressure burst the tube, scattering the valuable contents in all directions along with the débris of the walls. The estimated pressure required for this result had been in fact computed, and given in one instance as 20 atmospheres. In order, therefore, to preserve glass-enclosed radium salts, the most expensive substance the world has yet produced, it seemed desirable to unseal the tubes occasionally and give them a chance to blow and get rid of their enclosed products of manufacture. Arrangements were made on an elaborate scale to unseal a little glass radium tube which had been sealed for more than three years, containing 15 millogrammes of the purest radium bromide. An explosion chamber of thick glass was prepared, into which the tube could be made to burst at the proper time. In this explosion chamber the little radium tube was supported, with a few turns of platinum wire on its end, in such a manner that an electric current could be sent through the wire, the radium tube wall could be softened in its vicinity, the internal pressure could swell out the softened glass and allow it to burst into the explosion chamber. This chamber could then be connected with a quicksilver manometer, to measure the pressure of the escaped gases, and also with a Geisler tube apparatus for spectrometer tests as to the nature of the gases.

An experiment was made with the apparatus, employing a little glass tube containing air at ordinary pressure, in place of the precious radium tube. The explosion chamber was exhausted by a mercury air pump, and sealed off. The current was then passed through the platinum wire. The heated wire softened the end of the little glass air tube under test. The internal air pressure expanded and opened the wall of the air tube at the softened point. The manometer forthwith measured the pressure of the released gas. In short, the dress rehearsal went off in splendid style. On the appointed day, February 16, the real and precious little radium tube with its 15 milligrammes of purest radium bromide was inserted in the explosion chamber with appropriate ceremonies, and the apparatus closed air tight. Slowly and with great care, lest a premature explosion should occur, the air pump was allowed to exhaust the explosion chamber. This was at last sealed off safely. The electric current was then turned on the little platinum heating coil and the effects looked for with bated breath. The wall of the radium tube heated up and softened, but, instead of expanding outwards, with the pressure of internal gases, it refused to budge. In fact, it seemed more inclined to collapse. At this juncture the platinum heating wire unfortunately fused and brought the experiment to an untimely end, without any explosion to reward the patient investigator for all his precautions. The barometer showed no pressure of any consequence, and the spectrometer showed no helium. Although it was not possible to observe any hole in the wall of the radium tube after disassembling the apparatus, yet from the radioactivity set up outside, it was inferred that the wall had actually been penetrated by the melting process. The experiment seems to show that gases do not accumulate within glass-sealed radium tubes, and also that there are more ways in Nature of shattering glass tubes than letting them fall or exploding them. Just why and how radium tubes do break into shivers is now an open question, and a most interesting one. It looks as though radium were not content with being itself unstable, but was bent on making its neighbors also unstable.

POWER IN THE FAR NORTH.

Nothing can give a more forcible illustration of the generally accepted and unsensational character of high-voltage plants than the article this week by Mr. V. A. Moody on the great system designed to supply Winnipeg with light and power. Three or four years ago a transmission line of 65 miles at a nominal voltage of 60,000 would have been widely heralded, and the unusual voltage would have caused world-wide comment. To-day as one reads the article he is impressed only with the remarkable elaboration of the switchboard appliances to which the generators and lines appear to be merely adventitious. Yet with such a plant in full operation we have a pretty well defined opinion that the transmission line will be the most serious subject of attention, as it always has been in the past in spite of the fact that high voltage is commonplace. With respect to the line, the town construction has been unhesitatingly followed, we hope not too hastily, but with several modifications which are interesting. Each tower is thoroughly grounded and is converted into a true lightning rod by a steel rod carried well above the line. How effective this will be remains to be seen, but it looks like a step in the right direction. It is not certain that a tower so protected could be struck without breaking down the line insulation, though surely the lightning rod is better than allowing the line to serve in this capacity quite unaided, and it probably will serve a useful purpose in a good many cases. A further point of interest in the line is the use of the very flexible hemp-cored cables, which should add to the security of a long span line in a somewhat formidable climate.

We shall watch with interest the performance of this line, which is certainly the "farthest north" for anything like similar voltage. As is well known to many of our readers, there are numerous lines nominally working at 60,000 volts which really have never been pushed to this pressure save in an experimental way. In fact, one notable example of tower construction rated at 60,000 has had a hard time in holding up its insulation at 45,000 volts. The transformers on the Winnipeg system have very wisely been provided with taps for 40,000, 50,000 and 60,000 volts, so that the working pressure can be made to keep pace with improvements in the art of insulation, about which there is still considerable to be learned at these very high voltages. We believe that there are no better high-tension insulators than those turned out by American makers. At 60,000 volts and upwards not only is the ordinary pressure high, but there is a chance of surging and resonance forcing the instantaneous pressure up to more than 150,000 volts, and we do not believe that a factor of safety of 2 for the insulators is sufficient unless under exceptionally favorable conditions. Fortunately, save for mechanical strains due to storms and temperature changes, the Manitoba climate is no worse than many another.

With respect to the utilization of this power we note with interest that it was decided to work the line at 60 cycles and to use motor-generators rather than to depress the frequency below the point advisable for lighting for the sake of using synchronous converters. Unquestionably the change is highly advantageous in the matter of working the line on account of the controlling power given by the synchronous motors. This again appears to have been secured at a very trivial loss in efficiency, the combined efficiency of a motor-generator set at full load being 93 per cent. These sets are also arranged to run as motors on the direct-current side, enabling the synchronous motors to be worked as generators if occasion requires. In the switchboard and cable equipment very thorough precautions seem to have been taken against breakdowns. Especially the leads in the station, often sources of serious trouble, have been given thorough protection. It is a striking tribute to the present quality of electrical apparatus that one instinctively assumes that the generators will give no trouble and feels free to turn his attention mainly to the accessories. Even the high-voltage transformers have earned a reputation for trustworthiness, and if one looks over critically the causes of breakdowns in transmission stations they are usually found elsewhere than in the main items of equipment. On the hydraulic side the Winnipeg system presents no remarkable features save in the serious work required in the canal. The head is low for so large a plant, so that two double wheels had to be put in tandem to get the requisite generator speed. These wheels being practically at the forebay, the conditions for regulation are of the very best in spite of the rather low head. The whole installation appears to have been carried out in a thorough and workmanlike fashion, as is fitting for a plant which must be the main reliance of the chief city of the great Canadian Northwest. Its cost has been necessarily heavy, but it is working in a region where fuel is necessarily dear, and the relatively cheap energy which is can supply will be a boon to the manufacturer.

Extensive Lighting and Traction Consolidation in Pennsylvania.

An interesting and important consolidation is being carried out of the lighting and traction properties in Schuylkill County, Pa., at the heart of one of the richest anthracite regions of this country, with Pottsville as a center. Conditions for the economical production of electricity could hardly be more favorable; and the district is growing rapidly in wealth and population, with coal mining as a basic industry, bringing many large manufacturing developments in its train, such as in textile, cement, etc. No fewer than fifteen separate companies are gathered into the one group, to be known as the Eastern Pennsylvania Railways Company; and in addition to the electric lighting of the region, these embrace nearly 60 miles of electric railway to which will be added about 20 miles of new high-grade track. The companies are: Pottsville Union Traction Company, Pottsville & Reading Railroad Company, the Schuylkill Haven & Orwigsburg Street Railway Company, the Schuylkill Electric Railway Company, Edison Electric Illuminating Company, of Pottsville; Anthracite Electric Light & Power Company, of Pottsville; Frackville & Gilberton Light, Heat & Power Company, Tamaqua & Lansford Street Railway Company, the Tamaqua & Pottsville Electric Railway Company, Coal Castle Electric Railway Company, the Port Carbon & Middleport Electric Railway Company, Edison Electric Illuminating Company, of Tamaqua; Citizens' Gas Company, of Tamaqua; the Minersville Electric Light Company, Citizens' Gas Company, of Minersville, and the Minersville Fuel Gas Company.

The engineering and general management of the property will be assumed by J. G. White & Co. and $1,500,000 will probably be spent in the immediate future in making the contemplated electric railway and lighting connections, extensions and improvements. The power will ultimately be generated in two power stations, and it will be distributed through various sub-stations located with reference to the demands of service.

The financial syndicate has underwritten and sold $3,500,000 of first mortgage 5 per cent thirty-year gold bonds, $975,000 of 5 per cent cumulative convertible preferred stock, and $4,000,000 of common stock. Of these securities approximately one-half are taken and held by the original owners of the various properties, the balance being sold to investors, here and abroad, for completing the several purchases and providing the money for improving and extending the several properties. The financial syndicate is headed by W. A. Read & Co., of New York, and Forrest & Co., of Philadelphia, who have issued a circular based on the detailed reports of J. G. White & Co. and Mr. William Barclay Parsons, showing a very promising future for the enterprise. The gross for 1905 of $469,054 would leave a surplus of $22,081 after payment of fixed charges and the preferred dividend and this is rising yearly so that 1908 would indicate a gross of $955,236 with a net surplus of $162,196. The growth of business of the companies in this region, on the existing network of circuits and tracks has averaged not less than 12½ per cent yearly since 1904. The six power plants of 5,110 kw capacity will be replaced by two of 6,500 kw with marked saving.

Some Figures on Niagara Power.

Mr. H. W. Buck, the well-known electrical engineer at Niagara, contributes to the *Outlook* some interesting data on Niagara power. The total available water of the falls, says Mr. Buck, would represent about 3,500,000 hp. To generate 1 hp continuously for a year by a steam engine requires about 13 tons of coal. To generate, therefore, continuously, 3,500,000 hp by steam would require about 50,000,000 tons of coal per year.

To generate electric power by steam with the most modern steam plant costs not less than $50 a horse-power a year, allowing for fixed charges and operating expenses. Niagara power can be generated and sold in large quantities for $15 a horse-power a year, or for $35 a horse-power a year less than is possible from the use of coal and the steam engine.

From the above it will be seen that if all the hydraulic energy of the Falls were utilized for power purposes there would result to the country an annual saving of $35 a horse-power for 3,500,000 hp, or $122,500,000, and in addition there would be an annual saving in coal consumption of 50,000,000 tons.

These figures illustrate what it costs the people of this continent annually to maintain Niagara Falls as a spectacle. They represent the saving to those who would consume the power, and not the profit of those who might own the power developments.

This waste involved in prohibiting the development of Niagara power might be likened to a great conflagration in which 50,000,000 tons of coal were annually consumed. Such a conflagration might be one of the most magnificent sights in the world, and people might come from all parts to view it, but the human race would certainly be justified in using every effort to stop the waste by putting out the fire. Moreover, it does not follow that even a very extensive use of the power will mar the beauty of the falls.

Electricity on Steam Railroads.

At the meeting of the American Railway Master Mechanics' Association, held this week at Atlantic City, the Committee on Electricity on Steam Railroads presented a report which is of particular interest from its discussion of gasoline and gasoline-electric motor cars. This report is reprinted below, with a few omissions relating to electric traction statistics:

The instructions to the committee were to consider and present to the association the relative advantages of the different systems of electric traction now in use as applied to interurban and suburban lines; also, as far as possible the relative cost of operating such lines by electricity and steam. The committee was also instructed to include in its investigations the different systems of gasoline, gasoline-electric and steam motor cars. The report states that this is almost the first recognition by the association of other motive power than the steam locomotive. Main line operation was not considered, branch lines, suburban and interurban lines which are feeders to main lines alone being discussed. The committee also understood that the question relates mainly to passenger traffic, as electric traction of freight is carried on to a limited extent only at the present time. Mail, baggage and express are being handled, but these are generally considered in connection with or a part of the passenger traffic.

The class of service considered breaks away from the steam railroad ideas of trains of cars drawn by locomotives, and takes up the individual car or cars, each provided with means of propulsion taking power from some central source. The main business of railroads is to sell transportation, and the only object in considering electric traction is to ascertain whether the cost of carrying passengers can be decreased or the amount of travel be so increased as to provide additional revenue to the road offering it.

In the year 1890, the census report gave for the United States the following mileages of street and suburban railways:

Electric	1,261.97	miles.
Animal	5,661.44	"
Cable	488.31	"
Steam	711.30	"
Total	8,123.02	"

In 1902 the mileage was:

Electric	21,907.59	per cent,	increase	1636.
Animal	259.10	"	decrease	95.4
Cable	240.69	"	"	50.7
Steam	169.61	"	"	76.2
Total	22,576.90	"	increase	177.9

Statistics are quoted to show that while since 1890 electric traction mileage has increased enormously, yet the greater proportion of the increase was at the expense of the other methods of traction. During this period there were some ephemeral experiments in the use of batteries and of stored compressed air for power purposes on cars, but none of these survive. The above figures also show the backward development in street service of the steam-driven car or "dummy," despite the vast advance in steam railroading proper during these years, and this in itself is almost a complete argument against the steam car or other types of self-propelled car, except for special situations.

In early electric street railway traction several attempts were made to utilize an electric locomotive, but these were generally abandoned, although it is customary now on some roads to have trail cars attached to leading motor cars. The latest and most advanced practice is to have all cars equipped with motors controlled from the leading car. The development in electric cars has been marked not only by their increase in size and carrying capacity, but also in the size of motors employed. The earlier cars had 15 or 20-hp equipment, but it was soon found that these were inadequate to properly accelerate loaded cars, and now many heavy suburban cars are equipped with four 75-hp motors each, and in some cars the motor equipment totals 400 hp. There is thus available for comparison the steam railroad train, consisting of a locomotive with as many cars as the service demands, running at infrequent intervals, and covering perhaps 200 miles per day, as against the same road operated with individual electric cars, obtaining power from a general source, running at frequent intervals and fairly equivalent mileage.

It is perfectly apparent that the density of traffic is the ruling factor as to whether the steam or the electric road will prove the more profitable. It is quite well known on old-established lines what the passenger returns will be with fairly steady business conditions, provided there is no change in the train accommodations, but if there is an increase in train service it is almost sure to build up an induced traffic, the amount of which is difficult to estimate. Unless, therefore, there is a reasonable basis of expectation for such traffic, the steam railway that can fully care for its own is not in need of a new system, and the expediency is doubtful. On the contrary, there are many sections of country, well populated and suburban districts, where an increase of travel may be induced by improved facilities, the amount of which can be gauged by the density of population.

The travel which is contemplated is the local, short runs, which in many cases has been taken from steam railroads by competing electric lines, this proving that the more frequent service and general convenience of the trolley line is more attractive. Absence of smoke and cinders, open cars in season, connections with city lines, all add to the popularity of the trolley and give a business that can be profitably carried at lower rates, which, after all, is the main inducement. It is believed, therefore, that where there is a sufficient density of traffic it will pay steam railroads to handle their local suburban and interurban travel electrically, giving frequent trains and frequent stops, equaling the convenience and accessibility of trolley lines, for which the public does not have to stop to consult time tables, buy tickets and go to inconvenient points to get on trains. Traffic of this kind should have its separate tracks, as it would get in the way of fast through trains and itself would be impeded by slow freight trains, using the same tracks.

It would be possible to make a combination service in some territories, running slow freight though at certain hours when travel was light, or if the character of the freight would permit, to have special separate freight units which could keep out of the way of passenger traffic. As before stated, the particular class of service and the system to be used must be chosen with special reference to the situation, and these vary so that no general rule or information will apply. Few situations, however, will figure out profitably with the combination service, and if electrification is warranted for passenger traffic a complete change will be desirable, except possibly where there is through travel involved also.

By far the greater portion of present car equipments are for the use of direct current, but of late alternating current has entered the field and there are some very interesting single-phase operations, the motors employed being capable of running on either direct or alternating current, and by having suitable transformers on the cars, high line voltage may be carried, thus reducing the cost of distribution. Long-distance distribution is best accomplished by alternating current of high voltage, and if direct-current motor equipments are used the current is transformed at sub-stations at suitable intervals and generally not over ten miles apart. These stations are equipped with transformers for stepping down the voltage, and with rotary converters for changing the current to direct at suitable voltage for the line. Sub-stations on lines employing single-phase machinery have only the transformers, no rotaries being required, and this also reduces the cost of attendance.

The single-phase operation is economical on account of high voltage used on the line, and cheapens very much the cost of distribution from the sub-stations, there being no transformation between the power station and sub-stations. The car equipments however, are more expensive than direct-current apparatus, so that, assuming both to be of equal efficiency, the number of equipments and apparatus required must be considered, and their extra cost weighed as against the low cost of direct-current machinery and more expensive distribution to the line.

The present New York Central-New Haven Railroad situation is an interesting example of the application of these two systems of electric traction, and the ultimate working out of these two great problems will add greatly to the shaping and development of the future of electric traction.

The relative costs of operation with electricity and steam are difficult to state as there is very little accurate information of value. The results obtained by attempting to draw comparisons from hypothetical roads would depend entirely upon the assumptions which were made. For instance, a set of conditions could be assumed which would show a much lower cost of operation by electricity than by steam; another set could be assumed which would show practically equal cost, and a third set which would show that steam operation would be the most economical. In view of the fact that the assumptions would govern the results, it is believed that information of this nature would not be of value to the association and might lead to erroneous assumptions and misunderstanding. A number of electrifications are under way at the present time, employing various systems of distribution, and a considerable amount of data will no doubt be available in the near future.

Some time prior to the development of electric interurban railways the steam motor car or dummy, in many cases hauling a trailer, was used to a moderate extent, but at the present time few of these remain. In response to a demand from railroad managers for a motor car to operate on branch lines and special situations there has been recently a development of motor cars employing gasoline in an internal combustion engine, this engine either directly driving the car or driving a dynamo to generate current to be used for driving motors in the trucks. Some builders interpose batteries between generator and motors to store the energy when it is not all needed for propulsion, and to assist in starting on grades when the generator capacity may be insufficient. There is very great flexibility and convenience in this combination, but it is attained at very considerable expense and complication, and requires unusually skilled attendance not commonly available in railroad service.

The examples of the gasoline engine, electric generator, battery and motor types are the cars of the St. Joseph Valley Traction Company's line, built by F. M. Hicks, and the Strang car that lately made a successful run from New York to Kansas City. The gasoline engine on these types is set to run at a constant speed, and this characteristic is essential for the best economy of the internal combustion engine. The size of the engine used may be proportioned to the average power required for normal operation, and the speed variation and excess of power above normal requirements may be supplied by the battery equipment, which also comes into play for lighting and short movements and would also be available to bring the car in in case of a breakdown of the engine or generator.

The gasoline-electric type not employing batteries is illustrated by the D. & H. car recently built by the General Electric Company. The generator on this type of car has to be equal to the maximum requirements, and in order to vary the current for the conditions to be met, the field excitation is handled by a separate exciter, chain-driven from the main generator. The controller is semi-automatic and can be set for any predetermined maximum acceleration, and the speed of the car is governed by varying the field strength of the generator. The speed of the engine remains constant after acceleration. This application is very ingenious and effective, and the car has been put into regular service between Schenectady and Saratoga.

The Union Pacific motor car, representing the direct mechanical drive application of gasoline power, is driven by a six-cylinder reversible gasoline engine, with crank shaft at right angles to the length of car; a sprocket mounted on same, driving a special chain, transmits the power direct to the driving axle through a second sprocket attached to the axle. The chain easily shows a transmission of power with an efficiency of 97 per cent, which clearly demonstrates that this method of transmission is very close to the maximum efficiency possible.

For the initial start of car, or putting it in motion, a reducing gear is used, and, until the car attains a speed of six or seven miles per hour the economy of this transmission is somewhat reduced; but, as the use of the gears is only temporary and lasts only a few seconds, it can almost be left out of consideration.

One of the most important features in the development of the steel motor car is the reduction in height of car and consequent reduction in weight and decreased wind resistance, a result of which is the system of ventilation—taking fresh air from the front of car, delivering it at floor level and by suction, drawing the foul air out of the roof.

The roof of the Union Pacific motor cars is 24 in. lower than the standard height of coach roof. The car being built of steel, with pointed end and smooth exterior surface, the wind resistance is materially reduced, enabling a 100-hp gasoline engine to drive the car at the rate of 65 to 70 miles an hour. The car framing is a combination of steel shapes and braces, the whole tied together by steel plates, making a unit structure, each part supporting the adjacent ones and bearing its proportion of the burden imposed upon it. These cars weigh, motor and all, 26 tons, which of course is a very material factor in the high speed attained by cars in service, and affords considerable economy in comparison with the heavier steam motor cars, some of which weigh 75 tons and over, with the same seating capacity. Motor car No. 7 has seating capacity for 75 people, and has, in actual service, carried 95. It is equipped with round metal sash windows —a window impervious to cold air, dust or water; in fact, is tight as a porthole on an ocean-going vessel. These windows have demonstrated themselves to be a great luxury to the traveler. The enclosed inside steps, with side door entrance, have also proved very popular with the traveling public. This side door entrance is permissible with steel car construction without weakening same, the side sill being depressed and divided, a portion being carried over the door and the other portion under, all being tied rigidly in combination with the plate and steel sheathing of the car; forming a structure of such strength as to eliminate the usual weakness caused by a side aperture the size of door opening in these cars. The first cars—55 ft. in length, seating capacity 75, and with an engine of 100 hp—are particularly adapted for branch line service, where the traffic is insufficient to support a steam service or anything like electric service.

Interest in the steam car is also being revived, as, for example, the Ganz cars imported from Budapest by the Florida East Coast Railways; also the Erie Railroad and the C. P. Railroad are experimenting with a steam car equipped with a Scotch marine type of boiler, using a superheater and oil fuel. It is believed that some one may undertake to make a so-called flash boiler that will be applicable to this service.

It is recognized that the so-called motor car, one carrying its own motive power plant, whether gasoline, gasoline-electric or steam, occupies a distinct field of usefulness. On many branch lines, now existing, where travel is light, and on new extensions into unsettled country where the business will not return a profit on steam train service, it would have to be run at a loss until a sufficient business was induced or built up by the travel facilities afforded. These situations are the distinct field of the motor car, which can be operated for less per car-mile than by regular steam train or electric methods until the volume of business will warrant the regular transportation methods.

The use of motor cars on the Union Pacific in picking up passengers on branch lines and in delivering passengers at connecting points for through trains, has been found to be exceedingly lucrative. The matter of giving the branch line patrons of any steam road increased service, with more frequent trips per diem, is very much appreciated by the local community, and their good will is beneficial.

On the hypothesis of the same density of traffic, with the same class of service as would be encountered on one of the ordinary branch lines of the territory west of the Missouri River, the cost per mile for local train service, equipment consisting of two cars and a locomotive, would be about 24 cents, including repairs, fuel, oil, labor, cleaning, etc.; this for passenger as well as baggage, mail and express service. Electric service equipment, consisting of one car and trailer, figuring that the density of traffic is sufficiently regular to support same seven days in a week, is estimated at about 18 cents a mile.

The gasoline service (mechanical drive only considered), consisting of one car and trailer, with baggage, mail and express service, would cost 15 cents per mile. The latter, of course, would be independent of whether service was six days or seven days per week, the cost simply depending upon the service rendered.

Railroads, therefore, have a choice of the various systems proposed, and a study of the conditions to be met and facilities afforded, both in the way of care and maintenance, as well as the train service proposed, will give the elements by which each situation will have to be studied. The motive power departments will be called upon to participate more and more in advising as to these questions, and in order to be qualified to undertake such work it is very desirable to introduce information and discussion of these subjects in this association.

The report is signed by Messrs. C. A. Seley, chairman; W. R. M'Keen, Jr., L. R. Pomeroy, C. F. Street, F. J. Cole.

Control of Electric Railway Motors.

Four patents were issued on June 5 relating to the control of electric railway motors. A scheme proposed by Mr. F. E. Chase for controlling the speed and torque by varying the voltage on single-phase motors is indicated in Fig. 1. Each car is provided with two auto-transformers, each of which serves to supply current at variable potential to one or more motors. Instead of series-paralleling the groups of motors to obtain a greater range of voltage, the inventor secures the same result by series-paralleling the auto transformers, by means of the contactor switches which serve to interconnect the transformers as desired.

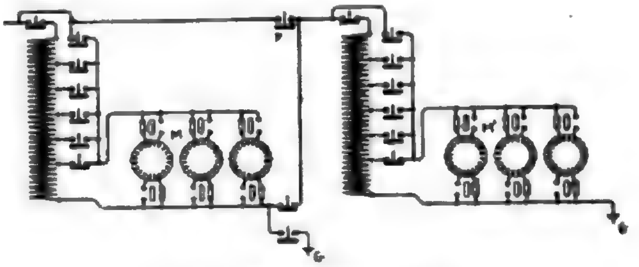


FIG. 1.—CASE CONTROL SYSTEM.

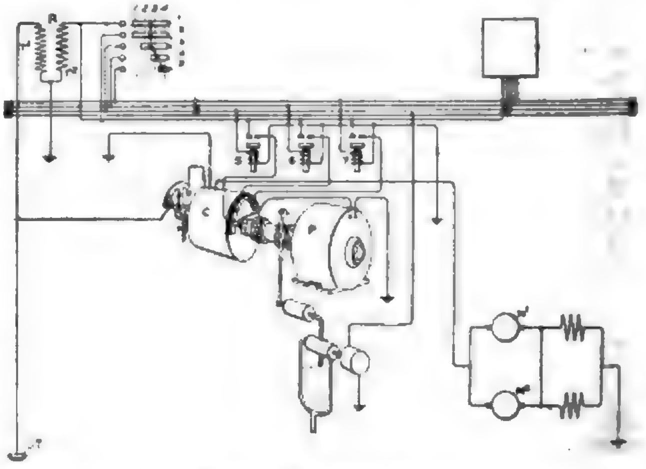


FIG. 2.—KROHN CONTROL SYSTEM.

Fig 2 illustrates a motor control system devised by Sigvald Krohn, of Berlin, Germany. The voltage supplied to the motors is varied by means of an induction regulator, the rotor of which is moved by pilot motor. A clutch, which mechancially connects the pilot motor with the induction regulator, is thrown in or out by a pneumatic device which receives compressed air from the braking system. The valve for admitting the air to the operating piston is controlled by an electromagnet. The circuits to this magnet, to the pilot motor and to the induction regulator are arranged as desired by means of a master controller.

When it is desired to regulate the motors on several cars of a train from a single point and no auxiliary source of current supply is provided, the control current must be obtained from the collecting devices of the leading car or from a bus line. If the bus line consists of only a single wire connected directly to the several current-collecting devices, current may pass from one car through the bus wire and to the motors of another car, necessitating the use of a heavy wire capable of carrying motor current. Mr. George H. Hill proposes to connect the motor circuits of each car directly to the collecting device on that car and to employ the bus line exclusively for obtaining current for the control system and for lighting and heating, if desired, as indicated in Fig. 3. The three patents outlined above have been assigned to the General Electric Company.

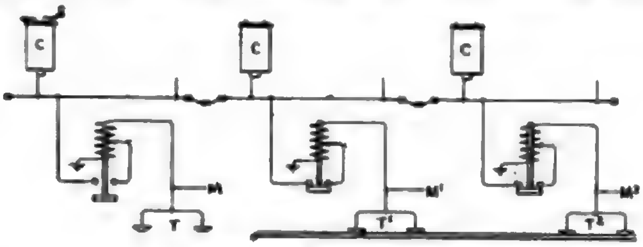


FIG. 3.—HILL CONTROL SYSTEM.

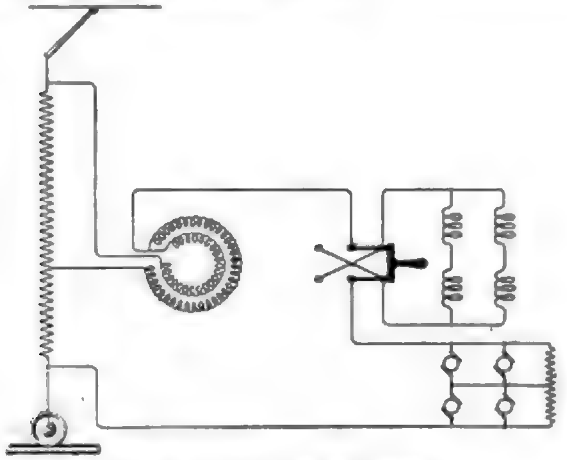
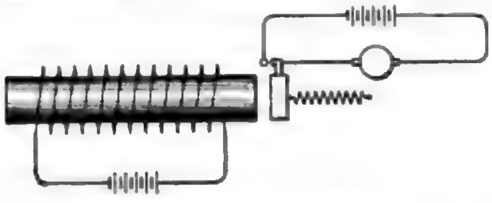


FIG. 4.—LAMME CONTROL SYSTEM.

Fig. 4 shows a system devised by Mr. B. G. Lamme for equalizing the potential differences between the terminals of the armature windings of single-phase motors when connected in series, in order to prevent the abnormal increase in potential across a motor in case the wheels should slip. As will be seen from the illustration an auto-transformer winding is connected between the outer terminals of the armatures and an intermediate point is connected to the armature winding terminals, which are joined together.

Electromagnetic Thermostat.

A patent issued June 5 to Prof. Elihu Thomson describes a method of utilizing the change in the magnetic permeability of certain alloys for the purpose of temperature indication and regulation. In the arrangement shown in the accompanying illustration a solenoid energized by current from a battery serves to set up a magnetic flux through the core which is made of a sensitive alloy, so that with constant excitation of the winding the magnetic flux through the core will undergo a substantial change when the temperature of the core reaches the critical temperature of the alloy. These changes in magnetic flux are used to change the position of the armature, thus opening or closing the local circuit through a motor which in turn performs such operative acts as are necessary to secure any desired temperature regulation. It is stated that a satisfactory alloy is obtained by using substantially 75 per cent copper, 24 per cent of an alloy of manganese and aluminum combined in their atomic proportions, and one per cent of lead, as this gives an alloy the permeability of which changes at approximately 60° C.



ELECTROMAGNETIC THERMOSTAT.

CURRENT NEWS AND NOTES.

DATING OF TELEGRAMS.—Congressman W. W. Smith has introduced a bill which provides that every telegraph company shall show plainly on every telegram delivered the time of day at which the telegram was handed in at the company's office at the place from whence it came. A bill introduced so late would not at best appear to have much chance of passing this session.

TELEPHONES AND HORSE THIEVES.—The Indiana Horse Thief Detective Association announced recently that the association was thoroughly organized in all the counties of the State and had during the past three years decreased thieving and outlawry at least 75 per cent. The association officers stated that no agency had been more helpful in apprehending wrongdoers than the telephone. As soon as a theft is reported the telephones are used and seldom do the perpetrators get out of the county before being arrested.

MUNICIPAL LEAGUE OF INDIANA.—The Municipal League of Indiana, held its eighth annual meeting recently. It will ask the next Legislature to make numerous changes in the new cities and towns code as well as in the general law in matters affecting municipalities. One of the changes to be demanded is power to require interurban and steam railroads to light the streets over which their lines pass. The present law on that subject was not upheld by the Supreme Court. The subject of municipal ownership was discussed informally, the majority of the members of the League opposing it.

TELEPHONY IN BALTIMORE.—The opening of the new St. Paul exchange of the Chesapeake & Potomac Telephone Company restores telephonic communication in Baltimore to more than its former efficiency. Some 10,000 telephones were "cut over." The opening of this new building marks for Baltimore one of the most complete equipments for telephone service in existence. The new building has nine stories and a basement, and a steel frame extends through the roof to receive two additional stories, for which the building is planned. The building is 40 by 150 ft., and is fire-proof. It was planned especially for telephone services. The steel frame is one of the heaviest of any building in Baltimore, on account of the great weight to be supported, in the shape of apparatus and machinery, and the necessity for absolute rigidity. The cost with ground and without telephone equipment, was $500,000. As it stands the structure provides for two exchanges, with a capacity of 40,000 telephones. With the two additional stories it will have a capacity of three exchanges, or 60,000 telephones. The switchboard for the St. Paul exchange occupies the whole of the ninth floor. The terminal apparatus, which is already installed for two exchanges, occupies the entire sixth floor. The eighth floor is given up to operators' quarters, locker rooms, reading-rooms and dining-room. The cost of the St. Paul switchboard was $325,000, making the total cost of the building and first exchange $825,000. The exchanges open with 10,000 working lines. There will be 160 operators at the start, 300 when the board is full, and 1,000 when the whole building is occupied by the three exchanges.

PHYSICS AT CORNELL.—The new Rockefeller Hall of Physics at Cornell University, Ithaca, N. Y., is to be dedicated on Friday, June 29. This will coincide appropriately with the meeting there of the American Association for the Advancement of Science, beginning June 28.

SURGES IN UNDERGROUND DISTRIBUTING SYSTEM.—In the editorial with this title in our issue of May 26 the third and fourth paragraphs should have had a separate head, as they do not refer to the I. E. E. paper of Mr. Patchell, but comment on the presidential I. E. E. address of Mr. John Gavey.

ELECTRICITY AND GAS IN ITALY.—United States Consul-General de Castro at Rome, Italy, states that the amount of gas and electricity produced by the 228 gas works and 5,086 electric plants was, for gas, 74,271,628 cubic meters extracted from coal and 1,419 from mineral oil; for electricity, 132,126,051 kilowatts.

NATIONAL TELEPHONE CONVENTION.—The annual convention of the National Interstate Telephone Association will be held at the Auditorium Hotel, Chicago, June 25, 26, 27 and 28, when a large attendance is expected. A number of addresses and papers will be presented, but apparently none of them will be of technical or engineering interest, except perhaps that on Southern toll lines and exchange development. There will, however, be committee reports on standard operating rules and regulations, on standardization of equipment, and on standard forms of accounting. Mr. T. Gary, of Macon, Mo., will present a paper on the financing of small telephone properties.

THE CANADIAN ELECTRICAL ASSOCIATION meets this week at Niagara Falls, Canada, the dates being June 19, 20 and 21. An interesting programme has been provided and the business sessions will be conducted at the International Hotel on the American side, as the new Clifton is not yet ready. Among the papers to be presented at the convention are the following: "Steam Plant Accessories," by John T. Farmer; "The Power Plant of the Electrical Development Company of Ontario," by F. O. Blackwell; "The Electrical Plant of the Canadian Niagara Power Company," by H. W. Buck; "The Plant of the Ontario Power Company," by V. G. Converse; "Some Legal Propositions of Interest to Electrical Men," by Robert McKay.

ENGLISH MUNICIPAL PLANTS.—A special cable dispatch from London of June 16 says: "The National Civic Federation Commission, which has reached Liverpool from Birmingham, continues to receive municipal hospitality, as well as facilities for conducting its inquiry into public and private ownership. It commands respect for practical ability, although *The Municipal Journal* gives warning that the commission represents two parties in the Federation, one in favor of municipal ownership and the other standing for private enterprise, and that the reports produced after the investigation of municipal and private plants will be mutually destructive. The commission will reach London by the end of next week, after completing an examination of the tramway and gas plant at Manchester."

THE N. E. L. A. CONVENTION.—Secretary Eglin, of the National Electric Light Association, in a memorandum on the recent convention, says: "Although the increased attendance at the conventions of the National Electric Light Association, the greater interest taken in the sessions, and the very largely increased membership, speak volumes for the good work the association is doing, perhaps even more encouraging is the fact that so many of the delegates took occasion to look up the secretary for the express purpose of expressing appreciation of prompt and efficient responses to letters asking for assistance and information during the year. One member in particular stated that information he had asked for so late that he hardly expected to get it, came instantly and was of such importance that it settled in favor of his company the award of a 25-year contract for street lighting. This is only one of many similar acknowledgments, showing that the really valuable work goes on all the year round and benefits members even if they never attend a meeting."

ELEVATED RAILROADS.—It had been supposed that elevated roads had seen their finish in New York, but electricity has not only given them a new lease of life, but created a taste for more. Last week the New York Board of Estimate heard vigorous arguments for an elevated loop line at the Manhattan end of the Williamsburg Bridge, for the benefit of Brooklynites. This was opposed by residents on the east side affected by the elevated loop plan of Bridge Commissioner Stevenson. Mr. J. E. Swanstrom said that the beautiful electric elevated road in Berlin had added to the value of property, and he added: "This subway craze is going to die out. We are going back to elevated roads—not the present kind, but ornamental noiseless roads." Ex-Comptroller Grout insisted that an electric elevated loop was the only way to "relieve the unbearable congestion of the bridges."

PUBLIC DUTY OF ENGINEERS.—At the laying of the cornerstone of the new Engineering Building of the University of Tennessee, President Humphreys, of the Stevens Institute of Technology, said: "The questions before the country to-day which are causing the most concern are largely industrial and technical, and hence the opportunities for misapprehension on the part of the public are greatly, dangerously, increased. I have thought much on the subject and not unlikely my opinions may be colored by my training—but it does seem to me that if we are in danger through the lack of information and misinformation of the public, sedulously cultivated by the yellow journals, the engineers of the country are peculiarly qualified—or should be—to combat this ignorance, and, therefore, they cannot avoid grave responsibility in this connection both as to the present and the future. It is coming to be more and more the practice to place technically trained engineers in charge of our industrial establishments. These men, then, should be prepared to recognize that capital and labor have their respective rights in which they should be protected, and should especially be ready to recognize that the contests between capital and labor—so-called—are frequently contests between leaders who manipulate capital and labor for their own ends."

KENTUCKY INDEPENDENT TELEPHONISTS.—At Louisville, Ky., on June 14, the annual meeting of the Kentucky Independent Telephone Association was held at the Louisville Home Telephone building. Companies in most of the towns and cities in the State were represented. It developed that in the State there are about 150 corporations giving independent telephone service, with 50,000 subscribers. Subjects of importance to the independent telephone interests were discussed and the delegates to the National Interstate Telephone Association convention, to be held in Chicago on June 26, 27 and 28, were elected as follows: J. A. Armstrong, president and general manager Louisville Home Telephone Company, Louisville; M. S. Taylor, general manager Fayette Home Telephone Company, Lexington; J. W. Chambers, secretary and general manager Old Kentucky Telephone Company, Winchester; R. T. Hickman, Henderson Telephone & Telegraph Company, Henderson; M. J. Thomas, Shelby Home Telephone Company, Shelbyville. New officers for the ensuing year were elected as follows: M. B. Overly, general manager Central Home Telephone Company, Louisville, president; H. K. Cole, secretary and general manager the Kentucky and Indiana Telephone Company, Owensboro, secretary; M. J. Thomas, Shelbyville, vice-president first district; Frank M. Hoge, Hopkinsville, vice-president second district; M. S. Taylor, Lexington, vice-president third district; P. H. Murphy, Nicholasville, vice-president fourth district; J. W. Brambers, Winchester, treasurer. The State was divided into four districts and arrangements were made to hold in each district at least four meetings a year to the end that the independent telephone movement might be fully discussed, ideas exchanged and a systematic and intelligent campaign carried on for its development and extension.

TOO MUCH LIGHT.—The participants in the recent meeting of the National Electric Light Association at Atlantic City were very much pleased with the festoons of incandescent lamps along the boardwalk, and the general electric lighting effect. But it is hard to please everybody, and in some of the more retired parts of the ocean front the hotel proprietors and visitors have asked that the lights be turned off in order that the moonlight can be enjoyed. It is said that the City Council will probably grant the request.

AUSTRALIAN ELECTRICAL GROWTH.—U. S. Consul-General John P. Bray supplies from Melbourne several Australian industrial items of interest as follows: There are some 50 miles of electric traction in operation at present in Australia, the lines being short ones in Melbourne, Sydney, Hobart, Ballarat and Bendigo. The further extension of electric lines is under consideration more or less by the State governments of most of the States, especially Victoria, New South Wales, West Australia and South Australia (where the electrifying of the street-car lines of Adelaide is contemplated). In Victoria many of the suburban municipalities have under consideration the construction of lines, and generally much interest is being displayed in that direction. There is no doubt that in the near future the number of lines in operation will be very largely increased both in the way of new lines and the conversion of old ones. Manganese and decarbonized steel, and copper wire are not manufactured in Australia, the supplies coming from the United States, England and Germany, with America leading.

EXCELLENT FOREIGN TRADE.—Note has been made in these columns from month to month of the excellent condition of foreign trade: The foreign commerce of the United States during the fiscal year which ends with this month promises to exceed in both imports and exports that of any earlier year. The details of ten months of the year's commerce have been announced by the Department of Commerce and Labor through its Bureau of Statistics, and should May and June show as large a monthly average as that of the ten months for which the record has been made, the imports will be 1,225 million dollars, and the exports 1,786 millions, or a total of a little more than 3 billion dollars. The figures of the fiscal year 1905 exceed, both as to imports and exports, those of any prior year, and the fact that the recorded imports of ten months of 1906 exceed by nearly 100 millions those of the corresponding months of last year, and that exports exceed by over 200 millions those of the corresponding months of last year, suggests that there can be no doubt that the fiscal year 1906 will make the highest record ever shown in both imports and exports, and therefore the largest total of foreign commerce. The gain in electrical apparatus and instruments has been quite considerable.

WOMEN VOTE FOR MUNICIPAL PLANT.—A special election was held in Potsdam, N. Y., June 14, at which a large number of women took advantage of their right to vote on a proposal to bond the village for $24,000 for the construction of a municipal lighting plant to supply street lights only. Fully one-third of the votes were cast by women, and their votes in favor of municipal ownership, according to a special dispatch from Potsdam, carried the proposition by a majority of 58. A year ago last March a proposition to raise $40,000 for a lighting plant to supply street lights and lights for residences, etc., was carried by a small majority. A few weeks later the Potsdam Electric Light and Power Company, which now lights the village, got an injunction restraining the village from proceeding with the construction of the municipal plant, on the ground that it had not procured permission from the State Gas Commission. This injunction was made permanent by a decision of Justice H. T. Kellogg, and the Appellate Division affirmed this judgment. The village has appealed to the Court of Appeals, where the case is now pending. The Municipal Ownership party, finding that the village could bond itself for a strictly municipal plant, brought about the special election on June 14.

MR. CARNEGIE'S TELEPHONE SYSTEM.—Mr. Andrew Carnegie has purchased a complete private automatic telephone exchange of twenty lines, for his Scottish estate, Skibo Castle, Scotland. Mr. Carnegie's sister-in-law, Mrs. Lucy Carnegie, has an automatic exchange of twenty-two lines on her estate, Dungeness, on Cumberland Island, just off the coast of Georgia. The Dungeness exchange has been in operation over two years, and Mr. Carnegie was so pleased with its working that he decided to use the same system at Skibo Castle. Mr. K. B. Weatherbee, Mr. Carnegie's mechanical engineer, was in Chicago during the latter part of May to familiarize himself with the system of the Automatic Electric Company and expects to install the exchange at Skibo Castle in August. The initial installation will be for thirteen telephones, five of which will be in the castle, one in the estate office, two in the stable and garage, one in the gamekeeper's lodge, one in the gardener's lodge, one in the golf house, one at the dock on Dornoch Firth, where Mr. Carnegie's yacht is kept, and one at the natatorium. The estate is about ten miles square.

THE INDEPENDENT ELECTRICAL CONTRACTORS ASSOCIATION OF GREATER NEW YORK, an organization of more than 200 of the prominent contractors, will have its second annual outing and clam bake on July 7th, at J. M. Donnelly's Boulevard Hotel, College Point, L. I., N. Y. Special prizes will be awarded to bowlers and winners in base ball and other games. The Second Battery Band, headed by G. E. Fuller, will furnish the music. The committee in charge are Messrs. Frederick G. Shafer, A. Neuberger, B. Glidden, E. Christesen and C. Hagemeyer. The officers of the Association are Messrs. T. Whitehead, president; A. Neuberger, vice-president; F. G. Shafer, treasurer; C. A. Christesen, financial secretary; F. W. Cohn, recording secretary; B. Glidden, sergeant-at-arms.

THE ORIGIN OF HELLO.—A correspondent of the *New York Times* says: A distinguished scholar and philologist writes me the following, which may be of interest to your readers: "'Holler' is the word halloo in its proper form, and halloo is a root common to all Indo-European languages. The root is spelled, in the comparative grammar of the Indo-European language, by Heinrich Fick, HLU, and is pronounced almost exactly h-loo. It appears in whole classes of words signifying to call (call itself being derived from that root) and to hear and meaning very nearly, 'stop and listen to me.' The first word in the old Norse Edda is HLIOTHS, and it means a listening silence, so that the concrete meaning of halloo is to be in a state of listening silence, or 'be still and listen.' I think that this is one of the most interesting philological contributions to the literature of the telephone, illustrating the exact meaning of the word 'hello.'"

DEVELOPMENT IN ITALY.—It is stated that an impetus has been given in Italy to water-power studies and electrical transmission by the news that the government, under the direction of the King, whose interest in such practical enterprises is notably keen, will invite the two great railway lines, Ferrovie Meditteraneo and Ferrovie Medidionali, to devote a large part of 1907 to the question of electrical traction and to take up various projects for trials on a large scale. In Northern Italy nearly all the small cities and a large number of villages are supplied with electric light, while many of them have installations of hydro-electrical power. Among the cities of from 10,000 to 50,000 inhabitants so equipped are Vercelli, Novara, Pavia, Bergamo, Brescia, Verona, Voghera, Alexandria, Mantua, Vicenza and Intra, many of them being in the Milan consular district and being prominently known for the importance of their manufactures and for their extensive contributions to the total of exports invoiced through this consulate. Hydro-electrical installations have played a strong part in the commercial advancement of these thriving towns.

WIRELESS AT SAN FRANCISCO.—A 216-ft. mast has been erected on Russian Hill by a local wireless telegraph company. It will be used as a station to connect San Francisco with a branch of the same system in Colorado.

THE WORD "AEROGRAM" is in growing use to designate a message sent by means of wireless telegraphy. The Pittsburg *Index* in approving it says: "Aerogram is well formed from the Greek words meaning 'air' and 'to write,' and admirably designates 'writing through the air.' It is easily pronounced, concise and to the point, and is appropriately analogous to the word 'telegram.' 'Aerogram' should come into universal use. Educated persons appreciate a well-formed word. If the editors of daily papers made 'aerogram' an office rule, the public would soon adopt it."

THE SIMPLON LOCOMOTIVES.—Cable dispatches from Switzerland say that the electric locomotives for the Simplon tunnel, chilled by the outdoor temperature, and entering the warm extremely moist atmosphere of the tunnel, have experienced short-circuits through the volume of condensation and the breaking down of the insulation. If true, this should prove easy to remedy; and it will certainly not be necessary to revert to steam, as suggested. The trip over the Mont Cenis and St. Gothard routes is always spoiled by the smoke and gases of the steam locomotives in the endless tunnels.

NEW YORK ELECTRICAL SOCIETY closed a very successful year with a smoker at the Hotel Astor on June 13 under the chairmanship of President Barstow. An excellent concert was given, with a collation. The membership of the society is well over 600 and the finances are in good shape. The following is the result of the annual election: President, George Herbert Condict; vice-presidents, Robert T. Lozier, Walter F. Wells, P. G. Gossler. The vice-presidents elected 1905 for two years are: H. G. Stott, Putnam A. Bates, Max Loewenthal; secretary, George H. Guy; treasurer, H. A. Sinclair. The society is taking offices in the new United Engineering Building, and believes that the enjoyments of such headquarters will bring it a large accession of membership.

MONEY SUNK IN MUNICIPAL.—Middleboro, Mass., is in serious difficulties as to its municipal plant, and according to the Boston *Herald* "from the very outset of the purchase the town has been unfortunate." In thirteen years the community has sunk $118,000 in its gas and electric light plants, and the end is in sight. Apparently both plants are pretty nearly in the condition of junk, and it is now a question of large new expenditures or abandoment. "The present board of commissioners cannot be blamed for the mistake made at the purchase nor for the management of the plant in its infancy, but it has been claimed that in many cases they have concealed matters which if divulged in town meeting would have given the citizens a chance to help and not hinder them. The affair has narrowed down to the question of whether the town will continue to pass out money to support the plant or whether the abolishment of municipal ownership is in sight. Many of the most influential citizens are in favor of selling the whole plant and buying lights on contract like the other small towns in the State."

CANADIAN COMMISSION APPOINTMENTS.—Two of the commissions made necessary by the enactments of the last session of the Ontario Legislative Assembly are now complete and ready to commence the labors which will be required of them. These are the new Hydro-Electric Commission, whose functions will enable the municipalties of the province to secure electric energy at an economical rate, and the Railway and Municipal Board. Premier Whitney has announced that it had been decided that the former body should be composed of Hon. Adam Beck, of London, the Minister who has been so closely identified with the power question of Ontario; Hon. J. S. Hendrie, of Hamilton, and Cecil B. Smith, who is now chairman of the Temiskaming & Northern Ontario Railway Commission, and consulting engineer of the commission of inquiry. Hon. Mr. Beck will naturally be the chairman of the Hydro-Electric Commission. The gentlemen who will with James Leitch, K.C., compose the Ontario Railway and Municipal Board, are: Andrew B. Ingram, who represents East Elgin in the Dominion House of Commons, and Henry Norman Kitson, of Hamilton. The gentlemen will receive $4,000 a year for their services on the board. Their secretary, H. T. Small, a barrister, will be paid a stipend of $2,000 a year.

NEW STEVENS LABORATORY.—The Stevens Institute of Technology, Hoboken, N. J., is growing rapidly under the vigilant fostering care of President Humphreys, and last week there was added to its equipment, with due ceremonies, the Morton Memorial Laboratory of Chemistry, built by the alumni as a memorial monument to the late Dr. Henry Morton, the physicist, chemist and electrician, first president of Stevens. The new building cost $150,000 and is believed to be the best equipped structure of its kind in the United States. In general charge of it will be Dr. Thomas B. Stillman, professor of chemistry at Stevens, well known for his original researches and results. The laboratory is the first building to be placed on the recently acquired campus at Castle Point, and adjoins the new athletic field.

ALLEGED TELEGRAPH FRAUDS.—A San Francisco grand jury brought in last week a charge against the telegraph companies of fraud of the grossest kind in accepting money for messages at the time of the disaster, and then forwarding them by mail and messenger instead of by wire. The jury went so far as to estimate that $1,000,000 had been collected in this manner. This charge has been denounced as an outrage by President Clowry, of the Western Union, and Vice-President Baker, of the Postal, and certainly does not conform with the facts as known at this end of the line, or with our own personal experience at the hands of the officials of both systems. The wonder is that the service was as good as it was, and we know of our own knowledge how officials and operators worked day and night to clear the traffic, while warning was given of liability to great danger. Col. Clowry says: "We supplied 23,000 newspapers with bulletins without charge for weeks. We forwarded free all messages dealing with relief; we telegraphed a great deal of money and took none ourselves. That seems to me a very substantial contribution to the relief fund, and our wires are always open free to the public on occasions of such disasters as the eruption of Vesuvius, the Russian massacres or the Baltimore and Galveston catastrophes. Many of our men stayed at work in San Francisco and did not even look after the safety of their families."

NIAGARA POWER IN BUFFALO, thanks to such men as Adams, Huntley, Rankine and Wickes, is now a greater reality than the pioneers imagined, and two-thirds of the motive power of industrial Buffalo comes from the falls. The Cataract Power & Conduit Company is erecting a new transformer house of 25,000 hp capacity, on the high bank of the river at Niagara Street and Front Avenue, Buffalo, to receive the power of the Canadian Niagara Power Company, Niagara Falls, by two power transmission lines running along the Canadian side of the Niagara River from the power house at the falls to Fort Erie, opposite Buffalo, whence entrance to the city will be made by an overhead span crossing the Niagara River at a height of 150 ft. above the river, suspended from shore towers 210 ft. in height. Connection already exists between the two power houses of the Niagara Falls Power Company on the American side and the power house on the Canadian side, and these three plants are now connected with Buffalo by four transmission lines along the American side of the river to the present terminal station, which will be known as Terminal House A. The new terminal power station, which will be designated as Terminal House B, will be connected with the old terminal station by underground cables, making a complete loop system for the transmission of Niagara power to Buffalo. The initial equipment of the new terminal station will consist of six 3,000-kw transformers, stepping down from 22,000 volts to 11,000, at which pressure, energy is distributed underground to five sub-stations located at various points about the city, where the pressure is again transformed to 2,200 volts for distribution for commercial use. The present productive capacity of the three power houses connected by this system is 155,000 hp.

Winnipeg, Manitoba, 60,000-Volt Hydro-Electric Plant.

By V. D. Moody.

Winnipeg, the metropolis of northwestern Canada, the capital of the Province of Manitoba, in the richest wheat belt on the Canadian soil, with a population of 100,000, has under completion one of the most modern water power constructions on the continent.

The City of Winnipeg is the distributing center of the Canadian Northwest, which is demonstrated by the great extensions and shipping facilities offered by the Canadian Pacific and the Canadian Northern Railway Companies, and the projections of the Grand Trunk Pacific Railways.

The possibilities of a manufacturing center were quickly grasped, and the project was taken in hand in 1901 by the Winnipeg General Power Company to harness the waters of the Winnipeg River for general power purposes, at a point distant a few miles from Lac du Bonnet, which is on a branch line of the Canadian Pacific Railroad, distant 65 miles from the City of Winnipeg.

In 1905 the Winnipeg Electric Street Railway Company, operating a steam station and controlling the street railway system, the general house lighting and power distribution, amalgamated with the General Power Company and became incorporated as the Winnipeg Electric Railway Company.

The advantages to be derived from such a hydraulic development were readily appreciated, due to the high cost of fuel for the operating expenses of a steam plant and the necessarily enormous cost of energy to the consumer. The cost of energy for operating the steam plant to the consumer being 12½ cents per kw-hour for general motor work and 20 cents per kw-hour for lighting, with the usual discounts for prompt payments of bills, which price with the new development, will be reduced approximately 50 per cent, with discounts for prompt payments.

The power house is located on the opposite side of the Winnipeg River, from Lac du Bonnet station. Difficulties experienced in conveying material to the site selected were overcome by building an eight-mile corduroy road from the river to the power house, and a similar eight-mile road from the power house to the headworks. The heavier electrical and mechanical machinery had to be conveyed in the winter when the ground and river were hard frozen, as the means of conveyance across the river at other times consisted of a small tug and barges.

To obtain the necessary water, a channel had to be cut to the upper river near Otter Falls, 120 ft. wide, with a clear depth of 8 ft. at normal low water, the channel being 8 miles long with a drop of 5 ft. to the mile, equalling a total head of 40 ft. In cutting this channel it was essential to blast with dynamite about 447,000 cubic yards of granite, which was lifted out of the passageway by means of derricks. With the rate of flow of water through this channel and the available head there can be developed about 30,000 electrical hp.

The greater part of the winter of 1002 was devoted to transporting the necessary material to begin operations in the spring. The development began with the excavations for the dam and tail race. At the point where the dam is located there is a natural fall, and the dam crosses almost at the crest.

Before starting these works it was essential to back up the water, which maintained from levels the year around at the point where the channel opened into the river, eight miles from the power house, an average elevation of between 8 and 9 ft. This was done by means of a cofferdam.

The actual amount of granite excavations made and concrete constructions for foundations in cubic yards is given in the following tabulations:

Granite excavations.	Cubic yards.
Tail race	26,442
Power house	78,000
Head race	67,608
Intake	274,503
Grand total	446,553

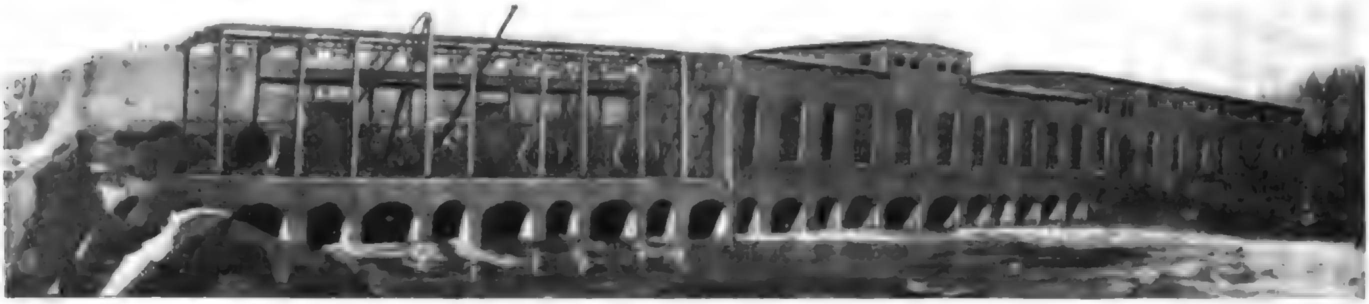


Fig. 1.—View of Power House, Showing Extension.

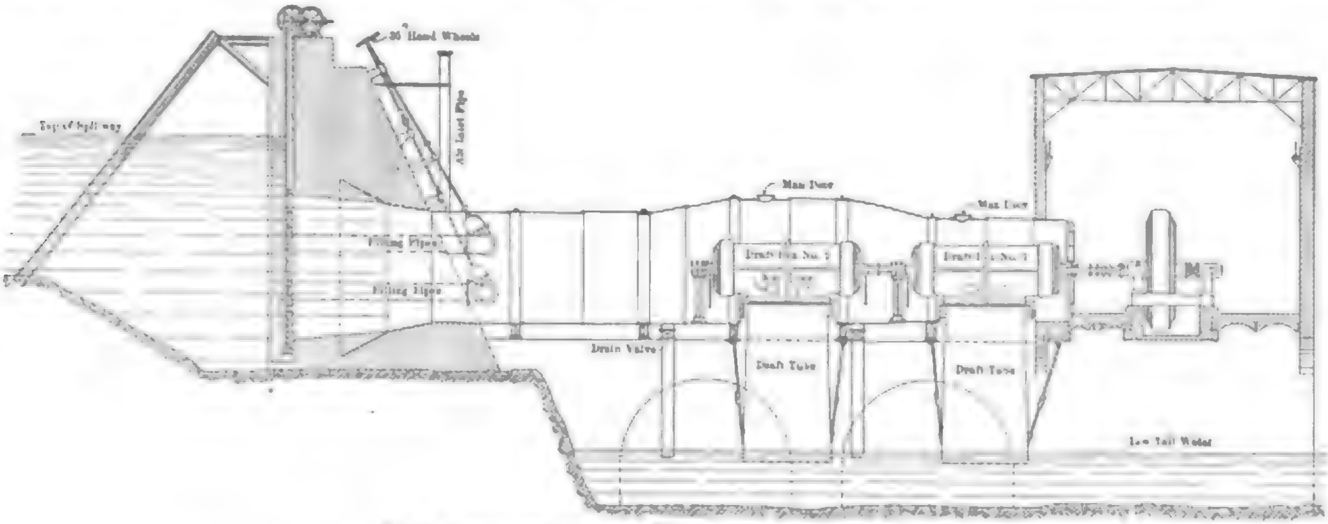


Fig. 2.—Arrangement of Machinery at Power House.

Concrete construction in cubic yards: mixture, one part cement, three parts sand, five parts broken stone.

Forebay wall	6,621
South wing wall	2,416
North wing wall	2,369
Transformer house foundation	1,915
Power house foundation	4,503
Overfall dam (spillway)	4,600
Boom piers to catch debris, consisting of concrete piers spanned by floating logs	277
Controlling works	1,200
Ice rack foundations	110
Grand total	24,011

As soon as excavations had been made, the foundations were laid for the power house requiring 4,503 cubic yards of concrete, and for the transformer house, an extension to the power house, requiring 1,915 cubic yards of concrete. The dimensions of the power house between inside walls are: Length, 330 ft.; width, 31 ft. 9 in.; height from foundation, 39 ft. 7 in. Transformer house: Length, inside walls, 176 ft.; width, 53 ft. 1 in.; height, 36 ft. 9 in.

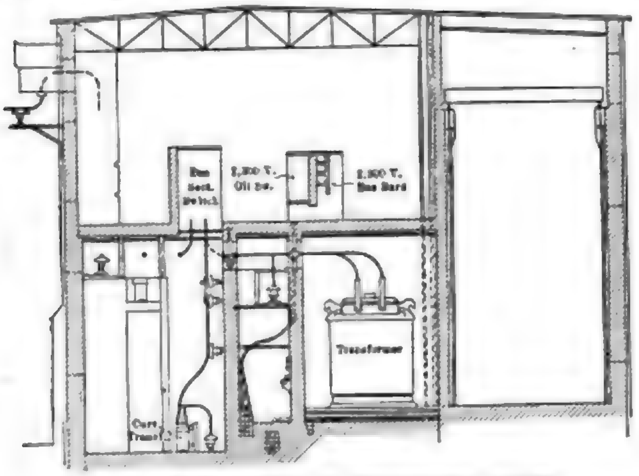


FIG. 3.—CROSS-SECTION OF TRANSFORMER HOUSE.

The buildings are absolutely fire-proof, being built of structural steel and brick throughout.

The main units in the power house consist of four 1,000-kw and five 2,000-kw, revolving-field, 60-cycle, 2,300-volt, three-phase generators, coupled to McCormick turbines with Lombard governors; two 100-kw, 125-volt, direct-current exciters, coupled to the same type turbines; and two 175-kw, 125-volt exciters, coupled to three-phase, 2,300-volt induction motors.

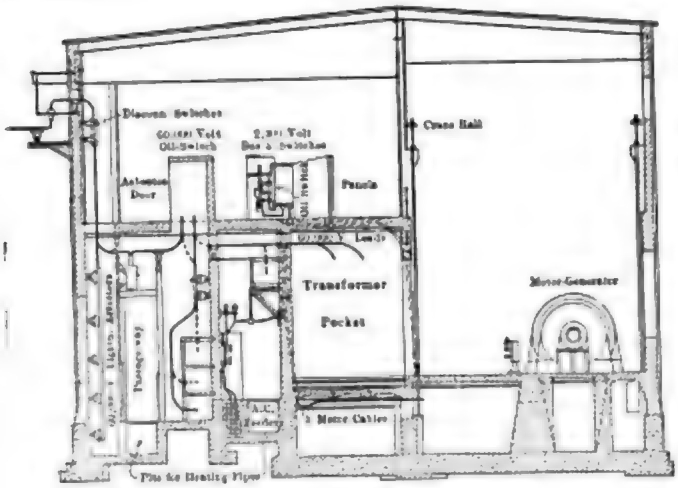


FIG. 4.—CROSS-SECTION OF SUB-STATION.

The following tabulations give the generating station capacity:

No.	Water wheels hp.	Generators kw.	Speed r.p.m.	Voltage.
4	1800	1000	200	2300
5	3600	2000	180	2300
2	200	100	600	125
2	Motor driven.	175	514	125

The generators have a manufacturer's guarantee of efficiency at full load of 95.5 per cent, regulation in percentage of full load volts, 4 per cent.

It is well to mention here that the turbine gates are protected by ice racks to keep out ice, logs, etc.

The switchboard is of black enameled slate and instruments of dull black finish. It is of the well-known benchboard type, and is located on a gallery about in the middle of the main generator room, where the operator can readily observe everything happening on the generator floor. The board sets on wooden beams. The controlling wires to the motor-operated oil switches, which switches are located in a gallery comprising the second floor of the transformer house, are run in 1¼-in. enameled iron conduit, as are also the generator and exciter field circuit leads. The exciter armature leads are run from the machines to the switchboard in 2½-in. pipes. The generator armature leads, consisting of cambric insulated cables, are run in 3½-in. tile duct to their respective oil switches—all of the conduit and duct being run in the concrete floors.

A general cross-section of the transformer house is shown in Fig. 3. The low and high-tension oil switch cells are on the second floor of the switch gallery. The switches are all three-phase, motor-operated, and each phase is separated by a 2-in. soapstone slab, the cells of the switches being separated from each other by 8-in. pressed brick walls. The low-tension bus compartments are directly behind the low-tension oil switches, each bus being separated by a concrete slab and each connector from switch to bus being separated by a 4-in. pressed brick partition. The low-tension buses are sectionalized by a motor-operated oil switch. The high-tension switch cells are placed 6 ft. 9 in. in front of the low-tension switches and consist of five transformer, one bus sectionalizing and two outgoing line motor-operated, 60,000-volt oil switches, their respective compartments and phases being separated by an 8-in. pressed brick wall. Each of the low and high-tension oil switches, low-tension bus compartments, lightning arresters and high-tension bus compartments is provided with an asbestos door.

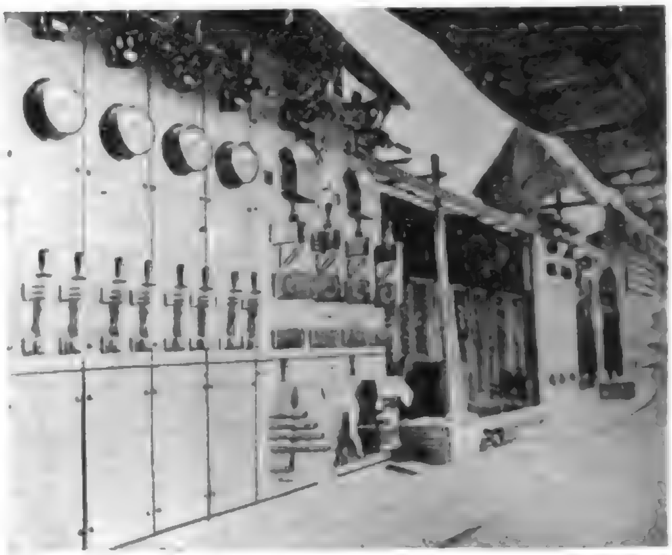


FIG. 5.—SWITCHBOARD IN SUB-STATION AT WINNIPEG.

From the low-tension buses, connectors run to the five low-tension transformer oil switches, two of which are on one side of the bus sectionalizing switch and three on the other side, the former and one of the latter controlling three banks of 1,800-kw transformers, and the other two switches controlling two banks of 830-kw transformers. From these switches cambric insulated cables are run through 3½-in. tile duct embedded in the concrete floor, to the low-tension side of the transformers themselves, which are located in brick compartments or pockets directly under the switch gallery, each transformer being in a separate pocket with a 12-in. brick wall on each side. The front of each pocket is provided with Kinnear steel doors.

There are fifteen transformers comprising five banks, consisting of two banks of 830 kw and three banks of 1,800 kw. The secondary and primary coils are provided with taps for the following voltages: 2,200, 2,300, 2,400 volts secondary; 40,000, 50,000, 60,000 volts primary. The transformers are arranged for delta connections on both the high and the low-tension side; the voltage m operation is stepped up from 2,300 volts to 60,000 volts for transmitting to the sub-station at Winnipeg over a distance of 65 miles.

The 1,800-kw transformers bear a manufacturer's guarantee of efficiency at full load of 98.2 per cent; regulation non-inductive, 1 per cent; regulation, 90 per cent power factor, is 2.5 per cent. The 830-kw transformers have a guarantee of full load efficiency of 97.7 per cent, the regulation to be the same as that of the 1,800-kw transformers.

For connecting up a bank of transformers, porcelain wall tubes 2½ in. inside diameter, 12 in. long, are placed between pockets, union couplings being provided on each transformer so that any one of a bank may be readily disconnected and two transformers run on an open "delta." The high-tension leads from the transformers out of the pockets to the high-tension delta consist of special copper tubes insulated in the same manner as the high-tension leads of the transformers. They are run on 60,000-volt porcelain insulators (tested for 120,000 volts) supported in the pocket by brackets and suspensions from the I-beams, and pass through the 16-in. brick back wall of the pocket through high-tension bushings, similar to those supporting the high-tension leads of the transformers.

Between the transformer pockets and the high-tension room all of which are on the first floor of the transformer house, there is a passageway separated from the above-mentioned compartments by 16-in. brick walls, in which the high-tension delta compartments are located 12 ft. from the floor level. The insulators for carrying the wires, consisting of No. 2-0 hard-drawn copper, are supported by galvanized-steel pins in a three-inch concrete slab, each outgoing phase to the high-tension transformer motor-operated oil switch, being separated in the delta compartment by a 4-in. pressed brick partition, all delta connections being made by copper connectors which may be readily disconnected. From the delta compartments the high-tension leads run on 60,000-volt insulators to the transformer oil switches and from the switches to the high-tension buses. The high-tension buses are separated by 3-in. concrete slabs, carrying 60,000-volt insulators, faced by a 4-in. pressed brick wall. Where the high-tension wires run to the oil switches located on the second floor, each phase is separated by a 2-in. pressed brick wall faced with a brick buttress from the first floor to the switch gallery.

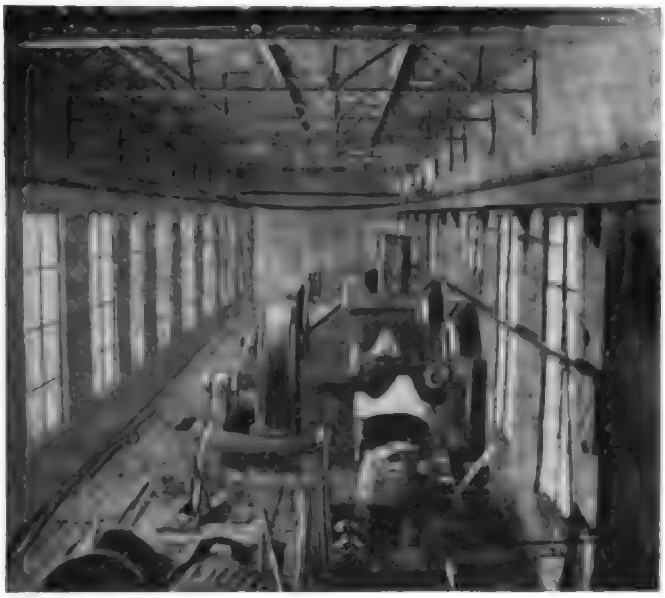


FIG. 6.—MAIN FLOOR OF POWER HOUSE DURING CONSTRUCTION.

The lightning arresters are located in compartments of pressed brick in the high-tension room directly opposite the high-tension buses, and as in the case of the high-tension cells they are provided with asbestos doors about 7 ft. high. The lightning arresters are well-grounded by a copper plate embedded in the mud in the tail race.

Disconnecting switches are provided between all oil switches and buses, both high and low-tension. The high-tension disconnecting switches are mounted on caps cemented to the heads of 60,000-volt insulators grouted by cement in the brick walls.

The transformers being of the oil and water-cooled type, there is provided a duplicate system of piping for both water and oil, valves being provided so that any one transformer or any bank can be cut off. The water piping is tapped from the tube of the exciter water wheel. The oil system is operated from oil tanks in the basement of the generator room by means of an air compressor driven by a three-phase, 220-volt induction motor, which was furnished by the Canada Foundry Company. There are provided three oil tanks, a receiving, a supply and an emergency.

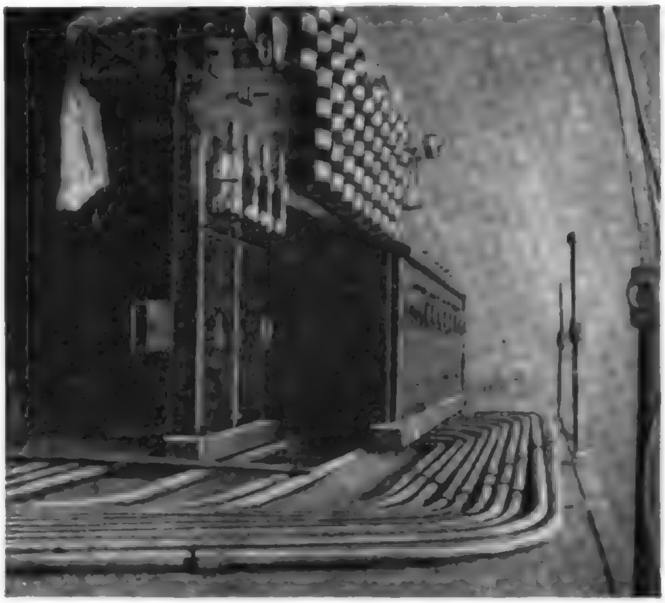


FIG. 7.—VIEW OF SWITCHBOARD AT POWER HOUSE, SHOWING CONDUITS.

The station lamps and auxiliary motors are operated from three-phase, oil-cooled transformers with secondary at 115 and 230 volts, controlled by an oil switch. Incandescent lamps are used throughout.

There is also located in the station a permanent water rheostat made of concrete with iron plates forming the three phases, which rheostat is connected to the buses by an oil switch.

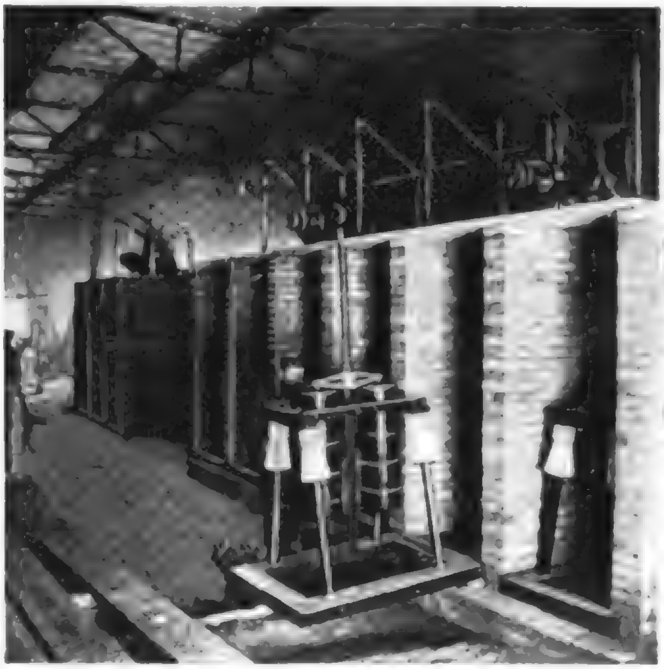


FIG. 8.—INSTALLING 60,000-VOLT MOTOR-OPERATED OIL SWITCHES.

From the power house there are run duplicate transmission lines of No. 2-0 cable, with a hemp center, on steel towers to the sub-station at Winnipeg. The steel towers are similar to those used by the Toronto & Niagara Power Company, recently described in this paper. In erecting these towers many difficulties were experienced, due to the nature of the country to be traversed, which necessitated the lines being paralleled by a corduroy road for several miles. Twenty-one standard towers 40 ft. high had to be placed on piles near the Lac du Bonnet end between the Winnipeg River and the power house. The line crosses the Winnipeg River with a span of about 760 ft., on 72-ft. towers, each weighing about six tons, with a sag in the line of about 23 ft. at 50° F. The standard towers are spaced 500 ft. apart, are 40 ft. high and the line sags about 14 ft. at 50° F. Each tower weighs about 2,400 lb.

There are four railroad crossings. The Red River crossing at Winnipeg near the sub-station has a span of about 1,100 ft., the towers being 105 ft. high, the sag in the line about 45 ft. at 30° F. Each 105-ft. tower weighs about 15 tons. The railway and the river crossing towers are built up on concrete footings. All of the towers are well grounded and are provided with lightning arresters, consisting of steel rods with ends pointed, bolted to the verticals and projecting mid-air above the highest point of the line. The transmission line, which has 10 complete transposition spirals, is paralleled by a telephone line of No. 8 hard-drawn copper wire, on the towers, which is transposed at each tower. The telephones are of the iron box type, purchased from the Mayer & Englund Company, Philadelphia, with 2,500-ohm ringers, so arranged that when the door of the telephone is closed the ringer is cut out of the circuit. These instruments are located every five miles along the line. There will be six patrolmen who will also be provided with watch-case transmitters for testing purposes.

Where the line leaves the power house and where it enters the sub-station, there are left in the wall of the building openings in which are mounted 60,000-volt insulators, and on the outside of the buildings there are provided hoods of expanded metal with cement coating, the bottom of which carries a high-tension Locke bushing, using 24-in. tube which has withstood test voltage of 130,000. The lines pass through these bushings over insulators supported on brackets to the towers. The line was designed for a drop not to exceed 10 per cent.

The general arrangement of the sub-station at Winnipeg is similar to that of the transformer house at Lac du Bonnet, the building being of brick and steel structure, having a length of 176 ft. and a width of 70 ft. 6 in., the height being 49 ft. 10 in.

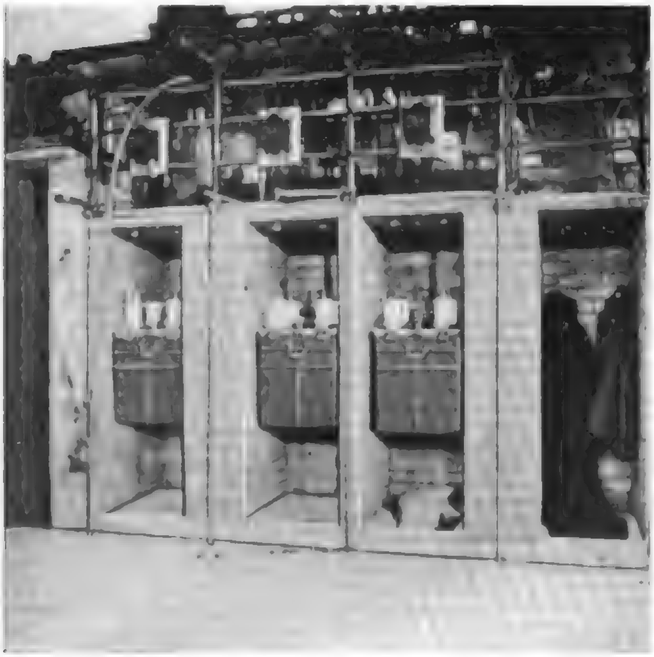


FIG. 9.—LOW-TENSION SOLENOID-OPERATED OIL SWITCHES AT WINNIPEG.

The high-tension switches, the low-tension transformer and bus sectionalizing switches are of the motor-operated, oil type. The feeder and motor-generator oil switches are of the solenoid-operated type. Disconnecting switches are placed between the high-tension and the low-tension buses and the oil switches.

The switchboard is of blue Vermont marble and is provided with dummy buses. It consists of the following panels arranged in the order designated: two two-circuit, direct-current power feeder panels, each circuit having 200-amp. ammeters, seven railway single circuit, direct-current panels, three of which have 1,200-amp. ammeters; four having 500-amp. ammeters; two two-circuit railway feeder panels, one of which has two 500-amp. ammeters, the other one 500-amp. and one 750-amp. ammeters; five two-circuit, 600-amp. railway feeder panels; seven 800-kw, 600-volt, direct-current railway generator panels; seven 800-kw, 2,300-volt, three-phase synchronous motor panels; five two-circuit, three-phase power feeder panels, capacity each two 550-kw, 2,300-volt circuits; two three-phase, 5,400-kw step-down transformer panels, 55,000 to 2,300 volts; one 2,400-kw, 5,500 to 2,300-volt step-down, three-phase transformer panel; one three-phase, 15,000-kw, 55,000-volt incoming line; one three-phase, 6,500-kw, 55,000 to 2,300-volt bus sectionalizing panel; one three-phase, 15,000-kw, 55,000-volt incoming line panel; three three-phase, 2,400-kw, 55,000 to 2,300-volt step-down transformer panel; ten two-circuit, 75-amp., single-phase, feeder panels; three two-circuit, 550-kw, 2,300-volt, single-phase feeder panels, with future extensions for 12 additional feeders.

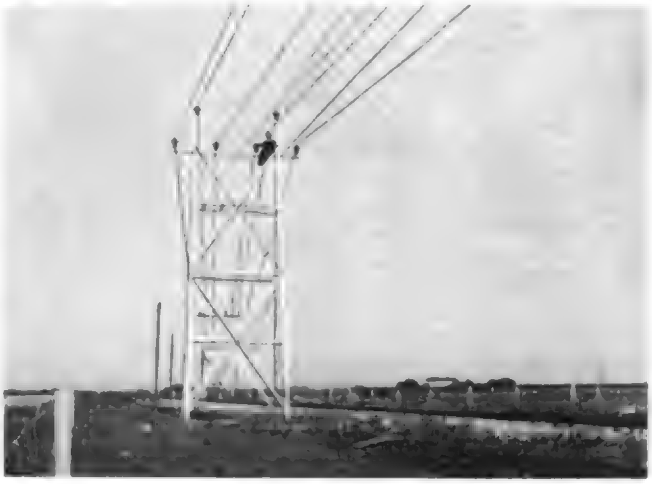


FIG. 10.—STANDARD 40-FT. TOWER.

All of the oil switches are arranged in hard pressed brick cells and all operating leads from the switches to the switchboard are run in 1¼-in. enameled iron conduit.

The source of supply for operating the motor-operated and solenoid-operated oil switches consists of 55 cells of chloride accumulators located in the basement of the building. The storage battery panel containing the 500-volt charging rheostat is located on the switchboard gallery about in the center of the main switchboard, where it is convenient for the operator. The low-tension buses are located in pressed brick compartments back of the low-tension switches, each phase being separated by a concrete slab.

The lighting feeders will consist of two-conductor cables, and the three-phase feeders of three-conductor cables run in 3½-in. tile duct from the top of the switch cells through the cableway, which consists of a passageway between the high-tension room and the transformer pockets, to cable bells, then through 3½-in. tile duct to manholes in front of the station to points of distribution. An interesting device used with the lighting feeders is an auxiliary lighting bus, so arranged with disconnecting switches on a marble base located in the cableway, that the lighting feeders from each of the oil switches tie on to the disconnecting switches, which are also connected to the auxiliary bus, and in case any lighting feeder oil switch goes out of commission the load on the particular switch, by means of the disconnecting switches, may be transferred to any other oil switch by means of the bus, making the lighting system entirely flexible. The lighting feeders are also provided with single-phase, motor-operated feeder regulators, each having a secondary wound for 150 amp., 115-volt 10 per cent boost or lower, the regulators being oil-immersed and self-cooled.

The arrangement of the high-tension compartments, transformer pockets and delta connections are similar to those at the transformer house at Lac du Bonnet. All of the cells for oil switches, lightning arresters and high-tension compartments are provided with asbestos lumber doors.

In the sub-station there are provided six 1,800-kw and nine 800-kw step-down transformers. The transformers are oil and water-cooled, with the same guarantees as to efficiency and regulation as those at the power house.

For direct-current railway and stationary motor work the ultimate capacity of the station will be seven 800-kw synchronous motor-generator sets operating at a speed of 400 r.p.m., with 2,300 volts on the alternating side, 550 to 600 volts on the direct side. The generators may also be operated as shunt-wound generators at 600 volts. With a proper shift of the brushes the direct-current machine may operate as a direct-current motor giving 630 to 700 kw from the synchronous motor operating as a generator. These machines are provided with 17-kw, 125-volt exciters mounted on brackets on the extension of the synchronous motor shafts, and are provided with speed-limiting switches and end play devices.

The manufacturer's guarantees on the motor-generators are: Temperature rise at normal load is not to exceed 35° C., and at 50 per cent overload for two hours not to exceed 55° C. The efficiency of the synchronous motor when used as a motor is 93 per cent at full load, 92 per cent at three-fourths load, and 90 per cent at half load. When the synchronous motor is used as a generator at 100 per cent power factor the full load efficiency is 95 per cent, the three-quarter load efficiency is 94 per cent, and the half load efficiency is 92 per cent. The above efficiencies are ascertained by including the exciter losses. The machines are also guaranteed to carry a 100 per cent overload momentarily without undue sparking. The direct-current generator has an efficiency of 93 per cent at full load and at one and one-half full load. At three-quarter load the efficiency is 91 per cent, while at one-half load it is 88 per cent. The temperature rise of the machine after a 24-hour run at normal load and 575 volts does not exceed 35° C.

The synchronous motor armature leads run from the top of the oil switch cells through 3½-in. tile duct on insulator racks in the basement to the respective machines, the cables being insulated with cambric. The field circuit leads of the motor and the armature and field circuit leads of the exciter are laid in concealed pipes back of the respective motor panels to insulator racks in basement. The generator leads run from the machines on insulator racks in the basement through concealed 2½-in. pipes to the back of their respective panels. The motor-generators are located on the main floor of the building. Four of these sets are at present installed.

The railway feeders run from the back of the panels in concealed 2½-in. pipes to the basement under the main floor through tile duct to manholes in front of the station to the points of distribution. All of the conduit work in the station runs in the concrete floors and brick walls, excepting the lighting circuits of the station, which are not concealed. The lamps and auxiliary station motors are fed from three-phase transformers, 2,300 volts primary, 115-230 volts secondary. There are duplicate oil and water piping systems for the transformers, the former being operated by an induction motor-driven air compressor, the latter by an induction motor-driven centrifugal pump.

The most essential feature in the station construction is the absolute protection to life and apparatus afforded throughout. The cost of the complete plant will amount to approximately $4,000,000.

The officers of the Winnipeg Electric Railway Company are as follows: William Mackenzie, president; William Whyte, vice-president; F. Morton Morse, secretary and treasurer; W. Phillips, manager. Dr. F. S. Pearson, of New York City, is the consulting engineer of the whole work, the details of which were carried out by Mr. L. J. Hirt, as mechanical and hydraulic engineer for Dr. Pearson.

The electrical apparatus was furnished by the Canadian General Electric Company, Limited; the turbines by the S. Morgan-Smith Company; the towers, air compressors and centrifugal pumps by the Canada Foundry Company, Limited; the transmission line copper by the Ansonia Brass & Copper Company, and the insulators by the R. Thomas & Sons Company.

Alternating-Current Magnets.

By D. L. Lindquist.

In order to afford a comparison between alternating-current and direct-current magnets, a brief review is given of the principles governing direct-current magnets. A direct-current magnet can be made for almost any desired lifting capacity with any desired power consumption. In order to decrease the power consumption, it is only necessary to increase the amount of copper used in the coil, or to increase the section of the iron, or both. As the magnet when working has to pull or hold the weight of its own core, it is self-evident that the increasing of the core will only do good up to a certain limit; after that the magnet pull increases more slowly than the weight of the core increases, and consequently the useful pull decreases. By increasing the copper, or, in other words, increasing the number of turns of wire on the spool, the self-induction is increased which, in its turn, increases the time of energizing. Another thing that prolongs the time of energizing is the induced currents in the solid iron core and yoke.

A direct-current magnet, when being energized, may be considered as a transformer where the winding is the primary and the core, yoke and other solid metal parts, the secondary. The primary current, or the current in the coil, tries to magnetize the core, and the secondary currents oppose the action of the primary current in the coil and always resist any changes in the magnetism. The secondary currents consequently not only retard the action of energizing, but also retard the action of de-energizing.

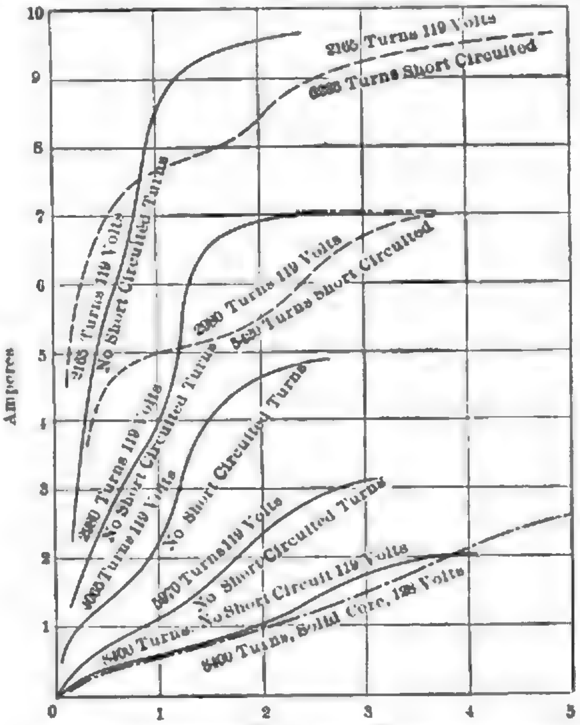


FIG. 1.—RETARDATION TEST OF DIRECT-CURRENT MAGNET.

Now, in order to make a direct-current magnet act quickly not only in lifting but in releasing, it is necessary that the secondary currents be a minimum. The customary way to decrease the secondary currents, and consequently the retarding effect of them, is to mill slots in the solid core and to split up the yoke as much as possible. Where the spool is of metal it should be divided by one slot which cuts the tube and flanges so as to interrupt the metallic circuit around the core. In some cases a very strong retarding action is wanted, and then the core and yoke are made solid and the magnet wire is wound on a heavy brass or copper spool. The retarding and the de-energizing may also be accomplished by placing resistance across the coil. Sometimes the magnet coil is wound in several sections, or with several taps in order to regulate the energizing by optional use of any section or sections, or the retarding by short-circuiting a certain other part of the winding.

This retarding effect is readily shown in the curves of Fig. 1, where the relation between energizing current and time of energizing with and without short-circuited turns is shown. These curves also show that the number of turns in a coil affect the time of energizing; and also the current consumption. The pull being the same in all cases, it can readily be seen from these curves that with 8,400 turns it takes about 4 seconds to energize and lift, while with 2,165 turns it takes only a little over one second. They also show that with 8,400 turns only about 2 amp. are taken to do the work, while with 2,165 turns it takes about 9.65 amp. The lower curve is plotted for the same magnet with 8,400 turns, but with solid core and 128 volts used for energizing, showing that under these conditions it takes about one second longer to reach the maximum. In general what is saved in current consumption is lost in time, and vice versa.

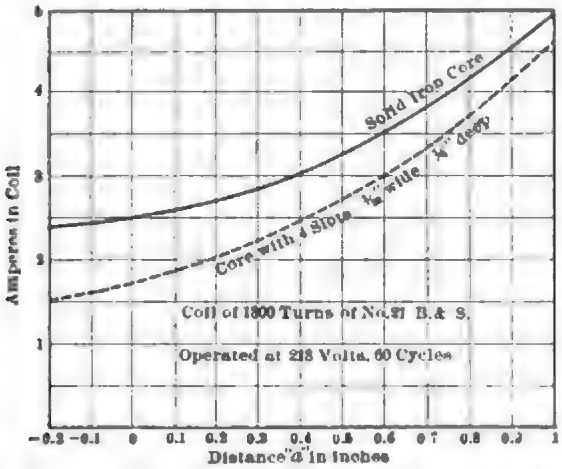


FIG. 2.—CURRENT CONSUMPTION OF MAGNET SHOWN IN FIG. 3.

As alternating current is coming more and more into general use and for many purposes will supplant direct current, a brief description of the general features of magnets for alternating current may be of some interest.

With alternating current the iron part must naturally be subdivided into parts more or less insulated from each other in order to minimize the secondary or eddy currents in the iron. If the magnet is intended for very intermittent work the iron parts may be made solid, but the disadvantages are that the iron will heat very quickly, and also that the magnet takes very much more current than with a laminated core of the same effective iron dimensions. By milling slots in the solid iron parts both the heating and the current are very considerably decreased, as shown by the curves of Fig. 2, which represent tests made on the magnet illustrated in Fig. 3.

Before describing the different types of magnets, the general principles of the theory will be discussed.

In the beginning of this discussion magnetic leakage will not be considered.

Let A = iron section of core,
a = length of air-gap,
n = number of turns in coil,
E = voltage applied,
f = cycles per second, frequency,
λ = field distortion coefficient,
P = pull of magnet in kg.,
W = weight of core,
B = magnetic density in iron core,

We then have from transformer relations:

$$E = 4.44\, f\, n\, B\, A\, 10^{-8} \qquad (1)$$

$$P = \frac{A\, B^2}{8\pi\, 981{,}000}. \qquad (2)$$

For any magnet there is a practical maximum limit for B. For alternating-current magnets the maximum limit of B is determined in general by the heating, and especially so where the magnet is intended for continuous service.

As the heating depends upon the quality of the iron in regard to hysteresis losses, the eddy-current losses, the ventilation and the C^2R losses in the coil, this magnet may be compared to a transformer in almost every respect.

Now, as the pull of a magnet is proportional to B^2 it is from a certain point of view favorable to have B as high as possible. If B is used at its maximum there will be obtained the smallest magnet for a given pull, but not necessarily the most efficient. The maximum magnetic pull exerted by a magnet is limited by the heating in the iron, but not by the heating of the coil, as this can be kept down to any desired temperature by increasing the cross-section of the wire.

Now, let us consider the most efficient magnet for a given pull and stroke; that is, a magnet which takes the least amount of volt-amperes for this given amount of work. There are two things now to be considered—the volt-amperes when the air-gap is maximum and the volt-amperes when the air-gap is at a minimum. The volt-amperes increase almost in proportion to the increase in the air-gap, so long as the air-gap is not too large in relation to the area of the core; that is, when the voltage loss caused by the leakage reactance of the coil itself is not excessive when compared to the impressed e.m.f.

The holding or minimum current practically depends upon the saturation in the iron, and the quality of the same, and also upon the length of the magnetic circuit and the clearance between the core and the yoke.

Now, at first let us consider the saturation curve for the iron as a straight line, then if current in the coil at start = I, we have the relation

$$I = C_1 \frac{B}{n}, \qquad (3)$$

where C_1 is a constant. From equations (1) and (3),

$$E\, I = 4.44\, f\, n\, B\, A\, 10^{-8}\, C_1 \frac{B}{n} \qquad (4)$$

$$E\, I = 4.44\, C_1\, f\, A\, B^2\, 10^{-8}. \qquad (5)$$

From equation (2),

$$A\, B^2 = P\, .\, 8\pi\, 981{,}000. \qquad (6)$$

hence,

$$E\, I = C_2\, f\, P, \qquad (7)$$

where C_2 is a constant.

This shows that the volt-amperes under the conditions stated above are directly proportional to the pull and to the cycles, but independent of the area of the plunger. Since the volt-amperes for a given pull are proportional to the cycles and the losses also increase with the cycles, the magnet will have a lower efficiency with an increase in the frequency.

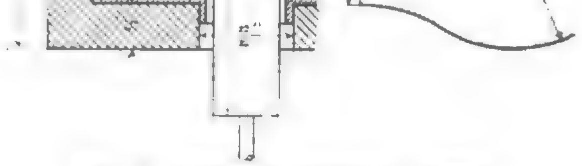


FIG. 3.—ALTERNATING-CURRENT MAGNET.

The influence of leakage and field distortion is either to increase the volt-amperes for a given pull or to decrease the effective magnetic pull for a given volt-ampere. Considering the leakage and the field distortion, we have:

$$I = n\, I\, [f(A)], \qquad (8)$$

where l is the leakage flux and $f(A)$ is a certain function which varies from $f(A) = \sqrt{A}$ to $f(A) = A$.

Electromotive force from the leakage flux in volts is

$$E_l = 4.44\, f\, .\, n^2 l\, [f(A)]\, 10^{-8} \qquad (9)$$

and the total electromotive force is

$$E = 4.44\, f\, n\, 10^{-8} \{ A B + n\, l\, [f(A)] \} \qquad (10)$$

$$P = \lambda \frac{A B^2}{8 \pi\, 981{,}000} \qquad (11)$$

$$l = C_1 \frac{B}{n}, \qquad (12)$$

where C_1 is a constant. Consequently,

$$E = 4.44\, f\, n\, 10^{-8} B \{ A + C_1 [f(A)] \} \qquad (13)$$

From equation (13) we have:

$$B = \frac{E}{4.44\, f\, n\, 10^{-8} \{ A + C_1 [f(A)] \}} \qquad (14)$$

and from (12),

$$B = \frac{I n}{C_2}, \qquad (15)$$

hence,

$$P = \lambda \frac{A E I}{C_2 4.44 f\, 10^{-8} \{ A + C_1 [f(A)] \} 8 \pi\, 981{,}000} \qquad (16)$$

If the design of the magnet is such that $f(A) = A$ and the saturation curve is a straight line, the pull is independent of the core section, A; but if $f(A)$ is nearer $\sqrt{A}$ the magnetic pull will increase slightly with the increase of the section of the core, A. As $f(A)$ varies with the design of the magnet and C_1 varies with the design and also depends upon the quality of the iron, it is impossible to give any universal formula. For this reason $f(A)$ and C_2 must be ascertained for each different magnet. If $f(A) = A$, the tangent to the saturation curve drawn from point o (see Fig. 4) will determine the density, B', to give the maximum ratio between the pull and the volt-amperes.

If, however, $f(A)$ is between A and $\sqrt{A}$ the most advantageous density, B, will be less than B'.

Now, let us consider the shape of the saturation curve. When the position of the core is such as to give a maximum air-gap, the shape of the curve is approximately a straight line unless the density is beyond practical limits. And for a magnet such as that shown in Fig. 5 there is always in the magnetic circuit a certain air-gap which naturally tends to straighten the saturation curve, and, in general, for this case the saturation curve may be considered a straight line without introducing any considerable error.

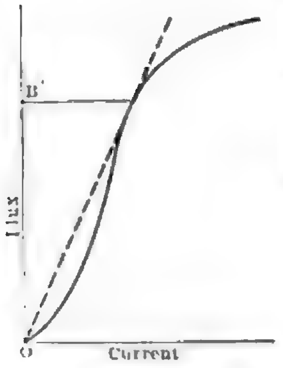


FIG. 4.—SATURATION CURVE.

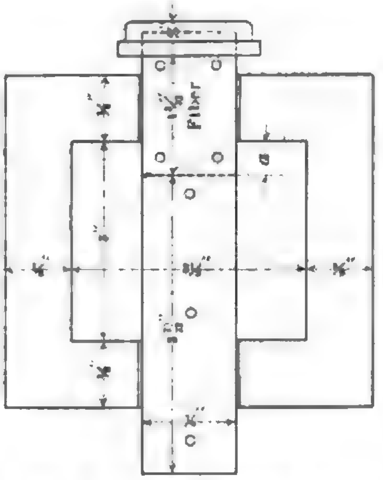


FIG. 5.—MAGNET WITHOUT PERMANENT STOP.

In a single-phase magnet a difficulty experienced is that much noise is caused by the reversal of current and the variation of the value of the magnetic flux, in consequence of which the pull on the core varies from zero to a certain maximum with each alternation.

Let us assume that the core when pulled by magnetic attraction is finally checked by a permanent stop, as shown in Fig. 6. At the time when the magnetic pull is less than the weight of the moving core, the core leaves the stop. Then as soon as the pull increases beyond this value the mass of the core is again lifted with accelerated speed and strikes the stop with a blow.

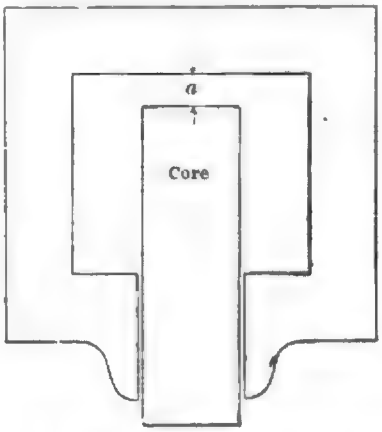


FIG. 6.—MAGNET WITH PERMANENT STOP.

Now, if weight is added to the core, it will naturally drop farther, but it will now cause a harder blow against stop, and produce greater noise. In order to eliminate this noise it is necessary to allow the core to come to a certain mean position; that is, a position in which the average effective pull balances the weight of the core. By the construction shown in Fig. 5 the core has free movement and the noise which would result from hitting is eliminated.

Another cause of noise is the vibration of the core sideways, caused by unequal air-gaps. This inequality is due partly to the fact that there must be some clearance between the core and the yoke to admit of free movement of the core; therefore, the core is pulled to the side having the least air-gap, causing most of the flux to flow on this side. It is, therefore, advisable to design the magnet with an air-gap larger than necessary for free movement and to guide the core centrally by means of some non-magnetic material. There are two ways to diminish the side pull: to increase the area of the air-gap between core or yoke at that point, or to increase the distance between core and yoke, so that the percentage difference of air-gap is small. By increasing the air-gap of course the current consumption is increased.

Unless the laminations are tight noise will be produced by internal vibration, and the greater the saturation the more liability to noise. All loose metal parts should be avoided. Now, as it is practically impossible to make the air-gap the same on the two sides, there is sure to be some side pull, thereby causing noise; this is especially true if the guide is of a metallic material. It is, therefore, advisable to make these guides of some non-metallic substance. Where the alternating-current magnets are used for closing an electric circuit by means of butt contacts, it is, of course, essential to make a permanent contact. For reasons previously mentioned, it is impossible to attach the contact holder rigidly. Therefore, it is necessary to use springs or some other yielding means, and preferably to attach these between the moving core and the contact holder. By this arrangement the core is free to move, and as this movement is very small, even when the magnet is excited from a 25-cycle circuit, the contact pressure caused by the reaction of the spring is practically constant.

It was shown above that it is impossible to get a constant pull with a single coil. It should be mentioned also that the current consumption naturally must be high, due to the construction necessary to prevent noise. A consideration of these facts leads to another form of alternating-current magnet, which is of the polyphase type, and which, as will be shown in a subsequent article, will give a practically constant pull.

A Graphic Method of Determining the Ratio of Speed-Voltage Variation in Shunt Motors.

By A. E. Kennelly.

When a direct-current shunt motor is operated in the ordinary way from direct-current distributing mains, under constant torque, its speed will be uniform so long as the voltage between the mains is uniform. This well-known condition is indicated in Fig. 1, where *m m* are the distributing mains, usually maintaining an e.m.f. of either 500 volts or 230 volts. The armature, *A*, is connected to a mechanical load of constant torque at any particular time considered. The load is, therefore, equivalent to some definite weight, *W*, lifted at constant pulley radius. The shunt coil, *F*, is connected in series with a field rheostat, *H*, which after being once suitably adjusted, is left in a fixed condition, so that the resistance of the shunt-field circuit remains constant.

If now the voltage between the mains *m m* changes, say, *v* per cent, the speed of the motor will thereby be caused to change *s* per cent. The percentage speed change, *s*, will differ, in general, from the percentage voltage change, *v*. The ratio, *s/v*, may be called the ***ratio of speed-voltage variation;*** or, briefly, the ***speed-voltage ratio.***

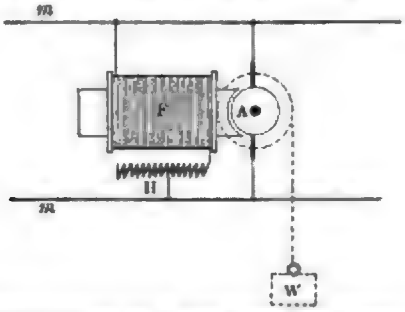


FIG. 1.—DIAGRAM OF SHUNT MOTOR WORKING UNDER CONSTANT TORQUE.

The numerical value of this ratio, *s/v*, is sometimes of practical importance in shunt-motor operation, when the voltage between the distributing mains is subject to considerable fluctuation, and when the speed of the driven machinery has to be maintained as nearly as possible uniform in spite of that fluctuation.

It is evident that the speed-voltage ratio should be as small as possible. An ideal motor would have $s/v = 0$. Compound winding in a motor may indeed compensate for changes in speed due to change in the load or impressed torque, but will not compensate for changes in main voltage at constant torque.

It is the purpose of this article to show how the speed-voltage ratio may be determined graphically in a very simple manner, when the usual data concerning the magnetic and electric circuits are available.

A preliminary consideration of two ideal simple cases will serve to elucidate the reasoning. Let us first suppose that the magnetic circuit of the motor in Fig. 1 is completely saturated, so that the magnetic flux through the armature will not be appreciably altered by changing the shunt field current *v* per cent, due to a change in main voltage of *v* per cent. Then it is evident that if the *I R* drop of pressure in the armature branch is negligibly small, the motor speed will be exactly proportional to the main voltage; or $s = v$ per cent; so that $s/v = 1$. Thus, if the main voltage increased, say, 2 per cent, the speed of the motor, with saturated field, would likewise increase 2 per cent, and the speed-voltage ratio would be unity.

Let us next suppose, on the contrary, that the magnetic circuit of the motor is completely unsaturated, so that the magnetic flux through the armature increases in direct proportion to the field excitation current; and, therefore, in direct proportion to the main voltage. If the main voltage now increases *v* per cent, the armature flux will also increase in this ratio, and the armature at the same speed will produce *v* per cent more c.e.m.f. Consequently, there will be no change of motor speed, or $s/v = 0$.

Inasmuch as motors operate with a magnetic circuit which is neither completely saturated nor completely unsaturated, but is in some intermediate condition, their speed-voltage ratio will lie between 1 and 0. In exceptional cases where, owing to extra resistance in the armature branch circuit, there is relatively large *I R* drop of pressure in that branch, the *s/v* ratio may become much greater than 1. A sensitive voltage-variation motor-device indicating instrument might be constructed in this way. Ordinarily, however, the *s/v* ratio of shunt motors in practical service appears to range between 0.6 and 0.9, so that if the normal voltage rises or falls, say, 5 per cent, the speed automatically rises or falls from 3 to 4.5 per cent according to the type of motor and to the resistance left in the field rheostat. The smaller the value that the *s/v* ratio can be made without increasing the cost of constructing or operating the motor, the better will be its automatic regulation of speed on mains of fluctuating voltage.

The speed-voltage ratio of a direct-current motor depends upon three quantities:

First. The saturation curve of the motor, or the curve connecting the useful armature flux with the main voltage, or exciting current proportional thereto.

Second. The extent of the impressed main voltage variation.

Third. The amount of *I R* drop of voltage in the armature circuit.

We will first consider the simplest case in which the extent of main voltage variation is very small, and in which the armature *I R* drop is also negligibly small.

Case I. Range of Voltage Very Small. Armature I R Drop Negligible.

Draw as in Fig. 2 the saturation curve of the motor, or adopt its saturation curve as usually supplied with the electrical data of the motor. If the *O X* abscissas are marked off in amperes of field excitation, a scale of main voltage corresponding thereto may be marked off, as indicated in the figure, along the line *O X*, when the resistance of the shunt field branch, including the rheostat, *H*, has been measured. Suppose that the normal main voltage is 120, at *c*. Then the perpendicular, *c C*, will intersect the saturation curve at *C*, the working point on the curve. The ordinates, *O Y*, are marked off in Fig. 2 as maxwells of magnetic flux through the armature; but this is not necessary. The ordinates may be marked off in volts generated in the armature at any constant speed. At the working point, *C*, draw a tangent, *C s*, to the curve, intersecting the axis of ordinates at *s*. Also draw a straight line, *C v*, from the working point, *C*, parallel to the *O X* axis and intersecting the axis of ordinates at *v*. Then the speed-voltage variation ratio of the motor will be $\dfrac{O s}{O v}$: or,

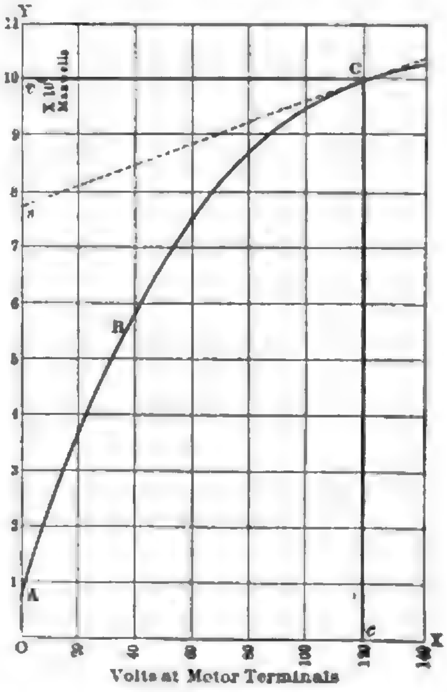


FIG. 2.—VERY SMALL RANGE OF VARIATION IN MAIN VOLTAGE. CASE I.

taking $O\,v$ as unit length, it will be numerically equal to the length $O\,s$. In the case of Fig. 2, the s/v ratio is 0.77, so that with negligible $I\,R$ armature drop, and a normal main voltage of 120, a small rise or fall, say, 1 per cent in voltage would produce 0.77 of 1 per cent of rise or fall in speed. This will be true no matter what the relative scales of co-ordinates used in drawing the saturation curve. In other words, any saturation curve of the motor will serve.

As an illustration amounting to a proof, suppose the motor of Figs. 1 and 2 to have $N = 600$ armature face-conductors, and that when 120 volts ($O\,c$) are impressed upon the shunt-field circuit, including the field rheostat, there will be a flux, Φ, of 10×10^6 maxwells, ($O\,v$), passing through the armature. Then the speed, n, revolutions per second will be determined from the relation

$$\Phi_1 N n_1 = 120 \times 10^8 \ \textit{abvolts}, \qquad (1)$$

so that $n = 20$ revolutions per second (1,200 r.p.m.).

The tangent to the curve at C indicates that at this point the armature flux varies 1,920 maxwells per volt of small change in main e.m.f. A change of 1 per cent in the main voltage would change the flux by 2,300 maxwells. If the main voltage should rise 1 per cent, the flux, Φ_2, would be 10.023×10^6 maxwells, and the equation:

$$\Phi_2 N n_2 = 121.2 \times 10^8 \ \textit{abvolts}, \qquad (2)$$

determines the new speed, n_2, which is $\dfrac{121.2 \times 10^8}{1.0023 \times 6 \times 10^8} =$ 20.154 revolutions per second, an increase of 0.77 per cent, which agrees with the ratio $\dfrac{O\,s}{O\,v}$ of Fig. 2.

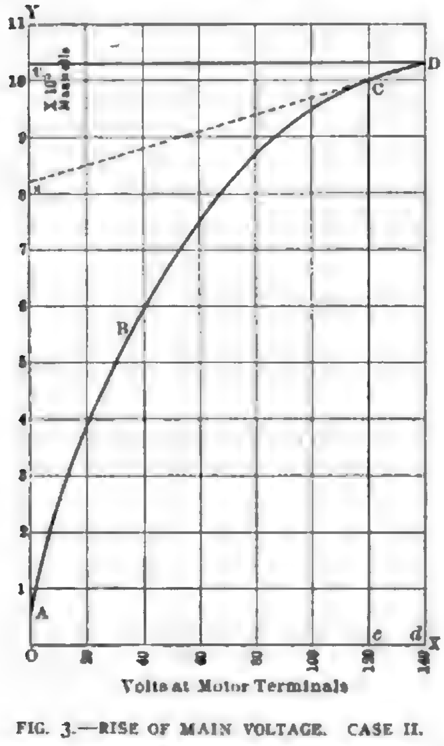


FIG. 3.—RISE OF MAIN VOLTAGE. CASE II.

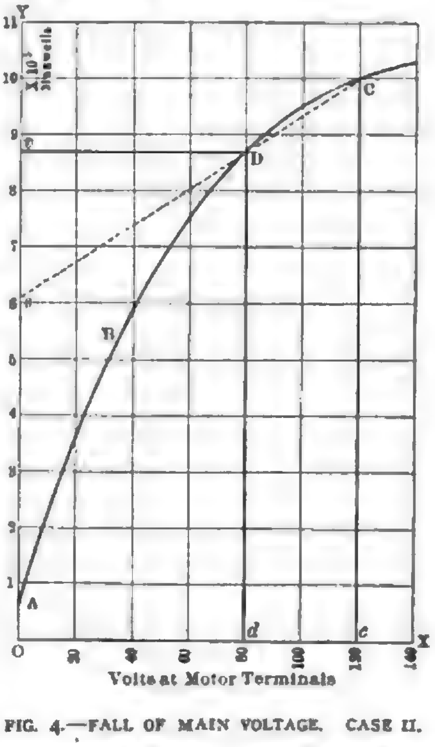


FIG. 4.—FALL OF MAIN VOLTAGE. CASE II.

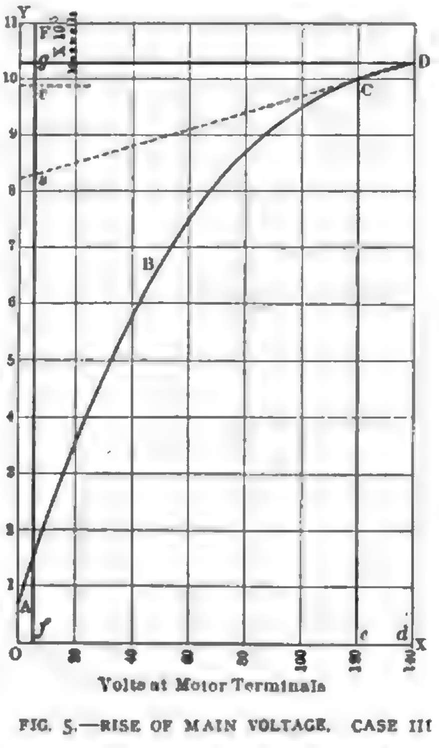


FIG. 5.—RISE OF MAIN VOLTAGE. CASE III

Case II. Voltage Variation Unrestricted in Extent. Armature I R Drop Negligible. (Figs. 3 and 4.)

Take the saturation curve of the motor as before and establish the normal working point, C (Fig. 3), on the curve corresponding to the normal voltage, $O\,c$, taken in this case as 120 volts. Let the main voltage rise to $O\,d$, indicated as 140, or through 20 volts = 16.6 per cent. The point reached on the curve will be D. Connect the points C and D on the curve by the chord $C\,D$, and extend the same to intersect the axis $O\,Y$ at s. Through D, the point attained, draw the straight line, $D\,v$, parallel to $O\,X$, and intersecting $O\,Y$ in v. Then the speed-voltage ratio for the change in main voltage, $O\,c$ to $O\,d$, will be $\dfrac{O\,s}{O\,v}$; or, taking $O\,v$ as of unit length, it will be numerically equal to the length $O\,s$.

As an example and also a demonstration, assume the figures of the last case. The armature flux at 120 volts = 10×10^6 maxwells and at 140 volts 10.3×10^6 maxwells. Combining equations (1) and (2) we have $\dfrac{n_2}{n_1} = \dfrac{140}{120} \times \dfrac{10}{10.3} = 1.1327$, an increase of $s = 13.27$ per cent. But the increase in voltage is $v = 16.67$ per cent; so that $s/v = 0.796$, which agrees with Fig. 3; for $\dfrac{O\,s}{O\,v} = \dfrac{82}{103} = 0.796$.

The case of a large drop in main voltage is illustrated in Fig. 4. Here the voltage falls from 120 to 80. The line $C\,D$, carried through the two working points on the saturation curve, $A\,B\,C\,D$, intersects the $O\,Y$ axis at s. The line through D, the point of deviation, drawn parallel to $O\,X$, intersects the $O\,Y$ axis in v. The speed-voltage ratio over the range $c\,d$ is $\dfrac{O\,s}{O\,v} = \dfrac{61}{87} =$ 0.7011. The armature flux at 80 volts is 8.7×10^6 maxwells; so that as before,

$$\frac{n_2}{n_1} = \frac{80}{120} \times \frac{10}{8.7} = 0.76629, \text{ or a diminution;}$$

$s = 23.371$ per cent. The diminution in voltage from 120 to 80 is 33.3 per cent. The ratio $s/v = 0.7011$, checking the graphical result.

It is evident that as the range of voltage variation diminishes, or the points c and d approach each other on the $O\,X$ axis, the line $C\,D$ joining the corresponding working points on the saturation curve approximates to a tangent line at C, as in the first case considered (Case I).

Case III. Voltage Variation Unrestricted and the Armature I R Drop Also Unrestricted. (Figs. 5 and 6.)

Mark off, as before, the normal working point, C (Fig. 5), on the saturation curve, $A\,B\,C\,D$, corresponding to the terminal or main voltage, $O\,c$, which is impressed on the shunt-field branch circuit. Let the main voltage rise to $O\,d$. Mark off the working point, D, arrived at. Join the points $C\,D$ by a straight line intersecting the $O\,Y$ axis, as before. Mark off at f along the $O\,X$ axis a voltage equal to the $I\,R$ voltage drop in the armature circuit. In this case, represented by Fig. 5, this $I\,R$ drop is 5 volts. Erect the perpendicular, $f\,F$. Carry the line $D\,g$, from the working point D, arrived at, or the point of deviation, parallel to the $O\,X$ axis and intersecting the line $f\,F$ in g. Lay off on $g\,f$ a length $g\,v$ proportional to the $I\,R$ armature drop with respect to the normal voltage; so that $\frac{g\,v}{g\,f} = \frac{O\,f}{O\,c}$. Let the line $C\,D$ extended cut the line $f\,F$ at s. Then the speed-voltage ratio will be $\frac{f\,s}{f\,v}$; or will be equal to the length $f\,s$ if $f\,v$ be taken as unity. In the case of Fig. 5, $f\,s = 8.275$ and $f\,v = 9.871$; so that $s/v = \frac{8.275}{9.871} = 0.8383$.

As a check on this result, we have from formulas (1) and (2), taking 5 volts of armature drop in each case,

$$\frac{n_2}{n_1} = \left(\frac{140 - 5}{120 - 5}\right) \frac{10}{10.3} = 1.1398,$$

an increase s of 13.98 per cent. The increase of impressed main voltage is $\frac{20}{120} = v = 16.6$ per cent. The ratio $s/v = 0.8383$, agreeing with the graphic result.

In Fig. 6 the main voltage is indicated as falling from the normal, $O\,c$, of 120, to $O\,d = 80$, a decrease of $v = 33.3$ per cent. The armature $I\,R$ drop, $O\,f = 5$ volts, or 4.175 per cent of normal voltage, $O\,c$. The chord, $C\,D$, extended, intersects the perpendicular, $f\,F$, in s, and $f\,s = 6.2625$ units on the scale of ordinates adopted. The horizontal, $D\,g$, through D, the working point reached, cuts $f\,F$ in g; such that $f\,g = 8.7$. Marking off $g\,v$ as 4.175 per cent of $g\,f$ to correspond to the normal percentage of armature drop, we have $f\,v = 8.3375$. The ratio $\frac{f\,s}{f\,v} = \frac{6.2625}{8.3375} = 0.7511$. The ordinary formula combining (1) and (2) gives

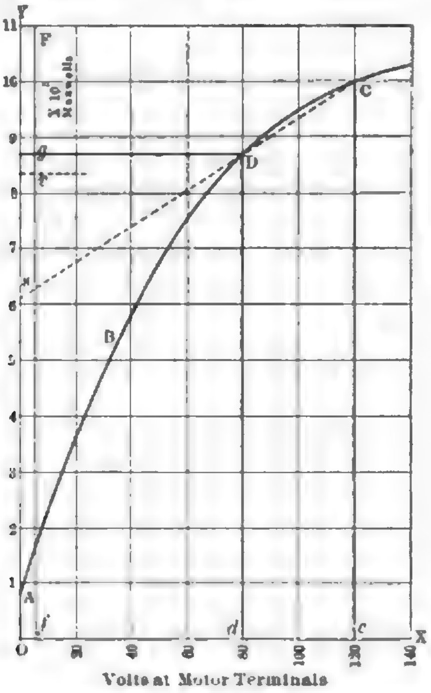


FIG. 6.—FALL OF MAIN VOLTAGE. CASE III.

$$\frac{n_2}{n_1} = \left(\frac{80 - 5}{120 - 5}\right) \frac{10}{8.7} = 0.74963,$$

a diminution s of 25.037 per cent as against a diminution v of 33.3 per cent; so that $s/v = 0.7511$, which checks the graphic result.

It is evident that by making the constant armature drop large enough, with the aid of extra resistance in the armature branch circuit, the speed-voltage ratio might be made theoretically as great as desired. In other words, a small motor like a meter motor, with nearly saturated, or permanent-magnet, field, and a suitable manganin resistance in the armature circuit, loaded with a definite constant torque, might be made to have a speed-voltage ratio of, say, 10; so that each 1 per cent of main voltage variation would produce 10 per cent change in normal speed. In that case the normal armature drop would be 90 per cent of the main voltage. Such a device might furnish a sensitive voltage-variation indicator.

It is also evident that in order to obtain the smallest speed-voltage variation, in cases where a close automatic regulation of motor speed is desired, a motor should be selected which operates low down on its saturation curve, say near B, in Figs. 2 to 6. The field rheostat, H, Fig. 1, should likewise be fixed to include maximum resistance, for the same reason. It would be possible to meet this condition in practice by taking a larger motor than would ordinarily be needed for the work required, and artificially weakening the field of this motor to the desired degree, by including extra resistance in the shunt field circuit, thereby bringing the working point low down on the saturation curve.

Very small variations of main voltage are found by experiment to possess a somewhat larger speed-voltage ratio than corresponds to the regular saturation curve, for the reason that small hysteretic cycles executed at any stage of a saturation curve are known to be flatter than the curve in the vicinity.

It may be noticed that the construction in Cases II and III correspond algebraically to

$$s/v = \frac{\frac{\Delta\omega}{\omega}}{\frac{\Delta E}{E}}, \qquad (1)$$

where ω is the normal speed of rotation of the motor and E the normal main voltage. $\Delta\omega$ is the change in speed due to a considerable change, ΔE in E. The construction in Case I corresponds similarly to

$$s/v = \frac{\frac{d\omega}{\omega}}{\frac{dE}{E}}, \qquad (2)$$

where $d\omega$ is the infinitesimally small change in speed due to a like small change in E.

From this standpoint, the construction of Case I is supplementary to a construction for the increase in voltage of a dynamo due to increase in driving speed published by M. Paul Boucherot.*

The simple speed-voltage ratio of Case I, Fig. 2, also corresponds to what Mr. H. S. Baker has proposed to call the "*percentage of saturation*" of a dynamo machine.†

The simple speed-voltage ratio of formula (2), Case I and Fig. 2, is also connected with the "*saturation-factor*" of a machine in a definite and simple manner. The saturation-factor may be defined as the percentage increase in excitation required at any stage of magnetization in order to generate one per cent increase in armature flux. It may be shown that, referring to Fig. 2, the saturation-factor $= \frac{O\,v}{s\,v}$. Consequently, if the speed-voltage ratio be denoted by r and the saturation-factor by f, we have

$$f = \frac{1}{1 - r} \qquad (3)$$

and

$$r = 1 - \frac{1}{f}. \qquad (4)$$

Thus, for the case represented in Fig. 2, where $r = 0.77$, we have $f = 4.348$, and again a saturation-factor of $f = 3$, say, would correspond to a speed-voltage ratio $r = 0.6667$.

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*[*Transactions* International Electrical Congress of St. Louis, 1904, Vol. I, p. 671.

†H. S. Baker, "Saturation Expressed in Percent.," *Electrical World*, p. 1037, Vol. XLVI, No. 25, Dec. 16, 1905.

Substation Equipment of the Long Island Railroad.

As supplementary to the outline description of the transmission system of the Long Island Railroad, which appeared in our issue for June 9, we are to give below a brief account of the equipment of the rotary-converter sub-stations which form the connecting link between the transmission and the distribution circuits.

The principal feature of each sub-station is its equipment of rotary converters and transformers. In a single instance, namely, at Hammel, a storage battery was installed as an adjunct to the sub-station machinery. The location and arrangement of each sub-station building is such as to enable the ultimate use of a storage battery should future conditions justify it, and the apparatus is so arranged that if the storage battery should be installed the necessary boosters can occupy the space allotted to one rotary converter. The initial and ultimate equipments of five sub-stations are listed in the table given below, which shows first, the amount of machinery that constitutes the present or initial installation, and second, the ultimate installation that can be accommodated in each of the sub-stations as now constructed.

Station.	Rotary Converters Kw.	Transformers Kw.	Boosters Kw.	A.B F'ders.	D.C. F'ders.
Grand Avenue:					
Present installation	3-1000	9-375	....	2	5
Ultimate capacity......	5-1500	15-550	....	4	11
East New York:					
Present installation	3-1000	9-375	....	5	6
Ultimate capacity.......	4-1500	12-550	....	12	16
Woodhaven Junction:					
Present installation.....	3-1500	9-550	....	12	10
Ultimate capacity......	6-1500	18-550	....	18	18
Rockaway Junction:					
Present installation	2-1000	6-375	....	4	6
Ultimate capacity	4-1500	12-550	....	11	16
Hammel:					
Present installation.....	2-1000	6-375	2-162	2	6
Ultimate capacity	5-1500	15-550	2-162	5	13

At Hammel, the initial installation also includes one storage battery of 3,200 ampere-hours capacity at the one-hour rate at 600 volts.

The sub-station equipment also includes two portable substations, each of which consists of a car containing one 1,000-kw rotary converter, three 375-kw transformers, and the necessary blower and switchboard panels, high-tension oil circuit breaker, and connecting leads to the outside circuit breakers.

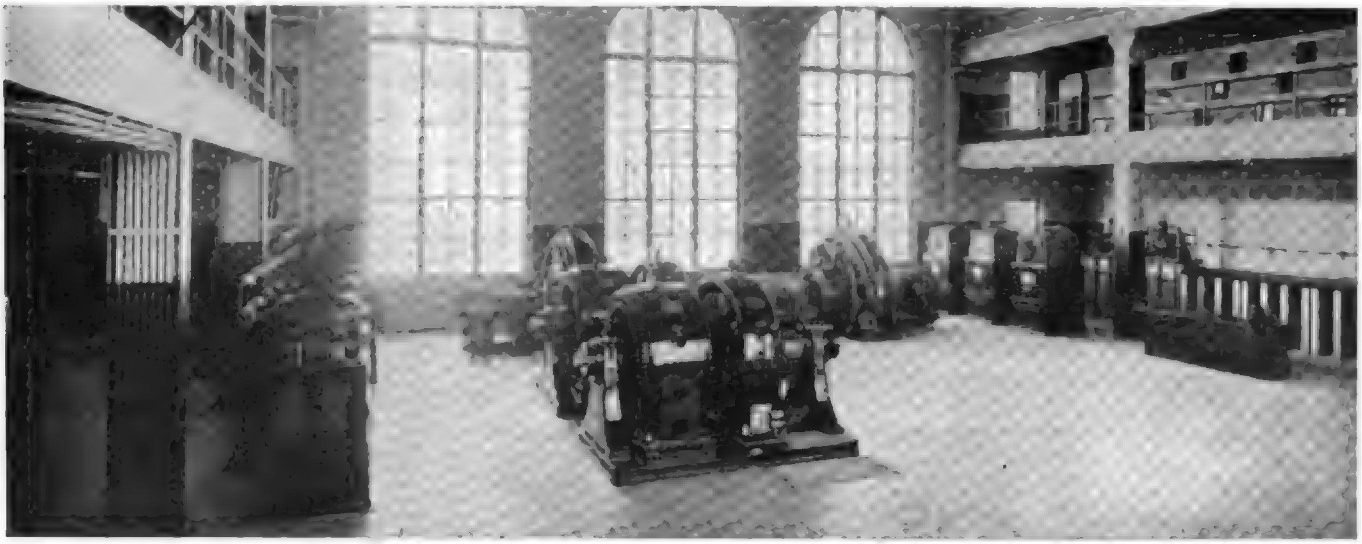


FIG. 1.—INTERIOR VIEW OF HAMMEL SUB-STATION, SHOWING TRANSFORMERS, OIL SWITCHES AND BOOSTERS.

The sub-station buildings are of a uniform type of construction throughout, excepting at Grand Avenue, where the reduced area of the lot made its adoption impracticable. This type consists of a central section of about 51 ft. span, which is wide enough to accommodate two 1,500-kw rotaries and the necessary transformers. The central space is flanked on each side by a narrow section, that on one side being devoted to high-tension busbars and switch gear, while that on the other side contains the low-tension switchboard and operating gallery. These leading features are illustrated in Figs. 1, 2 and 3.

Each sub-station is served by a 16-ton Niles crane, hand-operated from its trolley, thus obviating the usual hanging chains. It spans the central bay and it is available not only for handling the permanent heavy sub-station machinery, but also the apparatus of the portable sub-stations, which (excepting at Grand Avenue), can be run under it upon a track that enters one of the end bays of the building. (See Fig. 4.) A brief description of the portable sub-stations was given in our issue for November 4, 1905.

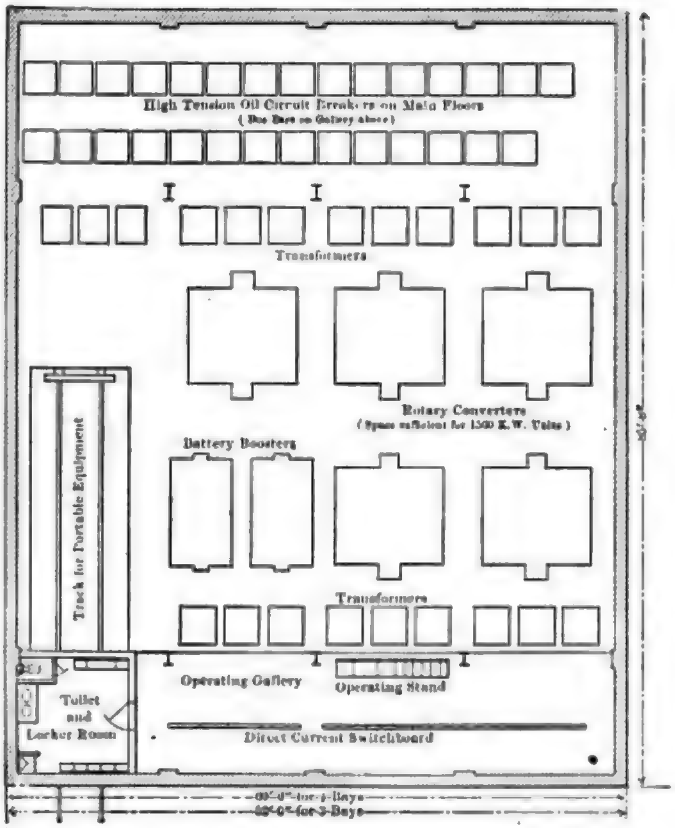

High Tension Oil Circuit Breakers on Main Floors
(Bus Bars on Gallery above)
Transformers
Rotary Converters
(Space sufficient for 1500 K.W. Units)
Battery Boosters
Track for Portable Equipment
Transformers
Toilet and Locker Room
Operating Gallery
Operating Stand
Direct Current Switchboard

FIG. 2.—PLAN OF TYPICAL SUB-STATION.

The electrical machinery in the sub-stations is all of Westinghouse manufacture. The rotary converters are of the two-bearing type with field frames divided in a horizontal plane. Each converter is provided with a starting motor, whose frame is mounted upon an extension of the base of the rotary converter. The fields are compound wound with the shunt winding arranged for self-excitation. The machines are over-compounded, so that if operated as direct-current generators at constant speed, the voltage will rise from 600 volts at no load to 650 volts at full load. The converters are guaranteed to withstand overloads of more than 2½ times the normal load at 600 direct volts without falling out of step, providing the e.m.f. at the alternating end is maintained within 14 per cent of the normal. The transformers used with the converters are of the air-blast type throughout.

As previously outlined, storage batteries are provided at Hammel sub-station only, though provision is made in the design of the other sub-stations for the ultimate installation of storage batteries should future conditions appear to require them.

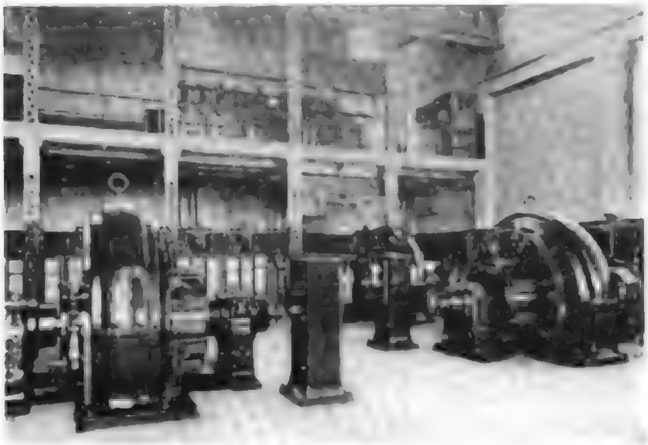


FIG. 3.—GRAND AVENUE SUB-STATION.

To properly effect the charging and discharging of the battery when used as a regulator for the rotaries, there are two direct-connected, motor-driven, separately-excited boosters, each consisting of one three-phase induction motor and one direct-current generator mounted on a common bedplate. The effectiveness of the battery for this purpose depends upon the quickness with which the intensity of the booster field can be varied and its polarity altered. This is accomplished by means of a small booster-exciter generator driven at a constant speed by an induction motor. The current from the armature of this exciter flows directly through the field coils of the booster. The desired change in the conditions of strength and polarity in the booster field can, therefore, be affected by altering the output of this little exciter generator and reversing its polarity. This is done by strengthening, weakening, or reversing the current in the field coils of the exciter, which is introduced into the system simply because it can deliver the relatively large current needed for exciting the booster—this amount being much greater than it would be possible to pass through the very sensitive regulator, which can, however, easily and instantly change the small magnetic field excitation of the little exciter. The action of the regulator is shown diagrammatically in Fig. 5, while Fig. 6 is a typical view of the regulator as applied for general work.

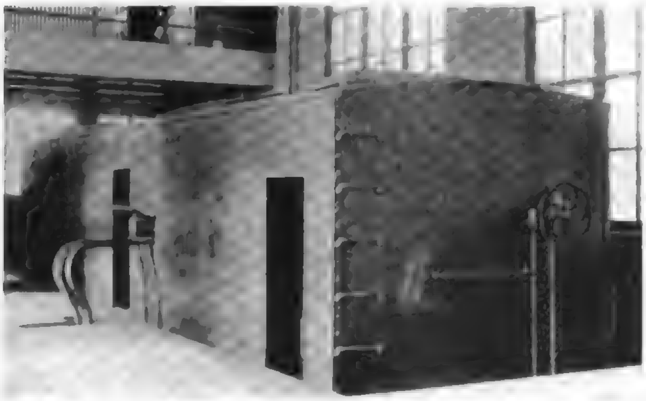


FIG. 4.—PORTABLE SUB-STATION IN SERVICE.

The booster is in series with the battery across the 600-volt station bus-bars. From the opposite ends and from the middle point of a section of 100 cells of the storage battery three circuits are led, one of which passes through the field coils of the small exciter to a connection that joins together two piles of carbon disks which are subjected to the pressure of a lever. The outer end of one carbon pile is then connected to one of the wires leading to the positive pole of the 100-cell section of storage battery, and the wiring from the outer end of the other carbon pile is joined up to the negative end of the 100 cells.

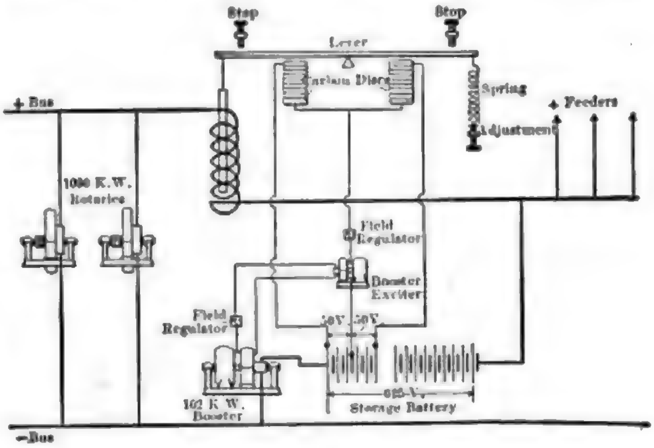


FIG. 5.—BATTERY REGULATOR.

Two circuits are thus formed, each of which includes a separate half of the battery section and one carbon pile, while both have a common connection from the center of the battery section, which passes through the field coils of the little exciter.

The lever which bears upon the tops of the two carbon piles is balanced upon a knife edge, and from one end of it is freely suspended the soft iron core of a solenoid, through the coil of which passes the entire output of the rotary converters. To the other end of the lever is attached a helical spring whose tension may be adjusted by hand to counterbalance the pull of the solenoid at any desired load on the machines. Through the action of the suspended core of the solenoid slight variations of load above or below this amount will cause changes in pressure on the carbon piles by means of this lever, and will result in wide variations in the contact resistance in the carbon piles. The pile that is compressed through the action of a small increase of current in the solenoid will have its resistance reduced, and more current will flow through it than through the other one upon which the pressure has been simultaneously released.

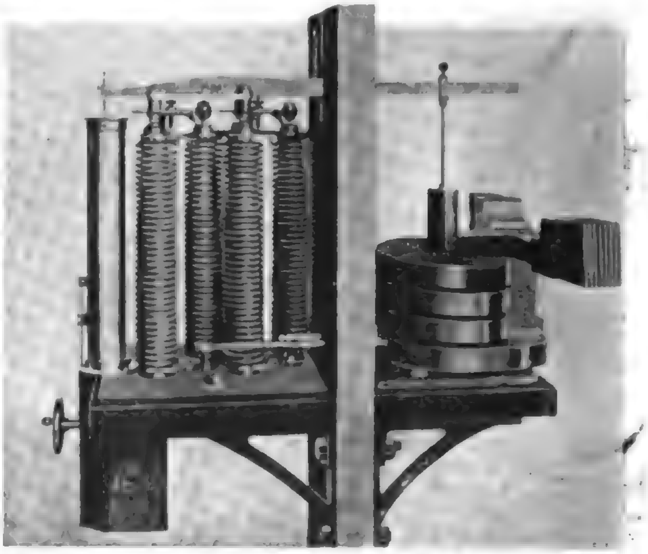


FIG. 6.—CARBON REGULATOR FOR STORAGE BATTERY.

By means of this regulator mechanism, the strength and the polarity of the booster-exciter field is caused to respond instantly to the fluctuations in the main power circuit from the rotary converters. The action of the exciter is simply to multiply this effect in the field of the booster itself, which changes its intensity or polarity in exactly the same way, and consequently charges or discharges the battery in almost instantaneous harmony with the changes in load upon the rotary converters.

The switches for manipulating the 12,000-volt current from the transmission system are oil circuit breakers of both the automatic and non-automatic types. All of the switches are automatic, except those used for interconnecting sections of the transfer bus and for connecting two transfer busses to the rotary bus. The non-automatic circuit breakers are electrically controlled from operating galleries, but are not provided with automatic tripping attachments. The automatic circuit breakers, although electrically operated by the manual control of switches on an operating stand, are also automatically opened through relays by the current in the circuit in which the breakers are located.

Direct current for the third-rail and track circuits is distributed from the rotaries to the outgoing circuits through panel switchboards of the standard direct-current type.

The design and construction of the foregoing sub-station system was carried out by Westinghouse, Church, Kerr & Company, engineers for the Long Island Railroad Company, under the direction of George Gibbs, chief engineer of electric traction of the Long Island Railroad Company, subject to the approval of an electrical committee consisting of the chief operating officials of the road, with the president as chairman.

Recent Electrochemical Developments.

DISCHARGES THROUGH GASES.

For a convenient classification of the field of electrochemistry we may distinguish two main groups of processes and apparatus. The first has as object the production of electrical energy from chemical energy and comprises all batteries, primary as well as secondary. The object of the second group is the reverse one, namely the production of chemical effects by electrical means. In this second group we may again distinguish three classes: Electrothermic or electric-furnace processes; electrolytic processes, and electric discharges through gases.

This classification is a convenient one, through it is not very sharp. The first and second classes overlap somewhat; for example, the production of aluminum is both an electrothermic and an electrolytic process. The third class, the production of chemical effects by electric discharges through gases, has achieved industrial importance in recent years only, and in this class are grouped together various processes which, in their chemical character, are essentially different, corresponding to the essential differences in the character of the electric discharges.

The silent discharge is very different from the arc discharge. Correspondingly, the effect of both kinds of discharges through a gas mixture, like air, is very different. The silent discharge results in the change of the oxygen molecules in the air into ozone: $3\ O_2 = 2\ O_3$. The arc discharge results in the dissociating of the nitrogen and oxygen molecules in the air into their atoms with subsequent combination to nitric oxide $(2\ N + 2\ O = 2\ N\ O)$ which may then be worked up into nitric acid or nitrates (fertilizers, etc.).

Concerning the mechanism of the formation of ozone, we have very little definite knowledge. It may be that the ultraviolet light of the silent discharge plays an important part in this process. With respect to the "fixation" of atmospheric nitrogen in the form of nitric acid or nitrates with the aid of arc discharges we are now reasonably sure that there is no specific unknown electric effect involved in it, but that the arc simply serves to raise the air to the required high temperature. It is, therefore, essentially an electric-furnace reaction, but one of very special character. It is necessary to heat the air to a high temperature and then to cool it with abrupt quickness, since by slowly cooling the reverse reaction would be enabled to go on, destroying again most of the products formed. It is, therefore, essentially necessary to remove the air through which the arc discharge has been passed as quickly as possible from the sphere of the arc discharge.

Of several recent patents relating to subjects of this class, one, which was granted to J. E. Mitchell and D. Parks, describes an apparatus for arc discharges through air. It contains a stationary electrode and two movable electrodes which make alternately contact with the stationary electrode. Thus an arc is produced alternately at one end and the other electrode. These movable electrodes are geared to pump cylinders which pump air into the electrifying chamber. The machine is claimed to be compact, simple and durable and adapted to operate at a high rate of speed.

The production of ozone for sterilization of water has been repeatedly introduced commercially in Europe, but is making slow progress in this country. On the other hand, it is reported that there are various mills in the West using ozone for bleaching flour. According to a recent patent of S. Leatham, a combination treatment is preferable for bleaching flour or cotton yarn or for sterilizing milk, etc. He passes air successively through two apparatus in one of which it is subjected to the action of a silent electric discharge and in the other to a spark discharge. Air, prepared in this way, is claimed to be very effective for bleaching and sterilizing.

Since it is important to know what kind of an electric discharge is going on in an apparatus, some indicator of the character of the discharge would be useful. In a recent patent of L. Gerard it is proposed to shunt the discharge-gap by a vacuum tube and to subject the rays emitted from the vacuum tube to physical analysis by spectroscopic methods.

New Telephone Patents.

NEW SWITCHBOARD CIRCUITS.

While the Kellogg idea of a divided multiple switchboard has been applied with the magneto system, it is, of course, equally applicable for common battery working. The circuit requirements are, however, different. Mr. J. H. Lendi had patented circuits for such a system. Of course, what he must accomplish is a differentiation at the will of the subscriber between the two-line signals of any line, so that calls may be sent at will to either switchboard. Mr. Lendi accomplishes this by an auxiliary line relay and a push button at the subscriber's station to ground one side of the line. For the main switchboard, therefore, everything works normally. For the auxiliary switchboard, the pushing of this button energizes the differential relay by closing the circuit of one of its windings alone. This relay not only lights its signal, but locks itself for the time being, and shunts out the normal line relay, so that the receiver hook does not affect it. The response of the operator restores everything to normal. The circuit is worked out for the two-wire multiple system of the Kellogg Company, to which the patent is assigned.

SUB-STATION APPLIANCES.

A visible indicator has been brought out by F. R. Lay, of Greenfield, Ind., to indicate which of several telephones of a group has rung. Such a device would be used in an office with several telephones. It contains a pair of magnets for each bell, and these affect a pointer which responds to each successive ring to show which instrument last received a call.

W. E. McCormick, of Chicago, has obtained a patent for a new switch hook, the improvement lying in details of construction. The International Telephone Manufacturing Company has been assigned the patent.

A novel form of receiver holder has been patented by Mr. C. Zimmerman, of Aberdeen, S. Dak. This is a head band with friction clutch for holding a hand type receiver. This clamp is padded to close up the ear to outside sounds, and the other end of the head band has a pad to close the free ear.

PARTY LINE LOCKOUT SYSTEMS.

Four patents have recently been granted for party-line lock out systems. Two of these relate to a system invented jointly by Messrs. N. S. McKinsey and A. R. Nelson, of Susanville, Cal. This is a step-by-step system in which all receivers except those of calling and called stations are shunted, and all bells are similarly shunted. The synchronous switching mechanisms are spring driven.

W. D. Watkins, of San Jose, Cal., has also patented a step-by-step system. In this the hook switches are locked against upward movement to prevent interference and the bell circuits of non-wanted stations are held open. J. H. Gorden, of Cooper, Tex., has devised a system with a magnetic hook switch lock and an arrangement such that two talking stations engage merely that part of the line between them, only leaving the remainder open for service between stations in either end section.

LETTER TO THE EDITORS.

Use of Frosted Bulb Lamps.

To the Editors of Electrical World:

Sirs:—We note in the Electrical World of May 26, 1906, page 1082, a communication from Mr. F. W. Willcox regarding our article in the issue of March 17, 1906, page 917, on the effect of frosting on the life of incandescent lamps. Mr. Willcox brings up the point that the life of a clear bulb lamp would be only 53½ per cent of the life values shown for the lamps in enclosing globes in the test if the lamps were, when enclosed in ground-glass globes, brought up to an efficiency which would give the same mean spherical candle-power as frosted bulb lamps. We agree with Mr. Willcox that if this is done the life of the lamp in the enclosing globe will probably be the same as that of a lamp in a frosted bulb. It may be advisable for manufacturers and users to consider whether lamps intended for frosting should not be selected from those which would give lower efficiency with clear bulbs than those which are intended to be used with clear bulbs. In other words, are not commercial frosted lamps being operated at present at a higher efficiency than will give the best results when cost of lamp renewals are figured? The authors will not attempt to say as to this, but it is a point worth thinking about.

At the present time the contention of Mr. Willcox in his letter is of more theoretical than practical value to users because as a matter of fact the conditions in the tests described by the authors, rather than the conditions suggested by Mr. Willcox, are those which exist in practice at the present time. In other words, it is hardly feasible to select higher efficiency lamps for use in enclosing diffusing globes than for use outside of such globes. It may, however, be advisable for the makers to select lamps of lower initial efficiency for frosting. Owing to the larger diffusing surface of the globe as compared to the frosted bulb lamp, it may be possible that even if the actual candle-power with the globe is lower, the ability to see will be equal where the lamps are placed low in the ordinary range of vision. It is not by any means the aim of the writers to discourage the use of frosted bulb lamps, but rather to encourage their use in every way possible, as they should be used in many more locations than they are at present. The aim of the tests was to bring out the commercial facts as far as possible.

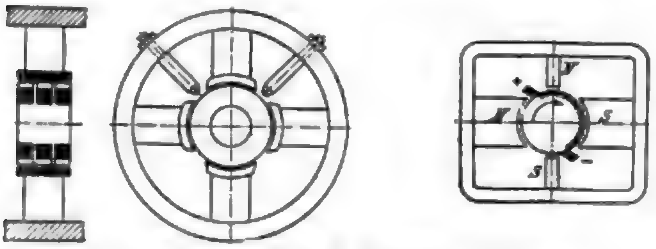
Chicago, Ill. J. R. Cravath.
New York, N. Y. V. R. Lansingh.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Commutation.—Dodd.—A long article, illustrated by diagrams, on "mechanical aids to commutation," the author first defines commutation and describes possible commutation curves. He then explains the purpose and limits of the various devices meant to improve commutation. It is possible to obtain perfect commutation with every machine if the resistance of the contact surface of the brush is infinitely high compared to the resistance of the coil and if we can arrange other forces so that they annul each other. The first condition is obtained in almost every direct-current machine. With carbon brushes and the ordinary style of armature winding if other forces are absent the commutation curve varies very little from a straight line. With copper brushes it may vary considerably from a straight line. In a general way, if we can annul all other forces, the proper place to put high resistance is in the brush contact surface. A high resistance in the armature, either in the coil or in the leads, is a distinct evil. The effect of induction from the outside circuit and the effect of self-induction are then briefly discussed. The effect of shifting the brushes forward is then briefly explained. A great deal can be done toward obtaining sparkless commutation by the use of chord winding on commutation which is very marked. But in order to get the full advantage of chord winding, the reduction in the coil span should be so great that the commutation of the upper coils in a slot must be entirely complete before the commutation of the lower coils shall have begun at the other brush. The author then deals with the effect of field distribution and shows that the following combination would be of great value; a narrow span to the armature coil; design the machine so that a great number of lines enter the armature from the pole so as to make a steep voltage curve directly at the brushes; provide the armature with high resistance leads; a thin brush covering preferably only one bar. In this way it should be possible to obtain all the advantages of high-resistance leads, and a great lead to the brushes without the disadvantage of having to shift the brushes. In all the above devices the limiting conditions are usually very soon reached and none of them will give perfect commutation at all loads and with a fixed position of the brushes. A high brush contact surface is of value, but it will give approximately perfect commutation only when the other forces are low. High resistance leads are of value only when we have self-induction and a great forward lead to the brushes, or its equivalent. Chord winding, even with all refinements, a thin brush, high density in the air-gap at the pole tips, and high resistance in the armature leads will merely have a tendency to straighten the curve at the leading edge. It will not straighten it over its whole extent at all loads. Moreover, high resistance is not altogether desirable. It introduces an undesirable amount of heat which must be dissipated and it lowers the efficiency. The high magnetic density in the air-gap usually means also a high magnetic density in the teeth, causing a considerable armature heating. The thin brush entails a very long commutator, which for high speed machines especially brings in additional mechanical difficulties with what is already a most difficult part of the machine. The only proper way of solving completely the problem of perfect commutation is to eliminate armature self-induction and induction from the outside magnetic circuit. The latter is in most machines induction from the main pole and it is a simple matter to make the distance between the main poles and the chord of the armature winding such that the commutated coil is entirely out of influence of the main poles. The problem of eliminating self-induction is solved by auxiliary poles (interpoles). With auxiliary poles, chord winding is of no special benefit, but rather the reverse. As to the limits of the advantages of auxiliary poles, it is difficult to speak at present with certainty. It appears for all time to make mechanical considerations and temperature rise the limiting factor in dynamo designs. On most machines we have already learned by other means to make these the limits; that is, commutation is not usually the limiting condition. It is only with the more difficult machines that auxiliary poles need at present to be considered; that is, with turbo-generators, alternating-current, direct-current motor-generator sets, variable-speed and variable-voltage machines. The tendency of engine construction is ever toward higher speed and its consequently decreased floor space. We are learning more and more the advantage of ventilation and the greater output of machines which it entails, especially with the higher-speed machines. It may be, therefore, predicted that auxiliary poles will also come into vogue with engine-type machines for the higher speeds. The degree to which they come in depends on the efficiency of ventilation. Comparatively speaking, however, their use will be limited.—*Elec. Jour.*, June.

Hunting of Direct-Current Machines with Interpoles.—Siebert.—An article on the fact that the provision of auxiliary poles may, under certain conditions, cause hunting. The motor with which he experimented is shown diagrammatically in Fig. 1; it was designed for 12.5 hp at 230 volts and for a speed varying between 400 and 1,200 revolutions per minute. The four-pole motor had only two auxiliary poles; this arrangement is permissible if a series winding and only one brush each for the positive and negative pole are chosen; further, by using a sufficient distance between the pole ends, etc., care must be taken that at those places where there are no interpoles, the external field is not distorted to such an extent as to generate obnoxious e.m.f's in the coils short-circuited during commutation. This arrangement results in less cost, less losses in the interpoles, better ventilation and a diminution of the hunting. As long as the brushes were in the central position, or shifted forward (i. e., in the direction of rotation of the armature), there was no hunting whether the machine was loaded or not. If, however, the brushes were shifted backwards, hunting occurred. With a strong main field the oscillations were quickly dampened; when the field was weakened and the speed increased, the oscillations increased. The more the brushes were shifted backwards, the lower was the speed at which hunting started. An increase of the armature current had the same effect. With unexcited interpoles these phenomena were not observed. Besides oscillations of the armature current, the speed and the shunt current also showed oscillations. These phenomena are explained as follows: If the brushes are shifted backwards (Fig. 2), a main pole and an auxiliary pole of opposite polarity act on the armature conductors between two brushes. The e.m.f's generated in the armature conductors, therefore, counterbalance each other to some extent. The effect is the same as though the main field was weakened. If now the speed of the motor is increased by weakening the field by means of the shunt regulator, then the acceleration of the armature requires a greater armature current. This weakens the main field (by the action of the intelpoles) and this results in another increase of speed, acceleration of armature, increase of armature current, and so on. If the main field is comparatively strong, the current and speed will reach a maximum within a few seconds. Since there is no further acceleration, the current and the action of the interpole decrease and the main field is strengthened. This results in an increase of the counter e.m.f. beyond the supply voltage. The machine now acts as generator and is braked. The speed decreases further, and so on. If the main field is sufficiently weakened, the auxiliary pole may get equally strong or stronger, whereby the counter e.m.f. disappears and an e.m.f. is generated in the same direction as the supply voltage and a short-circuit takes place. The oscillations of the shunt current are probably caused by the reaction of the oscillating armature current. The amplitude of the oscillations is determined mainly by the following four points: First, shifting of the brushes backwards from their central position under the interpoles; second, the comparative strengths of the main field and the field of the auxiliary pole; third, the resistance and self-induction of the armature and the interpoles; fourth, the moment of inertia of the armature and of the masses connected with it.—*Elek. Zeit.*, May 31.



FIGS. 1 AND 2.—HUNTING OF INTERPOLE MACHINES.

Commutator.—Livingstone.—The conclusion of his illustrated article on the mechanical design of commutators for direct-current generators. The author gives numerical examples illustrating the use of his formulas for the stresses in commutators and describes the best modern types of construction. He points out that the successful running of a commutator depends on the workmanship quite as much as on the design, and only the most experienced workmen should be allowed to build up a commutator.—*Lond. Elec.*, June 1.

Lamps and Lighting.

Nernst Lamps.—Hartman.—An article on the temperature of the glowing filament of the Nernst lamp. Early determinations of the same gave values which are now found to be much too high. These determinations were based on the law of radiation from a "black body." To this class of radiators, however, the Nernst glower does not belong; so that if the glower emits selective radiation as compared with the radiation from a black body, its measured "black-body temperature" might be much above its actual temperature. Careful tests by the author with the aid of thermo-elements gave results varying from 1,780° to 1,800° absolute temperature (1,507° to 1,527° C.). That the Nernst glower is far from being a black body, is strikingly emphasized, but its economic superiority over that of a black body is not as great as has been claimed for it.—*Phys. Rev.*, June.

Candle-Power and Watt-Consumption.—Lucas.—Voit has established the rule that within certain limits the candle-power of incandescent lamps is proportional to the third power of the watts consumed. The present author shows that this result follows from the thermodynamical laws of radiation, if the filament is assumed to behave as a "black body."—*Elek. Zeit.*, May 31.

Power.

Lubrication of Bearings.—Mattice.—An article in which the author refers to one of the commonest causes of trouble in two-part bearings, which is side binding. This occurs principally in vertical engines and in other machinery where the principal load on the bearing is that due to the dead weight of the rotating part. The bearing boxes are too often bored and scraped to a good fit all around without being cased off to prevent the wedging action near the parting of the boxes, which not only caused a tremendous pressure on the bearings at these points, but prevents the oil from getting in between the shaft and the bearings. A bearing is always much better if cased off so that it will be well clear of the shaft for at least 20 degrees of arc on each side of the center line, and even 30 degrees is not excessive. In the matter of oil grooves also, designers frequently seem loth to sacrifice bearing area. No area, no matter how great, can be sufficient unless properly lubricated. The smaller the amount of oil fed to the bearings, the more it costs. If just enough oil is fed to the bearings to permit of motion without damage, the oil becomes "worn out" by excessive friction. If, on the other hand, an excess of oil is supplied, a less quantity is actually worn out, while the excess can be recovered and used over again. The central gravity system of lubrication, which has come into extensive use in engine installations within the past few years, has resulted in a marked saving in cost of lubrication and the elimination of bearing troubles. An extension of the principle of continuous circulation of oil obtains in the flooded system of lubrication which has come into use in connection with steam turbines. There seems to be a wide misapprehension as to what is a safe temperature. An investigation by the author of the temperature of bearings of a large number of engines of various makes showed that many bearings were running at over 150 degrees, some considerably higher, and in one case a continuous temperature of 180 degrees was found, and in all of these cases the bearings were giving no trouble.—*Elec. Jour.*, June.

Interpole Motors for Industrial Plants.—Hipple.—The possibility of varying the speed of motors with auxiliary poles within wide limits makes them specially valuable for machine-tool driving in industrial plants. The author believes that the saving in wiring and power house equipment made possible by the use of the single-voltage power distribution will of itself be a large factor in leading to the general adoption of the system for industrial plants. At the same time the simplicity of the distribution system and the control makes the handling of the motors easy for inexperienced men and insures a minimum amount of trouble and interruption to work.—*Elec. Jour.*, June.

Traction.

Electricity for Canal Operation.—The German Congress has recently granted the funds for the building of the first portion of a large canal network in central Germany. The total cost will be more than $83,000,000. An essential point in the bill is the uniformity of the methods of handling on all canals in Western Germany. In connection with this project the opening of the Teltow Canal (connecting the rivers Spree and Havel south of Berlin) is of special interest, where electricity is used for various purposes, especially for hauling the boats from the banks of the canal, for auxiliary power purposes, for operating cranes, for lighting, etc. Electrical energy will also be furnished to private consumers, and it is expected that the banks of the canal will become the seat of industries. The Government has the right to condemn the property on both sides of the canal to a distance of 1 km. (0.6 mile) from the center of the canal. An article by Block, describing in detail the equipment of the Teltow Canal and profusely illustrated by diagrams, begins in the same issue. —*Elek. Zeit.*, May 31.

London.—An illustrated description of the new electric trains recently put into service on the Metropolitan Railway. They are composed of six coaches of which the two end cars are motor cars. The four centre cars do not carry motors; the two of these which are next to the motor cars are ordinary trailers, but those in the center are fitted with driving gear, so that during the hours of light traffic the six-car train can be divided into two parts, and each three-car train thus formed can be driven from either end. There are eight 200-hp motors per train, all controlled by the multiple-unit system. The third rail is used.—*Lond. Elec.*, June 1.

Electric Locomotives.—An illustrated description of the new electric locomotives on the Metropolitan Railway in London. The weight of each locomotive is 50 tons, distributed equally over the four axles, and the maximum draw-bar pull which they can exert is 20,600 lb. Each of the two trucks is provided with a 300-hp motor.—*Lond. Elec.*, June 1.

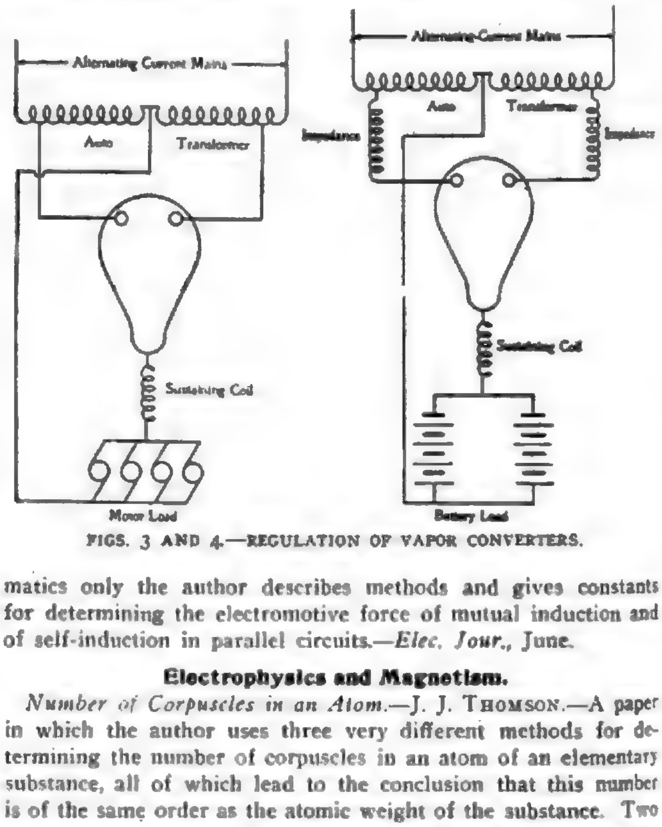
Long-Distance Magnetic Effects from a Trolley Line.—BAUER. —An abstract of a Phys. Soc'y paper. A close inspection of the magnetograms obtained during the past year at the United States Coast and Geodetic Survey Magnetic Observatory, situated at Cheltenham, Maryland, employing the sensitive Echenhazen-Edler variometers, has disclosed the fact that magnetic effects are being photographically registered daily which are to be ascribed to an electric car line 12 to 14 miles distant. This line, proceeding from Washington to Mount Vernon, Va., is a "single trolley" line with defective bonding of the rails. The magnetic element principally affected, viz., the vertical intensity, exhibits during the period of the day (5 a. m. to about one and one-half hours after midnight), when the cars are running, a number of short, more or less periodic waves of fluctuations superimposed upon the normal curve. The average deflection to be ascribed to the electric car effect is about 1/75,000 to 1/150,000 part of the vertical intensity. Up to this time it had been generally supposed that no electric car effects could be detected beyond five miles.—*Phys. Rev.*, June.

Installations, Systems and Appliances.

Regulation in Vapor Converters.—THOMAS.—Regulation of a converter is the drop in voltage produced in the delivered direct current by an increase in current from zero to full load, assuming the voltage of the alternating-current supply circuit to be constant. With the Cooper-Hewitt converter we cannot tell what its drop will be without knowing the character of load for which the outfit has been designed, for instance, whether for charging batteries or for running constant-speed motors. The actual drop consists of two parts, first the drop in the bulb, and second, the drop in the auxiliary apparatus. The drop in the bulb, which is due to an increase of current, is nearly zero, being slightly negative; i. e., at a small current there is a certain voltage loss in the bulb, while at a higher current a little less voltage is lost. The effect of the bulb is, therefore just the reverse of that of resistance. If the converter is to be used for operating motors, the arrangement of Fig. 3 is employed, where there is only the ohmic and inductive drop in the autotransformer and in the sustaining coils. Since the sustaining coil is transversed by direct current, this is principally ohmic loss, which may be made insignificant in amount. On the other hand, with the circuits shown in Fig. 4, which is intended for battery charging, a poor regulation or a certain amount of "backing" is obtained by the introduction of an impedance coil. The regulation of the vapor converter has this unique characteristic. While in itself it does not cause a loss in voltage (but on the other hand, a slightly rising voltage) due to an increase in current, yet it enables auxiliary appliances to be used either in the alternating-current circuit or in the direct-current circuit for obtaining any desired characteristics of voltage regulation over a considerable range. It therefore permits the flexible qualities of alternating-current devices, such as impedance coils, "tub" transformers, and the like, to be effectively utilized for the regulation of direct-current circuits. In this way the auxiliary apparatus used in connection with the converter may be designed to give a very small drop for constant potential or an enormously large drop for other service, as may be desired.—*Elec. Jour.*, June.

Wires, Wiring and Conduits.

Electromotive Force Induced in Transmission Circuits.—C. F. SCOTT.—An article on the calculation of the electromotive force, induced in transmission circuits. With the use of ordinary mathematics only the author describes methods and gives constants for determining the electromotive force of mutual induction and of self-induction in parallel circuits.—*Elec. Jour.*, June.



FIGS. 3 AND 4.—REGULATION OF VAPOR CONVERTERS.

Electrophysics and Magnetism.

Number of Corpuscles in an Atom.—J. J. THOMSON.—A paper in which the author uses three very different methods for determining the number of corpuscles in an atom of an elementary substance, all of which lead to the conclusion that this number is of the same order as the atomic weight of the substance. Two of these methods show in addition that the ratio of the number of corpuscles in the atom to the atomic weight of the element is the same for all elements. The evidence is rather indirect and the data are not very numerous, so that further investigation is necessary before we can reach an exact conclusion. The evidence, at present available, seem, however, sufficient to establish the conclusion that the number of corpuscles is not greatly different from the atomic weight.—*Phil. Mag.*, June.

Demonstration of Alternating-Current Phenomena.—SIMONS.—An illustrated description of an apparatus for demonstrating various alternating-current phenomena and especially properties of transformers.—*Elek. Zeit.*, May 10.

Electrochemistry and Batteries.

Disinfection by Hypochlorites.—Some notes on the new disinfecting plant of the Metropolitan Borough of Poplar. The electrolyte is a mixture of saturated solutions of magnesium chloride and sodium chloride. Hypochlorite solutions containing 4 grams of available chlorine per litre are produced. For use as disinfectant, the solution is diluted. It is used for watering the streets.—*Lond. Elec.*, June 1.

Units, Measurements and Instruments.

Mica Condensers as Standards of Capacity.—ROSA AND GROVER. —An abstract of a Phys. Soc'y paper, pointing out that the use of mica condensers as standards of capacity is justified by the most careful examination of their behavior. The capacity is not, however, perfectly constant, and in order to know the capacity at any given time it is necessary to know certain characteristic constants, namely, the temperature coefficient, the influence of *frequency* and the influence of the potential used. The power factor of the condenser is an indicator of its quality. The best condensers have extremely small, but measurable power factors. The power factor depends both on leakage and absorption. The latter must be small when the power factor is small.—*Phys. Rev.*, June.

Standard Cell.—Hulett.—A paper on mercurous sulphate and the standard cell. The author concludes from his investigation that mercurous sulphate is the most reliable preparation and gives detailed instruction on its preparation and on the preparation of the paste.—*Phys. Rev.*, June.

Troubles with Instruments.—McTighe.—An account of troubles experienced with instruments in central station practice. Proper care must be given to the connections of meters; with shunted instruments the shunts belonging to different instruments should not be interchanged; in instruments in which gravity plays an important part, due care must be taken in mounting the meters, etc.—*Elec. Jour.*, June.

Telegraphy, Telephony and Signals.

Directed Wireless Telegraphy.—The conclusion of the article by Braun, giving a description of his experiments; also a communication by Brown on similar work done by himself.—*Lond. Elec.*, June 1.

Miscellaneous.

Electric Blasting Apparatus.—Maurice.—A continuation of his illustrated serial on electric blasting apparatus, with special reference to its use in coal mines. In the present installment the author deals with dynamo exploders.—*Lond. Elec.*, June 1.

Electricity for Domestic Service.—Knowlton.—An illustrated article on applications of electricity for heating, cooking, driving sewing machines, etc.—*Cassier's Mag.*, June.

Fuel in Blast Furnace.—Richards.—In a continuation of his metallurgical calculations the author discusses the utilization of fuel in the blast furnace with numerous numerical examples.—*Electrochem. and Met. Ind.*, June.

BOOK REVIEWS.

The Management of Accumulators. Ninth Edition. By Sir David Salomons. New York: D. Van Nostrand Company. 174 pages, 36 illustrations. Price, $2.50 net.

This book is an amplified edition of Vol. I, of Sir David Saloman's older work entitled "Electric Light Installations and Management of Accumulators." The author states that it is merely a simple book for the guidance of those who have the care of storage battery installations. He mentions certain of his own experiences with cells of various kinds. Some of his deductions from observed phenomena are hardly in accordance with the accepted ideas of the present time. The usual descriptions of types of plates with their accompanying illustrations, appear. The book itself is well gotten up; the paper, cuts and type are all to be commended.

Reinforced Concrete. A Handbook for Architects, Engineers and Contractors. By F. D. Warren. New York: D. Van Nostrand Company. 271 pages, illustrated. Price, $2.50.

In his preface the author states that the object in preparing this volume was to produce a reference handbook particularly adapted to the wants of architects, engineers and contractors; and that the general form of design is treated rather than one particular or patented system, but the information may be applied to any such systems. The book is divided into four parts, as follows: In Part I a general but concise résumé is given of the subject from a practical standpoint, bringing out some of the difficulties met with in practice and suggesting remedies. Under Part 2 is compiled a series of tests justifying the use of various constants and coefficients used in the preparation of the tables in Part 3, which consists entirely of tables with descriptions thereof and instructions for their use. The final part treats of the design of trussed roofs from a practical standpoint. The author expresses the hope that the volume may tend to do away with the use of some of the empirical formulas and rule-of-thumb methods of designing reinforced concrete structures, and assist in the adoption of a standard and universal system based upon correct fundamental principles.

Physical Chemistry for Electrical Engineers. By J. Livingston R. Morgan. New York: John Wiley & Sons. 230 pages, illustrated. Price, cloth, $1.50.

The author has prepared in this volume a text-book on the elementary theory of electrochemistry for the study of physicists and electrical engineers. An advantage in the development of the treatise is that it is not tied up with any particular theory or hypothesis. It refers the reader to the experimentally observed facts in almost every case.

The volume is divided into eight chapters, the first of which deals with fundamental principles, the second with the properties of gases, the third with heat energy and its transformation, and the fourth with solutions. Chapters V, VI and VII relate to chemical mechanics, equilibrium in electrolytes and electrochemistry, respectively. The last chapter contains general problems for the student. There is room for a missing index of subjects. The author is a physical chemist and writes from the standpoint of that branch of science. He brings with him the tools of his guild. It is a pity to see the symbol π used for electromotive force in a book designed for electrical engineers; but of such is the symbolism of electrochemistry and the marked derivation from engineering practice ought to be eradicated by mutual agreement in the near future. The book is clear, precise and up-to-date. It will be welcomed by electrical engineers studying the theory of electrochemistry.

BOOKS RECEIVED.

Die Akkumulatoren. Vol. VI. By Dr. L. Lucas. Hannover: Dr. Max Janecke. 120 pages, 89 illustrations. Price, 4.40 marks.

Notes on Electrochemistry. By F. G. Wiechmann. New York: McGraw Publishing Company. 145 pages. Price, $2.00 net.

Die Elektrolyse Geschmolzener Salze. Dritter Teil: Elektromotorische Kräfte. By Richard Lorenz. Halle: Wilhelm Knapp. 322 pages, 75 illustrations. Price, 10 marks.

Practical Talks on Electricity. Part I. Principles and Construction of Dynamos and Switchboards. By William Baxter, Jr. Chicago: The Engineer Publishing Company. 362 pages, 233 illustrations. Price, $2.50.

Electric Illumination on Chesapeake & Ohio Trains.

On the Chesapeake & Ohio railway practically the entire passenger equipment, including baggage and mail cars, is lighted by electricity. This railroad has been carrying electric lighted cars for the past 14 years and at the present time they have some 260 cars equipped with incandescent lamps. During this time the Silvey Storage Battery System has been used in furnishing the current to the various cars in use on the railroad.

Each car is an independent unit carrying a complete storage battery equipment which furnishes current at 24 volts. This low voltage permits the use of lamps having short heavy filaments, and the drop in potential in 12 storage cells when connected in series is so slight as to be negligible in this particular class of work. The use of such a low voltage also very greatly reduces the liability of short circuits throughout the system, and in actual practice it is not necessary to use copper wire larger than No. 4 as main distributors. Since the length of a coach is not very great, the cost of additional copper wire is insignificant.

All the batteries are removed from the cars for recharging, and along the C. & O. railroad three charging stations have been established at Covington and Louisville, Ky., and Richmond, Va. A sufficient number of extra sets of batteries are always kept on hand at each of the above stations so that freshly charged sets can be supplied to the various trains whenever the batteries may be required. When the train pulls in, a special truck is run up along side of the coaches to the carboxes, which are usually suspended beneath the center of each car. Car box rollers are so placed that when the trays containing the storage batteries are disconnected, they can easily be drawn out onto the truck, which is also provided with rollers across its surface. The various coaches of a train are filled with fresh batteries in an almost incredibly short length of time. This system is the essence of simplicity, as on the trains there are no dynamos, regulating devices or other moving parts to be contended with while the train is in service. All the trays are numbered and a careful record is kept so that no mistakes will be made as to just when the battery will need to be removed for recharging.

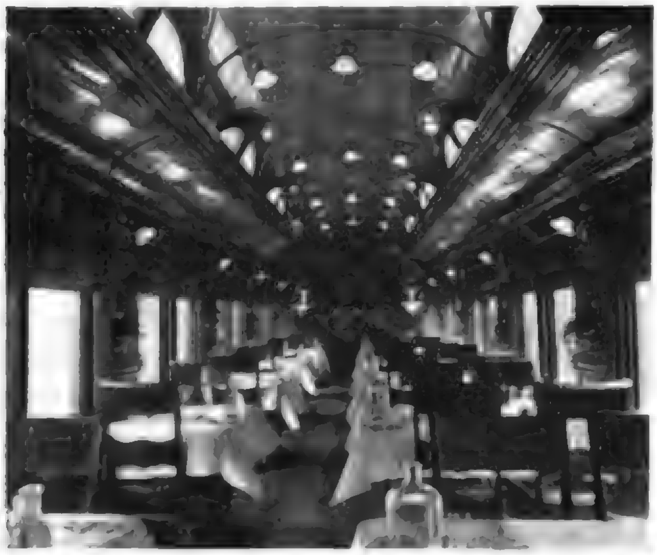


FIG. 1.—VIEW OF INTERIOR OF A DINING CAR.

Storage batteries having a capacity of 350 ampere-hours at 8-hour discharge rates are used, and the 12 cells are placed in two trays containing six cells each. The hard-rubber jars measure about 6½ in. wide by 12½ in. long and 11¾ in. high. The elements are so placed in the jars, trays and car boxes as to have the 12-in. dimension of the plate in the same line as the direction of motion of the train; thus there is no tendency for the plates to press against one another, or for the jars to do likewise when the train receives a severe shaking due to coupling on additional coaches, etc.

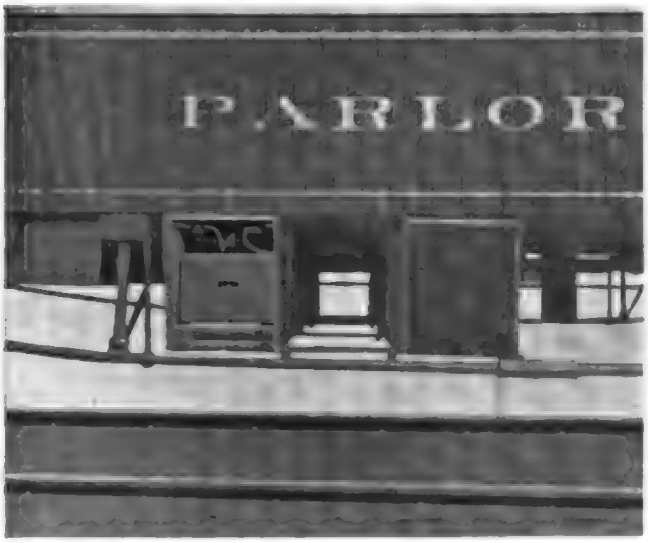


FIG. 2.—BATTERY BOXES UNDERNEATH CAR.

In many of the dining cars and Pullmans as many as 80 lamps are now placed in a single car, and this required increased battery capacity. To meet this requirement additional sets of cells have been placed in parallels across the line so that in certain cases as many as three sets are placed beneath a single car. This gives a total capacity of 1,050 ampere-hours at 24 volts. Cars equipped in this manner are expected to make a run of 2,000 miles on one charge of the batteries. Most of the express and baggage cars carry about 10 16-cp, high-efficiency, 2½-watt lamps, and one single set of cells will supply enough energy to run them for 21 hours on one charge.

Fig. 1 is an interior view of a dining car, which shows the location of the lamps. Fig. 2 shows the arrangement of the car boxes as placed beneath a parlor car. One of the boxes is open and the front roller is plainly visible beneath the tray. Fig. 3 shows the battery truck ready to be unloaded, and Fig. 4 is an interior view of one of the battery charging stations. Each section of the charging table is provided with a rheostat so that the current flowing to each particular set of cells can be carefully regulated. An ammeter is mounted on a small portable truck, and the connections are such that the ammeter can be easily inserted in any particular circuit so that the attendant can rapidly pass down the length of the room and ascertain the amount of current flowing into each set of cells. Fig. 5 is a sectional view of a Silvey storage battery having armored type plates. This battery is particularly adapted to railway train lighting work since the plates are designed to stand all kinds of rough usage without loss of active material, and consequent loss in capacity.

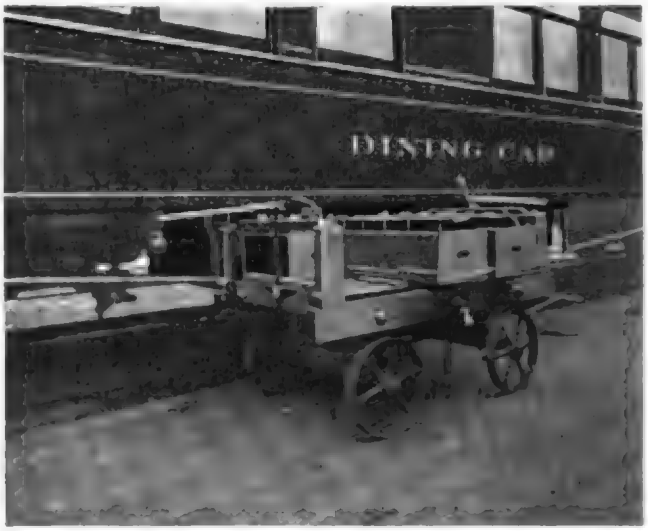


FIG. 3.—BATTERY ON TRUCK.

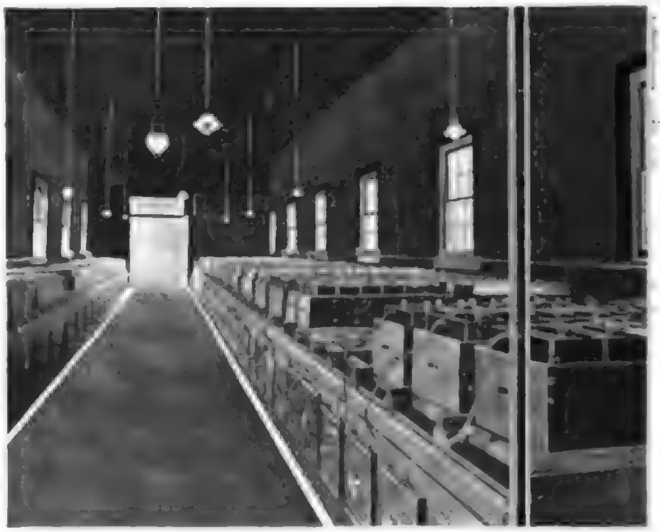


FIG. 4.—VIEW OF INTERIOR OF BATTERY-CHARGING STATION.

The grid is made in two parts, into each of which is forced thin perforated sheet lead so that each half of the grid contains a large number of small perforated pockets. These pockets are then filled with active material, and the two halves of the plate closed and held securely together by means of a large number of lead rivets. The electrolyte can circulate very freely through the perforations, but at the same time the active material is held securely in place so that there is almost no shedding from plates of this type. The plates are very rigid since the grid work is built up from lead containing a considerable per cent of antimony. This, combined with the efficient separators used, effectually prevents buckling of plates and moreover there is no tendency to buckle under the highest discharge rates since all parts of the plates are carefully balanced. These cells are designed to withstand very high discharge rates, and a long and elaborate series of tests was carried out which proved conclusively that the cells suffered no material loss of capacity when they were subjected to rapid discharges at excessively high rates. This ability to stand up well is in great measure due to the fact that the active material is in immediate contact with the grid since the individual plates can be repaired and new active material can be inserted by driving out the lead rivets and separating the two halves of the plates.

In place of the small hard rubber cover or elaborate covering case surrounding the individual cell which is used to prevent slopping of the electrolyte, a small splasher is placed on top of the plates, which resembles in appearance the criss-cross work placed in egg crates. These small pockets effectually prevent the formation of waves across the surface of the electrolyte. Since there is no covering other than the splasher it is possible to inspect the individual cells when they are removed from the train. The specific gravity of the electrolyte can be easily obtained and fresh electrolyte added to make up for evaporation without undue loss of time in removing troublesome coverings. In Fig. 5 this splasher has been removed in order to more clearly illustrate the construction of the elements.

The question naturally arises as to whether or not it is a profitable investment to maintain an elaborate equipment similar to the above in order to furnish current for lighting the cars by electricity. The Chesapeake & Ohio Company has kept very complete and accurate reports as to the cost of operating and maintaining its storage battery equipment throughout the 14 years. A summation of all these reports proves conclusively that it has been lighting its trains by electricity at just one-third the cost of Pintsch gas or oil lamps. This statement is further verified by a report of a committee appointed by one of the prominent railway associations to investigate the cost of the various systems of lighting railway cars in the United States. It is equally true, however, that this statement would not hold good were it not for the fact that practically the entire passenger equipment of the railroad is lighted by means of current furnished by storage batteries, so that on railroads using this system, but having a lesser number of cars in service which are equipped with electric lamps, the relative saving over Pintsch gas or oil is not quite so great.

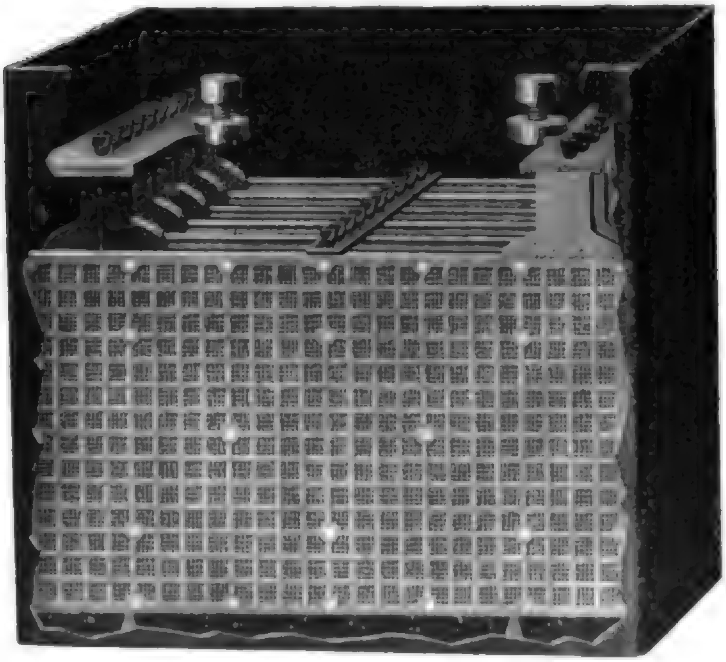


FIG. 5.—BATTERY PLATES.

A Convertible Telephone System.

The International Telephone Manufacturing Company, of Chicago, recently installed for the Macon County Telephone Company, of Decatur, Ill., a "growing-exchange" lamp signal magneto multiple switchboard, views of which are shown herewith. This system, which is convertible into a central energy system at any time, has been designed especially for the use of exchanges where companies are required to re-equip their central office to provide for the constantly increasing demands, and where they are not in position to rebuild for complete central energy at one time. The system is so constructed that it may be used in connection with common return or grounded line construction, and with the old-style individual generator call local battery instruments, and at any time changed to a full central energy equipment without discarding any of the central office equipment of their make installed.

The operating room is equipped with a main switchboard, chief operator's desk and a tollboard. The switchboard consists of four sections of three operators' positions each. The exchange line equipments are distributed with 120 and 130, respectively, in each alternate position, and with 50 self-restoring drop signals for farmer line work in the first annex position.

The board is built with a multiple jack capacity for 4,800 lines. The frame is constructed in sections, arranged for three operators' positions each. Each section is subdivided with eight panels for the multiple-jack space, and with nine panels for the line equipment space, arranged three panels to each position.

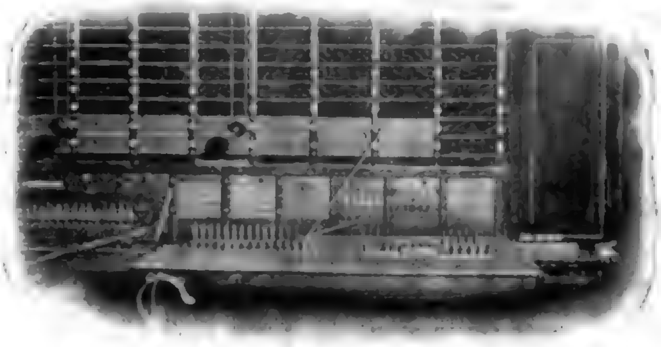


FIG. 1.—SECTION OF BOARD.

The plugboard is drilled for two supervisory clearing-out signals for each pair of cords. In the present equipment for magneto call service, only one clearing-out signal is installed, but all provision is made so that when the system is changed to central energy, the necessary apparatus may be installed for double supervision. On the key shelves are mounted the vertical type combination listening and two-party selective ringing keys.

Fig. 1 shows the face of the first section. The first position contains the necessary multiple jacks for serving as an annex to the second position containing the first exchange lines. The annex position is also equipped with 50 high-wound bridging non-inductive tubular self-restoring drop and corresponding answering jacks for magneto call rural party lines.

The plugs are of such size as to enable inserting two or more in adjoining multiple jacks which are built on ⅜-in. centers. The plug is provided with a loose sleeve to prevent kinking the connecting cord when the operator turns the plug, as is customary while making a connection. With this system the regular two-conductor connecting plugs and cords are used. The drop restoring device is mounted in the path of the plug and supported on a German silver compensating spring, which insures a positive restoring of the drop at all times, even after the parts have become worn from long-continued usage.

The equipment and wiring is so designed and arranged that the line signals respond to a very slight turn of the subscriber's telephone generator in the old instruments now in use, and so that when the instruments are replaced with central energy telephones the same equipment throughout can be used by simply changing the connection on the relays already provided, and operate as a regular central energy equipment.

The German silver contact springs of the line relays are more than two and one-half inches in length from the contact to the support, giving ample space for a wide and reliable break in the contacts. Each position of the board is provided with an operator's set, including a line pilot, clearing-out pilot and the necessary order wire circuit to the tollboard.

Multiple jacks, in multiple with the answering jacks, are mounted in each six panels of the eight panel sections, enabling each operator to make connection with any subscriber's line without reaching beyond the three-quarter section in which the call is received, making the reach only two-thirds of the adjoining positions. The line lamp jacks are built in conjunction with the associate answering jack. The lamps are supported in a spring collet brass socket, provided with an opalescent disc. The socket with lamp may be easily removed from the front of the board. The lamp jack springs are so constructed that the lamp can be inserted only so the terminals will make proper contact with the jack springs.

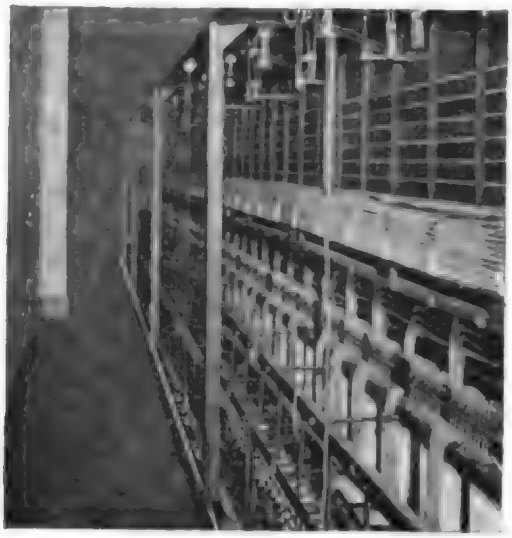


FIG. 2.—REAR VIEW OF SWITCHBOARD.

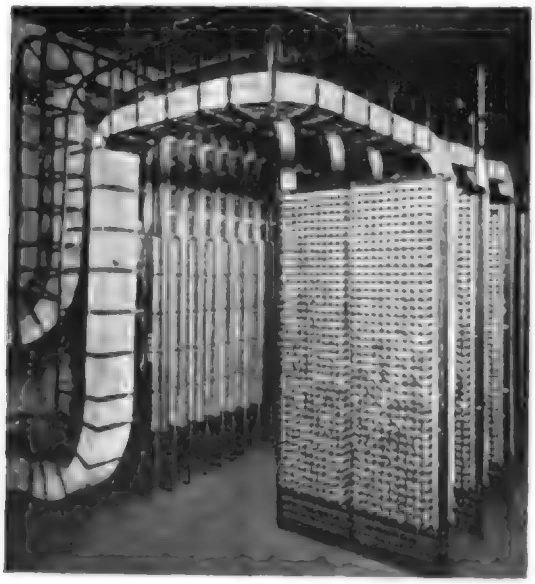


FIG. 3.—TERMINAL ROOM, DECATUR EXCHANGE.

The clearing-out lamp and also the pilot lamps are so constructed that they may readily be removed from the front of the board, facilitating the testing or changing of lamps in case of defective signals.

The chief operator's desk is of the cordless type, to allow all available space on the desk for clerical work. In the top cabinet is mounted a lamp, connected with the line pilot circuit, and one with the clearing-out pilot circuit of each operator's position on the main board. The cabinet also contains a special listening-in key for each operator's set. To signal an operator, the proper key lever is raised. When the key lever is placed in a downward position, the chief operator's set is connected with the main board operator's set. The circuit is so arranged that the main board operators cannot notice when the chief operator listens in.

Fig. 2 shows the rear view of the switchboard. The arrangement of the working parts of the switchboard apparatus is such that any detailed part may be readily inspected and tested. The frame is provided with a special iron run for the cables. Immediately below the cable run are mounted the clearing-out signal relays with ample space for the supervisory relays when the system is changed to central energy. The cord terminal strips are provided with cord clips and so mounted that the cords may be tested readily or conveniently replaced. The back of the frame is provided with paneled sliding doors, to properly close the board.

For maintaining the lamp signals and operating the relays, operators' transmitters, etc., the system is provided with a storage battery plant and regular power equipment. The charging machine is of sufficient size to operate the exchange when completed to its ultimate capacity, and is built to operate from a 110-volt, direct-current lighting circuit. The motor and dynamo of the charging set are connected by a flexible insulated shaft, giving them the appearance of a tandem machine. The dynamo end is of a necessary capacity to provide sufficient current at a suitable potential to meet the maximum demands of the storage batteries when completed to supply the ultimate capacity of the switchboard when operated as a central energy system. The charging machine runs very quietly and without undue heating. The power plant is also provided with a Roth dynamotor, built to operate from a 110-volt, direct-current lighting circuit, with a secondary output of 100 volts alternating. There was also furnished an auxiliary ringing machine, built to operate from a 24-volt storage battery plant, having a secondary potential of 100 volts alternating.

Fig. 3 shows the relay rack and distributing frames. The distributing frame is a combination main and intermediate rack. The line side is provided with 1,300 pair carbon block lightning arresters and Kaisling self-soldering heat coil protectors. The distribution of the lines is done with flame-proof jumper wire. The cable work between the relay rack, distributing boards and the main switchboard, is carried on special overhead iron cable chutes, and is connected in a neat and substantial manner.

This system thoroughly demonstrates the convertible telephone system, and places the independent companies in position to begin re-equipping their exchanges upon a permanent basis to meet future requirements of their telephone service.

Hawthorne Works of the Western Electric Company.

The Western Electric Company has recently completed at Chicago six groups of buildings, designated as the "Hawthorne Shops," which are being devoted to the manufacture of direct and alternating-current motors and generators, and of telephone and power cables and rubber in the various forms in which it is used for telephone service. The entire plant covers approximately 1,000,000 sq. ft. of floor space and is located on a tract of land of 110 acres.

The foundry is a brick and steel structure, having a tile roof, and is 400 by 176 ft. in floor area, and 75 ft. in height at its highest point. The machine shop is 860 ft. long and 150 ft. wide, and is of the same type of construction as the foundry, except the roof, which is of iron and tarred roof construction. A view of the interior of the machine shop is shown herewith. There are three bays: the center one, 76 ft. wide, is devoted to the manufacture of generators and motors. The north bay, 48 ft. wide, contains such machine tools as are required in the manufacture of small types of machines. In this bay is located the testing department. The south bay has two floors; the upper one being devoted to the manufacture of small field coils and the winding of small armatures. It also contains the small detail and finishing departments. The lower floor contains the commutator and large detail departments, stock rooms and general shop offices, including that of the shipping department. The lighting is obtained from overhead skylights and side windows. Over the main bay are located two 30-ton cranes, and over the north bay six 20-ton cranes. The entire plant is equipped with a system of industrial railways.

Entering the cable plant from the south is a railway track connecting the receiving department, which covers 15,000 sq. ft., at which the raw material is received. Adjacent to this are the insulating and wire twisting departments, covering 22,500 sq. ft., and from which the material passes into the cable twisting room, covering the same area. From here the cable passes into ovens, covering an area of 10,000 sq. ft., and is finally delivered through small openings in the wall to the pressroom, where the lead sheath is applied. This room is 360 by 100 ft. At the south end is located a storage pit for lead, in which under normal conditions is stored 4,000,000 lbs. Immediately adjoining this section is a room 100 by 50 ft., in which is a battery of six impregnating tanks, used in the insulating of power cables made in another adjoining room, covering 15,000 sq. ft. In addition to these departments, there are the testing and shipping sections, covering an area 440 by 50 ft. There are in process of construction and almost completed buildings which will increase the capacity of the present plant by over 100 per cent.

VIEW OF INTERIOR OF MACHINE SHOP.

The rubber plant forms an L to the cable plant. It has the same railroad connection as the cable plant, and is divided into four sections: the compound mixing, grinding and vulcanizing, sawing and finishing and shipping rooms; all covering an area of 40,000 sq. ft. A portion of this plant is two stories high, the second floor being devoted to the process of drying crude rubber. The buildings of the cable and rubber plants are identical in that they are of brick and steel construction—a special feature being a saw-tooth roof construction, so built that the windows face the north. This type of roof is used entirely in this section of the plant, except in the pressroom of the cable shops, where crane service is furnished by one 20-ton and one 5-ton crane, and in that portion of the rubber plant having two stories.

All of the machinery in the entire plant is electrically driven, an individual drive system being employed except in a few cases. The main machine shop and cable plant contains many variable-speed motors which are operated from a three-wire system. A compensator, or voltage balancer, located in each of these buildings, is of sufficient capacity to carry the unbalanced load resulting from the variable-speed motor load. The voltage balancer consists of two 115-volt machines connected in series directly across the mains, with the neutral wire connected between them. The machines are compound wound, the series field coils being connected in the neutral wire.

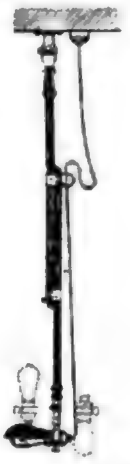
The various buildings are connected with the power house by a system of well-lighted and ventilated tunnels in which are located the telephone, lighting and power cables, and pipes for the drinking, city and house water, compressed air, live and exhaust steam, vacuum and trap returns, roof drain and hydraulic elevators. These tunnels have a uniform height of 7 ft., and vary in width from 4 to 10 ft.

Connecting with the tunnel leading to the machine shop is a system of concrete trenches surrounding the iron plates of the testing floor. Within these trenches are cables leading into junction points at which are available for testing purposes all voltages from 30 to 550 volts, both direct current and alternating current of 25 and 60 cycles.

The yard and building illumination consists of arc lamps, two in series on 220 volts, and incandescent lamps for local lighting. The generating equipment consists of four Western Electric direct-current generators, rated at 300, 500, 1,000 and 1,200 kw, respectively. The generators operate normally at 230 volts, but the main switchboard is so arranged that the two smaller units may be operated in series so that 550 volts may be available for testing purposes, the shunt field coils being of sufficient capacity to permit of an increase in the terminal voltage of the machines.

Universal Incandescent Lamp Holder.

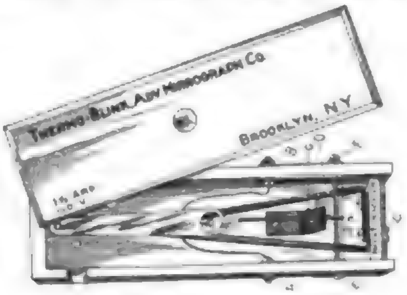
The accompanying illustration shows a lamp holder which has been designed to overcome the defects existing in the drop-cord method of using electric lamps. The holder allows the lamp to be swung in a complete circle eight feet in diameter, to be raised and lowered through a distance of three feet, and twisted and turned to any conceivable angle. Automatic friction clamps at all joints enable the lamp to be moved into any position and to stay where placed. This lamp holder is made by the Gail-Webb Manufacturing Company, 6 Lock Street, Buffalo, N. Y.



UNIVERSAL LAMP HOLDER.

Motorless Sign Flasher.

The Advertising Mirrorgraph Company, of Brooklyn, maker of "thermo-flashers," has recently placed on the market an inexpensive motorless flasher, illustrated in the accompanying illustration. This flasher is unaffected by exterior temperature changes and only operative when the current is applied. This result is obtained by heating alternately two opposed legs of the same expanding material which in turn throws a lever from one contact to the other. The breaking is done with a snap due to a retarder, and the contacts being platinum, the life of such an apparatus is almost indefinite.



SIGN FLASHER.

The Steam Railroad Convention at Atlantic City.

During the past ten days a very extensive exhibit of material and apparatus for "steam" railways has been made at Atlantic City in connection with the annual meetings of the Master Mechanics and Master Car Builders' Associations. The Steel Pier was occupied to overflowing with these displays, some of which were of a very extensive and pretentious character. As the Electric Light Convention had preceded this gathering, some exhibits were able to shift readily from Young's Pier to the other, but this juxtaposition would hardly explain the manner in which exhibits of an electrical nature are more and more invading the "steam" railway convention. Indeed, it is evident that the revolution or change as to motive power is well begun. Note is made below of the principal exhibits of this nature:

The General Electric Company, Schenectady, N. Y., jointly with the American Locomotive Company, showed on exhibition tracks at the Pennsylvania depot a complete electric locomotive, built for the New York Central Railroad in New York City. An all-steel car for the New York Central electric service, with full electrical equipment, was also exhibited, as well as one of the West Jersey Seashore cars, similarly equipped. At the booth on the steel pier Mr. F. H. Gale dispensed the hospitality of the company, which was represented at the convention by C. C. Peirce, Ralph Moore, L. R. Pomeroy, H. O. Hawkes, W. B. Potter, J. G. Barry, H. D. Tremper and J. R. Lovejoy.

Crocker-Wheeler Company, Ampere, N. J., was represented at the convention by Rodman Gilder, H. C. Petty, F. B. De Gress, Julian Roe, S. Russell, Jr., and H. L. Patterson. Catalogues, pamphlets and literature of the company were distributed from its booth.

Gould Storage Battery Company, New York, exhibited its batteries for signal and train lighting service. This company was represented by Messrs. W. S. Gould and George S. Milne.

Standard Paint Company, New York, had an attractive booth, exhibiting its ruberoid roofing for cars and ruberoid red and brown roofing, flexite metal preservative paints, Giant and P. & B. insulating paper, and P. & B. packing and air-drying varnishes. General Manager Paul M. Wade was present, as well as Messrs. J. N. Richards, E. C. Beckman and H. J. Thomas.

The Bullard Automatic Wrench people, of Providence, R. I., exhibited the famous Bullard wrench, now in general use in steam and electric railway repair shops. Mr. J. L. Blaisdell attended the convention.

Sprague Electric Company.—The Sprague electric monorail crane was exhibited and its actual operation was shown in a space not over 10 ft. or 12 ft. long. Flexible steel armored conductors, Greenfield flexible steel conduits and steel armored flexible cord outlet boxes were also exhibited by Messrs. A. E. Bradford, A. C. Bakewell and F. S. Douglass.

National Brake Company, of Buffalo, N. Y., was represented at the convention by its treasurer and general manager, G. S. Ackley and E. C. Rutherford, of Toronto, Can. A type of brake, similar to the well-known Peacock brake now in universal use on electric roads, applicable to steam passenger and freight car service, is being marketed by this company.

Cling Surface Manufacturing Company, Buffalo, N. Y., had a neat exhibit, illustrating the difference between belts treated with Cling surface and ordinary belts. Mr. F. Chase, of New York, attended.

Vacuum Cleaner Company, New York, had a very interesting exhibit on the exhibit track at the Pennsylvania Railroad station, in a Kenny portable vacuum cleaning plant, for both steam and electric railroad. It is especially adapted for this purpose, as it can be moved with facility and ease from one part of the road to the other. The company was represented by R. C. Hallett.

H. W. Johns-Manville Company, New York, had a very complete exhibit of all of its asbestos products, transite for the fire-proofing of electric railroad cars, fire-proof lumber fibres and cements, asbestos textile materials, pipe covering cement, felting and roofings, Vulcasbestos, piston rod packing, throttle rod packing, Keystone combination pump packing and its 85 per cent magnesia and fire-felt sectional boiler lagging. The company was represented at the convention by Messrs. J. W. Perry, L. B. Melville, J. C. Younglove, M. Fuhrer, W. F. Taylor, E. C. Sawyer, F. M. Gilmore, H. O. Fettinger and J. E. Meek.

Yale & Towne Mfg. Company exhibited 20-ton triplex chain blocks, 2-ton electric hoists built in trolley, 2-ton electric hoist with graduated speed control, 5-ton triple chain block in operation under load, one triplex and differential chain block, etc. Messrs. W. C. Bigelow and C. W. Beaver were present.

Jos. Dixon Crucible Company displayed the various Dixon graphite specialties and lubricants. The company was very liberal in the distribution of its lead and indelible pencils. It was represented by W. A. Houston, Lewis F. Lyne, Malcolm McNaughton, E. M. Taussig and C. H. Spatts.

Niles-Bement-Pond Company, New York, exhibited at the Pennsylvania Railroad depot a 90-in. extra heavy driving wheel chucking lathe. The company also entertained its friends and delegates at its booth on the ballroom stage on the steel pier. The representatives present were D. A. Normolye, Frank B. Ward, E. C. Lewis, Jos. K. Cullen, George T. Watts, J. P. Ilsby, L. A. Williamson, J. J. Hay, W. W. Ricker, H. M. Cleaver.

The General Storage Battery Company, New York, exhibited its Bijur battery for signal car lighting and power regulation. The company was represented by R. C. Shaal and F. E. Booss. As at the Electric Light Convention, the battery received very favorable comment.

The Westinghouse Exhibit consisted essentially of the display of air brake apparatus made by the Westinghouse Air Brake Company, which was represented by M. J. R. Ellicott and his large staff of assistants.

Bell Telephone Company, as in the case of the National Electric Light Association, extended special courtesies and facilities the members. To secure uninterrupted connections between the pier, the city system of Atlantic City and the long-distance trunk lines, an independent cable with twenty trunk lines was installed between the switchboard in the Atlantic City office and the temporary exchange at the company's booth in the center of the south side of the music hall.

Carborundum Company, of Niagara Falls, had an interesting exhibit of its corborundum specialties adapted for filing and cutting work, as a highly successful rival of emery. This abrasive is popular among railroad men as well as other mechanical managers. The concern was represented by Messrs. E. J. Eames, W. W. Sanderson, C. O. Taylor and C. C. Schumaker.

Dearborn Paint Company, of Chicago, had an exhibit of its paint and of its crude materials. It showed also acid and alkali-proof jars, battery boxes, etc., and was represented by Messrs. J. R. Van Allen and L. F. Lindley.

Electric Storage Battery Company, of Philadelphia, had a fine exhibit of its Chloride accumulators for railroad electrification showing two complete cells of the recently designed R type; a switchboard equipped with carbon regulator, automatic water-filling apparatus and recording hydrometer for pilot cells; Chloride accumulators for car lighting service, showing six types of two-compartment cells with specially designed containing vessels; Chloride accumulators for signal and interlocking service, showing stationary and portable types. The company, which has received large orders from the New York Central Railroad for its new electrical equipment, was represented by Messrs. Chas. Blizard, general sales manager; J. A. White and H. E. Hunt.

Lincoln Electric Manufacturing Company, of Cleveland, had a line of variable-speed motors specially applicable to machine tool drive in railroad shops. Mr. H. M. Hitchcock was present on behalf of the company.

J. T. Ryerson & Son, of Chicago, had a large variety of appliances and tools for locomotive and other railway work, car and track jacks, flue cleaning and welding machines, motor-driven shears, etc.

United States Light & Heating Company, of New York, had an equipment of its well-known train lighting system, represented by Mr. John J. Moore, the veteran central station expert and manager of the earlier Thomson-Houston régime.

The Allis-Chalmers Company, of Milwaukee, was represented at the convention by Messrs. F. C. Randall, C. A. Tupper and Guy Slafer. The company's booth was devoted to showing samples of stationary motors for repair shops and steam turbine vanes and discs

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Satisfactory conditions are reported in trade and industry considering the season of the year. General business is of average proportions, but in many lines it is in excess of a year ago. Fall orders for many lines of goods are coming forward in goodly volume, and jobbers appear optimistic as to the outlook. Machinery is generally well employed and the labor situation, while still disturbed at some points, has somewhat improved. Crop reports are more satisfactory, and the outlook is for a very good yield of wheat, though damage reports are numerous. In the cotton belt the situation is brighter, except at a few points, Georgia particularly, where severe rainfalls have damaged the plant. There is a slightly better tone to pig iron, the production of which is decreasing, and consumption is heavy, that fact preventing any large accumulation of stocks. Railway earnings are very large, the increase for May being over 14 per cent, this being the highest on record for May. Money continues easy, and collections range from fair to good. Building is active with a consequent heavy demand for hardware and materials in general. Copper is quiet, but prices are firmly maintained. Lake closed at 18 13/16c., Electrolytic, 18½, and casting stock 18 5/16. There were, according to *Bradstreet's*, 170 business failures in the week ending June 14, against 162 the week previous and 175 in the corresponding week last year.

THE OUTLOOK FOR COPPER.—Walker's copper letter to the *Boston Commercial* says: "Copper is quiet, but continues very strong. Lake is held at 18¾c. to 19c. per lb. for August and September delivery; electrolytic for nearby delivery is 18¼c., for September, and October delivery 18½c. to 18⅝c.; casting is 18¼c. to 18⅜c. There is a strong demand for prime grades of casting copper. The domestic situation is quiet at the moment and without special feature. Demand from European consumers continues strong. The recent activity of the foreign buying shows its effect in the copper exports for Europe, which are increasing steadily. Producers generally do not look for a very large increase this year over the output of 1905. Meanwhile the metal is going into consumption as rapidly as it can be produced, and there are many indications that this condition will continue for several months to come. The extensions now being added to several of the large refining plants in the East when completed will help to ease conditions and will also facilitate a more rapid turning over of copper from producer to consumer. The refining plants are now crowded to their utmost capacity, yet they are not able to keep pace with the demands being made on them." It is stated, with regard to the strong demand from Europe, that one producer booked 12,000,000 pounds of wire bars for September, October and November shipments to an electrical corporation which has two plants along the Rhine. Another German corporation in the electrical field is negotiating for 18,000,000 pounds, to cover requirements for the last quarter of the year. In speaking of the remarkable prosperity of Germany's copper consuming interests, one of the most important copper producers in the West informed the *New York Sun* that the largest consuming interest in American wire bars in Germany increased its 1905 business 62 per cent over the previous year, and its increase in the first four months of this year exhibits an increase of 26 per cent. over the corresponding period of 1905. This corporation has business on its books in cables alone that will call for the consumption of 20,000,000 pounds of American copper during this year.

POWER CABLES IN BROOKLYN.—The Department of Water Supply, Gas and Electricity has granted a permit to the Brooklyn Rapid Transit Company for the installation of its new 5,600-volt cables on the surface and elevated extension which the company has recently built to Canarsie. The granting of the permit was held in abeyance for nearly two months, pending an opinion by the corporation counsel as to whether the company had a right, through the provisions of its charter, to install cable of such high pressure. The corporation counsel, in an opinion rendered last week, said the company was entirely within its rights. The steam road which formerly ran between East New York and Canarsie has been rebuilt and connected with the Fulton Street "L" structure. At New Lots Road the trains will descend and run on the surface to Canarsie. High-speed motor trains will be operated over the line.

ROLLING STOCK FOR SAN FRANCISCO.—For the equipment of their new rolling stock, made necessary by the recent fire, the United Railroads of San Francisco have placed large orders with the General Electric Company for various types of railway motors. These include twenty-five four-motor, 40-hp equipments; fifteen four-motor, 50-hp equipments, and ten four-motor, 75-hp equipments. All will be supplied with the flexible Sprague-General Electric system of multiple-unit control. The United Traction Company of Albany, N. Y., has recently ordered twenty-five four-motor equipments, and the Philadelphia Rapid Transit Company, 100 four-motor equipments. In several instances the GE-80 is being substituted on cars already using a less efficient motor. Thirty-six equipments of four motors each were recently ordered by the St. Louis Railway Company, to replace old motors.

PLANT FOR ALBANY CAPITOL.—Following a meeting of the New York State Board of Trustees of Public Buildings, consisting of the Governor, Lieutenant Governor and Speaker of the Assembly, Governor Higgins has announced that the contract for installing an electric lighting plant in the basement of the Capitol had been awarded to W. N. Sheehan & Co., of New York, at their bid of $43,100. The contract stipulates that the work shall be completed within four months. In addition to lighting the Capitol, the state will light the State Hall, Geological Hall and the executive mansion. An appropriation of $65,000 was made for the work several years ago, but no definite action was taken until recently. The Capitol and other state buildings at the present time are lighted by the local lighting company.

WESTERN ELECTRIC WIRE PLANT.—It is stated that the Western Electric Co., which uses over 75,000,000 pounds of copper annually, is now making arrangements with a prominent manufacturing concern to erect a new plant for the exclusive purpose of making for it certain sizes of copper wire. The capacity of the plant will be 100,000 pounds of wire weekly, calling for nearly 5,000,000 pounds of copper every year. The Western Electric Co. maintains the largest factory of its kind in Belgium. It is credited with being the second largest consumer of copper in the world, being exceeded in amount used by the American Brass Co.

LAREDO FEDERAL BUILDING.—Sealed proposals will be received at the Treasury Department, office of the Supervising Architect, Washington, D. C., until 3 o'clock p. m. on July 17, and then opened, for the installation of a conduit and wiring system for the U. S. Post Office, Court House and Custom House at Laredo, Tex., in accordance with drawings and specification, copies of which may be had in Washington or at the office of the Superintendent of Construction, Laredo, Tex., at the discretion of the supervising architect.

CROCKER-WHEELER ORDERS.—The Crocker-Wheeler Company, of Ampere, N. J., has recently sold the Wm. Cramps & Sons, Ship & Engine Company, of Philadelphia, Pa., eight 5½-kw motor-generators for the U. S. Navy gun elevating equipments. The company has also received an order from the Columbia University, University Heights, New York City, for one 450-kw, 250-volt, direct-current generators for lighting and power for the University.

B. R. T. ORDERS.—The Brooklyn Heights Electric Railway Co. has concluded arrangements with the Westinghouse Traction Brake Co. to equip 100 new surface cars with motor-driven straight air brakes for the passenger division of the road. This order brings the total amount of air brake sets up to 527, which the Westinghouse Company has furnished to the Brooklyn Heights system within the last eighteen months.

STANLEY INSTRUMENT COMPANY, of Great Barrington, Mass., has been bought out by the General Electric Company. Adverse patent litigation restricts the operations of the company, which was incorporated a few years ago for the manufacture of electrical measuring instruments, with a capital stock of $300,000, and turned out some excellent apparatus.

THE LOS ANGELES RAILWAY CO has ordered from the Westinghouse Electric & Manufacturing Co. at one time 200 40 horse-power electric motors, which will be used in the equipment of fifty cars which the company is adding to its rolling stock.

THE DE LA VERGNE MACHINE COMPANY, of New York, reports the following recent sales of the well-known "Hornsby-Akroyd" crude and fuel oil engines. The Fulton Bag & Cotton Mills, Atlanta, Ga., 50-hp engine to drive general machinery; F. P. Pfleghar & Son, New Haven, Conn., 125-hp engine direct connected to generator; Wissahickon Electric Company, Fort Washington, Pa., 50-hp engine; Iola-Aurora Production Company, Iola, Kan., 20-hp engine for driving general machinery; Marconi Wireless Telegraph Company of America, New York City, 7-hp engine for furnishing power for wireless telegraph station.

Financial Intelligence.

THE WEEK IN WALL STREET.—Prices on the New York stock market were heavy under liquidation by pools and bearish activity on the part of traders. The feature was the weakness of leading stocks, such as Reading, Union Pacific and Erie, while some strength was exhibited in the Pennsylvania group. The market in general was narrow and entirely professional. Money was easy and the indications are that until the interior cities begin to draw money for crop-moving purposes, there will be little likelihood of any particular change in interest rates. Adverse crop reports from the West did not seem to receive any great attention. United States Steel stocks declined without any apparent reason. At the close of the week the general market was heavy and exhibited a downward tendency. The electric and traction stocks were also weak and in most all cases declines are noted. Allis-Chalmers common closed at 21 and preferred at 57, these quotations being net declines of 1½ and 2½ respectively. General Electric is 4 points lower on the week's business, the closing quotation being 166, ex.-div. Westinghouse, on the other hand, gained 2 points net, closing at 161. American Locomotive common closed at 69⅝ and preferred at 115, both of these quotations representing small declines. Brooklyn Rapid Transit closed with a net loss of 4 points and Inter-Metropolitan common with ⅜ and preferred 1⅜, the closing quotations being 80, 50 and 83, respectively. The last quotation of Metropolitan Street Railway was 113½. The curb market in the main followed the lead of the Stock Exchange list, with general recessions, under profit-taking or liquidating sales. In only a few exceptional cases were prices put up. Following are the closing quotations of June 19:

NEW YORK

	June 12	June 19		June 12	June 19
Allis-Chalmers Co.	21¾	20¾	General Electric	171½	166
Allis-Chalmers Co. pfd.	57	57⅛	Hudson River Tel.	...	...
American Dist. Tel.	25	30	Interborough Rap. Tran.	...	...
American Locomotive	72¾	71¼	Mackay Cos.	76	74⅝
American Locomotive pfd.	115	115	Mackay Cos pfd.	74⅛	73
American Tel. & Cable	90	91	Marconi Tel.	...	...
American Tel. & Tel.	139	137	Metropolitan St. Ry.	112	104
Brooklyn Rapid Transit	84⅛	80¼	N. Y. & N. J. Tel.	...	...
Electric Boat	18	25	Western Union Tel.	93⅛	93⅛
Electric Boat pfd	66	70	Westinghouse com.	158	156
Electric Vehicle	11	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	June 12	June 19		June 12	June 19
American Tel. & Tel.	139⅝	135¾	Mass. Elec. Ry. pfd	73½	70
Cumberland Telephone.	118	...	Mexican Telephone	4	3¾
Edison Elec. Illum.	238	246	New England Telephone	134½	135
General Electric	171½	172⅝	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	22⅝	20⅛	Western Tel. & Tel. pfd.	...	82

PHILADELPHIA

	June 12	June 19		June 12	June 19
American Railways	52	51⅛	Phila. Electric	8⅝	8⅛
Elec. Co. of America	11⅝	11⅛	Phila. Rapid Trans.	26	24¼
Elec. Storage Battery	73	73	Phila. Traction	99	98¾
Elec. Storage Battery pfd.	...	..			

CHICAGO

	June 12	June 19		June 12	June 19
Chicago City Ry.	174½	170	National Carbon	80	82
Chicago Edison	149	...	National Carbon pfd.	119	119
Chicago Subway	64⅛	...	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	...	...
Metropolitan Elev. com.	28⅛	28			

* Asked

DIVIDENDS.—Directors of the Electric Boat Co. have declared the regular quarterly dividend of 2 per cent on the preferred stock, payable July 2. Twin City directors have declared the regular preferred quarterly dividend of 1¾ per cent, payable July 2. The guaranteed quarterly dividend of 1¾ per cent on the Manhattan Railway Co. will be paid on and after Monday, July 2. The semi-annual dividend of 2 per cent on the stock of the Consolidated Tractions of New Jersey is payable July 15. This dividend puts the stock on a 4 per cent per annum basis, as required by the lease to the North Jersey Street Railway Co. The last dividend was at the rate of 3½ per cent per annum. Directors of the Garvin Machine Co. have declared the usual semi-annual dividend of 3½ per cent., payable July 2. The regular quarterly dividend of 1¾ per cent on Metropolitan Street Ry. is payable July 16. The directors of the Washington Water Power Co. have declared the regular quarterly dividend of 1¾ per cent, payable July 2. A dividend of $3 per share has been declared on the capital stock of Indianapolis Street Railway Co., payable June 30. The directors of the United Railways Investment Company of San Francisco have declared another scrip dividend on the preferred stock. The dividend is at the rate of 2½ per cent, and is for the period from September 30, 1905, to March 31, 1906. The scrip bears interest at 5 per cent. The directors of the Cumberland Telephone & Telegraph Co. have declared the regular quarterly dividend of 1¾ per cent, payable July 2. The Philadelphia Co. directors have declared a regular quarterly dividend of 1½ per cent on the common stock, payable August 1. A dividend of 75 cents per share has been declared on Reading Traction Co. stock, payable July 2. The directors of the United Railways Investment Co. have declared a regular semi-annual dividend of 2½ per cent upon the preferred stock, payable in scrip bearing interest at the rate of 5 per cent per annum from the date of issue to the date of redemption. The dividend is payable July 2. The directors of the Westinghouse Air Brake Co. have declared the regular quarterly dividend of 2½ per cent and the usual extra dividend of 2½ per cent, payable July 10. Directors of the United Gas Improvement Co. have declared a dividend of 2 per cent ($1.00 per share), payable July 14. Directors of the Otis Elevator Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable July 16. The Western Union Company has declared the regular quarterly dividend of 1¼ per cent. The Consolidated Car Heating Company has declared the regular semi-annual dividend of 1½ per cent, payable August 1. The Hudson River Telephone Company has declared the regular quarterly dividend of 1½ per cent, payable July 16. The Bell Telephone Company, of Canada, has declared a dividend of 2 per cent, payable July 16. The Canadian General Electric Company, Limited, has declared a semi-annual dividend of 3 per cent on its preferred stock and a quarterly dividend of 2½ per cent on its common stock, both payable June 30. The Toledo Home Telephone Company has increased its dividend rate from 5 to 6 per cent, payable quarterly. The directors of the Columbus, O., Railway & Light Company have declared a dividend of 1 per cent on the capital stock, payable July 16. The directors of the International Nickel Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable August 1. The directors of the National Carbon Company have declared a dividend of 1 per cent on the common, payable July 15.

AUTOMATIC ELECTRIC STOCK.—The Automatic Electric Company, says a Chicago dispatch, is preparing to increase its capital stock from $4,000,000 to $5,000,000. The proceeds of the issue, which is to be sold to the shareholders at par, will be used to enlarge the company's Chicago plant. The company manufactures automatic switchboards and telephones under the Strowger patents, and its growth of business in four years has now reached a point where immediate expansion is necessary. The company pays 8 per cent dividends, and interests behind it are almost identical with those of the Illinois Tunnel Company, now controlled by the Chicago Subway Company.

ALLIS-CHALMERS BONDS.—It is announced that a plan to create a bond issue of several million dollars in connection with the contemplated extensions of the Allis-Chalmers Co. will be submitted to stockholders. The fiscal year of the company ends June 30, 1906. The Allis-Chalmers Co. has shown a great improvement in earning power over the last twelve months, and the statement for the current year is expected to reveal a substantial increase in earnings. The report for the year ended June 30, 1905, showed net earnings of $68,982 after deducting $1,077,999 for maintenance and depreciation. The preferred stock outstanding is $16,150,000, and there is $19,820,000 of common stock. The current quotations are around 57-58 and 21-22.

N. Y. & N. J. TELEPHONE.—A special meeting of the directors of the New York & New Jersey Telephone Co. was held this week, at which it was voted to offer to stockholders at par $1,721,140 new stock. Stockholders of record June 30, 1906, will be entitled to subscribe in the ratio of one share of new for every ten shares of present stock. The right to subscribe expires July 31, and payment in full will have to be made before August 1, 1906. The capital stock of the company on December 31, 1905, was $17,360,000 and the company's plant was carried on the balance sheet, including equipment, at more than $17,000,000. The business is growing very rapidly

MEXICAN TELEGRAPH STOCK.—The Mexican Telegraph Company has listed $1,000,000 additional capital stock on the New York Stock Exchange, making a total of $3,000,000.

CHICAGO EDISON STOCK went off to 145 this week on the vetoing of its new franchise by Mayor Dunne.

LIGHTING RESULTS AT LOWELL, MASS.—The Lowell Electric Light Corporation, Stone & Webster, managers, reports as follows:

	April, '06.	April, '05.	Increase. or decrease.
Gross earnings	$21,389.79	$20,130.11	$1,250.68
Operat'g exp., incl'd'g taxes	14,904.06	12,374.16	2,529.90
Net earnings	$6,485.73	$7,764.95	$1,279.22*
Interest charges	662.51	734.90	72.39*
Balance	$5,823.22	$7,030.05	$1,206.83*
Bond sinking fund	579.16	579.16	....
Balance	$5,244.06	$6,450.89	$1,206.83*

REPORT FOR 12 MONTHS ENDING.

	April 30, '06.	April 30, '05.	Increase.
Gross earnings	$265,951.90	$242,974.94	$22,976.96
Operat'g exp., incl'd'g taxes	167,084.41	137,334.24	29,750.17
Net earnings	$98,867.49	$105,640.70	$6,773.21*
Interest charges	8,687.68	12,868.98	4,181.30*
Balance	$90,179.81	$92,771.72	$2,591.91*
Bond sinking fund	6,950.00	6,950.00	....
Balance	$83,229.81	$85,821.72	$2,591.91*

*Decrease

Construction charges during month of April, 1906............. $1,532.47
Construction charges during 12 months ending April 30, '06.. 15,298.51

CONDENSED BALANCE SHEET.
April 30, 1906.

Assets—		Liabilities—	
Plant	$1,037,940.80	Capital stock	$650,000.00
Current assets	33,178.76	Bonds	137,000.00
Bills receivable	25,805.68	Notes payable	20,000.00
Trustees of bond sinking fund	38,950.41	Accounts payable	16,100.64
		Bills not yet due	39,758.96
Suspense	3,401.06	Premium on sales of capital stock	22,831.50
Cash	3,949.32	Bond sinking fund	91,950.41
		Reserves and surplus	165,584.52
	$1,143,226.03		$1,143,226.03

LIGHTING AT BROCKTON, MASS.—Stone & Webster report as follows on the operations of the Edison Electric Illuminating Company of Brockton:

	April, '06.	April, '05.	Increase.
Gross earnings	$12,938.99	$10,508.94	$2,430.05
Operat'g exp., incl'd'g taxes	9,957.97	8,195.38	1,762.59
Net earnings	$2,981.02	$2,313.56	$667.46
Interest charges	729.17	669.61	59.56
Balance	$2,251.85	$1,643.95	607.90

REPORT FOR 12 MONTHS ENDING.

	April 30, '06.	April 30, '05.	Increase.
Gross earnings	$154,044.51	$129,182.74	$24,861.77
Operat'g exp., incl'd'g taxes	108,570.22	83,089.89	25,400.33
Net earnings	$45,474.29	$46,092.85	$618.56*
Interest charges	8,690.48	9,400.87	710.39*
Balance	$36,783.81	$36,691.98	$91.83

*Decrease.

Construction charges during month of April, 1906.............. $7.65
Construction charges during 12 months ending April 30, '06.....13,044.07

CONDENSED BALANCE SHEET.

April 30, 1906.

Assets—		Liabilities—	
Plant	$429,306.76	Capital stock	$250,000.00
Current assets	12,939.74	Bonds	100,000.00
Bills receivable	17,540.85	Coupon notes	75,000.00
Trustees of coupon note sinking fund	5,000.00	Accounts payable	2,815.65
Cash	15,528.87	Bills not yet due	9,162.38
		Suspense	626.21
		Coupon note sinking fund	5,000.00
		Reserves and surplus	37,711.98
	$480,316.22		$480,316.22

MACKAY COMPANIES' CONDITION.—The banking house of Osler & Hammond, of Toronto, has issued a circular bearing on the Mackay Companies, which says: "The chief underlying company is the Commercial Cable Co.—that company owns about $7,000,000 worth of railroad and other bonds which produce a constant income besides being a great reserve strength to the company. The gross and net receipts of the Commercial Cable Co. are continually increasing, particularly with the extension of its cable system by a fifth cable laid in the Atlantic last year. So also the gross and net receipts from the land line system are continually increasing. The Postal Telegraph Co. has telegraph contracts with the Pennsylvania Railroad, the Illinois Central Railroad Co., the Canadian Pacific Railway, the Chicago Great Western Railway, the Soo Line, and a number of other railroad companies, and the company is devoting its attention to increasing the number of such contracts where satisfactory and remunerative arrangements can be made. We are advised on the best authority that if in each year the entire profits of the Commercial Cable Co. and its land line system were paid to the Mackay companies, as might legally be done, and if the Mackay companies used all these profits, together with its income from other sources, for the payment of dividends, the amount would be sufficient to largely increase the present dividend on the common stock.

RHODE ISLAND TROLLEYS.—Advices from New Haven, Conn., state that the negotiations with the United Gas Improvement Company, of Philadelphia, for the acquisition of the trolley lines in Rhode Island controlled by that company had been unsuccessful, on the part of the New York, New Haven & Hartford Railroad. The price asked by the United Gas Company cannot be ascertained, but as high as $60 a share has been offered for large amounts of the railway and lighting company's common stock, of which $9,464,100 is outstanding, together with $5,535,900 of preferred stock, or a total of $15,000,000. The negotiations have been in progress for many months, and the question involved has been mainly one of price. In the later stages, however, it is stated authoritatively that the Philadelphia Company, which owns both the Rhode Island and the Connecticut Railway and Lighting Companies, has insisted that both of the great properties be bought together, and the price asked was one which the steam corporation declined to give.

NORTHERN OHIO TRACTION & LIGHT.—It is announced from Pittsburg that all the contracts have been signed and arrangements made for the transfer of the Tucker, Anthony & Co. traction holdings in Stark and Tuscararas counties, Ohio, to the Northern Ohio Traction & Light Co. The properties are owned in Boston, Mass., and are valued at about $4,500,000. The transfer will occur early in July and will include the Canton-Akron line, Canton City lines, Canton-Massillon lines, Canton-New Philadelphia line, and the Tuscararas Traction Co. The Boston people have agreed to accept stock as consideration and take an active part with the Everett-Moore people in the management of the consolidated company. The deal will double the tonnage of the Northern Ohio and make it a property with annual earnings of about $1,600,000.

LEHIGH COAL CO.'S TROLLEY LINE SOLD.—The Tamaqua and Lansford Street Railway Company, owned by the Lehigh Coal and Navigation Company, has been sold to J. G. White & Co., of New York. The negotiations have been pending for some time, J. G. White & Co. desiring the line as part of the consolidation of the Public Utility Companies in and around Pottsville. The Lehigh company received in cash all that was originally paid for the property and in addition $500,000 in securities of the new consolidated company. See page 1284.

DETROIT TELEPHONE SALE.—A number of St. Louis capitalists, including Henry Koehler, Jr., Adolphus Busch and others, are members of the syndicate that has bought the franchise of the Detroit Home Telephone Company, the project being financed by the Commonwealth Trust Company, it being proposed to issue $3,000,000 bonds and the same amount of stock. Detroit telephone properties are sold oftener and faster than any others in this country. It is a "continuous performance."

CHICAGO EDISON.—It is understood that the adjournment of the Chicago Edison annual meeting from June 11 to June 26 was to avoid publication of the annual report while the company's franchise proposition was before the city council. The report is understood to be the best the company has ever put out. As the council has passed the franchise ordinance, the company is free to go ahead with its plan of consolidation with the Commonwealth Electric.

MORE WESTINGHOUSE ACQUISITIONS.—A cable despatch from St. Petersburg says: "It is stated that the Westinghouse Company has bought of the Belgian owners the immense works of the Central Electric Company for the erection of dynamo machines at Moscow for $2,000,000." No details as to this are obtainable in New York, and the data are probably with Mr. Westinghouse, who is expected to return to America at an early date.

PLANT FOR ANTHONY, KAN.—The Citizens' Improvement Company, of Anthony, Kan., is to erect an electric light plant and invites inquiries from concerns desirous of bidding on this work.

ASWORTH, GA., LIGHTING BONDS.—The town of Asworth, Ga., has authorized by popular election the issue of $25,000 electric light and water-works bonds, bearing interest at 5 per cent.

LAFAYETTE ELECTRICAL MANUFACTURING CO., of Lafayette, Ind., of which Mr. Thomas Duncan is president, has increased its capital stock from $35,000 to $70,000.

BURLINGTON, VT., BONDS.—The city treasurer of Burlington, Vt., has awarded to Blodgett, Merritt & Co. $39,000 4 per cent electric plant bonds at 104.077.

GENERAL NEWS.

Construction News.

MOBILE, ALA.—The Council has authorized S. M. Hinckley, chief engineer of the Water Works, to prepare plans and estimates for a municipal electric light plant.

ELBA, ALA.—Work has commenced on the installation of a lighting system in this town by the Pea River Power Company. The company owns a large dam on the Pea River. For the present the company will supply the electricity for the system from a small dam on Beaver Dam Creek.

BESSEMER, ALA.—The Jonesboro Council has granted the Birmingham Railway, Light & Power Company a franchise for 99 years, and in addition to this the company is to be relieved of any taxation for a period of ten years. The Jonesboro line is being rapidly constructed and is expected to be in operation soon. It will probably be extended to reach the mines at Potter.

GADSDEN, ALA.—J. D. Gaboury, of Gadsden, manager of the Alabama City, Gadsden & Attalla Railway Company, and the Gadsden Light Company, announces that on June 25 contracts will be let for buildings and machinery for the proposed power plant, which will furnish power for the street car system, lighting for this city and power for manufacturing plants. The probable cost of the proposed plant is $15,000.

FORREST CITY, ARK.—The city is considering a proposition to buy the lighting plant of the Forrest City Electric Company for $18,500.

PINE BLUFF, ARK.—The City Council has directed that the Pine Bluff Light & Water Company be notified, that under the right reserved by the city, in granting the franchise, the city wishes to purchase the water plant.

LOS ANGELES, CAL.—Bids will be received about July 25 for the construction of an electric light plant.

OCEANSIDE, CAL.—The Sunset Telephone Company contemplates extending and improving its system in the city at a cost of $5,000.

REDLANDS, CAL.—The Tracy Manufacturing Company of Los Angeles has secured the contract for supplying the Redlands Home Gas & Electric Company, with two electric plants, for $57,330.

EUREKA SPRINGS, CAL.—The North Mountain Power Company has recently installed a Westinghouse steam turbine in its plant in this city. The company has contracted with the Eureka Water Company to supply electricity for the pumping station. The company will also soon begin the construction of its distributing system for Fields Landing.

REDDING, CAL.—Contracts have been let by the Northern California Power Company for the machinery and equipment, which will double the capacity of the company's power plant at Volta. The new plant will be a duplicate of the old one, but will be independent, capable of generating 3,000 hp. Two additional reservoirs will be built, one at the head of the pipe line and the other in Macomber Flat, ten miles above. The transmission line from Chico by the way of Tehma to Volta is nearing completion. The company has recently entered into large contracts to supply electricity, which has made it necessary to build the third plant. E. V. D. Johnson is general manager.

DURANGO, COL.—Thomas L. Loftus has applied for an electric light and power franchise in this city.

CRIPPLE CREEK, COL.—The City Council has passed the Frye electric lighting and power franchise with amendments. The franchise will materially cheapen the cost of lighting in this city.

DANBURY, CONN.—The Hudson River & Eastern Traction Company has secured a franchise to build a street railway from Ossining, N. Y., to Sherman Park. Francis A. Stratton, of Mt. Vernon, is president.

HARTFORD, CONN.—The Pratt & Whitney Company is now operating its plant by electric power. The electricity is supplied by the Hartford Electric Light Company, but later on the company expects to install its own power plant.

NEW LONDON, CONN.—The Court of Common Council has granted five franchise applications submitted by the Consolidated Railway Company. The corporation is granted rights to lay double tracks in Main, State and Bank Streets and to build a loop line on Bank Street from Bank Street to Blackhall.

WINDSOR, CONN.—The contract for wiring and installing electric motors for the various machines in the Windsor Print Works has been let to the Plummer Electric Company, of Boston, Mass. The contract calls for the installation of 1,600 lamps in the works. The company plans to operate all of its machines by electric motors.

WINDSOR LOCKS, CONN.—The new corporation which is to take over and consolidate the business of the Enfield Gas Company, the Enfield Electric Light & Power Company, and the Windsor Locks Lighting Company, has filed application in the superior court for permission to operate these companies under the name of the Northern Connecticut Light & Power Company. The new company will furnish gas and electricity for Windsor, Windsor Locks, Thompsonville, Warehouse Point, Enfield and South Windsor. A new power station will be erected at Windsor Locks. Burdett Loomis is president.

DUNNELLON, FLA.—The Council is making arrangements to establish an electric light plant.

PENSACOLA, FLA.—The Pensacola Street Railway Company has decided to electrify the steam division, connecting Pensacola and Fort Barrancas at once, and has also under consideration the extension of what is known as the North Hill line to Goulding, a distance of about three miles.

LUMPKIN, GA.—An election will be held on July 2 to vote on the proposition of issuing bonds for a lighting plant.

ACKWORTH, GA.—H. M. Putnam, City Clerk, writes that the citizens voted June 9 to issue $22,500 bonds for constructing water works and an electric light plant. Bids for construction will probably be received in August.

NAUVOO, ILL.—The Council has passed the new electric light ordinance. It is stated that Mr. Schenk will accept the ordinance and will soon begin work on the installation of an electric light plant.

CHICAGO, ILL.—A franchise has been granted to the American Telephone & Telegraph Company by the Board of Supervisors for the construction of a new telephone system from Chicago to Dubuque. Work will soon begin on the construction of the line.

BELLEVILLE, ILL.—The Belleville Gas & Electric Light Co. has been sold to a syndicate of Chicago, headed by K. A. Ames, the consideration being $500,000. There will be no change in the management at present. Harry Kirchner will be retained as manager. It is said that plans have been made to spend $100,000 in improvements and betterments and that a substantial reduction in both fuel and lighting gas and electric light will be made in the near future.

MUNCIE, IND.—The Central Union Telephone Company will expend over $100,000 in improvements, and will place its wires underground in the business section of the city.

SOUTH BEND, IND.—Plans are being prepared for grading the extension of the Northern Indiana Railway from South Bend to La Porte, a distance of 46 miles. Bids will be called for shortly. A. J. Hammond is chief engineer.

CONNERSVILLE, IND.—The Light, Heat & Power Company of this city is now installing a new generator which will be used in addition to its present equipment. The Board of Commissioners of Fayette County has given the company the privilege of stringing its wires along the highways of the county, and the company will soon be able to furnish electricity for light and power to the farmers of Fayette county.

CRAWFORDSVILLE, IND.—The electric light trustees recently made their annual report and presented the city with $5,000 as the income over expenses during the year. The trustees also reserve $1,000 as a sinking fund for repairs when needed. The people are divided in opinion concerning the advisability of retaining the plant, a good offer having been made some time ago.

MUSKOGEE, I. T.—The citizens of this city have raised $110,000 of the $175,000 to be subscribed for the Grand River dam and power plant.

BEDFORD, IA.—J. J. Clark has petitioned for a franchise for an electric light plant.

SHENANDOAH, IA.—Plans have been made for the new power house of the Artificial Ice, Power, Heat & Light Company, which is to be erected at the corner of Thomas Avenue and Maple Street.

NASHUA, IA.—W. Getsch, Secretary Nashua Water Power Company, writes that about $5,000 will be expended in improvements. The company expects to replace the old wooden dam with a concrete dam with 10-ft. head.

CLAY CENTER, KAN.—At an election held recently the citizens voted to issue $20,000 bonds for a new electric lighting plant.

TOPEKA, KAN.—The Topeka Electric Light Company has petitioned for a franchise. Willard N. Hall and J. W. Owens are interested.

BELLEVILLE, KAN.—W. A. Fuller, of St. Louis, Mo., has secured the contract for constructing the municipal electric light plant, for $18,095.

OTTAWA, KAN.—It is proposed to expend about $80,000 in improving the water works and electric light plant recently purchased. Owen Ford, St. Louis, Mo., is engineer.

MARQUETTE, KAN.—H. E. Bruce, city clerk, writes that it is proposed to construct water works and electric light plant combined, at a cost of about $12,000. B. L. Spindler, of Hutchinson, is engineer.

TOPEKA, KAN.—The Independent Telephone Company contemplates the construction of a new telephone building and several miles of underground conduits in this city. L. M. Wood, architect, can give information regarding the building. Mr. Roberts' electrical engineer has charge of the underground work.

LEXINGTON, KY.—Robert E. Hutton, general manager of the Lexington Light & Power Company, has placed orders for the necessary machinery and equipment for the improvements to the plant.

CROWLEY, LA.—Plans are being made for an electric railway from some point east of Crowley through this city, thence on to Jennings.

ALEXANDRIA, LA.—About $6,000 will be expended for extending the water and electric lighting system to the newly annexed territory.

OPELOUSAS, LA.—The Board of Aldermen has decided to expend about $7,500 in further extending the water works and electric light plant.

NEW IBERIA, LA.—The City Council has granted W. P. Connery, of New Orleans, a franchise for 25 years to operate a street railway through the principal streets of the city. The railway will extend to towns within a radius of 25 miles, making New Iberia the central point.

MARS HILL, ME.—It is stated that an electric lighting plant will soon be erected in this town.

BALTIMORE, MD.—The first of the 2,500-kw generators in the new power house of the Consolidated Gas, Electric Light & Power Company, near Westport, has been placed in commission, and it is expected that before the end of the year the full battery of five generators will be in operation. A new engine of 7,500-hp will soon be installed, in addition to the four McIntosh & Seymour engines of 3,000 hp each already in use. The boiler room is equipped with 18 Babcock & Wilcox boilers of 650 hp each. An auxiliary plant is being installed in the Pratt Street power house. P. O. Keilholtz is consulting engineer; Douglas Burnett is manager of the electrical department.

QUINCY, MASS.—The Quincy Electric Light & Power Company is building a new sub-station at the corner of West and Common Streets.

PITTSFIELD, MASS.—The Pittsfield Electric Company is extending its wires through the grove at Lake Pontoosuc, and is also placing new lamps in Dalton.

SPRINGFIELD, MASS.—The County Commissioners have awarded the contract for the construction of the power house for the Hall of Records to the Fosburgh Company.

WESTHAMPTON, MASS.—The Leather Board Company has made arrangements to light its mill with electric lights and has offered to furnish electricity to light the houses in the village at about cost.

MIDDLEBORO, MASS.—The Committee appointed to investigate the affairs of the municipal lighting plant gave its final report at the adjourned town meeting held June 13. It recommended the purchase of two gas engines in addition to the one already in use, the installation of a 300-hp gas-producing plant, and a new generator and switchboard; that the practice of selling of gas and electricity by contract be discontinded immediately, and that the service be metered. A day service was also recommended. It was voted to appropriate $20,000 to carry out the recommendations.

LOWELL, MASS.—A contract for lighting the suburban districts has been made with the Lowell Electric Light Corporation. The proposition includes the substitution of electric lamps for 400 gasoline lamps. Under the new contract the price of arc lamps is reduced from $120.45 to $100 per lamp per year; gasoline lamps changed to electric lamps and the price reduced from $27.75 per year on a 1 o'clock schedule to $22.60 per lamp per year for an all night and every night schedule. At the end of two years the time the old contract had to run, the question of lower price than $100 will be determined by the board of gas and electric light commissioners. The total saving on street lighting for the next two years will be $26,402.

CADILLAC, MICH.—It is said that the Electric Land and Development Company, of Traverse City, is considering the location of a paper mill here.

VERNON, MICH.—H. A. Sprague and Walter Bush, of Corunna, have been before the Council of this place with a view of securing a ten-year franchise to light the streets with electricity from the Shiawassee power plant, at $50 a light per lamp per year.

HART, MICH.—The Pere Marquette Light & Power Company, of Chicago, Ill., is now taking figures on the construction of a hydro-electric plant, to be constructed on Pere Marquette River in Mason County, Mich. The probable cost of the plant proposed is $120,000. L. J. Highland, First National Bank Building, Chicago, Ill., is engineer.

LITTLE FALLS, MINN.—The Northwestern Telephone Company has purchased the Ward telephone lines in Sauk Center and vicinity and will rebuild them.

SAUK RAPIDS, MINN.—The Sauk Rapids Power Company will commence work on the construction of its new power plant this year. The plant will cost about $500,000.

NASHWAUK, MINN.—The citizens voted June 5 to construct an electric light plant. The probable cost is placed at $5,000. Claussen, Burch & Pillsbury, of St. Paul, are the engineers.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company announces that a new electric light rate will go into effect July 1, for the consumers of electricity for lighting, which will mean a saving of about 9 per cent. The rate for electric light will be 14 cents per kw-hour for the first fifty-two hours use a month of the maximum demand, 6.66 per kw-hour for all in excess. These rates are subject to a 10 per cent ten-day cash discount, making the net rates 12.6 and 6 cents per kw-hour respectively. The new rate does not affect the city lighting, which under the present rate, effective since June 1, is $84 per lamp per year. The power rates are also unaffected.

KANSAS CITY, MO.—The North Electric Company, of Ohio, has filed articles to show that it had been incorporated under the laws of that State with a capital stock of $250,000, of which $50,000 is to be employed in Missouri, with an office in Kansas City.

ST. LOUIS, MO.—It is reported that the Clark Brothers, of Philadelphia, have acquired control of the Laclede Power Company and the Edison Electric Illuminating Company. The rumor is denied, but as the Clarks have large local interests there is thought to be something in it.

TWIN BRIDGES, MONT.—It is reported that the Conrey Placer Mining Company is contemplating the construction of a large reservoir on the Madison River, in Madison Valley, and will erect two power plants, one at the head and the other at the foot of the canyon. The power is to be used in operating the large dredge boats of the company now in operation at Ruby.

GREAT FALLS, MONT.—The Montana Independent Telephone Company will install a complete local exchange in this city.

BUTTE, MONT.—At a recent meeting of the City Council, the special committee appointed by the Mayor to confer with the management of the two electric light companies in regard to the reduction of the price of electric lights, announced that the Butte Electric Light & Power Company promises to reduce its rates. Beginning with July 1, the present domestic rate, which is 20 cents per kw-hour, will be reduced to 16 cents per kw-hour, with the customary discounts. The rate for stores, etc., which is at present 16 cents per kw-hour, with a flat discount of 10 per cent, will be cut to 16 cents per kw-hour, with a discount of 25 per cent for payment within ten days during the winter months, and 10 per cent discount during the summer months. The all-night rate will be reduced from 14½ cents per kw-hour to 10 cents with the customary discount. In addition to the above rates the company promises to make the minimum monthly rate $1 instead of $2, the present rate. The company also promises the city a rebate of 2 per cent of the gross earnings of the company, in lieu of the 1 per cent rebate now in effect.

ARAPAHOE, NEB.—The citizens have voted to issue $5,000 bonds for the construction of an electric light plant.

CONCORD, N. H.—The addition of the hydro-electric plant of the Concord Electric Company at Sewall's Falls is nearly completed and will soon be in operation. Two Allis-Chalmers turbo-generators of 500-kw capacity each have been installed, and other extensive improvements have been made.

BURLINGTON, N. J.—Municipal ownership of the electric light plant is under consideration here.

TRENTON, N. J.—Preliminary surveys are being made by the Public Service Corporation of New Jersey for the placing of its wires underground on Broad Street. Work will be started as soon as the surveys are completed.

CAMDEN, N. J.—The new power house of the West Jersey & Seashore Railroad at Westville, which is to supply the electricity for operating the third-rail electric system between Camden and Atlantic City, is nearly completed, and is expected to be in operation about the first of July.

NEWARK, N. J.—The special Aldermanic Committee chosen to investigate the feasibility of municipal lighting plant for Newark has decided to retain Runyan & Carey to report on the cost of a plant to light the streets and public buildings, including schools; also on the plan for lighting the City Hall and City Hospital with independent plants, the report to be submitted by October 1.

GREEN ISLAND, N. Y.—The Village Trustees have granted the Hudson River Telephone Company permission to place its wires underground in all of the streets of the village.

NEW YORK, N. Y.—Bids will be received until June 25 by C. B. J. Snyder, Superintendent School Buildings, for installing electric equipment in School 8, Borough of Manhattan.

SODUS, N. Y.—The telephone exchanges of the Empire State Telephone Company and the Wayne-Monroe Telephone Company in this town were entirely destroyed by fire on June 12.

PATCHOGUE, N. Y.—The Village Trustees have granted the New York & New Jersey Telephone Company permission to build a subway for the purpose of putting its wires underground.

ALBANY, N. Y.—W. N. Sheehan & Co., of New York City, have secured the contract for installing an electric light plant in the capitol for $43,100. J. G. White & Co., Inc., 43 Exchange Pl., New York City, are the engineers.

ELMIRA, N. Y.—The Elmira, Corning & Waverly Electric Railway is now securing rights of way for its line. The company has contracted with the Elmira Water, Light & Railroad Company to furnish power for the line beginning with June 1, 1907.

BATAVIA, N. Y.—The Genesee County Electric Light, Power & Gas Company, which recently secured a franchise for supplying the town with electricity, has contracted for four 33-kw transformers to be installed in the sub-station in this village. The company expects to be able to supply electricity in the county about the first of October.

JAMESTOWN, N. Y.—The Council has confirmed the appointments of the Mayor for the new electric light commission, the members of which are as follows: Louis C. Jagger, Warner F. Leidblad, Clayton E. Bailey and Fred Briggs. The light commission will take complete charge of the municipal electric light plant, the government of which heretofore has been vested in the Council.

CHARLOTTE, N. C.—The Southern Power Company expects to be able to furnish power from the Great Falls water power by the first of the coming year. Two dams are being built, one about 40 feet in height, and the second one some distance below, about 90 feet high. The company will transmit electricity as far as Greenville, nearly 90 miles away if conditions shall warrant such a step. Transmission lines are under construction from the falls to Spartanburg, a distance of 65 miles. The cost of the Great Falls development is placed at $5,000,000, and a great amount has been spent on the development near Yorkville and Fort Mill, 20 miles from Charlotte. The development of Buck Shoals, on the Catawba River, owned by the company, will be started next year.

BORDULAC, N. D.—The New Haven Telephone Company, of which Jay Blakely is secretary, will receive bids until July 2, for 27 miles of telephone line.

FARGO, N. D.—The Northwestern Telephone Company has commenced work on the construction of its conduit system in this city. The company will lay 40,000 feet of conduit.

BOSTON, OHIO.—The Boston Independent Telephone Company has applied for a franchise in this town.

BELLEVILLE, OHIO.—The Belleville Home Telephone Company will increase its capital stock from $10,000 to $75,000.

AKRON, OHIO.—The Central Union Telephone Company contemplates extensive additions to its cable system in this city.

ZANESVILLE, OHIO.—The Zanesville Railway & Light Company has secured a contract to place 17 lamps in Putnam Hill Park and 25 in MacIntyre Park.

AKRON, OHIO.—J. Milton Dyer, of Cleveland, has completed plans for the installation of an electric light plant in the old jail with which to light and heat the county building.

DAYTON, OHIO.—The Dayton Electric Light Company has secured permission to cross the Miami & Erie Canal at First, Second and Third Streets, Dayton, with wires enclosed in ducts.

ALLIANCE, OHIO.—The Sandy Valley Company has laid out a new route for its road between Alliance and Minerva by the way of Mt. Union. Work on the line will start next month.

TORONTO, OHIO.—The Steubenville Traction & Light Company has been granted permission by the City Council to double-track its lines through the city. The entire line from East Liverpool to Steubenville and Wheeling will be double-tracked.

NEWARK, OHIO.—The Ohio Central Railway Company, which was organized here recently for the purpose of building a line from Newark to Lancaster, has secured practically all the right of way, and is now arranging for an entrance to Newark.

KENTON, OHIO.—W. A. Ginn, of Columbus, chief engineer of the Ohio Central Railway Company is making surveys for the proposed line from Newark to Lancaster. The road will run from Thornport to Millersport, thence to Thurston and Lancaster.

CONNEAUT, OHIO.—The Conneaut & Southern Electric Railway Company, promoted two years ago, has been revived. It has been decided to purchase a private right of way between the two cities, instead of operating along the highway as originally proposed.

CONNEAUT, OHIO.—Charles Van Bibber, of Boston, Mass., has the contract for the construction of an electric railway from Erie to Cambridge Springs, Union City and Corry and connecting with Conneaut by the way of Erie. The road will be 40 miles long.

CONNEAUT, OHIO.—Business men of this city are interested in the promotion of an electric railway between Conneaut Lake and Meadville, Pa. Right of way has been secured over a greater portion of the route and a grant has been secured from the Village Council of Lineville, Pa.

FREMONT, OHIO.—The Lake Shore Electric Railway has secured a franchise in Fremont for the entrance for its new Fremont, Sandusky branch. The Erie County Commissioners have granted a franchise through that county. It is stated that construction work will commence this summer.

DAYTON, OHIO.—The Citizens' Electric Company, which recently secured an electric light franchise in Dayton, has submitted to the board of public service plans for the proposed underground system. The company states that it will commence the work as soon as the plans have been approved.

TOLEDO, OHIO.—D. H. James, president of the Toledo & Columbus Railway Company claims that arrangements have been made for the financing of the proposition which contemplates a line from Fremont to Bucyrus, giving through service from Columbus to Toledo in connection with the Lake Shore Electric Railway and the Columbus, Marion & Bucyrus Railway.

PAULDING, OHIO.—The village council has been negotiating for the purchase of the plant of the Paulding Electric Light Company, but the deal is now off, as the company asked $8,500 for the plant and franchise and the village was willing to pay only $6,500. A proposition is now being considered to build a new lighting plant installing the machinery in the water works plant which is being operated at a loss at present.

CLEVELAND, OHIO.—The Forest City Railway Company has been granted a franchise to lay a track on Fulton Street from Franklin Avenue to Lorain Street. M. A. Fanning, president, claims that the line on Denison Avenue, Rhodes Avenue and Fulton Street will be in operation this fall. Equipment for a temporary power station has been ordered. The company has made application to the city for an extension of its Denison Avenue line.

TOLEDO, OHIO.—J. Y. Todd and S. N. Young, of Toledo, who are promoting the Cleveland, Norwalk & Indianapolis Railway, are making rapid progress in the preliminary work for the building of this line. It will extend from Norwalk, Ohio, to Bluffton, Ind., connecting Cleveland and Indianapolis. Engineers are now at work making surveys from Bluffton to Van Wert, Ohio. The Riggs & Sherman Company, Toledo, is in charge of the engineering work.

SALEM, OHIO.—The Youngstown & Ohio River Railway has started work on its line between Leetonia and Columbia. This will connect the Youngstown & Southern with the Salem Railway, both of which are now steam roads, but are to be electrified and operated in conjunction with the Youngstown & Ohio River Railway. Contracts for the overhead materials are to be placed at once and it is expected to have cars running between Youngstown and Salem this fall.

CLEVELAND, OHIO.—A new suburban line between Cleveland and Elyria has been projected under the name of the Cleveland, Brooklyn & Elyria Railway, with $100,000 capital stock, by B. E. Ottman and W. E. Elliott, of Cleveland; L. J. Weadock and J. H. Knisley, of Toledo, and O. A. Thomen, of Elyria. It is proposed to construct a line from South Brooklyn through Eaton, Columbia and Strongsville, and thence to Elyria. The headquarters of the company will be in Elyria.

TOLEDO, OHIO.—The Toledo Gas, Electric & Heating Company, which has recently consolidated three gas electric and heating plants in this city, will close down the lighting equipment at the sand and the Floyd Street stations and will install motor-driven pumps for circulating hot water and rotary converters for handling power which will be generated at the Detroit Avenue station. A 3,500-kw Westinghouse-Parsons turbine is now being installed in this station giving it a total capacity of 8,150 kw.

MANSFIELD, OHIO.—The Cleveland, Ashland & Mansfield Railway Company, headed by G. A. Bartholomew and Thomas W. Latham, of Cleveland, has commenced work on its line between Ashland and Mansfield; as soon as it is completed the company will build north through Savannah and Greenwich to North Fairfield, where connection will be made with the Sandusky, Norwalk & Mansfield Railway. A power station will be erected at Ashland. It is expected that the first section of the road will be completed next spring.

GALLIPOLIS, OHIO.—The Gallipolis, Huntington, Ironton, Portsmouth & Columbus Railway Company, recently incorporated by Col. A. E. Boone, of Zanesville, proposes to build a large system of traction lines radiating from Gallipolis. There will be four divisions of the system as follows: Ohio River division, Gallipolis to Ironton and Portsmouth; Cincinnati division, Gallipolis to Waverly and Hillsboro; Columbus division, Gallipolis to McArthur and Lancaster to Columbus, and the Wilson division, Gallipolis to Jackson and Wellston.

TOLEDO, OHIO.—A. H. Sharp, of Columbus, who is at the head of a company which proposes to build a water power plant for the Sandusky River between Tiffin and Ft. Seneca, noted in last week's issue, has notified the city authorities that his company is desirous of bidding for the Toledo street lighting contract at the expiration of the present contract with the Toledo Railways & Light Company. The company proposes to furnish street lamps from $45 to $60, if the city will agree to establish a system of poles, wires and conduits. If the contract is secured it will necessitate the building of a fifty-mile high-tension transmission line from Ft. Seneca to Toledo.

CLEVELAND, OHIO.—The Cleveland Construction Company, of Cleveland, has been awarded the entire contract for building and equipping the line of the Cleveland, Ashland & Mansfield Traction Company. This road will be an extension of the Cleveland & Southwestern Traction Company system branching off from the southern division of that road at Seville and extending to Ashland and Mansfield. The new line to be constructed will be about 46 miles in length. It will be built entirely on private right of way except through villages. The Cleveland Construction Company is to commence work within sixty days, and will close contracts for construction work and material immediately. No power station will be built, and high-tension current will be transmitted from the Elyria power station of the Cleveland & Southwestern Traction Company over two circuits. There will be a cross-country line from the Wellington branch of the system to Polk on the new line, a distance of 16 miles, while another feeder will connect with the southern division of the Cleveland & Southwestern at Seville. The lines will be designed for 33,000 volts transmission, but 20,000 volts will be used at first. There will be five sub-stations, one of them a portable station, while the others are to be located in buildings at Leroy, West Salem, Nankin and Ashland. The sub-stations will be equipped with one 300-kw rotary convertor, two 100-kw transformers, switchboard, lightning arresters, etc. The stations will be of sufficient size to permit of doubling the capacity later. The road will be operated by the Cleveland and Southwestern Company.

CLEVELAND, OKLA.—The Pioneer Telephone Company has purchased the local independent telephone system at Cleveland, Okla., for a consideration of $11,500.

ASTORIA, ORE.—The City Council has granted F. H. Stowe, manager of the Home Telephone Company, a 35-year franchise for an automatic telephone system in this city.

OREGON CITY, ORE.—The power plant of the Portland General Electric Company in this city was badly damaged by fire on June 10. Three of the largest dynamos at the Oregon City station were burned out, three others were ruined by water, a switchboard and all connecting wires were destroyed, putting the plant temporarily out of commission. Temporary arrangements have been made for street lights and railway power. It is reported that it will be fully six months before the company can resume its complete service.

PITTSBURG, PA.—The Allegheny Valley Street Railway Company has filed notice with the State Department at Harrisburg of an increase of $2,000,000 in its capital stock.

HALIFAX, PA.—The Enterline-Halifax Telephone Company will soon ask for a charter to construct a line between the borough of Halifax over the mountains to Enterprise.

WAYNESBORO, PA.—Pen Mar Park and the buildings which belong to it, together with the wide walk from the trolley station to the pavilion, will be lighted with electricity furnished by the Chambersburg, Greencastle & Waynesburg Street Railway Company. Joseph F. Geiser, superintendent of the street railway and electric light plants, will have charge of the construction of the work.

POTTSVILLE, PA.—It is reported that a deal has been closed by a New York syndicate which gives it control of the plants of the Edison Electric Illuminating Company of this place; the Pottsville Union Traction Company's lines, including the Orwigsburg, Heckscherville and Middleport branches; the People's Railway and other trolley lines and electric lighting plant in this region. J. G. White & Co., of New York, N. Y., it is stated, engineered the deal.

KUTZTOWN, PA.—An election will probably soon be held to vote on issuing $10,000 bonds for enlarging the municipal electric light plant in this place.

PITTSBURG, PA.—Charters have been secured for seventeen electric plants, which will form a chain throughout this section. The titles of the companies securing the charters are: Coal Center Electric Company, Washington Electric Company, Monessen Electric Company, Rostraver Electric Company, Twilight Electric Company, Speers Electric Company, Stockdale Electric Company, North Belle Vernon Electric Company, North Charleroi Electric Company, Fallowfield Electric Company, Fayette City Electric Company, East Pike Run Electric Company, Elco Electric Company, Carroll Electric Company, Charleroi Electric Company, Allen Electric Company and California Electric Company. Each company has a capital stock of $5,000, and the directors are Jacob Van Wagner and Clarence W. Scheck, of Pittsburg, and John F. Cockburn, of Bellevue. It is understood that parties connected with the West Penn Railway system are interested in these companies.

CHARLESTON, S. C.—The United States Senate has passed a bill permitting the Charleston Light & Water Company to build a dam across Goose Creek.

CHATTANOOGA, TENN.—It is reported that S. H. Fisk, of the Great Fork's Power is interested in the plan to organize a company to take over the water rights that his company holds and to construct an electric railway from Chattanooga to Nashville.

NASHVILLE, TENN.—The Nashville Railway & Light Company and the Cumberland Telephone & Telegraph Company will soon award contracts for installing their wires in underground conduits. It is estimated that the work for both companies will cost about $400,000.

BRYAN, TEX.—The City Council has granted a franchise to Fritz Brantz to erect and operate an electric lighting and power plant.

FORT WORTH, TEX.—William Capps, attorney for the Northern Texas Traction Company, has announced that the company proposes to begin at once the construction of the South Side lines if the franchise is granted as asked.

FORT WORTH, TEX.—The Rosen Heights Street Railway Company is considering a proposition of constructing a line to the south side. It is also stated that the Fort Worth & Arlington Heights Traction Company has a similar line under consideration.

KAYSVILLE, UTAH.—A committee has been appointed by the Commercial Clubs of Kaysville and Farmington to make an effort to have an electric light and power plant installed, the plant to be owned and operated by the county.

SALT LAKE CITY, UTAH.—E. W. Tatlock and L. R. Derby have made application at the State engineer's office for the appropriation of water to be diverted from the Farmington Canyon for the purpose of generating electrical power for the Davis County. The power plant is to be erected on Farmington Canyon with a capacity of 500 hp.

WINDSOR, VT.—The Windsor Electric Company is contemplating the rebuilding of its electric lighting plant. W. S. Carter has resigned as president of the company, and George S. Rogers has been elected to fill the vacancy. Charles M. Hildreth has been elected vice-president.

LYNCHBURG, VA.—Plans and specifications are being prepared by Lamar Lyndon, of New York, N. Y., for the proposed municipal electric light plant. The City Council has decided to advertise for sale a 30-year franchise for electric lighting and power in this city.

RICHMOND, VA.—The joint committees on Finance and Electricity on June 14, passed a resolution asking the City Council to call for bids for lighting the city by electricity for 3 or 5 years from July 1, 1907.

WALLA WALLA, WASH.—The power plants of the Northwestern Gas & Electric Company on the Walla Walla River and Mill Creek were badly damaged by the floods caused by the severe storm of May 31. The loss is estimated at more than $40,000. E. K. Allen is manager of the company.

SEATTLE, WASH.—The Seattle, Renton & Southern Railway Company has filed an application with the Board of Public Works to double-track about a half a mile of its line in the city limits. In connection with the application the officers of the company have announced that it is the intention to double-track the entire system as fast as the work can be done.

MILWAUKEE, WIS.—The Radcliffe & Porter Manufacturing Company has had plans prepared for a new power house.

FOND DU LAC, WIS.—The Independent Light, Heat & Power Company is endeavoring to obtain a franchise in this city.

MARINETTE, WIS.—The contract for the construction of the new building of the Electrical Manufacturing Company has been let to E. R. Spaulding, of Menominee.

MADISON, WIS.—Bids have been received for the construction of the dam and electrical machinery for the power plant at Kilbourn. P. L. Spooner is interested. Prof. D. W. Mead is engineer.

MARSHFIELD, WIS.—M. G. Fleckenstein, City Clerk, writes that an election will probably be held in July, to vote on issuing $25,000 to be used for improving the water works and electric light plant.

MILWAUKEE, WIS.—The Common Council on June 11 voted to purchase property on Kinnickinnic River, as a site for the municipal electric light plant; also to issue $150,000 bonds toward the construction and equipment for the same.

MILWAUKEE, WIS.—The County Trustees have awarded the contract for the construction of the lighting plant for the county almshouse and hospital to the Milwaukee Engineering Company. The plant will cost $14,000.

BELOIT, WIS.—The Common Council has closed a contract with the Beloit Water, Gas & Electric Company for street lighting for a period of ten years. The company is to furnish 100 or more 2,000-cp arc lamps at $60 per year. This is an increase of thirty over the number of lamps which were in use under the old contract.

SUPERIOR, WIS.—The large power plant of the Great Northern Power Company, which is being erected at Thompson, is progressing rapidly and is expected to be completed before the end of the year. It is estimated that the plant will furnish 80,000 hp, but for the present only 30,000 hp will be developed. There will be installed in the power house three units of 10,000 hp each. The cost of the entire work, which was begun in January, 1905, is estimated between three and five millions dollars.

MEDICINE HAT, CAN.—The City Council proposes purchasing the telephone system here, and have it operated by the city. F. G. Forster is mayor.

CHIGNECTO, CAN.—The Maritime Coal Company is negotiating with the Robb Engineering Company for the installation of a large power plant at this place.

CAMAGUEY, CUBA.—The New Haven owners of the Puerto Principe Electric Company have sold their lighting and tramway property to Canadian capitalists interested with Sir W. Van Horne. The owners were Messrs. I. A. Kelsey, W. G. Bushnell and S. C. Morehouse.

WINNIPEG, MAN.—The Bell Telephone Company is making arrangements to equip a rural system around Glenboro. F. C. Patterson is district manager.

WINNIPEG, MAN.—The Winnipeg Electric Company will build a long-distance telephone line from this city to its power plant at Lac du Bonnet, a distance of 63 miles.

PACHUCA, MEX.—The Cia Electrica e Irrigadora de Hidalgo has recently placed a large order for electrical machinery with the Westinghouse Electric Company to increase the capacity of its power plant. The company has a hydro-electric plant of 40,000 hp, with a transmission line of sixty miles. The company furnishes electricity for the operation of the mines in and around the Pachuca region. Emilo Pinson is chief engineer.

BERLIN, ONT.—The ratepayers endorsed a by-law providing for the expenditure of [illegible] for a municipal electic light plant to be erected in this city.

HAMILTON, ONT.—Hon. Arthur Kennedy states that he will at once make arrangements for the construction of the Hamilton, Ancaster & Brantford Railroad.

BRANTFORD, ONT.—The Automatic Telephone Company is installing a telephone system in this city, and has decided to erect a large factory for the manufacture of telephone supplies.

OTTAWA, ONT.—The Bell Telephone Company is considering the erection of a large extension to its building in this city, plans for which have been prepared. C. F. Sise is president.

INGERSOLL, ONT.—At an adjourned meeting of the Council the Ingersoll Telephone Company was granted a 28-year franchise. The company, it is stated, will have its system installed and in operation by January 1, 1907.

WELLAND, ONT.—F. W. Houston, superintendent Welland Electric Light Company, writes that work will probably be commenced in about six weeks on the installation of a station at De Cew Falls for the distribution of electric power.

DELHI, ONT.—Bids will be received at the office of Messrs. Quance Brothers, Delhi, until June 25, for constructing a concrete dam, power house, flume, etc. John S. Fielden, 15 Toronto St., Toronto, is engineer of the work.

OTTAWA, ONT.—It is announced that the Grand Trunk Pacific Railroad will build a telephone system in connection with its transcontinental railway from the Atlantic to the Pacific and will also equip all its branch lines with telephones. F. W. Morse, of Montreal, is general manager of the company.

BARRIE, ONT.—The by-law to provide an expenditure of $37,000 for a civic electric lighting plant was carried by the electors. The equipment includes a 450-hp Corliss valve engine, direct connected to a two-phase, 2,200-volt, revolving field generator and all the necessary switches, arc lamps, etc. K. L. Aiken, 164 Bay Street, Toronto, is the consulting engineer.

New Industrial Companies.

THE CHARLES J. BOGUE ELECTRIC COMPANY, of New York, N. Y., has been incorporated by C. J. Bogue, L. Robertson and F. Plante. The capital stock is $50,000. The company proposes to manufacture electrical machinery, etc.

THE GENERAL VEHICLE COMPANY, of Kerhonkson, Ulster County, N. Y., has been incorporated with a capital of $1,750,000, to manufacture and deal in all kinds of motor vehicles. The directors are Phillip S. Hill, Charles H. Clark and Edward T. Magoffin of New York City.

THE SASKATCHEWAN TELEPHONE & ELECTRIC SUPPLY COMPANY, of Saskatoon, Can., has sold out to a local syndicate composed of J. C. Drinkle, Saskatoon; John Wilie, Moosomin, and others. It is understood the new company will make several important extensions.

THE WESTERN CONSTRUCTION & EQUIPMENT COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $250,000. The company proposes to construct railroads, telegraph and telephone lines, machinery, engines, cars, bridges, etc. The incorporators: N. B. Hersloff, Montclair; J. V. H. Lawrence and W. O. Maden, of New York City.

New Incorporations.

DENVER, COL.—The Florida Mesa Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are George W. Spencer and others.

CARLYLE, ILL.—The Citizens' Telephone & Telegraph Company, of Clinton County, has been incorporated with a capital stock of $15,000. The incorporators are Thomas E. Ford and others.

ORLEANS, IND.—The Irwin Telephone Company has incorporated with a capital stock of $6,000. The incorporators are R. E. Challrand, Wm. H. Taggart, Jas. W. Pickens, Aaron Speer, A. T. Marmon and others.

HOWELL, IND.—The Advance Telephone Company, capitalized at $6,500, has filed articles of incorporation with the Secretary of State. The directors are Fred Werkman and D. W. Fauquher, of Evansville, and Henry Young, Henry W. Hartig, of Howell.

COFFEYVILLE, KAN.—A company has been formed for the purpose of building an electric railway from the city to Forest Park, and application will be made immediately for a charter. The directors of the company are: W. H. Shepard, L. L. Birmingham, Dean Gill, S. D. Frazier, James Stanton, C. L. Hollingsworth and J. B. Tackett. The company will be capitalized at $35,000.

NEW ORLEANS, LA.—The New Orleans & Baton Rouge Railroad Company has been incorporated for the purpose of building an electric railway between Baton Rouge and New Orleans. The company has a capital stock of $2,500,000. The stockholders are W. O. Orten, C. S. Young, Edward Godchaux, Rene H. Himel, Walter Godchaux and Ferdinand E. Larue.

SPENCER, MO.—Articles of incorporation have been filed with a capital of $3,300 by the Spencer Mutual Telephone Company by C. C. Kramer and others.

SARCOXIE, MO.—The Sarcoxie Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are H. B. Boyd, Harry Bean, B. W. Ally and others.

HOLT, MO.—Articles of incorporation have been filed for the Clay County Telephone Company, with a capital stock of $50,000. The incorporators are W. H. Smith, J. A. Eby, George W. Sexton and others.

CHARDON, NEB.—The Chardon Telephone Company has filed articles of incorporation with the Secretary of State with a capital stock of $25,000. The incorporators are Adolph W. Rickman and others.

DUNKIRK, N. Y.—The American Lux Light Company has been incorporated with a capital stock of $400,000. The directors are Gustav Berg, Stockholm, Sweden; R. J. Gross and Carl Horberg, of Dunkirk, N. Y.

WILLIAMSON, N. Y.—The Williamson Light & Power Company has filed articles of incorporation with a capital stock of $10,000. The directors are Judson L. Transue of Williamson; Charles W. Mills and George R. Mills, of Sodus.

NEW YORK, N. Y.—The East Side Viaduct Railroad Company, which proposes to build and operate a new elevated line between First Avenue and Avenue A, from the terminus of the New York, New Haven & Hartford Railroad, in the Bronx, to East Thirty-third Street, Manhattan Borough, was incorporated in Albany on June 4. Capital, $50,000. Directors, O. W. Barnes, of Fishkill; F. H. Laamis, of Steubenville, Ohio, and L. C. Twombley, Chas. H. Cook and O. B. Nairs, of New York City. The road will be run by steam or electricity, as is found most convenient.

COLUMBUS, OHIO.—The Jesse T. Sheets Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Jesse T. Sheets and others.

LARUE, OHIO.—The Larue Telephone Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are J. H. Leonard, W. F. Kniffin, Charles F. Stahl, J. H. Raub and G. C. Altinger.

TIFFIN, OHIO.—The Old Fort Mutual Telephone Company, of Seneca, O., has been incorporated by R. G. Shannon, S. H. Fry, C. J. Fry, N. S. Beck and E. G. Zimmerman. It is proposed to build a mutual telephone system centering at Old Fort

YOUNGSTOWN, OHIO.—The Mahoning Valley Telephone Company, of Youngstown, has been incorporated with $10,000 capital stock by Max M. Zersky, Louise Zersky, Isaac Zersky, Louis A. Zersky and Anna Zersky. It is proposed to builu a telephone line through the Mahoning Valley.

CINCINNATI, OHIO.—The Covington, Middlemarch, Fort Thomas & Alexandria Interurban Railway Company has been incorporated by Cincinnati people to build a line along the Kentucky side of the Ohio River from Covington to Fort Thomas and then down the Licking River to Alexandria.

LORAIN, OHIO.—A. H. Hageman, of Lorain, Father Stuber and H. B. Martindale, of Avon, are forming a company to have $20,000 capital stock to build a line through Avon, Dover Center and French Creek and connecting with the Black River Telephone Company at Lorain. The central exchange will be at Avon.

CINCINNATI, OHIO.—Articles of incorporation have been filed for the Cincinnati Independent Telephone Company. The company has a capital stock of $10,000. The incorporators are Edward Puthoff, Charles H. Urban, William Klussmann, Arthur R. Morgan and George W. Griffith. The company proposes to establish a telephone system in the towns in Hamilton County outside of Cincinnati.

GREGG, OKLA.—The Farmer's Mutual Telephone Company has been incorporated with a capital of $30,000 by J. P. Lovingist and others.

ROSSVILLE, OKLA.—The Farmers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are C. A. Taft and others.

CARMEN, OKLA.—The Carmen Electric Light & Power Company has been incorporated with a capital stock of $12,000 by J. F. and S. A. Mott, of Carmen, and Z. B. Bird, of Enid.

LEBANON, PA.—The People's Electric Light Company has been incorporated with a capital of $10,000. Directors: Geo. H. Heisey, of Lancaster; Geo. B. Woomer, of York; Charles Davies, of Marietta, and others.

BERESFORD, S. D.—Articles of incorporation have been filed for the Gothard Telephone Company. The company has a capital stock of $25,000.

PALESTINE, TEX.—The Palestine Light & Power Company has been incorporated, with a capital of $400,000. John H. Fitzgerald and P. W. Brown, are the incorporators.

COOPER, TEX.—Articles of incorporation have been filed by the Delta Telephone Company with a capital stock of $15,000. The incorporators are C. M. Reed and others.

OTTAWA, ONT.—The Electric Heaters, Ltd., have been incorporated with a capital of $100,000 to manufacture gas, electricity, fixtures, lamps, etc. The directors are: A. A. Sears, W. L. P. Smith and A. F. Leggatt, all of Ottawa.

LONDON, ONT.—The International Electric Company has been incorporated here with a capital of $100,000 to manufacture electricity, electrical machinery, etc. The directors are: A. R. Bickerstaff, G. Stevenson, E. Mackenzie, all of Toronto, Ont.

MONTREAL, QUE.—The Saguenay Electric Light & Power Company has been incorporated with a capital of $250,000 to take over the business of the Cartierville Electric Light & Power Company and to carry on a general business as an electric light and power company.

Legal.

LIABILITY OF MUNICIPALITY.—The Supreme Court of California in the suit of Davonst versus the City of Alameda, has reversed the decision of the lower court favorable to the municipality. The plaintiff's wife was killed by the alleged negligence of the city in operating its municipal electric light plant. The points in the decision are as follows: (1) A municipal corporation in operating an electric plant is not exercising governmental functions, and hence is liable for damages caused by the negligence of its employees in the operation of the plant. (2). Where one was injured through the negligence of the employees of a city in operating an electric light plant, a contention that the city was not liable because the grant of authority to maintain the plant was given to "a board of trustees of the city" and not to the city was untenable. (3) Where one using a way over a vacant lot which had been used for many years by residents in the neighborhood was injured by coming in contact with a live wire of an electric plant negligently lying in the path, the operator of the plant could not escape liability on the theory that the one injured was a trespasser, as he was a licensee.

POLE LINES IN STREETS.—In the case of the Merced Falls Gas and Electric Company versus Turner et al., the Court of Appeal for the Third District of California has ruled against the company as to its undisputable right to maintain its poles in any special locations. The main points in the decision are as follows: (1) Where a gas and electric company had been granted a franchise to construct and maintain its poles in the streets of a city, the original location of the poles by the city's permission created no absolute indefeasible right or irrevocable license to maintain each pole at its particular location for all time. (2) Mere lapse of time is insufficient to create a prescriptive right in a gas and electric company to maintain its poles in city streets in the identical spot in which they were located. (3) The mere allegation of irreparable injury is insufficient in actions for an injunction. (4) Political Code, §§ 4354, 4408, 4410, 4411, 4413, under which the city is incorporated, vests in the city's board of trustees full power to establish, alter, open, improve and repair streets, remove obstructions therefrom, and generally manage and control the same. Const. art. 11 gives every city power to make and enforce within its limits all local, sanitary, police and other regulations not in conflict with general laws, and the fundamental law of the State also declares that franchises to use the streets shall be exercised under the direction of the superintendent of streets or other officer in control thereof. It is held that where complainant erected certain electric light poles in the streets of a city, it acquired no exclusive right to maintain the same in their original positions, and could not restrain the city from removing them to new locations.

PEDESTRIANS AND WIRES.—The Supreme Court of Georgia in the action of Havell against the Southern Bell Telephone & Telegraph Company has defined some of the rights of pedestrians in a decision of which its own syllabus is subjoined: (1) Where a declaration alleged that a telephone company, in stretching wires along a public street of a city, permitted one of them to sag while heavily charged with electricity, or to become so charged with electricity while thus sagging, at a place where it was likely to injure pedestrians, and gave no warning of the danger arising from such charge, in consequence of which a person walking along the street came in contact with the wire and was seriously injured by the electric charge, this sufficiently stated a case of negligence on the part of the defendant to withstand a general demurrer. (2) It is not negligence as a matter of law for a pedestrian to cross a public street at a point where there is no cross-walk. The use of public streets between crossings is not limited solely to animals and vehicles. Such use by footmen does not necessarily constitute negligence, if due caution is exercised. (3) Where a declaration alleged that a pedestrian was going along a street and started to cross it, when he was struck in the face by a wire which a telephone company had negligently allowed to sag while highly charged with an electric current, or to become so charged while sagging, without giving warning of the danger, and that while seeking to guard his face from the wire, the plaintiff's hands came in contact with it and was injured by reason of the electric current, and that he was without fault or negligence in and about the transaction, and was in the exercise of due caution and diligence, a general demurrer, on the ground that the plaintiff was not in the exercise of ordinary care and prudence for his own protection, and that by the exercise of such care he could have avoided the injury, was properly overruled.

THE MANUFACTURE OF ENERGY.—The Supreme Court of Louisiana in the suit of the State versus the New Orleans Railway & Light Company has held that the lower decision that the company must pay a license tax is sound and that the company is not a manufacturer, under article 229 of the constitution of 1898. The Court said: "It is a debatable question whether an electric light company is a manufacturer. Conceding, for the sake of the argument, that defendant company does manufacture electricity and light, the next question for solution is whether a producer of that kind of energy is a "manufacturer" in the sense of article 229 of the Constitution. In the legislative history of Louisiana the term "manufacturer" has never been applied to a gas, water or electric corporation. Section 683 of the Revised Statutes of 1870 speaks of "manufactures" of cotton, woolen, linen, silk, hempen, cloth and cordage, and of the "manufacture" or iron and other metals and things. It authorized the formation of corporations for the purpose of manufacture and for many other purposes, including the construction and operation of works to supply cities and towns with gas or water. As amended and re-enacted by Act No. 154, p. 288, of 1902, the word "manufacture" is used in the same restricted sense, and is not applied to works of public utility to supply cities and towns with water, electricity, gas or fuel oil. There is no reason of public policy for exempting light companies from taxation and at the same time denying exemption to other corporations exercising similar franchises in the interest of the public. In Commonwealth of Pennsylvania v. Northern Electric Light & Power Company, 22 Atl. 839, 14 L. R. A. 107, the Supreme Court of the State held that, while the defendant company might technically be considered a manufacturer of electricity and light, it was not a "manufacturing corporation" in the sense of a statute exempting the stock of such corporations from taxation.

SPIKES IN LIGHTING POLES.—The Supreme Judicial Court of Massachusetts (Norfolk) has sustained on exceptions the verdict against the plaintiff in the suit of Little versus the Hyde Park Electric Light Company, as to damages for an accident. The point raised was a simple but rather interesting one as to the proper nature of pole spikes used as steps. The plaintiff's case was that the spike which gave way under him was not a suitable spike for the purpose for which it was used, and that it was not properly driven into the pole. But in testifying that the superintendent promised a year before the accident to take out all driven spikes, and substitute screw spikes, the plaintiff admitted that he knew that driven spikes were then in the poles. It is true that he did not admit that he knew that driven spikes of the kind in question were in use, and there was evidence that they were more dangerous than beveled driven spikes. But he admitted in terms that "steps getting loose was not an infrequent occurrence during my time of employment," and "I would tell a step was loose by the feeling of it when I took hold of it, I suppose." The rest of the evidence touching on the plaintiff's due care is as follows: The plaintiff had been in the defendant's employ as a lamp trimmer for 11 years. As such it was his duty to climb each post belonging to the defendant (at the time of the accident there were 139) every other day, except on moonlight nights, and on those every three to five days. When the plaintiff's time was not wholly taken up trimming the lamps because there was a moon, he worked as a lineman in making repairs, including taking down and setting up poles. In that connection he had seen poles bored for spikes and new spikes put into poles, although in his testimony he did not admit that he personally had bored more than one hole for the driving of a spike, or had driven more than that one spike for which he had bored the hole. He testified that it was his duty to make a daily report on a blank furnished by the defendant for the purpose, and that one of the headings on this blank was: "The following repairs are needed on the circuit." He also testified that it was his duty to put upon that blank anything that might be seen to be needing repairs. He further testified that if he found a pole where a step was loose which he could not repair himself (although he did not think he ever had been told to do it), he thought he ought to report it and he did report it. Other evidence went to show that it was left to the trimmer to report needed repairs.

DEADLY GUY POST WIRE.—The Supreme Court of Wisconsin has affirmed against the Sheboygan Light, Power & Railway Company the decision for plaintiff in the suit of Wilbert versus F. Zurheide Brick Co., et al., on the ground that the defective insulator causing the fatality should have been discovered and changed. "The rule that one cannot be charged with negligence respecting the existence of a danger, not reasonably to be anticipated in the course of events, does not imply that the exact danger was to have been expressly contemplated, but it implies that a danger, in the nature of the danger appearing, was likely to rise in connection with the conduct of his business." It appears that the company had put one of its lighting poles near Mr. Zurheide's property. To the tops of the poles was attached the span wire from which the street lamp was suspended. A guy wire was attached to the pole at the southwest corner of this street crossing and was also fastened, about four feet from the ground, to a guy post, placed to the west, between the sidewalk and the gutter. A thin wire had been stretched from this guy post, about four feet from the ground, to a tree, at about nine feet from the ground. The tree was located to the east and near the light pole at the southwest corner of the street crossing. This wire had been placed there by Mr. Zurheide, who resided on the adjoining premises, for the purpose of holding the tree upright and to prevent its branches from dropping onto a railway gate near the street. This wire was fastened to the tree by a strap and was wound around the guy post in contact with the guy wire. The street lamp, which was suspended by an interlocking device from the span wire near the center of the street crossing, had a rope attached to it which led to the light post and was used to raise and lower the lamp. When the lamp was completely raised, the only break in the metallic connection from the lamp to the span wire was an insulator of the usual type. This was placed there to prevent the electric current, which fed the lamp, from passing from the lamp to the locking device, and thence to the span wire and the other connections forming a conductor for the electric current. The complaint alleged that the Sheybogan Light, Power & Railway Company negligently constructed and maintained its plant at this street crossing; in that it placed the guy post with the guy wire attached too near the ground and in contact with the span wire near the top of the light pole, and that it negligently used a defective insulator between the lamp and the span wire, and failed to exercise due care to discover the tree wire, the broken insulator, and the consequent escape of the electric current. Wilbert was killed by accidental contact with the tree wire.

Personal.

MR. E. W. RICE, JR.—Union College, Schenectady, N. Y., has conferred upon E. W. Rice, Jr., the honorary degree of Sc.D.

MR. GEORGE WESTINGHOUSE has had the degree of doctor of engineering conferred upon him by the Institute of Technology (Technische Hochschule) of Berlin.

MR. C. J. H. WOODBURY, of the staff of the American Telephone and Telegraph Company received the degree of doctor of science from Union College at the commencement exercises on June 13.

W. A. CLEMENT, of Oswego, N. Y., has resigned his position as superintendent and manager of the Ontario Telephone Company. John Fraser, of Syracuse, N. Y., has been appointed to the position of local manager.

PROF. F. B. CROCKER, of the electrical engineering department of Columbia University, New York City, sailed last week for England. He will participate in the hospitalities extended by the Institution of Electrical Engineers of England.

MR. JEAN BART BALCOMB has severed his connection with the Ferrolite Construction Company of San Francisco to become chief engineer of the Pittsburgh Filter Manufacturing Company, with headquarters in the Farmers' Bank Building in the latter city.

MR. W. H. BALDWIN, mechanical and hydraulic engineer, has been appointed superintendent of power houses for the Ottawa Electric Company, and Mr. W. B. Morrow has been appointed chief of the operating staff of the central power plant of the company.

MR. W. W. RUBLE, of San Jose, Cal., has invented a headlight for trolley cars. It has a movable base and a rod and gear connecting with the running gear of the car or automobile, so that the beam of light follows all curves with each minutest change of direction.

MR. FRANK H. TAYLOR, until recently vice-president, and still a director, of the Westinghouse Electric & Manufacturing Company, has just gone abroad with his family, and will spend the Summer in European travel, partly in England and largely in Mediterranean waters.

SIMES-MERRITT. Mr. Rowland J. Simes, Jr., a member of the staff of the old *Electrical Engineer* and for some years past engaged in the electrical supply industry, was married on June 14, at the Lindens, Hastings-on-the-Hudson, to Miss R. R. Merritt, daughter of Mr. and Mrs. Augustus H. Merritt.

MR. L. B. STILLWELL, the consulting electrical engineer, sailed for Europe soon after completing with Mr. B. J. Arnold his report on electrifying the Erie Railroad. Mrs. Stillwell has been in poor health for some time past, and the trip will be one purely of rest and sightseeing for both of them.

MR. H. M. HIRSCHBERG, president of the Excello Arc Lamp Co., sailed on the Celtic last week. While abroad, Mr. Hirshberg will visit the factories making the Excello lamps and carbons, arranging for prompt deliveries and the satisfactory handling of the large number of orders already being received for these goods, for next season's delivery.

MR. W. H. TAPLEY, who has made a more than national reputation as electrical engineer of the great Public Printing Office at Washington, with its hundreds of motors, thousands of lamps and unique electric heating plant, has resigned, having, it is said, received a flattering offer for a prominent electrical company in Philadelphia. He will be succeeded as chief electrician by Mr. F. L. Powers, his assistant.

MR. A. J. HAUSSEGGER, who has been engaged on electrical engineering work, especially applied to mining, in Australia, for the Ganz Company, Ltd., of Budapest, Austro-Hungary, is on his way home via the United States, and has been making a careful study of American plants and conditions from the Pacific Coast to the Atlantic seaboard. During the past week he has been visiting the power houses of New York previous to sailing for Europe.

MR. CHARLES A. SCHIEREN, JR., of the firm of Charles A. Schieren & Co., manufacturers of leather belting, 37 Ferry Street, New York, has returned from a European business trip. Almost all of Mr. Schieren's time was spent in Germany, the large European business of his firm being handled through a principal branch located at Hamburg. He reports Germany as very prosperous, and found that large orders were being received there from Russia.

MR. H. W. GOODE, president of the Portland, Ore., General Electric Company, is visiting the East, and has been in Boston to take up the recent consolidation of the electric light, power and traction properties in this part of the State with the owners, and details of one management for all the properties will be worked out. Plans are to be perfected not only for managing the big interests that are held under one ownership, but improvements will be outlined for bettering the service. Mr. Goode will be away for a month and upon his return it is expected that announcements will be made of further betterments.

MAJOR J. ORTON KERBEY, the well-known Washington correspondent, has just issued a well-illustrated and interesting book on South America, entitled "The Land of To-morrow." It is essentially a story of the search for rubber. Mr. Kerbey was formerly U. S. Consul at Para, and is thoroughly familiar with the great continent whose mighty inland waters he describes. One travels with him up the Amazon and sees many things with the eyes of a very observant traveler. The volume is one of some 400 pages, and has many halftones from photographs, and original drawings by Miss Ruth S. Clements, of Washington. The book is timely in view of the Pan-American Congress at Rio de Janeiro, which Mr. Kerbey will attend on newspaper duty.

MR. GEORGE FLETT, managing director of Dick, Kerr & Co., Ltd., of London, left New York this week for London, after a stay of a few days. This will complete a trip around the world lasting six months, during which Mr. Flett has visited Calcutta, Singapore, Hong Kong, Shanghai, Tokio and other places where the company has installed large and successful electric railway systems. On Monday, June 18, Mr. Flett was given a farewell luncheon at the Lawyers' Club, by Mr. James H. McGraw, at which there were present Messrs. F. J. Sprague, J. G. White, H. H. Vreeland, H. McL. Harding, T. C. Martin, P. G. Gossler, J. M. Wakeman, H. G. Stott, M. G. Starrett, S. M. Curwen, W. S. Burnham, J. Goodell, A. N. Connett, W. S. Doran. Some very interesting references to his trip were made by Mr. Flett, and data were discussed as to methods of traction and the results of the modern steel car in electric traction under varying conditions.

MR. R. W. SEARS, an old telegraph operator, is the head of Sears, Roebuck & Co., of Chicago, the greatest retail mail order house of the West, it is said, now being incorporated with a capital of $40,000,000. Last year the firm earned net $3,000,000. It is asserted that now its business is $5,000,000 a month. All this is done by mail and for cash in advance of shipment. Mr. Richard T. Sears, the head of the firm, began the mail order business while he was employed as a telegraph operator on the Northern Pacific. In his spare moments he sold watches and firearms to his fellow employees on the railroad. The success of the scheme prompted him to go to Chicago, where he opened a store devoted wholly to mail order business. The firm was assisted by Moses Newborg, now a Wall Street banker and broker, and it started with a capital of $150,000. In the eleven years the business has grown by leaps and bounds. It now employs 8,000 clerks and has 6,000,000 customers. There are eighteen railroads which enter its plant and 100 cars are shipped daily. Mr. Sears is not yet forty-five years of age. The enterprise built up within the last few years now comprises a small city, with its own police force, schools, hospitals, etc.

MR. JOHN MURPHY, of Ottawa, Can., has been appointed electrical engineer of the Department of Railways and Canals and of the Dominion Railways Commission. He was at one time connected with the Bell Telephone Company of Canada and for some years past has been power superintendent of the Ottawa Electric Company and the Ottawa Electric Railway Company. Mr. Murphy is a member of the American Institute of Electrical Engineers, a vice-president of the Canadian Electrical Association, an associate member of the Canadian Society of Civil Engineers, and a member of the National Electric Light Association of America. On the evening after he had severed his connection with the Ottawa Electric Company Mr. Murphy was the recipient of a beautiful gold watch and chain, suitably inscribed. The presentation took place in the board room of the Ottawa Electric Company, in the presence of representatives of every department of work in the company. The address was read by Mr. T. Ahearn, president, who referred in feeling and flattering terms to the valuable services rendered the company since its inception up to the present time, and held Mr. Murphy up as an example to the many young men present of what can be accomplished by sobriety and close attention to duty. Mr. Murphy, in replying to the flattering address, referred feelingly to the happy relations which had always existed between himself and the various heads of the company, and outlined the great development of electric lighting since he took charge of the first incandescent lighting dynamo started in Ottawa twenty years ago.

Obituary.

PROF. A. K. EATON, an inventor and scientist, died on Thursday at the home of his son, Hugh M. Eaton, in Brooklyn, N. Y. He was born eighty-four years ago in Stockbridge, Mass., and graduated as a physician from Hamilton College in 1840. He never practised medicine, but devoted himself to experimenting in chemistry and the sciences. For forty years he lived in Brooklyn. Once, for a period of two years he occupied the chair of his cousin, the late Darwin G. Eaton, in the Packer Collegiate Institute. His method of manufacturing crucible steel is still in use and he was one of the very earliest designers of telephonic apparatus, in connection with which his name became well known.

Trade Publications.

IRON FURNACES.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has issued a neatly illustrated bulletin devoted to open-hearth and re-heating furnaces for iron and steel works.

ELECTRIC FANS.—Convincing arguments concerning the energizing influence of a cooling breeze from an electric fan in the summer time are attractively presented in fliers Nos. 4503 and 5010 of the Fort Wayne Electric Works, Fort Wayne, Ind.

ATTACHMENT PLUGS.—Bulletin No. 32 of the H. T. Paiste Co., Philadelphia, is devoted to new taplets, attachment plugs and rosettes for 250-volt and 125-volt circuits. In the design of these devices especial attention has been paid to neatness.

LARGE DIRECT-CURRENT GENERATORS.—An instructive description of the constructive details of high-class modern direct-current generators for direct connection with steam engines is contained in bulletin No. 1079 of the Fort Wayne Electric Works, Fort Wayne, Ind.

PHOSPHOR BRONZE.—Price list No. 23 of the Phosphor-Bronze Smelting Company, 2200 Washington Ave., Philadelphia, Pa., deals with "Elephant Brand" phosphor-bronze for springs, pump cylinder linings, valves, ornamental work, perforated screens, diaphragms for pressure regulators and wires for telephonic and telegraphic work.

DIRECT-CURRENT MOTORS AND GENERATORS.—The Diehl Manufacturing Company, Elizabethport, N. J., has issued bulletin No 150, devoted to belted and engine type generators, and open, semi-enclosed and entirely enclosed motors. The generators vary in rating from 25 kw to 150 kw, while the ratings of the motors vary from 30 hp to 340 hp.

ENGINE-STOP.—In an exceptionally neat bulletin entitled "The Protection of a Monarch," the Consolidated Engine-Stop Company, 130 East Twelfth Street, New York, describes the Monarch engine-stop and speed-limit system. A large portion of the bulletin is devoted to exact reproduction of testimonials from well-known companies relating to the reliability of the above-named engine-stop.

INDICATING INSTRUMENTS.—An illustrated folder recently issued by the Wagner Electric Mfg. Company, St. Louis, Mo., gives a pictorial description of portable and switchboard voltmeters, wattmeters, ammeters, power factor and frequency indicators. It is stated that the line of instruments manufactured by this company is as complete as is manufactured by any maker, either in this country or abroad.

OIL ENGINES.—The De La Vergne Machine Company, of New York, has just issued a new 82-page catalogue describing the mode of operation of the Hornsby-Akroyd oil engine and giving illustrations and short descriptions of the more recent installations of these engines. It is stated that over 14,000 of these engines are now in operation, and that the cost of energy is only from ¼ to ½ cent per brake hp-hour.

REFLECTING ARC.—The Holophane Glass Company, 227 Fulton Street, New York, is distributing a neat desk blotter containing an illustration of the Pagoda "reflecting arc" which consists of a cluster of incandescent lamps, each being provided with a shade and the cluster as a whole being equipped with a concentrating reflector. It is claimed that these lighting equipments are ideal for the illumination of stores.

TURBO-GENERATORS.—The Allis-Chalmers Company, in preparing its bulletin No. 1504 on steam turbines and generators, has certainly added some valuable facts to the general knowledge on this popular type of prime mover. The impulse and reaction type are carefully compared as are also the preferable arrangement, whether horizontal or vertical. This is followed by a lucid description of the Parsons turbine manufactured by the company and of the generator used in connection with it.

ENGINEERING WORK.—The Westinghouse, Church, Kerr & Company, of New York, N. Y., have just published a neat 76-page booklet called "Work Done," describing some of the important installations for which they have acted as engineers. Among the work referred to may be mentioned the following: The Horgan's Falls (Ga.) power plant of the Atlanta Water & Electric Power Company; the Great Falls & Old Dominion Railroad Company; the Warren (R. I.) plant, and the Back Bay, Boston, station of the New York, New Haven & Hartford Railroad.

STORAGE BATTERIES.—The Electric Storage Battery Company, Philadelphia, Pa., has issued as bulletin No. 98 a photographic description of various equipments of "Chloride Accumulators" now in use. In connection with each equipment there is shown a station load curve which serves to illustrate the advantages of a storage battery in smoothing out the generator load, carrying the total day load, or tiding the station over emergencies. Bulletin No. 97 of the same company gives extended discussions of the "Chloride Accumulators" in railway and central lighting station service in the cities of Milwaukee and Chicago.

THE COOPER HEWITT ELECTRIC COMPANY, of New York City, has issued in large hardsome form a pamphlet descriptive and illustrative of its mercury vapor lamps. It is No. 12 in the company's series of publications and discusses its theme in a very interesting manner. The views include a variety of work and a number of letters are presented from the managers of offices, plants, docks, etc., where the lamps are in service. Some of these testimonials are very strong as to efficiency and economy. The pamphlet also devotes some space wisely to the mercury vapor converter that is now proving itself so valuable an adjunct to the alternating-current system of distribution.

THE GOULD STORAGE BATTERY CO., has just issued two new additions to its Catalogue J in the form of booklets ready for filing. Part 2 deals with the "stationary types" of batteries in glass and lead lined tanks. It shows an alteration the company has made in the conducting lug heretofore used; the new type being split, one part leading to the edge of the plate while the other reaches towards the center. This is a step forward in battery construction in that it does away with all local action and secures a more even distribution of the current. Part IV refers to "train lighting types" and shows various new styles of batteries. The new types have many commendable points among which are: The case is absolutely acid proof, having special attachments to prevent leakage; an insulating air gap is left between the cells, insuring insulation internally; porcelain rollers and spacing pieces are used on the case, insuring insulation from the car box and each other; all corrodible parts have been reduced to a minimum and the workmanship throughout is of the highest order. Both booklets contain matter and tables of great interest to those who have need of a constant and economical source of power. They may be obtained at the company's New York offices, 1 West 34th Street, or from the branch offices.

News of the Trade.

THE PARAGON INSULATING COMPANY, of Cleveland, which has recently erected a new plant at Findlay, has commenced shipping material from the new establishment. The first shipment was a carload of 40 tons of insulating material to the Pittsburgh Reduction Company, at Messina, N. Y. The company utilizes one of the waste products of the National Refining Company.

THE BECK FLAMING ARC LAMP.—A striking illustration of the remarkable illuminating powers of the flaming arc was given in the Convention hall at Atlantic City. Mr. Louis J. Aurbacher, of the Beck Flaming Lamp Co., installed one of the Beck Flaming Lamps to light up the hall. The lamp, taking only 352 watts at the arc, lights the hall very much better than the several hundred incandescent lamps regularly used. In fact, the light was so bright that Mr. Brudett, speaker of the evening, requested that it be turned out during his lecture.

THE CANADIAN WESTINGHOUSE COMPANY, of Hamilton, Ont., has shipped to the British Columbia Electric Railroad Company the largest generator ever made in Canada. The equipment consists of one 1,633-kw, three-phase, 60-cycle, 200-r.p.m., engine type, revolving field generator for direct connection to a water wheel; one rotary converter, 900 kw., 500 volts, three phase, 60 cycles, 400 r.p.m.; 8 air-blast transformers, each 479 kw, 2,200 volts to 24,300 volts, 60 cycles, also the necessary switchboards etc. R. H. Sperling is general manager of the railway.

THE REYNOLDS ELECTRIC FLASHER MFG. COMPANY, which has for the past few years been located at 221 Fifth Ave., Chicago, has moved to 191-193 Fifth Ave. This move was made necessary by the large increase in business of this concern. The quarters now occupied by this company are four times as large as those formerly occupied, and will enable it to fill all orders for its popular "Reco" and "Improved Reynolds Flashers" and "Reco Whirlers" very promptly. The Reyonlds Company has built its business by liberal treatment of the trade, fair business methods and the superior quality of the goods which it has produced.

STEAM PIPE COVERING FOR MINING PLANTS.—The H. W. Johns-Manville Co., of 100 William St., New York City, has for a number of years been meeting with remarkable success in the installation of its J-M combination felt coverings on pipes in mines and surfaces exposed to extreme weather conditions. In several instances it has demonstrated the feasibility of carrying steam considerably over a mile, having undertaken to accomplish this result even where engineers considered it an impossibility. The best results are obtained when the coverings are applied by the manufacturer, who maintains a force of thoroughly skilled mechanics for the installation of this covering in all parts of the country. All tests under actual working conditions prove the covering to be most efficient and durable, even when exposed to the most severe conditions. The H. W. Johns-Manville Co. will be glad to give full information regarding this product to anyone interested.

STANLEY-G. I.—At the recent exhibition by the National Electric Light Association at Atlantic City, the Stanley-G. I. Electric Mfg. Company, of Pittsfield, Mass., had a "live" exhibit of lighting supplies connected to a panel, equipped with instruments, Wright demand indicators, switches and circuit breakers, and seven forms of "G. I." enclosed arc lamps were exhibited, the 110-volt and series-multiple power circuit lamps being shown burning. A 3¼-ampere, 110-volt, direct-current multiple "Short" arc lamp (only 15½ inches high) attracted much attention. The exhibit also comprised a "G. I." direct-current motor-generator set and "S.K.C." induction motors and lighting transformers; a line of lightning arresters, hanger boards for arc lamps, several forms of floor and wall outlet boxes, flush push-button switches, pendant switches, knife-switches and punched-clip switches. The Stanley-G. I. Company were represented at the convention by Messrs. M. D. Barr, J. H. Nable, J. E. Cutler, A. W. Henshaw, H. C. Rice, A. H. Abell, G. H. Noble, Almon Foster, E. B. Dodd and J. S. Codman.

CROCKER-WHEELER COMPANY, Ampere, N. J., reports among recent sales, the following: One 425-kw and one 225-kw generator, two 100-hp, one 50-hp, and one 25-hp motor to the Lehigh Portland Cement Company, Ormrod, Pa.; two 75-kw, 2,300-volt alternators to the Southern Railway Company, Atlanta, Ga.; one 75-hp motor to the American Printing Company, Fall River, Mass.; one 60-kw, 230-volt, direct-current generator and motors of 5, 7½, 12 and 15-hp to the M. S. Brown Electric Company, Columbus, O.; one 50-kw generator to the Eton Brewery, Newark, N. J.; three 75-kw, 250-volt generators to J. MacWilliams & Company, Memphis, Tenn; two 75-kw, 240-volt generators to the American Fork & Hoe Company, Ashtabula, O.; one 150-kw generator to Maher & Flockhart, Newark, N. J.; one 75-kw alternating-current generator and one 4½-hp motor to the World Star Knitting Company, Pay City, Mich.; one 100-kw generator and motors of 20, 25 and 35-hp to the Floyd Wells Company, Royersford, Pa.; and three 1-hp motors to Wellman-Seaver-Morgan Company, Cleveland, Ohio.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 12, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

822,936. WIRELESS TELEGRAPH SYSTEM; Lee DeForest, New York, N. Y. App. filed Feb. 2, 1906. Designed to provide a wireless telegraph system whose natural mode of operation is monoperiodic and has an antenna system, and a closed oscillating circuit connected thereto, and so constructed and arranged that the two paths from the top of the antenna to earth are equal in natural period.

822,940. APPARATUS FOR RECOVERING PRECIOUS METALS; Edward J. Garvin, Portland, Ore. App. filed Jan. 15, 1906. An apparatus for recovering precious metals from ore solutions and ores, and consists more particularly in the details of an improved precipitating tank for the solution and ore.

822,951. RAILWAY SIGNAL; John S Jeffrey, Columbus, O. App. filed Nov. 15, 1905 Mechanical details of an electric signaling device, by which persons may flag a train at local stations without standing on the track. The device is arranged to be automatically replaced by the passage of a train.

822,961. TROLLEY PLACER AND GUIDE; Edgar A. Leake, Lawrence, Mass. App. filed Oct. 18, 1905. Pivoted in the trolley harp and adjacent to the usual wheel, are a pair of eccentric bearers or shoes, which automatically turn when the wire leaves the wheel, so as to replace the same thereon.

822,965. CALLING DEVICE FOR TELEPHONE-EXCHANGES; Frank A. Lundquist, Chicago, Ill. App. filed July 11, 1904.

822,966. CALLING DEVICE FOR TELEPHONE-EXCHANGES; Frank A. Lundquist, Chicago, Ill. App. filed Feb. 6, 1905.

822,968. RELAY; Ry H. Manson, Elyria, O. App. filed May 25, 1904. A telephone relay having a magnet with a bell crank lever forming an armature and arranged to move platinum tipped contact springs to close the relay circuits.

822,073. AUTOMATIC TELEPHONE SYSTEM; August A. Monson, Grey Eagle, Minn. App. filed Jan. 24, 1905.

822,987. ELECTRICAL MEASURING INSTRUMENT; Frank W. Roller, Plainfield, N. J. App. filed July 18, 1904.

823,019. LIQUID FILTER AND PURIFIER; Milton F. Adams, New York, N. Y. App. filed June 10, 1905. A water filter device having layers of conducting material through which the water flows and current passes, and where the current deposits the particles in the water so as to purify the same.

823,040. AUTOMATIC SAFETY TROLLEY POLE; John R. French, Los Angeles, Cal. App. filed Mar. 3, 1905. The trolley pole has a hinged section on its upper end which carries the wheel and which trips the tension spring of the pole so as to drop the latter when the wheel leaves the wire.

823,044. MULTIPLE FUSE PLUG; Alexander Hepke and Kurt Diener, Berlin, Germany. App. filed Feb. 16, 1905. Provides stationary fuse wires within the plug body and a current taking-up contact body movable in relation to the plug body and the fuse wires respectively.

823,055. TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER; Jacob Kruyswijk, Ryswijk, near the Hague, Netherlands. App. filed Aug. 3, 1904.

823,061. TELEPHONE-RECEIVER; Charles T. Mason, Sumter, S. C. App. filed Mar. 17, 1905.

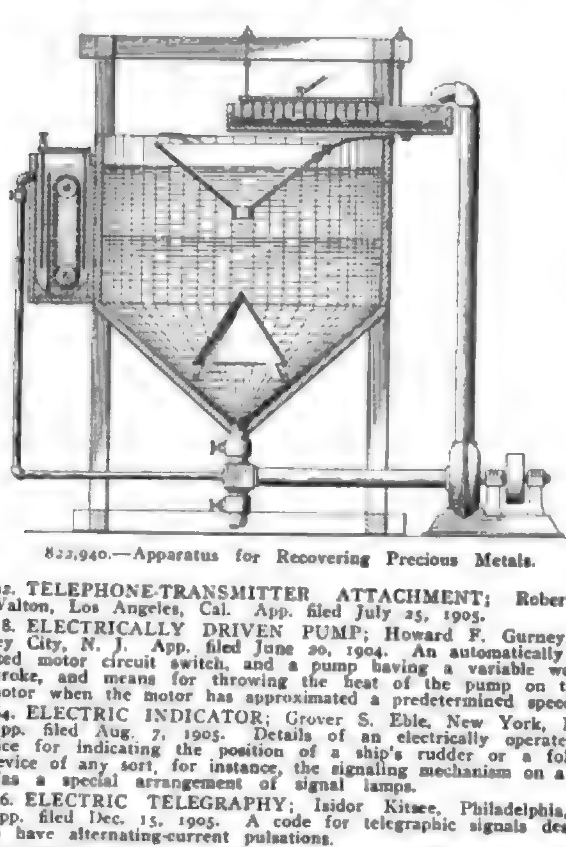
823,067. ELECTRIC RAILWAY SYSTEM; John L. Moore, New York, N. Y. App. filed Nov. 16, 1904. A railroad having a sectional trolley conductor, the divisions of which are successively energized during the passage of the car.

823,073. ELECTRIC SWITCH; William J. O'Leary and William Coonan, Montreal, Canada. App. filed Aug. 4, 1904. An electric switch comprising a bed plate and a gravity actuated frame pivotally mounted thereon, a pivotally supported locking member, and locking means carried by said bed plate in position to engage the respective ends of such pivoted locking member.

823,086. ALTERNATING CURRENT TRANSLATING DEVICE; Louis H. Thullen, Edgewood, Pa. App. filed Oct. 13, 1903. An alternating current relay having a movable member operated in one direction by electro-magnetic means when affected by an alternating current, and having a crank shaft and contact points located near the center of rotation of said shaft.

823,090. TELEPHONE-TRANSMITTER ATTACHMENT; Robert A. Walton, Los Angeles, Cal. App. filed July 25, 1905.

823,091. TELEPHONE SWITCHING APPARATUS; Robert A. Walton, Los Angeles, Cal. App. filed July 25, 1905.



822,940.—Apparatus for Recovering Precious Metals.

823,092. TELEPHONE-TRANSMITTER ATTACHMENT; Robert A. Walton, Los Angeles, Cal. App. filed July 25, 1905.

823,118. ELECTRICALLY DRIVEN PUMP; Howard F. Gurney, Jersey City, N. J. App. filed June 20, 1904. An automatically operated motor circuit switch, and a pump having a variable working stroke, and means for throwing the heat of the pump on to the motor when the motor has approximated a predetermined speed.

823,164. ELECTRIC INDICATOR; Grover S. Eble, New York, N. Y. App. filed Aug. 7, 1905. Details of an electrically operated device for indicating the position of a ship's rudder or a follower device of any sort, for instance, the signaling mechanism on a ship. Has a special arrangement of signal lamps.

823,176. ELECTRIC TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 15, 1905. A code for telegraphic signals designed to have alternating-current pulsations.

823,183. SWITCHBOARD; William C. Marchant, Chicago, Ill. App. filed Aug. 7, 1905. Details of a connection for a knife blade switch. The base plate of the switch has a projecting boss which is drilled to receive the wire.

823,196. SYSTEM OF TRAIN CONTROL; August Sundh, Yonkers, N. Y. App. filed Mar. 16, 1905. Complete diagram of circuits for a multiple unit control system of an electric train.

823,206. TELEGRAPH TRANSMITTER; Albert C. Crehore, Tarrytown, N. Y., and George O. Squier, Washington, D. C. App. filed Apr. 8, 1901. The telegraph transmitter is designed to transmit waves having a sine curve rather than the sharply cut waves which are ordinarily transmitted by automatic devices.

823,215. TELEPHONE SYSTEM; Calvin R. Green and David R. Green, Rising Sun, Ind. App. filed Aug. 24, 1905.

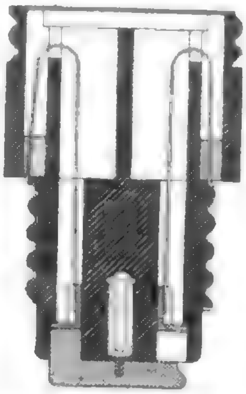
823,220. CIRCUIT CONNECTION FOR, AND METHOD OF, OPERATING ALTERNATING MOTORS; Dugald C. Jackson, Madison, Wis. App. filed May 16, 1904.

823,234. MAGNETIC ORE SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 20, 1905. An iron frame is wound to present a magnetic pole which inductively energizes a rotating cylinder diagonally disposed above a reciprocating body.

823,235. MAGNETIC SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 20, 1905. The ore particles are fed from a hopper so as to drop through a narrow space between pole faces which deflect the magnetic particles to one side so that they are collected in a separate receptacle.

823,265. FRAME FOR WINDING ARMATURE COILS; Louis R. R. De Planque and James Biggerstaff, Yonkers, N. Y. App. filed Sept. 14, 1905. Comprises a member having a portion provided with a plurality of steps and a shoulder portion and ears arranged on each of said steps. Has a detachable member adapted to act as a shoulder portion when assembled with the first member.

823,292. RAIL BOND; Edwin W. Robinson, Punxsutawney, Pa. App. filed July 18, 1905. A railway bond having threaded ends projecting through the rail which are received in conical plugs and which may be tightened into engagement with the rails.



823,044.—Multiple Fuse Plug.

823,295. DEVICE FOR CONTROLLING ELECTRICAL CIRCUITS; Edmund O. Schweitzer, Chicago, Ill. App. filed Mar. 26, 1904. A circuit breaker having connection through a fluid therein which expands to break the circuit when heated.

823,301. MAGNETIC SEPARATOR; Frederick T. Snyder, Kansas City, Mo. App. filed Sept. 2, 1902. Details of construction of a separator having an inclined shoot over which the ore is fed, and electromagnets below the shoot, disposed to present an edge of the polefaces diagonally across the bottom of the shoot.

823,302. MAGNETIC SEPARATOR; Frederick T. Snyder, Oak Park, Ill. App. filed Nov. 28, 1902. Relates to another form of construction having a rotary drum with a corrugated or serrated surface.

823,303. MAGNETIC SEPARATOR; Frederick T. Snyder, Oak Park, Ill. App. filed Dec. 1, 1902. A still further modification having certain features of construction slightly changed.

823,304. MAGNETIC SEPARATOR; Frederick T. Snyder, Oak Park, Ill. App. filed Dec. 6, 1902. A form of separator having a central drum and an electromagnet with two pole faces of different areas presented thereto.

823,332. TROLLEY FINDER; William J. Hinton, Danville, Ill. App. filed Aug. 16, 1905. A guide for replacing the wheel upon the wire. The guide has a lever attachment with the trolley cord, whereby it is only raised to operative position when the cord is taut.

823,336. TRANSMITTER-ARM; Herbert L. Knight, Cleveland, O. App. filed July 28, 1905.

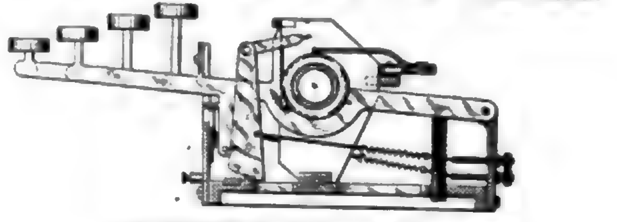
823,402. STATIC VALVE FOR WIRELESS TELEGRAPH SYSTEMS; Lee De Forest, New York, N. Y. App. filed Dec. 9, 1905. Designed to prevent static disturbances of the wireless system by atmospheric electricity. Has an oscillating detector and an electrolytic static valve.

823,435. PROCESS OF TREATING ORGANIC SUBSTANCES IN PRESENCE OF VANADIUM COMPOUNDS; Erich Oppermann, Hochst-on-the-Main, Germany. App. filed Aug. 31, 1904.

823,438. TROLLEY HANGER; Thomas Price, Minneapolis, Minn. App. filed June 5, 1905. The hanger has depending ears to engage the trolley wire and which may be clamped there against by a hollow sleeve and pressed downward thereon.

823,461. INSULATOR PIN; James H. Bullard, Springfield, Mass. App. filed Mar. 29, 1905. The insulator has a metallic bushing therein which is formed to receive a number of steel wires which project from the insulator and form a skeleton support therefor.

823,478. SAFETY SYSTEM FOR MOTOR PROPELLED CARS; John A. Miller, Baltimore, Md. App. filed Nov. 6, 1905. Circuit breakers are organized under the car so as to prevent the completion of the motor circuits until the doors are closed.



823,206.—Telegraph Transmitter.

823,484. ELECTRIC CONDUCTOR UNION; Frederick W. Sorg, Englewood, N. J. App. filed Feb. 21, 1905. A sleeve having a section like the figure 3 which encloses the two wires to be joined and is thereupon twisted so as to hold them properly together.

823,492. MAGNETIC SEPARATOR; Lewis A. Dunham, Kansas City, Mo. App. filed Dec. 8, 1902. A drum has iron sections mechanically separated from one another and energized inductively by passing over a centrally contained electromagnet.

823,494. GUARD FOR MOUTHPIECES OF TELEPHONE-TRANSMITTERS; Gerhardt E. Grimm, Philadelphia, Pa. App. filed May 18, 1906.

823,495. ALTERNATING-CURRENT MOTOR; John O. Heinze, Jr., Lowell, Mass. App. filed May 29, 1905.

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NEW YORK, SATURDAY, JUNE 30, 1906.

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Hands Across to Japan.

Step by step since 1902 the work has gone on of laying the Commercial Cable network in the Pacific Ocean, and it is with great pleasure that we note this week what may be regarded as the natural completion of the enterprise in bringing Japan into the system. President Roosevelt and Emperor Mutsuhito have exchanged felicitations in cordial and appropriate language that expresses their sense of the importance of this link, putting the Tokio office of the company in direct communication with Guam, and thence with the other lines. Japan and the United States have recently become great Pacific powers at the same moment; their relations are intimate and friendly, and this American cable has its rôle to play in the promotion of intercourse between the New World and New Asia.

We can but offer sincere and hearty congratulations to Mr. Clarence Mackay on the patience and skill with which he has thus seen his father's great enterprise in the Pacific Ocean rounded out successfully. Mr. John W. Mackay, to our way of thinking, has never yet been appreciated for the great man he was as a creator of wealth and industries, forceful, fightful, formidable, tenacious of purpose and large-hearted. He has been fortunate in handing on his big schemes and undertakings to competent hands; and America owes the Mackay family much for this addition to its resources of civilization. It is really a fine thing to record that the elder Mackay, despite legislative obstacles, scornful of subsidies, and indifferent even to governmental competition, went ahead bravely in 1902 and launched out undismayed and undeterred on the noblest piece of cable work the world has seen. For the span of cable from San Francisco to the Philippines is 8,000 miles, the depths are the greatest ever encountered, the absence of stations is extreme, and the possibility of financial return has not been excessive. But Mr. Mackay secured the best resources in talent and experience that Europe could furnish, and though his own sudden death intervened, the work went on in the hands of his capable associates, until it is now a grand accomplished task. A brief five years have sufficed to connect this country up with the Sandwich Islands, the Philippines, China and Japan, and in the history of the enterprise not the least important fact to dwell upon will be the celerity with which the 1,065 miles to Honolulu and the 8,000 odd miles to Manila were completed; the speed of laying apparently was accelerated toward the close.

We do not know how many more girdles will be put around the ribs of the world, but other outgrowths of the Mackay system can be readily imagined. For the network that now exists the traffic is said to be larger than was expected; while Oriental intercourse with our Western shores is obviously bound to increase. The perfection of wireless systems has evidently not yet been pushed so far as to deprive cables of business, or to deter capital from investing in such enterprises for fear of inadequate revenues.

Suburban Transportation.

The suburban transportation of our great cities is rapidly becoming electrified, and this summer sees more of electric traction for commuter service than ever; while all the new plans are along the same lines of development. Around New York, as on certain parts of the Long Island system, the benefits are already apparent, and later in the year there is promise of the change on the New York Central system. One of the incidental results has been a real estate boom of unsurpassed proportions and enthusiasm. Some of the prophecies attendant on the boom electricity will undoubtedly enable the seers to fulfill; other extravagant forecasts are beyond the ability of any motive power or body of men to "make good." The main thing is that a large bulk of the city population sees a hope of release from cramped rooms and flats that it had never dare indulge before; and many people are being tempted to consider the desirability of a country home who hitherto were deterred by dislike of stuffy steam travel, smoky tunnels and infrequent trains.

The stuffy steam travel and the smoky tunnels are "going," going rapidly, but many shrewd observers are watching the effect of electricity on the train schedule. One great ability of electric power is that of permitting the traffic manager to make incessant dispatch of smaller units. The bunching and congestion of traffic is thus avoided. The general theory of steam passenger traffic still in vogue has been to crowd all the business into one mass that the locomotive can get away with. We make bold to assert that the present managers of converting steam roads are still mentally subject to the old fetish of the locomotive, and that having found in the "multiple unit" system a substitute that gives them swifter acceleration with all the power to carry the old load, they are working the "multiple unit" for more than it is worth to the passenger. The "multiple unit" is for use rather than abuse, and one of its great neglected merits is its capacity for handling small trains at frequent intervals and high speed. Let us see a little more of that in electric suburban travel.

AMERICAN INDIVIDUALISM.

The members of the Municipal Ownership Committee of the National Civic Federation sent over to investigate the working of municipal plants and public service corporations are having a very nice time in England, and will now be taking a "look in" on the continent for the same purpose. They will bring back some very useful facts and figures with them, for they have been working hard, and some of the plants visited are quite interesting. But while the data will be of common acceptance in all probability, it is more than likely that there will be two sets of reports predicated upon them. The opinions and point of view will remain the same, we think, with all the commissioners, no matter what the data are. Mr. Ingalls pointed this out during the current week at a reception in London to the commission, when he intimated also that even if we had in America what we have not—a large supply of men who can give their time for nothing to public affairs—there would still be the choice to make between the socialism that masks in Europe under the guise of monarchism, or the persistent individualism that drove men to America for freedom of thought and action, and that has won practically all our triumphs. Recent political and economic history in America would indicate that the lawmaking power can preserve the individual, while leaving play for united effort in social and business life.

THE INTERPOLE MOTOR.

At the recent Milwaukee General Meeting of the American Institute of Electrical Engineers, one of the most interesting discussions was on the interpole type of motor, and the participation therein of engineers connected with a half-dozen manufacturing companies served to point out and emphasize that much which is relatively new and of increasing importance is to be expected from the application of that old and well-known device, the commutating pole. By the use of such poles the designer is free to select dimensions without reference to the limitations imposed by commutation; higher rotative speeds may be employed, thus obtaining greater outputs for the same material; and variable speeds may be obtained with ease from motors of both the series-wound and the shunt-wound types. It is difficult to predict the extent to which the commutating pole will be employed. It is safe to assume, however, that it will make itself felt more and more in electric railway and elevator motors and in high-speed turbo-generators, in addition to its present use in machine tools and similar changeable-speed work.

GRAPHICAL TREATMENT OF HIGHER HARMONICS.

On page 1338 Mr. R. E. Hellmund describes an interesting graphical method for determining the current which flows through impedances of different constants when subjected to a non-sinusoidal electromotive force. It is shown that when the complex e.m.f. is impressed upon a pure non-inductive resistance, a pure inductive reactance, or a pure condensive reactance, in each case each harmonic tends to produce a definite component of current just as though the other harmonics were not present. Thus, when such simple circuits are connected in parallel the currents due to the component harmonics can be added vectorially by the method commonly employed with assumed sinusoidal currents. Although the method proposed by the author can be so modified as to include inductive and condensive reactances and resistances in series or in series-parallel, and thereby to correspond more nearly with conditions as they exist, the graphical representation becomes exceedingly involved. Moreover, in any case the method necessitates an accurate resolution of the e.m.f. wave into its component parts. It would seem that the most convenient method for the general problem is the one which assumes the existence of a definite sinusoidal e.m.f. wave of fundamental frequency, with definite third, fifth, etc., harmonics, each wave being treated separately by algebraic methods. The several harmonic currents having been determined, the resultant can be ascertained as the square root of the sum of the squares of the various currents, effective values being used throughout. It is noteworthy that when the several components of currents of each harmonic in pure inductive and non-inductive circuits have been found it is unnecessary to determine the resultant harmonic current due to placing these circuits in parallel, because their squares can be added directly to give the total sum whose square root represents the effective value of the composite current. However, for the combination of currents of the same frequency, and especially for the location of the superposed upper harmonics upon the fundamental of the current wave, the graphical method possesses the advantage of combined simplicity and convenience.

THE TRANSFORMER EFFICIENCY OF TELEPHONIC INDUCTION-COILS.

The alternating-current transformer is not confined to power-distribution circuits. One of its most extensive applications is in the field of telephony. Every subscriber keeps a private induction coil on his premises. The purpose of the transformer in this case is to raise the alternating-current voltage generated by the action of the diaphragm transmitter. The action involved in the telephone transformer is extremely complex. A high voltage is desirable, and so, on that account, is a large ratio of transformation. On the other hand, however, a large ratio of transformation increases the waste of energy in the transformer, and thus, beyond a certain limit, defeats its own object. The secondary winding impedance is an objectionable feature at the receiving end of the line, reducing the strength of the received telephonic currents, both by I^2R and reflection losses. The best transformer for the sending end of the circuit is not, in general, the best for the receiving end. Moreover, as pointed out in the article on this subject by Mr. D. MacL. Therrell, on page 1344, the best transformer for one vocal frequency is not the best for another, so that in composite-frequency speech, a general average of best efficiency has to be sought for. A particular arrangement of circuits is described in the article, somewhat complex in appearance, which it is claimed is particularly advantageous over long-distance aerial telephone circuits. Assuming, however, that the particular disposition described has advantages on long-distance aerial circuits, it remains to be shown that it would also be superior on long-distance underground circuits, both plain and loaded. There is often a long stride between the best conditions possible and the best conditions capable of use in a large telephone system, where every variety of length and character of circuit may be found. It is not to be denied that the efficiency of the telephone transformer is low. It is much easier to criticise this transformer than it is to replace it with a better at a reasonable cost and in such a manner as to be readily incorporable with the large telephone systems of to-day.

Measurement of Feeble High-Frequency Currents.

Along with the development of kiloampere measurement, in the electric distribution of power, goes the measurement of microampere measurement in the electric distribution of ideas, by telephony. The little microampere is just as necessary to the transport of thought and speech in telephony as is the big kiloampere from a large turbo-alternator, to the transport of power. The apparatus needed for the measurements of these widely separated quantities is very different; but the same laws apply to the great as to the small. There is nothing aristocratic about electricity, nor blue blood in the electric fluid. The article this week on page 1341 by Herr Bela Gati on the measurement of very feeble telephonic currents indicates a direction in which we may expect new developments in microampere measurement. He employs the Fessenden solid barretter of minute platinum wire. Commencing with platinum wire ten micrometers in diameter, the finest he could at first obtain in all Europe, he has succeeded in inducing manufacturers to produce wire as fine as half a micrometer, which is about the length of a wave of green light.

Fine platinum wires are of great value in alternating-current measurements. In comparatively larger sizes they are employed to measure a few centiamperes, as in the Cardew voltmeter or the "hot-wire" expansion instruments so useful for switchboard purposes. In the delicate sizes of a few micrometers diameter they are capable of measuring currents of a few microamperes, as in telephony, or in wireless telegraphy. The finer the wire, the greater the care that has to be taken against accidental burn-outs. There is no difficulty in producing such a wire which will fuse at one milliampere, and at the diameter of half a micron, mentioned by Herr Gati, which is less than we have seen used here, the fusing current, *in vacuo*, should be only a fraction of a milliampere.

The Simple Circle Diagram of the Single-Phase Induction Motor.

The article of Dr. A. S. McAllister on page 1339 of this number forms a fitting sequence to his earlier article on the polyphase-motor circle diagram of May 26. It was there shown that from the tests of a polyphase motor both at no-load speed and at standstill, a circle can be quickly plotted, such that the locus of the primary current will conform therewith, for all intermediate loads, within a practically satisfactory degree of approximation. From an inspection of this circle, the behavior of the motor can be satisfactorily predicted at any or all loads. In the present article it is shown that when a polyphase induction motor is compelled to operate as a single-phase machine, by cutting one of the supply wires its current locus is still approximately a circle; but the circle shrinks in diameter about 50 per cent. This means that the losses in the machine will be increased for any given load that the machine can carry, and also that the capability of the machine to carry load will be reduced, or its output diminished, as might be expected. The curious condition is also determined from simple calculations that whereas the speed of a polyphase induction motor, taking synchronous speed as unity, is equal to the secondary efficiency, in the same motor limping along as a single-phaser, the speed is equal to the square root of the secondary efficiency. This proposition must apply to all single-phase induction motors.

It is a very fortunate circumstance that the current diagram of single-phase motors, as well as polyphase motors, may be practically regarded as circular, because the conditions in single-phasers are comparatively complex, and their simplification for engineering purposes is all the more welcome. It is true that we may not expect to have large single-phasers, but we may expect to have a large number of small ones. A single-phase induction motor develops at zero speed a simple alternating or reciprocating magnetic field. By the well-known kinetic analogy this may be regarded as equivalent to a pair of equal pure synchronously rotating magnetic fields revolving in opposite directions. Each of these components will take half the magnetic flux and supporting primary current. At standstill, the rotor is unable to make up its mind which way to turn, or which of the two virtual rotating fields to follow. Any mechanical or magnetic dissymmetry, however, such as an impulse, or an auxiliary condenser circuit, may permit the rotor to make up its mind and to initiate rotation in one or other direction. As soon as the rotor turns, the currents induced therein by the component field that the rotor follows set up an increasingly powerful accelerating torque, while the component that the rotor is running away from sets up parasitic currents that have but little dynamic effect. At full speed, therefore, as Dr. McAllister's diagram indicates, we have the preponderating revolving component or half-field driving the motor, while the other half acts as a virtual leak of definite admittance depending on the speed and placed across the primary terminals. There can be no doubt that the approximation circle diagram gives to alternating-current engineers a distinct benefit in simplifying the behavior of induction motors.

Important Electric Railway Legislation in Massachusetts.

Advices from Boston state that a sweeping bill designed to prevent foreign railroad corporations from purchasing Massachusetts street railway companies and forcing foreign companies to reliquish any such railways which they may control, has come before the Committee on Rules of the House on the question of the admission of the measure for consideration. The bill as drafted would affect particularly the New York, New Haven & Hartford Railroad. The suggested restriction of foreign railroad corporations follows a decisive defeat of the so-called "merger bill," which was pending in the Legislature for some time, and which gave domestic railroad corporations the same privileges to acquire street railway companies as is legally enjoyed by those under foreign charter. The following message was received in the Legislature from Governor Guild on the subject:

"I congratulate you on the defeat of a measure that would have sanctioned the possible consolidation of all transportation in Massachusetts under the control of a single corporation. The present railroad system, however, is most unjust and unequitable. Our steam railroad system is forbidden to meet the competition of electric street car lines by purchase or control of their stock, but another controlled by men who are not citizens of Massachusetts is not only permitted to exercise that privilege, but is exercising it to-day to such an extent that healthy competition in Western Massachusetts is almost throttled.

"Slowly, surely, the control of our own railroads, the control of the passage to market of every product, the control of the transportation to and from his work of every Massachusetts citizen, is passing from our hands to those of aliens. I therefore urge upon you with all the strength that is in me the passage of some legislation giving relief from the grave injustice. Let Massachusetts announce that transportation within her borders is in the future to be controlled by the people of Massachusetts and not by men beyond the reach of her laws and the inspiration of her ideals."

After a conference of various committee chairmen of the House, it was agreed that the Railroad Bill and Governor's message should have a public hearing during the current week.

Chicago Lighting Franchises.

As has been previously noted in these columns, a committee of the Chicago City Council has for some time been drawing up an ordinance providing for the reduction of electric light rates in that city. To aid it in its work, it employed as experts Messrs. Bion J. Arnold and William Carroll to make a report. As a result an ordinance was drawn up providing for several reductions in rates during the next five years. These rates were agreed to by the Chicago Edison and Commonwealth Electric Companies. Along with this ordinance another provision was made for the consolidation of the Chicago Edison Company and the Commonwealth Electric Company, both of which companies are owned by the same interests. The City Council passed this ordinance, but Mayor Dunne vetoed it and the Council has now upheld the veto. The veto of this ordinance, however, will have but little effect on the value of these companies' franchise rights. The Commonwealth Electric Company has a franchise which does not expire until 1947. This franchise covers the entire city. The Chicago Edison Company has a franchise which expires in 1912, at the end of which time its property, according to the present plans, is to be transferred to the Commonwealth Electric Company. The chief reason for the failure of the ordinance to pass over the Mayor's veto seems to have been that some question was raised as to whether some clauses in the ordinance would not give the Commonwealth Electric Company an opportunity to escape the payment of 3 per cent of the gross receipts on certain business upon which they would otherwise have to pay this percentage. The result of the whole matter is that electric lighting rates remain the same in Chicago as they were before, although undoubtedly some other ordinance will be passed later without provision for anything but a reduction of rates.

Work of the Department of Electricity in San Francisco.

A very interesting report covering the work accomplished by the Department of Electricity of San Francisco during April and May has been submitted by Chief William R. Hewitt, to the Fire and Police Commissioners of that city. As the report covers the work of the Department during the fire and immediately after, the following extract is of interest:

"Fees collected April 1 to 18, $586; fees collected from April 18 to June 1, $12.75; inspections of new wiring in buildings, April and May, $1,500; inspections of old buildings, April 18 to June 1, $7,000; certificates issued for new wiring, $90; permits issued to resume current on railway, lighting and telephone routes, April 22 to May 1, $15.

"There were 39 pieces of line trouble removed in April and 28 in May. Alarms of fire received during the month of April were fifty-two firsts, four seconds, one third and eighteen directs, making a total of seventy-five. In May there were only twenty-one firsts, one second, seven thirds, total, 29 alarms of fire.

"Concerning the operations during and immediately following the earthquake and fire I beg to report that on April 18 I arrived at the fire alarm office on Brenham Place at 5.40 o'clock and found it completely wrecked (with the exception of a couple of working lines), the batteries having been thrown to the floor, which was littered with a great deal of glass and covered with water, and the chimney and fireplace had caved in, causing a small blaze, fortunately extinguished before any serious damage was done.

"With the two operators and the lineman on duty I proceeded to re-establish the office—an almost impossible task under the circumstances. Linemen and other employees were soon arriving and several of them were dispatched for horses and wagons with which to haul material from the supply houses for restoring the signal system, while some were detailed clearing and removing fallen brick and debris.

"This work proceeded until about 9 o'clock a.m., when, after a survey of the progress of the fire, I realized the possibility of the central office being burned out with the remainder of the district. Leaving orders to proceed with the work, however, I went to the City Hall to arrange to re-establish connections there if possible. I found the switchboard in the City Hall office entirely unharmed, but with the fire raging, apparently unchecked, immediately south of Market Street.

"On returning to Brenham Place, the fire had made such progress that it was evident our efforts would be useless, and with the wagon and four or five men, I returned to the City Hall to remove the records and such instruments and material as might be necessary in re-establishing our signal office in a new location entirely removed from the reach of the fire; but, unfortunately, we were prevented from entering the building by a guard of Federal troops, who refused to listen to any argument or supplication whatever for the removal of our office, telling us their orders were to permit nobody to enter the building.

"The men with me were then ordered to meet at Brenham Place that afternoon, in order that if the fire had been brought under control we could proceed to restore our system and office. At 2 o'clock the conflagration was so close at hand that, with two linemen, we proceeded to dismantle the office and remove the instruments to Portsmouth square, leaving a sufficient number on the switchboard to enable us to open immediately, after a forlorn hope that the fire might not reach the central office. The conflagration raged in the vicinity of Brenham Place all that evening, and finally burned our central office between 12 and 1 o'clock.

"Thursday and Friday the raging fire made it impossible—in fact, unnecessary—to re-establish any signal system, because the entire Fire Department was fully occupied in battling with the general conflagration.

"Friday night, at 11:30 p. m., a survey of the lines showed that the fire had apparently been brought under control, and all linesmen and other employees who were available were notified to assemble at Lafayette Square the next day at 12 o'clock for re-establishing our system.

"At 10 a. m. Saturday I had secured the quarters of the upper flat at 2034 Steiner Street, and with the men arriving hourly we proceeded to take up the ends of our business and install a central office. Such instruments as we had saved were utilized, and the lines hurriedly run in, and from Saturday evening we were prepared to handle such alarms as might be sent in, and by Monday morning at 8 o'clock the unburned district was practically covered and protected by fire signal service.

"Saturday morning copies of a notice were given to the daily papers to the effect that all alarms of fire could be sent to the telephone company over their available lines, and in turn would be reported to our office across the street, which we would immediately transmit over our tapper lines until such time as our signal lines were in working order, and the Mayor was notified of this action, together with our action in taking 2032 Steiner Street, of which his honor was pleased to approve.

"It was necessary that provision for food, clothing and quarters be made for our men, so a commissary was organized, and by Saturday evening, April 21, we were in a position to supply eighty men with three meals a day—and this was continued until May 10, when the men had had time and opportunity to reestablish their homes.

"In the meantime our signal system had been fully restored in all unburned districts throughout the city, and we have resumed our old order of system and operation. We are to-day rapidly extending the system into the burned district and keeping pace with all reconstruction throughout the city.

"The estimated loss to the department on account of the earthquake and fire amounts to about $177,400, itemized as follows:

Central office at City Hall	$40,000
Damage to underground system	40,000
Overhead construction	35,000
Engine-house equipment	18,500
Fire boxes	16,600
Police boxes	15,000
Central office, Brenham place	7,500
Police station equipment	4,800
Total loss and damage	$177,400

Lighting and Power in San Francisco.

The work of lighting the streets in the burned district of San Francisco is being energetically pushed and within a short time the greater part of the area will be furnished with an adequate system of electric arc lights. On Market Street the San Francisco Gas & Electric Company has strung overhead service wires between the trolley poles of the United Railroads and hung arc lamps on the span wires close to the curb line at every other pole. This work has been completed on the north side of the street, from the ferry to Valencia Street, the construction being but temporary.

Some time before the fire the San Francisco Gas & Electric Company was given the contract for furnishing street lights by the Board of Supervisors, this being a part of the existing schemes being promoted for the beautifying of San Francisco. The corporation agreed to furnish poles of an ornamental design for Market Street, from the ferries to Valencia, and the work was to be done on this one street during the year.

This plan, however, is entirely separate from the proposal of the United Railroads for beautifying the main streets traversed by the lines of their system. After the fire the United Railroads voluntarily offered to furnish the city, free of charge, a system of street lights for Market Street and also Sutter Street. When this voluntary offer was made it was the idea of the railroad company to supply poles of a special design to be selected by the city. They declare that they stand ready to carry out their original plans for supply lights for these two thoroughfares as soon as the more urgent work of re-establishing street car service along such of their lines as were put out of commission by the fire is completed.

When the application of the Presidio and Ferries Railroad Company for a franchise to operate the overhead trolley system over its lines was made recently the question of street lights was brought up by some of the members of the Board of Supervisors, with a view to having this company assist in the establishment of a system of street lights along the lines operated by the company.

The United Railroads is now receiving practically all of its power from the California Gas & Electric Corporation's transmission system. About 18 months ago the corporation closed a contract with the United Railroads to supply all the electric power needed for the operation of the railroad's cars in San Francisco for a period of twenty years, beginning January, 1906. In order to guard against interruption of the service from failure of the long-distance transmission lines the electric company began the erection of a gas-engine plant and power station in Visitacion Valley, just across the city line in San Mateo County. Their plant is designed for 12,000 kw, or sufficient to pick up the entire load on the United Railroads' system within two minutes. It was near completion at the time of the earthquake and fire, the electric company having been granted one or two extensions on its contract, due to the delay in receiving some of the gas engine machinery.

The Visitacion Valley plant, or Martin plant, as it is called after Mr. John Martin, was slightly damaged by the earthquake, but it is being rushed to completion in order to provide sufficient reserve for the street railway peak load and also to ensure an uninterrupted service. Meanwhile the railway load is being carried entirely from the hydro-electric stations.

The general power load of the California Gas & Electric Corporation has not yet been built up to its old proportions in San Francisco, but, on the other hand, the demands for power in all the bay cities have increased very rapidly and the company is having its hands full in providing sufficient capacity for all new consumers.

Electrification of the Erie.

The management of the Erie Railroad, which, with commendable foresight towards a constant betterment and improvement of that immense railroad system, has for the last two years conducted a thorough investigation into the possibilities of electricity as a railway motive power, decided at a recent meeting of the Board of Directors, as already announced in these columns, to take the initial steps for operating electric trains by contracting with Westinghouse, Church, Kerr & Co. for the installation of an electric system on its Rochester & Mount Morris Division, a distance of 35 miles. This decision of the Erie Railroad management seems to be of the greatest importance when the facts are taken into consideration which led up to it. The company's electrical board consists of such eminent engineers as J. M. Graham, B. J. Arnold, L. B. Stillwell and A. M. Williams. Mr. Graham has been on a personal tour of inspection of electric railway systems in this country, as well as in Europe, and there cannot be any doubt that the recommendation of this board in favor of electricity is about as high an approval as electric railway propulsion could ask for. The system which the board of the Erie has decided to adopt is the Westinghouse single-phase alternating-current railway system, the same as is now being installed by the New York, New Haven & Hartford Railroad Company.

The preliminary contract with Westinghouse, Church, Kerr & Co. calls for the electrification of 35 miles of the company's line from Rochester to Mount Morris, the equipment of a transformer station and the installation of seven electric cars. These cars will be operated by single-phase motors, probably four of 150 hp capacity each to one car. The line construction calls for the single-phase catenary trolley system. The cars will be used to haul passengers; there will also be freight cars. The power for the operation of the road is to be obtained from the Niagara Falls power plant.

It has been the custom with many steam roads to allow the paralleling of their lines by trolleys. This had a result which invariably proved costly to the steam road, because the parallel electric road as a rule began by making inroads on the local passenger traffic, then obtained the express traffic, and at last absorbed the local freight. The outcome was that the steam road had to buy out its younger competitor. In the case of the Erie, this is obviated.

Pacific Coast Transmission Convention.

The annual convention of the Pacific Coast Transmission Association was scheduled to be held in San Francisco or vicinity on June 19 to 21. However, the earthquake and fire of April 18 and the resultant conditions have made it inadvisable to call any meeting for this summer. The members of the association are among the most actively engaged in the rebuilding of the city and in carrying on the necessary engineering work incident thereto and it was deemed by the officers that the association would do better to omit this year's convention, or at least postpone it until later in the fall.

An Incident in British Municipal Ownership.

The Newcastle-on-Tyne Electric Supply Company was organized several years ago for the distribution of power in the vicinity of Newcastle-on-Tyne. The company was debarred from supplying current to Newcastle owing to the existence there of a municipal plant, but it has had a remarkably successful career, notwithstanding this handicap. On the other hand, the municipal Tynemouth station has been uniformly unsuccessful from a financial standpoint, and recently the authorities were faced with the necessity of adding additional plant, which, while adding to the investment, would carry with it no corresponding increase in revenue. As a result of this situation, the municipality has just made a contract with the supply company for 1¼ million kilowatt-hours annually of electrical energy at a price less than one-half what it costs the municipal plant to generate its present output. The supply company is also given the right to supply large power consumers within the area of the corporation municipal supply district from sub-stations, the municipality to collect the accounts and retain 5 per cent commission.

Ethics of Engineering Commissions.

In connection with Dr. S. S. Wheeler's fine presidential address before the American Institute of Electrical Engineers on the professional ethics of engineers, the following passage may be quoted from an address by Dr. Rossiter W. Raymond to the graduating class of Lehigh University: "Perhaps the commonest question of casuistry occurring in modern business is that of commissions. As the agent of your employers you have to purchase a steam engine. After getting the prices and inspecting the engines of all the manufacturers you decide upon the machine most suitable, on the whole, for your purpose, and in all legitimate ways beat down the sellers thereof to their lowest price. Just as you are about to close the bargain at the price they say: 'This covers, of course, your commission of 10 per cent.' When you reply that you do not expect any commission and suggest that, instead of paying it to you, they take it from the amount of the bill they send to your employers they tell you that according to some trade agreement they cannot charge a lower price, but can pay a commission to the selling agent. Now, you are not the selling agent, but the purchasing agent, and, explaining this difference to them, you tell them that you will be in honor obliged to pay your employers whatever commission may be paid you. To this they reply, with a kindly but cynical smile, that they do not care what you do with the money after you have got it, and you see clearly that they regard your protestations of honor as part of the formula which precedes your acceptance of the money. They do not really believe that you will not keep it if you get it. I am repeating an episode of my own experience, and perhaps my solution may be of use to you. I declined the commission offered in currency; required it to be put in the form of a check to my order; indorsed that check to the order of my employers and presented it to them, leaving them, if they saw fit, to return it to me as a legitimate perquisite of my position. They did not see fit, and they were quite right. But the most important feature in my action was that the return of the check, thus indorsed by me in their favor, convinced the manufacturers of my honesty as no amount of high toned oratory on my part could have done."

Convention of Canadian Electrical Association.

The Canadian Electrical Association last week had the unusual and novel experience of holding its meeting in the United States. This gathering was the 16th annual event in the history of the association, and it was held at the Cataract-International Hotel, Niagara Falls, N. Y. Owing to the failure to complete the new Clifton House at Canadian Niagara in time for the meeting, the association was forced to meet on the New York side or abandon the pleasure of a trip to Niagara.

The first session of the convention was held Tuesday afternoon in the large old dining room of the Cataract House, President A. A. Wright presiding. Addresses of welcome were made by both Mayor R. P. Slater, of Niagara Falls, Ont., and Mayor O. W. Cutler, of Niagara Falls, N. Y. The official heads of both cities at the Falls agreed that there had been unnecessary alarm created about the Falls of Niagara being destroyed. The electrical engineers were told that their profession was to blame for much of what had been accomplished in the development of power, and they were asked to study the falls carefully and learn for themselves that Niagara is as beautiful as ever. "Tell folks that the Falls are not going to be destroyed," said Mayor Slater, "in our time, or in the lives of our children, but even should they ultimately be lessened in volume, think of the tons of coal and the hours of labor they would save."

After responding briefly to the remarks of the mayors, President Wright delivered his annual address. He drew attention to the action of the Dominion government in sending a number of able and competent gentlemen to Europe to investigate the best methods practiced there for smelting certain grades of ores by electricity. On their return a sufficient sum of money was placed at their disposal by the government to establish an experimental smelting works at Sault Ste. Marie, and the results of these experiments have surpassed the most sanguine expectations. The following are the results as reported by Dr. Maanel himself: First, magnetite can be economically smelted by the electro-thermic process as hematite. Second, ores of high sulphur content not containing manganese can be made into pig iron containing a few thousandths of a per cent of sulphur. Third, the silicon content can be varied as required for the class of pig to be produced. Fourth, charcoal, which can be cheaply produced, from mill refuse or wood, which could not be otherwise utilized, can be substituted for coke as a reducing agent without being briquetted with the ore. Fifth, a ferro-nickel pig can be produced, practically free from sulphur and of fine quality, from wasted nickeliferous pyrrhotite. Sixth, the experiment made with titaniferous iron ore containing 17.82 per cent of titanic acid permits the conclusion that titaniferous iron ores up to perhaps five per cent titanic acid can be successfully treated by the electric process.

President Wright also referred to the bill of the Dominion government for the purpose of controlling the exportation of electrical energy to the United States. No action other than introducing the bill has been taken, and further proceedings have been stayed pending a conference with the Ontario government with the view of having the two governments act in harmony in whatever action they may deem it advisable to take. "Until some real understanding has been arrived at, it will be impossible for us to discuss this matter intelligently, not knowing what the bill may provide for when it is finally completed and passed the House of Commons."

Reference was also made to the radical departure which the Ontario government has taken in appointing what is called "Hydro-Electric Power Commission," which consists of three members whose duties it will be to carry out the government's policy of supplying municipalities with cheap electric power through assisting municipalities interested in acquiring and developing water powers for the purpose of generating electricity for light, heat and power purposes; and to the probability of the Ontario government running the trains on the Temascing Railway by electricity.

The report of Secretary-Treasurer G. H. Mortimer, of Toronto, Ont., showed the amount of cash on hand to be $1,131.47, an increase over the amount on hand a year ago. The number of active members was given as 238, and the number of associate members as 152, making a total of 390. The report closed with this statement: "With the presentation of this, my fifteenth annual report, I beg respectfully to tender my resignation as secretary of the association. This step has been rendered necessary by the demands of my business. I have watched with pleasure the growth of the association from a membership of 25 to a membership of 390. Its position is now assured, and under the guidance of the many bright minds who have its welfare at heart, it will certainly go on to greater accomplishments in the future, keeping step with the wonderful developments of the science it represents."

The first paper read was by V. G. Converse, the subject being, "The Engineering Features of the Plant of the Ontario Power Company." A series of views exhibited by a stereopticon served to explain the paper, which was briefly discussed at the close of Mr. Converse's remarks.

In order that the business before the convention might progress as rapidly as possible, an evening session was held on Tuesday, at which time Mr. F. O. Blackwell read a paper on "Engineering Features of the Plant of the Electrical Development Company of Ontario, Ltd." The same evening Mr. H. W. Buck's paper on "Engineering Features of the Canadian Niagara Power Company's Plant," was heard. Considering the magnitude of the development of the three Canadian companies, it is hardly necessary to record that the members of the association were highly pleased with all the papers treating of the great Niagara power plants.

Attorney Robert McKay, of Toronto, Ont., read a paper on "Legal Points of Interest to Electrical Engineers." Of course, the paper was founded on Canadian law and decisions handed down by Canadian courts, for it is in the Dominion that the association has its interests. It was clear that Mr. McKay had made a very careful study of the laws bearing upon the electrical interests of his country, and the association knew its good fortune in having him meet with them.

Wednesday afternoon the convention went sightseeing. Invitations had been extended to visit the power plants on the Canadian side of the river, and the afternoon was spent in viewing the industrial wonders that have been established in Victoria Park. In the plant of the Ontario Power Company they looked upon the four big generators operated by twin turbines direct connected on horizontal shafts. In the plant of the Canadian Niagara Power Company they saw the generators operated on vertical shafts, and at the works of the Electrical Development Company, of Ontario, Ltd., they paid a visit to the big tunnel that has been driven from the wheel-pit under the river bed to the face of the grand old Horseshoe. The afternoon was replete with pleasure, and each member that made the trip to the Canadian plants has taken back home with him a very good idea of the immensity of Canadian Niagara and its power works.

Mr. John T. Farmer, of Montreal, read a paper on "Steam Plant Accessories" at the session Thursday morning. The executive committee will decide on the place of next meeting, but Montreal was suggested to the committee. The executive committee will name a supervisor of the "Question Box," but the wish of the convention was that Mr. A. A. Dion be continued in charge. Thanks were extended to the power companies that had assisted in making the convention pleasant, as well as to the retiring secretary, Mr. C. H. Mortimer, of Toronto. The election of officers resulted as follows: President, Mr. R. G. Black, Toronto, Ont; first vice-president, Mr. R. S. Kelsch, Montreal, Que.; second vice-president, Mr. W. R. Ryerson, Niagara Falls, Ont.; secretary-treasurer, Mr. T. S. Young, Toronto, Ont.; executive committee, Messrs. James Roberston, Montreal, Que.; A. A. Dion, Ottawa, Ont.; B. F. Reesor, Lindsay, Ont.; Charles B. Hunt, London, Ont.; Louis W. Pratt, Brantford, Ont.; J. J. Wright, Toronto, Ont.; W. Williams, Sarnia, Ont.; Lewis Burran, Quebec; H. O. Fisk, Peterboro, Ont.; J. W. Purcell, Walkerville, Ont.

Among the exhibitors at the convention were the Allis-Chalmers-Bullock, Ltd., of Montreal; the Pittsburgh Transformer Company; the Oneida Community, Ltd.; the Canadian Westinghouse Company. The Canadian General Electric Company was largely represented.

Convention of Railway Telegraph Superintendents.

The twenty-fifth, or "silver" anniversary, convention of the Association of Railway Telegraph Superintendents was held in Denver, Col., June 20 and 21. City Attorney Lindsley, of Denver, in the absence of the mayor, gave a warm welcome to the members of the association and the address was responded to by Secretary Drew.

After the election of several new active and associate members, Mr. Charles Selden, of the Baltimore & Ohio Railroad Company, opened the business of the convention by reading a paper on train order rules, which was discussed.

Mr. U. J. Fry, of Milwaukee, sent a communication to the convention on the subject of "Composite Circuits." In it Mr. Fry stated that the new instruments for this class of service furnished by the American Telephone & Telegraph Company were giving excellent results. In the discussion on this subject Mr. R. L. Logan, of Kansas City, Mo., referred to the value of portable telephone apparatus at "blind sidings." The "howler" type of apparatus, he said, appeared to give the best results, the instruments apparently never getting out of adjustment. Mr. F. H. Van Etten, of Chicago, also spoke favorably of the "howler" apparatus for composite circuits.

Mr. W. J. Camp, of Montreal, stated that he was at present conducting experiments on the lines of the Canadian Pacific Railway with the old style of American Telephone & Telegraph composite instruments and with telegraphone apparatus manufactured at Rochester, N. Y., and stated that he would communicate the results of his investigations to the association at a later date.

Mr. F. F. Fowle, of the American Telephone & Telegraph Company, spoke of the advantages of the new "howler" type of instrument, which he said was efficient, judging from a commercial standpoint. Mr. W. F. Williams, of the Seaboard Air Line, stated that he had several sets of this form of apparatus on his lines and all were giving excellent satisfaction. Some sets were used as often as from 30 to 40 times a day, and the few dry cells necessary to operate the composite service were renewed about every three months. Mr. B. A. Kaiser, of the American Telephone & Telegraph Company, of New York, called attention to the fact that his company had an experimental composite circuit in the convention hall over 100 miles in length, along one of the railroads, for the purpose of demonstrating the efficiency of the latest type of composite apparatus. Mr. E. P. Griffith, of the Erie Railroad, stated that many composite circuits on the Erie Railroad lines had worked successfully for over two years, the longest thus equipped being 82 miles in length.

In the afternoon Mr. W. W. Ryder, of the Burlington system, read a paper on "Increasing Railway Telegraph Facilities." He dealt with the question of economy of arranging the telegraph systems for a large railway and illustrated his points by means of a large map which he had prepared especially for the occasion.

Mr. F. F. Fowle discussed the question of "The Traffic of Railway Communications," showing the method of determining the facilities required for telegraph and telephone communication by the big railway systems. Mr. G. A. Cellar, of the Pennsylvania Railroad, Pittsburg, criticised Mr. Fowle's deductions and gave his experience in dealing with this class of work.

Referring to the subject of composite circuits, Mr. W. B. Glardon, of the National Telegraphone Company, Rochester, N. Y., stated that composite circuits have been expected by many to render as good service as metallic circuits. This was impossible. He referred to the number of telegraphones now in use on various railroads. This statement was evoked in reply to a statement made by Mr. H. C. Hope, of St. Paul, that he had not obtained satisfactory results in the operation of composite circuits. Mr. Hope also stated that his experience convinced him that composite apparatus would not work on circuits composed partially of underground wires or cables.

On the second day, after an executive session, Mr. John L. Davis, of Chicago, addressed the convention on the desirability of formulating uniform rules and regulations governing telegraph departments of railroads. He suggested the appointment of a committee to investigate the matter and report the results to the American Railway Association for its approval. The suggestion was adopted and a committee will be appointed later on to take the matter up.

In the discussion of the subject of pole line construction it was pointed out that formerly 28 to 35 poles to the mile were considered sufficient, but modern construction calls for from 40 to 50 poles, with the result that a more efficient and permanent service is secured.

Mr. E. Parsons, of the Illinois Central Railroad, read a paper on overhead crossings. In the discussion attention was called to the valuable legislative work in the United States and Canada governing the crossing of railroads by foreign telephone, electric light and power wires.

The election of officers resulted as follows: President, E. A. Chenery, of the Missouri Pacific Railway System, St. Louis, Mo.; vice-president, E. P. Griffith, of the Erie Railroad, New York; secretary and treasurer, P. W. Drew, of the Wisconsin Central Railway, Milwaukee, Wis. Atlantic City, N. J., was chosen as the place for the next meeting, which will be held June 19, 1907. After a vote of thanks for the courtesies extended to the members by the railroad, telephone and telegraph companies, the convention adjourned.

A brief account of the exhibits of apparatus in connection with the convention is given below.

The Western Electric Company showed composite and private line telephone apparatus, Mr. W. E. Harkness, of Chicago, being in charge. Samples of the latest railway composite telephones and of the wall, desk and portable "howler" types were shown in practical operation upon a quadruplex circuit between Denver and McCook, a distance of 225 miles.

The Gill telegraph selector, manufactured by the United States Electric Company, New York, was represented by Mr. Edwin R. Gill, who is the inventor of the device.

The American Telephone & Telegraph Company was represented by R. E. Putrick and B. A. Kaiser, of New York; F. F. Fowle and E. G. Francis, of Chicago; N. R. Fill, of St. Louis; George L. Pavy, of Milwaukee; F. A. Morley, Los Angeles; V. B. Minturn, of Kansas City, and John R. McDonald, of Omaha.

Mr. W. S. Burnett, of the Morse Code Signal Company, of Milwaukee, exhibited his signal system in practical operation.

Mr. George W. Conkling, general manager of the Delany Telegraphic Transmitter Company, showed novel devices for the purpose of improving automatically dot-making in telegraphy and affording relief to the transmitting operator.

The National Telegraphone Company, of Rochester, N. Y., had an exhibit of its latest type of composite instruments and its portable "howler" for use in connection with composite telephone sets. Samples of its standard condenser and loud transmitter were also shown. The exhibit was in charge of Mr. W. B. Glardon, assistant general manager and engineer of the company.

The North Electric Company, of Cleveland, showed a line of its magneto telephone equipment, switchboard equipment and linemen's portable compact test sets. Complete magneto switchboards for small exchanges were also shown. The exhibit was in charge of Mr. J. G. Mitchell.

The Sandwich Electric Company, of Sandwich, Ill., exhibited sets of the Sandwich telegraphone. This is a device which provides for a talking circuit on an ordinary telegraph line without interfering with the operation of the Morse telegraph circuit, the two operations being carried on simultaneously.

Messrs. J. H. Bunnell & Co., of New York, distributed an artistically illustrated brochure of the City of Denver, which was eagerly sought by the members and preserved as a souvenir of the convention.

The Railroad Supply Company, of Chicago, was represented by Mr. E. W. Vogel, the company's signal engineer, and by Mr. F. C. Webb, its Denver representative. An exhibit was made of the company's new lightning arrester, which is now being put on the market in two styles, namely, mounted on slate base in one or more units, and an enclosed pattern for outside use. These lightning arresters are built on the choke coil principle. All parts are made extra heavy and are especially designed for railroad lines.

CURRENT NEWS AND NOTES.

GUAM-JAPAN CABLE.—On June 26 cordial greetings were exchanged between President Roosevelt and Mutsuhito, the Emperor of Japan, over the American cable connecting the Island of Guam and Japan, which was recently completed. The President's message, expressing the good-will of the American people and himself, was sent the day before and the Emperor's reply reached Washington on Tuesday. The line is part of the Commercial Cable network in the Pacific.

"THIRD RAIL EYE" is the Boston name for a "complaint" known in New York ever since the elevated roads went into operation. The Boston Elevated Railway Company, by reason of a decision of the Supreme Court rendered this week, may find itself open to local suits arising out of injuries which have been known as "the third rail eye." It has been asserted that many persons have suffered injury to their sight in consequence of particles of metal falling from the elevated structure. In the case before the court the plaintiff got a verdict of $2,000, which the court reduced to $1,000. The defendant filed exceptions, which were overruled by the Supreme Court.

TELEPHONE CONVENTION.—The National Interstate Telephone Convention began at the Auditorium Hotel, Chicago, on June 26. President J. B. Hoge, of Cleveland, said in his address that competition was the only way to reduce telephone rates. "The public never can get reduced rates for telephone service in Chicago or any other city," continued Mr. Hoge, "until there is a competing company. Eleven years ago there were but 300,000 telephones in the United States. To-day there are 5,000,000, and the increase has been brought about by the independent telephone companies, who have 3,000,000 telephones. There are 7,000 operating independent companies and 12,000 exchanges."

ELECTRICITY IN AMERICA.—A book that partakes more of the nature of a report than a description of travel is: "From New York to New York by way of the St. Louis Exposition." It has just been issued by Messrs. J. Holzschuch, Gaston Roux and Andre Silva, whose combined efforts have resulted in a handsome square quarto of 712 pages, profusely illustrated with 800 engravings. The first and smaller part of the book comprises notes of travel as to New York, Chicago and other cities, in their technical aspects. At least two-thirds of the volume, however, is devoted to the electrical exhibits at St. Louis, and the data and views of the apparatus are very full and explicit. While written for foreign readers, there is much in the book of interest to Americans. A few copies—less than half a dozen—at the price of $7, are available at this office. Although in French, it is the first report obtainable in complete form on electrical exhibits at St. Louis in 1904.

AMERICAN INDIVIDUALISM.—The Municipal Ownership Commission of the National Civic Federation of the United States attended a conversazione given in their honor at the Natural History Museum, London, on June 26. Mr. M. E. Ingalls, chairman of the commission, in the course of an interview, said he noted as the most striking feature of British municipal government the number of men of first rate capacity and integrity who were willing to devote their time to civic affairs. Such men in the United States, he said, generally were engaged about their own affairs, and had no time for municipal work, and therefore municipal government in the United States was rarely as good as here. Mr. Ingalls further said that conditions in America were distinctly adverse to municipal ownership, adding: "It does not follow that because we find a system working well here we can immediately transplant it to America. Besides, we find instances, such as gas works, where private companies are doing public work with equal efficiency." Mr. Ingalls observed that it was very curious that monarchical England was tending so strongly toward Socialism, while republican America was still remarkably individualistic.

SMALL TEXTILE MOTORS.—A great increase in the use of small electric motors is noticeable in the textile factories of Plauen, Germany, reports United States Consul Hurst. Of the 2,004 shuttle lace machine establishments, nearly half are driven by electric power.

SIOUX CITY GARBAGE.—A plan is under discussion to utilize the garbage of Sioux City, Ia., to make "denatured alcohol, this in turn driving engines for operating the electric light plant of the municipal building and the public library. The potato peelings and biscuits, chicken bones and apple cores, old rags and cherry seeds will all be boiled up together and converted into power for thousands of electric lights."

SUBMARINE SIGNAL INSTALLATIONS.—The Mersey docks and harbor board, which controls the docks and the approaches to the port of Liverpool, is equipping all four of its pilot boats and both its lighthouse tenders with the submarine signal. The French lighthouse board has authorized the equipment of one of their tenders, and the installation of a submarine bell on the lightship at Sandettie. Steamers making the port of Halifax now get submarine signals from the station at the southwest entrance to that harbor. The equipment of this station consists of two bells.

TELEPHONES IN CHURCH are becoming quite a matter of every-day fact. The latest instance is in Chicago. For the convenience of persons with impaired hearing twelve telephones have been installed in the First Methodist Episcopal Church. Dr. J. P. Brushingham, who for many years has been pastor of the church, believes that this will add to the attendance at the church and take away from many who now plead deafness as their excuse for remaining away from worship their reason for not attending. The telephone receiver will be connected with a large transmitting disk on the pulpit.

SILICON AS A THERMO-ELECTRIC ELEMENT.—In a patent issued June 19 to Mr. H. E. Heath it is stated that silicon may be employed as one element of a thermo-electric couple, and that when thus employed it possesses the advantageous feature of being highly refractory, and thus capable of withstanding high temperature. The silicon member is cast into the form of a rod, and is associated with copper, nickel or the like, as the other member of the couple, the nickel or copper in the form of wire being wound tightly about one end of the silicon rod. It is stated that with a rise in temperature of about 600° Centigrade the e.m.f. of this couple amounts to about .25 volt.

A TELEPHONE DIRECTORY.—What the modern telephone directory means in a large city is not realized by many people. The employes of the New York Telephone Company began the work of delivering the new summer telephone books and collecting the old ones last week. About 200 men are employed for this task, which takes about four weeks to complete, and means the handling of about 800 tons of paper. The new directory contains the names of over a quarter of a million of business houses and individuals. Three hundred and sixty-five thousand books will be distributed. The company has recently issued a very interesting pamphlet that contains all its literature, advertising, etc., in the recent struggle against "duplication" by the admission of one or more competing systems.

FRANCHISES IN WASHINGTON.—Senator Housbrough, has given notice of amendment to the bill making certain changes to street railway tracks in Washington, which will provide that every railway company now authorized by law, or which may hereafter be authorized by law, to operate cars on any of the streets, avenues or highways of the District of Columbia, and all other public service corporations of the District, including the Chesapeake & Potomac Telephone Co., Potomac Electric Lighting & Power Co., the Washington Gaslight Co. and the Georgetown Gaslight Co., shall annually pay to the collector of taxes of the District of Columbia, as a franchise tax, in addition to the taxes now imposed upon them by law, an amount equal to twelve per centum of their respective net earnings.

CIVIC FEDERATION INQUIRY.—A special cable dispatch from London of June 23 says: "The Public Ownership Commission of the National Civic Federation of the United States will conclude a month's investigation of municipal ownership in Great Britain June 30. They have visited all the cities where municipal ownership has developed, and have had every facility placed at their disposal. In some cases the commissioners have examined privately-owned concerns, such as the Norwich street railroads, which they went over to-day. On Monday they will visit the works of the South Metropolitan Gas Company, and the greater part of next week will be spent in London and its vicinity, the programme including, however, a side trip to Bristol. The commissioners have also been invited to attend the sessions of the Institute of Engineers and will lunch with the Lord Mayor, Walter Vaughan Morgan, June 27. As London is inaugurating immense municipal undertakings, principally electric street railroads necessitating generating stations which will be the largest in the world, the American visitors will have their time in the metropolis fully occupied."

ELECTRIC TERMINALS IN NEW YORK.—There has been an idea prevalent that in adopting single-phase traction the New York, New Haven & Hartford Railroad proposed to use the Pennsylvania terminal on Manhattan Island rather than the Grand Central depot. Plans for improving the local terminal facilities of the railroad were laid before the Rapid Transit Commission last week. The railroad applied for a franchise to extend its present four-track system from Woodlawn, approximately 240th Street, to a point near West Farms, so that connection can be made with the line of the Harlem River & Port Chester Railroad, a subsidiary company. By this connection the railroad, when the line is finished, can stop running trains over New York Central tracks from Woodlawn into Grand Central Station, and can instead run over the new extension and then the Port Chester tracks into the Port Morris yards at 129th Street. As the New York Connecting Railroad, when built, will run into the Port Morris yards also, the New Haven trains can be run over that line into the Sunnyside yards in Long Island City, and thence through the Pennsylvania tunnel under the East River and into the Pennsylvania terminal now being constructed between Seventh and Ninth Avenues, Thirty-first and Thirty-third Streets. This is taken to mean that the New Haven road plans to use the Pennsylvania station instead of the Grand Central Station. The Pennsylvania Railroad and the New York, New Haven & Hartford Road jointly own the New York Connecting Railroad, and have close traffic alliances.

COOLING NEW YORK SUBWAY is one of the things now most interesting to Manhattanites. An ammonia refrigerating plant is to be put in the Subway at Times Square. Chief Engineer Rice, in a report to the Rapid Transit Commission last week, said that the Interborough had offered to install and pay for the air-cooling apparatus. The plant will be installed in the sub-subway, that is, beneath the trains. The sub-subway is to be ventilated to the street, so that the ammonia fumes may pass directly to the outside air. There are to be brine tanks and mains to distribute the cold brine to the proper points in the Times Square and Grand Central stations. The chief engineer, after describing the plan, recommended such refrigeration for temporary use, but he said there was too much danger of leakage of anhydrous ammonia to permit of permanent, wholesale refrigeration. Mr. Rice also told of plans for cooling the air at Brooklyn Bridge and Fourteenth Street. He wants to dig four wells into the earth beneath the Bridge station and get ground water and then carry this water in pipes through the station. The cooling and ventilating plant must have four fans with a combined capacity of 150,000 cu. ft. of air a minute, two pipe coolers with surfaces to cool 150,000 cu. ft. of air a minute, and air ducts to distribute the cool air over the platforms. Mr. Rice wants to try an experiment in cooling the Fourteenth Street station in another way, as ground water cannot be obtained there. The details of his plan were not given. The cost of the Brooklyn Bridge and Fourteenth Street experiments will be about $75,000, and the Interborough's refrigerating plant will cost $45,000.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.—The next convention of the Colorado Electric Light, Power and Railway Association will be held at Denver, September 18, 19 and 20, 1906. The programme is now under preparation and will be announced later.

POWER FOR MEMPHIS, TENN.—An act before Congress provides for the construction of locks and dams in the White River in Arkansas. If this permission is obtained it will involve the expenditure of $1,000,000 for transmitting electrical power for commercial purposes to Memphis. Local capital is interested. The transmission would be about a hundred miles.

STATISTICS OF CITIES.—The Bureau of the Census has just published Bulletin 45 giving statistics of 369 cities with a population of from 8,000 to 25,000 each. In these cities there are 189 waterworks owned by the municipality. Only 8 own gas works and 59 own the electric light plants. There were no regular firemen in 63, and in 41 the dependence was entirely on volunteer fire brigades.

LAMPS SMASHED BY HAIL.—A somewhat unusual occurrence was the destruction of large numbers of decorative incandescent lamps by hail at Coney Island during a severe storm on June 23. The hailstones were large and the explosion of the lamps at Luna Park, Dreamland and other places on the electric towers and exposed points made a loud noise heard distinctly above the roar of the storm.

WILL RUN HIS OWN PLANT.—The municipal plant at Tarentum, Pa., makes a minimum charge of $1 per lamp, regardless of the amount of energy consumed. One man whose two bills amounted actually to $1.20 has been charged the $2—"a high-handed robbery of 80 cents," says the local paper, which also states that "this man will put in a dynamo and soon produce his own light." It is a pity every worm does not turn in this courageous manner and install an isolated plant. These haughty managers of private corporations and municipal plants would soon be brought to terms.

ORANGE MOUNTAIN ACCIDENT.—A runaway trolley car on the Orange Mountain Traction Company's line, New Jersey, killed one man outright and injured a dozen more on June 24. The road is an extraordinary steep grade and was formerly cabled. Lately it was decided to adopt electricity with special brakes, employing a tongue that is let down on the surface of the track under the front wheels, blocking the wheels and applying friction directly to the rail. This first car out was going up the hill testing the emergency brake, but broke away backward near the top in some still unexplained manner. The inventor of the brake was among the injured.

WIRES IN SAN FRANCISCO.—Chief W. R. Hewitt, of the Department of Electricity, has reported on the work done in San Francisco for the fire and police departments since the fire. The estimated loss to the department is put by him at $177,400, including the central office at City Hall, $40,0000; damage to underground system, $40,000; damage to overhead construction, $35,000; engine house electrical equipment $18,500; fire boxes, $16,600; police boxes, $15,000; sub-central office, $7,500; police station equipment, $4,800. Mr. Hewitt is to-day rapidly extending the signal system into the burned district, and keeping pace with all the reconstruction in the city.

JAPAN AND WIRELESS.—It is noted from Washington that Mr. Asano, an official of the bureau of communication of Japan, was there last week, and left to attend the conference on wireless telegraphy to be held in London. There is a large delegation from the Japanese government—several naval officers, some civilian employees of the navy department and a representative of the ministry of foreign affairs. The Japanese are among the most important delegates to the wireless conference, having had a great deal of practical experience with naval telegraphy during the Russo-Japanese war. Their views on the subject are awaited with great interest by the other delegates to the convention, and they will have much to say in the settlement of the international questions involved in the new method of communication.

A CAR'S WILD DASH.—According to a special cable dispatch from London of June 23, one of the municipal London trolley cars, filled with passengers, became uncontrollable while going down a hill near the Archway Tavern, Highgate, a spot congested by the traffic of several converging roads. After striking a hearse and other vehicles, the car crashed into a motor omnibus, which it lifted bodily and forced through the front of a store. The damaged car then bounded onward, smashing lamp-posts and narrowly escaping a collision with another street car. Of the passengers on the runway car and motor omnibus, three persons were killed, two others are not expected to recover, twenty were seriously hurt and many sustained slight injuries. It will be interesting to see whether the accident and legal charges get into their proper place in the "operating expenses" of the system.

CARBORUNDUM PRODUCTION.—Mr. J. H. Pratt reports for the U. S. Geological Survey on the production of abrasive materials in 1905. He states that the production of carborundum in 1905 amounted to 5,596,000 pounds, as compared with 7,060,380 pounds in 1904 and 4,759,890 pounds in 1903. There has been a general growth in the carborundum industry for abrasive purposes, and recently another use has been advocated for carborundum, namely, as a refractory material for furnace linings. As the most refractory variety of carborundum is infusible at 7,000°F. and is unaffected by oxygen, ozone, or sulphur at 3,000° F., its use as a refractory material should meet with success and should furnish a market for a considerable quantity of carborundum. The value of carborundum varies from 7 to 10 cents per pound. Mr. Pratt gives the production of alundum or artificial corundum at 3,612,000 pounds, valued at $252,840, an average of 7 cents per pound; as compared with 4,020,000 pounds in 1904.

TANTALUM MINERALS receive special attention in a report by Mr. J. H. Pratt for the U. S. Geological Survey, dealing with the rarer metals now employed in one form or the other for lighting. Three or four instances are cited of the occurrence of tantalum minerals in the United States. Some has recently been discovered at the feldspar quarry of Mr. W. F. Patterson, Jr., at Henryton, Carroll County, Md., about 28 miles from Baltimore. It occurs in irregular masses and rough crystals in the feldspar, and during the past year a considerable amount of this material was encountered in quarrying, but it was all thrown over the dump, as no one realized what the mineral was or its value. A specimen, however, was sent to the Westinghouse Electric Company at Pittsburg, and a partial analysis by its chemist gives 38.19 per cent of tantalic oxide and 13.21 per cent of niobic oxide. On account of the high atomic weight of the tantalum, the molecular ratio of the tantalic acid to the niobic acid is approximately 3.5 to 2. It may be that the material analyzed has a certain amount of feldspar mixed with the tantalum mineral, which would account for the high percentage of silica. Mr. Patterson will have the dump which has accumulated during the past year worked over for the tantalum mineral that has been thrown away, and all of this material henceforth obtained during the quarrying operations will be saved. Near Glastonbury, Conn., an old feldspar quarry is being investigated by Mr. Everett B. Hurlburt, of Glastonbury, as to the quantity of columbite or other tantalum mineral that may be found in this feldspar. Years ago when the quarry was worked for feldspar, there was more or less of this mineral found, but no attempt whatever was made to save it. Some material obtained from Tinton, S. Dak., was concentrated at Portland, Ore., and a heavy black mineral was obtained with cassiterite and scheelite as concentrates from the Wifley table, which, upon analysis, gave 44 per cent of tantalic oxide and 30.5 per cent of niobic oxide, these determinations having been made by Dr. W. F. Hillebrand, of the United States Geological Survey. The specific gravity of the mineral was determined to be 6.8. In 1904 there was a small production of columbite, one of the tantalum minerals, most of which was shipped abroad; and in 1905 the production was still smaller.

Bishop Creek, Cal., Hydro-Electric Power Plant.

By J. D. Galloway.

The hydro-electric power plant of the Nevada Power & Milling Co. is situated on Bishop Creek, Inyo County, Cal., about seven miles from the town of Bishop, and the transmission line extends to Goldfield and Tonopah in Nevada. The first generator was placed in operation in September, 1905, and since then power has been supplied the last-named places. The company owns the local lighting plants of the two cities and thus a portion of the load is the lighting circuits, while the balance is stamp mills and mines. While no unusual features are to be noted in the plant it is deemed of sufficient interest to warrant description.

Bishop Creek lies on the eastern slope of the Sierra Nevadas and, with the exception of Owens River, is the only considerable stream on that side of the mountains for several hundred miles. Its headwaters are in the snow of the highest part of the Sierras, which here reach an altitude of over 14,000 ft. above sea level. The plain of Bishop or the Owens River valley lies at an elevation of about 4,000 ft. The mountains rise abruptly from the plain, and the descent of the stream is correspondingly rapid. Its fall is over 1,000 ft. in two miles. This, so far as the writer knows, is the most favorable location in this respect of any power plant in the West.

Water is taken from the creek at a small diverting dam and conveyed along the mountainside in a wooden stave pipe until it reaches a point above the power house, where it enters a steel pipe that leads to the power house on the creek bank.

The transmission line extends across the valley of the Owens River, then over the White Mountain and across the Nevada Desert to Tonopah Junction, 85 miles. From here the line branches to Tonopah, 18 miles, and to Goldfield, 10 miles, making the total length of line 113 miles. In crossing the White Mountains the line reaches an elevation of over 10,500 ft.

The pipe line commences at the diverting dam, there being no flume. The dam is a small concrete structure supplied with four wasteways provided with flash-boards for regulating the height of water. At the present time the supply of water is ample at all seasons of the year, but with an increase of load it is the intention to enlarge this small reservoir formed by the dam in order that it may act as a regulating reservoir. As the load factor on power plants of this description may vary from 0.7 to 1.0, an average being 0.8, a regulating reservoir at the end of the pipe lines becomes a necessity when using stored water.

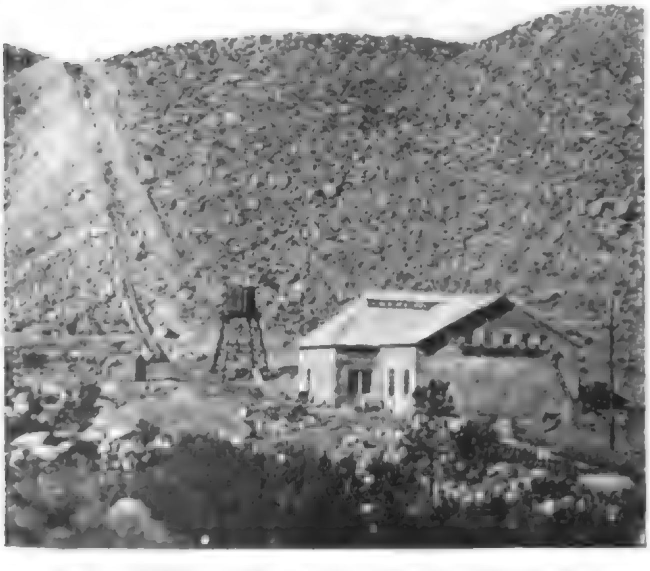


FIG. 1.—GENERAL VIEW OF PIPE LINE AND POWER HOUSE.

Water enters the pipe line through an intake chamber at one side of the dam. A screen is placed at the entrance to this chamber, made of ¼x1½-in. flat iron bars, the vertical bars being placed 2 in. apart and the horizontal bars 1 in. apart. Back of the screen are three timber gates operated vertically by rack and pinion. The wooden pipe enters the intake through the concrete wall, being built into it in place.

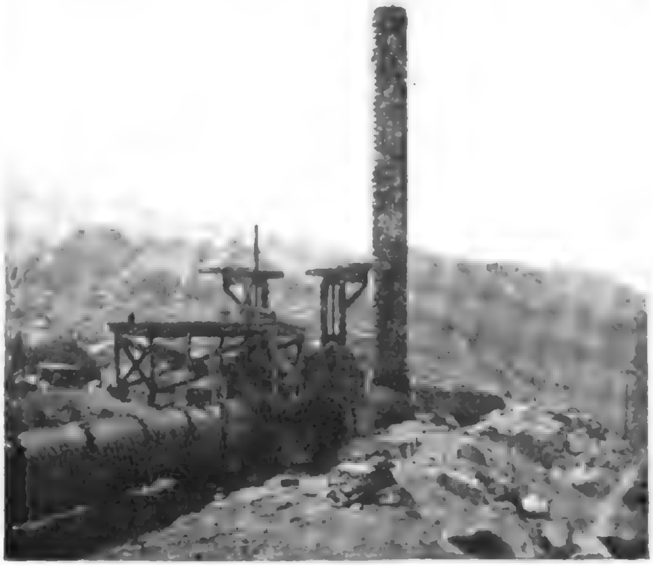


FIG. 2.—GATES AT HEAD OF PIPE LINE.

The pipe line is about 12,000 ft. long, consisting of 6,700 ft. of 42-in. wood-stave pipe, 2,150 ft. of 30-in. wood-stave pipe and 3,150 ft. of 24-in. steel pipe, all diameters being inside measurements. The 42-in. pipe lies on a nearly level grade, the static head at the lower end being about 30 ft. At this point are placed two 30-in. gate valves, one opening into the 30-in. pipe and the other provided for a future line. The 30-in. pipe descends the hill to a point that gives a static head of 265 ft. Here it joins the 24-in. steel pipe which descends a steep hill to the power house, the total static head being 1,068 ft. For about 500 ft. this steel pipe is laid on a slope at an angle of 38 degrees from the horizontal.

The 42-in. pipe is made up of twenty-five staves and the 30-in. pipe of nineteen staves, milled from a 2x6-in. piece. The lumber is red fir from Southern Oregon and the staves were milled there to the proper circle. The bands are of mild steel of circular section ½ in. in diameter with ends upset to ⅝ in. diameter. They were shipped straight and bent to form at the work. The lugs were of cast-iron of a form that allows the ends of the bands to pass each other and be tightened with nuts on each end. When the bands are tightened there is a slight bending of the rods, but this is not believed to be injurious. The ends of the staves were slotted and a 3/16x½-in. compressed paper dowel inserted. When wet this dowel swelled and was very effective in closing leaks.

Bands on the 42-in. pipe were spaced on 6-in. centers, although the pressure did not demand this close spacing. On the 30-in. pipe, which is subject to a considerable pressure, the writer used the pressure due to swelling of wood given by A. L. Adams, 100 lb. per square inch, but in addition to this an allowance was made for initial tension in the rods due to the stress necessary to bring the staves into form. The red fir is a very stiff wood, and by observation it was determined that it was necessary to use 2,100 lb. to bring the staves into position; this was calculated as being distributed along one lineal foot of pipe and distributed among whatever number of bands occurred in that length under different heads. Bands were spaced under these assumptions with a safety factor of four.

The question of initial tension on the rods is believed to be a vital one, as in the case of the stiff lumber used it required much cinching to make the staves come together. As the wood is hard, the bands crush into it but little under pressure and hence there is little relief to the stress. By tests it was determined that, with the wrenches used, an initial tension of 8,000 lb. per square inch could be easily obtained.

The wood pipe is laid directly on the ground, a few sills of culled material being placed at intervals. At points it was covered with earth as a protection from possible rocks rolling down the steep hillsides. The pipe was laid in easy curves, but in one case a curve of 100 ft. radius was made through nearly 90 degrees. For nearly two months the daily amount laid averaged 110 ft.

The wood pipe is provided with two 6-in. and one 30-in. standpipes, the former being of casing and the latter of 30-in. wood pipe. In addition 6-in. air valves are supplied in such number that there is a 6-in. opening every 1,100 ft. On the steel pipe, three 6-in. air valves were placed at the upper end. The material for the wood pipe was mostly hauled to the site on wagons, a minor portion being hauled up from the power house on the tramway used in laying the steel pipe.

The steel pipe is 24 in. inside diameter, of lap welded steel and was furnished by the Pelton Water Wheel Co., agents for the makers, a German firm. It is in three thicknesses, ½, ⅜ and ½ in. The sections are 30 ft. long and the ends are male and female, swelled and of cone shape, so that an angle may be made between sections. The maximum angle turned was 2 deg. 30 min. between two joints. The joints were connected by a single line of rivets, the holes being drilled in the field. The pipe is anchored at intervals by a strap clamped around the pipe and rods, with turnbuckles fastened to bed rock.

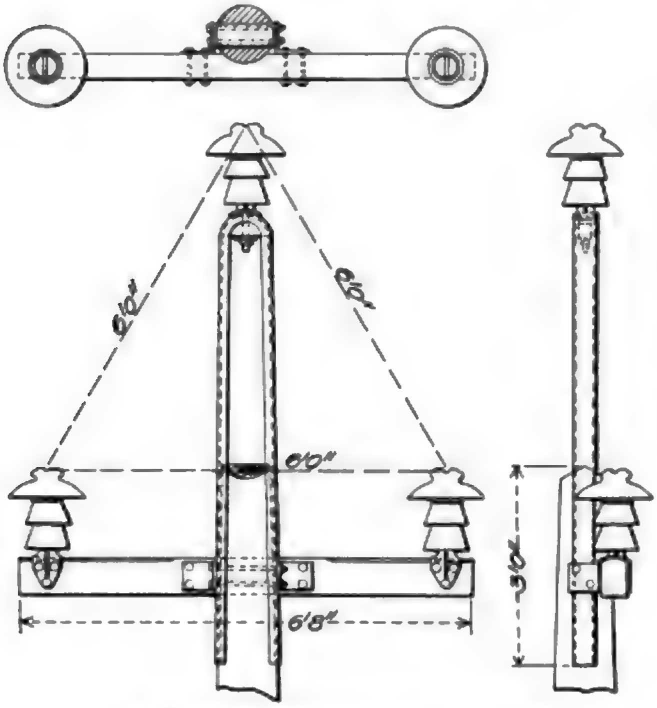


FIG. 3.—PLAN AND ELEVATIONS OF POLE TOPS.

The tramway for raising the pipe from the power house, where it was brought by wagons, was made of discarded narrow-gauge rails and ties laid alongside the pipe trench. The pipe sections were hoisted to place on a single car about 8 ft. long fitted with cables to fasten the joint to the car. The hoisting rope was a single ⅝-in. steel cable, and the hoisting was done by an electric hoist made by the Hendrie & Bolthoff Mfg. & Supply Co., of Denver. This hoist was provided with a friction drum of large size and was very effective in handling the loads. The length of the tramway was about 3,300 ft., and as there were several horizontal curves in the line, the cable was held in place by vertical grooved rollers. Rollers were also provided on the straight sections and no difficulty was had with the car returning to the foot of the hill by gravity. Loads of 5,000 lb. were easily handled.

For drilling and riveting purposes, a compressor operated by an electric motor was provided near the power house and an air-pipe line run to the top of the hill. This line was made of about 500 ft. each of 2-in. and 1½-in. pipe, the remainder being 1-in. This air pipe was provided with connections at intervals, and air drills and air hammers were used on all the work. In laying the pipe, the holes in the female end were drilled in the yard. The section was then taken up on the tramway, laid in place and the male end drilled, after which it was riveted without being disturbed. This gave very tight joints. Progress on this work was slow in the rock trench near the power house, but for a distance of 2,500 ft. the pipe was placed at the rate of 3⅓ joints laid, drilled and riveted per day. The steel pipe has been entirely covered.

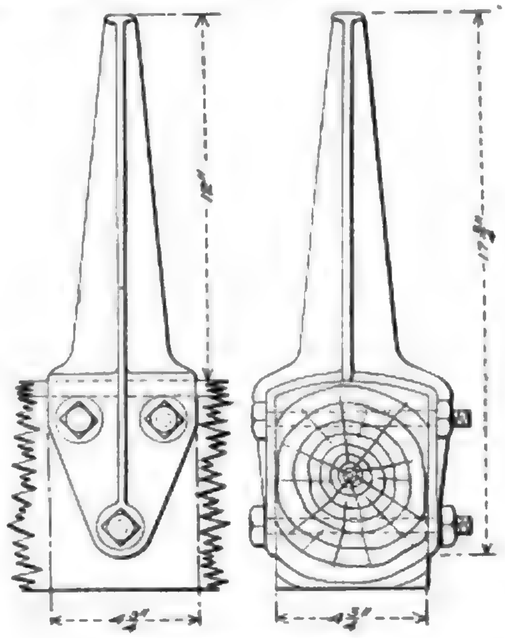


FIG. 4.—INSULATOR PINS.

The power house is a 32x82-ft. concrete building with a 23x52-ft. ell. The roof is of steel, covered with corrugated iron. The main section has a louvre for ventilation. Over the main section is placed a 10-ton, hand-operated traveling crane running on rails supported by reinforced concrete girders of 16 ft. span. The crane was made by the Cyclops Iron Works, of San Francisco. The building, together with the foundations of the machinery and the tail races, rests on a mass of large boulders, bed rock being unknown in the country.

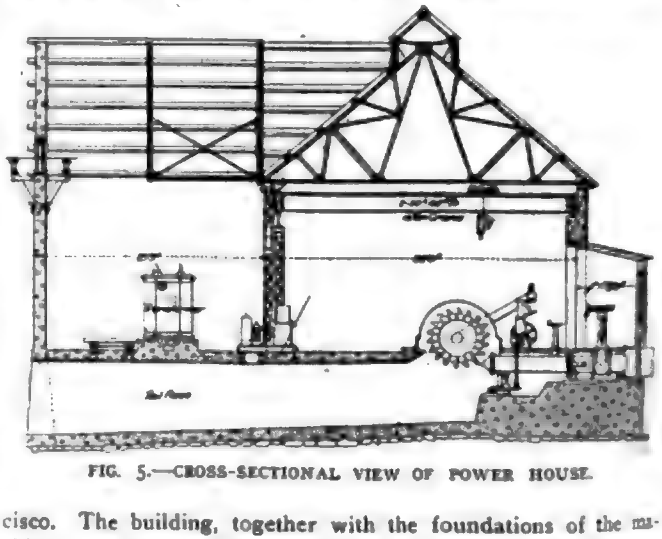


FIG. 5.—CROSS-SECTIONAL VIEW OF POWER HOUSE.

The equipment of the station consists of two 750-kw, 60-cycle, 2,200-volt, three-phase alternating-current generators running at 450 r.p.m. They were made by the National Electric Co. of Milwaukee, the same firm supplying the exciters. In addition there is now being installed a 1,500-kw generator running at 400 r. p. m., supplied by the Allis-Chalmers Co. This generator is shown in the sectional drawing and the location of it and the other machines is shown on the plan. There are two exciters of 60 kw each, delivering current at 140 volts pressure. Both exciters are operated by waterwheels, and in addition, one is provided with an induction motor.

The water wheels for the entire plant were made by the Pelton Water Wheel Co., of San Francisco. The two 750-kw machines have Sturgess governors and the 1,500-kw machine has a type Q Lombard governor. Hand-control mechanism is provided for each wheel. Oil is supplied the governors by two oil pumps operated by water wheels. The generators are of the two-bearing type, the water wheel overhanging the tail race.

From the generators the leads are laid in trenches to the switchboard and transformers. The switchboard is provided with Westinghouse instruments. The transformers, of which there is one spare, are 500-kw, oil-insulated and water-cooled apparatus, as made by the Stanley-G. I. Co. They are placed on pedestals and rest on iron rollers by which they can be removed to a car for repairs.

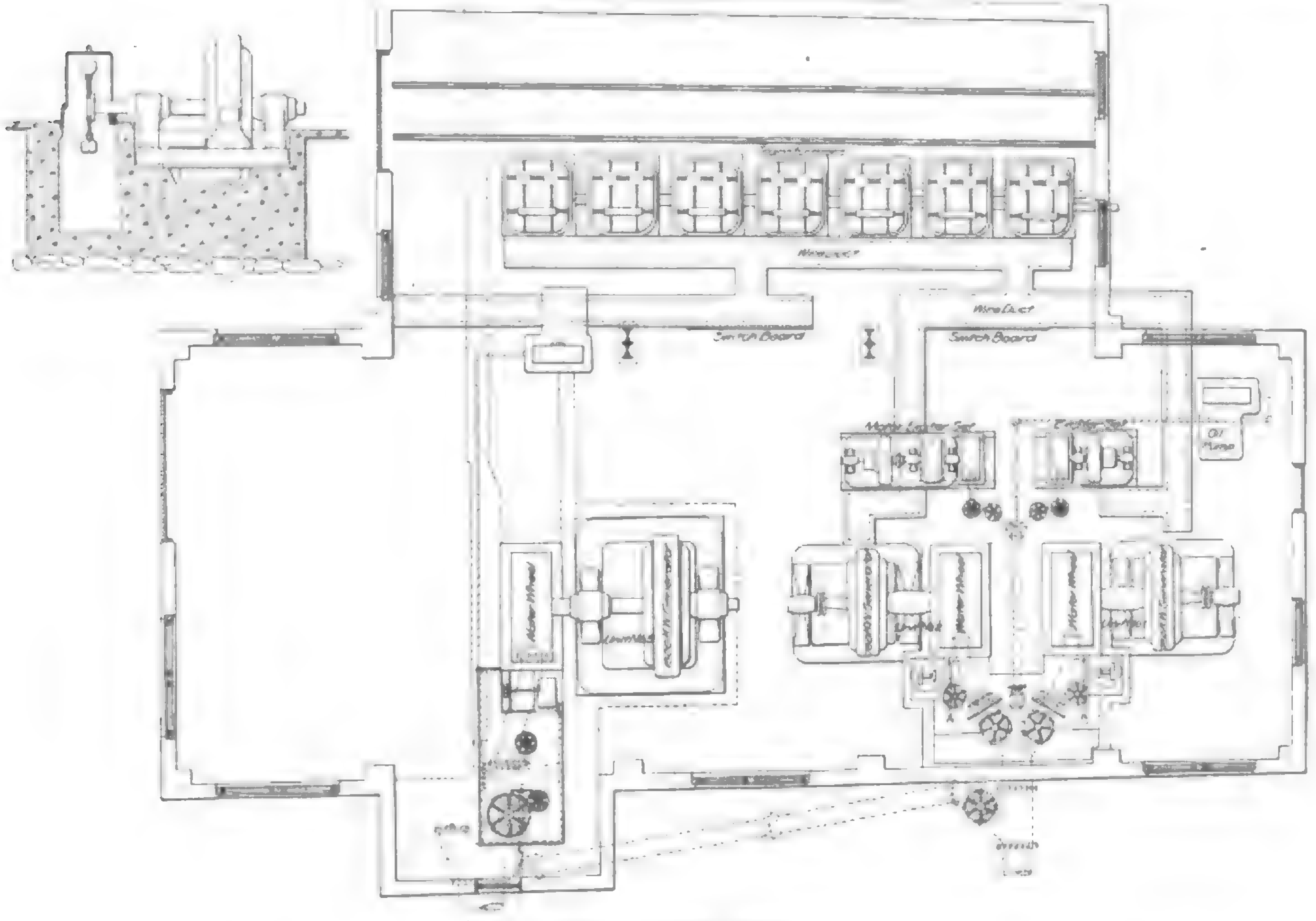


Fig. 6.—Plan of Power House.

The power lines pass the wall of the building through windows of 28-oz. glass in 36-in. square panes, there being two panes to each window, the outer one with a 6-in. opening and the inner one with a 4-in. opening. The line from the power house to Tonopah is of stranded aluminum equivalent to No. 0 copper. From Tonopah Junction to Goldfield the line is No. 2 aluminum stranded. The insulators are four-part porcelain, 14 in. in diameter held on malleable iron pins. The triangle of the wires is equilateral, with 72-in. sides, and the spans are normally 310 ft. On parts of the line near railroads, cedar poles from Oregon were used and in the mountains native timber. The poles were equipped with a steel channel at the top, bent and fastened to the pole with bolts. The channel supports the top insulator.

The building of this line was done under extreme difficulties, due to heat and absence of water on the desert. The cost of watering a horse amounted to 85 cents per day, and this can be appreciated when it is stated that if a four-horse team started on a day's haul, a similar team went along with the necessary water for the two.

A telephone line was built parallel to the power line, but on separate poles, and the wisdom of this has been shown this winter. The line is also practically free from the induction usually found where the telephone line is placed on the power line poles.

A switch station was built at Tonopah Junction and sub-station at Tonopah and Goldfield. They are of stone and each contains three oil-insulated, air-cooled Stanley transformers of 300 kw each. Current is reduced to a pressure of 6,600 volts for local distribution.

The line has been operated at a line pressure of 30,000 volts, but when the demand arises for more power, it will be operated at 50,000 volts by connecting the transformers in star.

The officers of the company are: F. J. Campbell, president; G. G. S. Wood, secretary, and C. M. Hobbs, general manager. The main office is at Denver, but the management of the construction was in the hands of Mr. C. M. Hobbs, at Tonopah and Bishop. Mr. C. O. Poole was consulting engineer on the entire installation of the first two units. R. M. Jones, in conjunction with Mr. Poole, designed and located the plant. The head dam, the pipe trench and a part of the wooden pipe were built under Mr. Jones' supervision. The construction of the remainder of the pipe, together with the building of the power house and the installation of the machinery, was carried out under the supervision of the writer, with Mason Galloway as assistant. The installation of the 1,500-kw generator and wheel is under the charge of the writer. The line construction was under the supervision of L. B. Curtis, with J. B. Balcomb and Charles G. Patrick as assistants. The operation of the power house is in charge of J. W. Todd, as superintendent.

Active work was commenced early in March, 1905, and current was turned on the line on September 17, since which time the plant has been in successful operation.

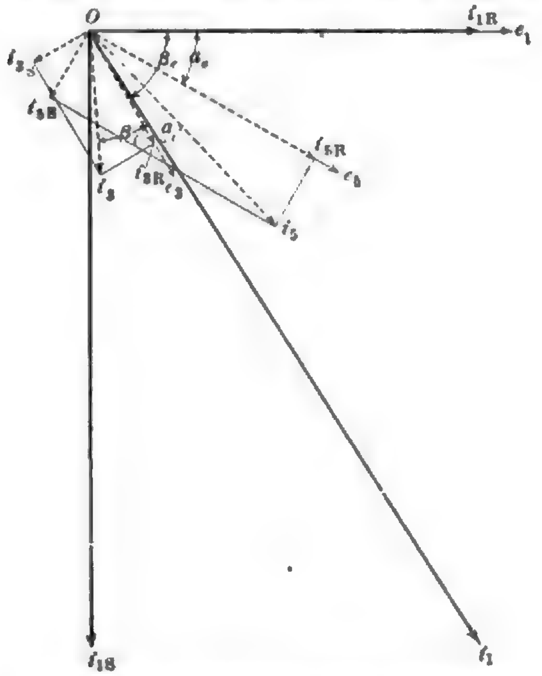
Graphical Treatment of Higher Harmonics.

By R. E. Hellmund.

In the treatment of alternating-current problems it is customary to assume a sine shape for the e.m.f's and currents. There are cases, however, where the difference between the actually impressed wave form and the sine wave is so great that it is necessary to take the real wave form into consideration. In such cases the wave shape of the impressed e.m.f. must be analyzed into its higher harmonics, and the analytical derivation necessary to obtain the desired data, even in simple cases, are so complicated that it requires an enormous amount of time and perseverance to carry them through.

It is believed that the graphical method described below reduces the necessary work considerably. If an e.m.f. having a wave shape containing certain harmonics is impressed upon a pure non-inductive resistance, the current of each harmonic will be in phase with the potential of the same harmonic, and the value for each harmonic may be found separately.

When a similar non-sinusoidal e.m.f. wave is impressed upon a pure inductive reactance, the phase of the current of each harmonic lags 90 behind the phase of the potential of the same harmonic, and the value of the current of each harmonic may likewise be found separately. In this latter case, care must be taken to recognize the increased frequency of the higher harmonics.



GRAPHICAL TREATMENT OF HIGHER HARMONICS.

When a pure non-inductive resistance is connected in parallel with a pure inductive resistance, the resultant value of each harmonic is simply the geometrical sum of the value of the component currents. Therefore, each harmonic may be treated separately by graphic methods, as it is possible and customary with simple sine waves.

For the present case this has been done in the accompanying diagram. The vectors, e_1, e_3 and e_5 represent the amplitudes of the first, third and fifth harmonic of the impressed e.m.f. In phase with them are the non-inductive currents, i_{1r}, i_{3r} and i_{5r} In right angle with the e.m.f. are the inductive currents, i_{1s}, i_{3s} and i_{5s}. As resultant currents for the different harmonics are found the vectors, i_1, i_3 and i_5. It remains now only to read the values of the resultant currents from the assumed current scale. It is comparatively simple to determine from this figure the effective total current, since there are only three components; of course, the shape of the resultant current wave may be also easily derived, also the form factor, etc.

In order to avoid mistakes, it is preferable to use lines of different characteristics for the representation of the different harmonics, as has been done in the illustration, where the amplitudes of the first harmonics are indicated by full lines, those of the third harmonic by lines of long dashes, and those of the fifth harmonic by lines of short dashes. In cases where the amplitudes of the higher harmonics are small in comparison with those of the first harmonic, the scale for the higher harmonics may preferably be taken equal to a multiple of the scale for the first harmonic.

If circuits with capacity enter the problem, similar ways of proceeding may be employed; of course, the currents must be represented in the diagram by leading vectors.

Attention should be called to the fact that in the diagram no graphical addition of currents of different frequencies has been accomplished. All that has been done is a graphical addition of the components of each harmonic separately. It should be noted also that it is not correct to consider the various vectors as representing effective current values as is customary in graphical treatments of single harmonic functions. With sine functions this is admissible, since there is always the same relation between effective and maximum current values; this is, however, not true in case of harmonic waves which are made up of sine functions of different frequencies. It is instructive to recall that the effective value of superposed sinusoidal currents of different frequencies is the square root of the sum of the squares of the effective values of the component currents.

The Estimation of the Temperature Rise of Armatures.

By A. Press.

The methods in vogue of estimating the armature temperature rise give in many cases results differing from actuality as much as 300 per cent either way. Although this great discrepancy is not in many cases reached, the estimation of temperature rises has almost become a standard joke among engineers. As a usual thing no account is taken of sparking at the commutator in the estimation of temperature rises, and further, the relation between the watts per square inch wasted on the commutator per unit peripheral speed and the watts wasted on the armature per unit surface and peripheral speed seems to have been entirely overlooked.

It must appeal to every one that if the temperature rise on the commutator is high, and that on the armature is low, an appreciable amount of the commutator watts will be perforce radiated on the armature by virtue of the high thermal conductivity of the copper that connects the commutator lugs to the armature coil ends. By taking this latter effect into account in a theory of heat distribution, it is possible to estimate the permissible watts per square inch that can be wasted on the armature as a function of the ratio of possible temperature rises on the armature and commutator at certain peripheral speeds.

Let W_c = commutator watts,
C = commutator radiation constant,
W_a = armature watts,
A = armature radiation constant,
B = constant depending on the conductivity of copper,
S_n = available cross-section of coil leads,
T_c = commutator temperature rise,
T_a = armature temperature rise,
D = armature diameter,
D_c = commutator,
$l + 2L$ = armature length of barrel surface; that is, including the axial length of the coil connections.
l_c = commutator face length,
R = revolutions per minute.

Inch units are used throughout.

Now it is obvious that what watts are not radiated from the commutator directly must be radiated by conduction from the armature surface. Expressing these facts analytically we have

$$W_c = C \pi^2 (D_c)^2 l_c R T_c + B S_n (T_c - T_a)$$
$$A \pi^2 D^2 l R T_a = W_a + B S_n (T_c - T_a),$$

or

$$W_c = C\,T_c + B\,(T_c - T_a)$$
$$W_a = A\,T_a - B\,(T_c - T_a)$$

Solving these equations one obtains for $\frac{T_c}{T_a}$ the following:

$$\frac{T_c}{T_a} = \frac{\frac{(A+B)}{(B+C)}\frac{W_c}{W_a} + \frac{B}{C+B}}{\frac{B}{(B+C)}\frac{W_c}{W_a} + 1}$$

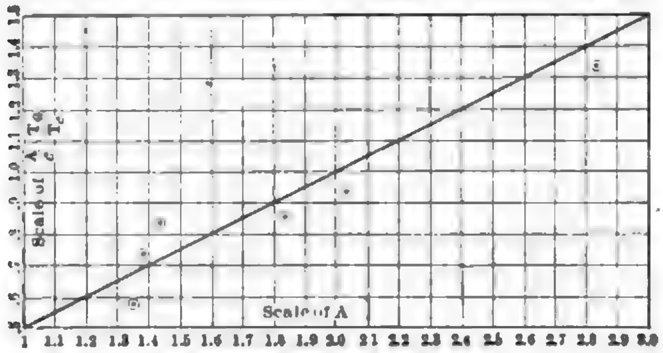
and if B is small compared to A or C,

$$\frac{T_c}{T_a} = \frac{A}{C}\cdot\frac{\dfrac{\textit{Watts per unit of commutator surface per unit}}{\textit{of peripheral speed}}}{\dfrac{\textit{Watts per unit of armature surface per unit}}{\textit{of peripheral speed}}}.$$

or

$$\frac{A}{C}\cdot\frac{T_a}{T_c} = \frac{W_a}{W_c}\left(\frac{D_c}{D}\right)^2 \frac{\textit{Commutator face length}}{\textit{Armature over-all length}}.$$

If now the small exchange of heat units from commutator to armature really affect the final temperature rises, by plotting $\frac{A}{C}\cdot\frac{T_a}{T_c}$ *from its value* $\frac{W_a}{W_c}\left(\frac{D_c}{D}\right)\frac{1_c}{1+2L}$ against the armature watts lost divided by the barrel surface one should obtain consistent results. The accompanying illustration shows actual plotted points for six different machines taken at random.



TEST RESULTS FOR SIX ARMATURES.

The cases taken were those in which the machines showed no excessive sparking. The range of diameters was from 8 to 40 in. The disagreement in the worst case was 17 per cent, whereas calculated by the ordinary theory there would be at least 200 per cent discrepancy in the worst case. The observed commutator temperature rises were in all cases below the estimated value. The discrepancy is due to the quite radical differences possible in the lug ventilation.

It is to be noted that the iron loss and the brush friction loss were calculated in each case; the armature copper loss, the brush I^2R and the temperature rises were observed. The formula used is the following:

$$\frac{\textit{Armature losses}}{\textit{Barrel surface}} = K\,\frac{P_s}{1{,}000},$$

where P_s is the armature peripheral speed in feet per minute and where K is determined by the particular value of $\frac{A}{C}\cdot\frac{T_a}{T_c}$ calculated from $\frac{A}{C}\cdot\frac{T_a}{T_c} = \frac{W_a}{W_c}\left(\frac{D_c}{D}\right)^2\frac{1_c}{1+2L}$.

By a happy coincidence it is seen from the figure that $\frac{A}{C}\cdot\frac{T_a}{T_c}\div A$ is equal to ½. Hence, it follows that the watts per sq. inch of armature surface may be expressed as $W_s = \frac{P_s}{500}\,\frac{A}{C}\,\frac{T_a}{T_c}$ for 40° C.

The estimation of the commutator temperature rises cannot be reduced to the same finality as the armature temperature rises.

Simple Circle Diagram of the Single-Phase Induction Motor.

BY A. S. MCALLISTER.

An article in the issue of the ELECTRICAL WORLD for May 26 gave a description of a simple circular locus of the primary and secondary currents of a polyphase induction motor for determining the complete performance of the machine. The present article shows the method by which a similar diagram may be used with a single-phase induction motor.

The chief difference between a single-phase and a polyphase induction motor resides in the character of the magnetic fields of the two machines. At synchronous speed each machine possesses a true revolving field. At standstill, however, while the magnetic field of the polyphase motor revolves synchronously and is of more or less constant strength, the field of the single-phase machine is unidirectional in space and alternating in value.

If, when the rotor of a polyphase motor is stationary, a circuit be opened so that current flows through only two leads of the machine, it will be found that the total volt-amperes taken by the machine decrease to about one-half of the former value, the power factor being practically unchanged. That the magnetomotive force of the current in each phase winding of a two-phase motor when the rotor is stationary produces a flux which (for constant reluctance of the core) acts as though the flux due to the current in the other winding were not present may be seen at once without proof. It will be appreciated, also, that the currents produced in the secondary by two alternating fluxes which are in electrical space quadrature do not interfere one with the other, so that the current in each primary winding flows just as though the other primary current did not exist. Thus the "equivalent single-phase" starting current of a two-phase motor is just twice that of the same motor when only one phase winding is used; the power factor is the same in the two cases. Both experimental and theoretical investigations show that the "equivalent single-phase" starting current of a three-phase motor is also equal to twice the current which flows through two leads when the third lead is interrupted.

If, when the rotor of a polyphase induction motor is revolving synchronously a primary circuit of the machine be opened, it will be found that the current flowing through the remaining leads increases and that the total volt-amperes taken by the machine remain practically constant, the power factor being practically unaltered. (The power component of the equivalent single-phase current increases to a small extent, while the wattless component decreases slightly.) The action of the machine at synchronous speed is attributable to the continued existence of a revolving magnetic field of practically constant strength which requires a definite component of current in phase with the voltage to supply the losses and another component in quadrature with the voltage to supply the "quadrature watts" for excitation. A subsequent article will explain the distribution of current in the secondary conductors, and will show in what manner the "quadrature watts" for the "speed field" are supplied by the primary exciting magnetomotive force.

When the rotor of a polyphase motor is revolving synchronously, the secondary current has a negligible value. In the single-phase motor, however, the secondary current at synchronous speed has a value such that its magnetomotive force produces in electrical space quadrature with the main alternating field through the primary coil, a field which is equal in value and in time quadrature with the main field. The value of the main field is determined by the primary e.m.f. just as is true in any transformer, while the field which is in quadrature both in time and in space therewith depends for its value both upon the

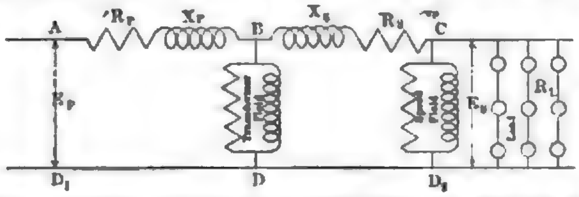


FIG. 1.—PRACTICALLY EXACT REPRESENTATION OF CIRCUITS OF A SINGLE-PHASE INDUCTION MOTOR.

"transformer field" and upon the speed of the rotor; the two fields are equal in effective value at synchronous speed, and at other speeds the "speed field" is equal to the "transformer field" multiplied by the speed, synchronous speed being taken as unity. Thus the "speed-field" component of the secondary current varies with the speed and is zero at standstill.

The circuits of a single-phase induction motor can be represented with a fair degree of accuracy if the primary and secondary resistances and the leakage reactances be arranged as shown in Fig. 1, the "transformer field" and "speed field" exciting circuits being connected as indicated. The current taken by the load and that used to produce the "speed field" pass through both the primary and the secondary coils, while the current required for the "transformer field" flows through only the primary coil. When the load circuit is opened, that is, at synchronous speed, the "speed field" current and the "transformer field" current are practically equal in value. When the resistance of the load circuit is zero, that is, at standstill, the "speed field" current is zero, and the current which flows through the coils of the machine acts as though the "speed field" circuit were not present. It is to be noted especially that the decrease in the "speed field" current below the value of the "transformer field" current is attributable to the variation of the rotor speed from synchronism and not to the drop in voltage across the secondary winding, which is caused by the load current. The "secondary load" current flows in electrical space quadrature to the "speed field" current, and the two currents in no way interfere with each other. The statements just made relate exclusively to the current whose magnetomotive force produces the "speed field," which current, on account of its electrical space position, does not react in any way upon the "transformer field." The secondary carries also another component of current in addition to the load current. The time-phase position and the electrical space positions of this component are such that its magnetomotive force tends directly to decrease the "transformer field"; thus, it acts like a "wattless" secondary current. It is this latter component of secondary current which is represented in the circuit diagram of Fig. 1. This component bears to the actual "speed field" current (approximately) the ratio of the actual rotor speed to the synchronous speed. Thus the voltage impressed upon the "speed field" circuit of Fig. 1 is (approximately) equal to that impressed upon the "transformer field" circuit multiplied by the square of the speed, synchronism being taken as unity. These facts will be discussed more fully in a subsequent article.

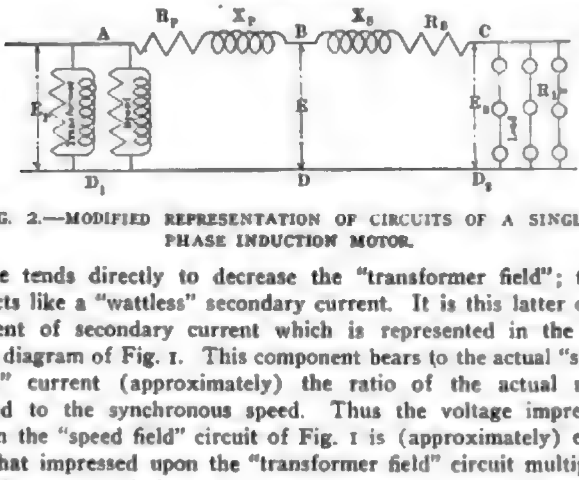


FIG. 2.—MODIFIED REPRESENTATION OF CIRCUITS OF A SINGLE-PHASE INDUCTION MOTOR.

Although it is possible to construct primary and secondary current loci based on the circuits shown in Fig. 1, the problem of dealing with the value and phase positions of the currents is greatly simplified without involving a detrimental loss of accuracy by using the modified arrangement of circuits indicated in Fig. 2.

The current diagram for the circuits shown in Fig. 2 is given in Fig. 3, where MN is the power and ON the wattless component of the primary current at synchronous no load, while FI is the power component and IM the wattless component of the primary current at standstill. The curve $OPFK$ is an arc of a circle having its center on the line ON prolonged. OL is the "speed field" current (assumed constant in the diagram, but properly accounted for in the computations). LM is the "transformer field" current, while OM is the total primary current at synchronism.

The line FI drawn perpendicular to MTI represents the total loss of the machine at standstill—the proper scale being used. HI indicates the so-called "constant" losses, while FH shows the sum of the "added" primary and secondary copper losses. If the distance GH be laid off to represent accurately the easily determinable "added" primary copper loss, then FG shows the "added" secondary copper loss. Straight lines being drawn to join the point F and the point G with O, of Fig. 3, if from any point P on the circular arc, $OPFK$, a perpendicular be dropped to the line MI the following values may be taken at once from the diagram:

OP is the "added" component of the primary current.
OP is also the "added" component of the secondary current.
PL is the total secondary current.
PM is the total primary current
$\cos EMP$ is the power factor.
$PT \div PM$ is the power factor,
ST is the "constant" losses of the machine,
RS is the "added" primary copper loss,
RT is the total primary losses (including "speed field" excitation current loss in secondary),
QR is the "added" secondary copper loss,
QT is the total losses of the machine,
PT is the input to the machine,
QP is the output.
$QP \div PT$ is the efficiency,
PR is the total input to the secondary (excluding the "speed field" excitation current loss).
$(PQ \div PR)^{1/2}$ is the speed with synchronism as unity.
$(PQ \times PR)^{1/2}$ is the torque in synchronous watts.

The representation of each of the quantities listed above, with the exception of the speed and the torque, will be appreciated at once from a comparison of Fig. 2 with Fig. 3, combined with a review of the article in the issue for May 26.

The speed and the torque can be ascertained in an extremely simple manner as follows: The "speed field" is under any chosen condition equal to the "transformer field" multiplied by the speed. Now the torque is proportional to the product of the "speed field" and that component of the secondary current which is in time phase with it and which crosses the core at the same mechanical position along the air-gap as that occupied by the "speed field." This component of the secondary current is in time quadrature with the "transformer field," and it has a value such that its product with the primary e.m.f. (for a unity ratio machine) represents the total power received by the secondary—exclusive of the loss due to the secondary excitation current. A little study will show that if the "speed field" were equal to the "transformer field," the torque in "synchronous watts" would be equal to the secondary input (excluding the excitation loss). Since the "speed field" varies directly with the speed, it is seen at once that the torque, D, is equal to the secondary input, W_s, multiplied by the speed, S. Thus,

$$D = S\,W_s. \qquad (1)$$

The torque is also equal to the output W_o, divided by the speed; therefore,

$$D = W_o \div S; \qquad (2)$$

hence,

$$S = (W_o \div W_s)^{1/2}. \qquad (3)$$

That is to say, *in a single-phase induction motor the speed is equal to the square root of the secondary efficiency.* When the speed varies only a few per cent from synchronism the slip is equal to one-half of the secondary loss expressed in per cent, as was pointed out by Mr. B. A. Behrend on page 884 of the issue of the ELECTRICAL WORLD AND ENGINEER for December 8, 1900. Thus at a speed of .98 the secondary efficiency is .9604; the slip is .02; the loss is .0396. It is interesting to observe in this connection that in a polyphase induction motor the speed is equal directly to the secondary efficiency.

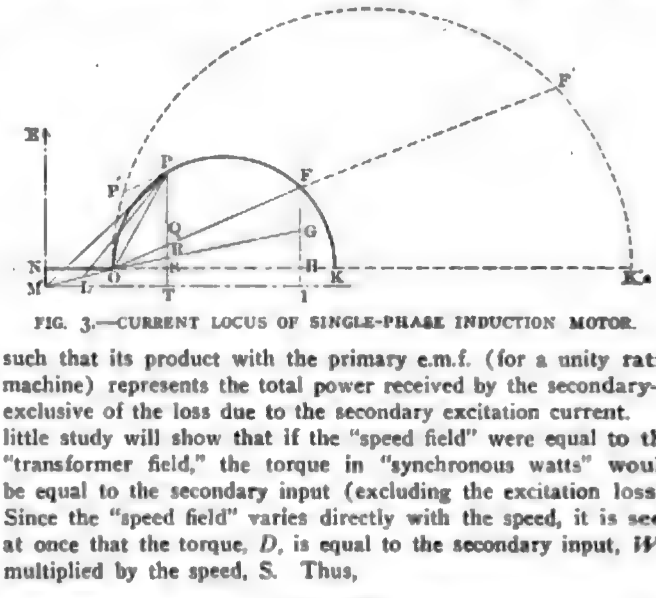


FIG. 3.—CURRENT LOCUS OF SINGLE-PHASE INDUCTION MOTOR.

Combining equations (1) and (3) above, it is found that the torque has the following value:

$$D = (W_o \times W_s)^{1/2}. \qquad (4)$$

That is to say, the torque is equal to $(PQ \times PR)^{1/2}$, from Fig. 3, as used above.

It is especially worthy of note that the speed and torque as here determined are not affected by the substitution of the modified circuits of Fig. 2 for the more nearly exact circuits of Fig. 1. The method here outlined gives correct results both at synchronism and at standstill, and at other intermediate speeds the slight errors introduced are of both positive and negative values, and they tend to cancel in the final results.

On account of the fact that at speeds below synchronism there is a slight decrease in the "transformer-field" current and a large decrease in the "speed-field" current (as it reacts upon the primary), while Fig. 2 assumes both of these currents to be constant, the operating power factor of a single-phase motor is somewhat greater than that shown in Fig. 3. The discrepancy is appreciable only in those cases where the "synchronous no load" current is large in comprison with the starting current. Thus Fig. 3 gives the power factor accurately for large motors, but small motors will show better power factors than there indicated.

It is instructive to compare the performance of a certain polyphase motor, when operated normally, with that of the same machine when used as a single-phase motor. Using "equivalent single-phase" quantities throughout, the polyphase starting current of the motor whose single-phase circle diagram is shown by the arc *O P F K* in Fig. 3, would be represented by the line *M F F'* (not completely drawn) having a length equal to twice that of the line *M F* (not drawn). The polyphase current locus is a circle passing through *F'* and *O*, its center being on the line *O N* prolonged. If the machine is operated as a single-phase motor at a certain primary current, such as shown by *M P* in Fig. 3, the output is *P Q*, as noted above. If the same output is to be obtained when the machine is operated polyphase, then the "equivalent single-phase" value of the polyphase current will be *M P'* (not drawn), the line *P P'* being (practically) parallel with the line *O F*. Thus the volt-amperes input as a single-phase machine is greater than as a polyphase machine in the ratio of *M P* to *M P'*, and the power factor is less in the ratio of *cos E M P* to *E M P'*; the losses are greater.

Although the circular diagram as developed above is applicable to all types of single-phase induction motors, the comparison just made refers exclusively to polyphase motors and the same motors used on single-phase circuits. The comparison between single-phase and polyphase machines is not quite so unfavorable to the former when each machine is designed primarily for its particular work. When a polyphase motor is operated as a single-phase machine, only a portion of the primary copper is fully employed; evidently a greater output can be obtained by altering the interconnections of the coils so as to use all of the copper.

With an induction motor having uniformly distributed coils, when the iron is subjected to the same magnetic density and frequency, and the same current density is used in the copper, the output varies largely with the groupings of the coils. Thus it may be shown that with such a motor the volt-ampere input can be represented, relatively, by the periphery of a polygon having sides equal in number to the number of groups per pair of poles, of which polygon the circumscribing circle represents the volt-ampere input for infinite groups, and double the diameter represents the input to the single-phase motor. Giving to the diameter of the circumscribing circle an arbitrary value of unity, the inputs to the machine for various groupings of coils are as follows:

No. of groups.	Type of machine.	Volt-ampere input.
2	Single-phase	2.000
3	Three-phase	2.598
4	Four-phase (Two-phase)	2.828
6	Six-phase (Three phase)	3.000

Since the coils of commercial two-phase induction motors are grouped similarly to those of a four-phase machine and the coils of a three-phase motor are arranged similarly to those of a six-phase machine, a three-phase motor has a volt-ampere input 1.061 times that of a two-phase motor (on the basis of equality of losses), while the volt-ampere input of a single-phase motor is .707 times that of an equivalent two-phase machine. The further discussion of these relations is beyond the scope of the present article.

Measurement of Feeble High-Frequency Currents.

By Bela Gati.

Among the various methods which have been proposed for measuring feeble high-frequency currents, those of Duddell and Kennelly are, perhaps, the most interesting. According to the description of the Duddell thermo-galvanometers, in using a heater having a resistance of 13,910 ohms a deflection of 250 mm. at a scale distance of one meter is obtained with a current of 31 micro-amperes, while a heater having 18 ohms resistance required 800 micro-amperes to give the same deflections.

A heater with a large resistance can be advantageously used to measure voltage. Thus in Fig. 1 the voltage at the end or beginning of the lines can be determined if the current through the shunted resistance, *A B*, is measured. Let this current be I_s micro-ampere, the resistance, R; the voltage at *A B*, $E_s = I_s R$. If $E_s = 0.1$ volt = 100,000, 10^{-6} = 100,000 microvolts; and if $R = 10.000$ ohm, then $I_s = 10.10^{-6}$ = 10 micro-ampere, which can readily be measured. It might seem at the first glance that the shunting does not correspond to conditions in practice, but it can be shown that the shunting of 1,000 ohms would be sufficient, especially in long-distance telephony, to represent the real practical conditions.

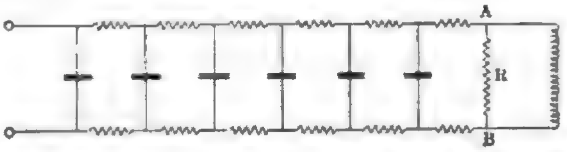


FIG. 1.—ARRANGEMENT FOR DETERMINING VOLTAGE BY MEANS OF SHUNTED RESISTANCE.

Similar results may be obtained by heating a series of Rubens thermo-elements with a Duddell heater, and measuring the current of the thermo-battery by means of a sensitive galvanometer. The sensitiveness of the latter arrangement, however, seems not to be equal to that of the Duddell thermo-galvanometer.

Better results are secured by employing Fessenden solid barretters, the use of which for telephone currents Kennelly described in a paper read before the recent International Electrical Congress. Kennelly places a condenser between the transmitting line and the barretter set, and measures the current strength at the end of the line. He determines from this current strength and from the e.m.f. measured in the beginning of the line the receiving end impedance, and from this receiving end impedance deduces the condition of the line (Fig. 2).

This system can be employed very successfully for testing a line, but care must be exercised if incorrect deductions are to be avoided. For instance, if the frequency is varied and the current is measured at the end of the line, the results obtained may not indicate the actual condition. It should be remembered that the strength of the telephonic current varies from point to point along the line, and that the form of the current wave varies with the frequency employed. If at a certain frequency a maximum current is noted in the measuring instrument, it is evident that at another frequency the current would not be maximum, but it would have some smaller value.

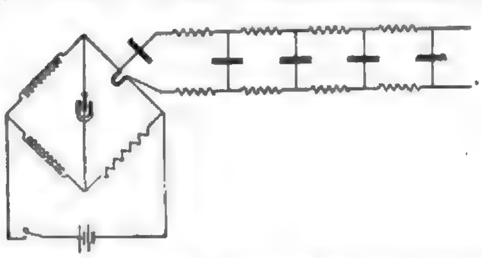


FIG. 2.—ARRANGEMENT FOR DETERMINING THE RECEIVING-END IMPEDANCE.

Fig. 3 shows the relation between the current strength and the frequency, as obtained in the loaded line from Wien to Innsbruck, when all or one-half of the applied Pupin coils were in circuit. Assuming the curves to be correct, it appears that the high-frequency currents are very much weakened, but telephonic experiments do not justify this conclusion.

In order to obtain acceptable results, it is necessary to make measurements both at the end and at the beginning of the line of the strength, the e.m.f. and the power of the telephonic talking current; or, what is equivalent, instead of the power the lag between the current and e.m.f. may be noted. These measurements can be made very simply by the use of the three-ammeter method, of which Fig. 4 shows the principle, while Fig. 5 indicates the arrangements in detail.

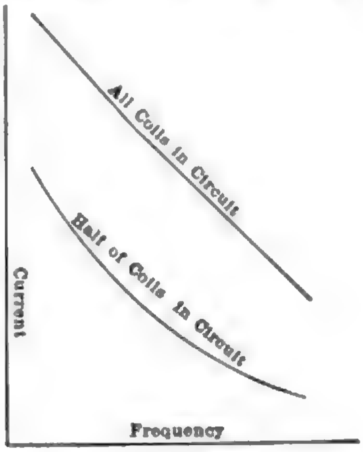


FIG. 3.—VARIATION OF CURRENT WITH FREQUENCY.

The power consumed in coil T is $E_2 I_2 \cos \phi$. The power in coil T and barreter set III is $E_3 I_3 \cos \phi$. In the barreter set of Fig. 5 only the barreter consumes alternating power because the inductive resistances used are so high, in relation to the barreter resistance, that the alternating current flows only through the barreter. The barreter resistance is practically non-inductive, and, therefore, the current is in phase with the e.m.f. $E_3 I_3 \cos \phi$ is to be calculated by means of the three-ammeter method, $R/2 \, (I_1^2 - I_2^2 - I_3^2) = E_3 I_3 \cos \phi$, where R is the non-inductive resistance, R I_1 I_2 I_3, are measured, and, therefore, $\cos \phi$ may be found from the expression $\frac{E_3 I_3}{E_2 I_2} \cos \phi - \cos \phi$ To get the power in coil T from $E_3 I_3 \cos \phi$ there must be subtracted the power consumed in the barreter. This power is in most cases very small, so that it may be neglected. By means of these measured and estimated data, it is possible to calculate the effective (ohmic) resistance, effective inductivity and capacity, and also the "conductance."

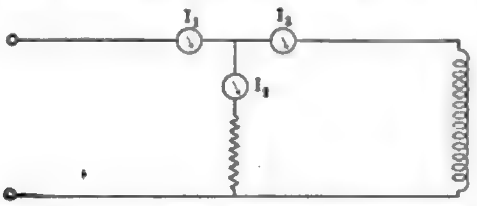


FIG. 4.—THREE-AMMETER METHOD OF MEASURING POWER.

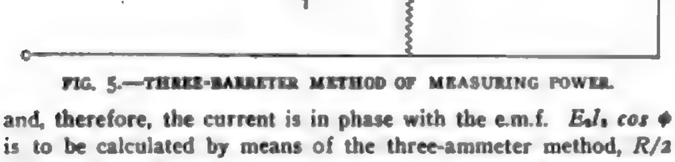


FIG. 5.—THREE-BARRETER METHOD OF MEASURING POWER.

Kennelly indicates in the above-mentioned paper that a current as small as ⅖ micro-ampere may be measured. This value is sufficiently small for telephonic currents, but in wireless telegraphy and in supermarine experiments it is necessary to obtain a greater sensitiveness. It seems desirable, therefore, to discuss the means by which the sensitiveness may be increased.

The barreter is made from a very thin platinum wire. Wires having a diameter less than 20 micrometers may be manufactured and handled only when they are covered with some other metal which can subsequently easily be dissolved. The platinum wire is ordinarily covered with silver. When the experiments of the author were begun no wire smaller than 10 micrometers in diameter could be obtained in Europe. Recently, however, the writer has stretched wires to reduce them to about 5 micrometers in thickness. Lately a platinum manufacturer, incited by American results, has also conducted some experiments, and he now makes wires 0.5 micrometer thick, and it does not seem impossible to make wires with 0.1 micrometer diameter.

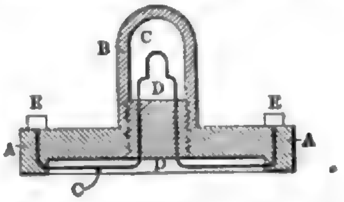


FIG. 6.—CROSS-SECTION OF BARRETER.

The dissolving of the silver from a three-micrometer wire is not difficult. Moreover, it is not necessary to use wires as thin as those above-mentioned, because with thin wires it is impossible to use large measuring currents in bridge branches, as the barreter will be burned. When the galvanometer receives the smaller current it will not be so sensitive. Fig. 6 shows the barreter in the form used in the writer's laboratory in Budapest. A A is a fibre plate, B a fibre capsule, D an ebonite stopper with screws, C are the barreter wires and E the terminals.

In Fig. 7 the barreter is placed in branch 2-2 of the Wheatstone bridge, in which is also placed a milliammeter. The branch 4-4 contains the resistances needful for preserving the balance of the bridge, together with a slide wire resistance. 1-1 and 3-3 branches have 1,000-ohm resistances with great inductivity, having iron cores and covered with iron wires. In the branches 6-6 is the battery having a small resistance; in branch 5-5 there is placed a reflecting galvanometer of great sensitiveness provided with shunts and having a small ohmic and a large inductive resistance. The bridge is placed in such a way that when the reading is about 2 milliamperes on the ammeter, the galvanometer does not show any deflection. Since the resistance 1-1 and 3-3 are equal for all strengths of the current, the resistance of 4-4 must be equal to that of 2-2 if the galvanometer deflection is to be zero. As shown in Fig. 8, there is connected to the barreter set, I, the resistance of the current source and the set II combined with set III. It is necessary to change the resistance in branch 4-4 till the galvanometer does not show a deflection. The barreter having about 20 ohms, the resistance, R, 1,000 ohms, and the coil of the current source about 1,000 ohms; if the resistance of the coil, T, is not too small it will be unnecessary to make a large change in the resistance of the branch 4-4

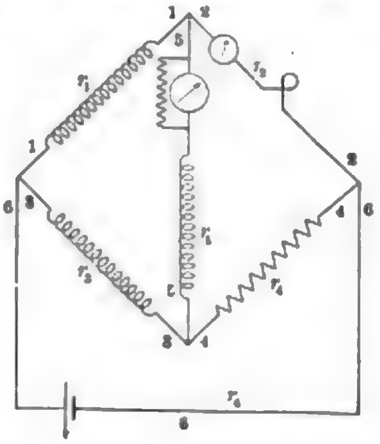


FIG. 7.—ARRANGEMENT OF SINGLE BARRETER SET.

To estimate the sensitiveness, it is necessary to know the current in the galvanometer branch. This current is i_5, where

$$i_5 = \frac{B\ (r_2 r_3 - r_1 r_4)}{N},$$

where r_1, r_2, r_3, r_4, r_5, r_6 are the resistance in the respective branches, and B is the e.m.f. in branch 6-6, while N is an expression for the sum of five terms; that is,

$$\begin{aligned} N = {} & r_5 r_6 (r_1 + r_2 + r_3 + r_4) \\ & + r_5 (r_1 + r_3)\ (r_2 + r_4) \\ & + r_6 (r_1 + r_2)\ (r_3 + r_4) \\ & + r_1 r_2 (r_3 + r_4) + r_3 r_4 (r_1 + r_2) \end{aligned}$$

Since the value of i_5 depends upon seven variables, it is difficult to obtain a simple expression for its maximum. It is to be noted, however, that i_5 increases as r_5 and r_6 are decreased. The barreter resistance should be a minimum, so that the power consumed by the barreter may be very small and practically negligible.

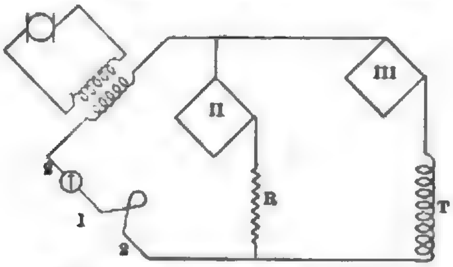


FIG. 8.—COMBINATION OF BARRETER SETS.

In dissolving the silver from the platinum wire, at the first dipping into nitric acid, a resistance of 20 ohms is ordinarily obtained. Now, r_4 is also about 20 ohms, while r_1 and r_2 can be made as large as desired. For instance, if the increase in barreter resistance, r_3, caused by the superposed alternating current is 0.01 ohm, then the final value of r_3 is 20.01, 20 ohms being the resistance without the superposed current; the resistance of r_4 remains 20 ohms, the temperature coefficient of the manganin wire being low and therefore negligible. When $r_1 = r_2 = 1{,}000$ ohms the coefficient of B in the equation above is $(1{,}000 \times 20.01) - (1{,}000 \times 20) = (20{,}010 - 20{,}000) = 10$; if $r_1 = r_2 = 100{,}000$, the coefficient will be $(2{,}001{,}000 - 2{,}000{,}000) = 1{,}000$; that is, it will be 100 times larger than the above. However, i_5 does not increase 100 times, because N also increases with an increase of r_1 and r_2. With an increase of r_1 and r_2 it is necessary to use a larger e.m.f. in the battery in order that the same current may circulate in the barreter branch. With a larger battery e.m.f., i_5 will also be larger.

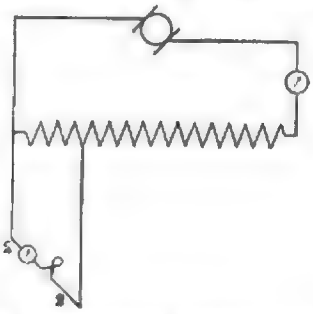


FIG. 9.—TEST TO DETERMINE RESISTANCE OF BARRETER.

It is necessary to know just what value of alternating current corresponds to each increase in the resistance of the barreter. To test this the connections shown in Fig. 9 may be used. Through the barreter is passed a current the strength of which can be accurately measured by means of precision transformers or the like. Since proper equipment was not obtainable it was found necessary to calibrate the instrument with direct current, assuming that the increase in resistance was the same with either alternating or direct current. For this purpose the impressed e.m.f. was increased in branch 6-6 (Fig. 7). The current through 2-2 became stronger and the change in the resistance of the barreter was noted. For instance, 1 milliampere increase gave 190 deflections. To return the galvanometer to the zero point, the resistance in branches 4-4 was changed. The deflection was diminished by 60° by a change of 0.1 ohm. The curve is shown in Fig. 10. The adjacent points are located on a straight line, and if, for instance, points 1 and 2 are found, point 3 between 1 and 2, or near 1 or 2 can be located. Each division on the milliammeter scale represented 0.1 milliampere; for more accurate measurement it is possible to use a galvanometer shunted with low resistance, the shunt being put in series with the barreter.

In measuring telephonic talking currents the galvanometer in the branch 5-5 (Fig. 7) will have a very rapid motion. The increasing and decreasing of the barreter resistance is almost momentary, and therefore the spot of light from the mirror is in constant motion. If the galvanometer is properly damped it is possible to avoid these variations, which might otherwise render the accurate reading of the deflection impossible.

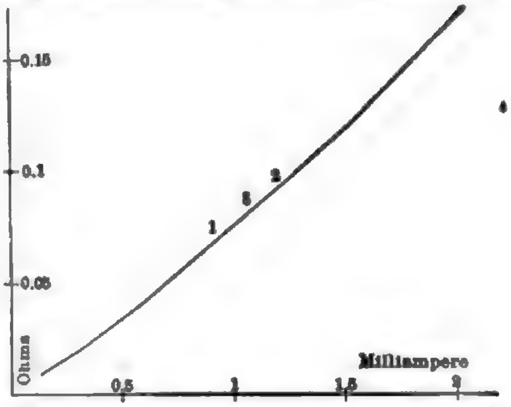


FIG. 10.—RELATION BETWEEN RESISTANCE AND CURRENT.

The method outlined above does not require a special source of current, and any type of high-frequency generator may be employed. Since a Wheatstone bridge set is to be found in every laboratory, it is evident that high-frequency investigations can easily be made.

The Resistivity Temperature-Coefficient of Copper.

By Dr. A. E. Kennelly.

It is now generally admitted that a conductor of good commercial copper increases uniformly in resistance with uniform increase in temperature, or follows a straight-line law of resistance with respect to temperature between 0° and 100° C. The temperature coefficient of copper resistivity is taken by the American Institute of Electrical Engineers as 0.42 per cent per degree Centigrade with reference to the value at zero Centigrade,* as represented in the accompanying figure, or in accordance with the formula

$$\frac{R_t}{R_0} = 1 + 0.0042\,t, \qquad (1)$$

where R_0 is the resistance of the conductor at zero Centigrade, and R_t the resistance at $t°$ C.

If we take a winding of copper, such as a dynamo armature, and, commencing with resistance R_t, at a room temperature $t°$C., allow it to be warmed by electric current to a final resistance, $R_{t+\theta}$, at a certain temperature elevation $\theta°$ C., i. e., at a final temperature $(t+\theta)°$ C., we have from (1):

$$\frac{R_{t+\theta}}{R_0} = 1 + 0.0042\ (t + \theta) \qquad (2)$$

The two equations, (1) and (2), permit the temperature elevation, $\theta°$, to be determined having given $R_{t+\theta}$ and R_t. For example, we may find from (1) the resistance, R_0, which the winding would offer at 0° C., and then inserting this value in

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*See Standarization Rules of the American Institute of Electrical Engineers.

(2) we may find $(t+\theta)$ and thus the temperature elevation, θ.

It is the object of this article to show that a much shorter and simpler computation can be made with the aid of the subjoined table, using the single formula:

$$\frac{R_{t+\theta}}{R_t} = 1 + a\theta, \qquad (3)$$

where a is a temperature coefficient varying with the initial temperature, t, and which becomes 0.0042, as in (1), when $t = 0$. We have in fact the following values of the temperature coefficient approximately:

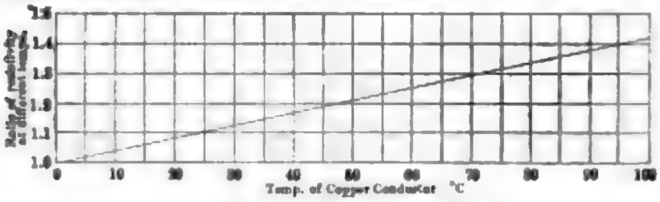
when $t = 0°$ C.	$a = 0.0042$
6°	0.0041
12°	0.0040
18°	0.0039
25°	0.0038
32°	0.0037
40°	0.0036
48°	0.0035

In the following table the coefficient a is multiplied by 100, or appears at its percentage value:

TABLE OF TEMPERATURE COEFFICIENTS OF RESISTIVITY IN GOOD COMMERCIAL COPPER AT DIFFERENT INITIAL TEMPERATURES CENTIGRADE.

Initial temperature °C. t	Temp. coefficient. in percentage per degree Cent. $a \times 10^2$	Initial temperature °C. t	Temp. coefficient. in percentage per degree Cent. $a \times 10^2$
0	0.4200	26	0.3786
1	0.4182	27	0.3772
2	0.4165	28	0.3758
3	0.4148	29	0.3744
4	0.4131	30	0.3730
5	0.4114	31	0.3716
6	0.4097	32	0.3702
7	0.4080	33	0.3689
8	0.4063	34	0.3675
9	0.4047	35	0.3662
10	0.4031	36	0.3648
11	0.4015	37	0.3635
12	0.3999	38	0.3622
13	0.3983	39	0.3609
14	0.3967	40	0.3596
15	0.3951	41	0.3583
16	0.3936	42	0.3570
17	0.3920	43	0.3557
18	0.3905	44	0.3545
19	0.3890	45	0.3532
20	0.3875	46	0.3520
21	0.3860	47	0.3508
22	0.3845	48	0.3495
23	0.3830	49	0.3483
24	0.3815	50	0.3471
25	0.3801		

As an example of the use of the above table, suppose that a dynamo armature winding has a resistance of 0.23 ohm at an initial room temperature, $t = 25°$ C., and after carrying a load increases its resistance to, say, 0.271 ohm. What is the temperature elevation?



CURVE OF TEMPERATURE COEFFICIENT.

The increase in resistance, being in the ratio $\frac{0.271}{0.23} = 1.1783$, is 17.83 per cent. The tabular temperature coefficient for the initial temperature of 25° C. is 0.3801 per cent. Consequently, the temperature elevation, $\theta = \frac{17.83}{0.3801} = 46.9°$ C.

Example 2.—A copper wire has a resistance of 400 ohms at 11° C. What will be its resistance at 55° C.?

The tabular temperature coefficient for 11° C. is 0.4015 per cent per degree C. The temperature elevation is 55° − 11° = 44°. The increase of resistance will be 44 × 0.4015 = 17.67 per cent, or in the ratio 1.1767. The final resistance will thus be 400 × 1.1767 = 470.68 ohms.

The use of the table will, it is believed, distinctly simplify all winding temperature computations.

Transformer Efficiency of Telephonic Induction Coils, as Related to Long Distance Transmission.

BY D. MACL. THERRELL.

IN the transmission of a simple electrical wave over a conductor of great length characterized by high resistance, electrostatic capacity and conductive leakages, the power lost or dissipated is proportional to and expressible in simple terms of the reactive constants of the system, and there is no distortion of the wave form.

Such, however, is not the case for a complex electrical wave composed of a plurality of co-existing waves such as those involved in the telephonic transmission of the human voice, which are composed of a prime or fundamental and an ascending series of partials corresponding to the overtones, of articulation and quality. These characteristics are, however, far from being responsible for the limitations of present long-distance telephonic transmission.

While conceding that great losses are properly chargeable to the dissipation in the main line conductors, owing to their electrical characteristics as outlined above, special researches by the writer have shown that, in so far as long aerial lines are concerned, operating under actual conditions—which may be called existing meteorological conditions—little, if anything, of average and permanent value is to be obtained by a tuning or adjustment of the line constants, but that much may be gained by improving the methods and apparatus in use for the electrical transformation and transmission of the primary power equivalents of the voice.

In the art of telephony there is used a primary circuit including a variable resistance in relation to a diaphragm, a source of electrical energy and the primary winding of an induction coil or transformer. The primary current being of the variable or pulsating type is capable of transformation by means of an induction coil or transformer, the primary of which is included in circuit with the ordinary variable resistance and source of energy, while the secondary is connected into the main line. By this means it is possible, even with the small current to which we are restricted by the transmitter, to so step up the voltage impressed upon the main lines as to reach over relatively vast distances. But in saying this it must be admitted that such results speak far more for the sensitiveness of the receiver than for the efficiency of transformation or transmission. For, though ordinarily we may have flowing in the primary circuit something like .3 of an ampere, the maximum value of the current impressed upon the main line, on long circuits, is not more than .0001 of an ampere, for the lowest frequency with a far greater loss in transformation for the higher frequencies.

In order to successfully effect the long-distance transmission of speech, the prime requisite is an increased power efficiency of the system for each and every frequency involved, and particularly for such frequencies as correspond to the overtones or speech characteristics, if the speech so transmitted is to be satisfactorily intelligible.

Long-distance transmission of telephonic currents make it necessary to raise the line potential by transformation. There is, however, a limit in thus obtaining the necessary main line potential beyond which we may not go, and wherein much is lost to telephony. To throw light on this point, it is well to consider briefly the secondary e.m.f. as produced in a transformer.

If there were no impedance voltage losses in the transformer, the secondary e.m.f. would be equal to the primary e.m.f. multiplied by the ratio of transformation. When the secondary carries current, however, the internal secondary e.m.f. is much reduced from this apparent value. Where the magnetic leakage is small, the secondary current on short-circuit has a value represented by the equation

$$I_2 = \frac{\frac{t_2}{t_1} E_1}{R_2 + \left(\frac{t_2}{t_1}\right)^2 R_1},$$

where I, E, R and t represent the current e.m.f. resistance and turns, respectively, the subscripts referring to primary or secondary quantities as indicated.

This equation shows the limitations of transformation for effective secondary potential. Furthermore, it not only shows that the apparent secondary potential must be divided by the secondary impedance, but that the primary resistance is a factor transferred to the secondary, and that the transformation ratio is also a factor in the divisor which increases as the square, while the secondary resistance increases directly. To illustrate, consider a transformer in which $t_1 = 400$, $t_2 = 2{,}400$, $R_2 = 60$ ohms. From the equation we would get a certain secondary current. Suppose the secondary turns, t_2, to be doubled, or made 4,800, what would be the result? It is admitted that we should obtain a secondary potential on open circuit of twice the original value, but since we have increased the secondary resistance to 120 ohms, and the square of the transformation ratio from 36 to 144, it is readily seen by substitution that insofar as secondary current on short-circuit is concerned, we have lost by the operation. This is one reason why telephonic transformers have not been operated on a transformation ratio beyond a certain moderate value.

Another reason is that a high transformation ratio has heretofore meant high secondary impedance, which resulted in a greater drop of potential across the secondary terminals, than across the receiver terminals, considering the receiving station or terminal of the circuit. This not only reduces the effective current through the receiver and thereby impairs the transmission, but it seriously interferes with the voice harmonics or overtones, as a result of wave reflection and dissymmetry of wave propagation, due to the position of the secondary impedance in relation to the receiver in the circuit. And, it is well known by telephone engineers that by shunting out the secondary of the high-potential coils, the efficiency of the receiver is raised by 50 per cent or more.

Having the problem stated, consider now the proposition of controlling the apparent primary self-induction, and rendering it independent of the secondary or line current. This can be done by the use of capacity in series in the primary circuit, whereby the apparent primary self-induction may be wholly or partially neutralized for any desired frequency, thus greatly increasing the primary current and thereby the secondary current in the main line.

The condition of perfect neutralization is possible only when

$2\pi f L - \frac{1}{2\pi f C} =$ zero, for any given period or frequency. For any periodicity above or below this, the two values will not cancel, and perfect resonance will not obtain.

The writer has found, however, that when a circuit is made resonant for any particular frequency, say, 250 p.p.s., the effects are experienced by all frequencies above 250, but in a gradually decreasing value.

One numerical example will be considered for the purpose of illustration. Assume a primary circuit including an induction, or transmitter coil, of the following constants:

$R_1 = .5$ ohm,
R_1 external $= 9.5$ ohm,
$L_1 = .022$ henry,
$E_1 = 10$ volts.

From the curves of Fig. 1 it will be seen that this circuit and coil, listed therein as circuit No. 4, offers an impedance of about 34 ohms to a current of 250 p.p.s., and that for a frequency of about 750 p.p.s. the impedance is more than 103 ohms.

Fig. 2 shows a series of curves of current resulting from the impedance in the circuits shown in Fig. 1 corresponding to the circuits and constants given, under the impressed e.m.f. of 10 volts. Thus, in Fig. 2, circuit 4, it is seen that for an impedance of 34 ohms $= \sqrt{R^2 + (2\pi f L)^2}$, and a frequency of $f = 250$, we get only .29 amp., while for 750 p.p.s. we get .097 amp. This is upon the assumption of the secondary being on a line of 8,000 ohms, or approaching open circuit.

Let us introduce into the primary a capacity, C. The primary impedance is then determined by the equation

$$I_m = \sqrt{R^2 + \left(2\pi f L - \frac{1}{2\pi f C}\right)^2}$$

Assuming $f = 250$ p.p.s., and that $2\pi f L - \frac{1}{2\pi f C} = 0$, then the reactance reduces to zero and the current rises to the value given by $I = \frac{E}{R}$. In the case under consideration this neutralization is obtained by a capacity of approximately 18 microfarads and the primary current rises from .29 amp. to 1 amp. as a result of this capacity in the circuit. Reference to Fig. 2 will also show that for a frequency of 750 p.p.s. the current resulting from the partial resonance amounts to .108 amp., against .097 amp. for the same circuit without the capacity; thus indicating clearly the benefits of primary resonance for telephonic currents, even where the circuit is attuned, or syntonized to but one frequency. Now, we may divide the primary circuit into a plurality of circuits, and include in each branch the primary of an induction coil, together with the capacity necessary to tune it for any given frequency, as illustrated in Fig. 1 wherein the current values for identical circuits—with R and L constants the same in each—are shown for different periodicities, without capacity, and with the circuits tuned for the frequencies of 250 p.p.s., 375 p.p.s. and 500 p.p.s., respectively.

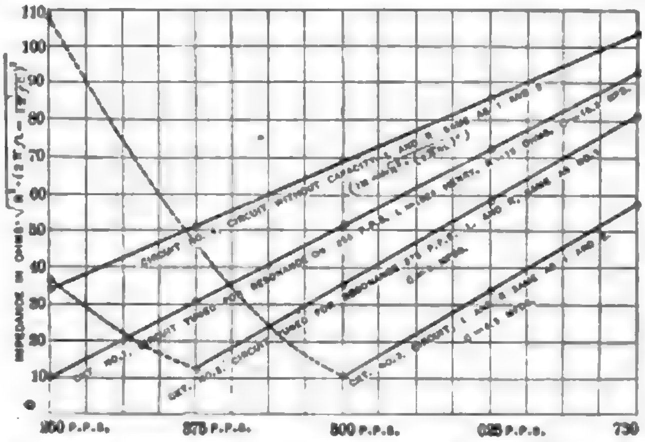


FIG. 1.—IMPEDANCE AT VARIOUS FREQUENCIES OF A CIRCUIT, CONTAINING CONSTANT RESISTANCE AND SELF-INDUCTION, TUNED FOR RESONANCE BY DIFFERENT CAPACITIES.

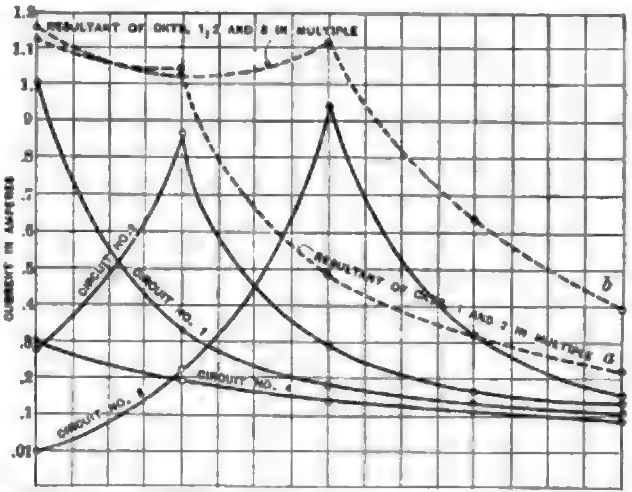


FIG. 2.—CURRENTS IN A CIRCUIT CONTAINING IMPEDANCES SHOWN IN FIG. 1, WHEN SUBJECTED TO 10 VOLTS.

Fig. 2 also shows in dotted lines curves representing the values of current in the secondary circuit, wherein the secondaries are connected in multiple, giving the vector sum of the currents in the different coils. Curve *a*, Fig. 2, represents the resultant of the currents in coils 1 and 2 in multiple; curve *b* the resultant of 1, 2 and 3 connected in multiple in the secondary, which is considered under short-circuit, at a transformation ratio of 1:1 neglecting losses.

Fig. 3 shows the arrangement of circuits as used in practice. Referring to this figure, it will be seen that there is a variable resistance, 1, in series with a source of constant potential, 2, in a closed circuit which divides at the points indicated by 3 and 4 into three branches.

One of these branches contains an inductance, *L*, with resistance adjusted to the other constants of the circuit, while the other two branches contain the primaries of induction coils or transformers 5 and 7 in series with capacities 6 and 8, of such value as to neutralize the inductance of the circuit and render the primary branches of the circuit resonant or partially resonant for given frequencies. But, while the circuit divides at 3 and 4 into three branches, the source of energy, 2, supplying a unidirectional current, can only cause a current to flow through the branch containing the low resistance inductance, *L*, the current through the other branches being stopped by the condensers, 6 and 8. This is the normal condition of the circuit when the telephone is not being used.

Consider now the result of varying the resistance, 1, where the constants of the circuit are as follows: normal resistance of the transmitter, 1, equal to 18 ohms; potential of battery, 2, equal to 10 volts; resistance of inductance, *L*, equal to 1 ohm; resistance of primary coils, 5 and 7, equal to .5 ohm.

Neglecting the internal resistance of battery 2, and the rest of the circuit, other than that of the variable resistance and the inductance, under normal conditions, 95 per cent of the potential of the battery, 2, falls across the variable resistance, 1, while 5 per cent is across the inductance, *L*, or points 3 and 4.

While no current flows ordinarily through the branches of the circuit containing capacities 6 and 8, these branches being a shunt around the inductive resistance, *L*, the condensers take a charge at a potential of .5 volt, which is the drop across *L*.

It follows, therefore, that if the variable resistance, 1, be suddenly lowered, say to 9 ohms, as is the case with a telephonic transmitter when a sound wave strikes the diaphragm thereof, the potential across *L* will be proportionately raised, and the condenser, 6, takes a direct charge at 1 volt. Upon the movement of the diaphragm in the opposite direction the variable resistance, 1, is again raised through normal to maxima, thus reducing the potential across the condensers which discharge through inductive resistance, *L*, and the primary coils, 5 and 7, giving a current, assuming a condition of resonance, of .66 amp.; and thus with each excursion of the transmitter diaphragm the variable resistance, 1, is alternately increased and decreased, raising and lowering the potential across the terminals of the condensers, which, in being charged and discharged, produces an alternating current through the primary coils and transmits a similar alternating current to the line.

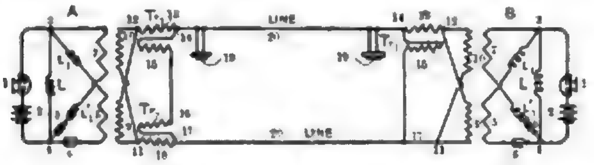


FIG. 3.—DIAGRAM OF TELEPHONE CIRCUITS.

With an ordinary transmitter primary circuit, using the same primary coil, transmitter and e.m.f., with a voice frequency of 250 p.p.s., there would be obtained in the ordinary primary coil a current of .017 amp., as against .66 amp. for the resonant circuit. At Tr_1 and Tr_2 are shown compensating transformers of special design for the purpose of regulating the line voltages and reducing the terminal impedance.

Based upon the researches and the principles leading to the brief general discussion of the subject as outlined above, the writer has designed a system of long-distance telephonic transmission which has, under extended experimental tests over actual lines, proved eminently confirmatory of the theory involved, and has shown increases in efficiency of transmission and reproduction fully 100 per cent over standard transmission in every instance noted. The wave definition, or articulate characteristics, are remarkably striking.

Standard Ratios for Frequency Changers.

By R. A. Philip.

THE evolution of American alternating-current practice has gradually eliminated the use of numerous frequencies until there are now but two frequencies left which are regarded as standard, namely, 25 and 60 cycles.

For alternating lighting systems the use of 25 cycles has been impracticable on account of the appreciable fluctuation of light of the incandescent lamps, and especially of the arc lamps. For railway systems the use of 60 cycles has been less economical than the use of the lower frequency, on account of the maintenance of 60-cycle rotary converters being higher and the cost of 60-cycle motor-generators being higher and their efficiencies lower than that of 25-cycle rotary converters. The more recently developed single-phase railway motor can also be much more advantageously operated from the lower frequency. It, therefore, appears probable that each of these two frequencies will continue to be used for a long time.

Growth followed by overlapping and consolidation of properties will more and more bring up the question of the electrical interconnection of the two systems through frequency changers. The 25-60-cycle (i.e., 5:12 ratio) frequency changer may, therefore, be expected to develop into a piece of standard apparatus and its limitations are consequently of great importance.

For an electric machine of given type and size there is in general some speed which should be approximated to secure economical design. Thus, in designing belted units, a speed of 100 r.p.m. would be too low for a 10-kw machine and 1,000 r.p.m. too high for a 100-kw machine. The speeds which are avaliable for alternators are rigidly limited to a certain progression downward from a maximum by the relation between the frequency and the number of poles, but a speed can usually be obtained which is a sufficiently close approximation to any desired speed. In the case of a frequency changer the number of available speeds is much further reduced by the fact that only speeds which are common to the two frequencies can be used. Thus, the maximum available speeds are 3,600 r.p.m. for 60-cycle machines, 1,500 r.p.m. for 25-cycle machines and 300 r.p.m. for 25-60-cycle frequency changers, and all available speeds, not lower than 100 r.p.m., amount to 36 for 60-cycle machines, 15 for 25-cycle machines and only 3 (as follows: 300, 150 and 100 r.p.m.) for 25-60-cycle frequency changers. This is a serious limitation, because a speed of 300 r.p.m. is much too low for the economical design of frequency changers of small or moderate size and the step from 300 to 150 r.p.m. is so great that only a very large machine would be designed for the second available speed. This practically limits the design to one speed, which is not suitable for most sizes in the range ordinarily desirable.

While there are only three speeds which are not lower than 100 r.p.m., which give the exact ratio of 25 to 60 cycles, there are numerous others which approximate to this ratio more or less closely. Thus, if a certain machine, with 14 poles, be coupled to another machine with 6 poles, a frequency changer will be obtained which will run at 514 r.p.m. when supplied with 60-cycle current, and will deliver 25.7 cycles, and will run at 500 r.p.m. and will deliver 58.3 cycles secondary from 25 cycles primary. Similarly a 60-cycle, 32-pole machine, and a 25-cycle, 14-pole machine will give 26.3 cycles at 225 r.p.m. and at 217 r.p.m. will give 57.1 cycles when operated from 60 and 25 cycles, respectively. Such odd combinations greatly increase the available range of speeds, and they give approximate frequencies sufficiently close for the proper operation of lamps, motors or other receiving apparatus, which may be connected to the system, but they have one vital defect. The essential function of a frequency changer is to unite two systems having different frequencies and it does not accomplish this result properly unless it provides for the future addition of other frequency changers which may run in multiple with it on both the primary and secondary side as required when the systems may be extended or consolidated with other systems also operating frequency changers. Machines giving the different odd combinations as illustrated above cannot run in multiple with each other or with frequency changers of the exact ratio, and they should, therefore, not be built.

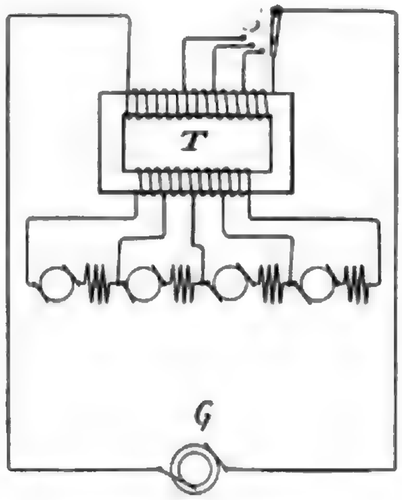
Considering the relation of the speeds of frequency changers to the series of speeds of the two alternating systems which are thereby united it is evident that the maximum speed of the frequency changer is the greatest common divisor of the maximum speeds of the two systems. A very small change in the relative frequency of the two systems will make a very great change in the greatest common divisor, and a small change if properly chosen may greatly increase the maximum available speed with excellent results. The most advantageous ratio which can be obtained approximating the ratio 25:60 is 24:60, giving 720 r.p.m. as a maximum instead of 300 r.p.m. Therefore, altering one frequency by 4 per cent raises the speed limit on the frequency changer by 140 per cent and gives 7 instead of 3 available speeds not slower than 100 r.p.m. Thus 24 to 60-cycle frequency changers may be built for 720, 360, 240, 180, 144, 120 and 103 r.p.m.

It is of course immaterial as far as it affects the frequency changer whether one frequency is changed from 25 to 24 cycles or the other from 60 to 62.5 cycles or whether each is changed a little as long as the ratio of frequencies is the same (i. e., 2:5), but considering the fact that the prevailing tendency is toward lower frequency it would appear better to lower the lower frequency rather than to raise the higher one, especially as this gives integral numbers for the expression of each frequency in cycles per second.

The essential point is the importance of discarding all odd ratios and of standardizing the ratio of frequencies at 2:5 instead of at 5:12.

Speed Control of Alternating-Current Motors

In a patent issued June 12 to Prof. D. C. Jackson means are described for proportionately dividing the line pressure between several alternating-current motors connected in series, in order to maintain a suitable apportionment of the work of the motors at all speeds. The arrangement proposed is indicated in the accompanying illustration. Use is made of an ordinary transformer, a switch being employed to place more or less of the primary winding in circuit according to the pressure desired for the motors. Since the armature and field windings of each motor are arranged in a locally closed electric circuit, each motor will operate as though the others were not present.



JACKSON MOTOR CONTROL.

It is stated that the method can be used with induction motors and repulsion motors as well as with series motors. It may also be used with polyphase motors, in which case an auto-transformer may be introduced with each phase in connection with the series-connected primary windings of the motors which belong to that phase, or a single auto-transformer related to one phase alone may be relied upon to suitably apportion the total impressed pressure.

New Telephone Patents.

NEW SWITCHBOARD CIRCUITS.

Fig. 1 shows a circuit for a switchboard in which the cord circuit has been simplified to the utmost, all relays being associated with the line circuit. A compound-wound relay permanently wired to the line serves the dual function of relay and retardation coil. A second relay wired to the jack sleeve serves as combined resistance and cut off relay. It will be seen that normally, with the telephone off the hook, the line relay lights the line lamp. When the plug is inserted the cut-off relay removes the line lamp and is of itself of such high resistance as to prevent the lighting of the supervisory lamp in series with it. The falling back of the line relay armature shunts out part of the series resistance, i. e., part of the cut-off relay coil, and by this means permits the lighting of the lamp. C. L. Boyce, of Detroit, is the patentee, the Western Electric Company being assigned the patent.

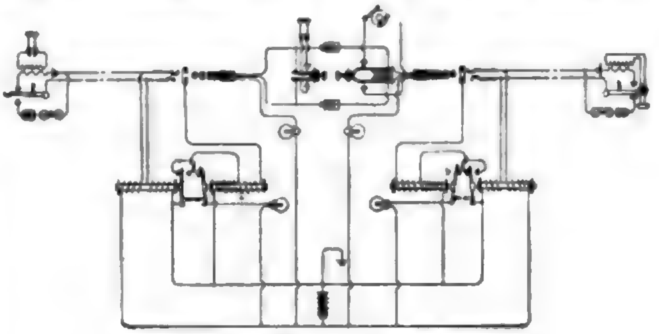


FIG. 1.—BOYCE TELEPHONE SYSTEM.

Mr. M. S. Conner, of Chicago, has obtained a patent for the now familiar 12,000-ohm relay trunk circuit of the Bell Companies. It will be recalled that the 12,000-ohm relay, while itself operating, prevents the operation of certain other relays at the distant end of the trunk, until part of its resistance is shunted out. It was by this means that through lamp signals were obtained while grounds are confined to one end of the trunk only.

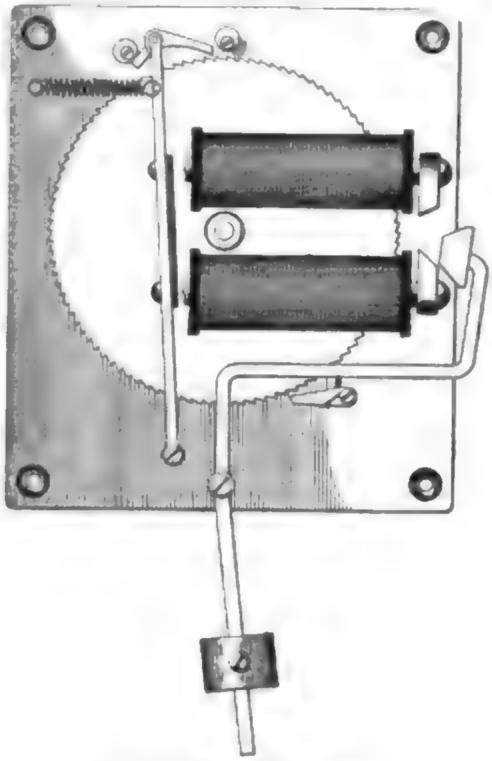


FIG. 2.—ENOCHS SELECTOR.

Mr. M. J. Kellogg has obtained a patent on a long-standing application, for a magneto system with oppositely polarized line and clearing out drop. Such an arrangement permits all drops to be permanently bridged.

A SIMPLE SELECTOR.

In Fig. 2 is shown a very simple form of selector for small automatic systems, the electromagnets being reduced to one. The operation is almost self-evident, the yoke armature being slow-acting and therefore unaffected by the rapid breaks in circuit necessary to operate the driving pawl. With all current cut off, however, the yoke armature restores and trips the retaining pawl. C. D. Enochs, of LaCrosse, is the inventor of this device, having assigned his patent to the Western Electric Company.

LETTERS TO THE EDITORS.

Motor-Generator Fly-Wheels.

To the Editors of Electrical World:

Sirs.—With reference to Mr. H. Ward Leonard's comments in your issue of April 21 on the article in your issue of March 3 entitled "Ward Leonard System in a German Colliery," it may be interesting to the public to know how the Ilgner system was started in Europe.

In the beginning of the year 1901 I worked out a project for operating an electrical winding engine at the Donners marckhütte, Upper Silesia. The electrical energy was available in a power station with 50-cycle, three-phase generators, 5,000 volts, driven by a gas engine. The power station was situated approximately 3 miles from the pit. The ordinary rheostatic control of the winding motor, which had approximately 700 hp capacity, was not advisable in view of the character of the power station and the high losses which would have been in the starting rheostat, owing to the starting period occupying a large part of the total cycle. It was, therefore, advisable to recur to a motor-generator consisting of a three-phase induction motor coupled to a direct-current generator according to the Ward Leonard system. This system had successfully been shown at the Paris Exhibition in 1900.

In order to overcome the overloads which the above mentioned power station would not have been able to handle a storage battery was taken into consideration, and the direct current generator for this apparatus divided in two, one with constant voltage and the other with variable voltage in order to allow for connecting the battery, and at the same time for the variable voltage control of the winding motor. This project, however, was found to be too expensive on account of the cost of the battery, and was rejected.

A new project was then worked out with the battery replaced by a fly-wheel, the use of a fly-wheel being well known from the steam engine and rolling mill practice in order to overcome load fluctuations during short periods. The characteristic of the induction motor, however, made it necessary to provide for a regulation of its input, and allow at the same time the flywheel to be discharged during the overloads. This could be easily effected by automatically inserting a resistance into the secondary of the induction motor so as to regulate for constant primary and secondary current, and for constant torque with a slip of the fly-wheel up to 15 per cent.

The machinery to suit this condition was laid out according to these instructions by the Westinghouse Electric & Mfg. Co., Pittsburg, and the undersigned went in August, 1901, with the complete project to the said company's district office at Breslau, handing the same to the sales manager of the district, Mr. Ilgner. The plant was never built and the said engineer left shortly after.

In 1902 at the Dusseldorf Exhibition the winding engine for the Zollern II Colliery in Germany was exhibited, but the control was by means of multiple voltage from a storage battery. The winding engine for the Preussen II Colliery driven by a three-phase motor was also shown in a drawing, but no motor-generator with fly-wheel was at this time put forward by the leading German electrical firms. It was not until the end of the year that a publication was made in the *Zeitschrift des Vereines Deutscher Ingenieure*, dated November 22, 1902, page 1704, that Mr. Ilgner and Siemens & Halske had developed a new winding system which, according to the description, was exactly the same as worked out by the Westinghouse company fifteen months previous.

The Zollern II Colliery later adopted the Ward-Leonard motor-generator with fly-wheel and automatic slip regulator, leaving the storage battery as a reserve. This was the start of the so-called Ilgner system, and up to this time there are more than 50 winding engines operated in Europe according to this system, one of the latest being the plant at the Mathias Stinnes Colliery, Germany, consisting of four large winding engines of 2,000 hp each, controlled by two motor-generators with a 40-ton fly-wheel each. When the whole installation is finished there will be running four Ward Leonard's sets, two of each being connected by an elastic coupling. The total motor-generator plant consists of four three-phase motors representing a constant load of 2,000 hp, four fly-wheels of 160 tons having an aggregate capacity of 500,000 hp-seconds approximately; eight direct-current generators with a maximum output of 9,200 hp (*Z. d. V. I.*, 1905, page 2075).

The essential difference between the Ward-Leonard motor-generator and the Ilgner system is in the automatic slip regulator, which in the case of a direct-current motor serves as an automatic field regulator. This slip regulator may be operated either by a centrifugal regulator or by a current relay connected into the mains from the power station, and tending to keep the current consumption of the motor-generator constant. Without this slip regulator the motor-generator with the fly-wheel would be of very little use, and I think it is this apparatus in connection with the Ward-Leonard motor-generator which is the essential characteristic of the Ilgner system.

The Ilgner motor-generator is to be used in Europe for driving the main rolls of rolling mills, the capacity of the machinery being several times in excess of the largest used for winding engines up to this time. Four rolling mills with capacities up to 13,000 hp, are being equipped at present.

Manchester, England. Rudolf Braun.

Steel Line Construction and Lightning.

To the Editors of Electrical World:

Sirs:—I have noted with considerable interest the editorials in the Electrical World dealing with lightning phenomena. They have at times contained suggestions of real value to the experimenters in this field, and should be even more helpful to the users of such apparatus in keeping their ideas moving in rational channels.

It should be borne in mind that the acquisition of information in this subject is a very tedious one, requiring care and the highest possible exactness to avoid misconception. For this reason I should like to take exception to your recent editorial of the issue of June 9, 1906, wherein certain new features are suggested for the investigation by the National Electric Light Association for the coming year, viz.: the effect of steel pole and tower constructions upon troubles from lightning. This is undoubtedly a point of great interest, and at present sufficiently general in its application to enable considerable data to be obtained, but it is after all only a small part of the information desired, and great care should be exercised not to let its novelty give it undue prominence in any future work, which such an organization might carry on.

I wish to emphasize by these remarks the need of concentrated co-operation in the study of such phenomena as the committee of the National Electric Light Association has begun so admirably, and to urge that it is above all else highly desirable that these observations in toto be repeated from year to year for a few years until a sufficient period has been passed to furnish fairly reliable conclusions.

Boston, Mass. N. J. Neall.

Capacity Effect in Electric Shock.

To the Editors of Electrical World:

Sirs: I should like to take exception to a statement made in an editorial in your issue of June 2, under the head "Capacity Effect in Electric Shock." You say "It is similarly possible to receive a lesser momentary discharge, or shock, through a condenser coming into contact with a high-tension circuit. Thus, if a condenser be connected with the system and be left insulated at the other terminal, the connection of that terminal to ground through a person would be able to pass a momentary discharge through his body."

By grounding one leg of an alternating-current system, while that leg is passing through zero potential (that is, zero to earth) a momentary contact may be made between that leg and ground, and no shock or flow of current follow. If the contact is of long duration, a succession of shocks will be given for each rise and each fall of the alternating potential above and below the normal earth potential. If the contact is made when the difference of potential between that leg and earth is at its maximum, a large flow of current may follow, this current being of a temporary nature. It is caused by the sudden discharge of a condenser, in this case the condenser being made up of the line insulation and earth.

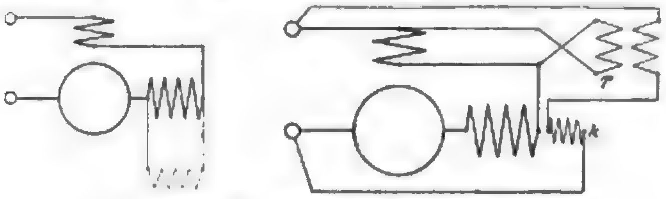
In large, high tension, alternating-current underground systems, where the capacity per leg to ground is large, the flow of current between one leg and ground, the system being insulated, is, say, 30 amperes distributed; that is, 30 amperes leaving the bus and falling of to zero along the line. By grounding one leg permanently and solidly, the current to ground through that contact would be, say, 50 amperes. On sudden application of a ground it might reach to 400 amperes, depending upon how the ground was made with respect to the voltage between that leg and the ground.

NEW YORK. T. W. VARLEY.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Series Motors.—RICHTER.—The first part of a long article illustrated by numerous diagrams. The author remarks that only recently the single-phase series motor has been so improved that it is almost as good as the direct-current series motor. The points in which the single-phase series motor is inferior to the direct-current series motor are the starting period (that is, with the same effective motor current the torque of the single-phase motor is smaller than that of the direct-current motor), commutation, capacity for continuous use for given dimensions, efficiency and power factor. In the present article the author gives a detailed summary of the various devices which are being employed by the Siemens-Schuckert Company in order to improve the deficiencies of the single-phase motor just mentioned. The author first deals with improvements in starting and describes several constructions of inserting resistances between commutator and armature windings. In the latest construction of the Siemens-Schuckert Company these resistances are wires which are provided not only for increasing the resistance of the short-circuited windings "below the brushes," but they are employed in the form of a special open armature winding in series with the main winding, and are so designed that they increase the capacity and efficiency of the motor. The theory and construction is explained in detail. The author then discusses commutation and describes a great many different constructions. In the latest designs of the Siemens-Schuckert works the series motor is claimed to be superior to the compensated repulsion motor in every respect, as far as the suppression of sparks is concerned. Two of these latest constructions are reproduced in Figs. 1 and 2. In Fig. 1 a resistance is connected in parallel to the compensation winding. Fig. 2 represents a special arrangement devised by Schenkel. Its characteristic feature is the provision of a transformer, *T*, which introduces an e.m.f., which if it was the only one would produce in the auxiliary winding, *h*, a flux compensating the commutation voltage. The polar diagram of this arrangement is given in the article. The article is to be concluded.—*Elek. Zeit.*, June 7.



FIGS. 1 AND 2.—SINGLE-PHASE SERIES MOTORS.

Exciting Current of Induction Motor.—MCALLISTER.—A mathematical note on the best method of predetermining the wattless component of the no-load current (the exciting current). The author shows that the value of the wattless component may be ascertained directly from the volume of the air-gap and the volume of the core material, without reference to the required magnetomotive force, the number or the distribution of the primary coils. The maximum magnetic density and the permeability of the iron must be known. In other words, the very quantities which are necessary in order to determine the core losses will serve simultaneously for the determination of the (quadrature) exciting watts, when the permeability of the core is known. An empirical formula for the permeability of iron, sufficiently accurate for most practical purposes, is given. The (quadrature) exciting watts of a certain polyphase motor are the same in value when all phase windings are used, or when only one winding is subjected to the primary pressure. Thus, when one phase winding of a two-phase motor is open-circuited, the other winding immediately takes double its former value of (quadrature) exciting current, the (quadrature) exciting watts remaining the same. Therefore, the most logical way to determine the exciting current of an induction motor is to ascertain the density of the magnetism in the core and in the air-gap, and then to calculate the quadrature watts, just as one ordinarily calculates the core loss watts.—Lond. *Elec.*, June 8.

High-Tension Transformer.—NAGEL.—An illustrated description of a 400,000-volt, 200-kw transformer, built by the Siemens-Schuckert works for cable testing. Several new improvements are employed in the design.—*Elek. Bahnen*, May 23.

Lamps and Lighting.

Lighting of Railway Carriages.—An illustrated description of the Vickers-Hall system of electric lighting for railway carriages. —Lond. *Elec. Rev.*, June 1; a correction of a diagram in Lond. *Elec. Rev.*, June 8.

Traction.

Adhesion Weight of Electric Locomotives.—OSSANNA.—A great advantage of the electric locomotive over the steam locomotive is the smaller weight and especially the more favorable ratio of the total weight of the locomotive to the adhesion weight (whereby in the case of steam the weight of the tender is to be added to that of the locomotive). With electric locomotives the adhesion weight may easily be made equal to the locomotive weight, but this is never possible with steam locomotives. In case of steam there are actual cases in which the adhesion weight is not one-third of the locomotive weight, and even with high-speed locomotives for mountain roads the adhesion weight is generally not one-half the locomotive weight. With the same adhesion weight, direct-current or three-phase current locomotives can develop greater tractive force than steam locomotives, because the torque of the former is constant, while with steam locomotives the maximum torque is greater by 15 or 20 per cent than the average torque. Thus in some cases of actual electrical practice the ratio of tractive force to adhesion weight is 1 to 3.5, while such a ratio has never been obtained with steam locomotives. This advantage of direct-current and three-phase current locomotives over the steam locomotive would appear not to exist for single-phase locomotives because the single-phase commutator motors develop a torque which varies in a much greater degree than that of the steam locomotive. As a matter of fact the maximum torque of a single-phase commutator motor is about twice that of the average torque. From this it would seem that in order to prevent entirely any slipping of the wheels on the rails, an adhesion weight is required twice that necessary for constant torque momentum. In this respect the single-phase locomotive would appear to be inferior even to the steam locomotive, but the author shows by mathematical analysis that this would be a wrong conclusion, and that as a matter of fact the single-phase locomotive is almost as good as the direct-current and three-phase locomotives in this regard. —*Elek. Bahnen*, May 4.

Electric Towing for Canals.—Block.—The continuation of his long detailed and fully-illustrated description of the recently opened Teltow Canal. Electric towing has been exclusively adopted. Electric locomotives run on rails on the tow path, being supplied with current from an overhead wire. At two places the canal passes through lakes, where it is impossible to tow the boats from a tow path so that they are to be hauled by tug boats. A great many tests were made with different kinds of tug boats. Electric tug boats were used, either equipped with a storage battery or supplied with current from a double overhead wire, but a tug boat provided with an oil engine was found most suitable. Absolute freedom from smoke was a necessity for æsthetic reasons. The two tow paths are provided with a track of one-meter gauge, with rails weighing 20 kg. per meter. Preliminary tests show that with a speed of 4 km. (2½ miles) per hour the tractive resistance is 0.85 kg. per ton of useful load, the total power 0.014 kw per ton and the energy consumption 3.5 watt-hours per ton-km. With a speed of 4.5 km. (2¾ miles) per hour, the corresponding figures are 1.035 kg., 0.021 kw, 4.25 watt-hours, with a speed of 5 km. (3 miles), they are 1.34 kg., 0.0284 kw and 5.25 watt-hours. The efficiency of the locomotive averaged about 65 per cent. The construction of the locomotive is shown in Fig. 3. It is provided with three axles. Only the two at the front are driving axles, each being provided with a series motor of 8 hp capacity for continuous operation, when running at 800 revolutions at 550 volts direct current with double gearing. Above the back axle a horizontal axle is provided around which the towing pole may be turned so as to be raised or lowered. This is done with a 3-hp electric motor. The upper end of this towing pole has a funnel through which the towing cable runs. This steel cable, which is 10 mm. thick, is wound on a drum which is also electrically driven by a 3-hp motor. The winding drum is not firmly fixed to its axle, but is connected to it by means of a friction coupling; the springs are generally adjusted so that when the tractive force becomes more than 1,200 kg. the drum revolves around the axle and the cable slowly passes off from the drum. At starting where for a load of a 600-ton boat a tractive force of about 2,000 kg. is required, the cable is slowly wound off from the drum so that the locomotive is not subjected to heavy pulls. The towing pole is raised when the locomotive passes boats on the bank of the river, which are being loaded or unloaded. The article is to be continued.—*Elek. Zeit.*, June 7.

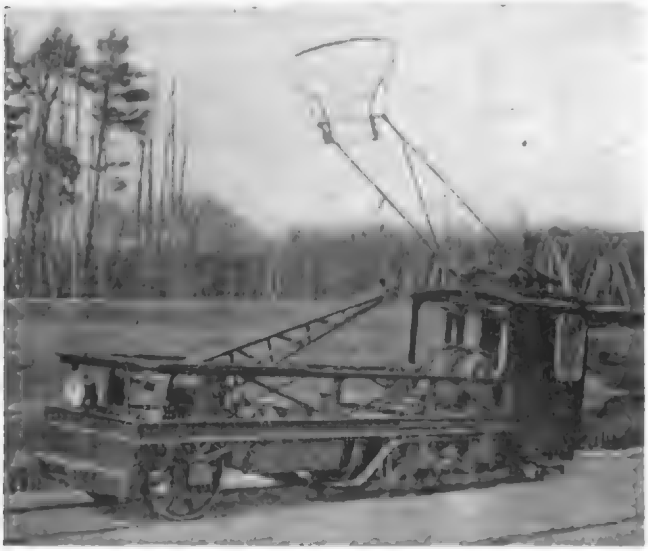


FIG. 3.—ELECTRIC TOWING LOCOMOTIVE.

Electrolysis of Underground Pipes.—A general summary of the report of the Committee on Electrolysis of the American Gas Light Association, of which A. G. Glasgow is chairman and A. F. Ganz, of Stevens Institute, is consulting engineer. The conclusions of the committee are as follows: First, electric railways should be held responsible, by the terms of their franchise, for all damage to others engaged in the discharge of franchise obligations or in any lawful pursuit or occupation, caused by their overt failure to control their own currents. Second, the immunity of street piping and other metal in centers of population from electrolytic damage due to stray currents demands that electric railways shall employ in such districts completely insulated metallic circuits for all currents; and such railways may be especially exempted by ordinance from responsibility regarding electrolysis so long as they effectively maintain such circuits. Third, in small communities where local conditions are favorable, or wherever the property liable to electrolysis damage is of minor value, the rails may be used for the return current, subject to clause first, provided: (1) The potential difference in the rails be sufficiently reduced by properly balanced return feeders and through bonding (the "committee cannot indicate suitable local voltages, but it has been seen that the German commission commend a present maximum potential difference of one volt"). (2) The rail foundations be constructed to increase as much as practicable the resistance between the rails and earth; and (3) There be proper supervision to insure conformance with these requirements. Fourth, in rural districts, or wherever no property is liable to electrolytic corrosion the uninsulated rails may be used *per se* for the return current.—*Progressive Age*, June 15.

Mountain Road.—Hotopp.—The first parts of a detailed illustrated description of the electric equipment of the Filder road, which connects Stuttgart with the Filderebene, and which has a total length of 31.4 km. While most of the line is built as an adhesion road, a length of 2 km. is rack and pinion. The line is supplied with direct current at 600 volts; the motors are specially constructed for mountain roads and are shunt-wound so as to recuperate energy when going down hill.—*Elek. Bahnen*, May 23 and June 2.

Single-Phase Railway.—Some notes on progress made on the Swiss experimental railroad between Seeback and Wettingen. The Swiss Federal Railway authorities have completed their official tests on the section between Affaltern and Regenstorf, and a regular service is now running as far as the latter station. Some trouble was experienced at first from the interference of the power circuit with the telephones near the track, but this has now been to a great extent got over. Work is being pushed forward on the Regenstorf-Wettingen section; 4,700 train-miles have been run since the commencement of operations on January 15, 1905. The newer of the two locomotives, which has been in service since November 10, 1905, is equipped with some of the largest single-phase motors in use, being of 250 hp capacity each. As soon as the whole line is complete a new 1,000-hp express locomotive will be put into service. The whole of the equipment was supplied by the Oerlikon Company.—Lond. *Elec.*, June 8.

Electric Railways of Switzerland.—Mueller.—In Switzerland the total length of electric roads is 15.8 per cent of all railroads (against 6.8 in Germany). The author gives a great many statistical data in very concise form on all Swiss electric railways. —*Elek. Bahnen*, May 4 and 14.

Block Signals.—An illustrated description of the block signal and interlocking system adopted for the electric zone of the New York Central lines in New York City. Alternating current is used for signal operation, the track rails being retained for the return direct-current circuit.—*St. R'y Jour.*, June 9.

Installations, Systems and Appliances.

British Central Station Statistics.—A large table giving in 20 different columns detailed information on the 423 British central stations and their equipment.—Supplement to Lond. *Elec. Rev.*, June 8.

South Africa.—Poole.—A table giving statistical data on electricity supply stations of South Africa. The paper gives information on 24 lighting systems and 8 tramway systems. The largest lighting plant is in Kimberley and has a capacity of 3,500 kw.—Lond. *Elec. Rev.*, June 1.

Starting Rheostats.—GEORGES.—A mathematical article on proportioning the steps in a starting rheostat for direct and alternating-current motors by graphical methods.—*Elek. Bahnen*, May 14.

Electrophysics and Magnetism.

Ratio of Electromagnetic and Electrostatic Units.—ROSA AND DORSEY.—An abstract of a Phys. Soc. paper. The ratio of the electromagnetic and electrostatic units is of fundamental importance in Maxwell's electromagnetic theory of light, since this ratio represents the velocity of light. Although this ratio has been determined by various investigators, their results do not give its value to within one part in a thousand, as there are considerable differences in the values obtained. The authors have been carrying out a series of investigations for nearly two years in order to determine its value at least to 1 part in 5,000, and hope to fix its value to within 1 in 10,000. They have employed more than one method and more than one apparatus and have averaged the working conditions in many ways. The mean value of all their measurements is about 299,610 km. per second. —*Phys. Rev.*, June.

Radiothorium.—HAHN.—In a previous paper the author has given an account of the methods of separation and the radioactive properties of a very active substance, called radiothorium, which was prepared from the Ceylon mineral, thorianite. Radiothorium was found to be probably a slowly changing product of thorium—the latter is then supposed to be inactive—which lies between thorium and thorium-X. Radiothorium possesses in an intense degree all the radioactive properties of thorium, for it gives rise to thorium-X, the thorium emanation, and the characteristic active deposit. On account of its great activity radiothorium is a far more suitable source than the feebly active thorium for the investigation of the properties of its radiations. In the present paper the author discusses the range of the alpha particles in air from the active deposit of radiothorium by the methods of scintillation and by an electrical method. He proves that the product, called thorium-B, is complex and consists of two distinct alpha-ray products which have different ranges of ionization in air. He finally investigates the magnetic and electrostatic deflection of the alpha particles from the active deposit. —*Phil. Mag.*, June.

Ionization Produced by Alpha Rays.—BRONSON.—A paper containing an account of an investigation of two entirely distinct but closely related problems. The first is an investigation to determine how the ionization produced by an alpha particle varies near the end of its path. It appears likely that the alpha particle looses its energy very rapidly near the end of its path by collision with the gas molecules and is quickly absorbed by a thickness of air of 7.2 cm. The second part of the paper is an investigation to prove definitely whether radium-B emits alpha particles which are able to ionize the air for even a short distance. This question is answered by the author in the negative.—*Phil. Mag.*, June.

Discharge Between Parallel Plates.—TOWNSEND.—A mathematical paper with an account of experiments on the field of force in a discharge between parallel plates.—*Phil. Mag.*, June.

Units, Measurements and Instruments.

Color Phenomena in Photometry.—DOW.—An abstract of a British Phys. Soc. paper. The question has often been raised whether it is physiologically possible to compare lights of different colors. The author has found that it is chiefly a matter of practice. A great difficulty arises from the fact that the central portion of the retina is more sensitive to red, and less sensitive to green, than the surrounding portion. Therefore, when we attempt to photometer lights of different color, enormous differences are found as the distance of the eye from the photometer screen is altered, and utterly different results are obtained with different photometers. Curves are given in the paper showing the effect of altering the distance of the eye when an incandescent mantle is compared against a gas standard with the Joly photometer. Differences of 5 per cent can easily be obtained. An experiment was shown at the meeting to demonstrate that the Purkinje phenomenon, generally regarded as a great cause of uncertainty in ordinary work, only becomes noticeable at very small illuminations and with comparatively large fields of view. The Purkinje effect can be physiologically explained by the action of the "rods" and "cones" on the retina. The comparative weakness of the Purkinje effect with small fields can be explained by the fact that the central portion of the eye contains practically no rods, but only cones. The paper also describes experiments to show that flicker photometers seem to be affected by color phenomena, but to a smaller extent than ordinary ones. In any case, whether flicker or an ordinary photometer is adopted, it is necessary to specify the size of the field, the distance of the eye and the order of illumination used, in order to get consistent results.—Lond. *Elec.*, June 8.

Measuring Short Intervals of Time.—DEVAUX-CHARBONNEL.—A note on a French Society paper describing a method of measuring very short intervals of time by means of the discharge of a condenser, for which method a high degree of accuracy is claimed. It is specially adapted for determining the period which elapses while the contact lever of some chronograph apparatus passes over from one contact to another in order to eliminate the error introduced by its appreciable time of action. A condenser of a capacity, *C*, is taken and shunted by a resistance, *R*. One side of the condenser is connected to one pole of a battery and to one terminal of a ballistic galvanometer. The other side is connected to the moving lever and the two contacts are connected to the other terminals of the battery and galvanometer, respectively. When the lever ceases to make contact with stud connected to the battery, the condenser commences to discharge itself through the resistance, R, until the other contact is reached, when the remainder of the charge passes through the ballistic galvanometer. This has been previously calibrated by allowing the whole discharge to pass through it. The fraction of the charge passing through is equal to $e^{-\frac{t}{CR}}$, from which the time (t) can be calculated. Results of observations of the time taken to close a discharge key are given, and are of the order of 0.001 of a second.—Lond. *Elec.*, June 8.

Bifilar Galvanometer.—CAMPBELL.—Before the British Phys. Soc. the author recently exhibited a bifilar galvanometer free from zero creep. For measuring direct currents and voltages of ordinary range (from 0.1 amp. or volt and upwards) moving coil galvanometers with shunts or added resistances are convenient. The usual instruments, however, are affected by gradual displacement of zero (due to elastic set) when a deflection is maintained for some time. This difficulty is overcome by replacing the ordinary torsional suspension by a bifilar system in which the two wires are so far apart that the gravity control quite swamps that due to the torsion of the wires. In the instrument shown the wires were more than 1 cm. apart and the sensitivity with 40 ohms resistance was 400 mm. at 1 metre for 0.001 amp.; this is sufficient for many purposes. The full deflection may be maintained for hours without causing a zero creep of 1 part in 2,000. To attain good damping a very powerful magnet is used.—Lond. *Elec.*, June 8.

Galvanometer.—An abstract of a Phys. Soc. paper of a mathematical nature on some properties of the moving coil galvanometer.—*Phys. Rev.*, June.

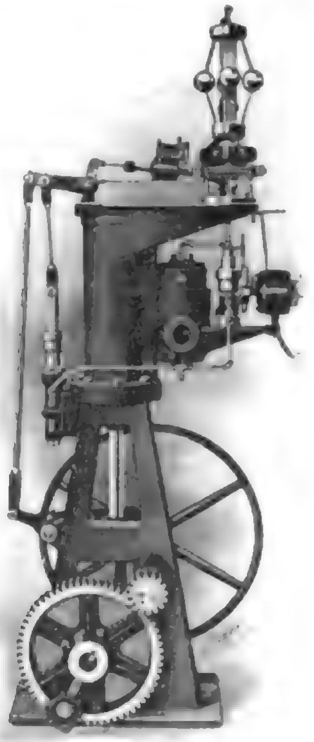
Magnetic Action at a Distance on Board Ship.—ENDE AND ABLDT.—Two mathematical communications on this subject.—*Elek. Zeit.*, June 7.

Telegraphy, Telephony and Signals.

Electrolytic Wave Detector.—AUSTIN.—An abstract of a Phys. Soc. paper on the Fessenden electrolytic wave detector. The principal results of the experiments of the author are as follows: When the polarization is complete, enough so that a sensitive galvanometer can be used, a few thousandths volts alternating e.m.f. can be detected. The decrease in the resistance of the cell is approximately proportional to the square of the applied alternating e.m.f. With increasing polarizing e.m.f. the sensitiveness increases to a maximum, after which it remains constant or decreases. Under favorable conditions the cell is found to be about equally sensitive with positive (oxygen) or negative (hydrogen) polarization. At times, however, the action with negative polarization is irregular, the resistance occasionally increasing instead of decreasing. The resistance of the cell is very variable, depending on the polarizing e.m.f. When the polarizing e.m.f. is low, it may be 50,000 ohms or more, while at the point where the polarization is beginning to break down it is sometimes less than 1,000 ohms. In the case of rapid oscillations the effective resistance is modified by the fact that the cell acts as a condenser. For slow alternations the cell is equally sensitive whether the small electrode is minute or of considerable size. For oscillations of the period usually employed in wireless telegraphy the area should not exceed 0.0003 mm. This difference in action is probably due to the capacity effect of the point. In order to test the hypothesis that heat is a prominent factor in breaking down the polarization resistance at the small electrode, this electrode was made in the form of a loop of wire through which an alternating heating current could be passed. It is found that the heating of the electrode produces a marked diminution in the resistance of the cell, which indicates that heat is at least one of the factors in the phenomenon.—*Phys. Rev.*, June.

Water Wheel Governors.

The Lombard Governor Company, Ashland, Mass., has recently placed on the market a form of water wheel governor, designated as Type Q, which has been designed for maximum stability and accessibility of the controlling mechanism. As shown in the accompanying illustration, the terminal shaft is placed near the ground with the power cylinder above. The hydraulic cylinder is cast of hard iron, in one piece with the valve chamber and the support for the centrifugal balls. The base frame has the shaft bearings cast integral, so that the heavy stresses which are transmitted cannot possibly cause displacement of any parts. The piston rod is of drawn steel, the rack is forged and cut from open hearth steel and the rack gear is cut from a solid steel bar. The terminal shaft is ground and has the rack gear shrunk on by heat. All relay and regulating valves have renewable parts of hardened steel. The centrifugal and anti-racing mechanisms are of standard form. The hand wheel device has a simple disconnecting clutch for the terminal shaft.


WATER WHEEL GOVERNOR.

The governor is equipped with a regulating valve and a relay valve, each of which has an adjustable lap. The sensitiveness of the governor may be increased or diminished at will, while it is in operation, by moving the micrometer cap of the regulating valve. The maximum speed of motion of the turbine gates may be varied through a wide range by the relay valve adjustment. When safety permits, the governor may be adjusted to completely open or close the turbine gates within one second. Much slower action is easily obtainable; but it should be generally known that where hydraulic conditions permit, the speed regulation will be better in proportion as the governor moves quicker. Any governor for rapidly varying loads, requiring more than two or three seconds to make its complete stroke, will not give regulation which is good enough for present commercial requirements.

General Electric Tantalum Incandescent Lamps.

The tantalum lamp is now being produced in this country at the General Electric Company's lamp works at Harrison, N. J., and is offered by it to the electrical trade as a lamp giving the lowest consumption of any form of commercial incandescent lamp available to-day. The General Electric tantalum lamp gives an actual consumption of two watts per candle, based on the mean horizontal English Parliamentary Standard, with an average useful life on direct-current circuits of 700 hours or more. When used with the special Holophane pagoda reflectors provided with the lamps, as shown in the accompanying illustration, the downward illumination is increased to one candle per watt or better. Two forms of reflectors are provided: the distributing form and the concentrating form, which gives a more centralized distribution beneath the lamp.

The lamp is at present supplied by the General Electric Company in but one size, having a consumption of 44 watts and giving a mean horizontal rating of 22 cp, equivalent to 25 hefners. It is made for voltages of 100 to 130 volts and fitted only with the standard Edison base. It is not recommended for use on alternating-current circuits.

22-CP TANTALUM LAMP.

This lamp will enable central stations to reduce the cost of lighting to the customer and therefore meet and resist competition, secure additional desirable business and increase their net earnings. While the first cost of the tantalum lamp is somewhat higher than that of the ordinary carbon filament lamp, this additional cost is saved several times over by the consumer buying electricity at average meter rates given by electric lighting companies. The average life of the lamps is about 750 hours and the value of the new lamp as shown by the saving they secure in consumers' cost of electricity at various rates per kilowatt-hour, is given in the following table:

Rate per kw-hour cents.	Saving in cost of electricity at various rates of 22-cp, 44-watt tantalum lamp. Over present 3.5-watt, 22-cp lamp.	Over present 3.1-watt, 25-cp lamp.
10	$2.47	$1.80
11	2.83	1.98
12	2.97	2.15
13	3.24	2.33
14	3.47	2.51
15	3.72	2.69

It is expected that the new lamp will be supplied to lighting customers on direct-current circuits on a liberal policy as to charges, either on a renewal or on a purchase basis. The lamp possesses several attractive features which should appeal both to the central station man and to his customer. The advertising value of this new lamp as a novelty represents an asset to the lighting company first introducing it to the public in its section. The brilliancy and quality of light of the tantalum lamp is unsurpassed and is predicted to render it most attractive to the consuming public.

On an equal pro-rated useful life basis with present 16-cp, 3.1-watt lamps, central stations now supplying free renewals could afford to supply tantalum lamps at a low figure without adding to their present lamp renewal costs. Central stations now furnishing free renewals of 3.5-watt lamps could similarly supply the tantalum lamp at a little higher figure without increasing their renewal costs. In any case the consumer, as shown by the foregoing table, would save several times the value of the charges of the tantalum lamp.

◆

Riveted Frame Induction Motors.

The Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., has just placed upon the market a type of polyphase induction motor which possesses the distinguishing characteristic of having the laminated iron core of the stator freely exposed to the air around its entire periphery. The frame is held together by means of a riveted construction which has rendered it possible to do away with the cast iron ribs which are used with motors of larger sizes. In this way it is unnecessary to use end castings of greater diameter than the laminations, and thus the dimensions and weights of the motors are greatly reduced. The design and construction are such that the assembled structure is made rigid and incapable of distortion. The feet of the motor, which are a part of the end-frame casting, are spread well apart so as to give the motor a substantial base.

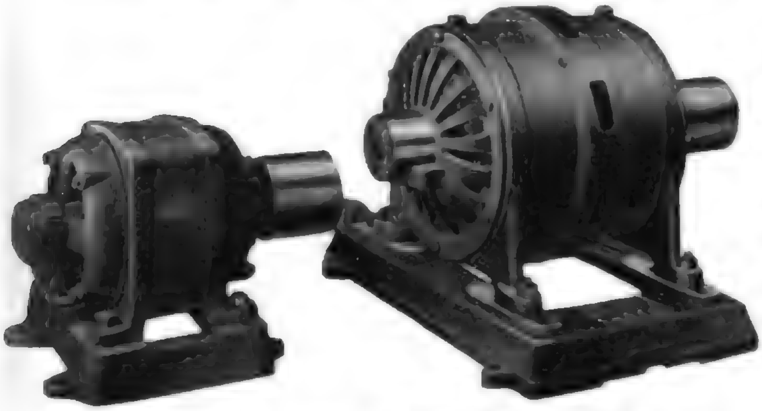


FIG. 1.—NEW MOTOR AND OLD STANLEY MOTOR OF TYPE BUILT 15 YEARS AGO.

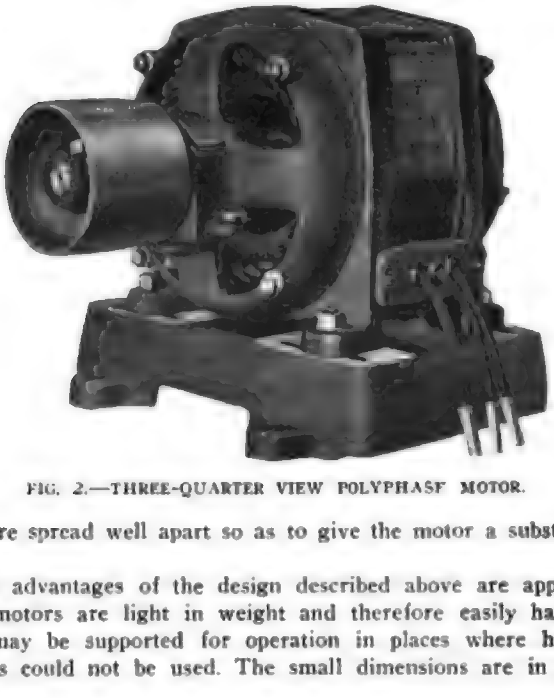


FIG. 2.—THREE-QUARTER VIEW POLYPHASE MOTOR.

The advantages of the design described above are apparent. The motors are light in weight and therefore easily handled, and may be supported for operation in places where heavier motors could not be used. The small dimensions are in many cases of great advantage. This is particularly true where the motor is to be direct connected to or built into a machine which it is to drive. Particular attention is called to the fact that this design secures a motor of small dimensions and light weight, not so much by a reduction of the motor proper as by the curtailment of the material which is of no active value. Every particle of the material included is put to valuable use.

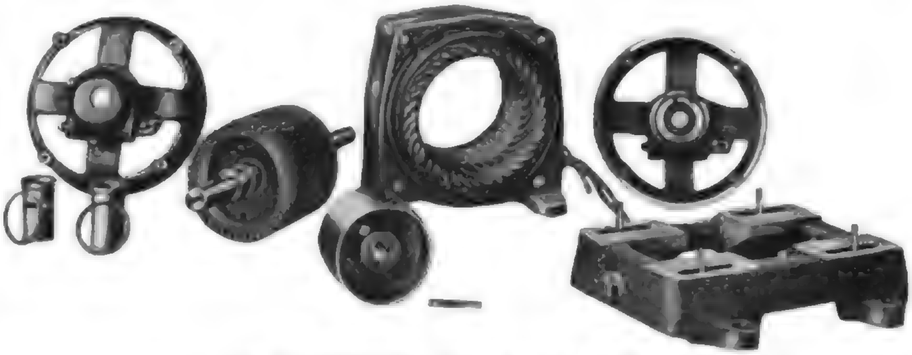


FIG. 3.—DISSEMBLED VIEW OF 3-HP MOTOR.

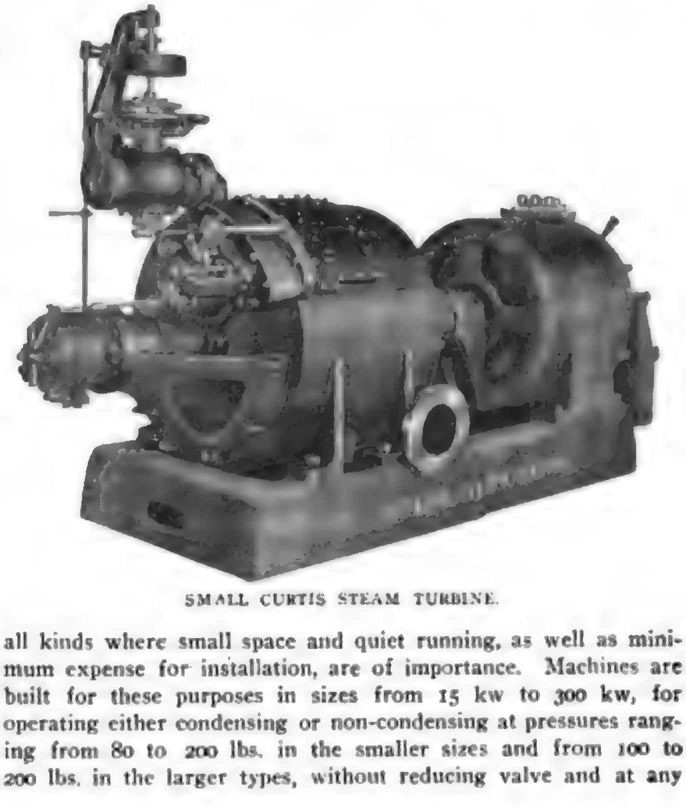
Fig. 1 illustrates a motor of this new type side by side with an early Stanley motor of higher speed and the same output, which was on the market fifteen years ago. The progress in induction motor engineering cannot be more strikingly illustrated, especially when it is remembered that the present motor excels the old type in points of efficiency and general performance to as marked a degree as in size and weight.

These motors are built in sizes from 1 to 75 hp, and for two-phase or three-phase current. The secondary is in each case of the squirrel-cage type, the simple and indestructible character of which is well known. No switches or moving electrical contacts whatever are used, so that the motor is unaffected by dust or dirt. Furthermore, there is no danger from electric sparks.

◆

Small Curtis Steam Turbine.

The accompanying illustration shows a 75-kw Curtis steam turbine generating set, of a type adapted for train-lighting, as an exciter in generating stations and for auxiliary power of all kinds where small space and quiet running, as well as minimum expense for installation, are of importance. Machines are built for these purposes in sizes from 15 kw to 300 kw, for operating either condensing or non-condensing at pressures ranging from 80 to 200 lbs. in the smaller sizes and from 100 to 200 lbs. in the larger types, without reducing valve and at any



SMALL CURTIS STEAM TURBINE.

degree of superheat up to about 200° F. without danger of injury.

In these smaller sizes of turbines the bearings are supplied with oil by the usual oil rings and wells of ample proportions. Since the system is closed, there is no waste of oil from spattering or other causes. No internal lubrication is necessary, and as a result the exhaust steam can be used in heating systems or in manufacturing processes, as it is entirely free from oil.

The speed of the turbine is held constant by a centrifugal governor which controls the steam supply entering the turbine. A uniform speed is obtained irrespective of load conditions. In addition to the regular governor an emergency governor is supplied which shuts off the steam, if for any reason the speed should rise a certain percentage above that fixed as normal. This entirely eliminates any danger of excessive speeds.

The generators in these turbine sets gain indirectly in compactness because of the higher operating speeds as compared with generators of the engine driven type, and the cylindrical design of the turbine suits exactly the compact, well proportioned electrical unit.

From their compactness and absence of vibration, the small Curtis steam turbine sets have found a wide field in electrical train lighting, mounted either on the locomotive or in the baggage car, as exciter sets in power houses, and for small power and lighting installations. Being easily and quickly located in an odd corner, they have been found exceptionally well adapted for auxiliary units in manufacturing establishments. In the smaller sizes the set makes an ideal unit for marine work.

Improvements in Water-Tight Floors for Central Stations.

In laying out storage battery rooms special attention must be given to the drainage, the ventilation of the room and to the material used in the construction, owing to the presence of free sulphuric acid in the air caused by the gassing of the batteries. Cement floors are not suitable for battery rooms because of the chemical action of sulphuric acid on the cement; but inasmuch as cement enters largely in the construction of the floors of nearly all modern fire-proof structures, it cannot be readily eliminated, so that some means of protecting it must be used. The usual method of laying battery room floors is first to place a layer of concrete over the arches and floor beams and then finish with a coat of cement. When this is dry the floor is thoroughly mopped with hot asphalt and tile or vitrified brick is then laid with 1/16-in. joints which are filled with hot asphalt so as to make the floor both acid and water-proof. It is characteristic of asphalt, however, to become soft in warm weather and to be depressed under the weight of the batteries which causes the material to ooze up between the tile or other paving material. Moreover, the commercial asphalt is so adulterated with tar and pitch that it soon becomes useless for the purpose intended, if it is not so from the beginning.

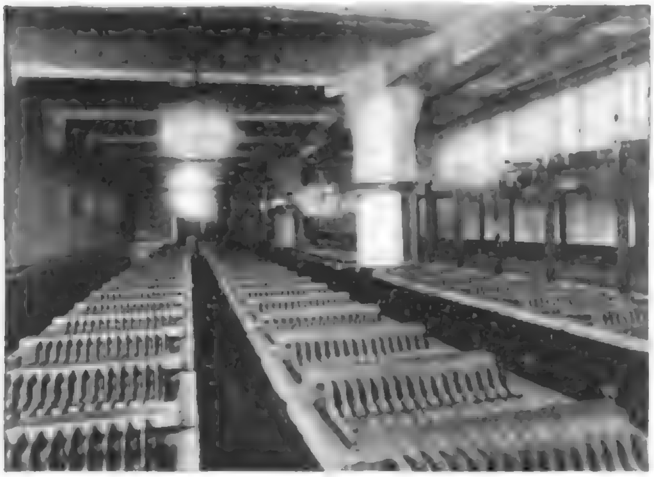


FIG. 1.—BATTERY ROOM, DUANE STREET STATION OF THE NEW YORK EDISON CO.

A compound which is coming into very general use for this purpose is known as "Hydrex," and in combination with "Hydrex felt," has been successfully employed on the battery room floors of some large central stations. The compound is melted and mopped on hot to the floor and between two layers of the felt, the latter being again mopped before the tile or brick is laid. The joints of the paving material are run with the compound, and in this respect the procedure is similar to that described above, the only difference being in the material applied, depending primarily upon specially made felt. The Hydrex compound is said to possess superior acid-resisting qualities and does not become soft at the moderate temperatures which render asphalt soft, so that it does not ooze, nor place the floor out of alignment. There is considerable knack in applying the substance so as to properly drain the floor and the walking surface above it. The exposed surfaces in the room and the conduits for carrying off the gases are painted with Hydrex cement, a liquid having the consistency of thick black paint, which is applied with a brush. Iron, wood or any other substance heavily coated with this cement is said to be rendered acid-resisting.

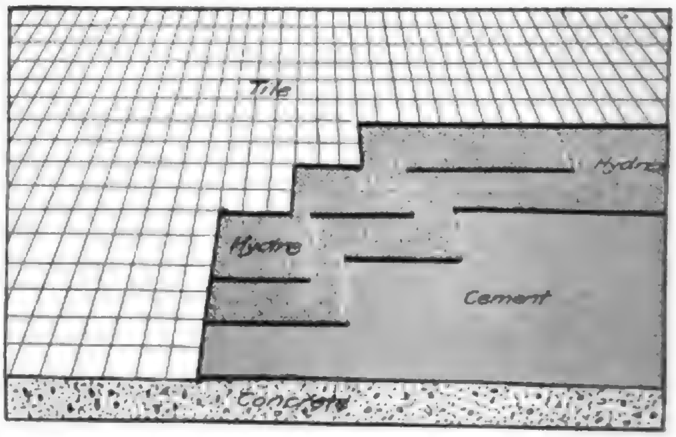


FIG. 2.—APPLICATION OF "HYDREX" FELT.

The felt used is very tenacious and pliable and possesses excellent water-proofing qualities, being absolutely impervious to water. The felt was originally made for underground water-proofing and to resist the severe conditions of such work. It has been extensively used in water-proofing foundations of power houses and in water pressure work. The felt also possesses excellent insulating qualities, and besides being used under generators to insulate them from the ground where this is desirable, it has also been adopted for third rail insulation on some of the large trunk lines. The ordinary tar or asphalt papers which are not of themselves water-proof, are not suitable for such work, since they soon dry out and disintegrate when exposed to the atmosphere. There has always been a demand for a felt having the nature of a membrane which in addition to being saturated like the ordinary so-called water-proof papers was at the same time treated by some additional process, so as to be in itself impervious to air and water. This would mean a felt which if shaped into a box and filled with water would still be durable and elastic and not let a drop of water pass through.

By means of the construction above outlined, battery rooms may be placed on the upper floors of stations, leaving the basement free for all cable runs, high-tension bus-bars, air chambers, rheostats, resistances, etc., and permitting a well-designed drainage system which would be impractical were the battery in the basement as is often the case. An impervious felt being a fair insulator, it may be used in a number of places where a cheap insulating substance is desired. The felt, which is made by the Hydrex Felt & Engineering Company, of New York City, is now being used in water-proofing the Pennsylvania tunnels under New York. The increasing use of concrete, especially in the foundations of modern power houses, emphasizes the necessity of a reliable material and method for water-proofing. The chief requisite in a water-proofing substance is elasticity, which will not crack with any settling or cracking of the masonry. The felt is also used in the roofs of power houses and for engine foundations.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Wholesale trade was quieter, but on the whole very satisfactory conditions prevail. Relief from drought in many important farming sections restored prospects of bountiful harvests, and the business of the nation maintained a volume that is exceptionally heavy for the season. Some evidences of conservatism regarding production beyond assured demands are noted, but in many of the leading industries contracts have been placed for the entire ouput during the remainder of the year, while steel mills are booked well into 1907. One of the features of the week was the settlement of the coal mining troubles in Ohio. Railway earnings thus far available for June show a gain of 10.5 per cent over last year's figures, and foreign commerce at the port of New York exceeds the volume in 1905 by $5,791,920 as to imports and $2,515,542 as to exports. Manufacturers in a number of lines, notably hardware, fine cottons and shoes, report orders booked ahead to a greater extent than is usual at this time. One of the events of the week in the iron market was the dissolution of the so-called gentlemen's agreement to maintain prices on Southern foundry pig iron and the booking of some orders at a reduction of $1 per ton. Outside of the competitive zone, however, the tendency is to maintain the firmness of the past week. The steel-making irons are higher and positively scarce, while Bessemer and forging steel billets and light steel rails have been advanced 50 cents to $1 per ton. Incidentally, makers of cast-iron pipe are being offered premiums of $1 to $2 per ton for early deliveries, and there is talk of raising sheet bars. Demand for finished material is heavy, while the steel-rail mills have added to their already heavy commitments for 1906 and 1907. Wire products display more activity than is usual at this season, and sales of 100,000 tons of steel bars have been made in the Chicago district. Copper is dull and, prices are easier. For the first time since May 11 copper prices were reduced, the reduction amounting to ⅛ to 3-16 cent. This was on indifferent demand, with a desire on the part of some holders to work off a portion of their holdings. The closing quotations were 18 13/16 for Lake, 18½ for electrolytic, and 18 5/16 for casting stock. *Bradstreet's* reports 173 business failures last week. This is three more than those of the week previous; also of the corresponding week last year.

CONDITION OF COPPER MARKET.—In discussing the recent situation, *Copper Gossip*, the bulletin of the National Conduit & Cable Company, says: "It is the consensus of opinion that copper will be in good demand, not only until the end of 1906, but that the tendency is for another year of great activity in 1907. A great deal depends upon the character of this year's crops. If they turn out as favorable as last season's business will undoubtedly feel the stimulating effect of a splendid agricultural situation. With the many encouraging features noticed at all trade centers there is abundant reason to regard the outlook optimistically. Developments in electrical quarters all point to an immense demand on account of new work from this source. The wire consuming industry is feeling the expansion in this field to an extraordinary degree, and with the prospects in sight an enormous tonnage of copper will be required for electrical equipments alone. Cables, miscellaneous wire products, motors, dynamos and telephone installations are all using up steadily increasing quantities of copper. The end it not yet, and what with the electrification of the railroads begun, the extent to which electrical improvements will be spread will eventually be on a tremendous scale. Electrical demand for copper will, therefore, continue to be a leading factor and a very marked feature in the copper situation. There are many interesting phases in connection with the copper market, but the growing demand for the wider introduction of electrical appliances is one of the most vital in maintaining the unusual strength now seen in the copper trade. Domestic consumption is estimated at the rate of 60,000,000 pounds of copper per month, and on this basis the quantity available for export is confined to proportionately narrower limits than in former years. Latest transactions include sales for October and November, at prevailing prices."

ALLIS-CHALMERS TURBO-GENERATOR FOR MERIDEN.—The Meriden (Conn.) Electric Light Company has recently placed its order with the Allis-Chalmers Company, of Milwaukee, for a 500-kw turbo-generator unit to be installed at the power house in Meriden late in the fall for lighting and power purposes. In additon to the turbine and generator proper, the Allis-Chalmers Company will furnish a structural steel foundation frame and a surface condenser with 2,000 sq. ft. of cooling surface, including centrifugal circulating pumps, air pumps, etc. The turbo-generator is the standard 500-kw construction, wound for 60 cycles, 2,300 volts, two-phase, with a steam pressure of 125 lbs. per square inch. The turbine is direct-connected to the revolving field of the generator. The turbine and alternator rotors, each carried on two bearings, will rest on a continuous bed plate, which is provided with suitable slides to allow for the expansion and contraction of the turbine cylinder, and in order to preserve the alignment of the entire unit. Units simlar to this one are now on order for the city of Jacksonville, Fla., the Western United Gas & Electric Company, of Aurora, Ill., and the Muncie Electric Light Company, of Muncie, Ind. Both turbine and alternator are the products of the Allis-Chalmers Company. The alternator will be built at the company's electrical works, Cincinnati, and the turbine will be built in the West Allis works.

ORDERS FOR VOLTAX.—The Public Service Corporation of Aurora, Ind., has recently placed a large order with the Electric Cable Company, of 17 Battery Place, New York, for Voltax, the new insulating compound, which it will use for purposes of waterproofing. The Electric Cable Company has recently sold a large quantity of Voltax to Paul Smith's Hotel Company as a waterproof paint for use on telegraph and trolley poles and fence posts on its property in the Adirondacks. The Electric Cable Company has been selling this compound extensively for this purpose. The Brass Goods Manufacturing Company, of Brooklyn, New York, has placed a large order with the Electric Cable Company for Voltax for waterproofing concrete floors.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, of Rochester, N. Y., reports having closed contracts for switchboards for the following places: Volant, Pa.; Chicago, Ill.; Dispatch, N. Y.; Sodus, N. Y.; Old Fort, N. C.; Walnut, Kans.; Herkimer, N. Y.; Syracuse, N. Y.; Leon, Ia.; Seattle, Wash. It has also closed contracts with the Metropolitan West Side Elevated Railway Company, Chicago, Ill., and the Cuban Eastern Railway Company, New York.

THE VALLEY FORGE SYSTEM, of railroads, with offices on the twenty-first floor, Land Title Building, Philadelphia, is to build a third-rail, low grade, private right of way line without grade crossings, from Philadelphia to Phoenixville, Pa. Much of the right of way is already acquired. Mr. L. Knowles Perot is president; Marshall S. Lynch, chief of engineers; G. U. G. Holman, electrical engineer, and Wm. J. Phillips, Jr., manager of right of way.

LARGE CANADIAN CONTRACT.—Westinghouse, Church, Kerr & Company have been retained by the Grand Trunk Railway Company, of Canada, as engineers to construct in Toronto one of the most modern and up-to-date terminals in the Dominion of Canada. This new station is to cost over $2,000,000 and will have most complete facilities for the freight and passenger transportation of the Grand Trunk and the Canadian Pacific railroads.

MILL AND PACKING HOUSE.—Libby, McNeil, Libby Company, of Union Stock Yards, Chicago, has ordered one 200-kw generator and eight motors, ranging from 10 to 35 hp, from the Crocker-Wheeler Company, of Ampere, N. J. The Ipswich Mills, of Ipswich, Mass., have recently ordered from the Crocker-Wheeler Company one 250-volt generator to furnish light for their building.

W. M. SHEEHAN & COMPANY, 136 Liberty Street, New York City, are installing an addition to the present plant at the State Training School for Women at Hudson, N. Y., and in addition are installing twelve 40-hp motors on brick machines at the yard of the Bartlett Brick Company, at Hudson, N. Y.

GENERATOR FOR MILLER LOCK COMPANY.—The Crocker-Wheeler Company, of Ampere, N. J., has received an order from the Miller Lock Company, of Philadelphia, Pa., for a 250-kw, 250-volt, engine-type generator to furnish power for running various motor-driven machinery.

INCREASE OF PLANTS.—The Alliance (O.) Gas & Electric Company expects to increase its power plant, putting in new boilers, and proposes also to adopt steam turbines.

BELL TELEPHONE PROSPERITY.—Figures of recent Bell telephone output have been given in these columns. The output statement of the American Telephone & Telegraph Company for May, remarks the *Wall Street Journal*, surpassed all previous records in both gross and net output. The best previous record was for April, 1906. The May gross output, for the second month in the history of the company, exceeded the 200,000 mark. These record-breaking results are the reflection of the aggressive policy of the company, of the general business prosperity of the country, and of the summer demand for telephones, which usually begins about the middle of May. The replacing of the telephone service destroyed by the San Francisco fire is also partly accountable for the large output. The company lost over 35,000 stations by the fire, and several heavy shipments of instruments West have already been made. The following table shows the gross and net outputs for the months of January, February, March, April and May, 1906, together with those of the corresponding periods of 1905:

	Gross		Net	
	1906.	1905.	1906.	1905.
January	176,607	130,634	113,383	92,934
February	161,775	134,301	112,933	86,724
March	188,102	169,159	121,506	121,514
April	206,557	174,207	141,200	129,226
May	211,573	168,764	152,230	115,552
Total	944,614	777,065	641,252	545,950
Increase	167,549	268,693	95,302	240,624

NEW YORK NAVY YARD TURBINES.—The Navy Department in its recent power extensions to the New York Navy Yard has, through its Bureau of Yards and Docks, adopted Westinghouse-Parsons steam turbines, which will be installed in Building No. 41. The present installation will comprise two 500-kw units operating under 150 pounds steam pressure, 28-inch vacuum and on superheated steam at 100 degrees Fah. The power plant supplies three-phase alternating current at 2,300 volts and 60 cycle frequency to the machine shops and dry docks and for other general purposes about the New York yards, including lighting of buildings. The boilers will be of the Stirling water tube type, with Foster internal superheaters. Worthington surface condensers will be used. This will make the second turbine plant that the Westinghouse Machine Company has installed for the Navy Department, the first one being at the Boston Navy Yard, where the turbines have been giving very good service.

TELEPHONY IN SAN FRANCISCO.—The Independent Home Telephone Company of that city, immediately upon the granting of the franchise (for which it paid the city $25,000, and, in addition, donated $75,000 to the relief fund), signed contracts with the Automatic Electric Company, of Chicago, for automatic telephone equipment with immediate provision for 10,000 lines. Work will be begun as soon as conditions in the stricken city will permit. It is impossible to say at this time how soon the exchange will be in operation. The time is auspicious for the entrance of the independents into San Francisco. The partial destruction of the Bell equipment there and the delays of rebuilding should, it is thought, make the road of the independents much easier to travel.

STEAM TURBINES FOR D. L. & W.—The Delaware Lackawanna & Western R. R. Company has contracted with the Westinghouse Machine Company for two Westinghouse-Parsons steam turbines to be installed in its new passenger terminal at Hoboken, N. J. The turbines will operate under a steam pressure of 140 pounds, 28-inch vacuum and moderate superheat, driving 550-kw, three-phase, 60-cycle Westinghouse generators of the rotating field enclosed turbo type. These machines will supply current to the station and yards. Internal superheaters will be used, while the condensing system will be Worthington barometric. Babcock & Wilcox boilers will supply steam, using small anthracite coal.

THE DERBY GAS COMPANY, Derby, Conn., has retained W. S. Barstow & Company, 56 Pine Street, New York, as engineers in making extensive additions to its electric power plant and distributing system. The present plant will be remodeled to conform with the new installations. When the plant is completed it will be one of the most modern of its kind and will include some interesting departures from current practice.

MONTREAL RAILWAY POWER HOUSE.—The Montreal Street Railway Company is about to have constructed a large new steam power house. It will be equipped to have a capacity of about 22,000 hp. The plant, which will be of modern construction in all particulars, will be built by the Canadian branch of J. G. White & Co.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was depressed, general declines having occurred in pool stocks, such as Reading, as well as in the United States Steel shares and specialties, like Interborough-Metropolitan. The latter, which had been supported at 50, broke violently early in the week and dropped at one time to 41. The cause of this decline was inexplicable. There was a general rally at the close of the week. The telegraph stocks, of the electrics, are the only ones that closed with gains, Western Union closing at 92 ex div., an advance of ¼ point, and American Telegraph & Cable at 91, which is a like gain. Allis-Chalmers common closed at 21, and preferred at 56¼, the latter being a decline of ¾ point. General Electric is off a fraction, closing at 165¾, and Westinghouse dropped 3 points, the last quotation being 158. American Locomotive common closed at 69, and preferred at 115. Among the tractions, Brooklyn Rapid Transit suffered a net loss of 2 points, and Metropolitan Street Railway 3, the closing prices being 78 and 110, respectively. Interborough-Metropolitan common closed at 43, which is a net decline of 7 points, and preferred at 78½, a loss of 4½ points. The market for outside securities was irregular, following the course of the main market. The following are the closing quotations of June 26:

NEW YORK

	June 19	June 26		June 19	June 26
Allis-Chalmers Co.	20¾	19⅝	General Electric	166	163
Allis-Chalmers Co. pfd.	57⅛	56¾	Hudson River Tel.	...	...
American Dist. Tel.	30	30	Interborough Rap. Tran.	..	..
American Locomotive	71¼	68¾	Mackay Cos	74⅝	73
American Locomotive pfd.	116	113½	Mackay Cos. pfd.	73	72⅝
American Tel. & Cable	91	90	Marconi Tel.	..	..
American Tel. & Tel.	137	137	Metropolitan St. Ry.	104	*112
Brooklyn Rapid Transit	80¼	77⅝	N. Y. & N. J. Tel.	...	..
Electric Boat	25	18	Western Union Tel	92¾	91⅜
Electric Boat pfd	70	65	Westinghouse com.	158	155
Electric Vehicle	10	10	Westinghouse pfd.	..	...
Electric Vehicle pfd.	16	16			

BOSTON

	June 19	June 26		June 19	June 26
American Tel. & Tel.	136¾	137	Mass. Elec. Ry. pfd	70	68
Cumberland Telephone.	...	...	Mexican Telephone	3¾	
Edison Elec. Illum.	240	241	New England Telephone	135	130¾
General Electric	172¾	...	Western Tel. & Tel	...	..
Mass. Elec. Ry.	20¼	19¾	Western Tel. & Tel pfd.	92	.

PHILADELPHIA

	June 19	June 26		June 19	June 26
American Railways	51¼	51⅛	Phila. Electric	9⅛	8¾
Elec. Co. of America	11¼	11⅜	Phila. Rapid Trans.	24⅛	24¾
Elec. Storage Battery	72	70	Phila. Traction	98¾	
Elec. Storage Battery pfd.	...	..			

CHICAGO

	June 19	June 26		June 19	June 26
Chicago City Ry.	170	167½	National Carbon	83	85
Chicago Edison	...	146	National Carbon pfd.	119	*117
Chicago Subway	..	52¾	Union Traction	...	...
Chicago Tel. Co.	...	117	Union Traction pfd.	...	..
Metropolitan Elev. com.	26	26			

* Asked

STONE & WEBSTER ENGINEERING CORPORATION.—An engineering and construction company, with a fully paid-in cash capital of $250,000, has been organized by Stone & Webster, under the laws of Massachusetts, to engage in a general engineering and construction business in connection with large undertakings. The engineering corporation will take over the engineering part of the business of Stone & Webster, which was originally the important part of their general business. Stone & Webster, some 16 years ago in Boston, were among the first to enter the field of electrical development as electrical engineers and experts, the business soon reaching large proportions. During the last few years, however, on account of other important interests of the firm, their efforts along these lines have been almost exclusively devoted to the "executive" requirements of the various companies under their management. As the firm desires to devote its time and energies to financial affairs and the management and development of the numerous properties which it operates, it has formed the Stone & Webster Engineering Corporation, the personnel of which will largely consist of men who have been associated with the firm for years in connection with the engineering and construction side of their business. In addition, arrangements have been made to associate with the new company engineers of prominence in their various lines, with the idea of placing it in a position to undertake engineering and construction work of importance throughout the country. All the stock of the company has been taken by Stone & Webster and their associates.

MEXICAN TELEGRAPH.—The Mexican Telegraph Company for the June quarter shows a gross of $170,500 as compared with $135,000 last year, a net of $142,500 and a total surplus of $2,193,734.

DIVIDENDS.—The directors of the Electric Storage Battery Company have declared a dividend of 1¼ per cent, both on the common and preferred stocks, payable July 2. The American Telephone & Telegraph directors have declared the regular quarterly dividend of 1½ per cent and an extra dividend of ¾ per cent, payable July 15. The directors of the Union Switch & Signal Company have declared the regular quarterly dividends of 2 per cent on the common stock and 2½ per cent on the preferred stock, both payable July 10. The directors of the Hall Signal Company have declared the regular quarterly dividend of 1½ per cent on the common stock, payable July 2, to stock of record June 23. The directors of the New York Air Brake Company have declared the regular quarterly dividend of 2 per cent, payable July 18. The Bell Telephone Company of Philadelphia directors have declared the regular quarterly dividend of ½ per cent, payable July 16. The directors of the Chicago Telephone Company have declared the regular quarterly dividend of 2½ per cent, payable June 30. The Detroit United Railway Company directors have declared the usual quarterly dividend of 1¼ per cent on the capital stock. The directors of the Central & South American Telegraph Company and the Mexican Telegraph Company have declared the regular quarterly dividends of 1½ and 2½ per cent, respectively. The Washington Water Power Company has declared a quarterly dividend of 1¾ per cent, payable July 2. The directors of the Westinghouse Electric & Manufacturing Company have declared the regular quarterly dividend of 2½ per cent upon the preferred assenting and non-assenting stocks, payable July 10. The directors of the Memphis Street Railway have declared a semi-annual dividend of 2½ per cent on the preferred stock. The directors of the Duluth Edison Electric Company have declared a dividend of 1½ per cent on the preferred stock, payable July 1. The directors of the Tri-City Railway & Light Company have declared a dividend of 1½ per cent on the preferred stock, payable July 2. The directors of the New Orleans Railway & Light Company have declared the regular preferred quarterly dividend of 1¼ per cent, payable July 16. The dividend of 1¼ per cent declared by the directors of the Detroit United earlier in the week is payable August 1. The Manchester Traction, Light & Power Company has declared a regular quarterly dividend of 1½ per cent and 1 per cent extra, payable July 16. The directors of the United Railways of St. Louis have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 10. The Omaha Electric Light & Power Company has declared a semi-annual dividend of $2.50 per share on the preferred stock, payable August 1. The directors of the E. W. Bliss Company have declared the regular quarterly dividend of 2 per cent on the preferred stock and 2½ per cent on the common stock, payable July 2. The directors of Manning, Maxwell & Moore, incorporated, have declared a regular quarterly dividend of 1½ per cent on the $5,000,000 capital stock, payable July 2.

THE BALTIMORE CONSOLIDATION.—The plan for the consolidation of the Consolidated Gas Company with the Consolidated Gas, Electric Light & Power Company is made public. The latter company owns 61 per cent of the stock of the former and there is to be a scaling down of capital. The minority stockholders of the gas company are offered 80 per cent in new preferred and 50 per cent in common for their holdings, while the preferred stockholders of the Consolidated Gas, Electric Light & Power Company are offered 50 per cent in new preferred and 40 per cent in new common. The common stockholders are offered 30 per cent in new common, while the holders of the prior lien stock, of which there is only $700,000 outstanding, are to receive 100 per cent. A syndicate has been formed by the Continental Trust Company, of Baltimore, which offers $83 a share for the stock of the gas company, and proposes to place all acquired in the consolidation. The company has also formed a syndicate, which has underwritten the entire issue of common stock of the new company at 40 per cent on the par value, and every stockholder of both companies has the option of either accepting the new common stock of the Consolidated Company, or, in lieu thereof, $40 a share in cash. The stockholders of the gas company are offered the further option to exchange the new preferred stock receivable by them for the 4½ per cent general mortgage bonds, part of the $7,102,000 of such bonds heretofore issued by the power company on the basis of exchange of bonds at par for the preferred stock at par, provided notice of such election is served on the trust company not later than June 28.

ALLIS-CHALMERS BONDS.—The Allis-Chalmers Company is to offer to its stockholders $12,000,000 first mortgage ten-thirty-year sinking fund bonds, an issue recently decided upon by the directors for the financing of the additions to the company's plant at Milwaukee and to pay for the Bullock Electrical Works at Cincinnati, as well as to provide working capital for the increased business. The stockholders' privilege to subscribe is at the rate of 80 and interest pro rata, according to their holdings. The bonds, which are dated July 1, will be redeemable after ten years at 110 and interest. The sinking fund provides for the purchase of the bonds in the open market after five years at a maximum of 110, and, if carried out, should retire the bonds by maturity. The bonds will be underwritten by a syndicate managed by Shearson, Hammill & Company.

KEY WEST CONSOLIDATION.—Stone & Webster, of Boston, have purchased the Key West Electric Company, which does the entire electric railway and lighting business of Key West, Fla. The company will retire all the outstanding securities and the new capitalization will be as follows: Bonds, first mortgage, 50-year, 5 per cent gold, to be authorized, $1,000,000; to be issued, $450,000; preferred stock, 6 per cent non-cumulative, to be authorized and issued, $230,000; common stock, to be authorized and issued, $500,000. New money will be provided to re-equip the power station, to purchase cars and equipment, to extend the lighting system, to develop the gas business under the franchise owned by the company, and to put the entire property in the best operating condition. The present street railway mileage is five miles.

UNITED STATES TELEPHONE STOCK INCREASE.—The capital stock of the United States Telephone Company was increased from $2,500,000 to $5,000,000 at a meeting of stockholders in Cleveland. This was deemed advisable in order to place the company in position to increase its holdings and enlarge its scope in accordance with plans already decided upon. The board of directors was increased to fifteen by the election of six new members who represent the new interests which have recently acquired large holdings in the company. The new directors are H. C. Stitle and A. H. Bower, of St. Louis; S. Hopkins, Columbus; A. B. Taylor, Elyria; Clarence Brown, of Toledo, and Herbert Wright, of Cleveland. The directors of the company declared a dividend of ¼ of 1 per cent on common and 1½ per cent on preferred, payable July 10.

NEW ENGLAND TELEPHONE.—The New England Telephone & Telegraph Company have offered $3,965,500 of new capital stock to shareholders at par in proportion to their respective holdings. Each stockholder of record June 20, 1906, will be entitled to the new stock in the ratio of one share for each seven of present holdings. The rights to subscribe expire July 18, 1906, and all subscriptions and assignments of rights must be filed with the secretary of the company by the latter date. Payments for the new stock must be made, one-half by August 20, 1906, and the balance Feb. 20, 1907. The proceeds of the issue will be used to provide funds for extension of the property and business of the company and for payment of bonds due in 1907.

LONG ISLAND TROLLEY BONDS.—The New York & Queens County Railroad, which runs from Long Island City, opposite the Thirty-fourth Street Ferry, to Flushing, Corona, Jamaica and other points, has applied to the State Railway Commissioners for permission to issue $10,000,000 bonds on a first and refunding mortgage. Mr. Noel Gale, of Strong & Cadwalader, explained that the object of the loan was to liquidate some outstanding indebtedness and to furnish funds for improving the road and providing more cars and power. The Commissioners directed Mr. C. R. Barnes, their electrical expert, to investigate conditions on the road and to make a report

INTERSTATE TELEPHONE RECEIVERSHIP.—The referee in the Interstate Telephone receivership matter has made his report to the New Jersey Court of Chancery at Trenton. He reports there is due on the mortgage given to secure the bonds the sum of $2,054,083, and that the property of the company should be sold as a whole. The Trenton Trust & Safe Deposit Company was the trustee, but recently resigned, and Carroll Robbins was elected trustee. Robbins brought suit to have the mortgage foreclosed to satisfy the bondholders.

NEW ORLEANS BONDS.—The $13,643,000 of the general mortgage 4½ per cent bonds of the New Orleans Railway & Light Co. have been issued, to satisfy obligations and for general corporate purposes, $13,357,000, and for acquisitions, extensions, betterments, $286,000. The New Orleans Railway & Light Co. owns about 190 miles of track, and operates 500 cars. The gas franchise is perpetual and exclusive until 1925. The electric light franchise is perpetual, and the street railway franchises are generally for from thirty to fifty years.

SOUTH AMERICAN TELEGRAPHS.—The Central & South American Telegraph Company shows for the June quarter a gross of $353,000 as compared with $300,000 last year and net of $246,000 against $194,500. The surplus is $1,656,749.

GENERAL NEWS.

Construction News.

SYLACAUGA, ALA.—The Council has decided to issue $16,000 bonds for improving the water works and electric light plant.

LANGLEY, ARK.—D. A. Allen, of Altus, Ark., president of the Southern Power & Development Company, writes that it is proposed to build a dam 3 feet wide at top, 235 feet at bottom and 50 feet high, for furnishing electric power for operating saw mills and lighting plants.

LITTLE ROCK, ARK.—The City Council has granted John G. Vogel a 50-year franchise for an electric light, heat and power plant, and also embodied in the ordinance a contract for the lighting of the streets of the city with 60 electric lamps, for which the city agrees to pay during the life of franchise $600 per month.

HARRISBURG, ARK.—The Harrisburg Light & Power Company has been merged with the Royal Handle Manufacturing Company, and it is proposed to consolidate the two plants in the near future. The officials for the new company are Morris Hayutin, president; J. J. Mardis, vice-president; T. B. Steele, secretary and treasurer.

GARDEN GROVE, CAL.—The Edison Electric Company will put in a power plant for the Garden Grove Irrigation Company.

LOS ANGELES, CAL.—Property owners on East Seventh Street have raised $75,000 for the construction of an electric railway.

LOMPOC, CAL.—Messrs. Woods and Lewis, of Los Angeles, are interested in the construction of an electric light plant at Lompoc.

CHICO, CAL.—The Northern Electric Company has purchased a site at Second and Main Streets, on which it will erect a building at a cost of $75,000.

OAKLAND, CAL.—The Oakland Gas, Light & Heat Company has been awarded the contract for lighting the streets and public buildings for the year 1906-1907. The price paid for arc lamps is $75 per year.

STOCKTON, CAL.—The City Council has passed an ordinance calling for an election on July 31, to vote on issuing bonds for $764,000 for municipal improvements, including the building of an electric lighting plant.

UKIAH, CAL.—The Snow Mountain Power Company has been granted a franchise by the Board of Supervisors to erect and maintain a transmission line to supply electricity for light, heat and power, and to erect telegraph and telephone lines along and over certain highways in Mendicino County.

REDDING, CAL.—The Northern California Power Company has leased the power plant on Battle Creek, of the Battle Creek Power Company, for a period of fifty years, at an annual rental of $500. By the lease the Northern California Power Company assumes all existing contracts and is to pay at maturity the $1,000,000 bonds issued by the Mercantile Trust Company.

SAN FRANCISCO, CAL.—The work of lighting the streets in the burned district has been started, according to the plans now being made, the greater part of this area, which has been intotal darkness, will soon be lighted by electricity. After the fire the United Railroads of San Francisco voluntarily offered to furnish the city, free of charge, lamps for Market and Sutter Streets; the company will supply poles of a special design to be selected by the city. This will be done as soon as the work of re-establishing its street car service is completed.

ROCKY FORD, COL.—E. L. McKelvey, city clerk, writes that the Weber Gas & Gasoline Engine Company, of Kansas City, Mo., has secured the contract for two 100-hp gas producers, two 100-hp gas producer engines, a triple single-acting high-duty pump and a 50-kw direct-current generator for $16,553.

BOULDER, COL.—Westinghouse, Church, Kerr & Company have been engaged by the Northern Colorado Power Company as engineers and constructors of the large power and transmission plant, which is to be built in this place. The equipment for the system will be installed by the Westinghouse Electric & Manufacturing Company. The plant will cost $1,000,000 and will supply a number of towns in Colorado and Wyoming with electricity for lighting and for the operation of street railways.

NORWALK, CONN.—The Reed & Volk Electrical Company is installing an electric lighting plant at Midbrook, the residence of Mr. Samuel R. Weed in Brookside.

STAFFORD SPRINGS, CONN.—Smith & Cooley have recently installed a new electric plant and are now operating their plant by electricity. The Rhode Island Company will soon install an electric plant and use electricity for power.

COS COB, CONN.—The Westinghouse Electric Company has installed in the power house of the New York, New Haven & Hartford Railroad Company the first of the units which are to supply the electricity for the operation of the new electrical service from Stamford to New York. The unit installed is of 3,000 hp. It is expected that the capacity of the power house, when completed, will be [illegible] hp. Other units will be installed as soon as completed.

ST. AUGUSTINE, FLA.—The Southern Bell Telephone Company is planning to make extensive improvements to its system here.

CARTERSVILLE, GA.—The citizens voted June 16 to issue $25,000 bonds for a municipal electric light plant.

BRUNSWICK, GA.—Plans are being prepared by the Southern Bell Telephone Company for a new exchange building at Brunswick, Ga.

WAYNESBORO, GA.—Sydney C. Jones, city clerk, writes that the citizens voted June 14 to issue bonds for water works, sewers and electric lights.

GRANGEVILLE, IDA.—Estimates have been approved by the Pacific States Telephone & Telegraph Company for the rebuilding of the Grangeville exchange and putting in an up-to-date telephone system at a cost of about $2,500.

CAMP POINT, ILL.—At an election the citizens voted against municipal ownership of the local electric lighting plant.

CAMP POINT, ILL.—The Camp Point Electric Light & Power Company has sold its plant to a company consisting of A. A. Callahan, E. B. Sawyer, of Camp Point, and E. E. Hollister and George C. Gill, of Quincy, Ill. The new company will erect a new building and install a new engine and boiler. The electrical part of the plant was rebuilt last year.

RICHMOND, IND.—The City Council has appropriated $35,000 for the purchase of new machinery for the electric light plant.

GOSHEN, IND.—Plans have been made by Frank Shaffer for the rebuilding of the entire electric lighting system in this city.

FORT WAYNE, IND.—The Ft. Wayne & Springfield Traction Company has been financed for the construction of its line between Ft. Wayne and Decatur.

KOKOMO, IND.—The proposition to install a new electrical fire alarm system in this city is now being considered and it is expected that bids will be invited soon.

INDIANAPOLIS, IND.—The Indianapolis, Huntington, Columbia City & Northwestern Traction Company has increased its capital stock from $50,000 to $1,500,000.

COLUMBUS, IND.—C. F. Ferguson has filed a petition for a franchise for an interurban railway which he is projecting from this city to West Lick and West Baden.

RICHMOND, IND.—An ordinance has been passed by the City Council requiring all telephone companies to place their wires under ground when they reconstruct their plants.

CONNERSVILLE, IND.—The Connersville Natural Gas Company has been granted a franchise to construct and operate an artificial gas and an electric lighting plant in this city.

GREENCASTLE, IND.—An electric lighting plant is to be installed by the auohtrities of De Pauw University for the purpose of lighting the buildings. The plant will cost from $5,000 to $6,000.

GREENWOOD, IND.—The Central Union Telephone Company has absorbed the Greenwood Telephone Company. The present wire system will be supplanted by cables as rapidly as possible.

ANDERSON, IND.—The Remey Electric Manufacturing Company, of this city, has let a contract to Bert Wright to erect a large addition to the company's present plant. The new addition will be equipped with electrical machinery.

WALKERTOWN, IND.—The new municipal electric lighting plant is being installed in this town. The equipment will consist of a 50-kw alternator, a 125-hp engine and 21 series arcs. Norman McKenzie will have charge of the plant.

INDIANAPOLIS, IND.—The plans for the remodeling of the City Hospital include an entire new heating and electric lighting equipment and a laundry which will also have electrical apparatus. The improvements will cost $100,000.

PERU, IND.—The McCarmack Construction Company, of Columbus, Ind., has secured the contract to erect the new Court House in this city for $227,000. The plans contain several new features relative to electrical equipment, and when completed the building will be the best lighted and equipped in the State.

ARDMORE, I. T.—The Ardmore Electric Company has been granted a franchise for an electric railway system in this city.

CHICKASHA, I. T.—It is reported that the financing of the City Railway Company has been successfully carried out, and that construction work will commence within 30 days. Eight miles of track will be laid.

BEDFORD, IA.—J. J. Clark has petitioned for a franchise for an electric light plant.

DOON, IA.—The citizens have voted to issue bonds for the construction of a lighting plant.

FAIRFIELD, IA.—The plant of the Fairfield Gas & Electric Company was destroyed by fire on June 18.

WATERLOO, IA.—G. H. Merrill has secured the contract to erect an electric light station for the Citizens' Gas & Electric Compay.

IOWA CITY, IA.—Work has commenced on the new power house for the State University. Prof. B. J. Lambert will have charge of the construction work.

OSKALOOSA, IA.—The Home Telephone Company will make extensive improvements in its system in this city. A new building is to be erected at a cost of $50,000 and all of the wires are to be placed underground.

DES MOINES, IA.—The North Des Moines plant of the Iowa Heat, Light & Power Company, which was advertised to be sold at a sheriff sale on June 18, failed to attract a single bidder. The plant was ordered sold on an execution given the Iowa Loan & Trust Company for $12,000.

CHERRYVALE, KAN.—Chas. F. Fertig and E. H. Sunderlin, of Colorado Springs, Col., have purchased the plant of the Cherryvale Electric Light & Power Company, and will expend about $50,000 in improvements.

DANVILLE, KY.—It is reported that contracts will soon be awarded for the construction of the Danville & Scottville Railway. Work will begin at McKinney and will proceed in both directions.

BALTIMORE, MD.—The United Railways & Electric Company has completed the surveys for a line from Towson to Timonium. It is expected to have the line completed in September. It is understood that it is the intention of the company to ultimately build the line through to Cockeysville.

BALTIMORE, MD.—The merger of the Consolidated Gas, Electric Light & Power Company and the Consolidated Gas Company was effected June 20. The new company will be known as the Consolidated Gas, Electric Light & Power Company. The officers of the new company are as follows: Gen. Ferdinand C. Latrobe, president; Alten S. Miller, vice-president and general manager; Joseph W. Clark, treasurer; W. Stuart Symington, assistant treasurer; Charles M. Cohn, secretary; Douglass Burnett, manager of electrical department.

WORCESTER, MASS.—The Worcester Electric Light Company will soon commence work on the construction of its underground system in this city.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company has advised the Selectmen that it will continue the custom of furnishing, without charge, light for the band stands at the evening concerts.

FALL RIVER, MASS.—An electric lighting plant is being installed in the boiler house near the wharf station. Electricity will be furnished to the wharf station, the cotton sheds and other buildings in this vicinity.

PITTSFIELD, MASS.—The New York, New Haven & Hartford Railroad Company has decided to light all of the stations on the Berkshire division between this city and Great Barrington by electricity, which will be furnished by the Berkshire Street Railway Company.

HOLYOKE, MASS.—The new power plant of the Holyoke Water Power Company is completed and in readiness to supply electricity. The B. F. Perkins Company will use electric power as soon as arrangements are completed for operating its machinery by electricity.

MIDDLEBORO, MASS.—A. H. Eaton, town clerk, has been appointed a member of the committee to have charge of the purchase of the new machinery for the electric light station, taking the place of C. H. Leonard, who resigned. The committee has organized with Elisha T. Jenks as chairman and A. H. Eaton as secretary. Mr. Eaton states that bids will probably be received in July for the machinery for the municipal lighting plant.

WEST SPRINGFIELD, MASS.—At a special town meeting held recently the selectmen were authorized to make a contract for street lighting. The United Electric Light Company, which now has the contract for lighting the streets, offered to renew the contract for a term of three years with a concession of 10 per cent of the company's commercial receipts in consideration of the use of the poles and wires that are town property. The company has agreed to furnish electricity for 1200 arc lamps at $73 per year, and 40-cp incandescent lamps at $12 per year, provided enough lamps are used to give the company an annual revenue of at least $6,500. The selectmen are now empowered to make the contract, and will consider the bids of any other person or company that may desire to bid for it.

GRAND RAPIDS, MICH.—The sub-station of the Grand Rapids-Muskegon Water Power Electric Company at Wealthy Avenue bridge is nearly completed, and it is expected that the company will be ready to furnish electricity to the local consumers who have already contracted for it within 30 days. No effort will be made to contract for further power until the new dams have been built, which will not be completed for another year. The Muskegon Interurban Company is using energy furnished by the company. In Muskegon two large factories, the Shaw Electric Crane Company and the Amazon Hosiery Company, are both using electricity supplied by the Grand Rapids-Muskegon Water Power Electric Company. The large plant which is being erected by the Brunswick-Balke-Collender Company will also be supplied with energy by the electric company.

STAPLES, MINN.—The Northwestern Telephone Company will rebuild the local exchange in this place.

MOOSE LAKE, MINN.—The Barnum Telephone Company has been granted a franchise for a local exchange.

MINNEAPOLIS, MINN.—The contract for the construction of the addition to the power house at the State University has been awarded to J. and W. A. Elliott.

DULUTH, MINN.—Bids are wanted until July 9 for $375,000 bonds for the purpose of improving water and light plant. H. W. Cheadle is city clerk.

BERMIDJI, MINN.—The Northwestern Telephone Exchange is contemplating a number of improvements to its system in this city. The service is to be enlarged and a heavier line built.

NASHWAUK, MINN.—Bids will be received by the Village Clerk until July 10 for the installation of a 50-kw dynamo, wiring, pole line and engine. Claussen, Burch & Pillsbury, of St. Paul, are the engineers.

DULUTH, MINN.—At a recent meeting of the City Council a resolution was passed authorizing the water board to make a contract with the Great Northern Power Company to furnish electricity for operating the pumping station. Under the proposed contract the maximum price for pumping 1,000,000 gallons is $6.50. Last year it cost the city $8.90 per million gallons without counting the cost of depreciation in the plant.

JACKSON, MISS.—The Jackson Electric Light, Railway & Power Company has changed its name to the Edwards House & City Railway Company, and is now operating under a charter bearing that title.

LA BELLE, MO.—The municipal electric light plant was destroyed by fire on June 17. It will be rebuilt.

SEDALIA, MO.—The Business Men's Association of this city has applied to the City Council for a franchise to sell gas and electricity and to operate a street railroad.

CARTHAGE, MO.—The City Councils of Carthage and Joplin have granted a franchise to the company which proposes to build an electric railway from Independence to Chanute.

ST. JOSEPH, MO.—The Citizens' Telephone Company is now making arrangements for making many improvements and greatly enlarging its system in this city. Dr. J. J. Newell is manager.

ST. LOUIS, MO.—The Board of Public Improvements has authorized the Western Union Telegraph Company and Postal Telegraph Companies to place their wires under ground in the downtown section of the city.

ST. LOUIS, MO.—The capital stock of the Suburban Telephone Company has been increased from $100,000 to $600,000. A certificate to this effect has been filed at Clayton, St. Louis County. H. W. Karrenbrock is president and Joseph B. Greensfelder, secretary.

BENEDICT, NEB.—The Village Board has purchased the electric lighting plant of W. G. Keeler for $2,200.

RULO, NEB.—The Village Council is endeavoring to have an electric light and water works plant established in this village.

UNIVERSITY PLACE, NEB.—The question of issuing bonds for improving the electric light plant is now being considered.

WYMORE, NEB.—The Bell Telephone Company is preparing to rebuild its system. The improvements contemplated will cost about $25,000.

SWEETWATER, NEV.—The New Bodie Mining Company is making arrangements for the construction of a large electric generating station on the East Walker River, which is intended to supply electricity for operating the mines of Aurora, Masonic, Bodie and southern Nevada. It is said that 10,000 hp will be developed, and that the station alone will cost $150,000. W. D. Searles is chief engineer of the New Bodie Mining Company.

FRANKLIN, N. H.—The Franklin Light & Power Company is preparing to construct a new electric power plant at Giles Mills. Material has been received for the construction of the new penstock.

SOUTH ORANGE, N. J.—Charles H. Ingersoll, who advocated the establishment of a municipal lighting plant in South Orange, a project which met with opposition, now offers to subscribe $5,000 to a fund to be used for the purpose of erecting a plant which will supply electricity to the village at a lower rate than is now paid.

POTSDAM, N. Y.—The citizens voted June 14 to issue $24,000 bonds for an electric light plant.

FREDONIA, N. Y.—The Village Trustees are considering improvements to the electric light plant, to cost about $10,000.

BROCKPORT, N. Y.—The Village Board has granted a franchise to the Buffalo, Lockport & Rochester Electric Railway Company to extend its lines to the streets of this village.

FORT SLOCUM, N. Y.—Sealed bids will be received by E. N. Jones, constructing quartermaster until 11.15 A. M., July 10, 1906, for the construction of an electric lighting system.

SENECA FALLS, N. Y.—The Seneca Edison Company has made application to the State Gas and Board Commission for permission to consolidate with the Geneva Light & Power Company.

BROOKLYN, N. Y.—The H. B. Smith & Company has engaged Frank M. Smith, architect, of Cincinnati, Ohio, to draw the plans and supervise the construction of its power plant to be erected on Kent Street. The plant will cost $1,000,000.

SYRACUSE, N. Y.—Joseph Dunfee, of Syracuse, has secured the contracts for the construction of the conduit systems for the telephone wires in Oswego, Fulton and Baldwinsville. The Oswego contract calls for an expenditure of $25,000—Fulton, $10,000, and Baldwinsville, $10,000.

HART'S ISLAND, N. Y.—Bids will be received until July 3 by Francis J. Lantry, commissioner of correction, New York City, for furnishing and installing a new 100-kw compound and shunt-wound 250-125-volt, three-wire engine type generator, with field rheostat for switchboard mounting, etc., on Hart's Island.

MIDDLETOWN, N. Y.—The West Branch Light & Power Company has been granted a certificate of authority by the Commission of Gas and Electricity to supply electric light in the villages of South Kortright, Hobart and Stamford, Delaware County. Bonds to the amount of $45,000 may be issued by the company, and capital stock to the amount of $5,000. The company also received consent to purchase the stock of the Stamford Electric Light Company.

CHARLOTTE, N. C.—The Charlotte Consolidated Construction Company has under consideration the building of an electric railway to the Catawba River, 12 miles distant, furnishing a resort for the people of Charlotte.

CHARLOTTE, N. C.—The Southern Power Company proposes to build a transmission line to Statesville, a distance of about 50 miles, and expects later to furnish electricity to Statesville from another water development, farther up the Catawba River.

WINSTON-SALEM, N. C.—William and Sinclair Mainland, of Oshkosh, Wis., have purchased the gas and electric plants in this city and contemplate extensive improvements. It is said that about $200,000 was paid for the properties, and that they will be turned over to the Continental Public Utilities Corporation.

GRAND FORKS, N. D.—Edward L. Healy, of Red Lake Falls, Minn., has secured a franchise for an electric light plant.

CLEVELAND, OHIO.—The stockholders of the United States Telephone Company have voted to increase the capital stock from $2,500,000 to $5,000,000.

BELLEFONTAINE, OHIO.—The Urbana, Bellefontaine & Northern Traction Company will build a new city line on West Columbus Avenue to the corporation line.

DAYTON, OHIO.—The Board of Public Safety has petitioned for an appropriation of $15,000 for the purpose of putting the wires of the police and fire department underground.

NILES, OHIO.—The contract for furnishing a steam engine, generator and street lighting system for the municipal electric lighting plant has been awarded to the Machinery Sales Company.

STEUBENVILLE, OHIO.—The Council of Wellsburg has granted a franchise for the Wellsburg terminus of the Wheeling & Bethany Electric Railway. The company will commence construction work immediately.

LAKEWOOD, OHIO.—Chas. W. Root, Village Engineer, 736 Society for Savings Building, Cleveland, writes that an election will be held on July 5 to vote on issuing $25,000 bonds for the extension of the electric light plant.

SPRINGFIELD, OHIO.—John S. Harshman, general manager of the Springfield & Washington Traction Company, states that work on the extension of the line of South Charleston to Washington C. H. will be started within the next few weeks. Arrangements have been made for selling the bonds on the extension, and material is now being purchased.

COLUMBUS, OHIO.—Dr. S. B. Hartman, of Columbus, has made application to the County Commissioners for a franchise to build a suburban line from the south end of the Central Market Street line, along High Street to the Hartman farm, opening up a new suburban district. It is stated that when this line is completed the road will be extended to Commercial Point and Washington C. H.

ZANESVILLE, OHIO.—The Southeastern Ohio Railway & Light Company has commenced the construction of a dam across South River at Powell's Mills. A lake will be formed supplying water to the new power station. The villages of Roseville and Crooksville have submitted a proposition to the company to install additional pumps at its power station and to build pipe lines to supply these villages with water.

CLEVELAND, OHIO.—The Cleveland Construction Company, which has the contracts for building the Youngstown & Ohio River Railway from Columbiana to Lisbon and East Liverpool, and the Cleveland, Ashland & Mansfield Traction Company's line from Seville to Ashland and Mansfield, has placed contracts for trolley wire, direct-current and high-tension feeders, with the American Steel & Wire Company, covering the quantities needed for both lines. Several other contracts for miscellaneous material have also been closed. Proposals are under consideration for power-house equipment. Both steam turbines and reciprocating engines are being considered; two units of 1,000-hp capacity each will be purchased, and the contracts will be closed in the near future. Work of grading has already been started on both of these roads.

FREELAND, PA.—The Borough Council has granted a franchise to the Consumers' Electric Light Company.

DELTA, PA. The Castle Fin Electric Company is preparing to build an electric plant at Castle Fin Forge on Muddy Creek.

NEW HAVEN, PA.—D. S. Martin, of Bellevue, has secured the contract for constructing an electric light plant for $15,000.

POTTSVILLE, PA.—The Borough Council will receive bids until September 18 for lighting the borough for 5 years from February 15, 1907.

DANVILLE, PA.—The contract for the construction of the power house for the Hospital for the Insane has been awarded to J. T. Buchanan & Company.

JOHNSTOWN, PA.—The Dale Borough Light, Heat & Power Company will make application to the City Council for a franchise to furnish heat, light and power in this city.

WILKESBARRE, PA. A company has been organized with J. B. Ford, president and Geo McDonald, secretary, to establish a new lighting plant in Wilkesbarre

READING, PA.—The Edison Illuminating Company and the West Chester Steam, Heat & Power Company have consolidated under one charter, with a capital stock of $70,000.

READING, PA. The contract for furnishing electricity for lighting the County Home has been awarded to W. F. Krick, of Sinking Spring, at the rate of 30 cents per lamp per month. About 225 lamps will be used.

LOCK HAVEN, PA.—The Council has entered into a contract with the Lock Haven Electric Light & Power Company to furnish street lamps for a term of five years. The company is to furnish 80 or more lamps of 2,000-cp each at $65 per lamp per year. The price paid under the old contract was $71 per year.

BIRDSBORO, PA. Work on the new power plant of the Birdsboro Electric Company, which is now being erected near the canal locks, is progressing favorably. The new water wheel has been installed and is working satisfactory. The steam engine, dynamo and other equipment will soon be moved from the present plant and placed in the new building.

ALTOONA, PA.—The Altoona, Hollidaysburg & Bedford Springs Railway Company has awarded the contract for the construction of its power house to the Allis-Chalmers Company, of Milwaukee, Wis. The contract calls for two 500-kw railway generators, two 800-hp Corliss engines. Four 300-hp Babcock & Wilcox water-tube boilers will be installed. The plant will be located at Duncasville.

PROVIDENCE, R. I.—Bids will be received until July 2 by Jeremiah H. Hall, chairman committee on city property, for installing ventilating and heating system, engines, generators, belting and switchboard required for the additions and alterations to the Technical High School. The Richard D. Kimball Company, Beacon Street, Boston, Mass., is the engineer. Martin & Hall, Providence, are the architects.

CHARLESTON, S. C.—Bids will be received until July 21 by Mordecai T. Endicott, Chief Bureau Yards and Docks, Navy Department, Washington, D. C., for furnishing at the Navy Yard, Charleston, S. C., two air compressors and accessories as per specification 1497; estimated cost, $22,000; boilers and accessories, coal handling apparatus, electrical equipment, pumps and piping as per specification 1498; estimated cost, $90,000; four turbo-alternators, engines, generators, switchboard, wiring, etc., as per specification 1499; estimated cost, $85,000.

LLANO, TEX.—The Texas Telegraph & Telephone Company is preparing to extend and improve its lines. Several of the lines will be entirely rebuilt. The company contemplates an expenditure of about $10,000.

LAREDO, TEX.—Bids will be received until July 17 by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for installing a conduit and wiring system in the U. S. Post Office, Court House and Custom House at Laredo.

SALT LAKE CITY, UTAH.—The Utah Copper Company, of which D. C. Jacklin is general manager, has awarded the contract for the electrical equipment for the new Garfield mill to the General Electric Company.

OGDEN, UTAH. The Ogden Electric Supply & Fixture Company has been awarded a contract by the Utah Smelting Company to put in a transmission line, together with all machinery, from Brigham City to the smelter.

RICHMOND, VA.—The Southern Bell Telephone Company will spend about $400,000 for extensions and improvements to its system in this city this year. A new building is to be erected and new switchboard installed and the wires are to be put underground.

RICHMOND, VA.—The Committee on Electricity has asked the city attorney, superintendent of the water works and city electrician, to frame an ordinance providing for an electric light plant for municipal uses only, not to exceed $250,000 in cost, and to report the same at the next meeting of the committee.

NORFOLK, VA.—The Norfolk Railway & Light Company has placed orders for the equipment of its new power house, which will have a capacity of 10,500 kw, consisting of three 3,000 and one 1,500 kw Curtis turbines, of the condenser type, and fourteen Babcock & Wilcox boilers of 650 hp each, which will be equipped with Roney stokers. The company will install three sub-stations at the present time; one at Ocean View, one at the power house in Norfolk and one at Portsmouth, which will replace several small generator plants. Later on a sub-station will be installed at Suffolk.

YAKIMA, WASH.—The Yakima Inter-Valley Traction Company has been organized here for the purpose of building an electric system for this city and the entire valley.

PORT TOWNSEND, WASH.—Ivan L. Hyman, of Seattle, has purchased the property of the Port Townsend Gas & Electric Company, which was sold at sheriff's sale on May 26.

SPOKANE, WASH.—The Referendum League, recently organized, is stated to have decided to petition the Council to call an election to vote on constructing a municipal electric light plant.

BELLINGHAM, WASH.—The Home Telephone Company is putting in a new automatic telephone system in this city. The company also contemplates putting in a system in Anacortes.

OLYMPIA, WASH.—Plans and specifications have been received for the new telephone exchange building for the Olympia Sunset Telephone Company and work on the structure will begin at once.

PULLMAN, WASH.—Work has commenced on the transmission line from Moscow to Pullman. M. J. Shields & Company, of Moscow, who have a franchise to operate an electric lighting and power plant, which is to be in operation by July 1, have commenced work on the transmission line from Moscow. Power is to be brought from Asotin, Wash. The company will lease the city system until the next general election, when the citizens will vote on the proposition to sell the plant to the company.

BENWOOD, W. VA.—The City Council is considering the question of constructing a municipal lighting plant at a probable cost of $30,000.

MADISON, WIS.—The Council has made an appropriation to buy a site for a municipal electric lighting plant.

ABBOTSFORD, WIS.—This city would like to correspond with parties interested in an electric light franchise. Address Louis Olson, village clerk.

WEST MILWAUKEE, WIS.—The Village Council has awarded to the Milwaukee Electric Railway & Light Company the contract for street lighting at $84 per arc lamp per year.

MANITOWOC, WIS.—The Fox Valley Railway Company has increased its capital stock from $25,000 to $200,000. The company will construct an interurban line between Sheboygan and Kaukauna

SUPERIOR, WIS.—The Northern Power Company, of Duluth, Minn., has leased a portion of the Superior Water, Light & Power Company's building on Hughitt Avenue for a period of ten years, the space to be used for its generators. The Northern Power Company is to pay $400 a year for the present space and $200 a year for each additional generator installed.

CARDSTON, ALB. Debentures are being sold for the purpose of installing a municipal electric lighting plant. J. A. Hammer is mayor.

REVELSTOKE, B. C.—The Prince Mining Company is arranging to lay an electric tramway to cost $60,000 from here to the mine. J. A. Stone is vice-president.

ROSSLAND, B. C.—The Trail electric light plant, owned by the Consolidated Mining & Development Company was burned to the ground. Loss, $18,000.

SASKATOON, CAN.—Willis Chapman, civil engineer, of Toronto, has plans for a municipal electric lighting plant which will be installed here. J. Clinskil is mayor.

PRINCE ALBERT, CAN.—Prince Albert rate payers have decided to move the electric light plant to the power house at the water works and to improve the plant at a cost of $35,000.

OTTAWA, ONT.—The civic lighting plant, it is stated, shows a net profit of $826 for 6 months after paying the interest and sinking fund claims.

FORT WILLIAM, ONT.—The International Telephone Company has closed a contract with the town for a new central telephone outfit for 750 instruments. J. Whalen is mayor.

CHATHAM, ONT.—The Chatham, Lake Erie & Wallaceburg Electric Railroad will extend its line from here to Rondeau Harbor, 20 miles, and is having surveys made for a line to Sarnia, a distance of 100 miles.

TORONTO, ONT.—The Toronto & York Radial Electric Railway Company is building a new power house at Keswick. It will be 100 ft. x 150 ft. , and will supply the power for the Metropolitan Electric Railway, from Newmarket to Jackson's Point.

WINNIPEG, MAN.—The City Council has passed a by-law to issue debentures to the amount of $3,250,000 for the purpose of acquiring rights of ways and other necessary property for building and maintaining an electric street railway to be owned by the city, independent of the Winnipeg Electric Street Railway, and for constructing a power plant on the Winnipeg River at a point to be selected by the Council.

WINNIPEG, MAN.—The Board of Works of the Winnipeg City Council has ordered the Winnipeg Street Railway Company to build a new line from the corner of Broadway and Osborne Streets to Portage Avenue. This is to be a double-track line. The company is also ordered to build its new line on Sargeant Avenue, from Sherbrooke to Arlington Streets. The Council has the power to order these extensions by the terms of the company's franchise.

MEXICO, MEX.—The Compania Electrica e' Irradora del Estado de Hidalgo has increased its capital stock from $2,000,000 to $4,000,000.

DAWSON, Y. T.—It is reported that a large electrical plant will be installed this summer to operate the placer mines in Klondyke Basin.

New Industrial Companies.

THE HENRY RYCRAFT & COMPANY, electrical constructors and engineers, with headquarters at 166 Genesee Street, Utica, N. Y., has been formed by Henry Ryecraft.

THE NEW YORK ELECTRIC FOUNTAIN COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000. The directors are S. S. Mittenhall, I. M. Mittenhall and G. S. Jacobson, of New York, N. Y.

THE INTERMOUNTAIN CONSTRUCTION COMPANY, of Butte, Mont., has been incorporated with a capital stock of $100,000 for the purpose of building telegraph and telephone lines. The incorporators are T. B. Lane and others.

THE SMITH ELECTRIC & MANUFACTURING COMPANY, of Charlottee, N. C., has been incorporated with a capital stock of $25,000 to carry on a fixture and electrical business in Charlotte. The incorporators are H. C. Dotger, E. F. Cresswell and Samuel J. Smith.

Company Elections.

HARTFORD, CONN.—At the annual meeting of the Farmington River Power Company held recently, the following board of directors was chosen for the ensuing year: Henry Roberts, E. B. Bennett, H. C. Judd, A. C. Dunham, Atwood Collins, John S. Hunter, E. C. Terry, W. W. Smith, James Terry.

NEW ALBANY, KY.—At the annual meeting of the Eureka Telephone Company held recently the present officers were reelected as follows: E. F. Windell, president; H. C. Beanblossom, secretary; H. C. Keys, treasurer.

BALTIMORE, MD.—At the annual meeting of the stockholders of the Mount Washington Electric Light & Power Company held recently at the company's offices, Mount Washington, the following officials were elected for the ensuing year: President and general manager, Thomas W. Offutt; vice-president, Alten S. Miller; secretary and treasurer, Harry J. McIntyre.

LITCHFIELD, MINN.—At the annual meeting of the Litchfield Telephone Exchange Company, held June 11, the present officers were reelected for another year as follows: H. L. Peterson, president; G. H. Sullivan, vice-president; T. F. McClure, secretary; G. A. Settergren, treasurer.

ANACONDA, MONT.—At a recent meeting of the directors of the Montana Telephone Company, Harry A. Gallway, of Butte, was elected president, and Charles J. Kelly, vice-president.

CLEVELAND, OHIO.—At the annual meeting of the Cleveland Telephone Company, held June 15, the following officers were elected: L. R. Richardson, president; Heman J. Pettengill, vice-president; Charles A. Grant, secretary; A. H. Kirkwood, treasurer and assistant secretary; John Balch, assistant treasurer.

New Incorporations.

OAKLAND, CAL.—Articles of incorporation have been filed with the County Clerk for three allied companies, which are to engage in the lighting and power business in Lodi, Auburn and Richmond and the surrounding regions. The incorporators are the same in each company and are as follows: W. F. Russell, C. A. Wilson and M. Brand, of San Francisco; H. A. Potter and F. A. Osborn, of Oakland. The first company is called the Lodi Gas Improvement Company, the second the Auburn Gas Improvement Company, and the third the Richmond Gas Improvement Company. The capital stock of each of the companies is $100,000. The principal place of business is to be at Oakland.

CHICAGO, ILL.—The Carthage & Western Illinois Electric Company has filed articles of incorporation with a capital stock of $2,500. The incorporators are W. M. Vose and others.

LEROY, ILL.—The Leroy & Southwestern Railroad Company has been incorporatd with the principal office at Bloomington. The capital stock is $2,000. The incorporators and first board of directors are Alvin H. Shelby, J. A. Taylor, Bloomington, Ill.; L. A. Hinton, A. Hinton, Normal, Ill.; George W. Shelby, Wapella, Ill.

SPURGEON, IND.—The Spurgeon Home Telephone Company has filed articles of incorporation. The capital stock is $12,000. The directors are E. H. Grubb, J. A. Wiggs and John W. Scales.

WINCHESTER, IND.—Articles of incorporation have been filed by the Muncie & Union City Traction Company with a capital stock of $500,000. The directors are James A. Van Osdol and others.

MUNCIE, IND.—The Ardmore Heat & Light Company has been incorporated with a capital stock of $200,000, to produce oil and gas, build pipe lines, construct and operate gas and electric light plants and to sell gas, oil and electricity for heat, light and power. John W. Smith is chairman board of directors.

MOORLAND, IA.—The Moorland Mutual Telephone Company has filed articles of incorporation.

COLO, IA.—Articles of incorporation have been filed by the New Albany Mutual Telephone Company with a capital stock of $5,000.

AUGUSTA, ME.—The Tri-State Telephone & Telegraph Company has filed articles of incorporation with a capital stock of $3,000,000. E. H. Moulton is president.

MINNEOTA, MINN.—The Minneota Telephone Company has been incorporated with a capital stock of $5,000.

LINCOLN, NEB.—The Fillmore County Telephone Company has increased its capital stock to $100,000.

MARTEL, NEB.—Articles of incorporation have been filed with the Secretary of State by the Martel Farmers' Telephone Company with a capital stock of $300. The officers are Albert Egger, president; John A. Sittler, vice-president; William H. H. Moore, secretary; Edward H. Bohmont, treasurer.

BUFFALO, N. Y.—The Buffalo & Lackawanna Traction Company has filed articles of incorporation with the Secretary of State. The company operates a five-mile electric road in Buffalo, and has a capital stock of $1,000,000. The directors are J. B. Mayer, W. F. Sheehan, C. H. Werner, M. J. Dodge, Ashley T. Cole, of New York; J. C. Calisch, J. F. Burke, C. V. Nellany and O. F. George, of Buffalo.

BONSAL, N. C.—The Cape Fear Telephone Company has been chartered with a nominal capital stock of $675. T. L. Womble is incorporator

HILLSBORO, OHIO.—The Hillsboro, Belfast & Peebles Traction Company has been organized for the purpose of building a line through Belfast and Peebles with a branch to the Ohio River at Aberdeen. The officers are P. M. Hughes, Lovett, president; J. W. Letherman, Belfast, vice-president; W. B. Cochrane, Hillsboro, secretary.

CLEVELAND, OHIO.—The Municipal Traction Company has been incorporated with a capital stock of $10,000 for the purpose of leasing the Forest City Street Railway Company. The last-named company has increased its capital stock from $250,000 to $2,000,000. Of this amount $700,000 will be issued at once and will be used in the completion of the lines already started, the purchase of power house equipment, rolling stock, etc. The remaining $1,300,000 will be issued and sold from time to time and the proceeds applied to new construction. The property which the Forest City Railway Company will turn over to the Municipal Traction Company consists of five miles already built and nine miles under construction.

HOUTZDALE, PA.—A company has been organized here under the name of the Houtzdale Electric Light, Heat & Power Company, with a capital stock of $10,000. Samuel T. Henderson is treasurer.

EDENSBURG, PA.—At a meeting of the telephone companies in the northern part of Cambria County it was decided to consolidate all the independent farmers' line under one company to be known as the Northern Cambria Farmers' Telephone Company. H. M. Gooderman was elected president.

Legal.

SOUTH TEXAS TELEPHONE ENJOINED.—Mr. H. E. Huntington, the Los Angeles, Cal., street railway man, who is making an effort to obtain control of the long distance independent telephone properties in the Southwest, to-day obtained a temporary injunction in the district court, Austin, Tex., against the South Texas Telephone Co., restraining its representatives from hypothecating $115,000 of its bonds.

TELEPHONE UNDERGROUND WIRES.—In an action brought by the village of Carthage against the Central New York Telephone & Telegraph Company, the Court of Appeals has just rendered a decision against the village. The suit was brought to determine whether the village had the right to compel the company to put its wires under ground. Justice Andrews at special term decided in favor of the company, and from the decision the village appealed to the Appellate Division, which reversed Justice Andrew's decision. The companpy then took the case to the Court of Appeals, which decides in the negative the question whether a village can compel a telephone company to put its wires under ground.

GAS PRICE REDUCTION VALID.—The Appellate Division of the Supreme Court of New York has handed down a decision against the Consolidated Gas Company in two cases. The court holds in effect that the company must not shut off the gas from any consumer who tenders the 80-cent rate fixed by the last session of the Legislature. Justice Laughlin wrote the opinion, Presiding Justice O'Brien and Justice Patterson concurred. Dissenting opinions were written by Justice McLaughlin and Houghton. In his dissenting opinion Justice McLaughlin says: "It is a somewhat alarming proposition that a legislative body can simply by its own fiat arbitrarily fix the price at which the owner of a product must sell it, and it is equally so that a court will refuse to the owner of the product the right to sell it at the price at which he had heretofore sold it, pending a judicial determination as to the validity of the legislative act, when sufficient money is paid into court to reimburse a purchaser for the difference in price in case the act is declared valid." Justice Houghton, also dissenting, says he does not think that the State courts have been ousted by the Federal courts from jurisdiction, buf he thinks that no extraordinary remedy in the form of a temporary injunction should be granted.

SERIES PARALLEL CONTROLLERS.—In the United States Circuit Court of Appeals for the third circuit, sitting in Philadelphia, Pa., a patent decision was handed down on June 11th in favor of the General Electric Co., who had brought suit against the Garrett Coal Co. on the charge that the defendant company had been using series parallel controllers, manufactured by the Morgan-Gardner Electric Co., of Chicago. These controllers, it was alleged, are an infringement upon the plaintiff's patents No. 587,441 and 587,442 of August 3rd, 1897. The Court of Appeals speaks in high terms of the invention contained in these two patents and states the advantages as follows: "The method is a gradual, or step by step, progress from the series to the parallel supply of the electric current to the motors, by which the current may be safely broken as to one motor in series, the same be at once changed to parallel relation to the other, and the multiple rate of speed attained, without shock and without sparking, there being, during the progress, no shutting off of the current or reduction of speed." This decision covers the "K" form of controller of which more than 86,000 have been sold and put into operation, and which is used almost exclusively on electric street railway systems of this and other countries.

NIAGARA POWER NOT INJURIOUS.—In a report filed by Referee Charles M. Williams in the condemnation proceedings brought by the Niagara, Lockport and Ontario Power Company to acquire the lands of Mary Van Riper in the town of Brighton, the referee holds that the company has the right to condemn land in Monroe or any other county along the line from Lockport to Syracuse. A decision filed by Justice Sutherland in the case of Mary S. Oliver gave the company temporary possession of the property on the same grounds, though a settlement of the case was effected before it had been concluded on its merits, an appeal having been taken from a preliminary ruling. The referee was appointed October 25, 1905, by Justice Sutherland to take testimony in the case. As in the opinion given by Justice Sutherland, the opinion holds that the corporation is a public service corporation within the meaning of Chapter 722 of the laws of 1894, and thus has the right of extension beyond the limits of Niagara, Orleans and Erie County, the counties named in the charter. The conclusions of the law also find that the company has full authority to take from the Niagara River the amount of water necessary to develop a practically unrestricted amount of power at Lockport. The grant of the charter to the company by the Legislature, it is stated, was a valid grant and gives the company full authority to divert water from the river within the provisions of this grant. The opinion also holds that the grant of these privileges does not grant to the company any money or property of the State of New York within the meaning of Section 9 of Article 1 of the constitution. The findings of the fact go into a long discussion of the company's history from its incorporation, including the purposes for which it was formed. A power canal, work on which was commenced a year or two ago, but which is still uncompleted, awaiting the outcome of the charter rights which are still questioned, is discussed in detail. This canal, it is stated, will be used to develop power at Lockport, at which place not over 10,000 horse-power annually will be consumed. At this point, it is stated, the transforming station is located and the company must necessarily transmit power to other places. This is one of the basic grounds for the ruling as to the necessity for extension. It is also found that the scenic effect of Niagara Falls will not be affected by the water which is taken from the river. The referee finds that the claim that the navigability of the Niagara River from Lewiston to Lake Ontario would be affected is unfounded and says that the navigability of this stretch of the river would not be affected if all the water from the river were to be diverted at Lewiston by another channel into Lake Ontario, as the water would get back into the lake. Above Lewiston, the report states, the river is only navigated as far as the falls by the Maid of the Mist. The development of from 100,000 to 200,000 horse-power at Lockport would reduce the water in the upper level from 3 to 6 inches only.

Obituary.

MR. H. BOTTOMLEY.—Mr. John Bottomley, vice-president of the Marconi Wireless Telegraph Company, received word this week of the death of his brother, Harry Bottomley, at Knutsford, England, on June 23. Harry Bottomley was born in Belfast, Ireland, 32 years ago. He was the son of William Bottomley, a justice of the peace. For the last three years he had been assistant treasurer of the English branch of the Westinghouse company. Before taking that place he was a tea planter in India. He leaves a widow.

MR. C. E. TRIPLER.—Mr. Charles Eastman Tripler, inventor of a method for making liquid air, died on June 20, of Bright's disease, at Liberty, N. Y., after an illness of several months. He was born in New York City in 1849, and while attending private schools showed an aptitude for mechanics and chemistry. When he was 23 years old he constructed a naphtha condensing engine and then devoted himself for several years to experimenting with chemicals. In 1890 he discovered a method of liquefying air, and two years later succeeded in producing liquid oxygen and nitrogen. His method employed great compression and produced a temperature of 312 degrees below zero. A stock company capitalized at $20,000,000 was formed to put the discovery into commercial use, and all sorts of claims were made for the product. The company was never a financial success. Mr. Tripler made a demonstration with liquid air at the Electrical Exhibition in New York City a few years ago

MR. C. C. NEWTON.—The death of Charles C. Newton, president and treasurer of the Newton Machine Tool Works, Inc., Philadelphia occurred at Bremen, Germany, June 13. He had not been in good health for some time and had gone to Europe to seek relief. He was born February 9, 1846, at Cambridge, Washington County, N. Y., and at the age of 19 he indentured himself as apprentice to the Brooks Locomotive Works at Dunkirk, N. Y., spending most of his time in the tool room. After serving his apprenticeship and working in various shops, Mr. Newton returned to Dunkirk in 1875, and, in partnership with J. D. Cox, manufactured twist drills, reamers, cutters, etc., removing to Cleveland, O., in 1876, to broaden the scope of their work, which had largely increased, operating under the firm name of Newton & Cox. In 1880 Mr. Newton sold out his interest to Mr. Cox, who formed out of the old firm the Cleveland Twist Drill Company. Removing to Philadelphia Mr. Newton laid the foundation for the present Newton Machine Tool Works. He was the sole proprietor of the works until July 14, 1897, when articles of incorporation were taken out, and the firm became the Newton Machine Tool Works, Inc., with Mr. Newton as president and treasurer. He was a member of the Engineers' Club and of the American Society of Mechanical Engineers.

Personal.

MR. W. R. COOPER, M. A., B.Sc., M. I. E. E., A. M. Inst. C. E., has been offered and has accepted the editorship of the London *Electrician*, in the place of Mr. F. C. Raphael, who retires June 30.

MR. N. A. CHRISTENSEN, who has just associated himself with the Allis-Chalmers Company, for air compressor, brake work, etc., is making a trip to Europe before assuming his new duties, and will spend the time over there chiefly in automobiling.

MR. WM. B. FLYNN, assistant electrical engineer of the New York, Westchester & Boston Ry. Co., was married June 16 to Miss Edna Ans of Hasbrouck Heights, N. J. The couple afterwards left for a two weeks' trip through Northern New York.

DR. F. S. PEARSON has sailed for Europe, accompanied by Mrs. Pearson. From London they will go to Rio de Janeiro, Brazil, where Dr Pearson has large interests in the electric lighting, trolley and telephone system, and has a large power transmission enterprise in Land.

MR. N. B. ROPER, formerly chief engineer for the Cananea C dated Copper Company, Cananea, Mexico, has recently been engag the Power and Mining Machinery Company, Milwaukee, Wis., as r engineer to represent it at its New York sales office, No. 52 William

MR. F. F. FOWLE, formerly of New York City, is now perman located in Chicago as manager there for the American Telephone & graph Company. Mr. Fowle has made a specialty of long distance t phone work and of late has given great attention to installations for railroads—work that involves many interesting problems.

MR. WALTER C. DEAN has opened offices in the Bank of Commerce Building at Norfolk, Va., and will represent the C. & C. Electric Company there. He is a graduate of the Massachusetts Institute of Technology, and has had considerable experience in the equipment department of the Norfolk Navy Yard, where he has made a specialty of variable speed motors for driving machine tools.

MR. PAUL J. KRUESI, secretary-treasurer of the American Lava Company, of Chattanooga, Tenn., has, according to the journals of that city, become engaged to Miss Myra Kennedy Smartt of Chattanooga. The wedding will take place during the summer, and the honeymoon be spent north. Mr. Kruesi is the son of the late John Kruesi, one of the founders of the Edison lighting industry in America.

MR. J. G. WHITE took a large party of friends in the electrical and financial worlds, by special car, on Saturday, June 23, to see the 'Varsity boat races at Poughkeepsie. Assisted by Messrs. Gossler, Collette, Reed and Bunnell of the J. G. White Company, he extended lavish hospitality and the day was not marred for the host by the sight of his alma mater, Cornell, pulling off two of the big events in splendid style.

MR. W. H. WHITESIDE.—Among the passengers leaving New York for Liverpool, June 19, on the Cunard steamer "Coronia" was President W. H. Whiteside of the Allis-Chalmers Company, who, accompanied by his wife and daughter, will devote several weeks to a recreation trip abroad. Mr. Whiteside and his family will visit various points of interest in England, Germany, Switzerland and France, spending most of their time on the Continent.

MAJOR F. V. HANSEN, of Sweden, with Mr. G. Malm, C. E., has been making an investigation of the chief American and Canadian hydro-electric plants, with the objects of ascertaining how far they may suggest methods for the utilization of the Trollhattan Falls, which the Swedish Government proposes to utilize for electrical work on the State railroads. They have accumulated a large amount of data and sailed for home this week.

MRS. W. C. GOTSHALL, wife of the railroad promoter, broke ground last week for the New York and Port Chester Railroad, using a gold shovel. After six years of legal battle in the courts and before the State Railroad Commissioners and the city authorities, the Port Chester Railroad Company has won. The road will cost $30,000,000. It will consist of twenty-five miles of four-track road, operated by a third rail. Its temporary terminus in Manhattan will be at 177th St. and the subway. It will be ready in about two years.

MR. GEO. U. G. HOLMAN, who promoted and built the Levis County Railway, Quebec, Canada, and now of 180 Broadway, New York City, is associated with Mr. L. Knowles Perot, of Philadelphia. Mr. Holman was recently appointed electrical engineer of the Valley Forge System, which will build and operate a third-rail private right-of-way line between Philadelphia and Phoenixville, Pa., with Philadelphia offices on the twenty-first floor, Land Title Building. He is also vice-president of the Public Service Investments Company, which is the holding company for eleven Pennsylvania corporations. Mr. Holman retains his New York office.

MR. GARDNER C. SIMS, having recently been elected to the presidency of the William A. Harris Steam Engine Company of Providence, R. I., builder of Corliss engines, has resigned his position as general manager of the Marine Engine & Machine Company, of Harrison, N. J., and will return to Providence to assume his duties there. The William A. Harris Steam Engine Company has purchased a large tract of land at Central Falls, R. I., and plans are now being prepared for the building of new works. Mr. Sims has a world-wide reputation as a builder of high-speed, closely regulating engines, and his valuable aid in the beginnings of the electric lighting art in this respect are not likely to be forgotten.

MR. F. E. DRAKE, who has been actively and prominently connected with the development of American interests in Germany, and is now director of the International Pneumatic and Electric Company, of Berlin, has sustained a severe bereavement in the death of his wife in that city. Mrs. Drake had been ill for some time, and had visited the Riviera in the quest for health. The end came suddenly and painlessly. Mrs. Drake was a member of the executive committee of the American Woman's Club of Berlin, which misses her as an influential worker in behalf of its social and charitable interests. The funeral services were held in the American Church at Berlin on May 31, and were attended by U. S. Ambassador Tower and many members of the American colony.

BATES-VERNAM.—One of the largest weddings held in Morristown, N. J., this season was that of Miss Emeline Goold Vernam, daughter of Mr. and Mrs. Albert H. Vernam, to Putnam Asbury Bates, the consulting electrical engineer, of New York. The wedding was celebrated in St. Peter's Church. The ceremony was performed by the rector, the Rev. Philemon F. Sturges. Miss Alice Vernam was her sister's maid of honor, and the bridesmaids were Miss Matilda Frelinghuysen, Miss Emily Maver, Miss Carrie Warfield, Miss Elizabeth Heron of Pittsburg, Miss Adelaide McAlpin of New York, and Miss Marguerite Vernam. The best man was T. Power Bates, brother of the bridegroom, and the ushers were A. Harold Vernam, Jr., a brother of the bride, John Grenville Bates, brother of om, Albert H. Putnam, Anton H. Schafer, William W. Press- A tt P. Robbins, Leonard S. Horner, and William B. Boulton. ew York. Immediately after the ceremony a reception was ernam home on Madison Avenue.

News of the Trade.

THE NOVELTY INCANDESCENT LAMP COMPANY, St. Mary's, Pa., has completed its new plant for the manufacture of Elk new and Novelty refilled lamps.

W. T. PRINGLE.—The business of W. T. Pringle, of Philadelphia, has been transferred to the Pringle Electrical Manufacturing Co., Inc. Business will be carried on at the same address as before, 1906-8 North Sixth St., that city.

CALIFORNIA ELECTRICAL WORKS, of San Francisco, announce the opening of a Seattle branch about August 1. The temporary office there is now located at 439-40 New York Block, in charge of Mr. P. J. Aaron, to which point all orders and inquiries relative to the northwest territory should be sent. A complete stock of electrical supplies will be carried there.

THE AMERICAN CONDUIT MANUFACTURING COMPANY.—In our issue of May 19 we called attention to the fact that the Underwriters' Laboratories of Chicago had started their factory inspection service in a number of factories the names and addresses of which were given in the item. To the list on unlined conduit should be added the name of the American Conduit Mfg. Company, of Pittsburg, Pa., which, for some unaccountable reason, was omitted.

THE ABNER DOBLE COMPANY announces that it has relocated its offices at its former site, Fremont and Howard Sts., San Francisco. The company is one of the first to resume operations in the burned district, and has taken contracts for a large amount of work in addition to the orders on hand previous to the fire. Work is progressing rapidly on the company's new shops and warehouses in the Potrero district at Seventh and Hubbell Streets. Temporary pattern and forge shops are already in operation on the new site.

THE ELECTRICAL INSTALLATION COMPANY, Monadnock Building, Chicago, has been awarded a contract for the power house and substation buildings and equipment, all overhead electrical construction and rolling stock for the Indianapolis-Crawfordsville & Western Traction Company's line, 45 miles. Allis-Chalmers Company's steam and electrical machinery and car equipment will be used. The company has opened offices in the Traction Terminal Building, Indianapolis, Ind., where the engineering and direct supervision of the construction and equipment of the Indianapolis, New Castle & Toledo Electric Railway Company's system and the Indianapolis, Crawfordsville & Western Traction Company's line will be managed.

THE ONEIDA COMMUNITY, LTD., Oneida, N. Y., are now putting out a chain for the suspension of incandescent lamps for street work. This chain is of the same construction as their No. 1 Oneida galvanized chain commonly used for the suspension of arc lamps, and has the strength, durability and flexibility that is characteristic of No. 1 chain. This size used is termed No. 5, and is made from the best open hearth steel, being heavily galvanized at their own plant by the hot galvanizing process. This material will prove of interest to central station men for suspending incandescent lamps in the middle of the street, and a sample length sufficient for the suspension of one lamp is furnished free of charge to any manager desiring to test the chain.

THE VAN DORN & DUTTON COMPANY, of Cleveland, Ohio, has increased its capital stock from $50,000 to $150,000 to cover extensive improvements to its plant. The improvements will consist of additional machinery and the erection of a large new building, which will be utilized almost exclusively in the production of gears. The new gear cutting machinery will be of the most improved type and it is asserted that the plant will be the most complete of its kind in the country. A considerable portion of the plant will be occupied by the Van Dorn-Elliott Electric Company, which is closely affiliated with the Van Dorn & Dutton Company, and is well known to the trade through the production of electrical supplies and for its repair work. One of the important improvements which will be installed for this company in the new plants will be a pneumatic outfit for impregnating armature and field coils.

THE ELECTRIC CABLE COMPANY, of 17 Battery Place, New York, has just placed orders with the American Railways Company, of Altoona, Pa., and with the Taluca Light and Power Company of Taluca, Tex., for Voltax compound, to be used in both cases for insulating purposes. Voltax is meeting with extensive sales among the railway, light and power companies of the United States, which use this material not only for insulating and waterproofing purposes, but in connection with underground conduit systems. It is claimed that the underground conduit system consisting of wooden troughs into which Voltax insulating compound is poured after the manner of the underground transmission systems which have been in use in Germany for several years, may be installed and maintained at a cost ranging to 33 per cent less than any other transmission system now in operation. No poles or other expensive equipment is required, and the low cost of the materials and the ease with which such an underground system may be laid is rapidly bringing it into favor not only with the railway and light companies but with exposition companies and State fairs, where pavements do not interfere with underground work. In order to fill the large orders which the Electric Cable Company has received during the past three months, its force at Bridgeport, Conn., has been tripled within the past three months.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 19, 1906.

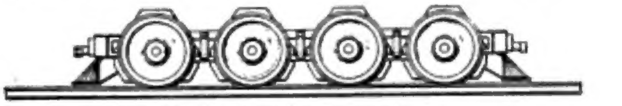
[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

823,505. ELECTRIC SYSTEM OF TRANSMISSION; Charles G. Burke, Brooklyn, N. Y. App. filed Dec. 9, 1902. A telegraph system in which the line may be tuned in such a way that the charging period of the line corresponds in length to the period of the telegraph signals. Also provides means whereby the line may be used for a telephone or telegraph system.

823,513. SAFETY SYSTEM FOR OPERATING RAILROADS; William H. Damond, Detroit, Mich. App. filed Feb. 17, 1905. The track is provided with insulated sections which constitute receiving stations by which messages are transmitted to the train from points along the road. Also exhibits danger and caution signals in front of the train.

823,521. WEIGHT ACTUATED APPARATUS; Eugene Fuller, Arctic, R. I. App. filed May 15, 1905. A fire alarm device in which a hammer is operated to strike a bell by means of a heavy weight. The device is arranged to be automatically rewound by an electric motor.

823,542. FIRE ALARM; George H. Oatway and Charles E. May, London, England. App. filed Apr. 3, 1905. In order to make a hot wire alarm device more sensitive in use the patentee arranges the expansible wire between levers which are connected by an expansible rod. In this way the expansive effect of the rod is multiplied and added to that of the wire, which slackens and makes the alarm circuit.



823,968.—Electric Locomotive.

823,560. ART OF METALLURGY; Enrique A. Touceda, Albany, N. Y. App. filed Jan. 28, 1905.

823,561. METALLURGICAL APPARATUS; Enrique A. Touceda, Albany, N. Y. App. filed Jan. 28, 1905.

823,566. DYNAMO ELECTRIC MACHINERY; William L. Waters, Milwaukee, Wis. App. filed Sept. 24, 1904. A construction for the attachment of lamanations to the pole pieces of a revolving field frame. The lamanations are held in place by transverse bolts and specially formed castings.

823,568. COMMUTATOR; William L. Waters, Milwaukee, Wis. App. filed Dec. 5, 1904. In order to more efficiently ventilate the commutator of a generator the segments are arranged in two series or groups thereby virtually forming two separate commutators.

823,569. BRUSH HOLDER; William L. Waters, Milwaukee, Wis. App. filed Jan. 20, 1905. Details of construction of a commutator brush having a frame with a pair of carbon brushes guided therein to have a normal movement against the face of the commutator. Each of the brushes is spring impelled by an adjustable bow spring.

823,579. TRANSMITTER-SUPPORT; Sidney A. Beyland, Elyria, O. App. filed Feb. 28, 1905.

823,642. COLLECTING BRUSH FOR ELECTRIC CURRENT GENERATORS AND MOTORS; Otto Siebers, Dresden, Germany. App. filed July 9, 1903. A composite copper brush having folded plates which are dovetailed together and enclosed within a metallic sheathing so as to form a unitary and resilient structure.

823,646. SIGNALING SYSTEM; Jacob B. Struble, Wilkinsburg, Pa. App. filed Feb. 12, 1903. A signaling system for railway employing an alternating current as a motive power and a rail of the track as a return for the alternating current, in which a closed track circuit is employed. Has a translating device which may in turn control a circuit including an operating mechanism for a signal device, comprised in a railway signal, or the translating device may directly operate the signal.

823,648. RAILWAY SIGNALING; Louis H. Thullen, Edgewood, Pa. App. filed Feb. 5, 1904. Relates to a signal system particularly adapted to railways over which electric cars are propelled, the motive power for the motors of which is alternating current, and with a return for the propulsion current through the rails. Has a source of direct current for energizing the rails of the block sections.

823,671. ELECTRIC WATER PURIFIER; Albert E. Dieterich, Washington, D. C. App. filed Apr. 10, 1906. A cylindrical housing contains a spiral casting having a pair of strips through which the current passes. The current of water is directed spirally between these strips where it is exposed to the electric action and the particles suspended therein precipitated.

823,682. SYNCHRONIZING MECHANISM FOR TIMEPIECES; Augustus L. Hahl, Chicago, Ill. App. filed Sept. 26, 1903. The escapement pallet is movable transversely so as to release the escapement wheel This movement is effective to position a stop in the path of an arm on the escapement wheel and corresponding to zero position thereof. The transverse movement is accomplished by a magnet energized by a circuit from the master clock.

823,724. ELECTRICAL RECEPTACLE AND PLUG; John C. Hatzel and Edgar L. Morley, New York, N. Y. App. filed Feb. 2, 1904. A plug or floor box having a chamber in which is received a porcelain block upon which the circuit wires are fastened and which automatically makes connection with certain spring blades when inserted into position within the housing.

823,758. SUPPORTING-ARM FOR TELEPHONE-TRANSMITTERS; Sidney A. Beyland, Elyria, O. App. filed May 12, 1904.

823,763. TELEPHONE-RELAY; Edward E. Clement, Washington, D. C. App. filed June 16, 1898.

823,768. TELEPHONE-TRANSMITTER; William W. Dean, Elyria, O. App. filed Sept. 13, 1904.

823,774. ELECTRIC SIGN; William Gierth and George Latimer, Jr., Newark, N. J. App. filed Oct. 20, 1905. An electric sign having lamps on both faces. Comprises a sheet metal box of which the front and rear sides are both removable. Bus bars are arranged within the box and extension connections may be made to the lamps on either side.

823,811. AUTOMATIC CIRCUIT MAKING AND BREAKING DEVICE FOR AUTOMOBILES AND THE LIKE; Andrew L. Riker, Bridgeport, Conn. App. filed Oct. 8, 1903. A vibrator for the ignition systems of automobiles. The contract spring is attached to the vibrator spring by a stud or link which permits a certain amount of lost motion between the two.

823,820. PRONG INSULATOR; Louis Steinberger, New York, N. Y. App. filed July 10, 1905. The insulator has a saddle shaped body of porcelain with a pair of overhanging edges or "spouts" which drain the water from the upper surface thereof. A double pronged hook projects from the upper part of the insulator through which the line wires may be engaged.

823,886. TELEPHONE; Thomas J. Merryman and Carl L. Allen, Lincoln, Neb. App. filed Aug. 25, 1904.

823,912. INSULATOR; August Biele, New Haven, Mo. App. filed July 25, 1905. The cross arms are drilled with circular holes through which the line wires pass and a cylindrical insulator is adapted to slip on to the wires and passed into said holes. Means are provided for holding the wire centrally in the insulator.

823,958. ELECTRIC ARC LAMP; Edwin J. Murphy, Rugby, England. App. filed Sept. 9, 1904. Details of an arc lamp having two carbons. Relates particularly to the construction of a pair of solenoids and a U-shaped cord therefor for positioning the electrodes and an auxiliary armature adapted to bridge the ends of the legs of said U-shaped core to impinge on the ends of the solenoids.

823,968. ELECTRIC LOCOMOTIVE; Edward D. Priest, Schenectady, N. Y. App. filed Jan. 28, 1905. Electric locomotive having four pairs of wheels on each of which is a direct connected motor. The invention relates particularly to a form of suspension by which the weight is evenly distributed on all of the wheels.

823,969. ELECTRIC LOCOMOTIVE; Edward D. Priest, Schenectady, N. Y. App. filed Jan. 28, 1905. Relates to modifications of the above, and particularly to a transverse suspension system for keeping the pole faces of the motor in parallelism with the armature.

823,973. INDUCTION COIL; Stanislaus H. Sauve, Spokane, Wash. App. filed May 23, 1905. An induction coil of the ordinary form is provided with a supplemental secondary winding the circuit of which is not closed, but which may be connected to a condenser.

823,979. AUTOMATIC AIR BRAKE; Friedrich J. R. Wagner, Berlin, Germany. App filed Dec. 9, 1899. An engineer's valve having the usual air passages and electric segments which complete electric circuit to special magnet operated valves.

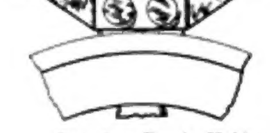
823,984. LOCKING AND TRIPPING DEVICE FOR SWITCHES; Harry M. Acly, Pittsfield, Mass. App. filed Nov. 17, 1904. Details of a magnet circuit breaker or cut-out having a switch element which is normally pressed into circuit closing relation by a toggle jont, but which may be tripped so as to open the circuit by a magnet acting on the toggle joint to destroy the alignment of the links thereof.

824,003. WIRELESS TELEGRAPH SYSTEM; Lee De Forest, New York, N. Y. App. filed Feb. 20, 1906. Designed to provide a coupled wireless telegraph system whose natural mode of vibration shall be monoperiodic, and which shall have a greater persistency of vibration than those now commonly employed. Has two paths from the top of the entenna to earth which are equal in natural period, a spark gap associated with said circuit, and an auxiliary shunt path containing a capacity connected across said spark gap.

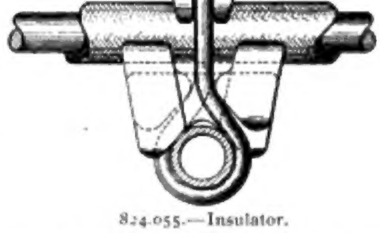
824,015. THERMO-ELECTRIC COUPLE; Harry E. Heath, Lynn, Mass. App. filed Aug. 7, 1905.

824,021. RECEPTACLE FOR ELECTRIC LAMPS; Paul H. Jachnig, Newark, N. J. App. filed May 4, 1904. Construction of water-proof socket having a base block with passages therein in which the connections are made by means of metallic clips. The passages are afterward filled with cement in order to make the receptacle water proof.

824,028. TELEGRAPHIC SENDING DEVICE; Isidor Kitsee, Philadelphia, Pa. App. filed Jan. 27, 1903. Telegraph apparatus having an automatic receiving element and having a transmitting or sending element which, while it affords the necessary variety of signals, is very simple in manipulation. Has a series of movable members provided with a series of lines of raised characters, each of said lines designating a numeral of different value.



823,569.—Brush Holder.



824,055.—Insulator.

824,030. TELEPHONY; Isidor Kitsee, Philadelphia, Pa. App. filed July 23, 1904.

824,031. TELEGRAPHIC TRANSMITTING KEY; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 11, 1905. A transmitting key having a lever depending from a fixed point by means of a resilient spring, and arranged to swing between contacts so as to complete circuits of alternate polarity by successive movements.

824,029. TRANSMITTING KEY FOR TELEGRAPHIC CIRCUITS; Isidor Kitsee, Philadelphia, Pa. App. filed Mar. 25, 1904. Designed to secure the current reversals of a transmitter for a submarine cable through a simple Morse key. The key operates a relay in the form of an escapement wheel which alternately makes the circuit from a positive and from a negative battery pole.

824,032. TELEPHONY; Isidor Kitsee, Philadelphia, Pa. App. filed Apr. 10, 1905.

824,046. ELECTROMAGNET; Charles F. A. Sturts, San Francisco, Cal. App. filed Apr. 28, 1905. A construction of electromagnets designed for the winding mechanism of clocks. Two magnet poles act on an armature pivoted between them so as to swing the same in a direction to wind up an escapement wheel.

824,048. INSULATED COIL FOR ELECTRICAL APPARATUS AND PROCESS OF MAKING THE SAME; Elihu Thomson, Swampscott, Mass. App. filed Sept. 11, 1903.

824,055. INSULATOR; Harry M. Aley, Pittsfield, Mass. App. filed Nov. 12, 1904. A construction of insulator for large cables which are designed to be supported from horizontal supporting pipes. Includes porcelain blocks which are placed between the parts and held in position by metallic wires or straps.

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